5-3 Basic Plans

5-3-1 Water Supply Facilities Plan

The basic plan for the water supply facilities will be prepared based on the design policies described in 5-1-5-(2) while attempting to achieve compatibility with water supply improvement projects currently being implemented by GCWSA and also taking the field survey results into consideration.

The basic processes for preparation of the basic plan for water supply facilities for the Project are shown in Fig. 5-2.

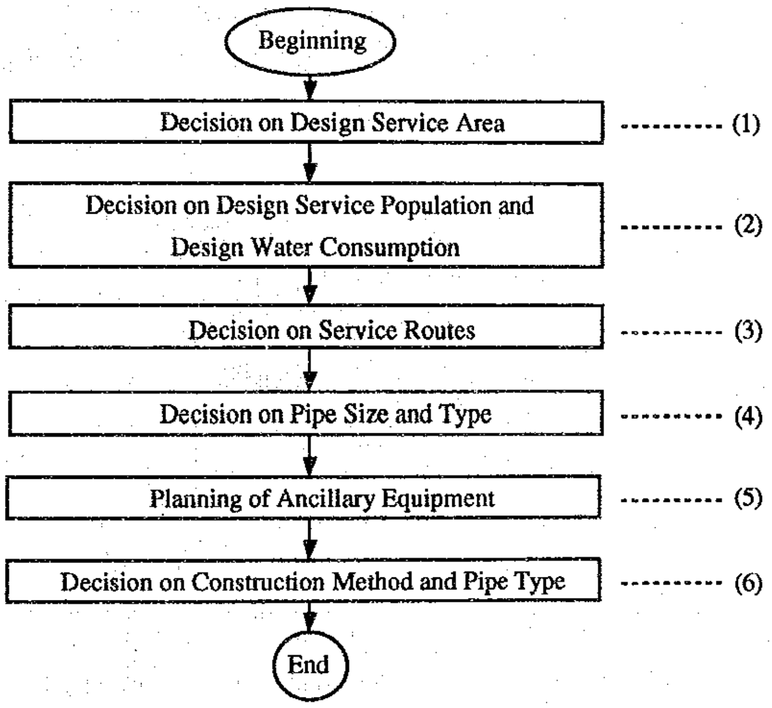


Fig. 5-2 Basic Plan Flow for Water Supply Facilities

Each of the above processes for the Project is described below.

(1) Design Service Area

The design service area under the Project is the Project Site (185ha) shown in Basic Design Drawing EMU-W-01.

(2) Design Service Population and Design Water Consumption

1) Service Population

In accordance with the Upgrading Plan of Water Supply and Sewer System in South Giza, the design service population in the target year (2010) is 247,000.

2) Design Mean Water Consumption

In accordance with the Upgrading Plan of Water Supply and Sewer System in South Giza, the design mean water consumption is 140 ltr/person/day.

"The Study of Water Supply for City of Giza" (hereinafter referred to as the Giza Water Supply Study) prepared with German assistance introduces three water supply consumption classes depending on the living standard of consumers as shown in Table 5-6.

Table 5-6 Design Mean Water Consumption Based on Different Living Standards

Living Standard	Design Mean Water Consumption (ltr/person/day)	
High class	250	
Middle class	160	Average: $\frac{160+120}{2}=140$
Lower class	120	

As the Project Site predominantly consists of residential areas for middle and low income people, the design mean water consumption of middle and lower classes of 140 ltr/person/day coincides with the proposed water consumption in the Upgrading Plan of Water Supply and Sewer System in South Giza. As a result, the design mean water consumption of 140 ltr/person/day planned for the Project is deemed appropriate.

(3) Branch Line Routes

1) Water Supply Branch Lines (diameter: 300-600mm)

The planned routes for the branch lines (diameter: 300-600mm) will be compatible with those of the Giza Water Supply Study. These routes will be determined taking the proposed routes by the Giza Water Supply Study, road and land use plans in the Project Site, workability and construction cost, etc. into consideration.

The planned water supply network by the Giza Water Supply Study and the routes of branch lines (diameter: 300-600mm) for the Project, planned based on the said network, are shown in Fig. 5-3 and Basic Design Drawing EMU-W-02.

a) El Cornesh Street

The existing water supply branch line (diameter: 300mm) along El Cornesh Street is buried on the opposite side of the street from the South Giza Waterworks. The new line will, therefore, be buried on the Waterworks side of the street to avoid any interference of the existing line. Connection between the existing water supply trunk line (diameter: 1,000mm) located near the entrance to the Waterworks and the newly constructed branch line (diameter: 600mm) will be conducted using the under-pressure drilling and tapping method to prevent any water supply stoppage during the connection work.

b) Monib Square

The planned route to pass Monib Square will avoid the rotary and the fountain.

c) Cairo-Aswan Railway Crossing Section

It is planned to extend a water supply branch line (diameter: 500mm) from El Cornesh Street to Monib Street, crossing the Cairo-Aswan railway tracks. The planned route is at a right-angle to the tracks to minimise disruption of train operations. As described later, the work at this section will first employ the pipe jacking method using reinforced concrete pipes as a sleeve pipe, followed by the insertion of the actual water supply pipes inside the concrete pipes to ensure safety for trains, vehicles, carts and passersby.

d) Zomor Canal Crossing Section

The planned route for the branch line described in c) above will also cross the Zomor Canal at a right-angle in view of workability, construction cost, site conditions and environmental conditions as described later.

e) Monib Street

At present, water supply lines in the Project Site are only buried under Monib Street and part of El Kasabgy street. The planned route for Monib Street will be determined taking the location of the existing water supply line, site conditions and environmental conditions, etc. into consideration.

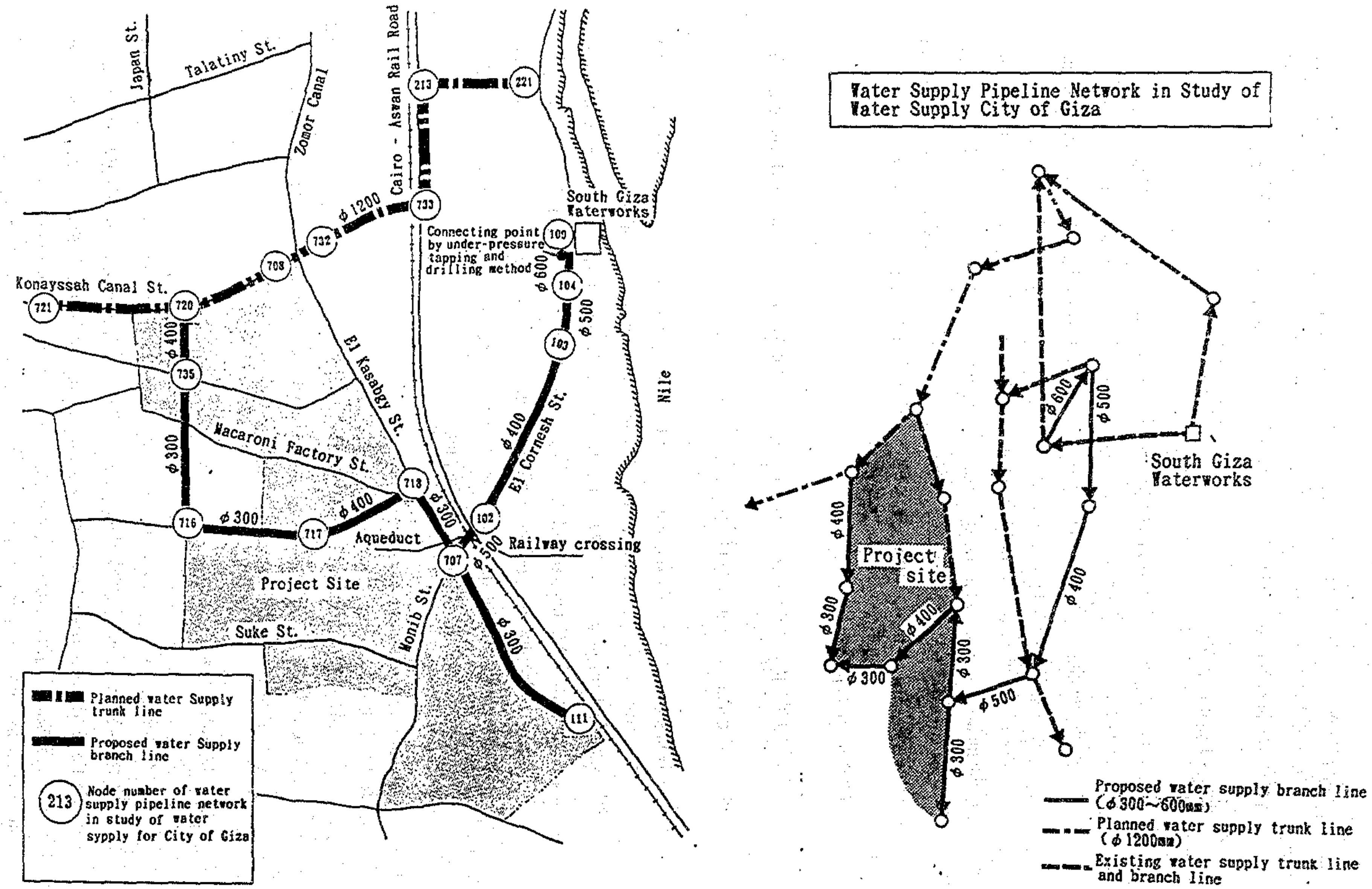


Fig. 5-3 Planned Routes for Water Supply Branch Lines (Diameter: 300-600mm)

f) Terra Nirsa Street

As the construction of a sewer branch line (diameter: 300-600mm) is planned for Terra Nirsa Street, the route of the water supply line should be planned to avoid any interference to the planned sewer line. The route and burying depth should also ensure easy work and a low construction cost, etc.

2) Water Supply Branch Lines (diameter: less than 300mm)

Water supply branch lines less than the diameter of 300mm which branch off from water supply branch lines (diameter: 300-600mm) will be planned along branch roads in priority areas with a high concentration of housing and shops in the Project Site where the benefits from these lines will be strongly expected. Further details are given in 5-3-3.

The routes will form a network along branch roads so that a constant water pressure and water supply volume can be maintained throughout the Project Site. Networking will also prevent the occurrence of residual water. The field survey will ensure optimal routing taking the existing underground facilities into consideration.

(4) Diameter and Type of Pipes

1) Pipe Diameter

The pipe diameters of the water supply branch lines (diameter: 300-600mm) will be compatible with those set by the Giza Water Supply Study to ensure appropriate water distribution. Comparison between the pipe diameters given in the request for the Project by the Government of Egypt and the contents of the Giza Water Supply Study revealed some discrepancies in the pipe diameters of branch lines. In order to ensure the desired water supply volume to the Project Site, the requested pipe diameters of some branch lines have been changed as shown in Table 5-7 to conform to those of the Giza Water Supply Study.

Table 5-7 Changed Pipe Diameters of Water Supply Branch Lines

Changed Section	Length (m)	Pipe Diameter in Request (mm)	Pipe Diameter Set by Giza Water Supply Plan
El Cornesh Street	approx. 20 approx. 830	500 500	600 400
Section between Konayssah Canal Street and Terra Nirsa Street	approx. 370	300	400

2) Type of Pipes

The type of the pipes for the water supply branch lines will be decided based on the following criteria.

- maximum use of Egyptian products
- safety for internal pressure
- safety for external pressure
- suitability for site conditions
- no adverse impact on water quality
- high watertightness
- high durability
- resistance to ground deformation
- good workability
- easy maintenance
- low maintenance cost

a) Type of Pipes to be Examined

The following types will be examined for use in the Project in view of past application in Egypt, availability, quality, economical aspect and workability, etc.

- ductile cast iron pipes
- steel pipes
- asbestos cement pipes
- PVC pipes

b) Water Supply Branch Lines (diameter: 300-600mm)

Ductile cast iron pipes have been selected for both straight pipes and pipe fittings (bend and tee branch, etc.) for water supply branch lines (diameter: 300-600mm) because of the following reasons.

- wide use and availability in Egypt
- use in Omrania West Project with no problems
- sufficient strength against internal and external pressures
- better corrosion-resistance, better workability and lower cost than steel pipes
- superior durability and workability than fragile asbestos cement pipes
- maximum diameter of PVC pipes manufactured in Egypt of 250mm

- prospect of strongly contributing to economic development and increased employment opportunities in Egypt

3) Water Supply Branch Lines (diameter: less than 300mm)

PVC pipes have been selected for both straight pipes (diameter: 100-200mm) and bends (diameter: 100mm) for water supply branch lines because of the following reasons.

- availability in Egypt
- better workability and lower cost than fragile asbestos cement pipes
- better workability and lower cost than steel pipes and ductile cast iron pipes

Cast iron pipes have been selected for tee branches (diameter: 100-200mm) and bends (diameter: 200mm) because of the following reasons.

- non-availability of irregular PVC pipes of these diameters
- availability of cast iron pipe fittings of these diameters in Egypt
- quality of these cast iron pipe fittings confirmed by GCWSA

(5) Ancillary Equipment

The following plan for such ancillary equipment as gate valves and air valves, etc. has been prepared based on agreement with GCWSA and also taking the relevant Japanese standards (as stipulated in the Design Criteria for Water Works Facilities published by the Japan Water Works Association) and the relevant plan for the Omrania West Project into consideration.

1) Gate Valves

Gate valves will be installed at both connection and branching off points between the existing water supply lines and the new water supply branch lines to be constructed under the Project. The main specifications are as follows.

a) Types : butterfly valve (for pipes with a diameter of 400mm or more)
sluice valve (for pipes with a diameter of less than 400mm)

b) Material : ductile cast iron

c) Joint Type : flange joint (for flexible pipes in and out of the valve chamber)

d) Valve Chamber Structure : flexible pipe on both sides of the valve chamber and expansion pipe inside the valve chamber

2) Wash-Out Valves

Wash-out valves will be installed at some low pipeline sections, including concave sections and the railway crossing point. The main specifications are as follows.

a) Types : sluice valve

b) Diameter : 100mm (for a water line diameter of not more than 300mm)
150mm (for a water line diameter of 400mm or more)

c) Joint Type : flange joint

d) Wash-out Method : The higher elevation of these wash-out pipes than that of the design flood water level of the Zomor Canal (AD+19.25m) makes gravity drainage impossible. A drainage pit will be installed and wash-out operation will be conducted using a mobile submersible pump.

3) Air Valves

Air valves will be installed at some high pipeline sections, including convex sections and aqueduct. The main specifications are as follows.

a) Types : single mouthed air valve (for pipes with a diameter of not more than 300mm)
dual mouthed air valve (for pipes with a diameter of 400mm or more)

b) Accessory : gate valve to be installed to help repair work in the future

c) Joint Type : flange joint

d) Miscellaneous : steel cover to be provided for air valves at aqueduct to prevent damage or theft

4) Fire hydrant

The locations of fire hydrant must be convenient for fire-fighting activities. Fire hydrants will be installed at intervals of some 150m along water supply branch lines (diameter: 300-600mm) and intervals of some 150-200mm along lesser branch lines (diameter: less than 300mm). The main specifications are as follows.

a)	Types	: single jet hydrant (for pipes with a diameter of 100mm or more but less than 300mm) dual jet hydrant (for pipes with a diameter of 300mm or more)
b)	Accessory	: gate valves will be installed to help repair work in the future
c)	Miscellaneous	: diameter and thread to be compatible with those of fire hoses used in Egypt

5) Protection of Pipe Fittings

Concrete blocks, the specifications of which are given in Basic Design Drawing EMU-W-04, will be used for the protection of pipe fittings.

(6) Construction Method and Type of Pipes

As described earlier in 5-1-5-(2), the scope of work for the Japanese side will be limited to the laying of the water supply branch line at the railway crossing section using the sleeve pipe jacking method and to connection work with the existing water supply trunk line using the under-pressure drilling and tapping method.

1) Ordinary Sections of Water Supply Branch Lines

For ordinary sections of water supply branch lines, the materials will be provided by the Japanese side while the actual construction work using the open-cut method will be conducted by the Egyptian side using its own funds.

The type of pipe and joint method for ordinary sections which are outside the scope of the Japanese responsibility are described below.

a) The ductile cast iron pipe is selected because of its proven reliability in Egypt as described in 5-3-1-(4).

b) The push-on type joint is selected in view of its workability, low cost and good watertight performance.

2) Railway Crossing Section

a) The pipe jacking method will be employed at the railway crossing section to ensure safe and undisrupted train operations. The actual method will be the sleeve pipe jacking method with reinforced concrete pipes (minimum diameter: 1,800mm) which will also be used for the construction of the sewer trunk line to ensure easy pipe laying work and low construction cost.

The sleeve pipe jacking method is illustrated in Fig. 5-4 and further details are given in Basic Design Drawing EMU-W-05.

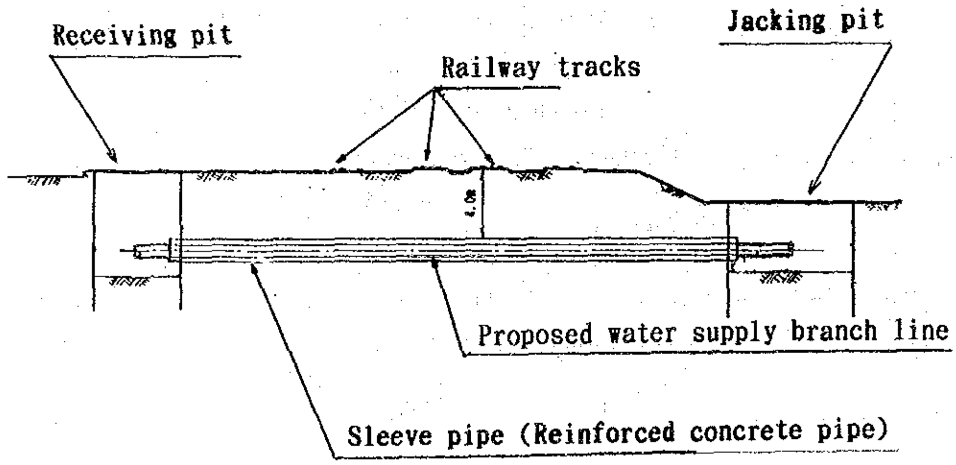


Fig. 5-4 Sleeve Pipe Jacking Method for Railway Crossing Section

b) The water supply pipe (diameter: 500mm) will be laid inside the sleeve pipe. A valve chamber equipped with a gate valve and wash-out valve will be installed at both ends of the sleeve pipe.

c) The actual method to be used will be the slurry semi-shield jacking method which will also be used for the construction of the sewer trunk line to be described later in 5-3-2-(6).

d) Ductile cast iron pipes will be used for the water supply branch line (diameter: 300-600mm). These pipes will be laid on a concrete foundation and will be fixed by a steel U-band to prevent horizontal deformation and/or movement.

e) The locations of the jacking pit and receiving pit and the depth of earth cover will be set as follows based on the construction conditions demanded by Egyptian State Railway for the Omrania West Project.

- The minimum distance from the edge of the railway tracks to the jacking pit or receiving pit will be 14-15m.
- The minimum depth of the upper side of the sleeve pipe from the railway track ground will be 3.5m.
- The commissioning of any work to the Egyptian State Railway will be conducted by Giza City, if necessary.

3) Aqueduct

An aqueduct will be introduced at the Zomor Canal crossing section in view of the difficulty of underground construction work, construction cost, operation and maintenance requirements in the future and the present technological level of the Egyptian side. Such an aqueduct was also introduced in the Omrania West Project.

The materials for the aqueduct will be provided by the Japanese side and the actual construction work will be conducted by the Egyptian side.

The location and design conditions described below have been decided through discussions between the Study Team and the Giza Irrigation Bureau as well as GCWSA. The aqueduct is illustrated in Fig. 5-5 and details are given in Basic Design Drawing EMU-W-06.

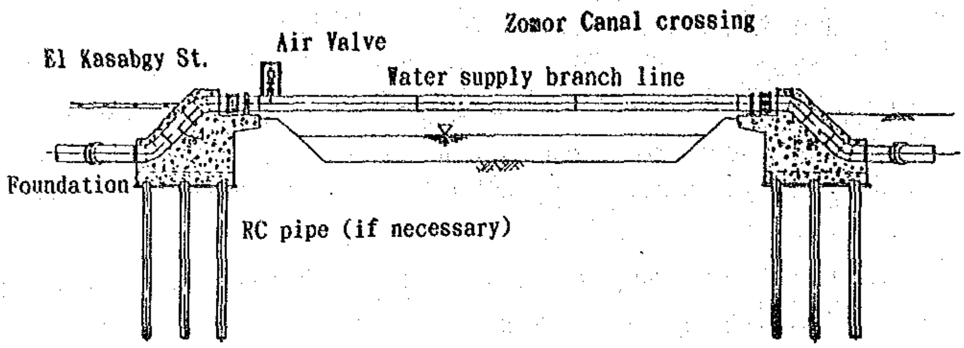


Fig. 5-5 Aqueduct

a) The aqueduct in question will be introduced in the lowerstream of the existing bridge over the Zomor Canal where the canal width is narrower than other sections to minimise the construction cost and to make the work easier.

b) The diameter of the aqueduct will be 500mm as stipulated by the Giza Water Supply Study.

c) The aqueduct will be made of steel.

d) A minimum margin of 1.0m will be allowed between the design high water level of the canal and the lower face of the aqueduct.

e) Flexible pipes will be used at both ends of the aqueduct in view of possible uneven settlement.

f) An air valve will be installed at the convex section of the aqueduct and will be protected by a steel cover to prevent theft.

g) Expansion pipes will be used at both ends of the aqueduct in view of the expansion and contraction of the steel pipes.

4) Connection with Existing Trunk Line by Under-Pressure Drilling and Tapping Method

The water supply branch line (diameter: 600mm) to serve the Project Site will be buried under El Cornesh Street along the South Giza Waterworks. As this will branch off from the existing trunk line (diameter: 1,000mm) near the entrance to the Waterworks, connection work will be required.

If this connection work is conducted using a method which temporarily suspends the water supply through the existing trunk line, a wide area in Giza City will be affected by the suspended water supply for a few days. In addition, there is a strong likelihood that muddy water would be supplied with the recommencement of water supply. Therefore, the under-pressure drilling and tapping method, adopted in the Omrania West Project and highly evaluated by the Egyptian side due to the absence of disruption to water supply and the non-occurrence of muddy water, will again be adopted for the connection work in question.

The under-pressure drilling and tapping method is illustrated in Fig. 5-6

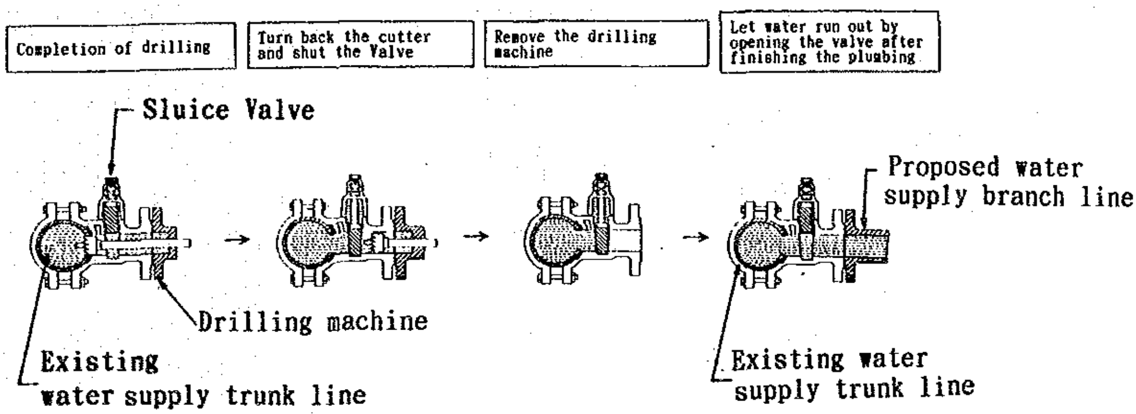
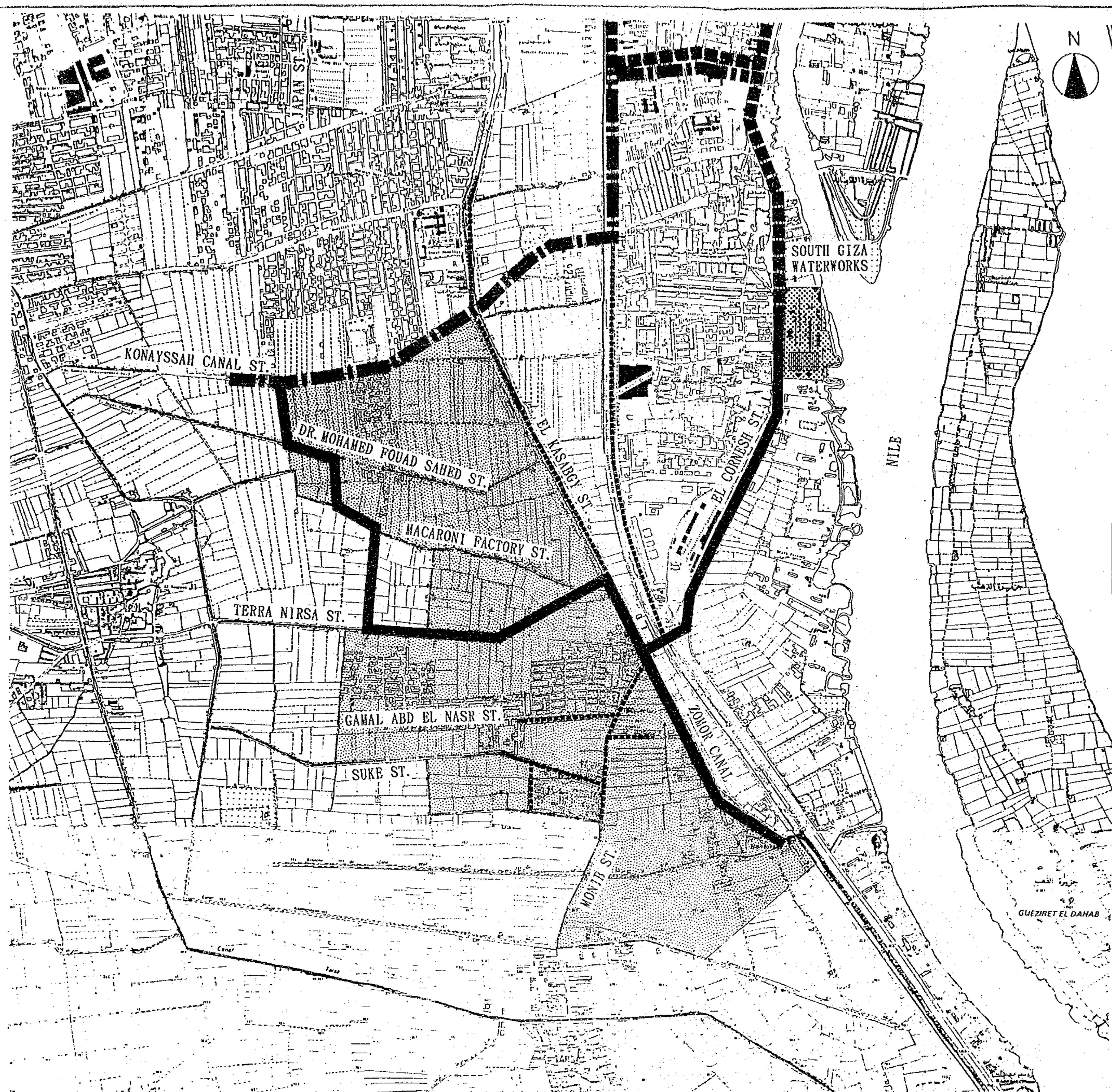


Fig. 5-6 Under-Pressure Drilling and Tapping Method

(7) Basic Design Drawings

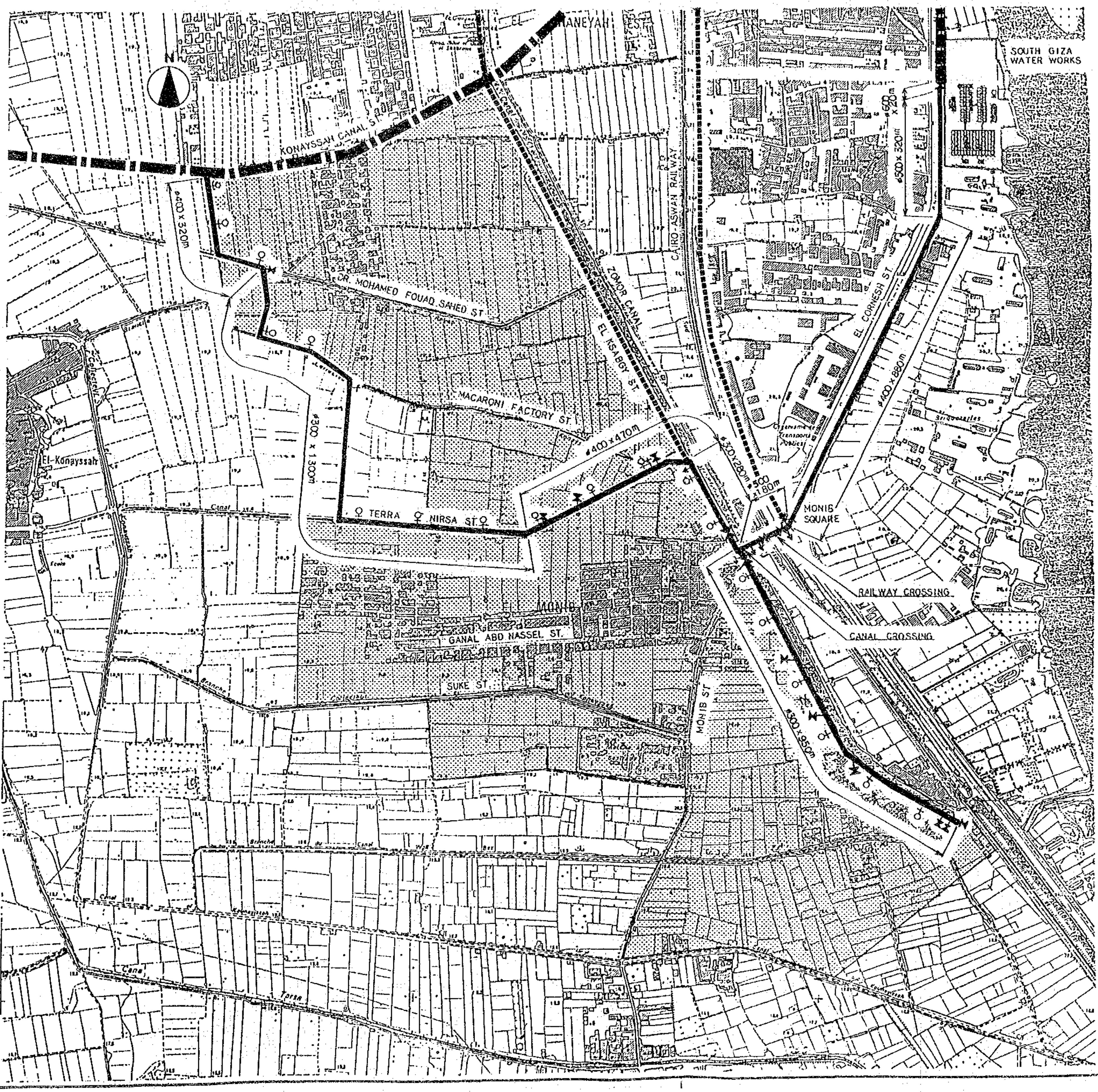
The basic design drawings for the water supply facilities planned in the Project are listed below.

EMU-W-01	Plan for Water Supply Facilities
EMU-W-02	Plan for Water Supply Branch Line Facilities (Diameter: 300-600mm)
EMU-W-03	Standard Structure of Ancillary Equipment (No.1)
EMU-W-04	Standard Structure of Ancillary Equipment (No.2)
EMU-W-05	Plan and Cross-Section of Railway Crossing Point
EMU-W-06	Plan and Cross-Section of Canal Crossing Point



THE ARAB REPUBLIC OF EGYPT GIZA CITY, GIZA GOVERNORATE				SCALE
THE PROJECT FOR THE WATER SUPPLY AND SEWER SYSTEM UPGRADING IN MONIB				DWG. No.
Plan for Water Supply Facilities				EMU-W-01
DATE	DESIGNED	CHECKED	APPROVED	REVISION
JAPAN INTERNATIONAL COOPERATION AGENCY				

PLAN OF APPURTENANCES FOR WATER SUPPLY BRANCH LINE (ø300～ø600) S = 1 / 5 000



REGEND

- PLANNED WATER SUPPLY TRUNK LINE (ø1200)
- EXISTING WATER SUPPLY TRUNK LINE
- PROPOSED WATER SUPPLY BRANCH LINE (ø300～ø600)
- EXISTING WATER SUPPLY BRANCH LINE
- AIRRELIEF VALVE
- WASH-OUT VALVE
- FIREHYDRANT
- VALVE
- PROJECT SITE

NOTES

1. FOR THE DETAIL OF RAILWAY CROSSING, SEE DRAWING NO. EMU-W-05.
2. FOR THE DETAIL OF CANAL CROSSING, SEE DRAWING NO. EMU-W-06.
3. FOR THE DETAIL OF VALVE CHAMBERS, SEE DRAWING NO. EMO-W-03.

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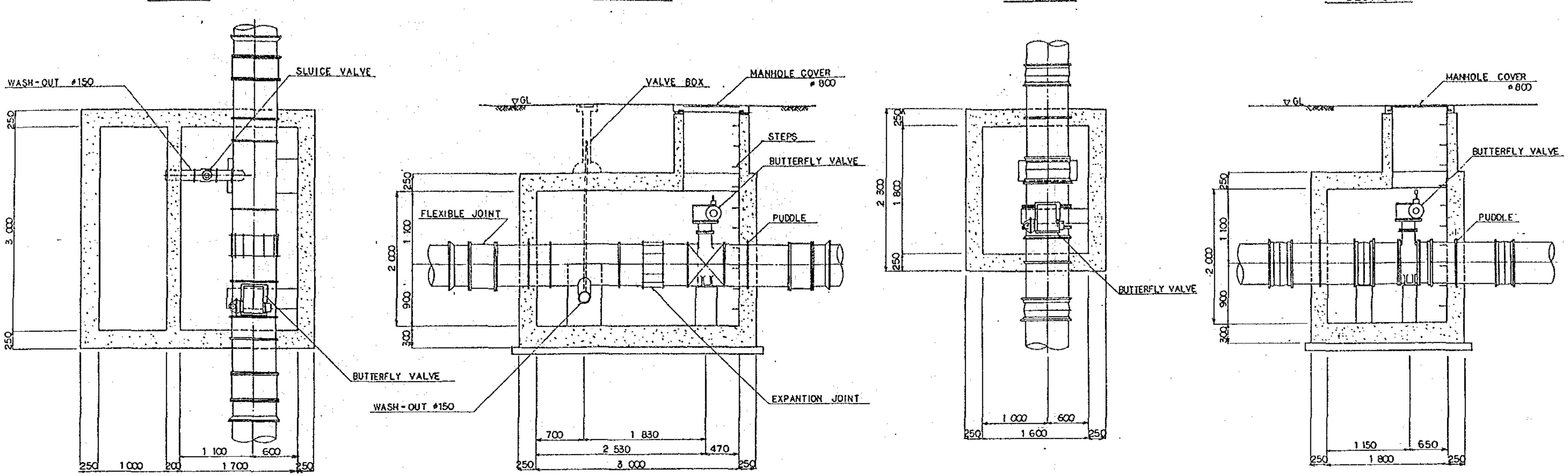
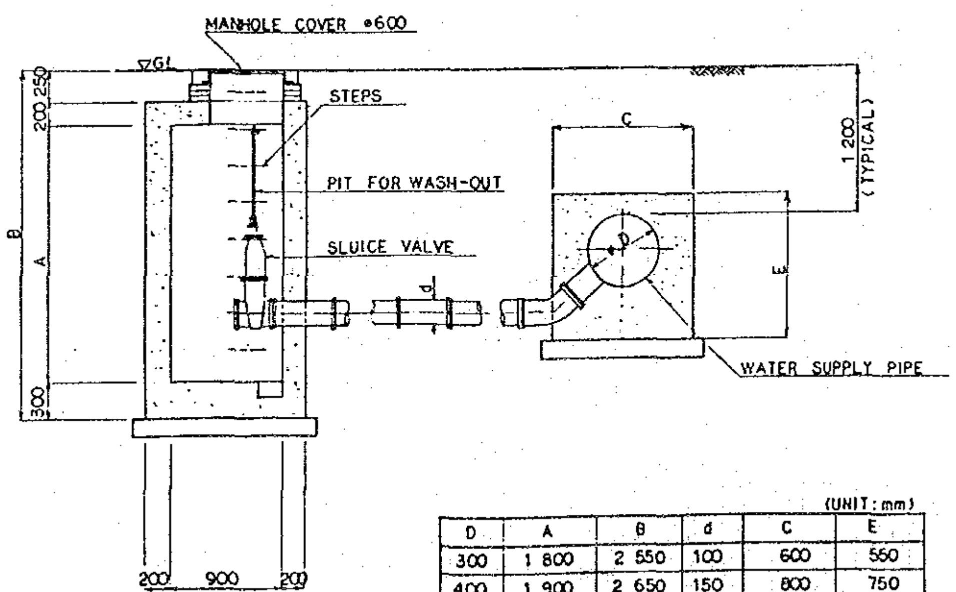
VALVE CHAMBER

TYPE - A
(FOR ø500 BATTERFLY VALVE CHAMBER WITH WASH-OUT)

TYPE - B
(FOR ø400 BATTERFLY VALVE CHAMBER)



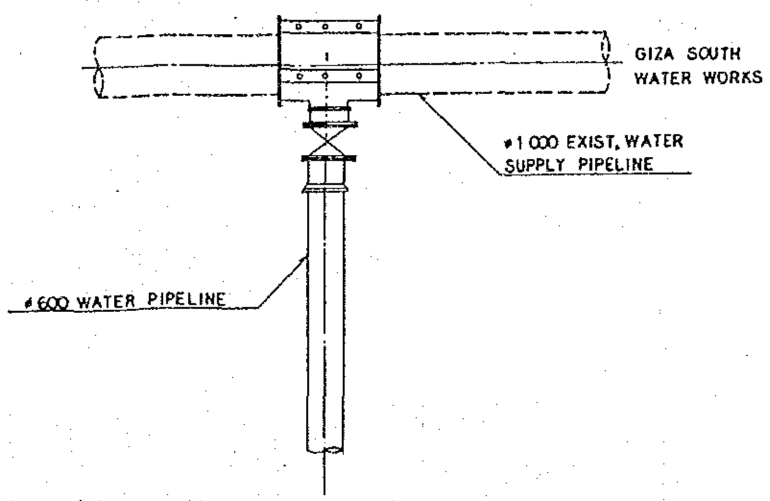
WASH-OUT VALVE CHAMBER
S=1:30



(UNIT: mm)

D	A	B	d	C	E
300	1 800	2 550	100	600	550
400	1 900	2 650	150	800	750
500	2 000	2 750	150	1 000	900
600	2 100	2 850	150	1 200	1 050

CONNECTION



THE ARAB REPUBLIC OF EGYPT GIZA CITY, GIZA GOVERNORATE	SCALE
THE PROJECT FOR THE WATER SUPPLY AND SEWER SYSTEM UPGRADING IN MONIB	DWG. No.
Standard Structure of Ancillary Equipment (No.1)	EMU-W-03

DATE	DESIGNED	CHECKED	APPROVED	REVISION

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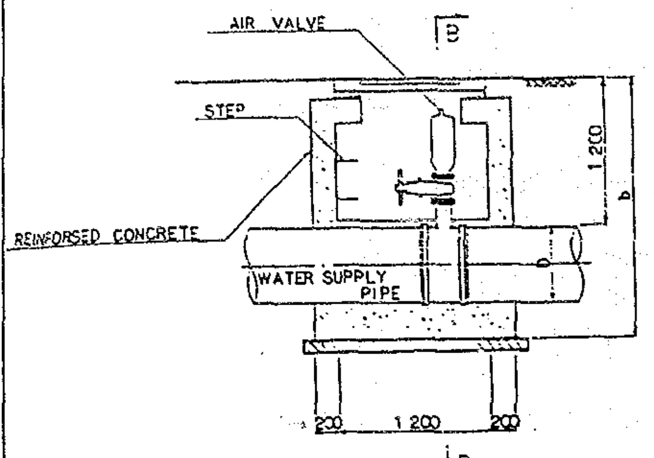
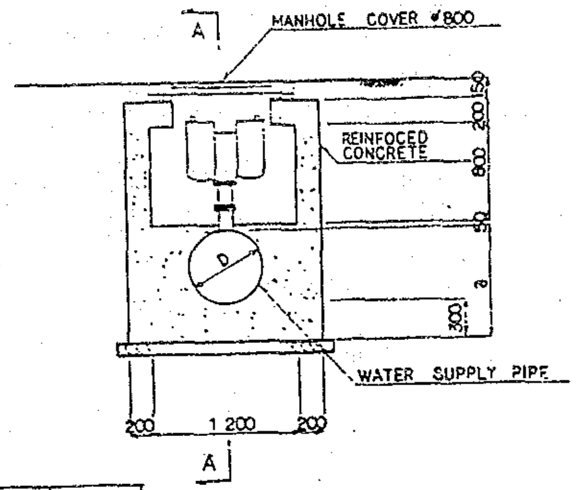
AIR RELIEF VALVE CHAMBER
S=1:30

SECTION A — A

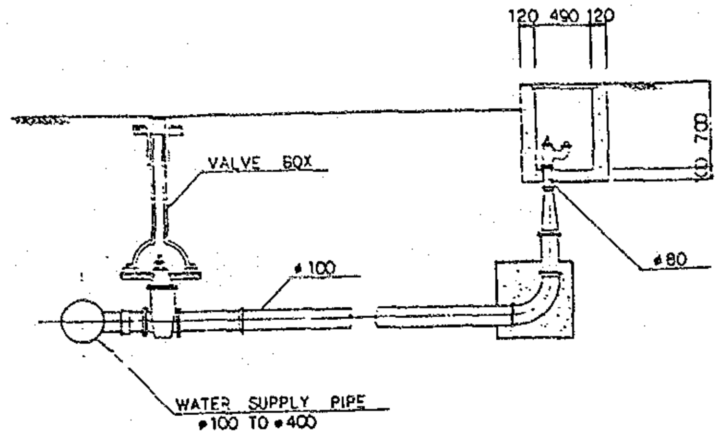


SECTION B — B

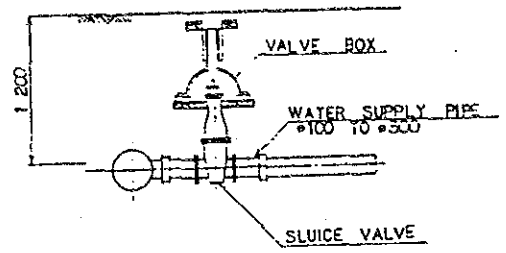


D (mm)	a (mm)	d (mm)
400	700	1 900
500	800	2 000
600	900	2 100

FIRE HYDRANT
S=1:30



VALVE BOX FOR ø100 TO ø300
S=1:30



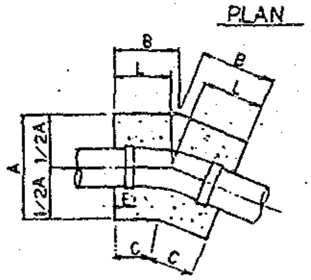
NOTE

1. FOR THE ARRANGEMENT OF AIR RELIEF VALVE CHAMBER, FIRE HYDRANT AND VALVE BOX, SEE DRAWING NO. EMU-W-02.

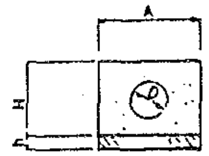
ANCHOR BLOCK FOR BEND AND TEE
S=1:50

IN CASE OF 22 1/2° BEND

PLAN

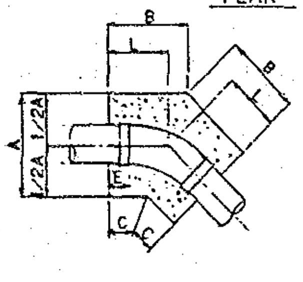


SECTION

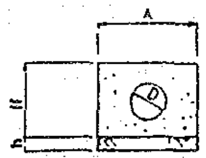


IN CASE OF 45° BEND

PLAN

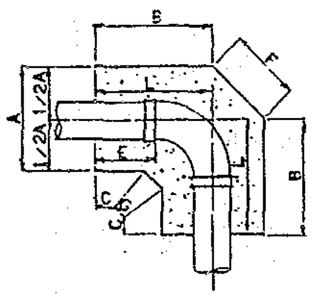


SECTION

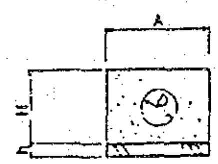


IN CASE OF 90° BEND

PLAN

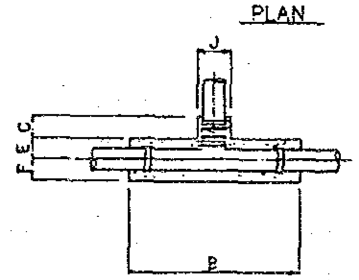


SECTION

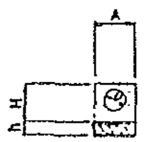


IN CASE OF TEE

PLAN



SECTION



D	A	B	C	E	H	h	L
100	320	—	—	200	310	150	—
200	430	—	—	200	410	150	—
300	620	671	382	200	520	150	527
400	1 300	830	570	250	900	200	700
500	1 400	940	660	300	1 000	200	800

D	A	B	C	E	H	h	L
100	320	473	341	200	310	150	—
200	430	588	382	200	410	150	—
300	620	671	410	200	520	150	527
400	1 300	970	430	270	900	200	700
500	1 400	1 090	510	290	1 000	200	800

D	A	B	C	E	F	G	H	h	L
100	350	424	278	200	373	83	310	150	—
200	450	513	326	200	538	166	410	150	—
300	650	624	355	449	746	207	700	200	950
400	1 300	1 150	300	490	920	300	900	200	1 150
500	1 400	1 560	650	800	990	240	1 000	200	1 560

D	A	B	C	E	F	H	h	J
100	300	1 010	255	130	170	310	150	260
200	450	1 180	300	180	270	410	150	360
300	550	1 330	305	230	320	520	200	470
400	1 300	1 800	—	550	650	900	200	1 300
500	1 400	2 400	—	700	700	1000	200	1 400

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THE PROJECT FOR THE WATER SUPPLY AND SEWER SYSTEM UPGRADING IN MONIB		DWG. No.
Standard Structure of Ancillary Equipment (No.2)		EMU-W-04
DATE | DESIGNED | CHECKED | APPROVED		REVISION
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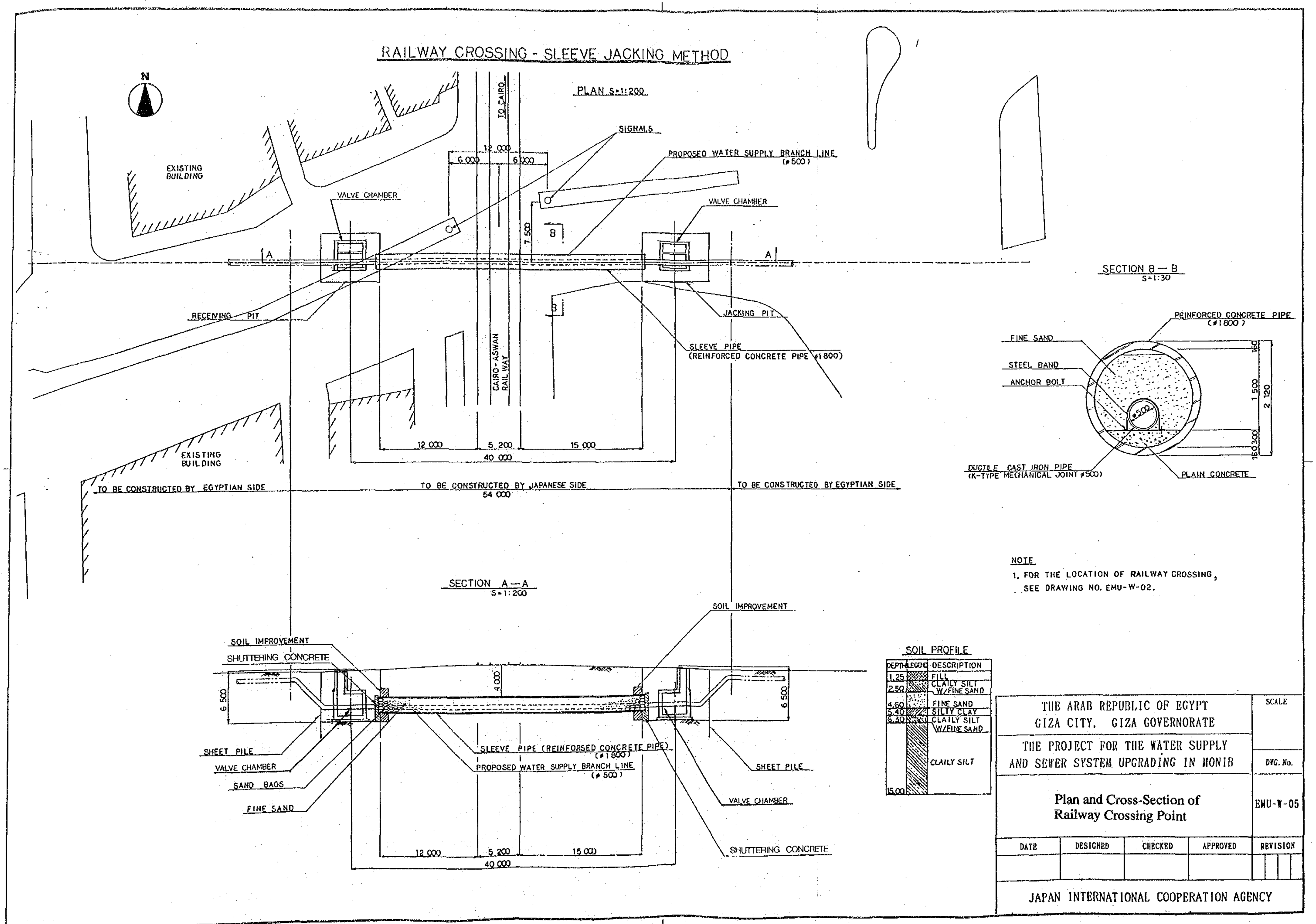
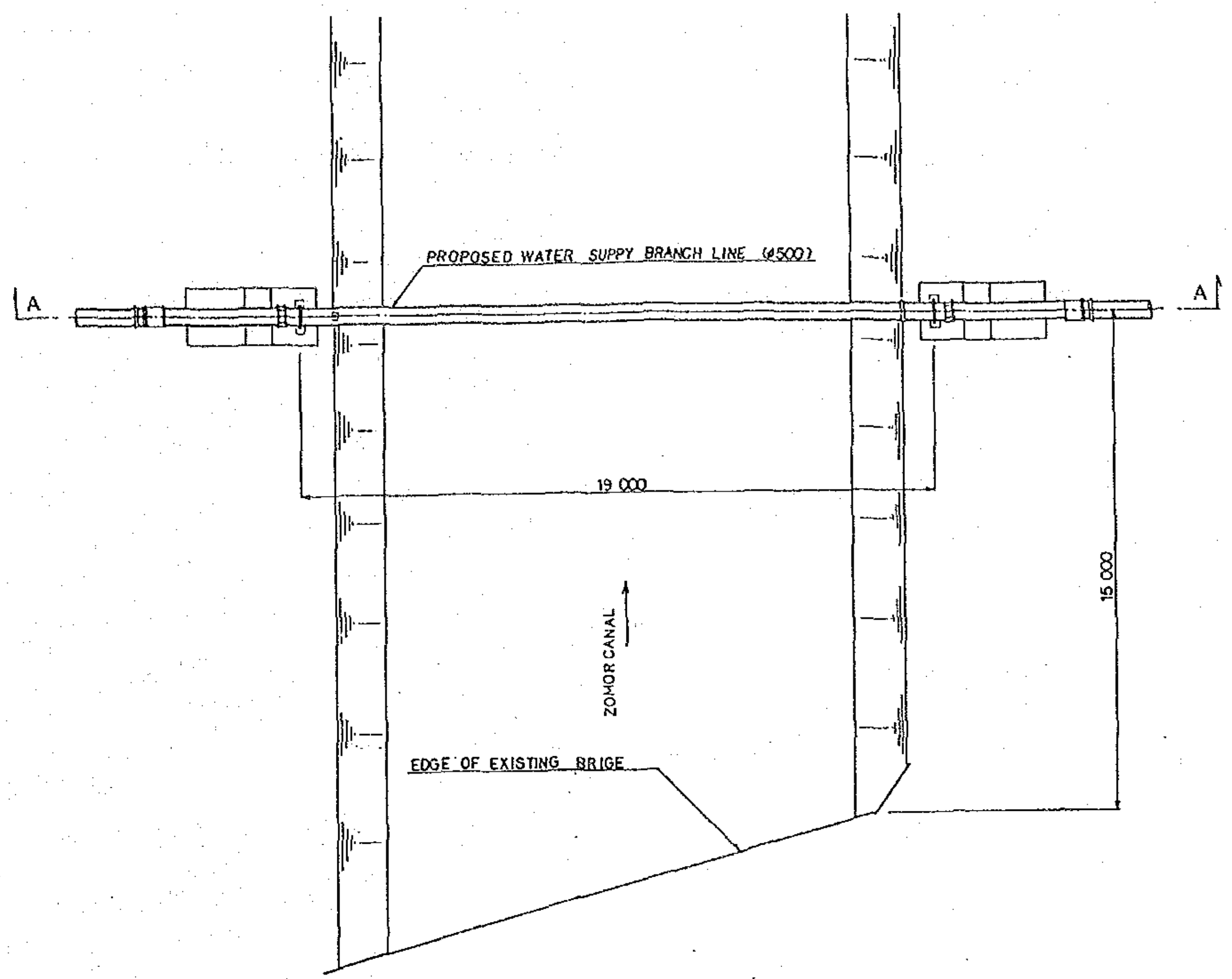


THE ARAB REPUBLIC OF EGYPT GIZA CITY, GIZA GOVERNORATE		SCALE
THE PROJECT FOR THE WATER SUPPLY AND SEWER SYSTEM UPGRADING IN MONIB		DWG. No.
Plan and Cross-Section of Railway Crossing Point		EMU-W-05
DATE	DESIGNED	CHECKED
APPROVED		REVISION

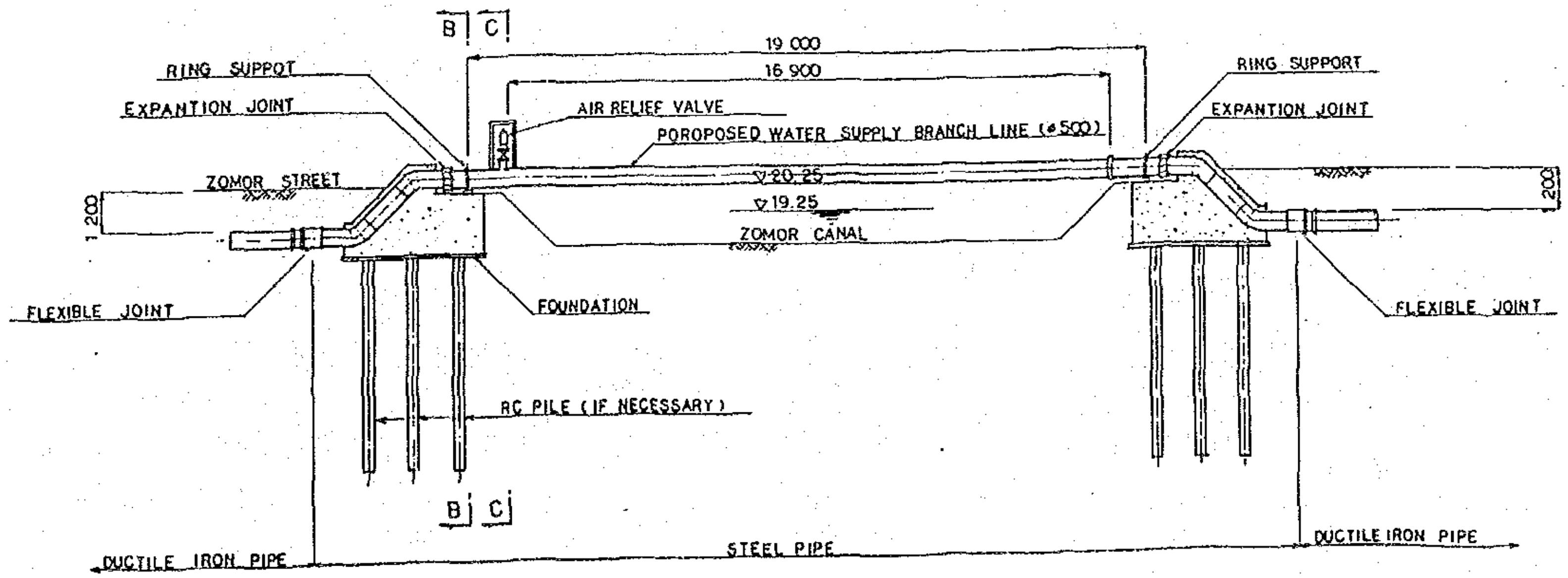
JAPAN INTERNATIONAL COOPERATION AGENCY

CANAL CROSSING - AQUEDUCT

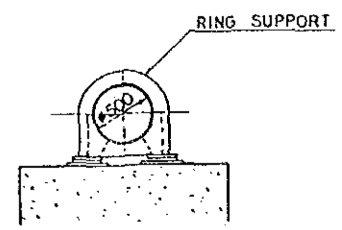
PLAN S:1:100



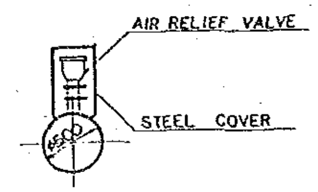
SECTION A — A S:1:100



SECTION B — B S:1:30



SECTION C — C S:1:30



NOTE

1. FOR THE LOCATION OF CANAL CROSSING, SEE DROWING NO. EMU-W-02.
2. PIPING MATERIALS FOR AQUEDUCT SHALL BE PROVIDED BY JAPANESE SIDE AND THE CONSTRUCTION OF AQUEDUCT INCLUDING FOUNDATIONS SHALL BE CARRIED OUT BY EGYPTIAN SIDE.

THE ARAB REPUBLIC OF EGYPT GIZA CITY, GIZA GOVERNORATE				SCALE
THE PROJECT FOR THE WATER SUPPLY AND SEWER SYSTEM UPGRADING IN MONIB				DWG. No.
Plan and Cross-Section of Canal Crossing Point				EMU-W-06
DATE	DESIGNED	CHECKED	APPROVED	REVISION
JAPAN INTERNATIONAL COOPERATION AGENCY				

5-3-2 Sewer Facilities Plan

The basic plan for the sewer facilities will be prepared based on the design policies described in 5-1-5-(3) while attempting to achieve compatibility with the Abu Nomros Main Collector Project currently being implemented and the No.5 (B) Pump Station Project planned by GOSD, and also taking the field survey results into consideration. The basic processes for the preparation of the basic plan for sewer facilities, including the sewer trunk line, for the Project are shown in Fig. 5-7.

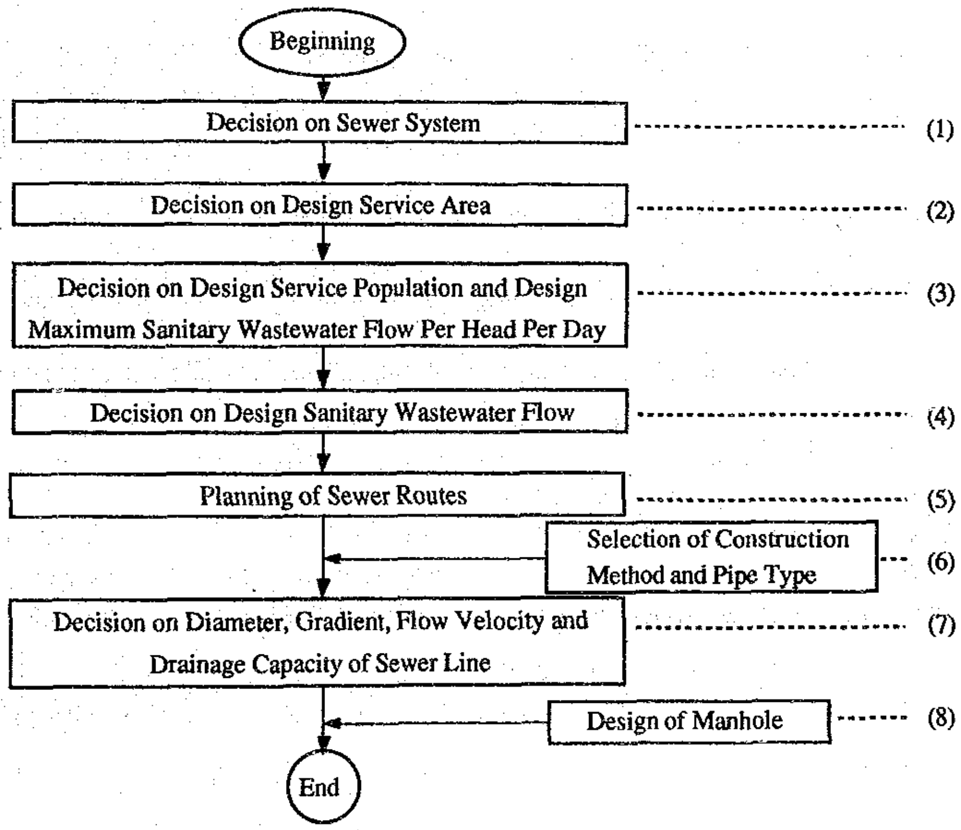


Fig. 5-7 Basic Plan Flow for Sewer Facilities

Each of the above processes is described in further detail below.

(1) Sewer System

The combined system whereby sewage and rainwater are drained in the same channel will be adopted. In preparing the basic design, stormwater will be ignored as the mean monthly rainfall is as low as some 2mm. The design wastewater flow will, therefore, consist only of sanitary sewage.

(2) Design Service Area

The design service area will consist of those described in 1) and 2) below.

1) Sewer Trunk Line

The sewer trunk line planned by the Project is part of the Abu Nomros Main Collector line, planned and currently under construction by GOSD. Fig. 5-8 shows the route of the Abu Nomros Main Collector line and its drainage area.

2) Sewer Branch Lines

The design drainage area for the sewer branch lines to be constructed under the Project will be the Project Site (185ha) shown in Basic Design Drawing EMU-S-01.

(3) Design Service Population and Design Maximum Sanitary Wastewater Flow

1) Design Service Population

In accordance with the Upgrading Water Supply and Sewer System in South Giza, the design service population in the target year (2010) is 247,000.

2) Design Maximum Sanitary Wastewater Flow

GOSD has set a maximum sanitary wastewater flow per head per day of 190 ltr (including infiltrated water such as groundwater) for the design of the Abu Nomros Main Collector line. This figure will also be used for the Project to ensure compatibility of the sewer facilities under the Project with those of other projects.

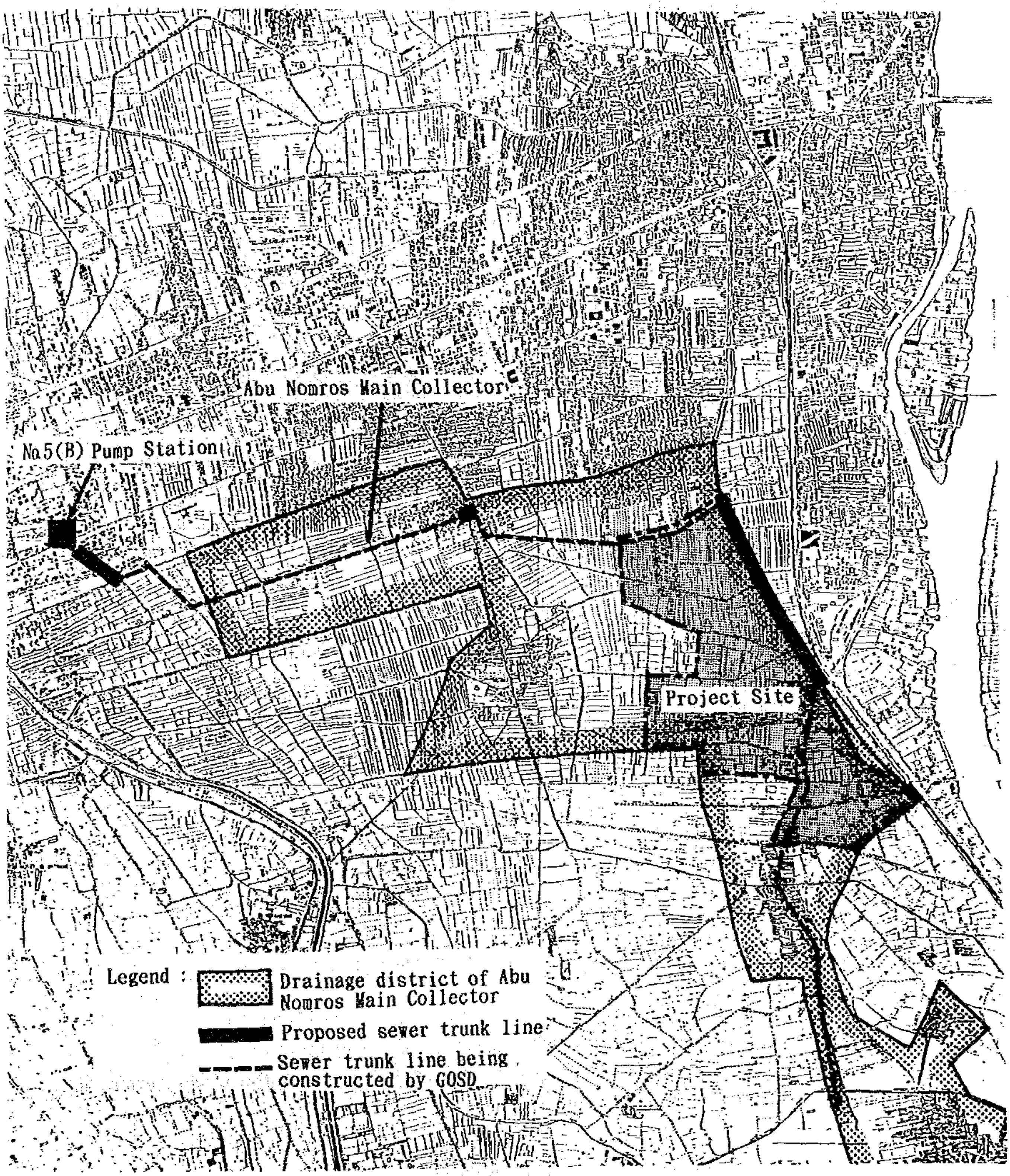


Fig. 5-8 Abu Nomros Main Collector Line and Its Drainage Area

(4) Design Sanitary Wastewater Flow

1) Design Maximum Sanitary Wastewater Flow Per Hour

The design of the sewer size will be based on the design maximum sanitary wastewater flow per hour per hectare which is calculated using the following equation.

Equation to Calculate Design Max. Sanitary Wastewater Flow Per Hour

Design Max. Sanitary Wastewater Flow Per Hour Per Unit Area (Qu) ($m^3/sec/ha$)

$$= \frac{\text{Domestic Sanitary Wastewater + Groundwater Infiltration}}{24 \times 60 \times 60 \times \text{Drainage Area}} \times \text{Allowance Coefficient}$$

$$= \frac{\text{Design Max. Sanitary Wastewater Flow Per Head Per Day} \times \text{Design Service Population}}{86.400 \times \text{Drainage Area}}$$

$\times$ Allowance Coefficient

where,

Design Max. Sanitary Wastewater Flow Per Head Per Day	:	190 ltr/person/day
Design Service Population	:	247,000
Drainage Area	:	185ha
Allowance Coefficient	:	1.3 (trunk line)
	:	1.8 (branch line)

The resulting design maximum sanitary wastewater flow per hour (Qu) is shown in Table 5-8. The allowance coefficient used is the same as that used by GOSD for the Abu Nomros Main Collector line for the sewer trunk line. The standard allowance coefficient in Japan, i.e., 1.8, will be used for sewer branch lines.

Table 5-8 Design Maximum Sanitary Wastewater Flow Per Hour (Qu)

	Qu ($m^3/sec/ha$)
Sewer Trunk Line	0.00382
Sewer Branch Line	0.00528

2) Sanitary Wastewater Inflow

The sanitary wastewater flow (Q) drained flowing into the sewer system is calculated using the following equation.

Equation to Calculate Sanitary Wastewater Inflow (Q)

Q (m^3/sec) = Qu $\times$ Drainage Area (ha) Covered by Sewer System

(5) Planned Routes

1) Sewer Trunk Line

The sewer trunk line for the 3 sections listed in Table 5-9 will be constructed by the Japanese side. These sections are part of the Abu Nomros Main Collector line, the planning of which commenced by GOSD in 1986 to consolidate the sewer network for an area of 1,450ha in south Giza, including the Monib District. Although construction work is currently underway using the open-cut method, these 3 sections appear to be beyond the technical capability of the Egyptian side because of the required burying depth, geological conditions, construction conditions and groundwater level, etc., necessitating Japanese technical assistance.

Table 5-9 Planned Sections of Sewer Trunk Line

Section	Length
Kordy Street (Inflow Site to No.5 (B) Pump Station)	approx. 297m
Osman Moharam Street Crossing Point	approx. 80m
El Kasabgy Street (along Zomor Canal)	approx. 1,377m

a) Kordy Street Section

As shown in Basic Design Drawing EMU-S-01, this section will form the end part of the Abu Nomros Main Collector line and will be connected to the No.5 (B) Pump Station (using screw pumps with a drainage capacity of 190,000m^3/day) planned by GOSD. Kordy Street is a narrow street with a width varying from 5m to 7m and is lined with buildings right to the edges. The existing sewer line is buried at a depth of approximately 4m and is connected to the existing No.5 (A) Pump Station (using centrifugal pumps with a drainage capacity of 30,000m^3/day).

b) Osman Moharam Street Crossing Section

This section crosses Osman Moharam Street which is a 15-20m wide important trunk road connecting Pyramid Street, a major trunk road in Giza, and the Konayssah District in south Giza.

c) El Kasabgy Street Section

This section consists of El Kasabgy Street running along the Zomor Canal. El Kasabgy Street connects Pyramid Street and the Project Site. It has a relatively narrow width of 9-12m and is lined to the edges in some parts by buildings.

d) Demarcation Point Between Project-Related Section and Section Constructed by GOSD

The demarcation point between the sewer trunk line to be constructed under the Project and the sewer trunk line (Abu Nomros Main Collector line) currently under construction by GOSD will be the manhole to be installed at the end of the Project-related sewer trunk line. Following completion of the said manhole, GOSD will connect their trunk lines with the manhole.

The demarcation points between each of the 3 sections listed in Table 5-9 and the sections under construction by GOSD are shown in Basic Design Drawings EMU-S-02 and EMU-S-03.

2) Sewer Branch Lines

In the case of sewer branch lines, the materials will be provided by the Japanese side while the actual construction work will be conducted by the Egyptian side at its own expense. The planned routes for the sewer branch lines are described below.

a) Sewer Branch Lines (diameter: 300-600mm)

These lines will branch off from the sewer trunk line and will be constructed on the main road, such as Macaroni Factory Street and Suke Street. The planned routes for this type of branch line are outlined in Basic Design Drawings EMU-S-01 and EMU-MP-02.

b) Sewer Branch Lines (diameter: less than 300mm)

These lines will branch off from the larger branch lines (diameter: 300-600mm) and their routes and pipe diameters are described in 5-3-3 in line with the policies relating to the provision of piping materials described in 5-1-5-(4).

Fig. 5-9 shows the expected sewage flow in the Project Site when the trunk and branch lines are completed.

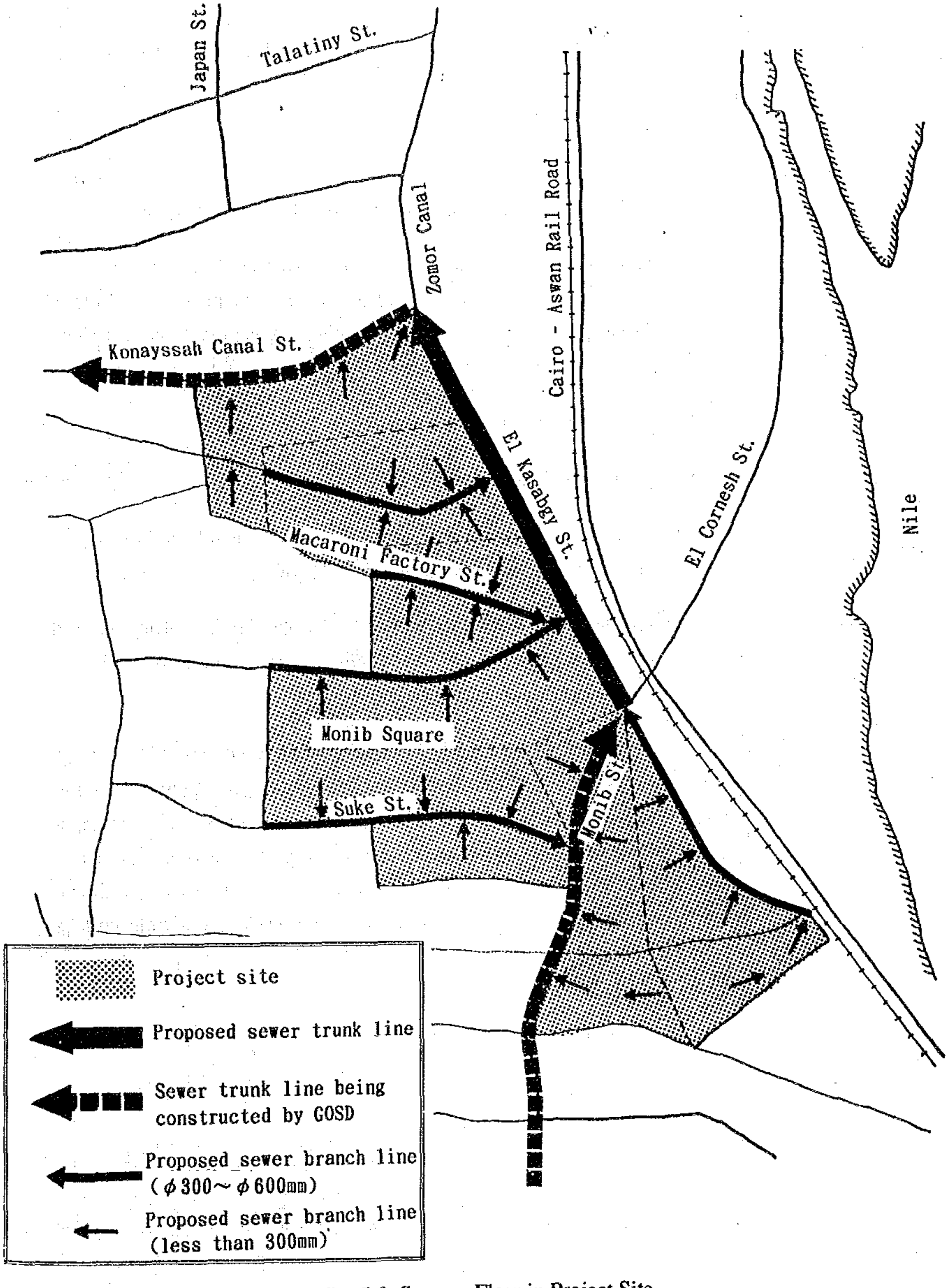


Fig. 5-9 Sewage Flow in Project Site

(6) Construction Method and Type of Pipes

1) Sewer Trunk Line

a) Construction Method

i) The pipe jacking method will be used because of the following reasons.

- If the open-cut method is used, many protection works and detours will be required along the planned route due to the presence of many underground public services. In comparison, the pipe jacking method will only require small sites to locate pits.

- The groundwater level in the area is high.

- The ground is soft with intricated soil layers.

- The pipe jacking method will ensure the safety of tall buildings (4-6 storeys) which are built right to the edges of streets.

- The pipe jacking method will minimise the potential for traffic jams and nuisance accompanying the construction work in view of the heavy traffic at the planned construction sites.

ii) The long span pipe jacking method (with a span of some 110-200m) will be used for the Project to minimise the number of both jacking and receiving pits in order to minimise noise and vibration hazards for local residents, to minimise adverse impacts on traffic and buried public services in the area and to keep the construction cost low. The locations of these pits are shown in Fig. 5-10. Following the completion of the work, a manhole will be installed at each pit location.

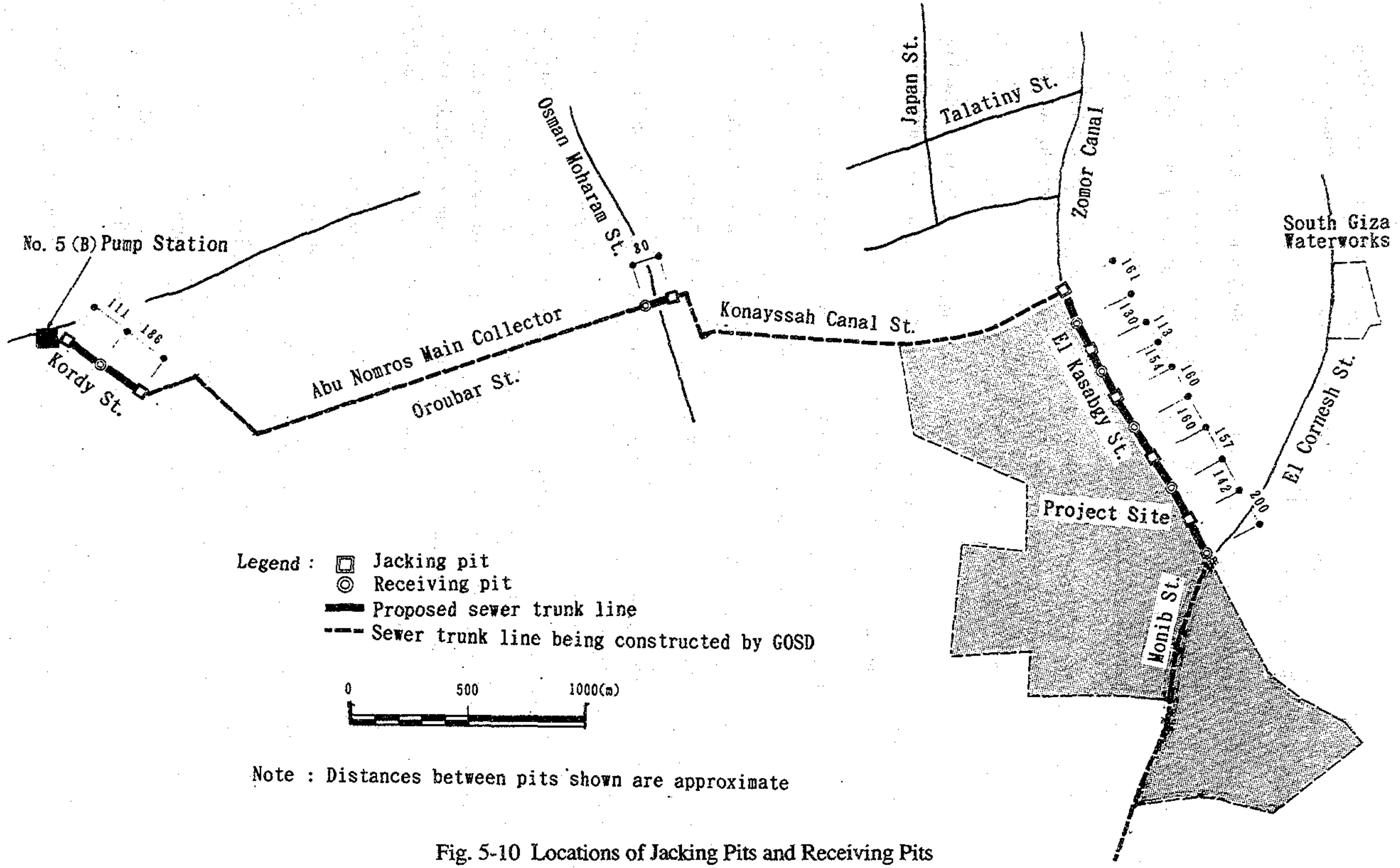


Fig. 5-10 Locations of Jacking Pits and Receiving Pits

iii) The actual construction method will be the slurry semi-shield jacking method which is a type of slurry pressure jacking method because of the following reasons.

- The selection of a method which is capable of dealing with various soil conditions is necessary due to the presence of groundwater at a depth of 1-3m below the ground surface and intricated clayey and sandy soil formations.

- This method will minimise the water drainage requirement during construction work, thereby reducing the burden of introducing measures to prevent ground subsidence.

- This method will keep ground loosening to a minimum to prevent damage to existing buildings and underground public services and to maintain their proper functioning.

- Excavation and concrete work at the ground surface which could have adverse effects on traffic will be minimised.

- The impacts on local residents and local traffic will be minimised as the ground structure necessitated by this method will be fairly small.

- This method have been proven both reliable and safe in the Omrania West Project.

The mechanical structure of the slurry semi-shield method is illustrated in Fig. 5-11. This method involves the provision of a bulkhead in front of the shielding machine to prevent collapse of the face. Slurry (specific gravity: 1.3-1.5) is poured into the space behind the bulkhead to give fluidity to the excavated soil there and to balance both the soil and water pressures at the face.

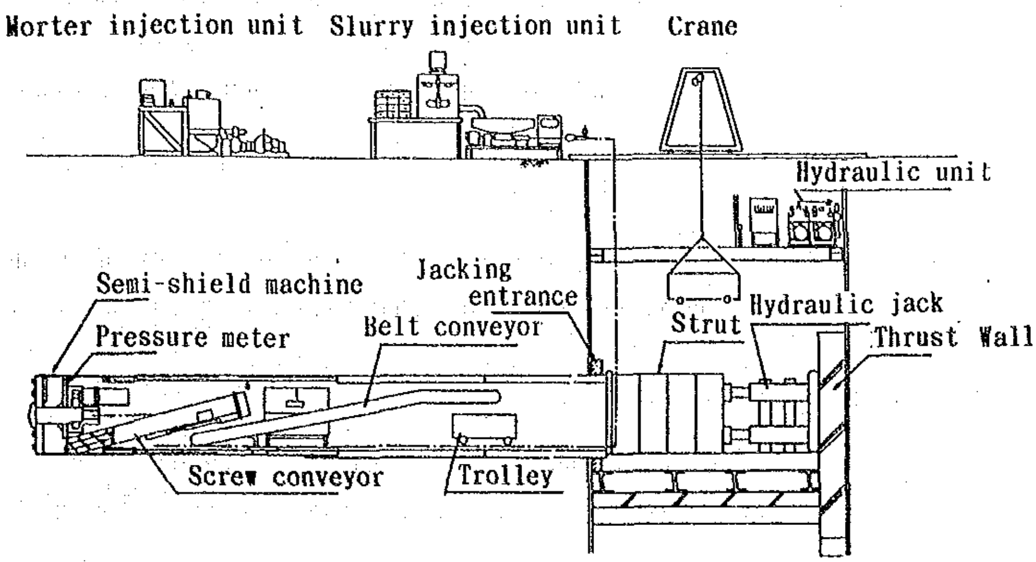


Fig. 5-11 Mechanical Structure of Slurry Semi-Shield Method

iv) Steel sheet piles or liner plates will be used for earth retaining purposes at the jacking and receiving pits. The El Kasabgy Street section of the planned sewer trunk line along the Zomor Canal is the longest section with buildings constructed right to the edges of the street. In addition, the street width is narrow in some parts. Liner plates will be used at the pit locations at narrow sections of the street squeezed by buildings for earth retaining purposes despite the relatively high cost in order to secure passage for traffic (pedestrians, vehicles and carts, etc.) and also to prevent damage to buildings, noise and vibration. Low cost steel sheet piles will be used at other pit locations along El Kasabgy Street and at the other 2 sections to shorten the construction period and in view of the absence of the hazards described above due to the availability of sufficient working areas.

v) The groundwater level in the Project Site is fairly high and clayey and sandy layers are intercalated. As a result, accidents may occur due to heaving or boiling during the pit construction stage. Ground improvement work will, therefore, be conducted to prevent such accidents in those places where safety must be ensured, such as areas around pit sites, pit bottoms and entrance part of jacking machine.

With regard to the Kordy Street section, the distance between the bottom of the manhole for the sewer line flowing into existing No.5 (A) Pump Station and the top of the jacking pipe for the planned trunk line flowing into the

No.5 (B) Pump Station will be as small as some 50cm. Ground improvement work will be conducted for the lower side of the existing manhole and surrounding areas to prevent accidents due to subsidence or deformation of the existing manhole, in turn caused by loose ground due to pipe jacking work.

Such ground improvement will be conducted using cement grouting to obtain the necessary strength and to prevent groundwater contamination.

b) Type of Pipes

Since the construction of the sewer trunk line will be conducted using the pipe jacking method, the pipes to be used must be suitable for this method.

i) Pipes Subject to Examination

The following types of pipe can be used for the pipe jacking method.

- ductile cast iron pipes
- steel pipes
- prestressed concrete pipes
- reinforced concrete pipes

ii) Selected Pipes

The use of reinforced concrete pipes has been decided because of the following reasons.

- Although ductile cast iron pipes are superior in terms of durability and strength, they are more expensive than reinforced concrete pipes. In addition, ductile cast iron pipes suitable for the pipe jacking method are not produced in Egypt.

- In addition to the questionable durability, steel pipes are more expensive than reinforced concrete pipes.

- While prestressed concrete pipes are produced in Egypt, each pipe is as long as some 6m, requiring a large pit and site. It would be difficult to secure passage for pedestrians and vehicles and to prevent other disturbances if these pipes were selected.

- There is no precedence in Japan of such long prestressed concrete pipes being used in association with the pipe jacking method, thus denying any prospect of using Japanese machinery. Consequently, there is no guarantee that the construction work would be completed on schedule.

- Reinforced concrete pipes are mass-produced in Egypt. They are both cheap and sufficiently strong and were used for the Omrania West Project. The relatively short length of some 2.5m/piece does not require a large site, in turn making it easy to secure safe passage for pedestrians and vehicles. The use of these pipes will minimise disturbance and hazards caused by construction work and there will be fewer technical problems. The Japanese contractor will be able to safely complete the work on schedule as he will be thoroughly conversant with the Japanese machinery to be used.

2) Sewer Branch Lines

a) Construction Method

The construction of the sewer branch lines will be conducted by the Egyptian side at its own expense using the open-cut method while the piping materials will be provided by the Japanese side.

b) Type of Pipes

Although both clay pipes and PVC pipes are believed to be suitable for these branch lines; clay pipes have been selected because of the following reasons.

- Wide use of clay pipes as small diameter (less than 600mm) sewer pipes in Egypt.

- Less expensive than PVC pipes.

- Limited production of PVC pipes in Egypt (maximum diameter of PVC pipes domestically produced: 250mm).

(7) Examination of Pipe Diameter, Gradient, Flow Velocity and Drainage Capacity

Manning's formula given below is used to examine the required pipe diameter, gradient, flow velocity and drainage capacity.

Manning's Formula

$$Q = W_A \times V$$

$$V = \frac{1}{n} \times R^{2/3} \times I^{1/2}$$

where, Q : flow rate (m^3/sec)
W_A : flow area (m^2)
W_P : wetted perimeter (m)
V : flow velocity (m/sec)
n : coefficient of roughness
R : hydraulic mean depth (m) = W_A/W_P
I : gradient

1) Abu Nomros Main Collector Line

The pipe diameter and gradient, etc. of the Abu Nomros Main Collector line planned by GOSD were examined. Fig. 5-12 shows the sanitary wastewater inflow at the lowest point of each section to be constructed under the Project which is part of the Abu Nomros Main Collector line. The required pipe diameter and other data collected on the basis of this inflow volume are given in Table 5-10, indicating that the planned sewer facilities will be sufficient to meet the drainage requirements.

Table 5-10 Required Pipe Diameter and Gradient of Abu Nomros Main Collector Line Planned by GOSD

Point of Examination (see Fig. 5-12)	Flow Rate to Main Collector Line: Q_a (m^3/sec)	Pipe Diameter (mm)	Gradient (‰)	Drainage Capacity: Q_f (m^3/sec)	$\frac{Q_a}{Q_f} \times 100$ (%)
A	1.815	1,600	0.56	1.987	91.3
B	2.225	2,000	0.35	2.848	78.1
C	2.86	2,000	0.35	2.848	100.4

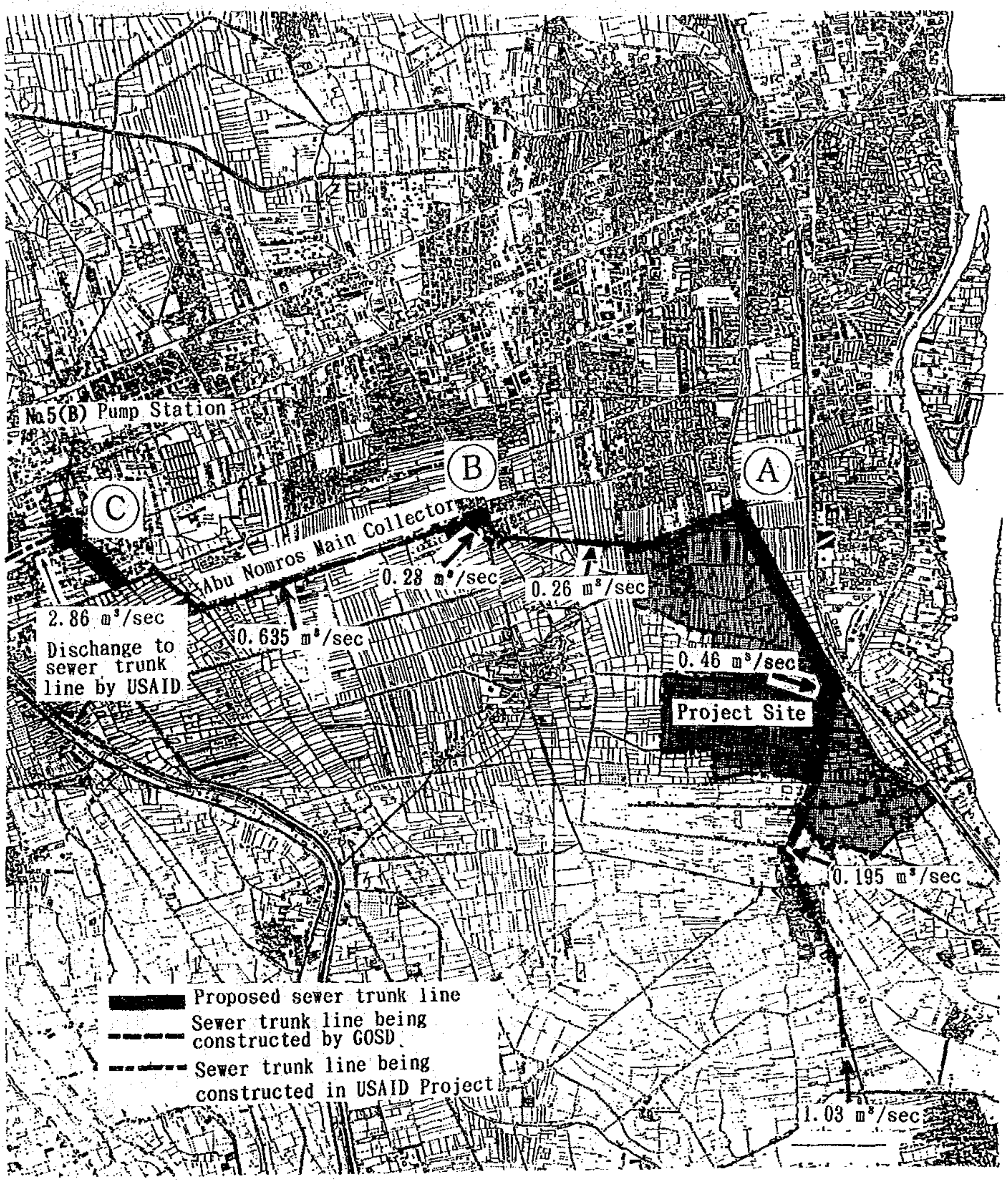


Fig. 5-12 Sewage Flow Rate of Abu Nomros Main Collector Line

2) Sewer Trunk Line Planned Under Project

The pipe diameter and gradient, etc. of the sewer trunk line planned under the Project will, in principle, conform to those of GOSD but will also be determined based on a comprehensive examination of the required flow rate, drainage capacity, construction period, economical aspect and workability.

The tentative jacking pipe diameters agreed upon with GOSD are shown in Fig. 5-14. Following thorough examination of the various factors involved, Plan 2 which involves 2 pipe diameter types, i.e., 1,800mm and 2,000mm, has been selected in view of the construction period, cost and minimum prospect of mechanical breakdown of the jacking machinery. This selection necessitates pipe diameter adjustment as illustrated in Fig. 5-13 for the El Kasabgy Street section where the use of a 2,000mm pipe jacking machine is planned to ensure punctual completion of the work despite a pipe diameter of 1,600mm planned by GOSD. Based on the comparative study results shown in Fig. 5-14, Plan A (concrete invert lined with acid-resistant bricks) has been selected with an adjusted pipe diameter of 1,700mm.

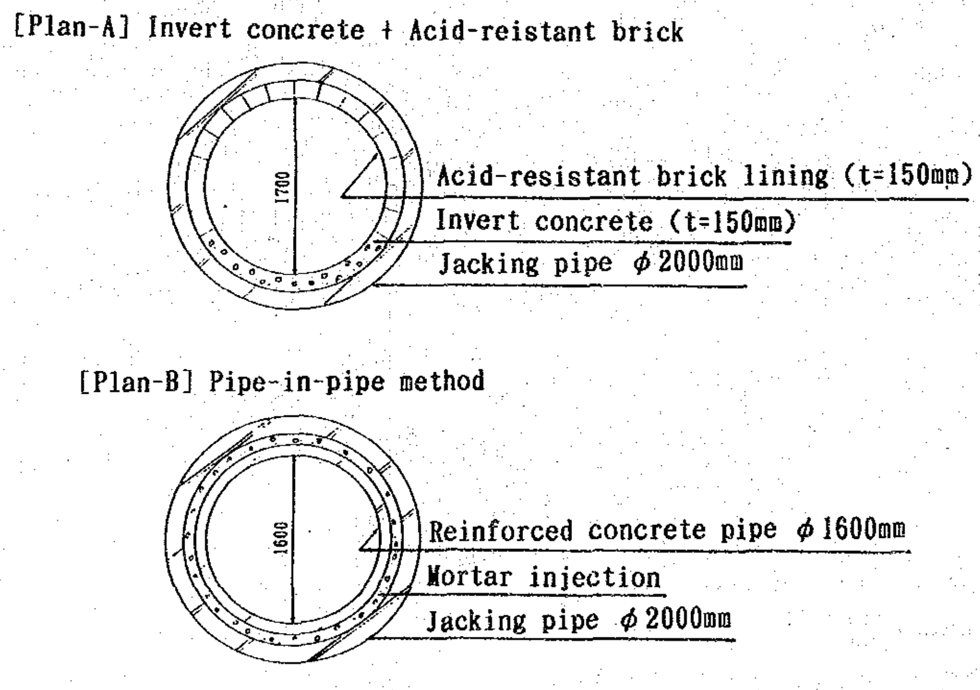


Fig. 5-13 Pipe Diameter Adjustment Work

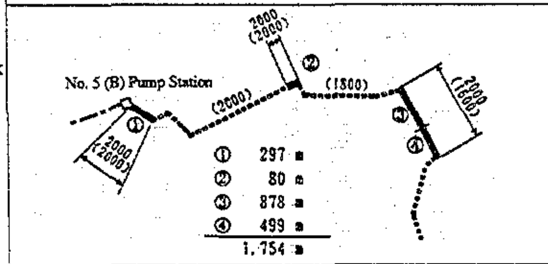
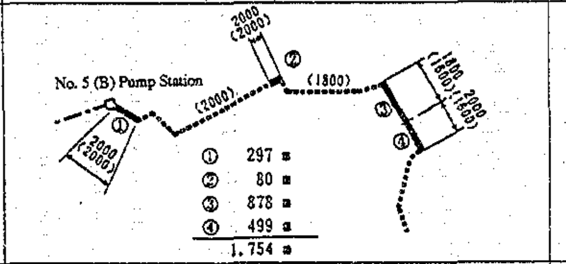
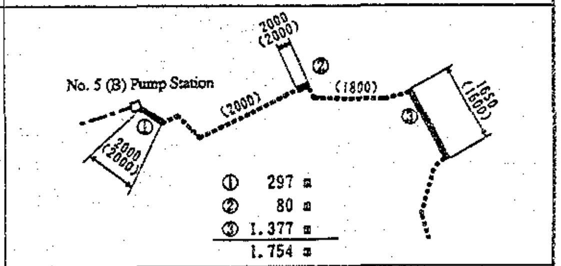
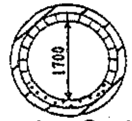
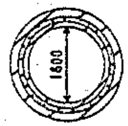
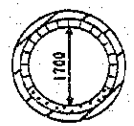
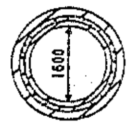
	Plan 1		Plan 2		Plan 3
Diameter of Jacking Pipe, Number of Jacking Machines, Work Length	Pipe Jacking Machines : diameter 2,000mm × 2 Work Length : diameter 2,000mm for 876m (① 297m, ② 80m, ③ 499m) diameter 2,000mm for 878m (③ 878m)		PipeJacking Machines : diameter 2,000mm × 1, diameter 1,800mm ×1 Work Length : diameter 2,000mm for 876m (① 297m+②80m + ③499m) diameter 1,800mm for 878m (④878m)		Pipe Jacking Machines : diameter 2,000mm x 1, diameter 1,650mm x 2 Work Length : diameter 2,000mm for 377m (① 297m+ ②80m) diameter 1,650mm for 1,377m (③1,377)
					
Diameter Adjustment Work	A Invert Concrete + Acid-Resistant/Bricks  (Sections ③ and ④: L = 1,377m)	B Pipe-in-Pipe  (Sections ③ and ④: L = 1,377m)	A Invert Concrete + Acid-Resistant/Bricks  (Section ④: L = 499m)	B Pipe-in-Pipe  (Section ④: L = 499m)	No diameter adjustment work is required.
Advantages and Disadvantages	1) Construction cost is higher by some 65 million yen than Plan 2 (A). 2) Construction period is almost the same as Plan 2 and Plan 3. 3) Because of the spare parts compatibility between the pipe jacking machine and ancillary equipment, it is easy to deal with mechanical problems. 4) Diameter adjustment work involving invert concrete and acid-resistant bricks is relatively easy to conduct.	1) Construction cost is higher by some 85 million yen than Plan 2 (A). 2) Construction period is almost the same as Plan 2 and Plan 3. 3) Because of the spare parts compatibility between the pipe jacking machine and ancillary equipment, it is easy to deal with mechanical problems. 4) Because of the narrow space of some 5cm between internal and external pipes, this method is difficult to use.	1) Construction cost is the lowest. 2) Construction period is almost the same as Plan 1 and Plan 3. 3) Because of the compatibility of almost half the spare parts, it is relatively easy to deal with mechanical problems. 4) Diameter adjustment work involving invert concrete and acid-resistant bricks is relatively easy to conduct.	1) Construction cost is higher than Plan 1 (A) by some 10 million yen. 2) Construction period is almost the same as Plan 1 and Plan 3. 3) Because of the compatibility of almost half the spare parts, it is relatively easy to deal with mechanical problems. 4) Because of the narrow space of some 5cm between internal and external pipes, this method is difficult to use.	1) Construction cost is the highest and is some 120 million yen higher than Plan 2 because of the additional pipe jacking machine although no diameter adjustment work is required. 2) Construction period is almost the same as Plan 1 and Plan 2. 3) No compatibility of spare parts exists for the pipe jacking machines and ancillary equipment. 4) This plan is uneconomical and inefficient because of the short length of the 2,000mm diameter section.
General Assessment			◎		

Fig. 5-14 Alternative Plans for Jacking Pipe Diameter

Table 5-11 compares the pipe diameter, gradient, flow velocity and drainage capacity originally planned by GOSD for the sewer trunk line in question with those adopted for the Project.

Table 5-11 Comparison of Sewer Trunk Line Specifications Adopted by GOSD and the Project

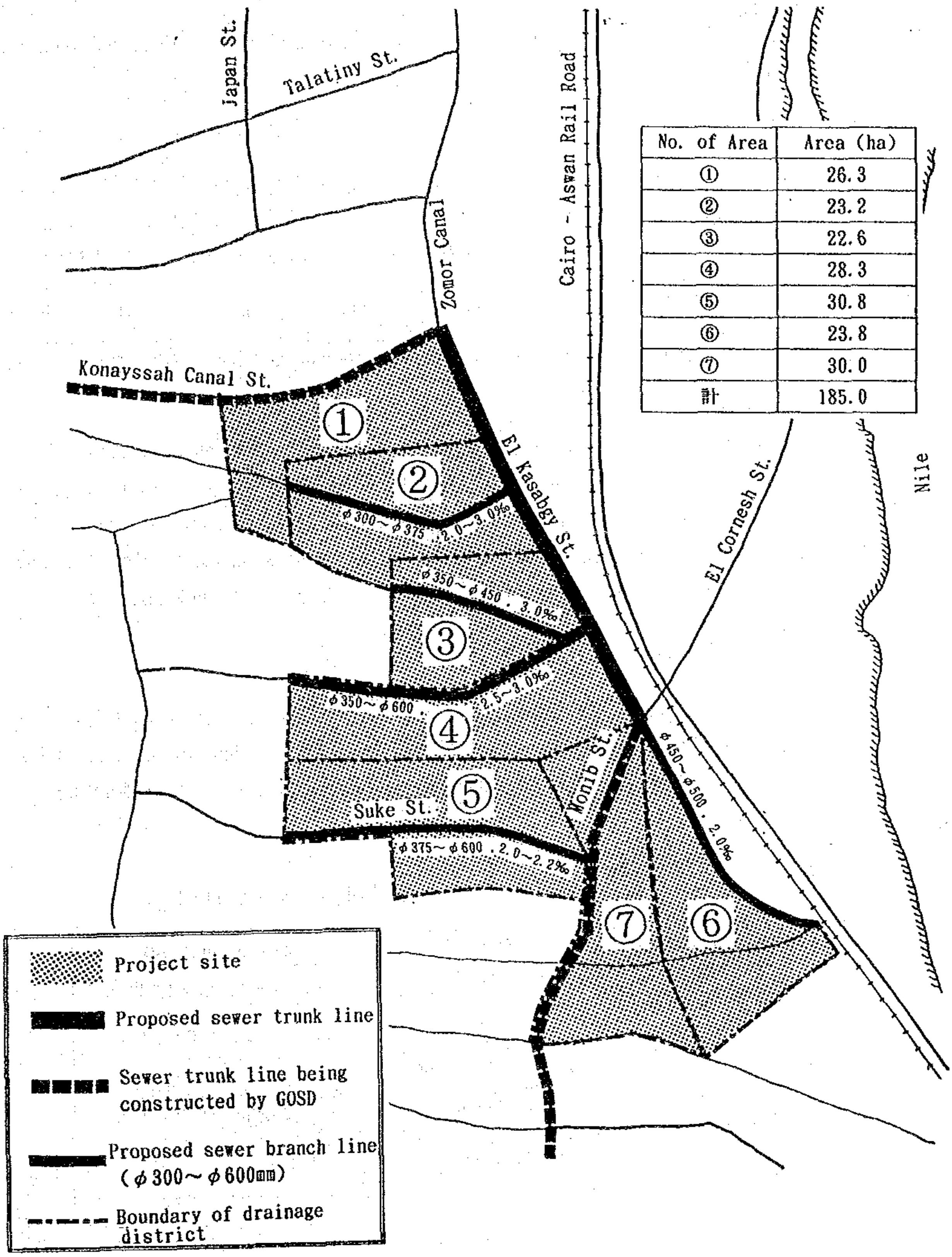
	Section	Pipe Diameter (mm)	Gradient (‰)	Flow Velocity (m/sec)	Drainage Capacity (m^3/sec)	Design Flow Velocity (m/sec)	Maximum Flow Volume (m^3/sec)
GOSD	El Kasabgy Street	1,600	0.56	1.12	1.987	0.6-1.5	1.815
	Osman Moharam Street Crossing Point	2,000	0.35	1.00	2.848		2.225
	Kordy Street	2,000	0.35	1.04	2.848		2.86
The Project	El Kasabgy Street	1,800	0.35	0.95	2.151	0.6-1.5	1.815
	Osman Moharam Street Crossing Point	2,000	0.35	1.00	2.848		2.225
	Kordy Street	2,000	0.44	1.09	3.405		2.86

3) Sewer Branch Lines

The design drainage area of the sewer branch lines (diameter: 300-600mm) is shown in Fig. 5-15 which also gives the pipe diameters and gradients of these branch lines, decided on the basis of the size of the design drainage area. The pipe diameters and gradients of the branch lines (diameter: less than 300mm) have been similarly decided. These data are included in Basic Design Drawing EMU-MP-02.

(8) Manhole Design

The construction of manholes for the sewer trunk line is included in the scope of work for the Japanese side. Design specifications will be determined based on the Japanese sewer design standards and common manhole specifications used in Egypt. The manhole design for the sewer branch lines will be based on Egyptian standards as they will be constructed by the Egyptian side at its own expense.



No. of Area	Area (ha)
①	26.3
②	23.2
③	22.6
④	28.3
⑤	30.8
⑥	23.8
⑦	30.0
計	185.0

Fig. 5-15 Drainage Area of Sewer Branch Lines (Diameter: 300-600mm), Pipe Diameter and Gradient

1) Manhole Interval

The manholes will be installed in accordance with the standard intervals given in Table 5-12.

Table 5-12 Standard Manhole Intervals

Pipe Diameter (mm)	300 or less	301-600	601-1,000	1,001-1,500	1,650 or More
Maximum Interval (m)	50	75	100	150	200

Source: Guideline and Manual of Sewage Facilities Design, Japan Sewage Association

Since the pipe diameter for the trunk line planned under the Project is 1,700-2,000mm, the maximum manhole interval will be 200m. The location of manhole will be decided taking into consideration the availability of empty space in the surrounding area, road width, necessity to secure passage for traffic, access to housing or shops and connection of sewer branch lines to the trunk line, etc.

2) Manhole Structure

The internal manhole measurements have been decided as shown in Table 5-13 pursuant to the Japanese sewer facilities standards and the manhole measurements for GOSD project and taking the diameter of connected pipes into consideration.

Table 5-13 Internal Manhole Measurements

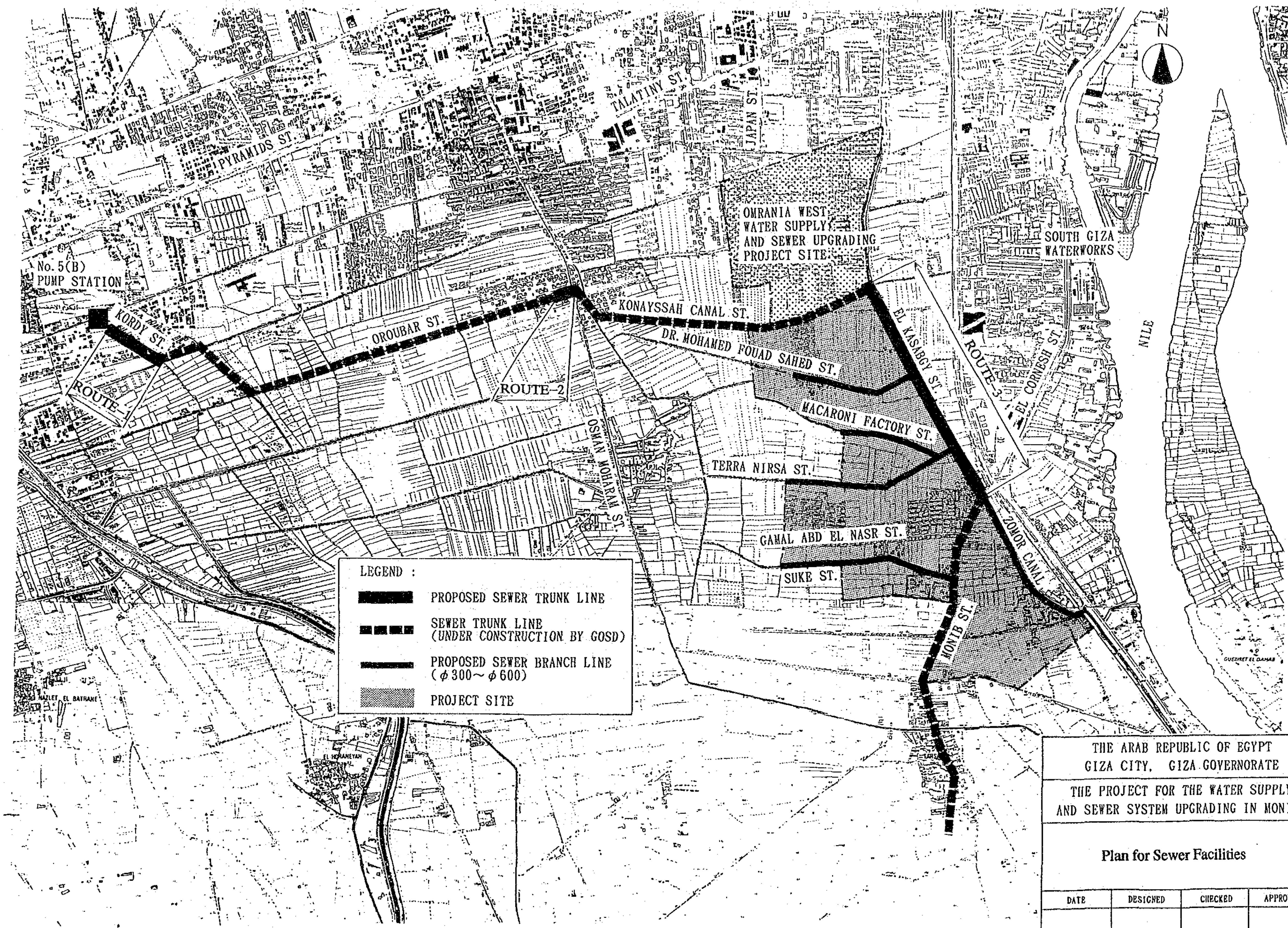
Pipe Diameter (mm)	Section	Measurements (mm)
1,700 (after adjustment)	El Kasabgy Street (approximately 499m)	midway point: 2,100 × 1,800
1,800	El Kasabgy Street (approximately 878m)	connection point: 2,100 × 2,100
2,000	Osman Moharam Street (approximately 80m) Kordy Street (approximately 297m)	midway point: 2,600 × 2,000 connection point: 2,600 × 2,600
	Manhole at inlet to No.5 (B) Pump Station	3,000 × 3,000

The manhole structure is shown in Basic Design Drawing EMU-S-05. The internal walls of the manhole will be lined using acid-resistant blue bricks to prevent corrosion by harmful acid.

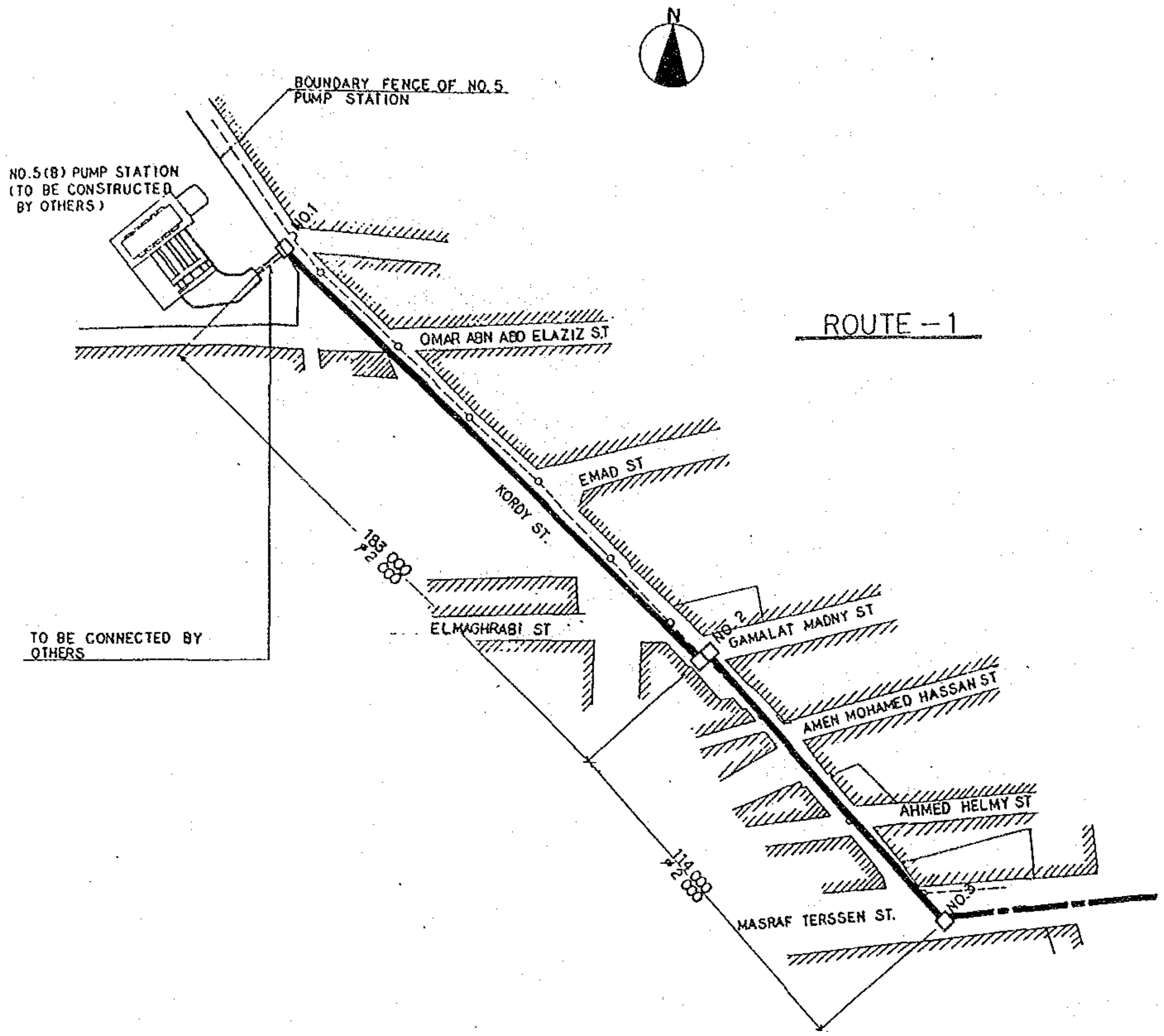
(9) Basic Design Drawings

The Basic Design Drawings for the sewer facilities to be constructed under the Project are listed below.

EMU-S-01	Plan for Sewer Facilities
EMU-S-02	Plan for Sewer Trunk Line (No.1)
EMU-S-03	Plan for Sewer Trunk Line (No.2)
EMU-S-04	Profile of Sewer Trunk Line
EMU-S-05	Manhole Structure (No.1)
EMU-S-06	Manhole Structure (No.2)

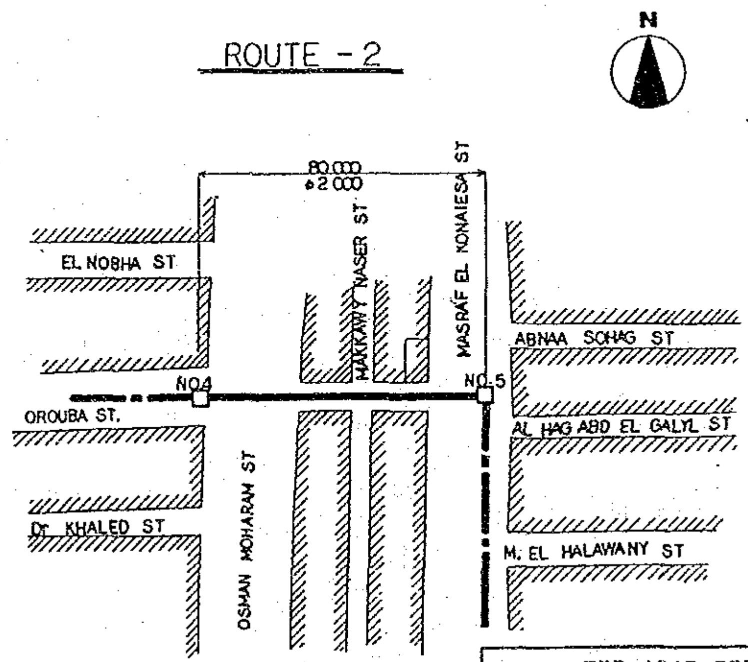


THE ARAB REPUBLIC OF EGYPT GIZA CITY, GIZA GOVERNORATE	SCALE
THE PROJECT FOR THE WATER SUPPLY AND SEWER SYSTEM UPGRADING IN MONIB	DWG. No.
Plan for Sewer Facilities	EMU-S-01
DATE / DESIGNED / CHECKED / APPROVED	REVISION
JAPAN INTERNATIONAL COOPERATION AGENCY	

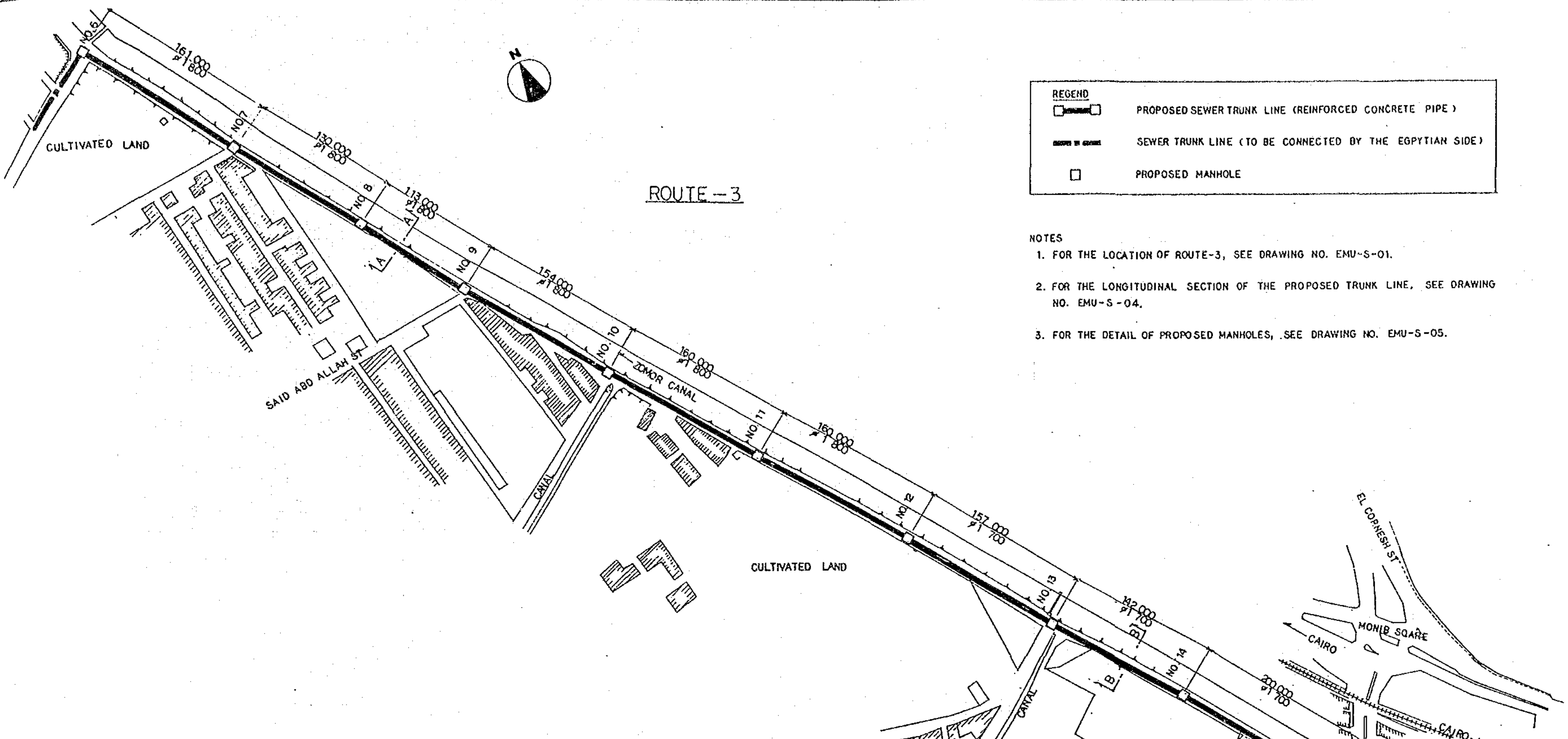


REGEND	
▭━━▭	PROPOSED SEWER TRUNK LINE (REINFORCED CONCRETE PIPE)
▬ ▬ ▬	SEWER TRUNK LINE (TO BE CONNECTED BY EGYPTIAN SIDE)
o------o	EXISTING SEWER BRANCH LINE
□	PROPOSED MANHOLE
o	EXISTING MANHOLE

NOTES
1. FOR THE LOCATION OF ROUTE-1 AND 2, SEE DRAWING NO. EMU-S-01.
2. FOR THE LONGITUDINAL SECTION OF THE PROPOSED TRUNK LINE, SEE DRAWING NO. EMU-S-01.
3. FOR THE DETAIL OF PROPOSED MANHOLES, SEE DRAWING NO. EMU-S-05.



THE ARAB REPUBLIC OF EGYPT GIZA CITY, GIZA GOVERNORATE				SCALE
THE PROJECT FOR THE WATER SUPPLY AND SEWER SYSTEM UPGRADING IN MONIB				DWG. No.
Plan for Sewer Trunk Line (No.1)				EMU-S-02
DATE	DESIGNED	CHECKED	APPROVED	REVISION
JAPAN INTERNATIONAL COOPERATION AGENCY				

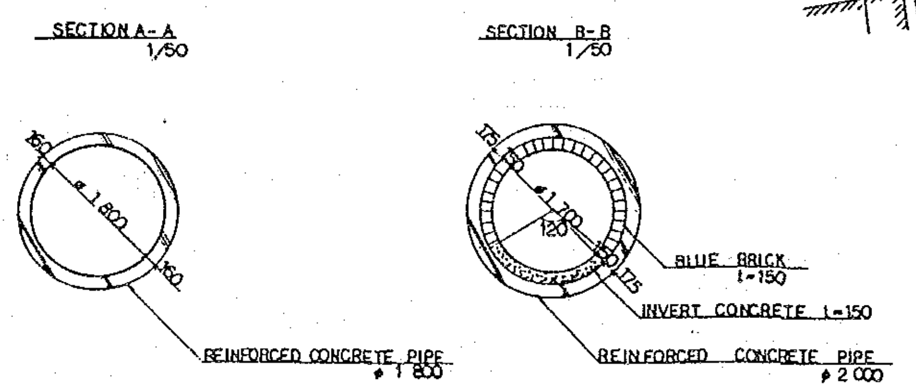


REGEND

(symbol)	PROPOSED SEWER TRUNK LINE (REINFORCED CONCRETE PIPE)
(symbol)	SEWER TRUNK LINE (TO BE CONNECTED BY THE EGYPTIAN SIDE)
□	PROPOSED MANHOLE

NOTES

1. FOR THE LOCATION OF ROUTE-3, SEE DRAWING NO. EMU-S-01.
2. FOR THE LONGITUDINAL SECTION OF THE PROPOSED TRUNK LINE, SEE DRAWING NO. EMU-S-04.
3. FOR THE DETAIL OF PROPOSED MANHOLES, SEE DRAWING NO. EMU-S-05.



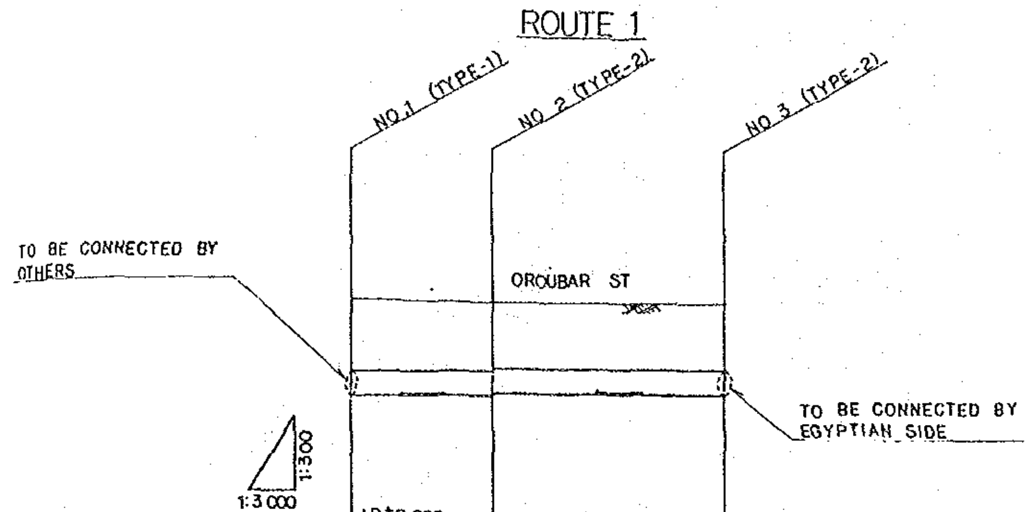
THE ARAB REPUBLIC OF EGYPT GIZA CITY, GIZA GOVERNORATE	SCALE
THE PROJECT FOR THE WATER SUPPLY AND SEWER SYSTEM UPGRADING IN MONIB	DWG. No.
Plan for Sewer Trunk Line (No.2)	EMU-S-03

DATE	DESIGNED	CHECKED	APPROVED	REVISION

JAPAN INTERNATIONAL COOPERATION AGENCY

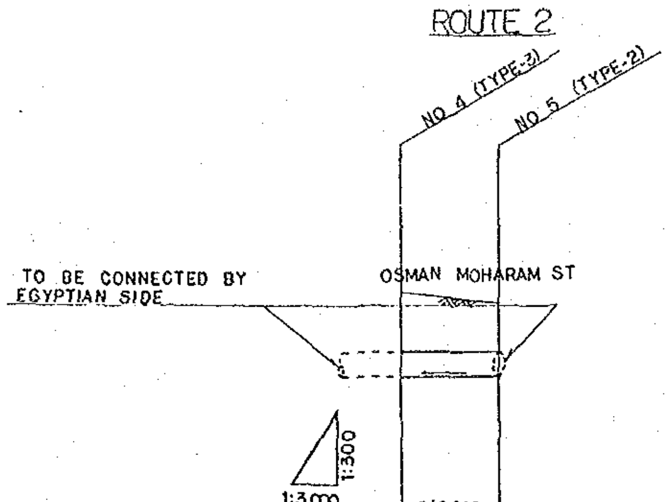
LONGITUDINAL SECTION OF PROPOSED SEWER TRUNK LINE

ROUTE 1

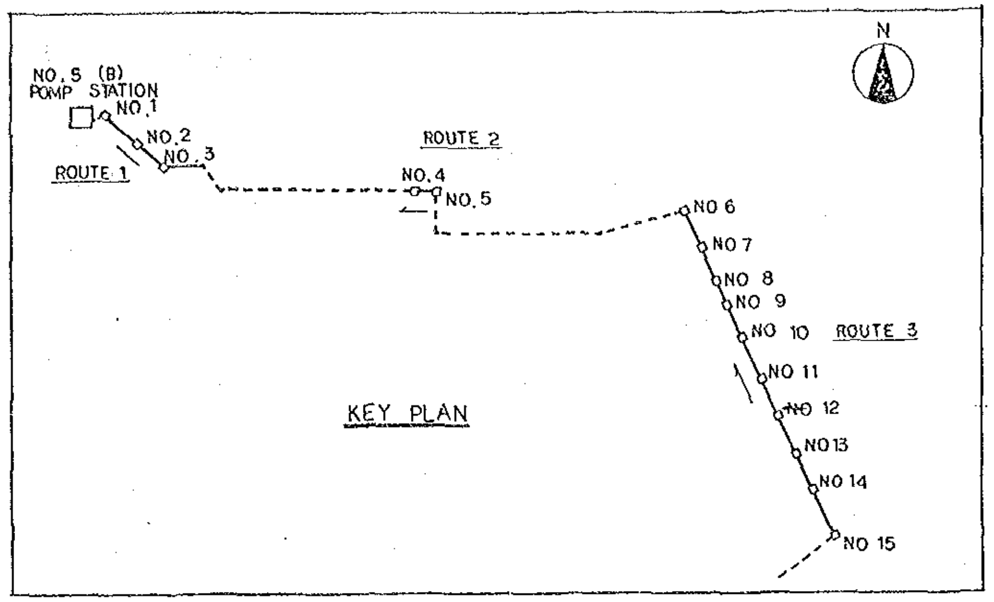


SLOPE (%)	0.44%		
PIPE DIAMETER (mm)	ø2 000		
GROUND LEVEL (m)	18.11	18.08	17.96
INVERT LEVEL (m)	(10.36) 10.40	10.45 10.46	10.56 (10.60)
DISTANCE (m)	0.00	111.00	297.00

ROUTE 2



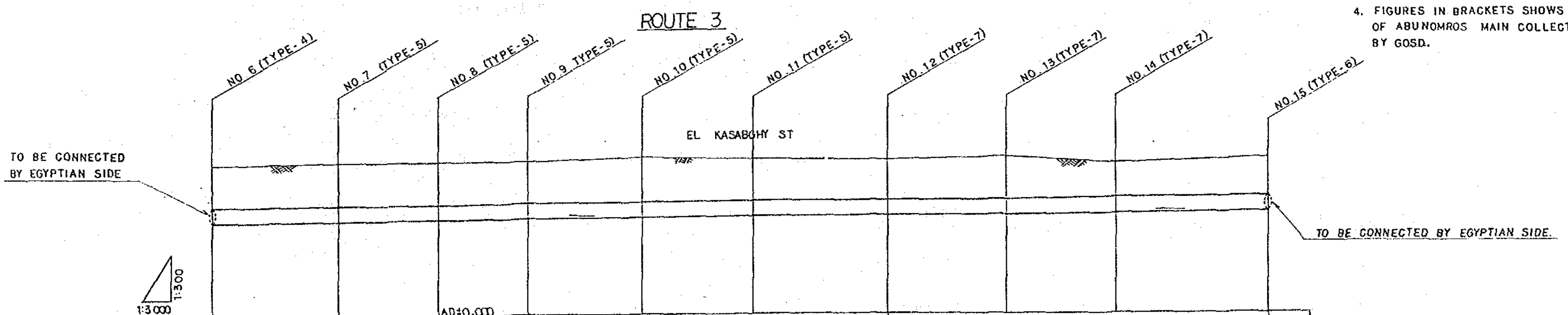
SLOPE (%)	0.35%	
PIPE DIAMETER (mm)	ø2 000	
GROUND LEVEL (m)	18.48	17.68
INVERT LEVEL (m)	(11.47) 11.54	11.57 (11.65)
DISTANCE (m)	0.00	80.00



NOTES

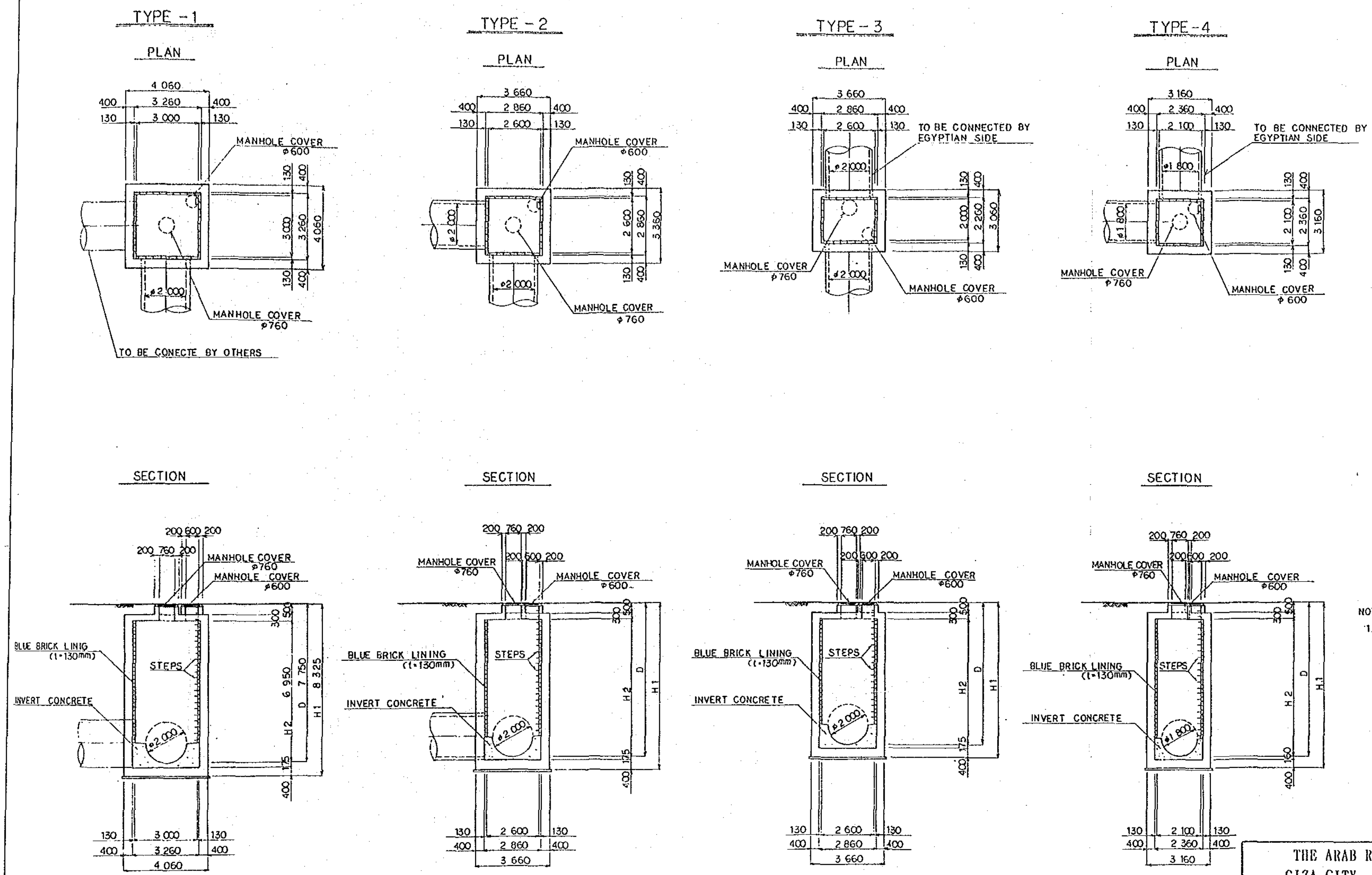
1. FOR THE LOCATION OF ROUTES, SEE DRAWING NO. EMU-S-01.
2. FOR THE PLAN OF ROUTE-1 AND 2, SEE DRAWING NO. EMU-S-02.
3. FOR THE PLAN OF ROUTE-3, SEE DRAUING NO. EMU-S-03.
4. FIGURES IN BRACKETS SHOWS THE INVERT LEVEL OF ABUNOMROS MAIN COLLECTOR TO BE CONNECTED BY GOSD.

ROUTE 3



SLOPE (%)	0.35%						0.35%			
PIPE DIAMETER (mm)	ø1 800						ø1 700			
GRAND. LEVEL (m)	19.86	20.11	20.11	20.11	20.74	20.52	20.27	20.60	19.85	20.47
INVERT. LEVEL (m)	(12.29) 12.34	12.39 12.45	12.50 12.56	12.60 12.66	12.71 12.77	12.83 12.89	12.95 13.01	13.06 13.12	13.17 13.23	13.30 (13.35)
DISTANCE (m)	0.00	161.00	291.00	404.00	558.00	778.00	878.00	1035.00	1177.00	1377.00

THE ARAB REPUBLIC OF EGYPT GIZA CITY, GIZA GOVERNORATE	SCALE
THE PROJECT FOR THE WATER SUPPLY AND SEWER SYSTEM UPGRADING IN MONIB	DWG. No.
Profile of Sewer Trunk Line	EMU-S-04
DATE / DESIGNED / CHECKED / APPROVED	REVISION
JAPAN INTERNATIONAL COOPERATION AGENCY	



NOTE

1. FOR THE LOCATION OF MANHOLE, SEE DRAWING NO. GMU-S-02 AND GMU-S-03.

MANHOLE LIST

MANHOLE NUMBER	DEPTH (m)	TYPE	MANHOLE HIGHT H1 (m)	H2 (m)
NO. 1	7. 750	1	8. 325	6. 950
NO. 2	7. 550	2	8. 125	6. 750
NO. 3	7. 360	2	7. 935	6. 560
NO. 4	7. 010	3	7. 585	6. 210
NO. 5	6. 030	2	6. 605	5. 230
NO. 6	7. 570	4	8. 130	6. 770

THE ARAB REPUBLIC OF EGYPT
GIZA CITY, GIZA GOVERNORATE

THE PROJECT FOR THE WATER SUPPLY
AND SEWER SYSTEM UPGRADING IN MONIB

Manhole Structure (No.1)

SCALE

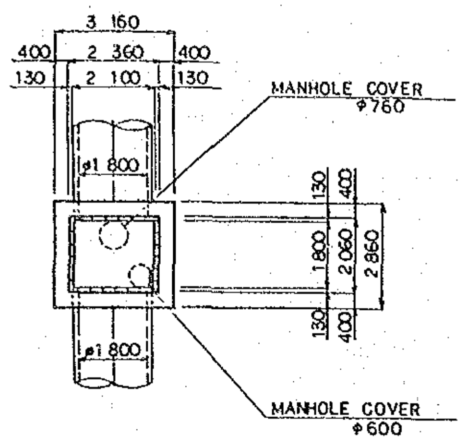
DWG. No. EMU-S-05

DATE	DESIGNED	CHECKED	APPROVED	REVISION

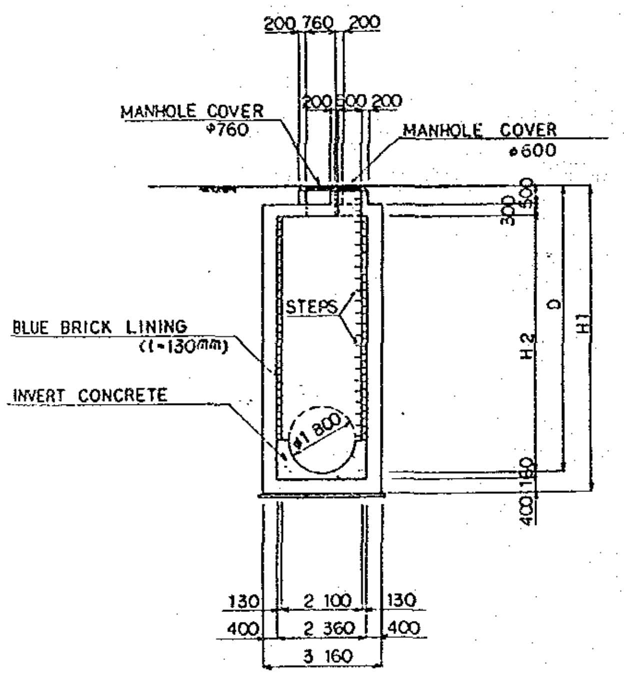
JAPAN INTERNATIONAL COOPERATION AGENCY

TYPE – 5

PLAN

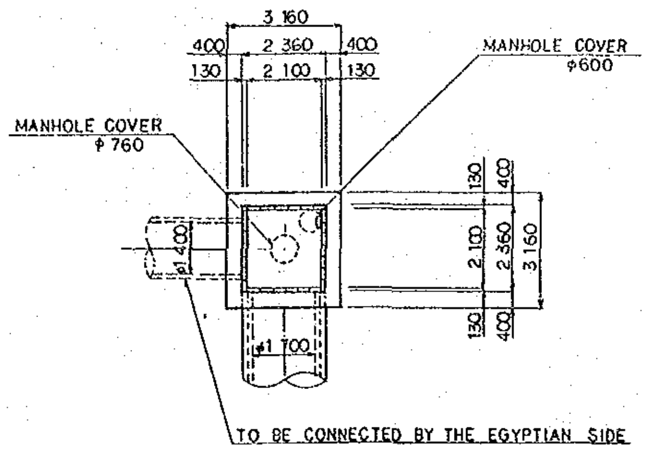


SECTION

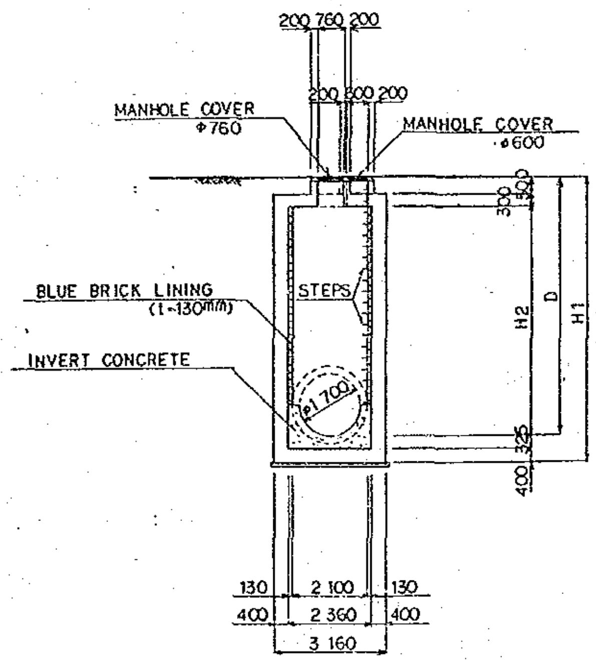


TYPE – 6

PLAN

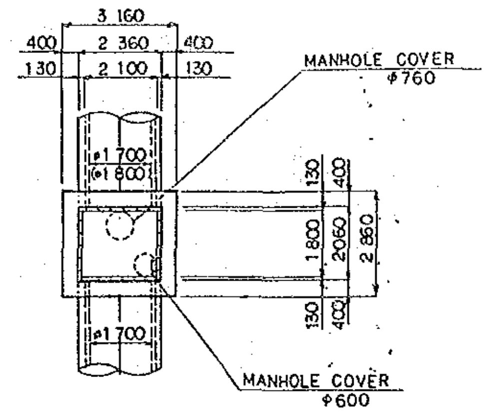


SECTION

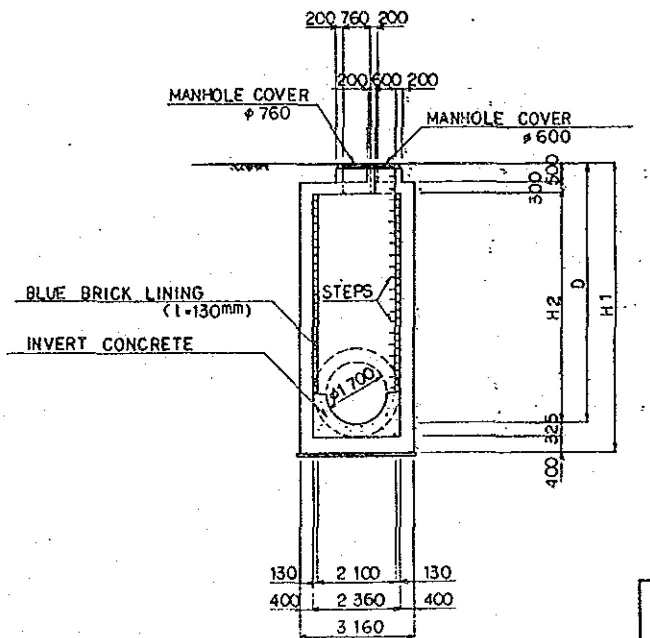


TYPE – 7

PLAN



SECTION



MANHOLE LIST

MANHOLE NUMBER	DEPTH(D) (m)	TYPE	MANHOLE HEIGHT H1 (m)	H2 (m)
NO. 7	7.720	5	8.280	6.470
NO. 8	7.610	5	8.170	6.360
NO. 9	7.510	5	8.070	6.260
NO.10	8.030	5	8.570	6.770
NO.11	7.690	5	8.250	6.440
NO.12	7.320	7	7.880	6.070
NO.13	7.540	7	8.100	6.290
NO.14	6.680	7	7.240	5.430
NO.15	7.170	6	7.730	5.920

NOTES

1. FOR TEH LOCATION OF MANHOLE, SEE DRAWING NO. GMU-S-03.
2. DIAMETER φ1 800 SHALL BE APPLIED FOR THE SECTION BETWEEN MANHOLE NO. 6 TO NO. 12.. ON ROUTE-3.
3. DIAMETER φ1 700 IS THE DIAMETER TO BE ADJUSTED AFTER 2 000 mm DIA. PIPES ARE LAYED BY JACKING METHOD FOR THE SECTION BETWEEN MANHOLE NO. 12 AND NO. 15 ON ROUTE-3

THE ARAB REPUBLIC OF EGYPT GIZA CITY, GIZA GOVERNORATE	SCALE
THE PROJECT FOR THE WATER SUPPLY AND SEWER SYSTEM UPGRADING IN MONIB	DWG. No.
Manhole Structure (No.2)	EMU-S-06
DATE / DESIGNED / CHECKED / APPROVED	REVISION
JAPAN INTERNATIONAL COOPERATION AGENCY	