Kimara Reservoir	Solution & Storage Tank $2.5m^3$ x 2 units Dosing Pump 60 l/h x 0.2 kw x 2 units 53 l/h x 0.2 kw x 1 unit	Chlorination House 72 m^2

3-3-3 Construction Site

Construction sites are separated into 8 places as shown in Fig. 3-9 and described with the type of construction work as follows:

- Installation of Valves for Division of the Upper And Lower Service Areas: Manzese and Mtambani
- Installation of Kijito Nyama Trunk Main: Between University Reservoir and Mwana Nyamala
- Replacement of Low Lift and High Lift Pumps : Upper Ruvu Intake and Water Treatment Plant
- Replacement of Air Valves: Between Upper Ruvu Water Treatment Plant and Kimara Reservoir
- Installation of Chlorination Equipment: Kimara Reservoir and University Reservoir

Every construction site excepting the site for installation of Kijito Nyama Trunk Main are already occupied by the existing water supply facilities; therefore, problems regarding land occupation will not occur at the time of construction.

The pipeline route is sited outside the City area designated by the Dar es Salaam City Master Plan, 1979。 Places neighboring the Dar es Salaam University are planned for the Institutional Area。 Other areas of the pipeline route belong to unplanned area and land use plan is not proposed。

Pipes are installed parallel with the existing pipeline from the University up to the place to be connected with the existing ϕ 525 mm pipe through connection with the existing ϕ1,350 mm pipe。 There are no structures which would obstruct the installation work or present problems。 From the point connecting

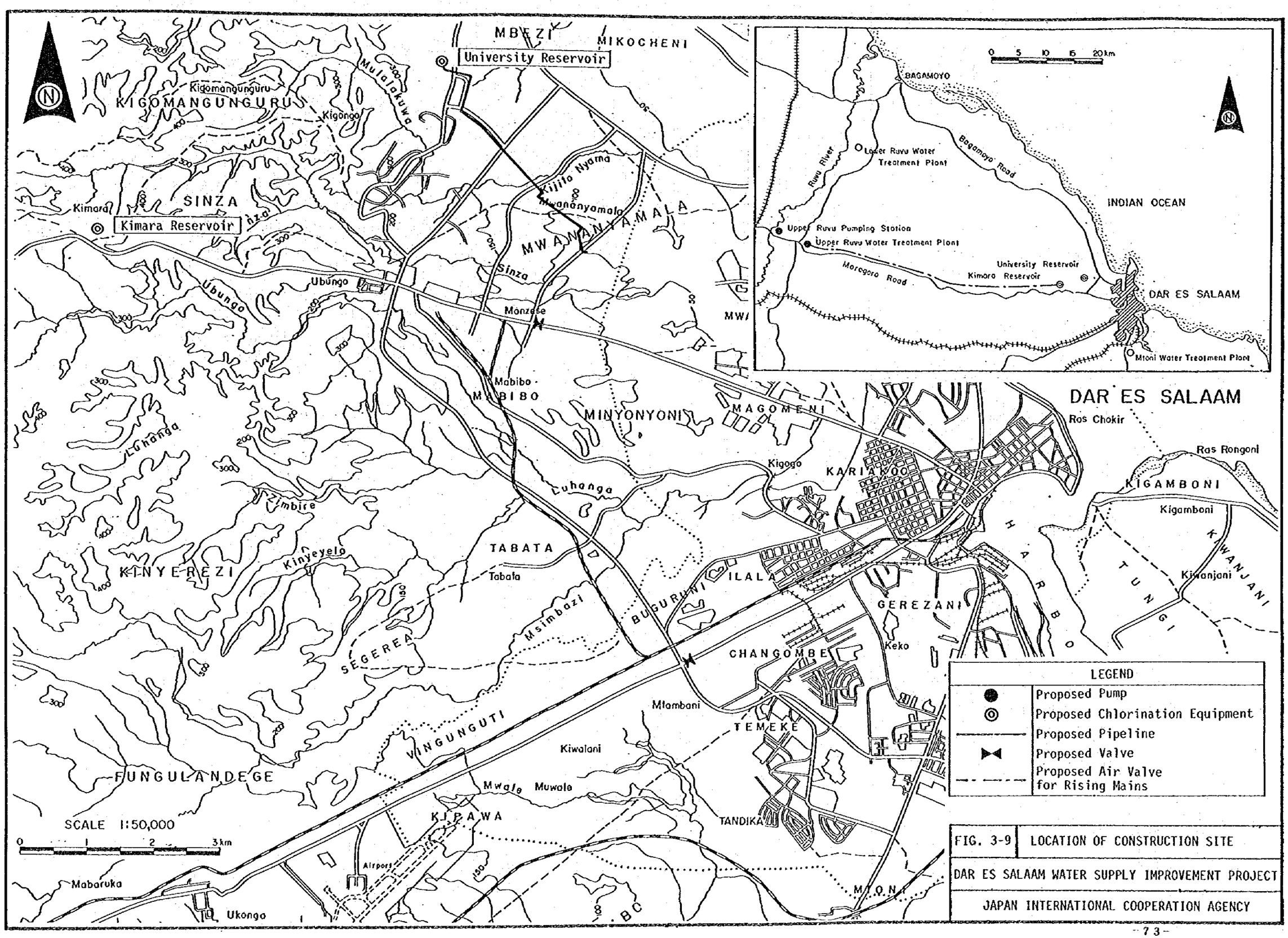


FIG. 3-9 LOCATION OF CONSTRUCTION SITE

DAR ES SALAAM WATER SUPPLY IMPROVEMENT PROJECT

JAPAN INTERNATIONAL COOPERATION AGENCY

the ϕ 525 mm pipe to the ϕ 750 mm pipe, pipes are laid in the site approved for occupation. There are several houses which would become obstructions if the pipeline route is aligned straight. Accordingly, the route is aligned parallel with the existing rural road. As a basic rule, the pipes are laid 8 meters away from the edge of the existing road.

Pipes are installed to a length of 4,100 m. Since the ground elevation at the University is El. 63 m and the place for connection with the existing ϕ 750 mm pipe is El. 23 m, the elevation difference is therefore 40m. It is assumed that the soil, all along the pipeline route, consists of silty sand to a depth 3 m below ground level where the bottom of the pipes is planned to be laid, with sufficient load bearing capacity for pipe laying. Groundwater level is assumed to be low enough below the planned bottom level to form a free groundwater level.

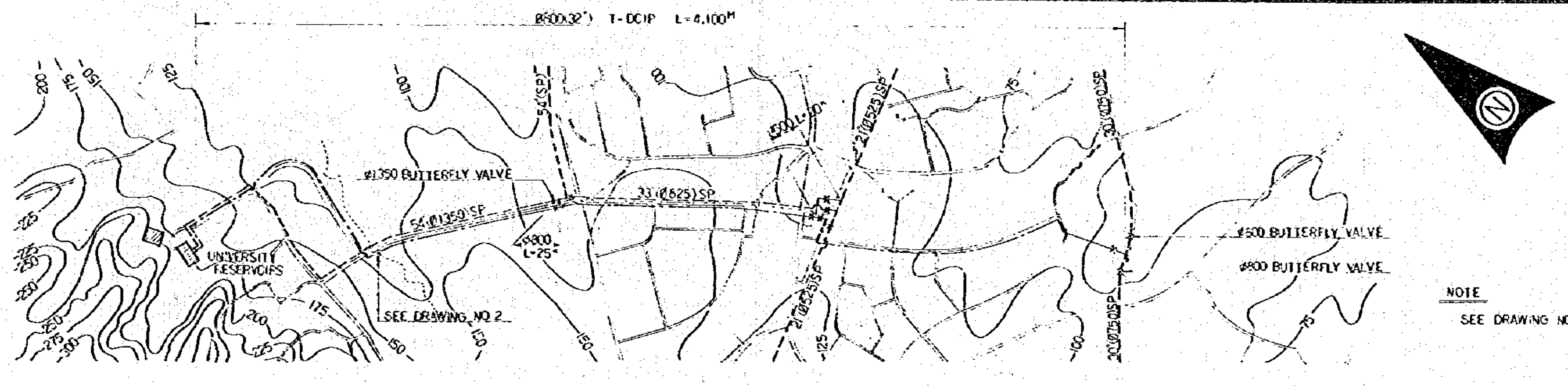
For occupation of land to be used, approval is required since all land is considered national property. Approval for occupying land within the City Area is under the administration of the City Planning Committee of the City Council. Therefore, consultation between NUWA DSMB and the Committee will be required for the installation of pipeline. Regarding the occupation of land, at the time of construction work, compensation would not be required for demolition and/or relocation of structures, but compensation for destruction of any fruit trees, such as mango, cashew nut, etc. will be required more or less.

3-4. Basic Design Drawings

The drawings to be prepared for the basic design are listed in Table 3-13 below:

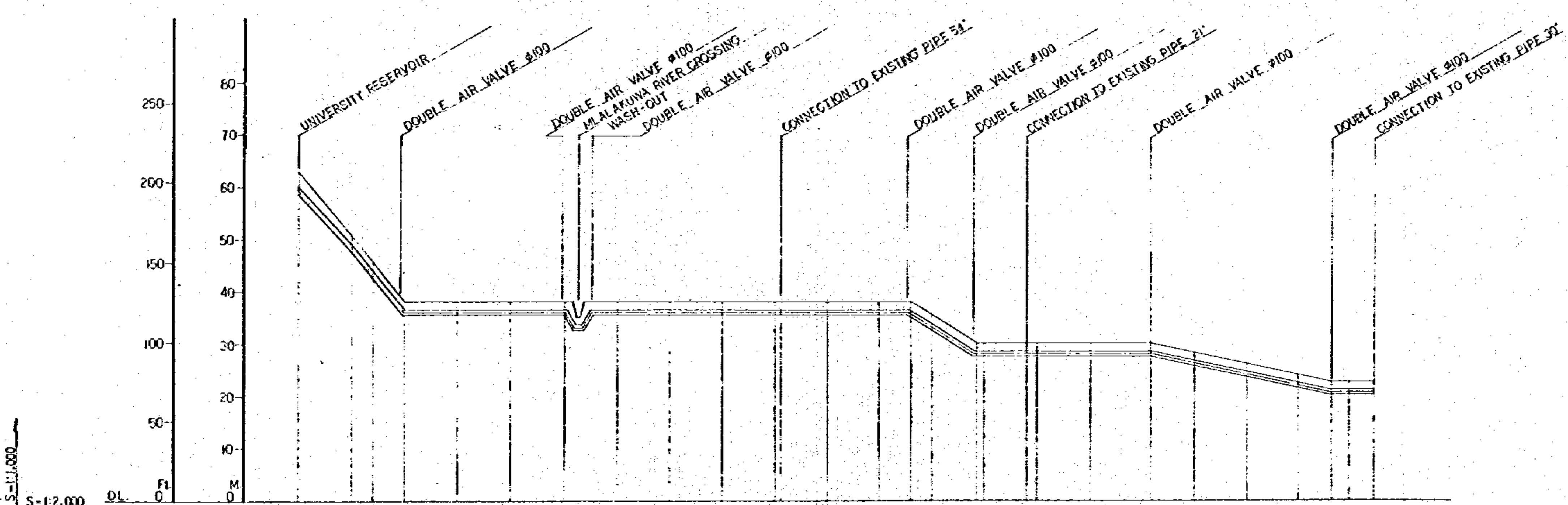
Table 3-13 List of Basic Design Drawings

No.	Drawing Title
1	ϕ 800 Pipeline Plan and Profile
2	Detail of Mlalakuwa River Crossing
3	Detail of Valve Chamber
4	Low Lift Pump Station (1/2), Plan
5	Low Lift Pump Station (2/2), Section
6	High Lift Pump Station, Plan
7	Chlorination System for Kimara Reservoir
8	Chlorination System for University Reservoir
9	Chlorination House



NOTE
SEE DRAWING NO 3 FOR BUTTERFLY VALVE

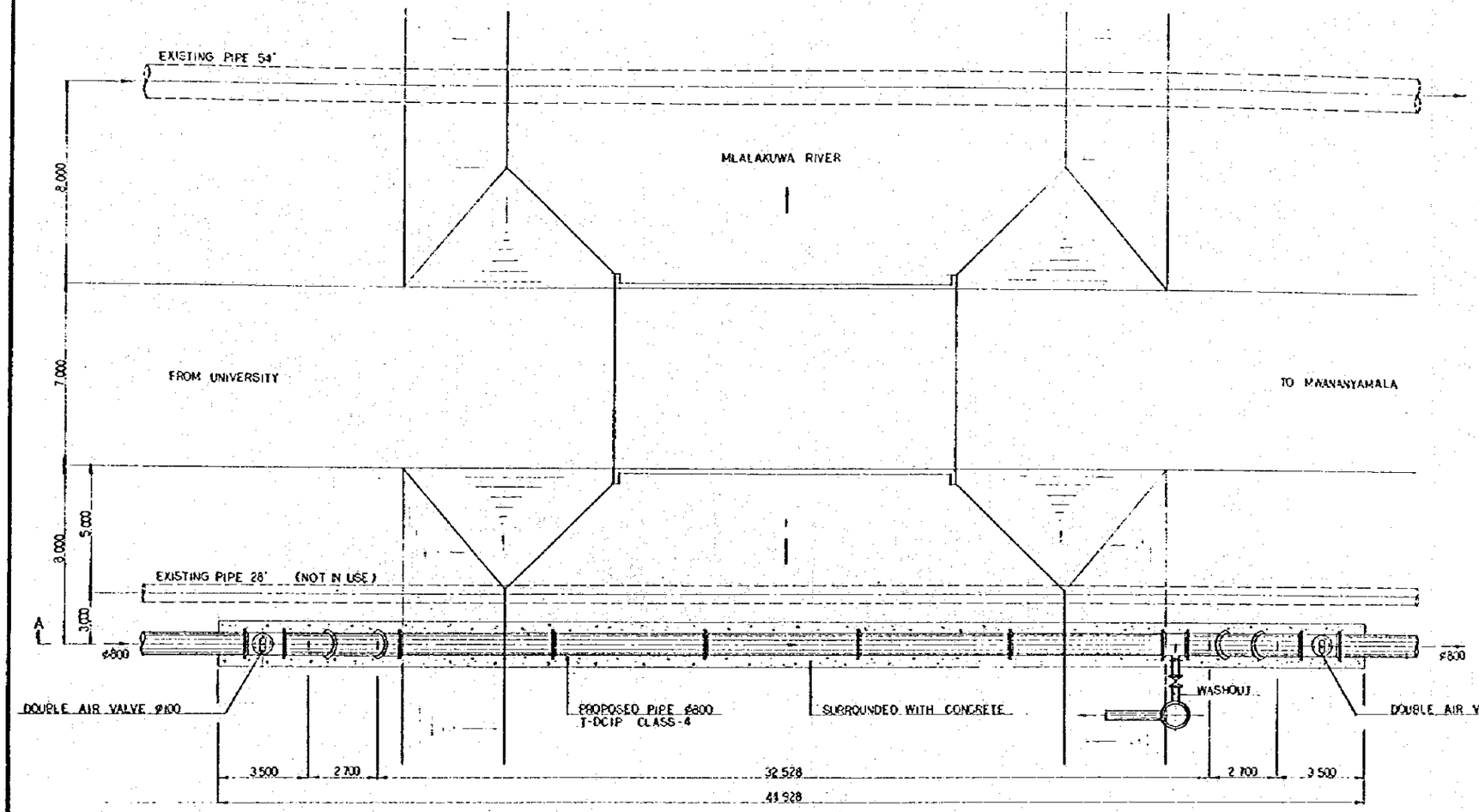
PLAN S-1:10,000



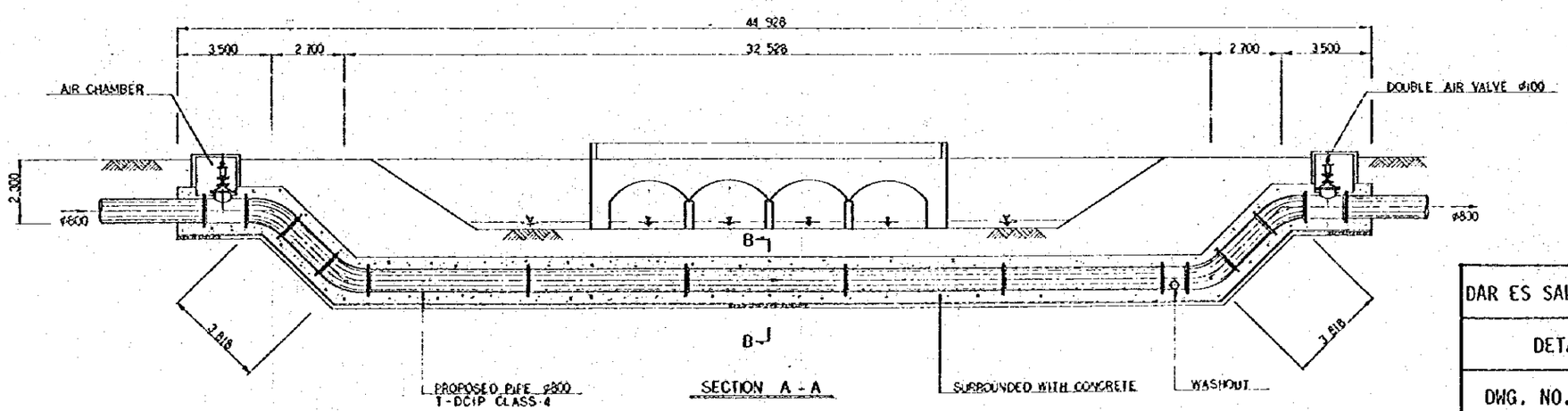
CONTROL POINT	DEPTH OF EXCAVATION	INVERT LEVEL	EXISTING GROUND LEVEL	CHAINAGE	PART DISTANCE
NO 0	4.10	58.60	62.70	0.0	0.0
NO 1	2.30	48.40	50.70	200.0	200.0
+80	2.30	43.40	45.70	280.0	80.0
NO 2	2.30	35.80	38.10	400.0	120.0
NO 3	2.30	35.80	38.10	600.0	200.0
NO 4	2.30	35.80	38.10	800.0	200.0
NO 5	2.30	35.80	38.10	1000.0	200.0
NO 6	2.30	35.80	38.10	1200.0	200.0
NO 7	2.30	35.80	38.10	1400.0	200.0
NO 8	2.30	35.80	38.10	1600.0	200.0
NO 9	2.30	35.80	38.10	1800.0	200.0
+20	2.30	35.80	38.10	1820.0	20.0
NO 10	2.30	35.80	38.10	2000.0	180.0
NO 11	2.30	35.80	38.10	2200.0	200.0
+120	2.30	35.80	38.10	2320.0	120.0
NO 12	2.30	33.80	36.00	2400.0	80.0
+170	2.30	28.20	30.50	2570.0	170.0
NO 13	2.30	28.20	30.50	2600.0	30.0
+160	2.30	28.20	30.50	2760.0	160.0
NO 14	2.30	28.20	30.50	2800.0	40.0
NO 15	2.30	28.20	30.50	3000.0	200.0
NO 16	2.30	28.20	30.50	3200.0	200.0
+30	2.30	28.20	30.50	3230.0	30.0
NO 17	2.30	26.30	28.60	3400.0	170.0
NO 18	2.30	24.20	26.50	3600.0	200.0
NO 19	2.30	22.20	24.50	3800.0	200.0
+130	2.30	20.70	23.00	3930.0	130.0
NO 20	2.30	20.70	23.00	4000.0	70.0
+100	2.30	20.70	23.00	4100.0	100.0

PROFILE

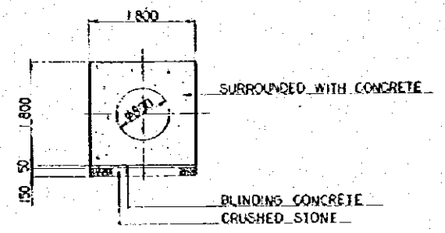
DAR ES SALAAM WATER SUPPLY IMPROVEMENT PROJECT		
Ø800. PIPELINE PLAN, PROFILE		
DWG. NO. 1	DATE: OCT. 1984	SCALE:1:1,000 1:1,200
JAPAN INTERNATIONAL COOPERATION AGENCY		



PLAN

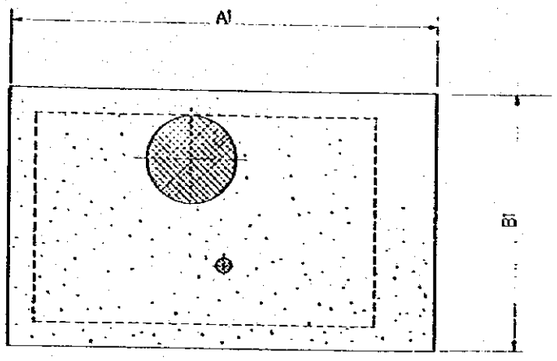


SECTION A - A

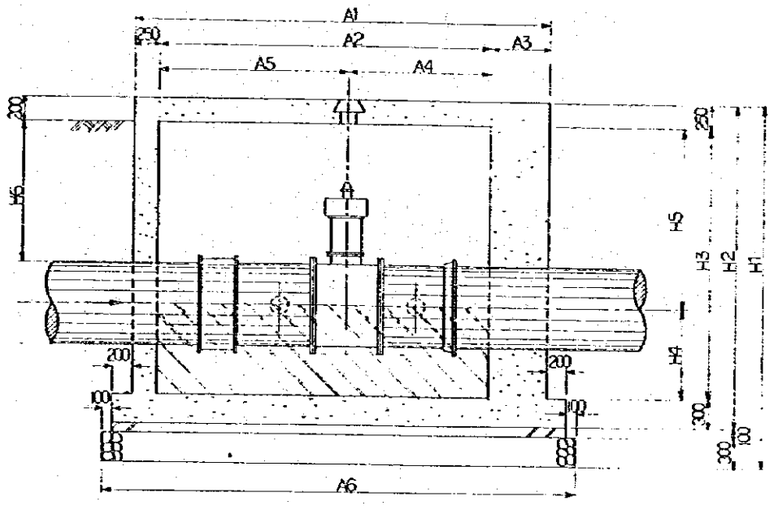


SECTION B-B

DAR ES SALAAM WATER SUPPLY IMPROVEMENT PROJECT		
DETAIL OF MLALAKUWA RIVER CROSSING		
DWG. NO. 2	DATE: OCT. 1984	SCALE:1:200
JAPAN INTERNATIONAL COOPERATION AGENCY		



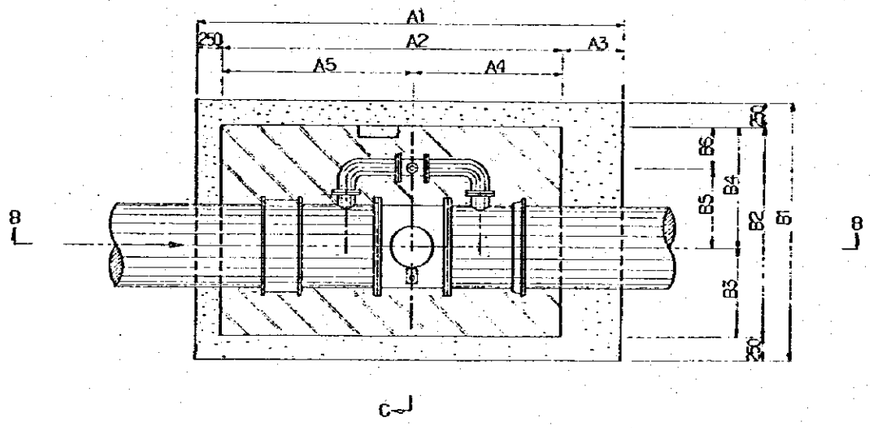
PLAN



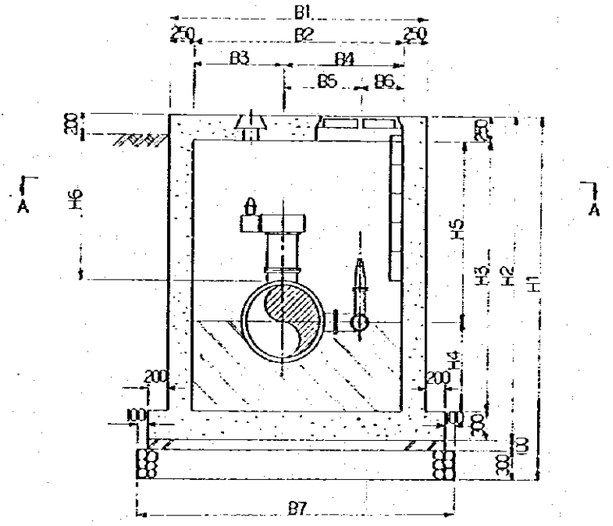
SECTION B - B

DIMENSIONS

ITEM	φ500	φ800	φ1350
A1	3700	4250	5200
A2	2900	3400	4300
A3	550	600	650
A4	1120	1480	1900
A5	1650	1930	2370
A6	4300	4860	5800
B1	2300	2650	3350
B2	1800	2150	2850
B3	760	920	1220
B4	1040	1230	1600
B5	610	800	1180
B6	400	430	650
B7	2900	3250	3950
H1	3300	3750	4450
H2	2900	3350	4050
H3	2350	2800	3500
H4	740	930	1200
H5	1610	1850	2300
H6	1400	1550	1850

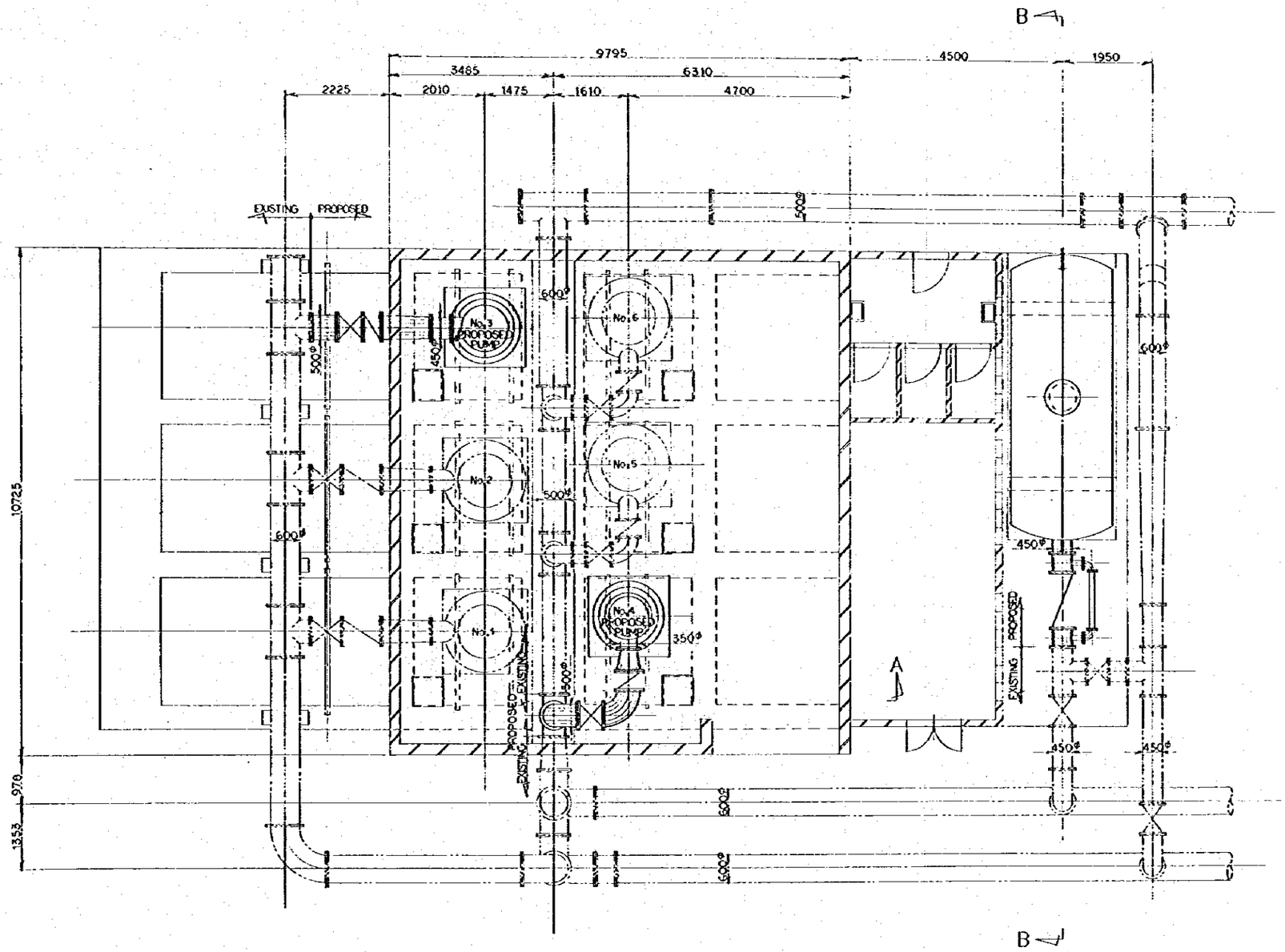


SECTION A - A



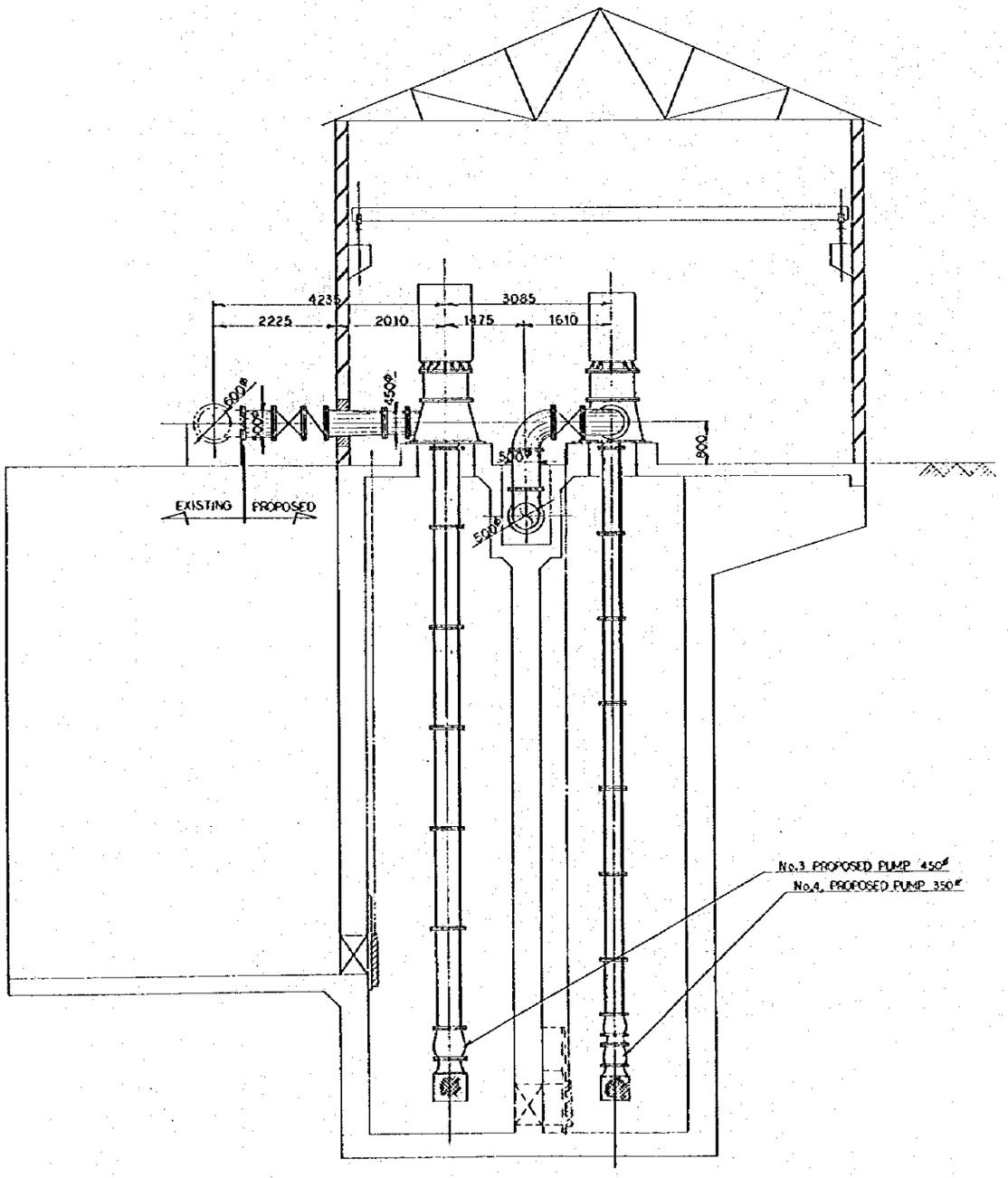
SECTION C - C

DAR ES SALAAM WATER SUPPLY IMPROVEMENT PROJECT		
DETAIL OF VALVE CHAMBER		
DWG. NO. 3	DATE: OCT. 1984	SCALE: NONE
JAPAN INTERNATIONAL COOPERATION AGENCY		

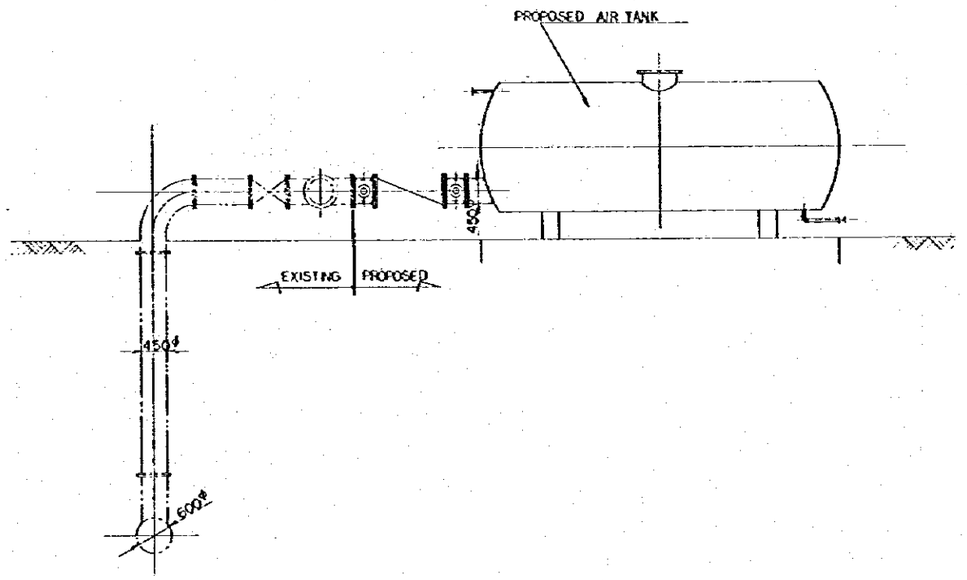


DAR ES SALAAM WATER SUPPLY IMPROVEMENT PROJECT		
LOW LIFT PUMP STATION (1 of 2), PLAN		
DWG. NO. 4	DATE: OCT. 1984	SCALE:1:100
JAPAN INTERNATIONAL COOPERATION AGENCY		

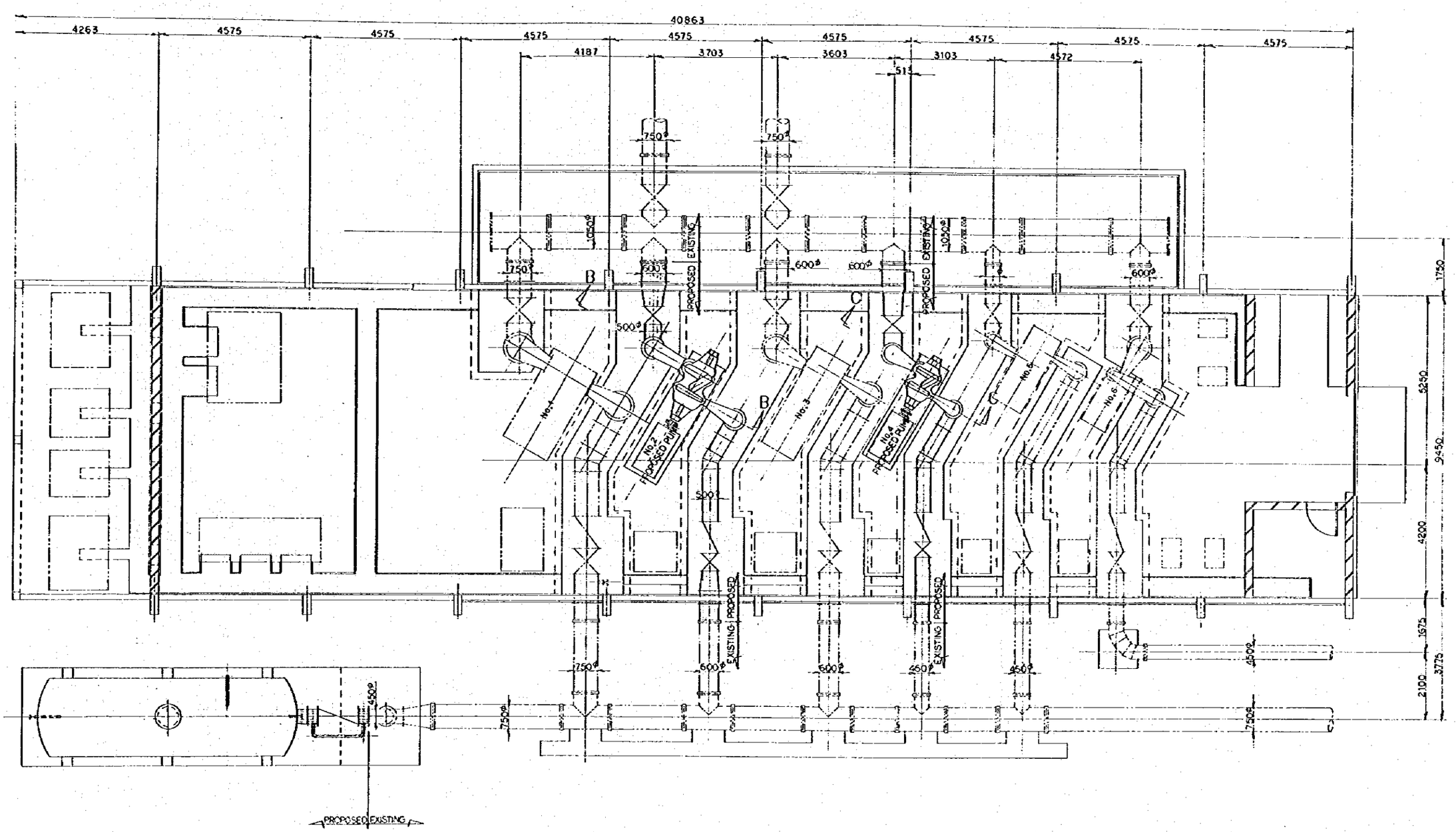
SECTION A - A



SECTION B - B

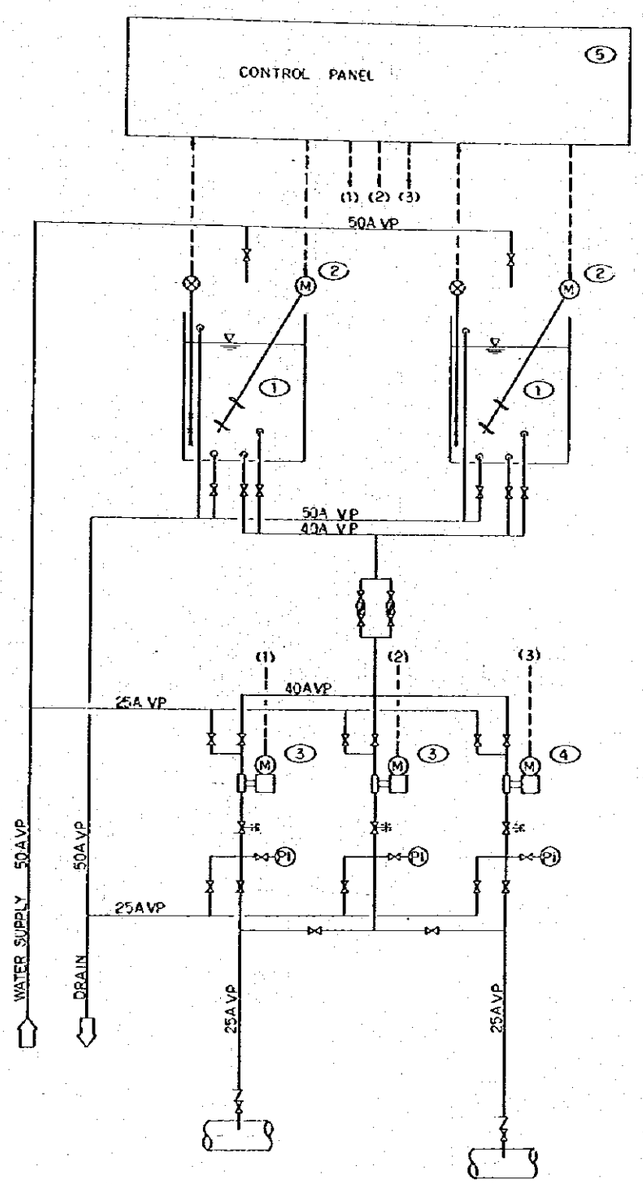


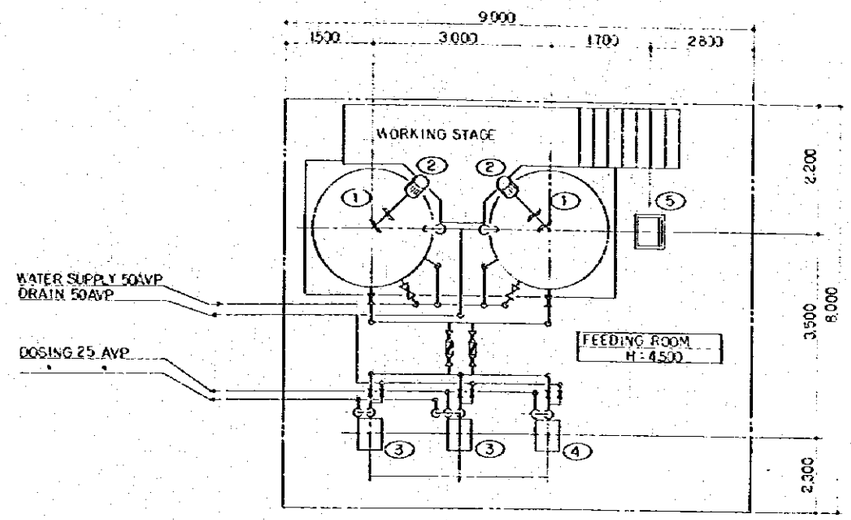
DAR ES SALAAM WATER SUPPLY IMPROVEMENT PROJECT		
LOW LIFT PUMP STATION (2 of 2), SECTION		
DWG. NO. 5	DATE: OCT. 1984	SCALE:1:100
JAPAN INTERNATIONAL COOPERATION AGENCY		

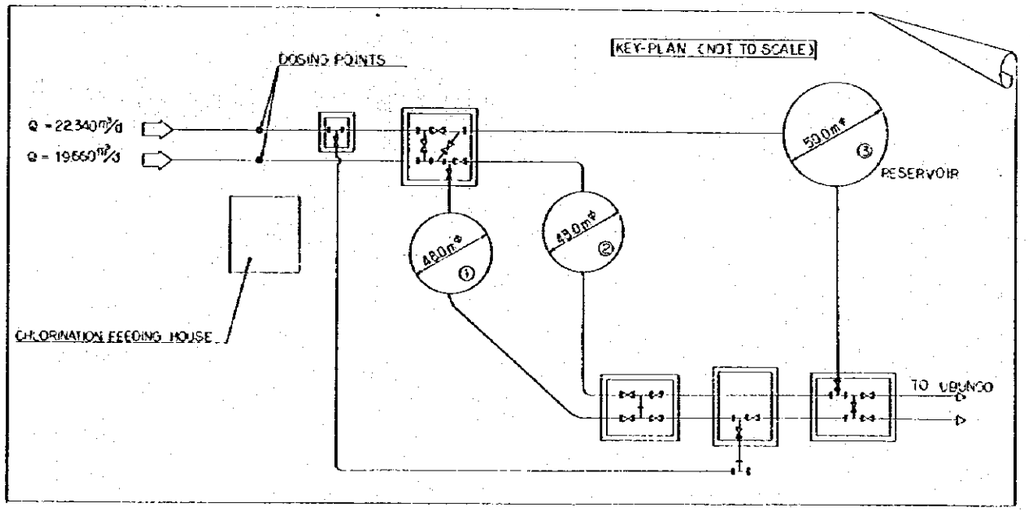


DAR ES SALAAM WATER SUPPLY IMPROVEMENT PROJECT		
HIGH LIFT PUMP STATION, PLAN		
DWG. NO. 6	DATE: OCT. 1984	SCALE:1:120
JAPAN INTERNATIONAL COOPERATION AGENCY		

FLOW DIAGRAM



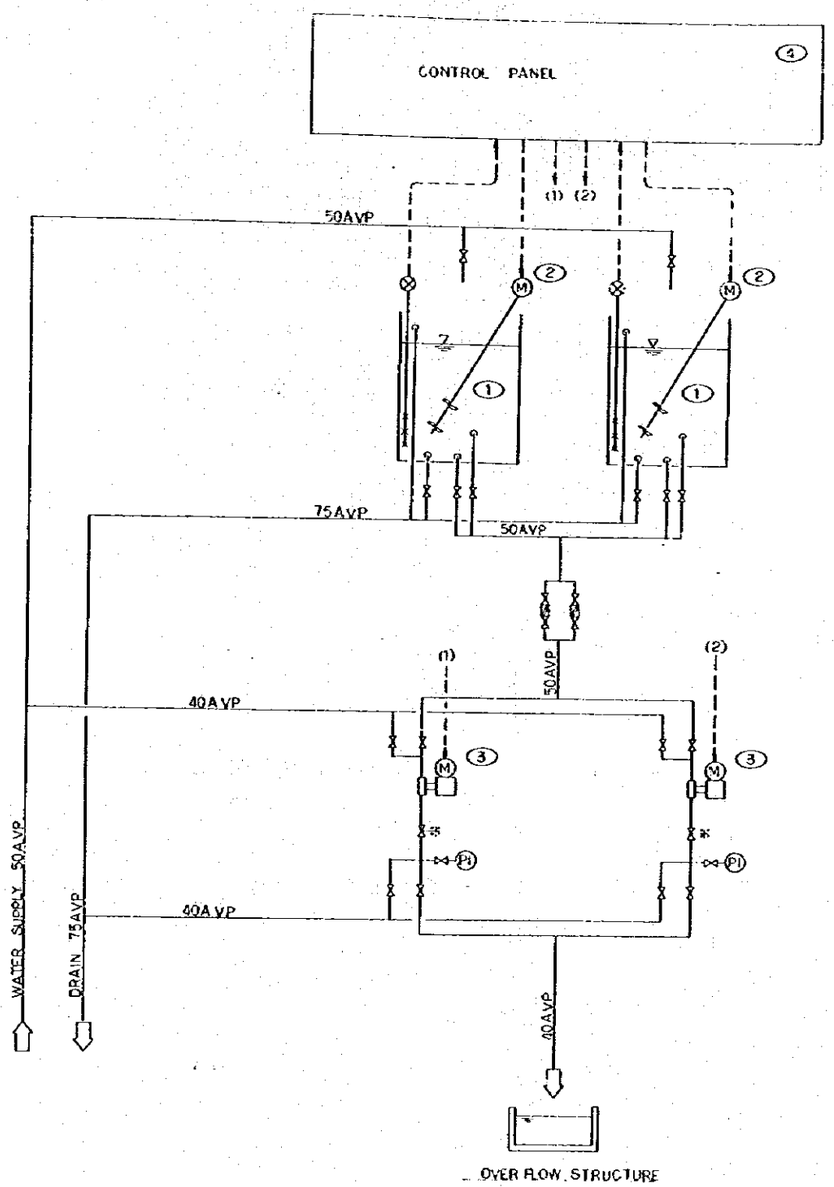


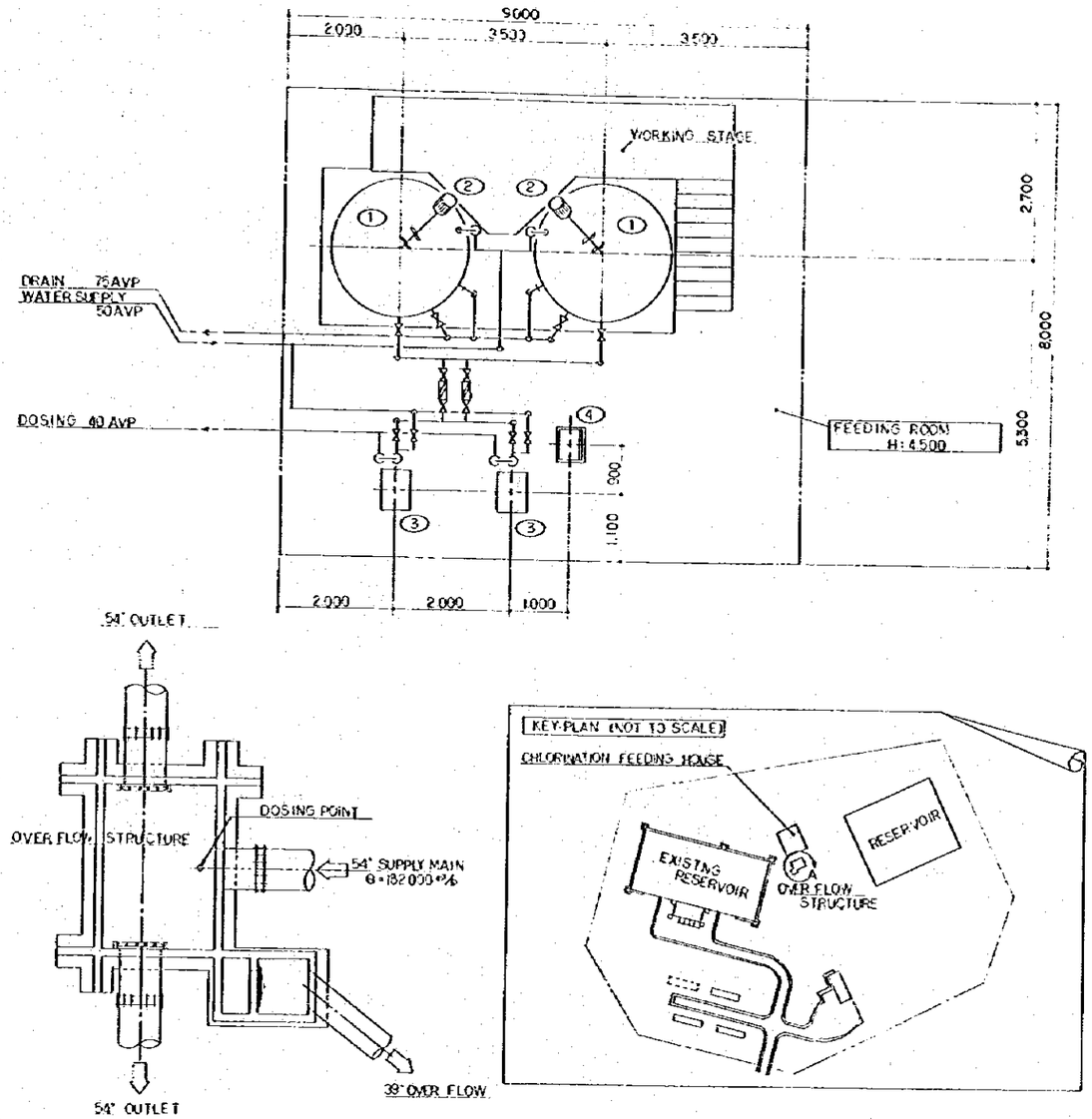


ITEM No.	①	②	③	④	⑤
NAME	SOLUTION STORAGE TANK	MIXER	FEEDING PUMP(1)	FEEDING PUMP (2)	CONTROL PANEL
NUMBER	2	2	2	1	1
CAPACITY	2.5 m³	——	60 ℓ/H ×2kg/cm²	53 ℓ/H ×2kg/cm²	
TYPE	CYLINDRICAL, OPEN-TOP	PORTABLE TYPE	DIAPHRAGM TYPE	DIAPHRAGM TYPE	SELF STANDING TYPE
MATERIAL	PE	SHAFT: SUS304+PVC	PUMP HEAD: PVC	PUMP HEAD: PVC	
DIMENSION	1500φ × 1500H	——	——	——	500W × 400D × 1950H
MOTOR	——	3φ × 400V × 1.5kw	3φ × 400V × 0.2 kw	3φ × 400V × 0.2kw	——

DAR ES SALAAM WATER SUPPLY IMPROVEMENT PROJECT		
CHLORINATION SYSTEM FOR KIMARA RESERVOIR		
DWG. NO.7	DATE: OCT. 1984	SCALE: 1:100
JAPAN INTERNATIONAL COOPERATION AGENCY		

FLOW DIAGRAM

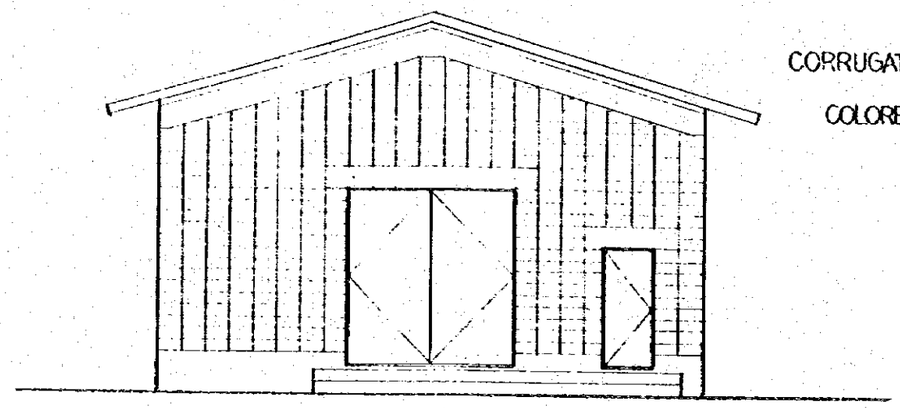




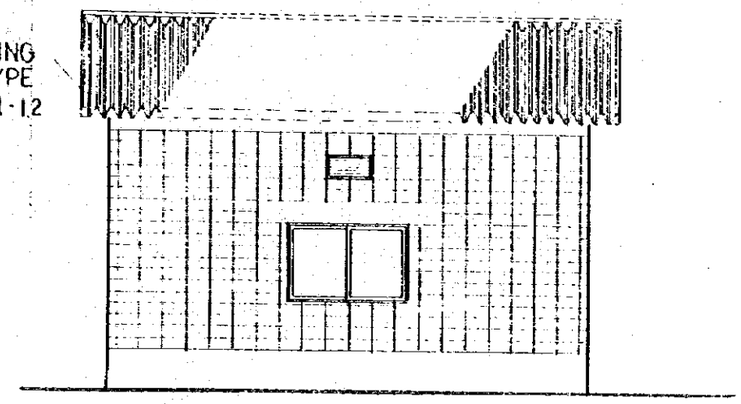
DETAIL-A (NOT TO SCALE)

ITEM No	①	②	③	④
NAME	SOLUTION STORAGE TANK	MIXER	FEEDING PUMP	CONTROL PANEL
NUMBER	2	2	2	1
CAPACITY	100㎥	——	484 ℓ/H x2 ½ kgf	——
TYPE	CYLINDRICAL, OPEN-TOP	PORTABLE TYPE	DIAPHRAGM TYPE	SELF STANDING TYPE
MATERIAL	PE	SHAFT: SUS304+PVC	PUMP HEAD: PVC	——
DIMENSION	2,360ϕ x 2640H	——	——	500W x 400D x 1950H
MOTOR	——	3ϕ x 400V x 2.2kw	3ϕ x 400V x 0.4 Kw	——

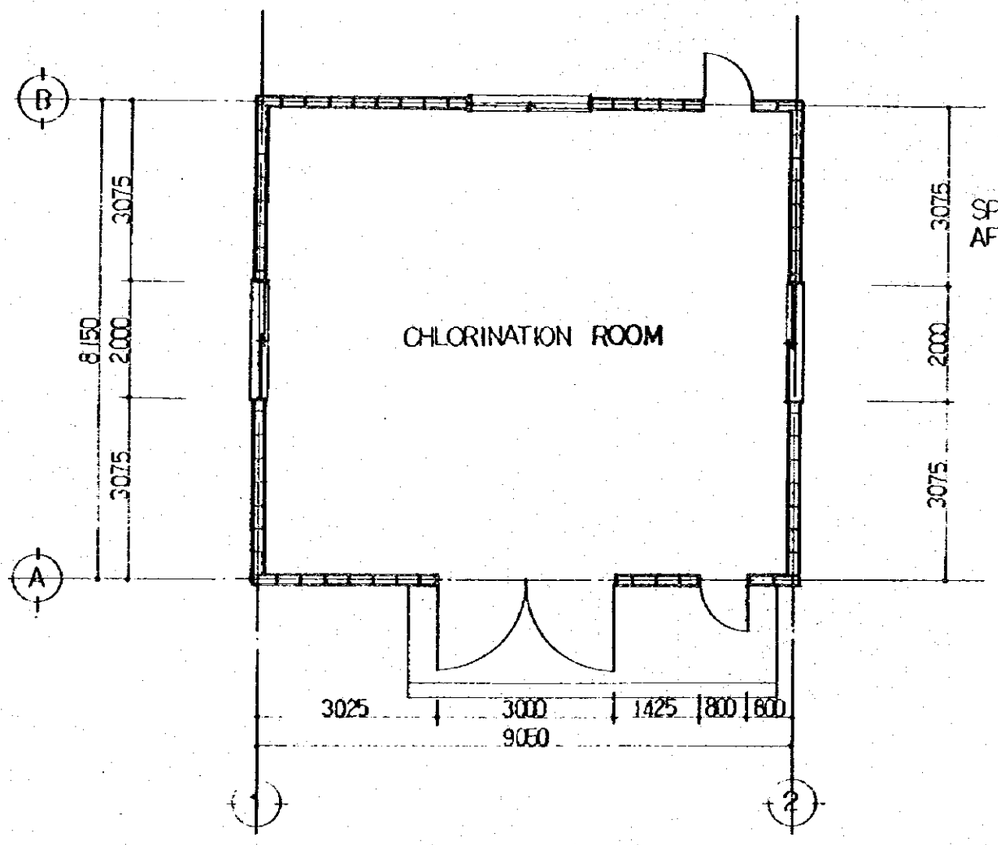
DAR ES SALAAM WATER SUPPLY IMPROVEMENT PROJECT		
CHLORINATION SYSTEM FOR UNIVERSITY RESERVOIR		
DWG. NO. 8	DATE: OCT. 1984	SCALE: 1:100
JAPAN INTERNATIONAL COOPERATION AGENCY		



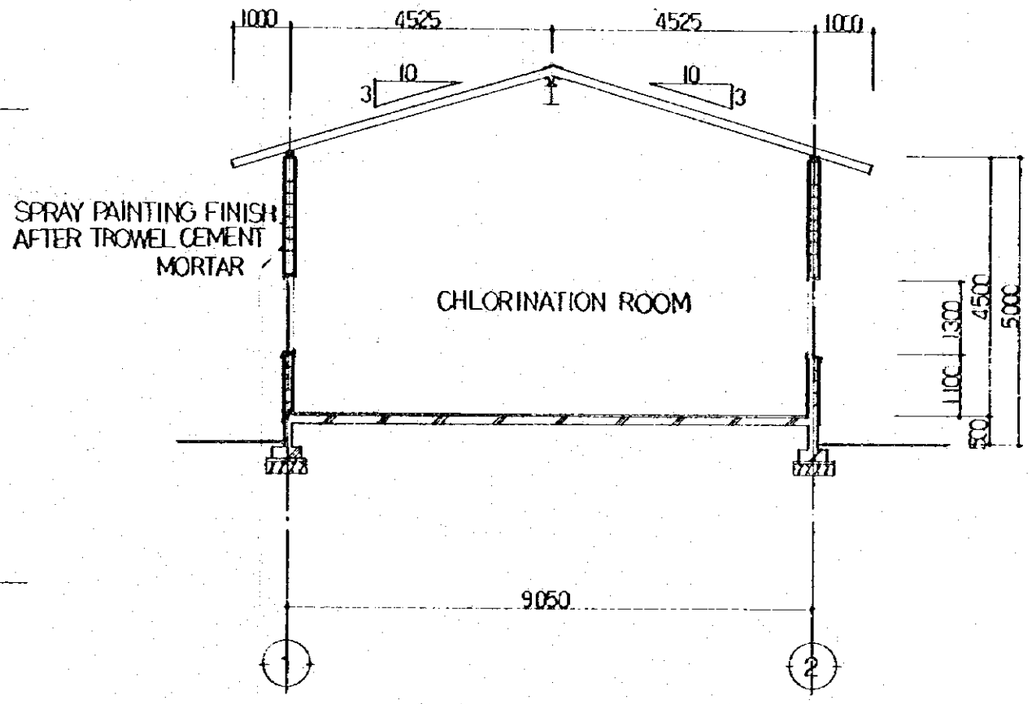
ELEVATION SCALE 1:100



ELEVATION SCALE 1:100



PLAN SCALE 1:100



SECTION SCALE 1:100

DAR ES SALAAM WATER SUPPLY IMPROVEMENT PROJECT		
CHLORINATION HOUSE		
DWG. NO. 9	DATE: OCT. 1984	SCALE:1:100
JAPAN INTERNATIONAL COOPERATION AGENCY		

Chapter 4

IMPLEMENTATION OF THE PROJECT

Chapter 4 IMPLEMENTATION OF THE PROJECT

4-1 Executing Agency

In consideration of the fact that the NUWA DSMB will be in charge of the operation and maintenance of the constructed facilities, it is considered most fit to assume the role of executing agency for implementation of the Project.

Since the Take-over of functions by NUWA DSMB from the DSMWSCS was relatively recent, on July 1st, 1984, it is presently still in the process of assuming full responsibility, and is naturally expected to experience some difficulties during the transition period. However, it is expected to be able to adequately handle the implementation of the Project with the assistance of the NUWA head office and MEW. Also, most of its staff are former members of DSMWSCS, with some having participated in the construction of various Dar es Salaam water supply facilities.

4-2 Construction Plan

4-2-1 Determination of Contractor

NUWA DSMB holds construction machines and staff to execute the work of laying pipes of less than ϕ400 mm and small scale construction work for the course of usual maintenance of the existing facilities. However, the nature of the project, consisting of laying large size pipes, installing various equipment and the large scale construction works, in which construction force of NUWA DSMB has never had the experience, necessitates implementation of the Project, with the assistance of a foreign contractor, preferably by contracting with a Japanese construction company, inasmuch as this Project will be implemented under grant aid from the Government of Japan.

4-2-2 Work Plan

It will require 15 months to complete the work as shown in Table 4-1. Each work item is described below.

1) Preparatory Work

This work includes the following:

- Building site office
- Building Warehouse
- Temporary electrical supply
- Arrangements for authorization to occupy road.
- Arrangements concerning the site
- Preparing stockyard for pipes

Operation of construction machinery is expected to cause traffic disruption on the road; hence, measures to mitigate traffic disruption such as discussion with responsible authorities for traffic must be considered before commencement of construction. Preparatory work will take three months following the contract signing.

2) Installation of Valves Dividing Upper and Lower Service Areas

Valves will be installed in two sites. The work for each site will take about a week following arrival of the valves at the site which will take 4 months. During installation of the valves in the existing pipes (CIP at Manzese, SP at Mtanbani) distribution service will be stopped.

To minimize the period of stoppage, every effort will be made to conduct the work during the night when water demand is less than during the daytime. Also, due attention should be paid to operation of the existing valves to keep the affected area as small as possible.

3) Installation of Kijitonyama Trunk Mains

This work will determine the total period of the Project. It will take four months to produce the pipes and transport them to the site, and laying work will take seven months. Because of various constraints restricting the period of construction and the urgent necessity to utilize the constructed facilities, laying pipes should be done by two corps in order to complete the work as soon as possible.

Pipe laying requires 10-meter wide space on both sides from the center of the pipe. Pipe is laid with a 1.5 meter standard earth covering.

When new pipes are laid parallel with existing pipes, center of the new pipe is laid three meters apart from that of the existing pipes.

Backhoe is used for excavation and truck crane for setting the pipe.

T-type ductile iron pipe, class 4, is used with push-in joint to lay pipes in straight line and K-type mechanical-joint for fittings.

New pipes are connected to the existing pipes at four sites; namely, outlet pipe of the University Reservoir (Ø700 mm diameter), distribution mains (Ø1,350 mm, Ø525 mm, Ø750 mm diameter).

As the outlet pipe from the University Reservoir is now out of service, stoppage of service is avoided during connection work. However, as other pipes are now in use, due attention should be paid to quick connection in order to avoid unnecessarily long service stoppage.

4) Replacement of Low Lift and High Lift Pumps

Two sets of low lift pumps (vertical mixed flow type) and two sets of high lift pumps (horizontal volute type) in the Upper Ruvu system will be replaced.

It will take eight months to design, manufacture and transport the pumps to the site, while it will take one month to install the low lift and the high lift pumps respectively. A pressure tank, will be installed simultaneously. After installation, half a month will be required to adjust the pumps and the pressure tank.

As there is only limited space within the existing pumping stations, the pumps which are out of order will be removed from the station to provide space for the new pumps.

5) Replacement of Air Valves

It will take three months to transport the air valves to the site and another two months to install them. Leakage has been discovered in the air valves in the rising mains in the Upper Ruvu system, hence replacement of the air valves will be conducted, using new dual air valves consisting of nine (9) sets of 100 mm and four (4) sets of 150 mm diameter.

The work of replacement requires completion as soon as possible, since one of the double rising mains will be out of commission during the work, consequently resulting in a decreased amount of water to be supplied to consumers.

Being submerged, the air valve chamber will require dewatering during the installation work.

6) Installation of Chlorination Equipment

It will take three months to transport the chlorination equipment to the site, and another five months for installation and adjustment, construction of the building and laying the chlorine feeding pipes.

Chlorine will be supplied to the following points:

- Two inlet pipes at the Kimara Reservoirs.

- Junction well at the University Reservoir.

As electricity is to be fed from the existing distribution panel, precaution will be required during the connecting work not to adversely affect the existing facilities.

4-2-3 Supervision

Supervision will be conducted by the Consultant and the staff of the Project Team of NUWA DSMB, covering a period of 11.5 months.

Supervision will be commenced first in Japan with discussion of design with the contractor and inspection of equipment and materials. When the site work begins, discussions will be held with the staff of the NUWA DSMB and site representatives of the contractor.

During the construction, site inspection will be continuously conducted by the Consultant with the staff of the NUWA DSMB.

Record of the supervisory work will be submitted to NUWA DSMB within half a month after completion of the construction. Members of the consultant supervisory group, consisting of one (1) civil engineer, one (1) electrical and mechanical engineer and one (1) hydraulic engineer, will be dispatched to the site at appropriate times, taking into account the progress of construction.

4-3 Scope of Work

4-3-1 Responsibility of the Japanese Government

The Project is classified into five works, as described below. The scope of each work is indicated in Drawings 1-9.

Preparatory work includes such items as construction of field office, warehouse, etc., discussion with authorities concerned and setting up procedures to implement efficiently and effectively each work.

1) Installation of Valves for division of the Upper and Lower Service Areas

- Sluice Valve, 375 mm (15 inch) diameter (for installation at the existing distribution pipe (CIP) in the Manzese area), including chamber.

- Sluice valve, 300 mm (12 inch) diameter (for installation at the existing distribution pipe (SP) in the Mtambani area), including chamber.

2) Installation of Kijitonyama Trunk Mains

- Laying of ductile iron pipe, 800 mm (36 inch) diameter, 4,100 m length.

- Associated appurtenances such as air valve, washout etc.

- Connection with outlet pipe of 700 mm (28 inch) diameter from the University Reservoir.

- Connection with distribution pipes of 1,350 mm (54 inch), 525 mm (21 inch) and 750 mm (30 inch) diameters respectively.

3) Replacement of Low Lift Pumps and High Lift Pumps.

- Low lift pumps at the Upper Ruvu intake plant :
  22.8 m3/min x 70.2 m x 380 kw : 1 unit
  11.4 m3/min x 70.2 m x 190 kw : 1 unit

- High lift pumps at Upper Ruvu purification plant :
  22.8 m3/min x 152.5 m x 800 kw : 1 unit
  11.4 m3/min x 152.5 m x 400 kw : 1 unit

- Control panel for low lift and high lift pumps : 1 set each

- Connection of pumps with the existing delivery pipes including installation of check valves, control valves, meters and appurtenant piping.

- Installation of pressure tanks and compressors for relief of water hammer in the low lift and the high lift pumps respectively and related work.

4) Replacement of Air Valve of Upper Ruvu Rising Mains

- Dual air valve of 100 mm (4 inch) and or 150 mm (6 inch) diameter: 13 sets

5) Installation of Chlorination Equipment

- Installation of chlorination equipment :
  Kimara reservoir: Two (2) sets
  University reservoir: Two (2) sets

- Laying connecting pipes :
  Kimara Reservoir Dosing 2 places
  Junction well at University Reservoir Dosing 1 place

- Installation of control panel for chlorination equipment apparatus (1 set each for University and Kimara reservoirs), including electrical wiring: 2 sets
- Installation of chlorine solution tank and mixer (1 set each for University and Kimara reservoirs): 2 sets

- Construction of house for chlorination equipment (1 each for University and Kimara reservoirs): 2 each

4-3-2 Responsibility of the Tanzania Government

The booster pumping station (Link Project), now being constructed by NUWA DSMB, is an integral part of this project. Therefore, completion of the booster pumping station with the scope of work shown in Fig. 4-1 is essential for effectiveness of the Project.

4-4 Implementation Schedule

The Project is scheduled to be carried out according to Table 4-1.

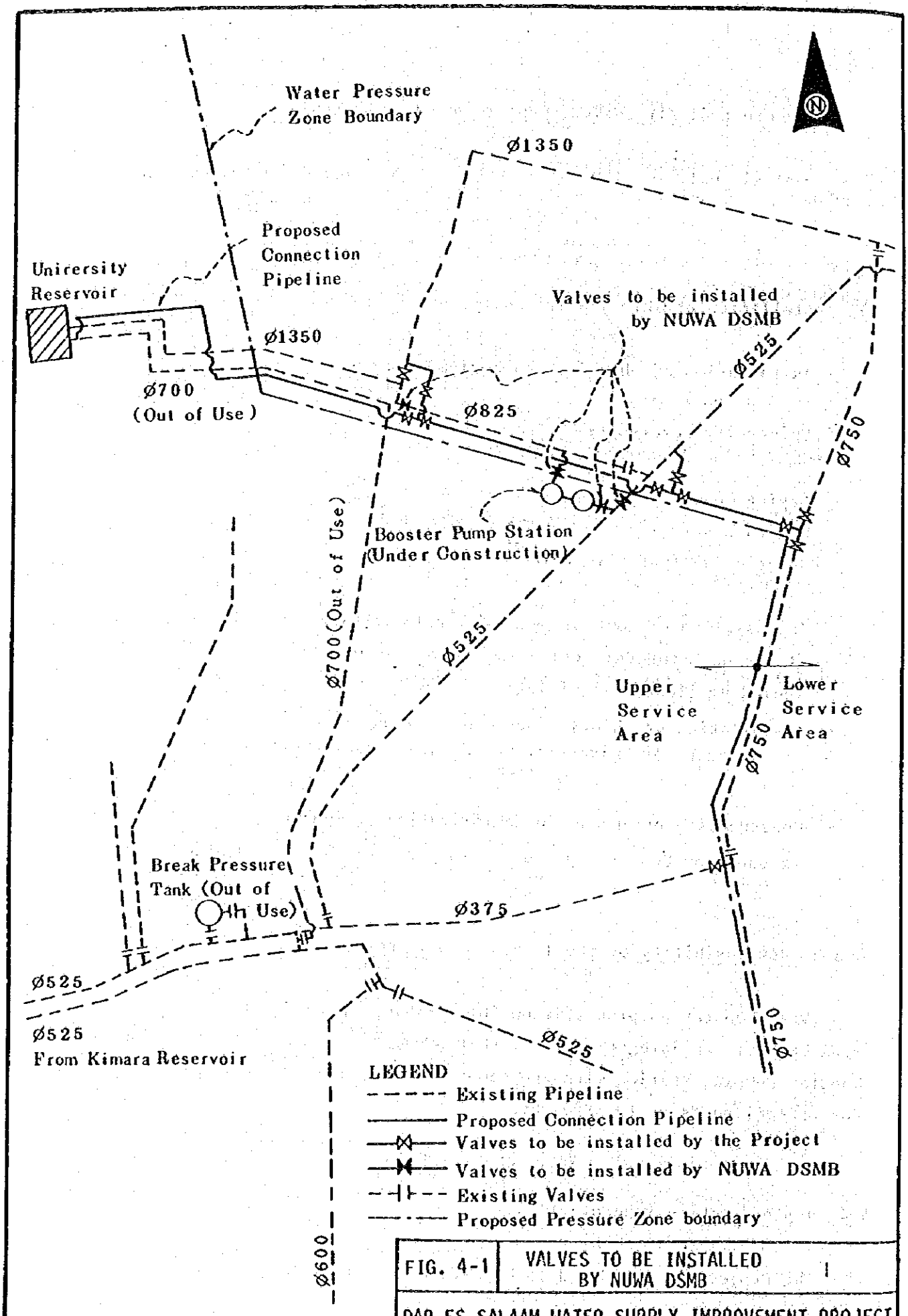
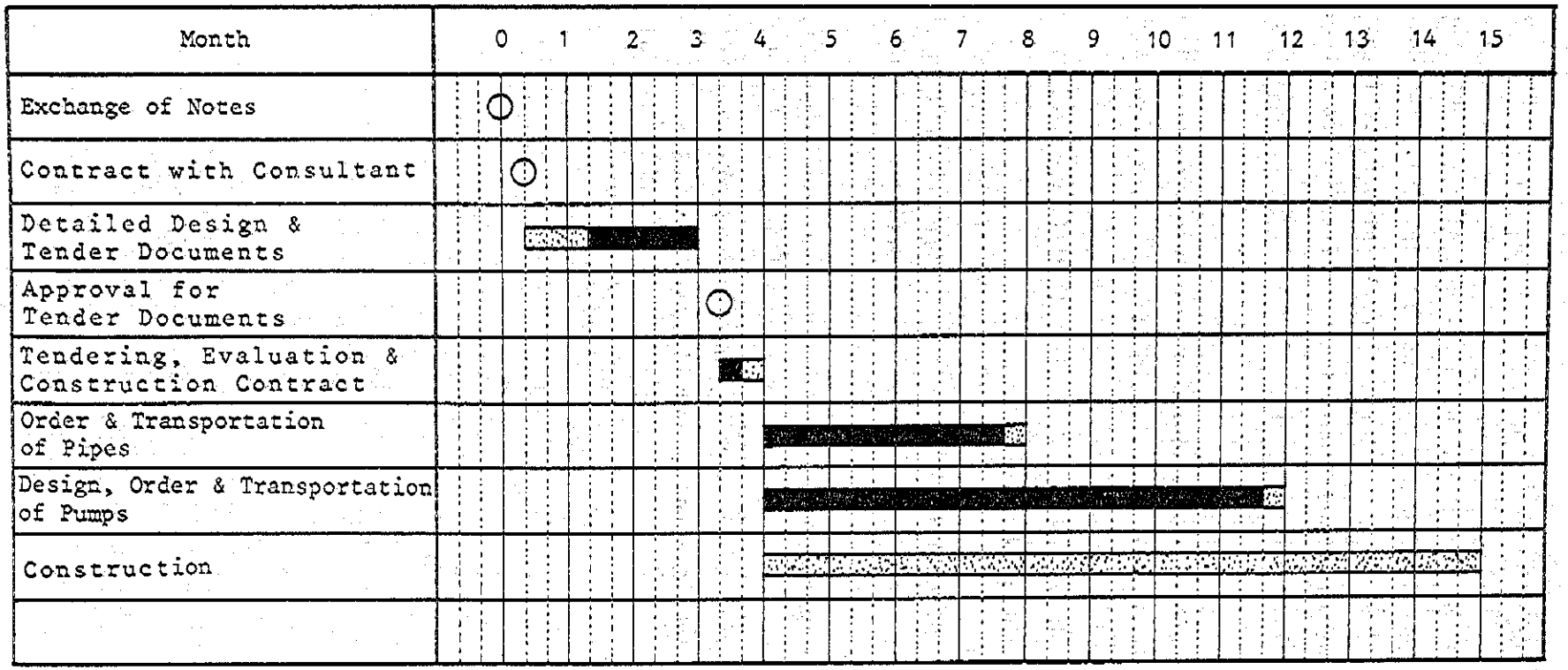


FIG. 4-1	VALVES TO BE INSTALLED BY NUWA DSMB
DAR ES SALAAM WATER SUPPLY IMPROVEMENT PROJECT	
JAPAN INTERNATIONAL COOPERATION AGENCY	

Table 4-1. Implementation Program



4-5 Operation and Maintenance Plan

4-5-1 Operation and Maintenance Plan

The responsibility for operation and maintenance falls under the NUWA DSMB. Operation and Maintenance Department, as shown in Fig. 2-1. The Water Source and Treatment Section is responsible for the intake plants and treatment plants of the Upper Ruvu, Lower Ruvu and Mtoni Plants. Distribution network is maintained by the five Area Offices under the Distribution Section.

The constructed facilities and equipment for this Project, therefore, must be operated and maintained under the existing framework, as described below.

- Kijito Nyama Trunk Mains and Valves dividing the service area :	Distribution Area office
- Low lift pumps, high lift pumps and air valves :	Upper Ruvu water treatment office
- Chlorination equipment :	Kimara & University reservoir office

Expendable items of one-year durability will be provided, including necessary spare parts, taking into account the site situation.

4-5-2 Cost of Operation and Maintenance

Cost for operation and maintenance of the facilities and equipment installed by the project consist mostly of the electrical charge for the low lift pumps and high lift pumps and the chemical cost for the chlorination equipment.

The operation and maintenance costs are estimated as follows:

Low lift and high lift pumps

Annual electricity consumption: 12.2×10^6 kwh
Annual electrical charge (unit charge): 5.5 million Shs

Chlorination Equipment (University and Kimara reservoirs)

Annual consumption volume: 146 10^3 kg
(Calcium Hypochlorite, 60% as chlorine)
Annual chemical cost: 2.2 millions Shs

Operation and maintenance cost for the trunk mains is almost nil. The pumping equipment and the chlorination equipment require careful maintenance and operation. The estimated cost of 0.5 million Shs, which is about 2% of the initial construction cost, is considered to be sufficient for the operation and maintenance of the equipment.

4-6 Procurement

4-6-1 Materials, Equipment and Labour

Sand, gravel, etc. are abundant in supply, while manufactured materials such as cement and steel bars are scarce. Tanzania Portland Cement Company and Tanga Cement Company operate a total of three cement factories. The two companies produce 50,000 tons per year (t/y) and 60,000 tons per year (t/y) respectively; however, they are now operating at half capacity.

Steel bar is produced by Tanganyika Steel Company, which is also operating at half capacity, so that an abundant supply of steel bars can not be expected. PVC pipe from 3/8 inch to 8 inch diameter is produced, while steel pipe and ductile iron pipe are not produced.

Among the required materials and products, the following goods will be procured from Japan:

- Ductile iron pipe and its appurtenances, such as valves and air valves
- Pump, motor, pressure tank, control panel, delivery and suction pipes, electrical wiring and their accessories
- Chlorination appurtenances, such as injection pump, mixer, solution tank, pipe, control panel, etc.
- Steel bar
- Cement
- Lubrication oil

The following goods will be procured in Tanzania:

- Fine aggregate, coarse aggregate, sand and crushed stone
- Timber
- Concrete block
- Gasoline, heavy oil

Construction machinery will be procured in Japan basically. The main items are as follows:

- Backhoe
- Truck crane
- Vibration roller
- Tamper
- Cutter for ductile iron pipe
- Welder and generator
- Drain pump

Ninety percent of imported goods to Tanzania are unloaded at Dar es Salaam port, which has eight berths where 35,000-ton ships can be accommodated. Also, Japanese ships call regularly at this port two times a month. Therefore, procured materials, products and construction machinery will be unloaded there.

Arrangements for labour force in Tanzania such as labourer, carpenter, welder, etc., will be made through the Tanzania construction company.

Even after the completion of this Project, some repair work might become necessary to be carried out, as in operation and maintenance work.

Therefore, training of the staff of NUWA DSMB will be included during the Project.

4-6-2 Responsibility

Discussion with the City Planning Committee of Dar es Salaam will be necessary because the Project will require authorization for the use of roads under which pipes will be laid, the site for temporary storage of pipes, and construction of temporary roads, although no cost will be incurred due to the public nature of the work.

Charges for water and electricity during test and adjustments of pumps, etc., after installation will be borne by NUWA DSMB.

Chapter 5

PROJECT EVALUATION

Chapter 5 PROJECT EVALUATION

The existing facilities hinder and disturb the daily life of the citizens through the restrictions imposed on water consumption and the turbid water from the water taps. Also, the frequent water shortage has resulted in the decline of industrial products.

The plan, being an Urgent Improvement Programme to make the existing distribution system more effective without changing the capacity of the existing facilities, aims to rehabilitate the existing facilities by replacing all deteriorated equipment and/or supplementing some parts of the facilities. In addition to the rehabilitation of the respective facilities, a complete division of the upper and the lower service areas is to be accomplished by installation of valves, while the supplementary distribution trunk main is provided to improve the water supply situation.

The two new major items in this plan include the chlorination facilities, as well as the Kijito Nyama trunk main. They are expected to contribute toward ensuring provision of a clean water supply which will safeguard the health of the populace.

Therefore, the performance of this project through the rehabilitated functioning of the existing facilities will contribute toward upgrading the public sanitation of the citizens of Dar es Salaam and improve the living environment through provision of a clean and continuously adequate water supply. In addition, the increase of factory products is expected to activate the national economy.

On the basis of these positive expectations which will have far-reaching effects on the country of Tanzania, as well as its capital city, the grant aid from the Japanese Government is expected to be an important and effective contribution toward achievement of the project goal.

Chapter 6

CONCLUSION AND RECOMMENDATION

Chapter 6 CONCLUSION AND RECOMMENDATION

In order to resolve Dar es Salaam's water shortage problem, which is seriously affecting the entire city, the Study Team has drawn up a practical plan to improve the situation as soon as possible to assure a continuously adequate and potable supply of water mainly in the Upper Service Area, where institutions, industries and residences are located, including the airport, University and various factories. Due to the urgent nature of the situation and the condition of the nation's economy including that of NUWA DSMB, the most appropriate form for implementing this project is considered to be a grant which is expected to be provided by the Government of Japan.

The Urgent Improvement Programme focuses on resolving the immediate problems of restoring the available capacity of Dar es Salaam's existing water supply system by improving its existing facilities as economically as possible.

Completion of the project is expected to result in a properly functioning system that will prevent water shortage and provide a constant, adequate and sanitary water supply for Dar es Salaam.

However, it is considered that water shortage will probably re-occur in the future as increasing demand exceeds capacity of the water supply system. Dar es Salaam is beset by many problems other than that of its water quantity such as the improvement of other facilities, water quality, maintenance and expansion of facilities, for which sound waterworks management is required.

In order to resolve these additional problems, it is recommended that a long-term master plan be established, based on a review of previous master plans, and its development plan executed under water management policies set under the long-term master plan.

APPENDICES

Appendix 1 Minutes of Discussion

MINUTES OF DISCUSSION
ON
THE DAR ES SALAAM WATER SUPPLY IMPROVEMENT PROJECT, THE UNITED REPUBLIC OF TANZANIA

In response to the request by the Government of the United Republic of Tanzania for assistance in improving the Dar es Salaam Water Supply (hereinafter referred to as "the Project"), the Government of Japan has sent through the Japan International Cooperation Agency (JICA) a study team headed by Mr. Hideyuki AOKI, Director, Design Division, Construction Department, Kanagawa Water Supply Authority, to conduct the Basic Design Study on the Project from June 18 to July 9, 1984.

The Team held a series of discussions and exchanged views with the relevant Authorities of the Government of the United Republic of Tanzania.

As a result of the study and discussions, both parties have agreed to recommend to their respective Governments to examine the result of the survey attached herewith towards the realisation of the Project.

June 27, 1984.

H. Aoki

Hideyuki AOKI
Leader
JICA Study Team

Alois A. SENGUO
Director General
National Urban Water Authority
(NUWA)

Attachments

1. The Objective of the Project is to improve urgent problems of the Dar es Salaam Water Supply System.

2. The main role of the Project is as follows :-

   It is understood that the urgent problems of the Dar es Salaam Water Supply System are connected with the water shortage in high distribution zone and deterioration of facilities in the upper Ruvu system. Therefore, the main role of the Project is to resolve these problems.

3. The Japanese Study Team will convey the desires of the Government of the United Republic of Tanzania to the Government of Japan that the latter will improve the Dar es Salaam Water Supply as listed in Annex I within the scope of Japanese economic cooperation in grant form.

4. The Government of the United Republic of Tanzania will take the necessary measures listed in Annex II.

5. Both sides confirmed that the Japanese Study Team explained Japan's Grant Aid Programme and that the Tanzanian side understood it.

Annex I

Main Project Feature is as follows :-

1. To install control valves on the distribution mains which are connected from the Kimara reservoir to provide constant water supply from the reservoir to the high distribution zone.

2. To install a distribution mains from the University Reservoir to suitable point in the low distribution zone.

3. To replace intake pumps and water transmission pumps for the Upper Ruvu Plant system to secure present flow rate.

Annex II

Required Arrangements to be undertaken by the Government of the United Republic of Tanzania

1. To secure land necessary for the construction of the facilities and to clear, fill and level the site as needed before the start of the construction.

2. To construct and prepare the access road to the Project site.

3. To ensure prompt unloading, tax exemption and customs clearance at ports of disembarkation in Tanzania and prompt internal transportation therein of the products purchased under the grant.

4. To exempt Japanese nationals engaged on the Project from customs duties, internal taxes and other fiscal levies which may be imposed in Tanzania with respect to the supply of the products and the services under the verified contracts.

5. To accord without delay to Japanese nationals whose services may be required in connection with the supply of the products and services under the verified contract such facilities as may be necessary for their entry into Tanzania and their stay therein for the performance of their work.

6. To maintain and use properly and effectively the facilities constructed under the grant.

7. To bear all the expenses, other than those to be borne by the grant, necessary for the construction of the facilities.

8. To provide the space necessary for such construction as temporary offices, working areas, stock yards and others.

Appendix 2 List of Study Team Members

Position	Name (and Staff Title)	Organization or Firm
Leader:	Hideyuki AOKI (Team Leader)	Director, Design Division Construction Department Kanagawa Water Supply Authority
Members:	Takashi KOMORI (Project Coordinator)	Basic Design Division Grant Aid Department Japan International Cooperation Agency
	Heiichior MAKINO (Chief Enginer/ Water Supply Planning)	Tokyo Engineering Consultants Co., Ltd.
	Katsutoshi IWASAKI (Engineer/Water Distribution Planning)	Tokyo Engineering Consultants Co., Ltd.
	Masaharu TAKASUGI (Engineer/ Facility Planning)	Tokyo Engineering Consultants Co., Ltd.
	Takashi SUZUKI (Engineer/Electrical, Mechanical Planning)	Tokyo Engineering Consultants Co., Ltd.

Appendix 3 Field Investigation Schedule

Date	Place	Work
June 18 (Mon)	Japanese Embassy JICA DSM office	• Arrival at DSM (10:00AM) • Explanation of study schedule
" 19 (Tue)	MOF MWE DSM WSCS	• Explanation of Inception Report • Request for data collection • Investigation of water supply situation
" 20 (Wed)	City Area DSM WSCS Reservoir (Kimara & University)	• Measuring water pressure of main pipes • Reporting the results of measuring water pressure • Studying the detail drawings of existing distribution pipeline • Confirmation of points of flow rate measurement
" 21 (Thu)	University Reservoir	• Measuring distribution flow rate (ø1,350 pipe)
" 22 (Fri)	Kimara Reservior DSM WSCS Upper Ruvu Plant	• Measuring distribution flow rate (ø550 pipe) • Receipt of suggestions for the study from DSM WSCS • Study of the Upper Ruvu system facilities
" 23 (Sat)	Lower Ruvu Plant	• Study of the Lower Ruvu Plant facilities
" 24 (Sun)	Hotel	• Discussion of DSM WSCS suggestions • Preparation of draft minutes of discussion

" 25 (Mon)	DSM WSCS	• Receipt of detail drawings of Upper Ruvu Plant • Report and discussion of draft minutes
" 26 (Tue)	Upper Ruvu Plant	• Review of technical details of Upper Ruvu Plant facilities
" 27 (Wed)	NUWA	• Signing of minutes • Preparation of the result of field investigation
" 28 (Thu)	DSM WSCS	• Receipt of requested data • Explanation of supplementary study
" 29 (Fri)	MOL DSM WSCS	• Data collection (aerial photograph, drawings of pipeline profile and topography) • Departure DSM (Leader, Mr. Aoki and Member, Mr. Komori)
" 30 (Sat)	Kimara Reservoir	• Measuring distribution flow and inflow rate
July 1 (Sun)	Hotel	• Data analysis
" 2 (Mon)	Kimara Reservoir NUWA DSMB	• 24-hour consecutive measurement of distribution flow rate • Data collection
" 3 (Tue)	MOL JETRO Meteorological agency NUWA DSMB	• Data collection

" 4 (Wed)	City Area	· Confirmation of Location of distribution pipes and valves · Survey for the proposed distribution main pipeline route
" 5 (Thur)	University Reservoir NUWA DSMB MECCO	· Discussion of Technical Understanding · Collection of data on construction materials
" 6 (Fri)	NUWA DSMB Japanese Embassy MOF	· Confirmation of the new drawing of existing distribution pipe line · Signing of Technical Understanding · Reporting of study
" 7 (Sat)	City Area Hotel	· Measuring water pressure at Msasani district · Data analysis of the daily report of Upper Ruvu Plant
" 8 (Sun)	Hotel	· Preparation for return to Japan of remaining 4 staff members
" 9 (Mon)		· Departure/DSM

Appendix 4 List of Interviewees

Ministry of Finance

Mr. F. . BYABATO	Assistant Commissioner for External Finance
Mr. E.K. KAMBA	Private Secretary
Mr. MBENA	Finance Officer

Ministry of Water and Energy

Mr. KAZAURA	Parmanent Secretary
Mr. J.H. NKOMA	Director of Constuction & Maintenance

National Urban Water Authority

Mr. A.A. SENGUO	Director General
Mr. J.J. NKONDOLA	Director of Manpower Development & Administration

NUWA DSM Branch

Mr. J. MLENGU	Manager of Branch
Mr. J. SIWA	Water Distribution Engineer
Mr. J. NKUZI	Planning and Construction Engineer
Mr. R. MTORO	Planning Engineer
Mr. K. KISHINA	Emergency Section

Japanese Embassy

Mr. M. ASABA	Ambassador
Mr. T. SUZUKI	Councillor
Mr. M. FURUICHI	First Secretary

Mr. I. MUTOH	Second Secretary

JICA Dar es Salaam office

Mr. M. SANO	JICA Office Manager
Mr. T. TAKAHATA	

JETRO Dar es Salaam office

Mr. K. KOBAYASHI	

Appendix 5 Water Demand Categories (by Use)

(1) Take-off Flow at Each Junction (Upper Service Area)

Junction No.	Domestic use	Hotel use	Industrial use	Government & school use	Total
3	(11)x$\frac{1}{2}$ = 870		(10)x$\frac{1}{3}$ =1,000		1,870
4	(25) = 90 (34) = 830		(10)x$\frac{1}{3}$ =1,000	(3) = 90	2,010
5	(29) =3,100 (30) =1,240 (31) =2,170				6,510
7				(18) =2,790	2,790
9	(32) =2,760		(9) = 640	(19) =1,080 (20) =1,080	5,560
14	(35) = 240				240
15 65			(13)x$\frac{1}{2}$ = 2,290 (14) =13,700		15,990 (15- 3,200) (65-12,790)
17 67	(11)x$\frac{1}{2}$ = 870		(10)x$\frac{1}{3}$ = 1,010		1,880 (17- 940) (67- 940)
19				(1) =1,600	1,600
21		All=470	(13)x$\frac{1}{2}$ = 2,290 (15) = 590	(21) = 200	3,550
Total	12,170	470	22,520	6,840	42,000

(2) Take-off Flow at Each Junction (Lower Service Area)

103	(33)x$\frac{1}{3}$ =6,510				6,510
104	(25) = 130 (33)x$\frac{1}{3}$ =6,510				
109	(9)x$\frac{1}{2}$ =1,790 (40) = 530		(11) = 250	(2) =19,040	21,610
110	(9)x$\frac{1}{2}$ =1,800			(4) = 120 (5) = 60 (6) = 120	2,100
111	(8)x$\frac{1}{2}$ =4,310				4,310

Junction No.	Domestic use	Hotel use	Industrial use	Government & school use	Total
113	(2) = 130 (4) = 930 (5) =1,460 (6) =2,920 (39) = 930 (41) =1,990		(12) = 590		8,950
114	(3)x$\frac{1}{2}$ = 790 (38) =2,520				3,310
115	(7)x$\frac{1}{2}$ = 330				330
116	(1)x$\frac{1}{3}$ = 270				270
117	(1)x$\frac{1}{3}$ = 270 (3)x$\frac{1}{4}$ = 400	0 = 10			680
120	(1)x$\frac{1}{3}$ = 260			(7) = 200	460
121	(8)x$\frac{1}{2}$ =4,320 (37) =3,050				7,370
122	(12) 7,700 (36) =2,520				10,220
123	(28)x$\frac{1}{2}$ =1,920 (29)x$\frac{1}{2}$ = 990				2,910
124				(9) = 150	150
125	(15)x$\frac{1}{3}$ =2,960		(7) = 200		3,160
126	(16)x$\frac{1}{2}$ =2,390 (17) = 400 (18) =2,920 (19) =1,060 (20) =1,590 (21) =14,870 (22) =13,810 (23) =1,730 (26) =3,050 (27) =1,990 (28)x$\frac{1}{2}$ =1,930		(1) = 3,600 (2) = 3,500 (3) = 2,660 (4) = 890 (5) = 390 (6) = 2,220 (8) =12,460	(13) = 60 (14) = 610 (15) = 150 (16) = 350 (17) = 640	73,270
129	(14)x$\frac{1}{3}$ =1,190			(8) = 170	1,360
130	(15)x$\frac{1}{3}$ =2,960			(11)x$\frac{1}{2}$ = 130	3,090

Junction No.	Domestic use	Hotel use	Industrial use	Covernment & school use	Total
131	(3)x$\frac{1}{4}$ = 400 (7)x$\frac{1}{2}$ = 330				730
132	(13) = 270 (14)x$\frac{1}{3}$ =1,200				1,470
133	(14)x$\frac{1}{3}$ =1,200				1,200
134 184	(10)x$\frac{1}{2}$ =1,860	K =100 N = 50 M = 30		(11)x$\frac{1}{2}$ = 130 (12) = 260	2,430 134- 1,210 184- 1,220
105	(29)x$\frac{1}{2}$ =1,000 (30) = 800				1,800
135 185	(10)x$\frac{1}{2}$ =1,860 (15)x$\frac{1}{3}$ =2,970	T = 10			4,840 135- 2,420 185- 2,420
127	(16)x$\frac{1}{2}$ =2,390 (24) =3.850			(10) = 90	6,330
128	(33)x$\frac{1}{3}$ =6,500				6,500
Total	132,760	200	26,760	22,280	182,000

Appendix 6 Take-off Flow

(1) Domestic use

Distribution area	District	Population	Ratio(%)	Water Consumption(m3/d)
Upper Service Area	11. Ubungo	12,242	14.3	1,740
	25. Tabata (1/2)	637	0.7	90
	29. Vingunguti (2/3)	21,831	25.5	3,100
	30. Kiwalani (2/3)	8,7	10.2	1,240
	31. Kipawa	15,235	17.8	2,170
	32. Gongolamboto	19,404	22.7	2,760
	34. Mabibo	5,819	6.8	830
	35. Kimara	1,672	2.0	240
	Sub-Total	85,545	100.0	12,170
Lower Service Area	1. Msasani Peninsula	4,536	0.6	800
	2. Msasani Bay	750	0.1	130
	3. Dyster Bay	8,400	1.2	1,590
	4. Regene Estates	4.585	0.7	930
	5. Kinondoni A	7,480	1.1	1,460
	6. Kinondoni B	15,840	2.2	2,920
	7. Kinondoni East	3,520	0.5	660
	8. Mwananyamala	46,094	6.5	8,630
	9. Kijito Nyama	19,278	2.7	3,590
	10. City Centre	20,000	2.8	3,720
	12. Magomeni	41,336	5.8	7,700
	13. Upanga West	1,365	0.2	270
	14. Upanga East	19,040	2.7	3,590
	15. Kariakoo	47,712	6.7	8,890
	16. Ilala	25,812	3.6	4,780
	17. Benderatatu Kurasini	2,232	0.3	400
	18. Kurasini	15,390	2.2	2,920
	19. Keko	5,312	0.8	1,060
	20. Chang'ombe	8,416	1.2	1,590
	21. Temeke	79,485	11.2	14,870
	22. Tandika	73,681	10.4	13,810
	23. Kigamboni	9,100	1.3	1,730
	24. Kigogo	20,743	2.9	3,850
	25. Tabata (1/2)	636	0.1	130
	26. Keko/Gerzani	16,401	2.3	3,050
	27. Mtoni	10,725	1.5	1,990
	28. Buguruni	20,724	2.9	3,850
	29. Vingunguti (1/3)	10,916	1.5	1,990
	30. Kiwalani (1/3)	4,352	0.6	800
	33. Manzese	103,884	14.7	19,520
	36. Hanna Nassif	13,222	1.9	2,520
	37. Kinondoni	16,588	2.3	3,050
	38. Mikoroshoni	13,167	1.9	2,520
	39. Mikocheni	4,763	0.7	930
	40. Mwenge	3,135	0.4	530
	41. Kawe	10,307	1.5	1,990
	Sub-Total	708,927	100.0	132,760
Total		794,472		144,930

(2) Government Industrial and Institutional use

Distribution Area	Government, School	(ha) Area	Ratio (%)	Water Consumption (m3/d)
Upper Service Area	1. University College, ARDHI Institute of Water Resources Institute TANESCO Offices, Water Supply Offices.		5.5	1,600
	3. Transmission Station School	18	0.3	90
	18. Airport	640	9.6	2,790
	19. Prisons	250	3.7	1,080
	20. Ukonga Military Area	250	3.7	1,080
	21. Kunduchi Military Area.	50	0.7	200
	Sub-Total	1,574	23.5	6,840
Lower Service Area	2. Luggalo Barracks	4,376	65.4	19,040
	4. Audio-Visual Institute Institute of Mass Communication Institute of Scoial Welfare	24	0.4	120
	5. Village Museum	15	0.2	60
	6. Telecommunication	26	0.4	120
	7. Ras Kankadya Military Area	50	0.7	200
	8. Muhimbili Hospital Azanzia Secondary School Jangevani Secondary School	40	0.6	170
	9. Institute for the Deaf Anglican-Episcopal Centre	36	0.5	150
	10. Mzimbasi Catholic Mission	22	0.3	90
	11. High Court, Central Library, SIDO Hostel, College of Business Education, Technical College, Aga Khan Hospital	60	0.9	260
	12. Institute of Finance Management	62	0.9	260
	13. Kivukoni College	12	0.2	60
	14. Kigamboni Military Area	140	2.1	610
	15. Police Academy	36	0.5	150
	16. National Service Facilities Teacher Training College Salvation Army National Stadium	80	1.2	350
	17. Military Academy DSM School of Accountancy	145	2.2	640
	Sub-Total	5,124	76.5	22,280
	Total	6,698	100.0	29,120

(3) Industrial use

Distribution Area	Industry	Area (ha)	Ratio (%)	Water Consumption (m3/d)
Upper Service Area	9. Gongolambuto	27	1.3	640
	10. Ugungo	126	6.1	3,010
	13. Kunduchi Quarries	190	9.3	4,580
	14. Wazo Hill (excluding Quarry)	571	27.8	13,700
	15. Mjimwema Quarry	25	1.2	590
	Sub Total	939	45.7	22,520
Lower Service Area	1. Kigamboni	150	7.3	3,600
	2. Kurasini-Tazara	146	7.1	3,500
	3. Port Facilities	112	5.4	2,660
	4. Kurasini Service Industries	37	1.8	890
	5. Shell/Caltex Depot	16	0.8	390
	6. Gerezani	93	4.5	2,220
	7. Breweries	8	0.4	200
	8. Pugu Road/Chang'ombe	520	25.3	12,460
	11. Bicycle Factory	10	0.5	250
	12. Kawe	25	1.2	590
	Sub-Total	1,117	54.3	26,760
Total		2,056	100.0	49,280

(4) Hotel use

Distribution Area	Hotel	Number of rooms	Water Consumption(m3/d)
Upper Service Area	Kunduchi Beach Hotel	100	100
	Silver Sand Hotel	80	80
	Bahari Beach Hotel	64	60
	Rungwe Beach Hotel	50	50
	Africana Hotel	180	180
	Sub-Total	474	470
Lower Service Area	Kilimanjaro Hotel	198	100
	New Africa Hotel	104	50
	Motel Agip	57	30
	Twiga Hotel	28	10
	Oyster Bay Hotel	20	10
	Sub-Total	407	200
Total		881	670