

GOVERNMENT OF JAPAN  
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)  
STATE OF ERITREA  
MINISTRY OF LAND, WATER AND ENVIRONMENT

STUDY  
ON  
GROUNDWATER DEVELOPMENT AND WATER SUPPLY  
FOR  
SEVEN TOWNS IN SOUTHERN REGION  
OF  
ERITREA

FINAL REPORT

MENDEFERA

VOLUME III DRAWINGS

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JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

STATE OF ERITREA  
MINISTRY OF LAND, WATER AND ENVIRONMENT

**STUDY  
ON  
GROUNDWATER DEVELOPMENT AND WATER SUPPLY  
FOR  
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OF  
ERITREA**

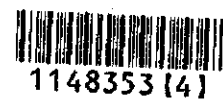
**FINAL REPORT**

**MENDEFERA**

**VOLUME III DRAWINGS**

**JANUARY 1999**

**SANYU CONSULTANTS INC.**



1148353 [4]

## List of Reports

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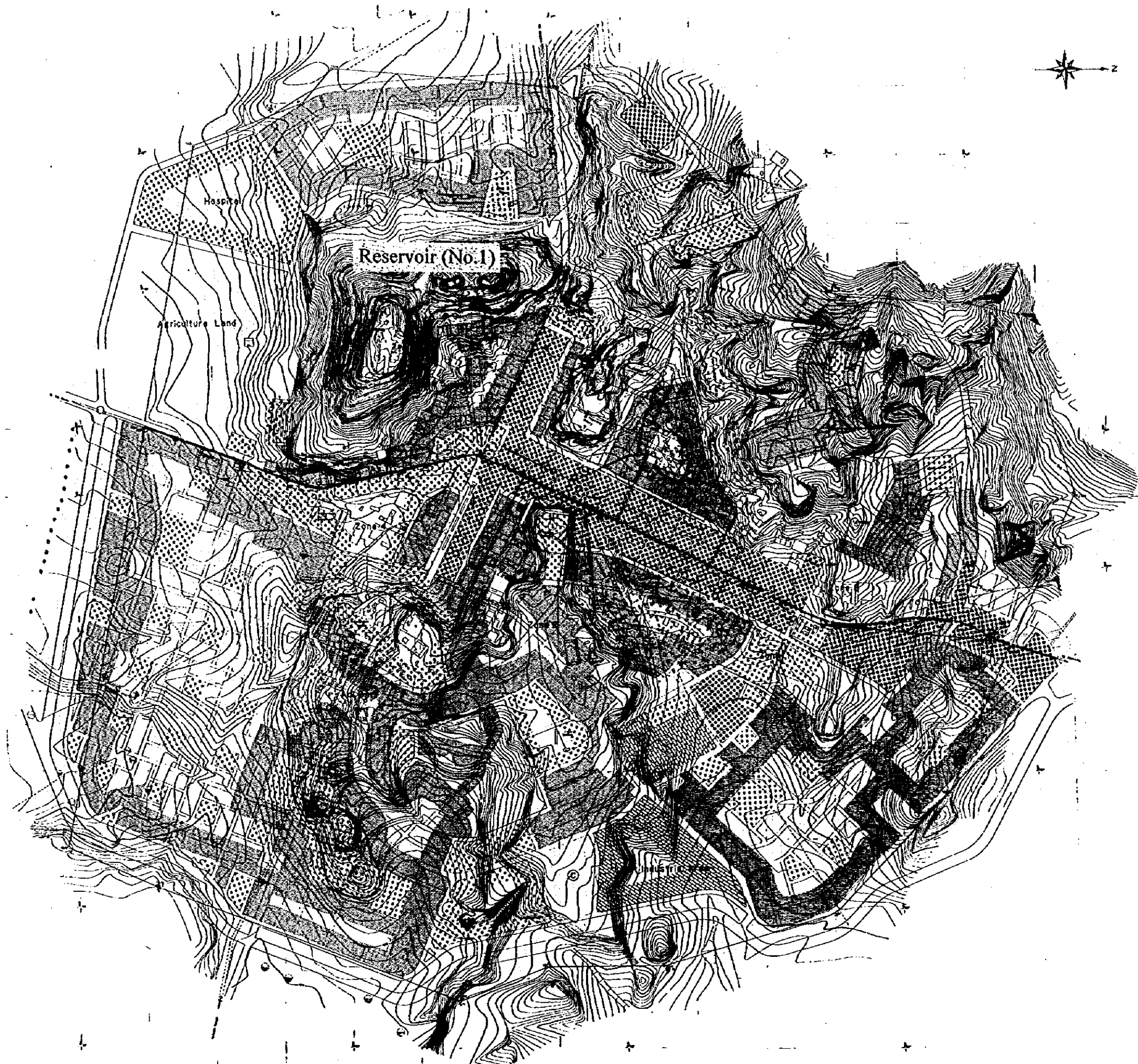
Operation and Maintenance Manual for Water Supply Facility

Hygiene Education Manual

Training Manual for Staff of WSA

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LEGEND	
	Boundary
	Commercial Area
	Administration Area
	Residential Area
	Industrial Area

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STUDY ON GROUNDWATER  
 DEVELOPMENT & WATER SUPPLY  
 FOR  
 SEVEN TOWNS IN SOUTHERN REGION

Land Use and Zone Boundary  
 MENDEFERA (2010)

WATER RESOURCES DEPARTMENT  
 (ASBABA, ERITREA)  
 BANTU CONSULTANTS INC.  
 HAZARD 1999

Drawing No.  
 1 / 22







LEGEND

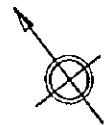
	Boundary
	Commercial Area
	Administration Area
	Residential Area
	Industrial Area

STATE OF ERITREA  
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 ENVIRONMENT  
 JAPAN INTERNATIONAL  
 COOPERATION AGENCY

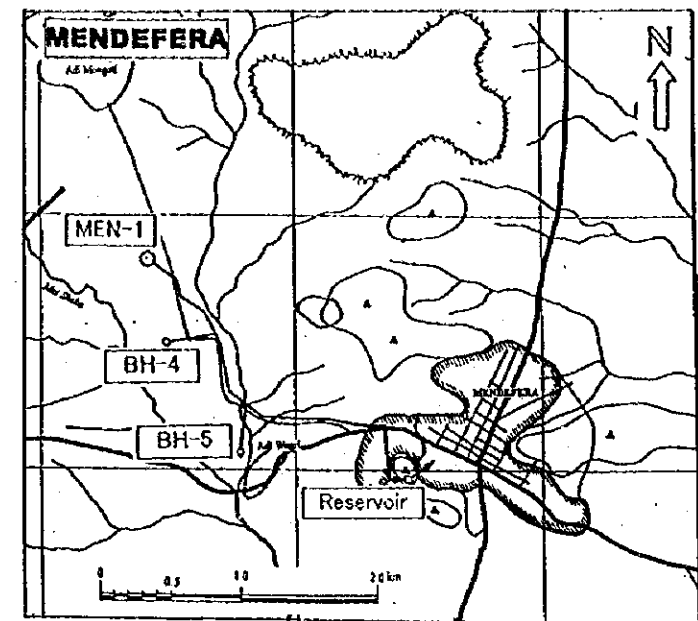
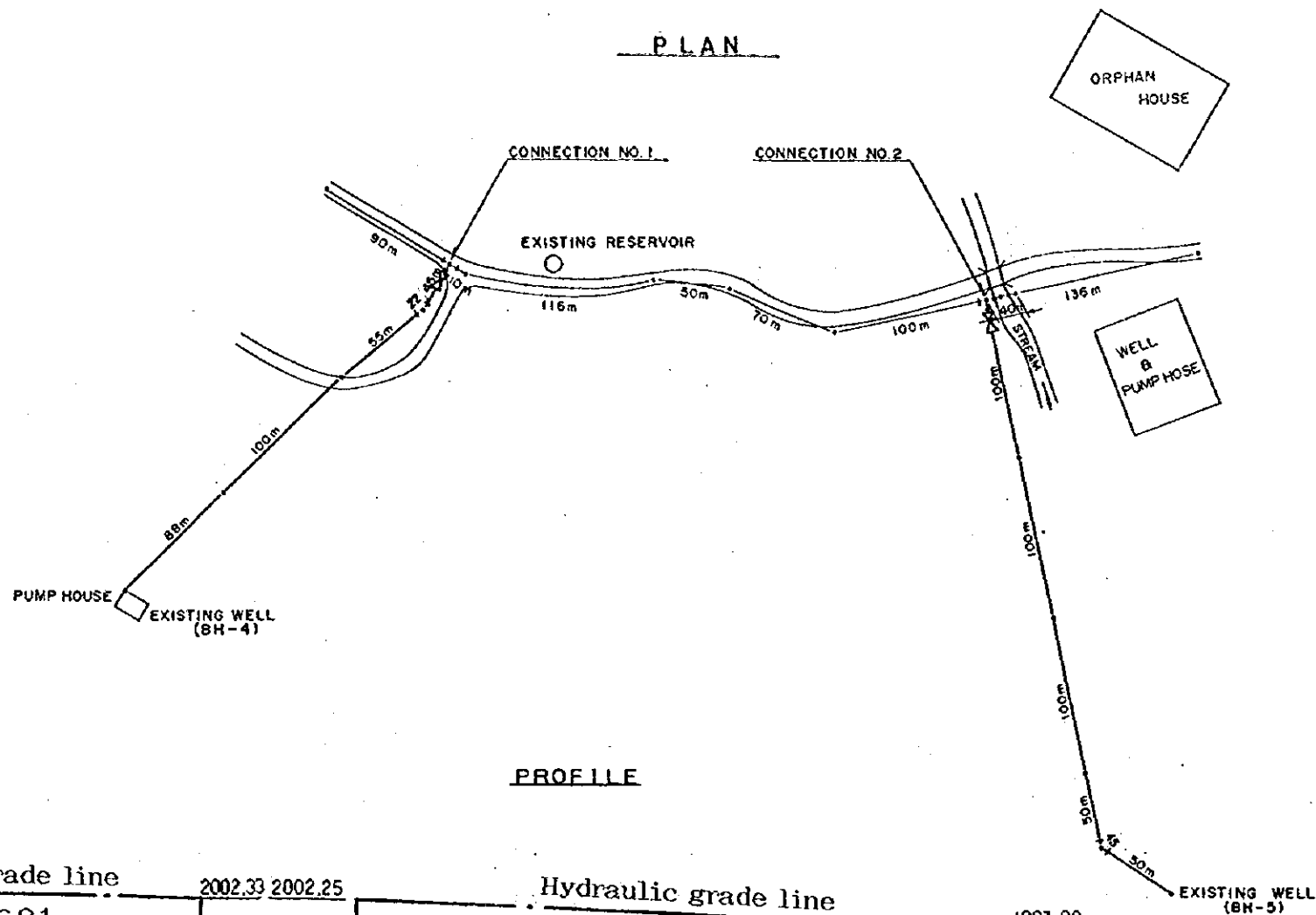
STUDY ON GROUNDWATER  
 DEVELOPMENT & WATER SUPPLY  
 FOR  
 SEVEN TOWNS IN SOUTHERN REGION

Land Use and Zone Boundary  
 MENDEFERA (2010)

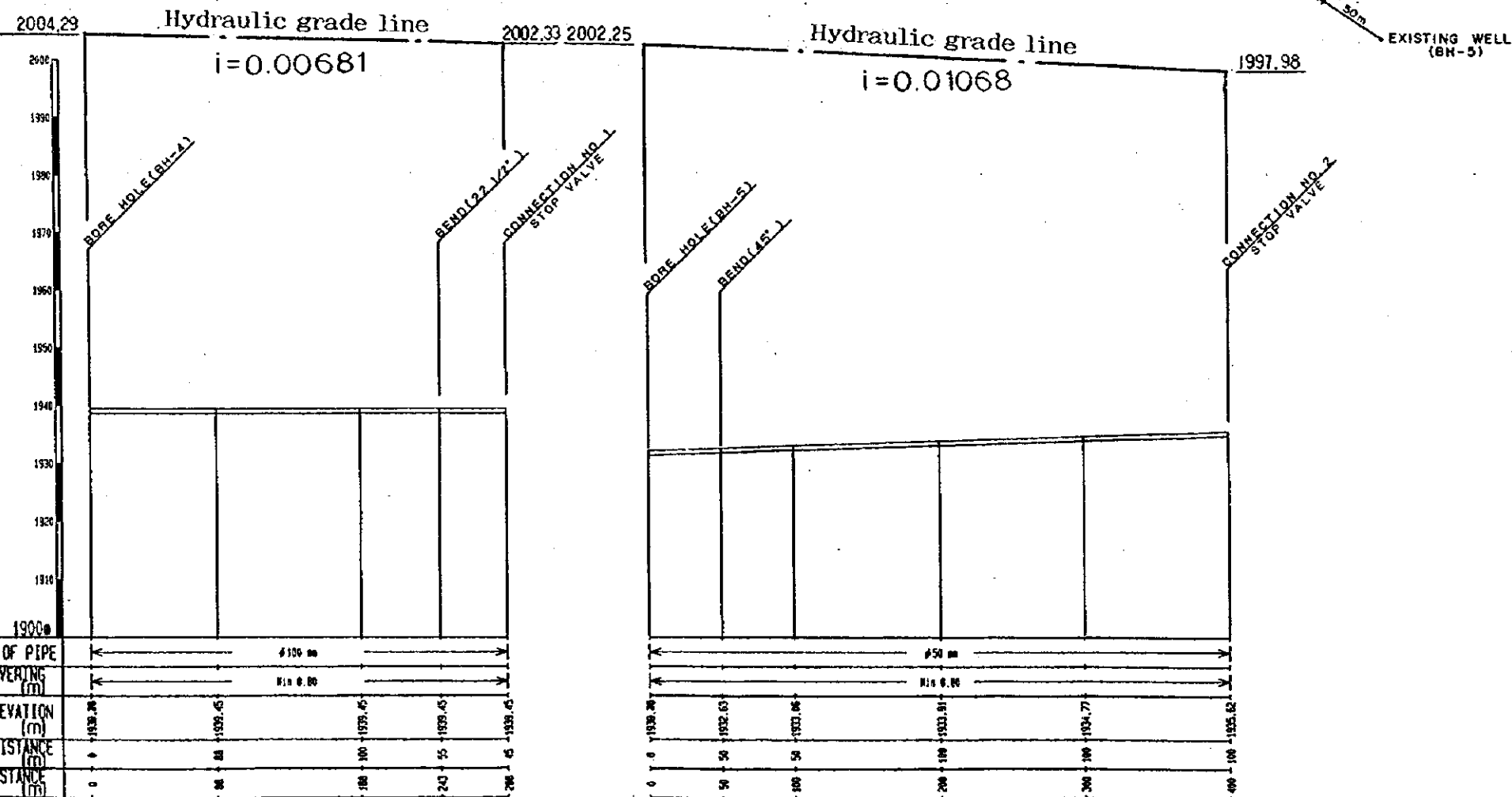




PLAN



PROFILE



LEGEND	
	BEND 90°
	BEND 45°
	BEND 22 1/2°
	BEND 11 1/4°
	TEE
	WASH OUT
	AIR VALVE
	STOP VALVE

Note: Water hammer analysis will be required and its countermeasure will be taken, if necessary

DATUM 1900	
SIZE/TYPE OF PIPE	Ø 100 mm
EARTH COVERING (m)	1.1 x 0.80
GROUND ELEVATION (m)	1339.28, 1339.45, 1339.45, 1339.45, 1339.45
PARTIAL DISTANCE (m)	0, 88, 100, 243, 296
TOTAL DISTANCE (m)	0, 88, 100, 243, 296

SIZE/TYPE OF PIPE	Ø 50 mm
EARTH COVERING (m)	1.1 x 0.80
GROUND ELEVATION (m)	1339.28, 1332.63, 1333.06, 1333.81, 1334.77, 1335.82
PARTIAL DISTANCE (m)	0, 50, 100, 200, 300, 400
TOTAL DISTANCE (m)	0, 50, 100, 200, 300, 400

STATE OF ERITREA  
MINISTRY OF LAND, WATER & ENVIRONMENT

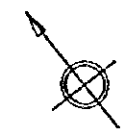
JAPAN INTERNATIONAL COOPERATION AGENCY

STUDY ON GROUNDWATER DEVELOPMENT & WATER SUPPLY FOR SEVEN TOWNS IN SOUTHERN REGION

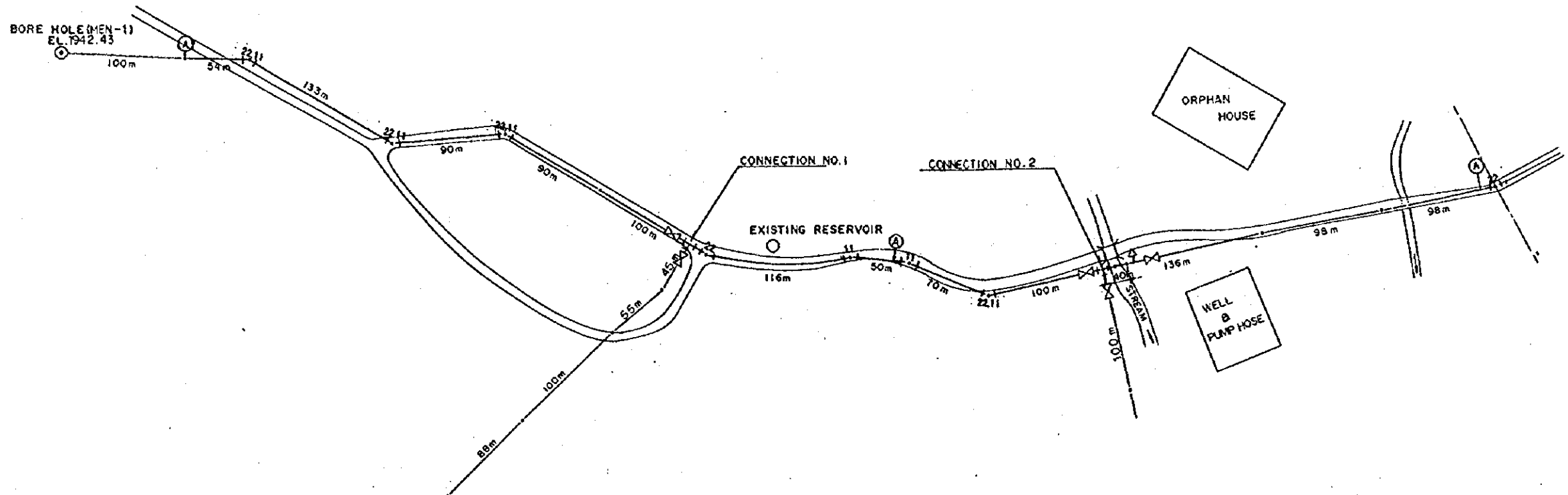
Plan & Profile for Transmission Pipeline (2005)  
MENDEFERA

WATER RESOURCES DEPARTMENT (ASMARA, ERITREA)  
SANTU CONSULTANTS INC. (JAPAN) 1999

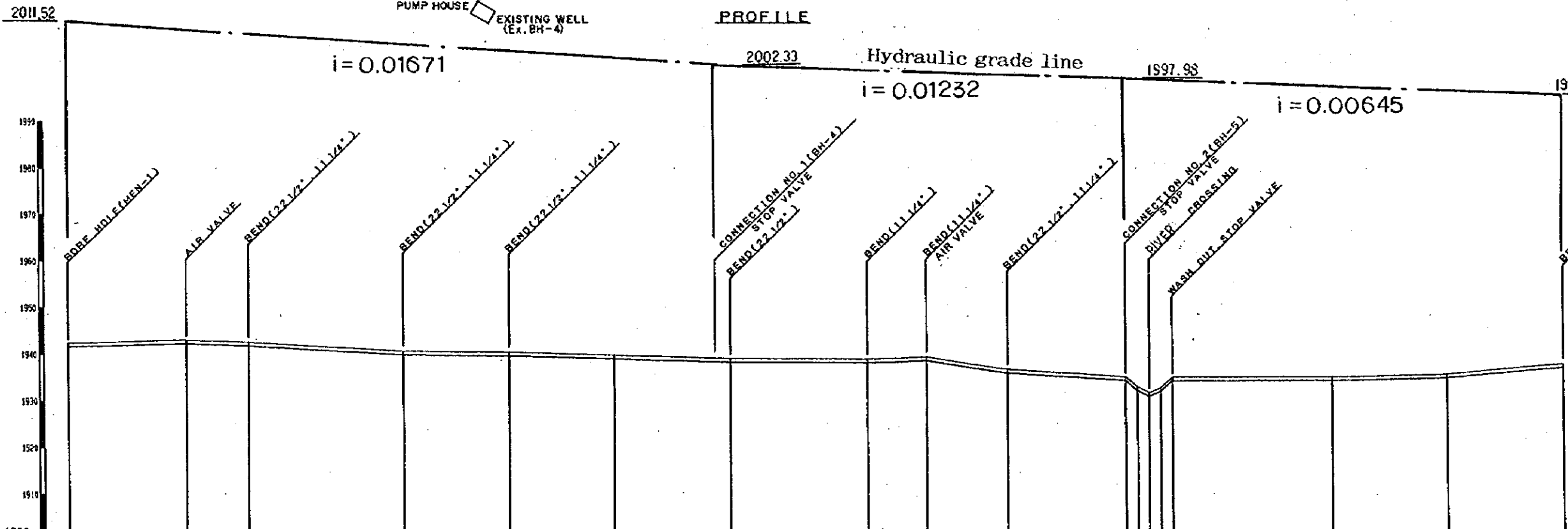
Drawing No. 2/22



PLAN



PROFILE



LEGEND	
	BEND 90°
	BEND 45°
	BEND 22 1/2°
	BEND 11 1/4°
	TEE
	WASH OUT
	AIR VALVE
	STOP VALVE

SIZE/TYPE OF PIPE	100 mm										125 mm									
EARTH COVERING (m)	0.30																			
GROUND ELEVATION (m)	1942.43	1942.24	1942.05	1940.91	1940.91	1940.11	1937.41	1937.41	1937.27	1935.62	1935.42	1935.26	1935.26	1935.56	1935.65	1935.24	1935.24			
PARTIAL DISTANCE (m)	0	100	154	267	377	467	567	683	733	803	903	923	933	943	1073	1177				
TOTAL DISTANCE (m)	0	100	154	267	377	467	567	683	733	803	903	923	933	943	1073	1177				

STATE OF ERITREA  
 MINISTRY OF LAND, WATER & ENVIRONMENT

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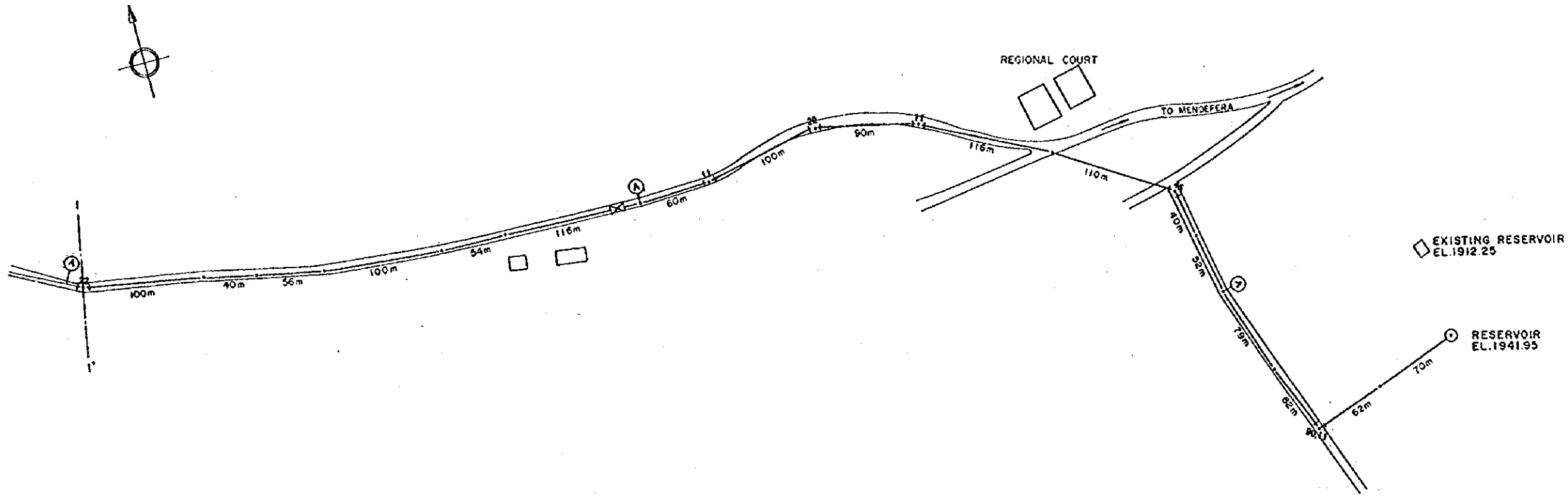
STUDY ON GROUNDWATER DEVELOPMENT & WATER SUPPLY FOR SEVEN TOWNS IN SOUTHERN REGION

Plan & Profile for Transmission Pipeline (2005)  
 MENDEFERA

WATER RESOURCES DEPARTMENT (ASKARA, ERITREA)  
 SANTU CONSULTANTS INC. JAPAN 1999

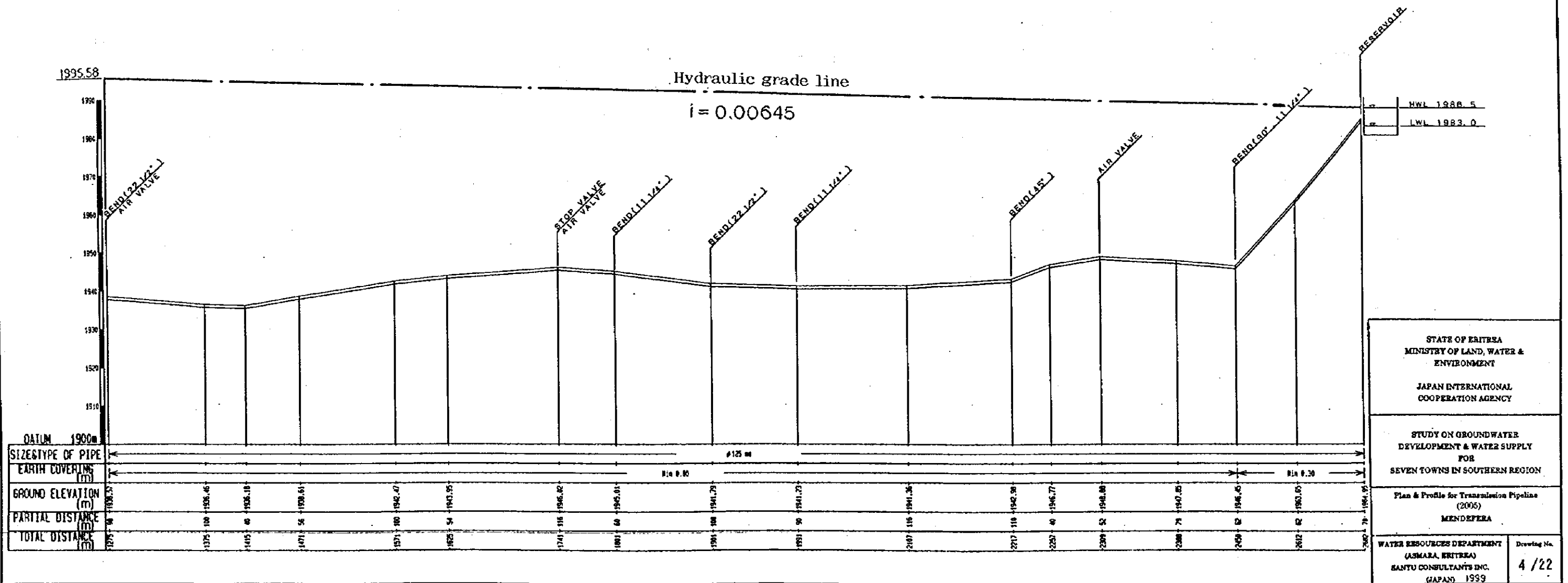
Drawing No. 3/22

PLAN



LEGEND	
	BEND 90°
	BEND 45°
	BEND 22 1/2°
	BEND 11 1/4°
	TEE
	WASH OUT
	AIR VALVE
	STOP VALVE

PROFILE



STATE OF ERITREA  
MINISTRY OF LAND, WATER & ENVIRONMENT

JAPAN INTERNATIONAL COOPERATION AGENCY

STUDY ON GROUNDWATER DEVELOPMENT & WATER SUPPLY FOR SEVEN TOWNS IN SOUTHERN REGION

Plan & Profile for Transmission Pipelines (2005)  
MENDEFERA

WATER RESOURCES DEPARTMENT (ASMARA, ERITREA)  
SANTU CONSULTANTS INC. (JAPAN) 1999

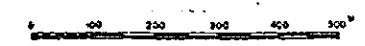
Drawing No. 4/22



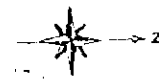
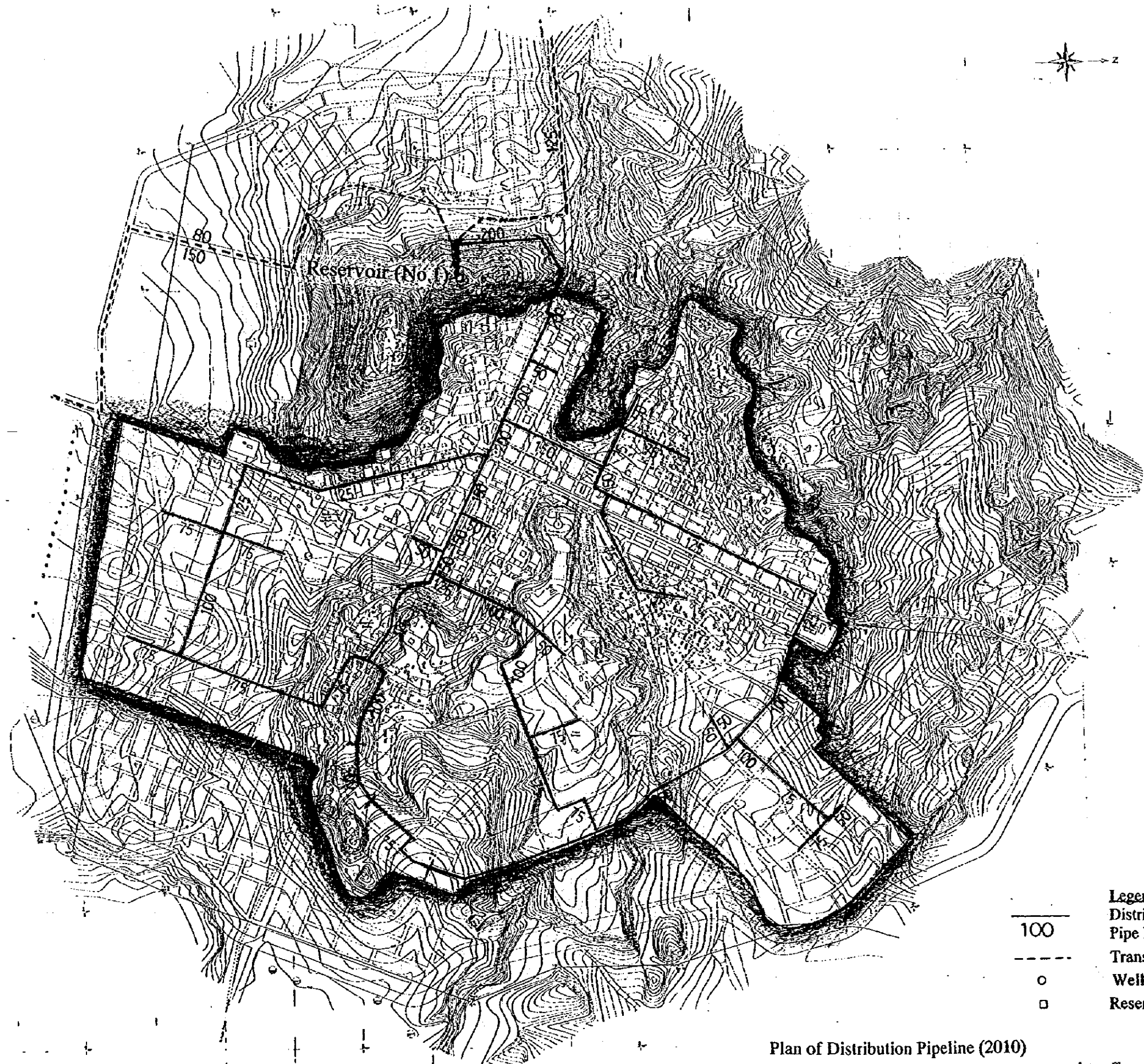
Reservoir (No. 1)

- Legend**
- 100 Distribution pipeline  
Pipe Diameter (mm)
  - Transmission pipeline
  - o Well
  - Reservoir

Plan of Distribution Pipeline (2005)

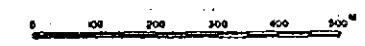


STATE OF ERITREA MINISTRY OF LAND, WATER & ENVIRONMENT	
JAPAN INTERNATIONAL COOPERATION AGENCY	
STUDY ON GROUNDWATER DEVELOPMENT & WATER SUPPLY FOR SEVEN TOWNS IN SOUTHERN REGION	
PLAN OF DISTRIBUTION PIPELINE (2005)	
MENDEPERA	
WATER RESOURCES DEPARTMENT (ASMARA, ERITREA)	Drawn No.
KANTU CONSULTANTS INC. (JAPAN) 1999	5 / 22

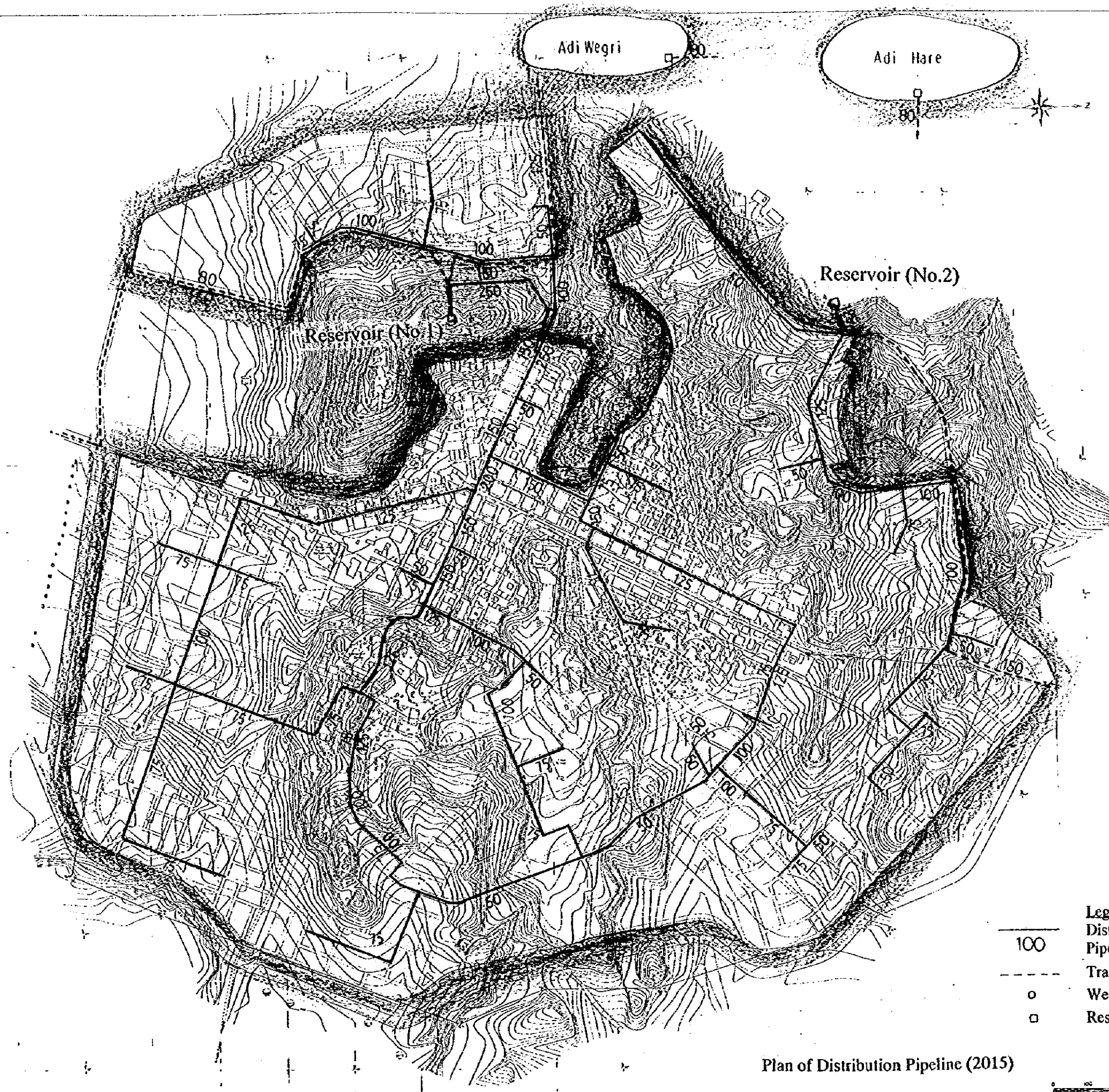


- Legend**
- 100 — Distribution pipeline  
Pipe Diameter (mm)
  - - - - - Transmission pipeline
  - Well
  - Reservoir

Plan of Distribution Pipeline (2010)

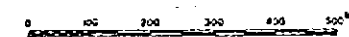


STATE OF ERITREA MINISTRY OF LAND, WATER & ENVIRONMENT	
JAPAN INTERNATIONAL COOPERATION AGENCY	
STUDY ON GROUND WATER DEVELOPMENT & WATER SUPPLY FOR SEVEN TOWNS IN SOUTHERN REGION	
PLAN OF DISTRIBUTION PIPELINE (2010) MENEFERA	
WATER RESOURCES DEPARTMENT (ASMARA, ERITREA) SANYU CONSULTANTS INC. (JAPAN) 1999	Drawn No. <b>6 / 22</b>



Plan of Distribution Pipeline (2015)

- Legend**
- 100 Distribution pipeline Pipe Diameter (mm)
  - Transmission pipeline
  - o Well
  - Reservoir

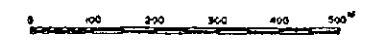


STATE OF ERITREA MINISTRY OF LAND, WATER & ENVIRONMENT	
JAPAN INTERNATIONAL COOPERATION AGENCY	
STUDY ON GROUNDWATER DEVELOPMENT & WATER SUPPLY FOR SEVEN TOWNS IN SOUTHERN REGION	
PLAN OF DISTRIBUTION PIPELINE (2015) MENDZEFERA	
WATER RESOURCES DEPARTMENT (ASKARA, ERITREA) SANYU CONSULTANTS INC. (JAPAN) 1999	Drawing No. <b>7 / 22</b>



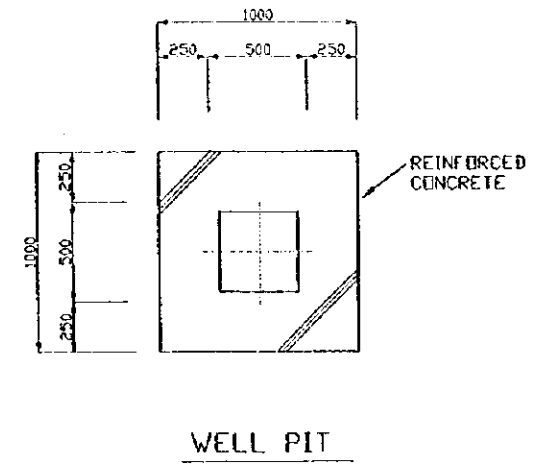
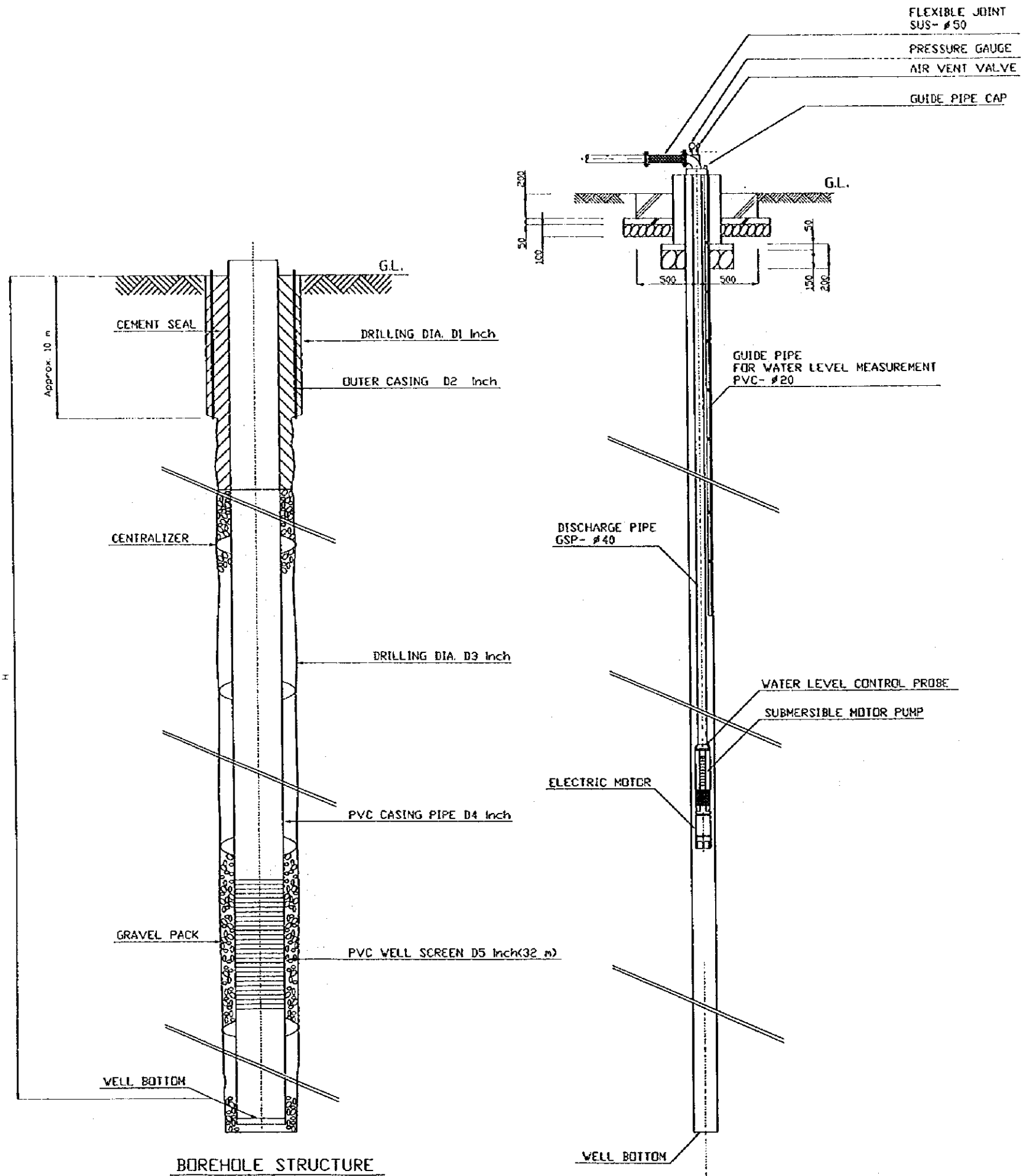
- Legend**
- Communal water points for 2005 (No. 1 - 13)
  - Communal water points for 2010 (No. 14 - 26)
  - Communal water points for 2015 (No. 27 - 41)
- 4 c.w.p will be added for 2 villages in 2015.

Location of Proposed Communal Water Point



STATE OF ERITREA MINISTRY OF LAND, WATER & ENVIRONMENT	
JAPAN INTERNATIONAL COOPERATION AGENCY	
STUDY ON GROUND WATER DEVELOPMENT & WATER SUPPLY FOR SEVEN TOWNS IN SOUTHERN REGION	
LOCATION OF PROPOSED COMMUNAL WATER POINT MENDEPERA	
WATER RESOURCES DEPARTMENT (ASMARA, ERITREA) BANYU CONSULTANTS INC (JAPAN) 1993	Drawing No. 8 / 22





Site Name	Water Source No.	New Borehole Construction						SUBMERSIBLE MOTOR PUMP	
		D1	D2	D3	D4	D5	H	Q <sub>ty</sub> (lit/min)	Total Head (m)
MENDEFERA	N. MEN-2	17'1/2	14'	12'1/4	8'	8'	60	120	61
	N. MEN-1	17'1/2	14'	12'1/4	8'	8'	60	120	18

STATE OF ERITREA  
 MINISTRY OF LAND, WATER &  
 ENVIRONMENT  
 JAPAN INTERNATIONAL  
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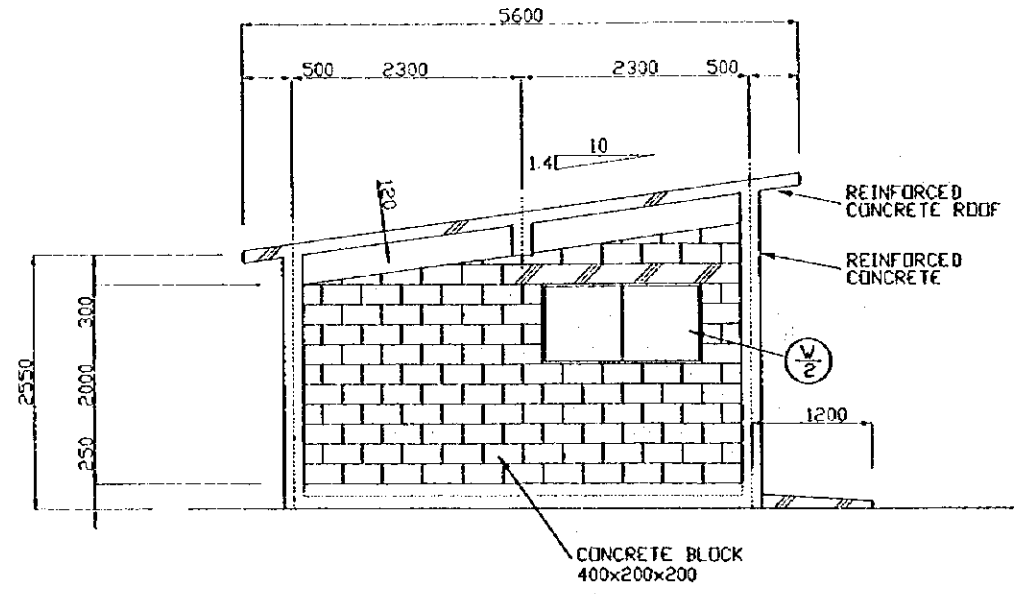
STUDY ON GROUNDWATER  
 DEVELOPMENT & WATER SUPPLY  
 FOR  
 SEVEN TOWNS IN SOUTHERN REGION

BOREHOLE STRUCTURE AND  
 SUBMERSIBLE MOTOR PUMP  
 INSTALLATION  
 MENDEFERA

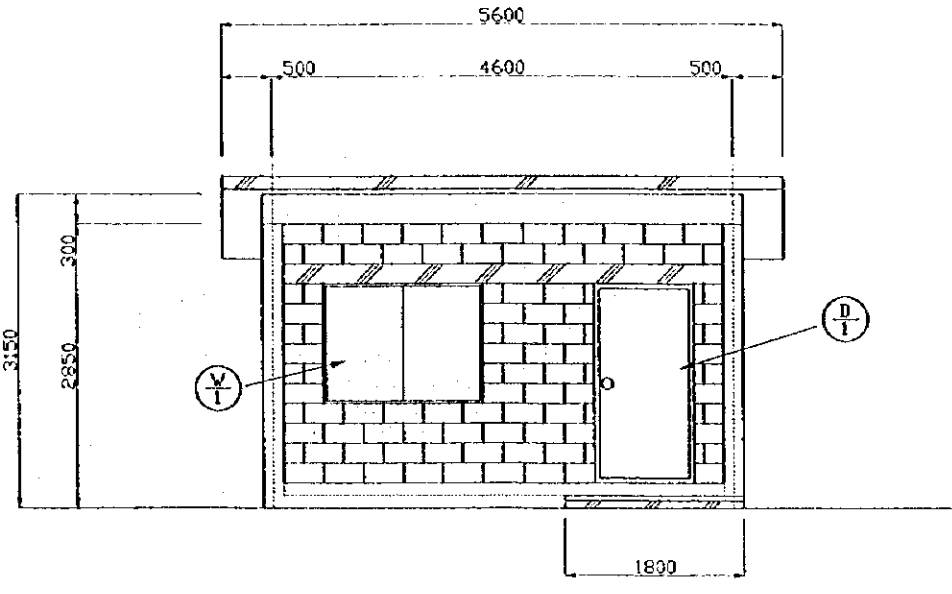
WATER RESOURCES DEPARTMENT  
 SANYU CONSULTANTS INC.  
 (JAPAN) 1999

Drawing No.  
 9/22

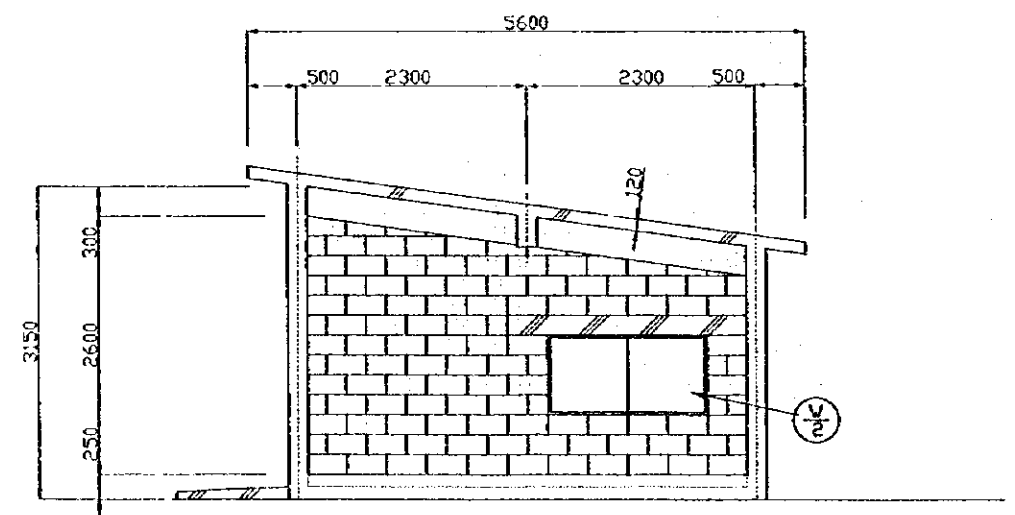
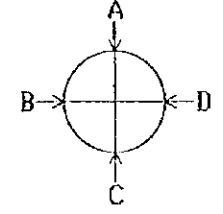
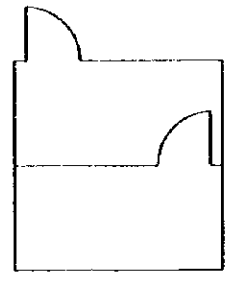
SUBMERSIBLE MOTOR PUMP INSTALLATION



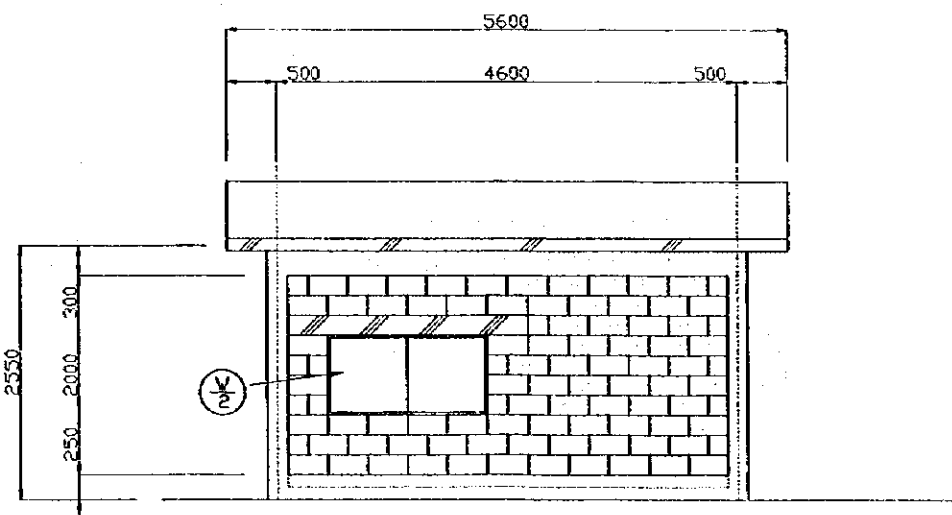
D-ELEVATION



A-ELEVATION



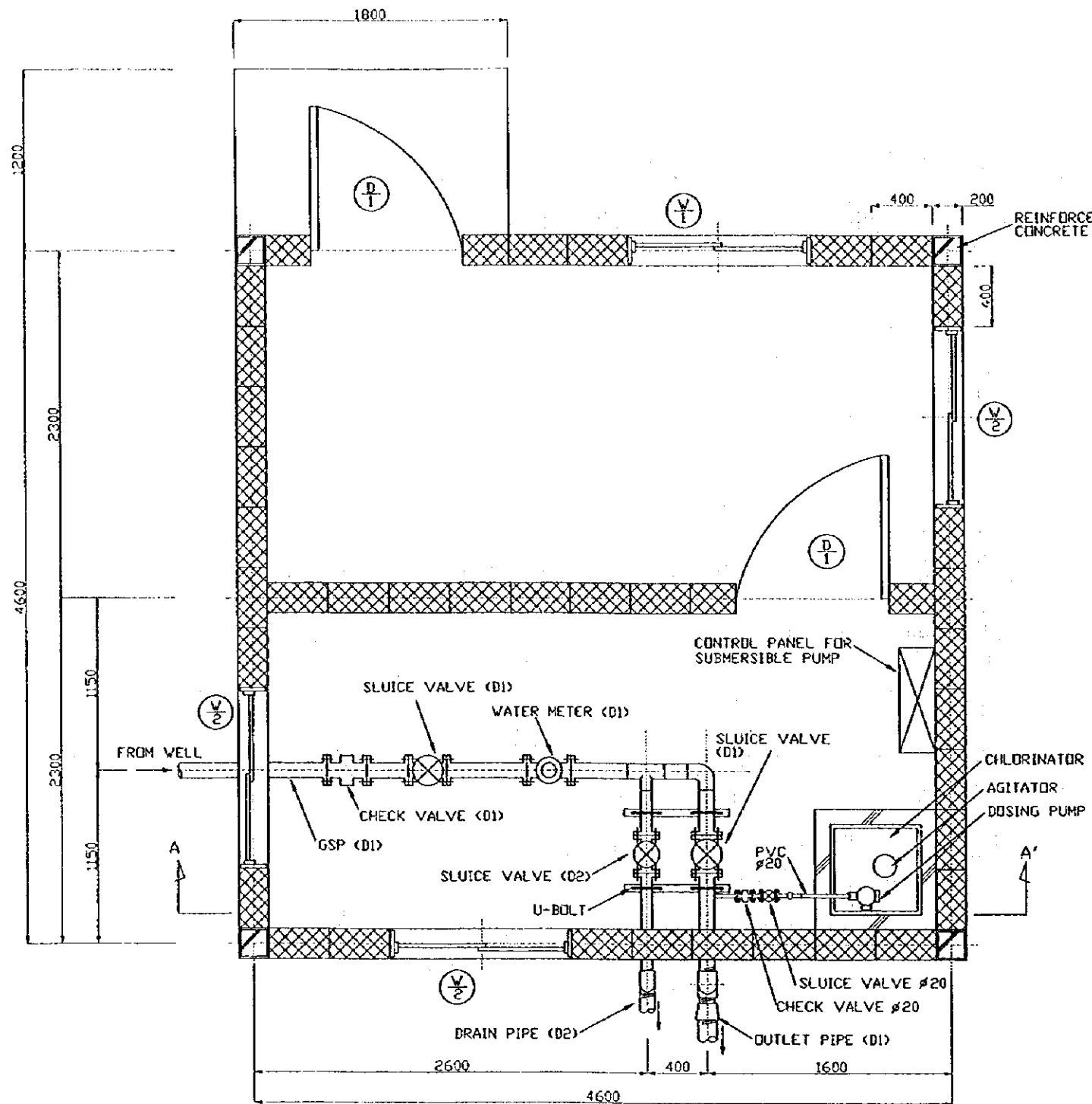
B-ELEVATION



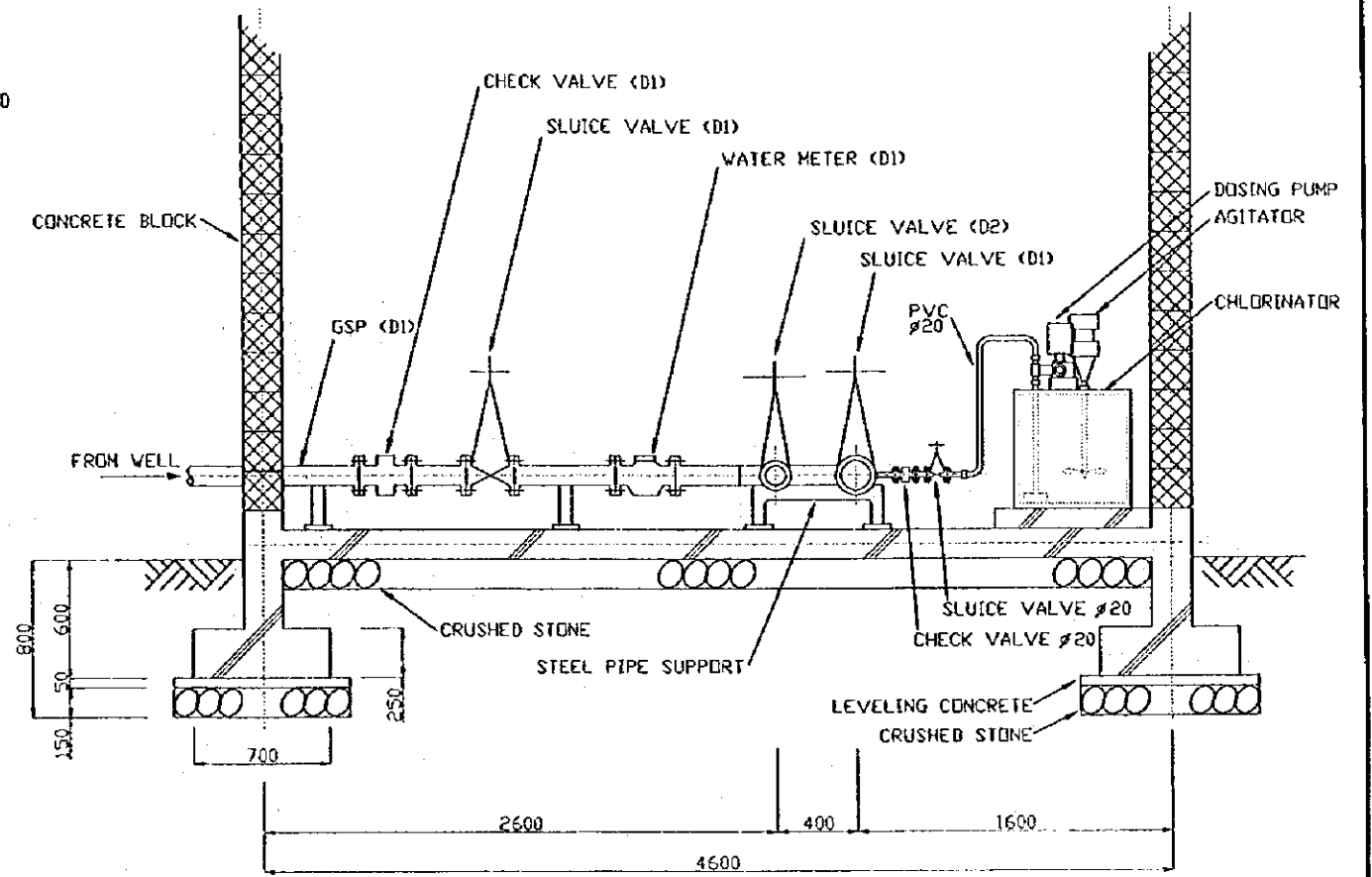
C-ELEVATION

	V	H	ea
(D-I) STEEL DOOR	800	1,900	X 2
(V-I) WINDOW WITH WIRED GLASS	900	900	X 1
(V-2) WINDOW WITH WIRED GLASS	900	600	X 3

STATE OF ERITREA MINISTRY OF LAND, WATER & ENVIRONMENT	
JAPAN INTERNATIONAL COOPERATION AGENCY	
STUDY ON GROUNDWATER DEVELOPMENT & WATER SUPPLY FOR SEVEN TOWNS IN SOUTHERN REGION	
STRUCTURE OF BOREHOLE PUMP STATION MENDEFERA	
WATER RESOURCES DEPARTMENT SANYU CONSULTANTS INC. (JAPAN) 1999	Drawing No. 10/22



PLAN



SECTION A-A'

- |   |                         |                 |    |
|---|-------------------------|-----------------|----|
|   | V                       | H               | ea |
| ⊕ | STEEL DOOR              | 800 X 1,900 X 2 |    |
| ⊕ | WINDOW WITH WIRED GLASS | 900 X 900 X 1   |    |
| ⊕ | WINDOW WITH WIRED GLASS | 900 X 600 X 3   |    |

Water Source	D1	D2
MEN-1	65	50
BH-4	80	50
BH-5	65	50
N. MEN-2	65	50
N. MEN-1	65	50

STATE OF ERITREA  
MINISTRY OF LAND, WATER &  
ENVIRONMENT

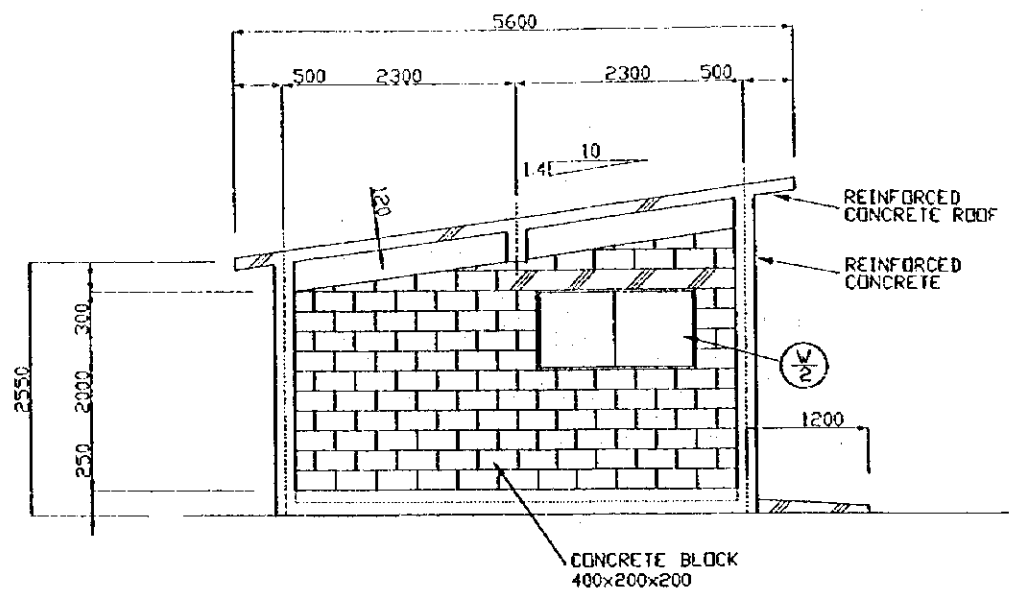
JAPAN INTERNATIONAL  
COOPERATION AGENCY

STUDY ON GROUNDWATER  
DEVELOPMENT & WATER SUPPLY  
FOR  
SEVEN TOWNS IN SOUTHERN REGION

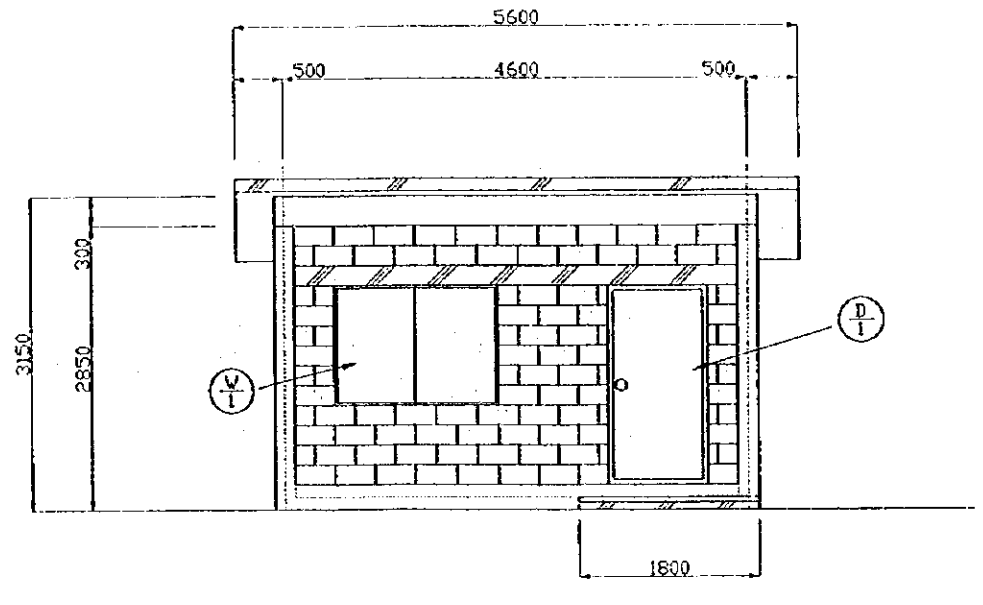
BOREHOLE PUMP STATION  
MENDEFERA

WATER RESOURCES DEPARTMENT  
SANYU CONSULTANTS INC.  
(JAPAN) 1999

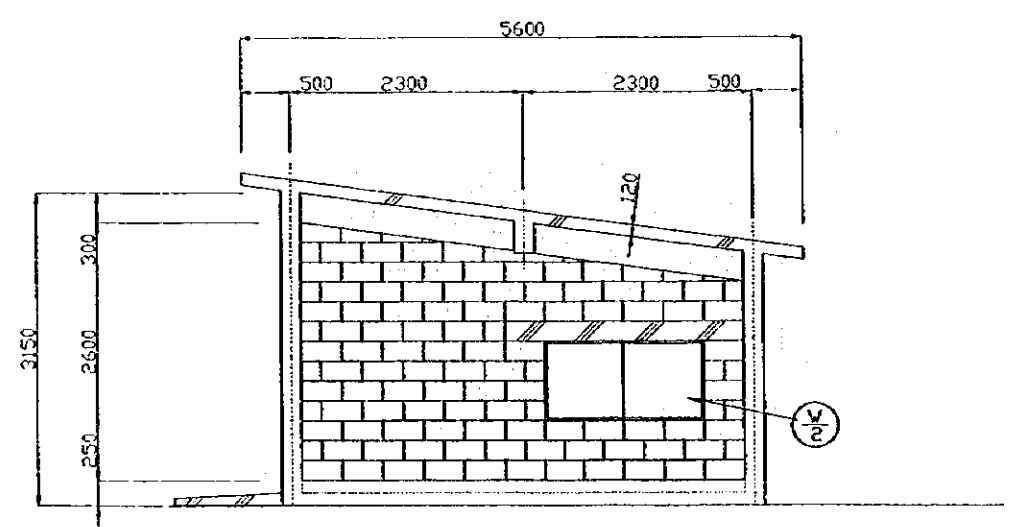
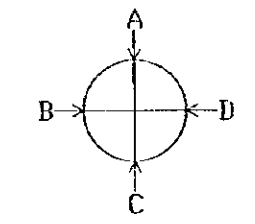
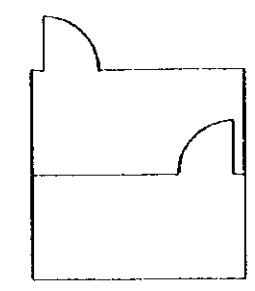
Drawing No  
11/22



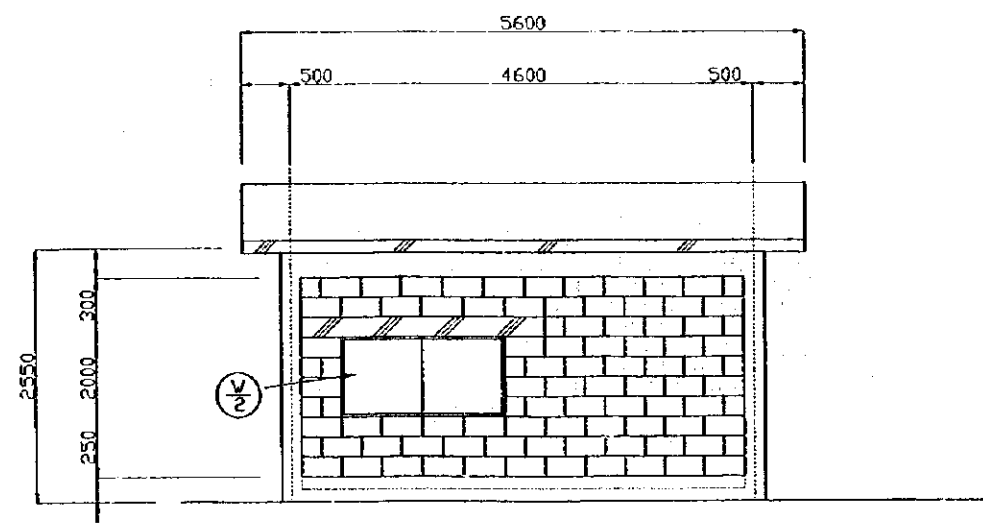
D-ELEVATION



A-ELEVATION



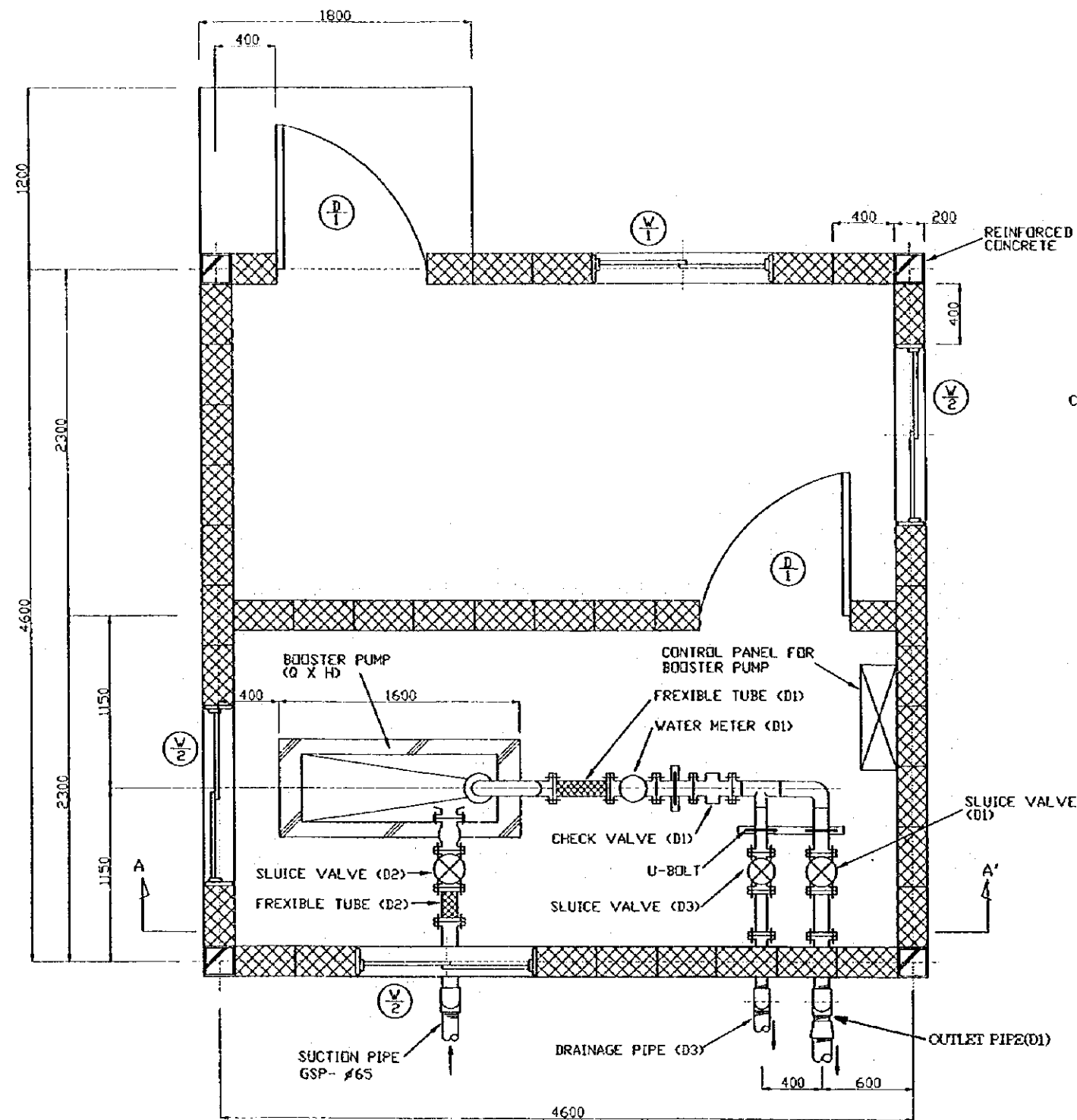
B-ELEVATION



C-ELEVATION

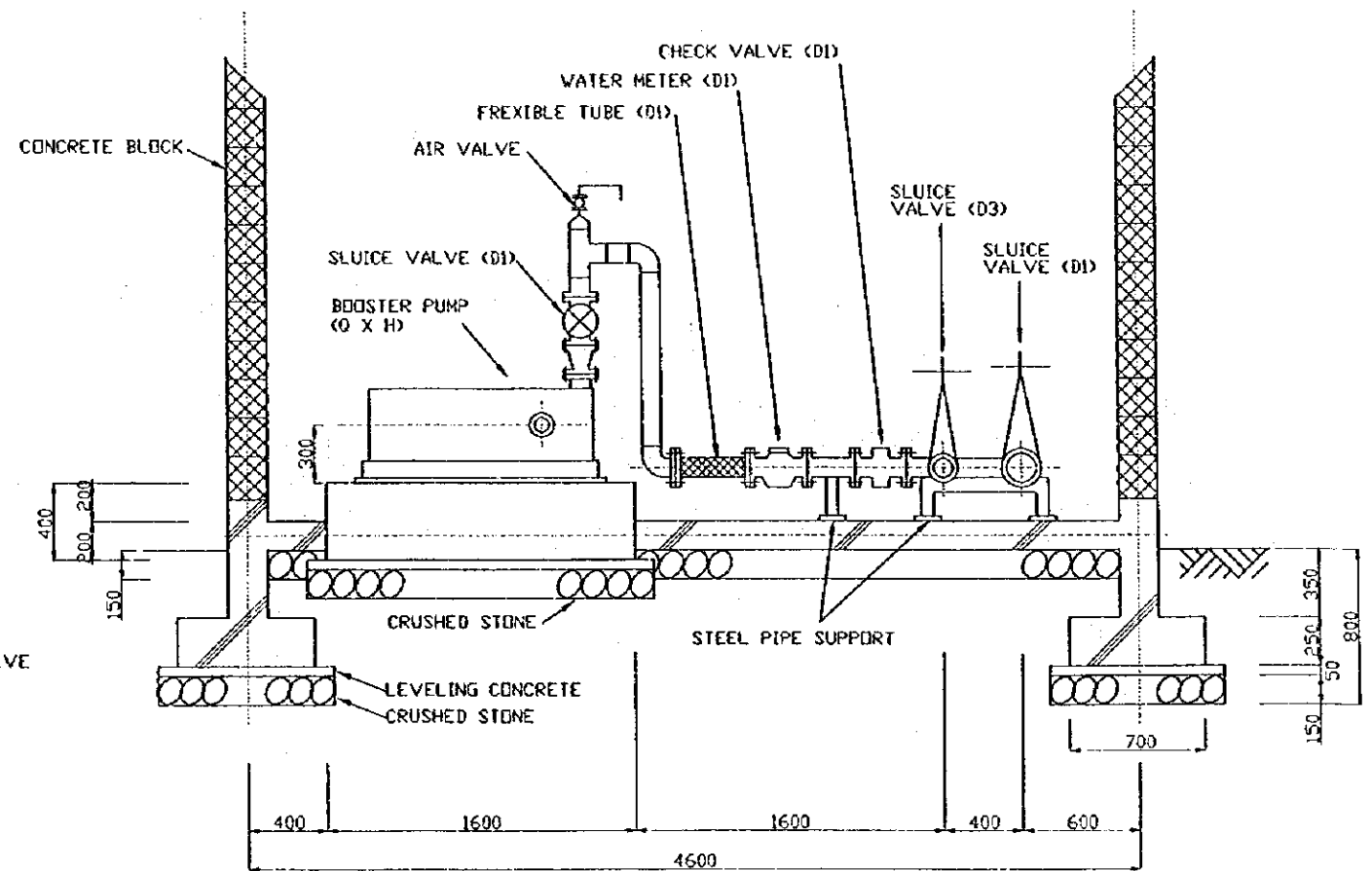
	W	H	ea
(D1) STEEL DOOR	800	1,900	2
(V1) WINDOW WITH WIRED GLASS	900	900	1
(V2) WINDOW WITH WIRED GLASS	900	600	3

STATE OF ERITREA MINISTRY OF LAND, WATER & ENVIRONMENT	
JAPAN INTERNATIONAL COOPERATION AGENCY	
STUDY ON GROUNDWATER DEVELOPMENT & WATER SUPPLY FOR SEVEN TOWNS IN SOUTHERN REGION	
STRUCTURE OF BOOSTER PUMP STATION MENDEFERA	
WATER RESOURCES DEPARTMENT SANYU CONSULTANTS INC. (JAPAN) 1999	Drawing No 12/22



PLAN

- |   |                         |     |     |     |
|---|-------------------------|-----|-----|-----|
| ⊕ | STEEL DOOR              | W   | H   | ea  |
| ⊕ | WINDOW WITH WIRED GLASS | 900 | 900 | X 1 |
| ⊕ | WINDOW WITH WIRED GLASS | 900 | 600 | X 3 |



SECTION A-A'

Water Source	D1	D2	D3	Q (lit/m)	H (m)
BOOSTER-21	65	50	50	240	100
BOOSTER-22	65	50	50	240	102

STATE OF ERITREA  
 MINISTRY OF LAND, WATER & ENVIRONMENT

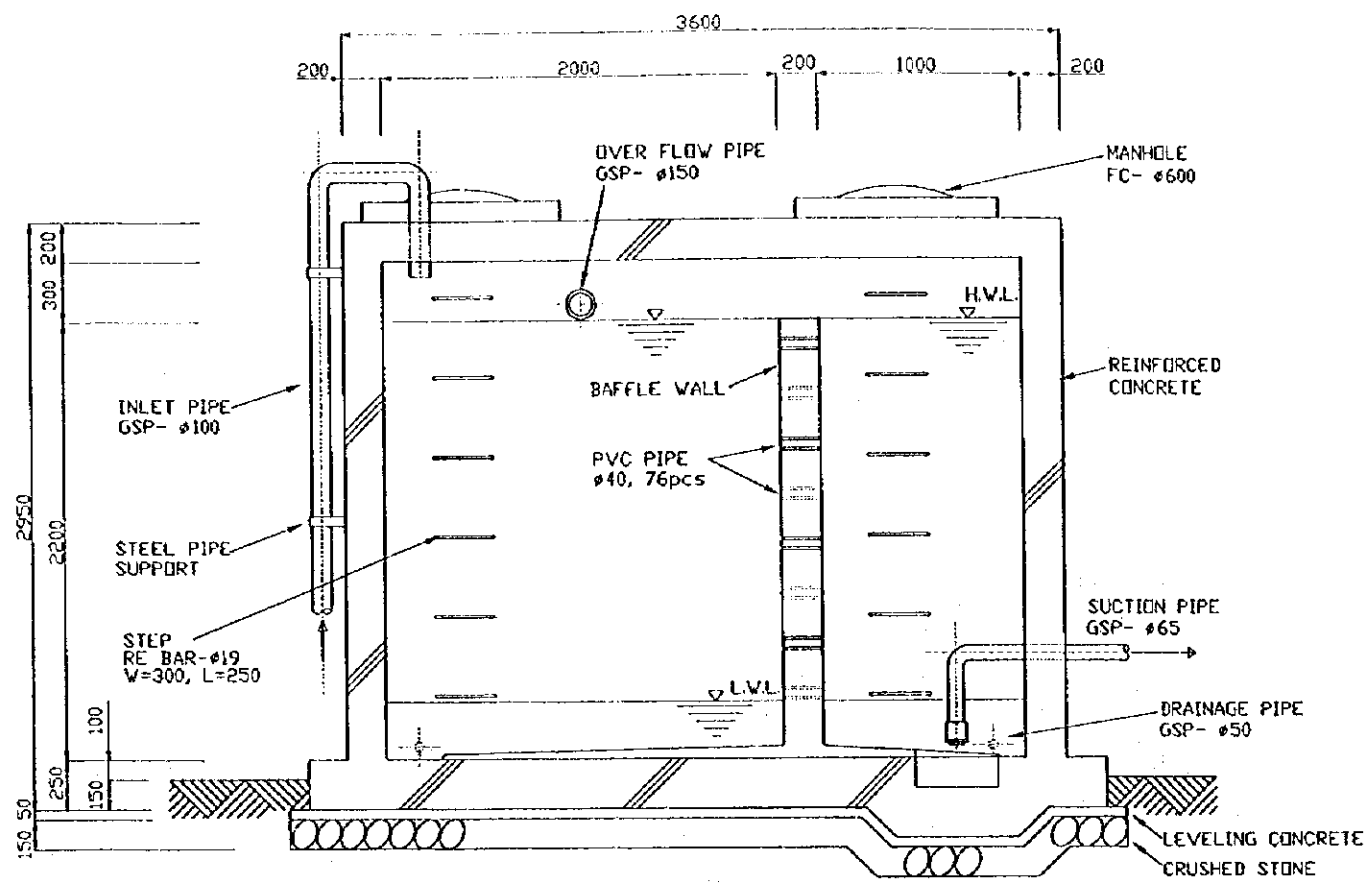
JAPAN INTERNATIONAL COOPERATION AGENCY

STUDY ON GROUNDWATER DEVELOPMENT & WATER SUPPLY FOR SEVEN TOWNS IN SOUTHERN REGION

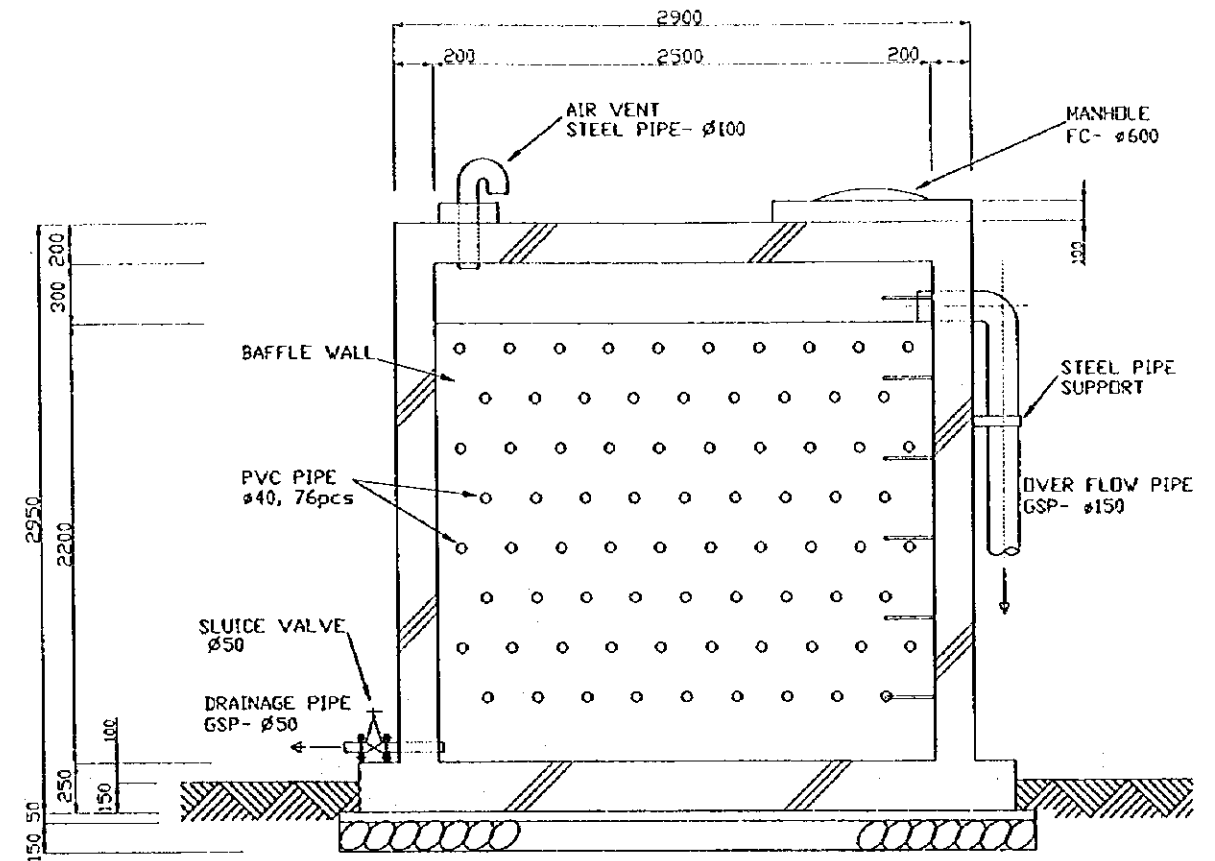
**BOOSTER PUMP STATION MENDEFERA**

WATER RESOURCES DEPARTMENT SANYU CONSULTANTS INC. (JAPAN) 1999

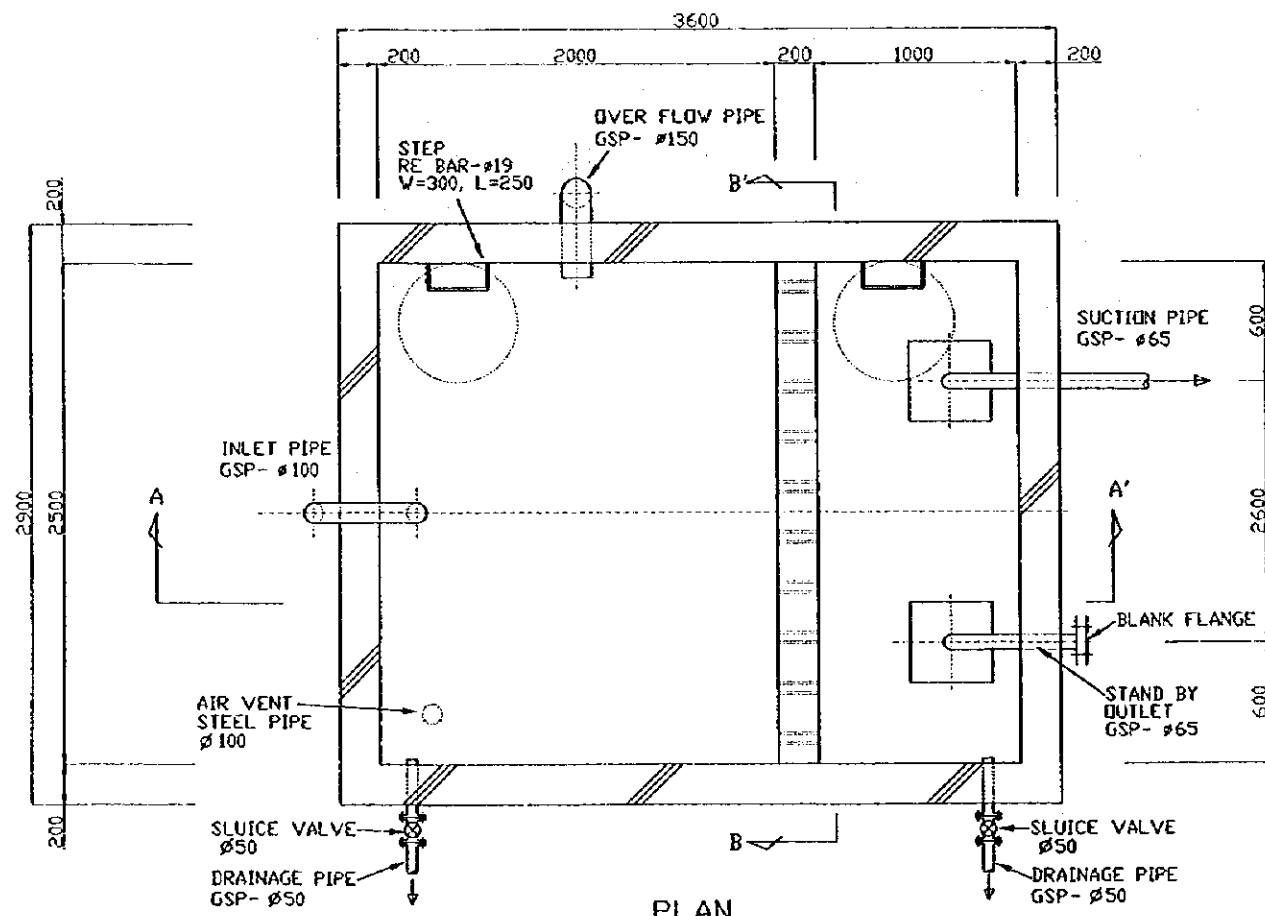
Drawing No. 13/22



SECTION A-A'

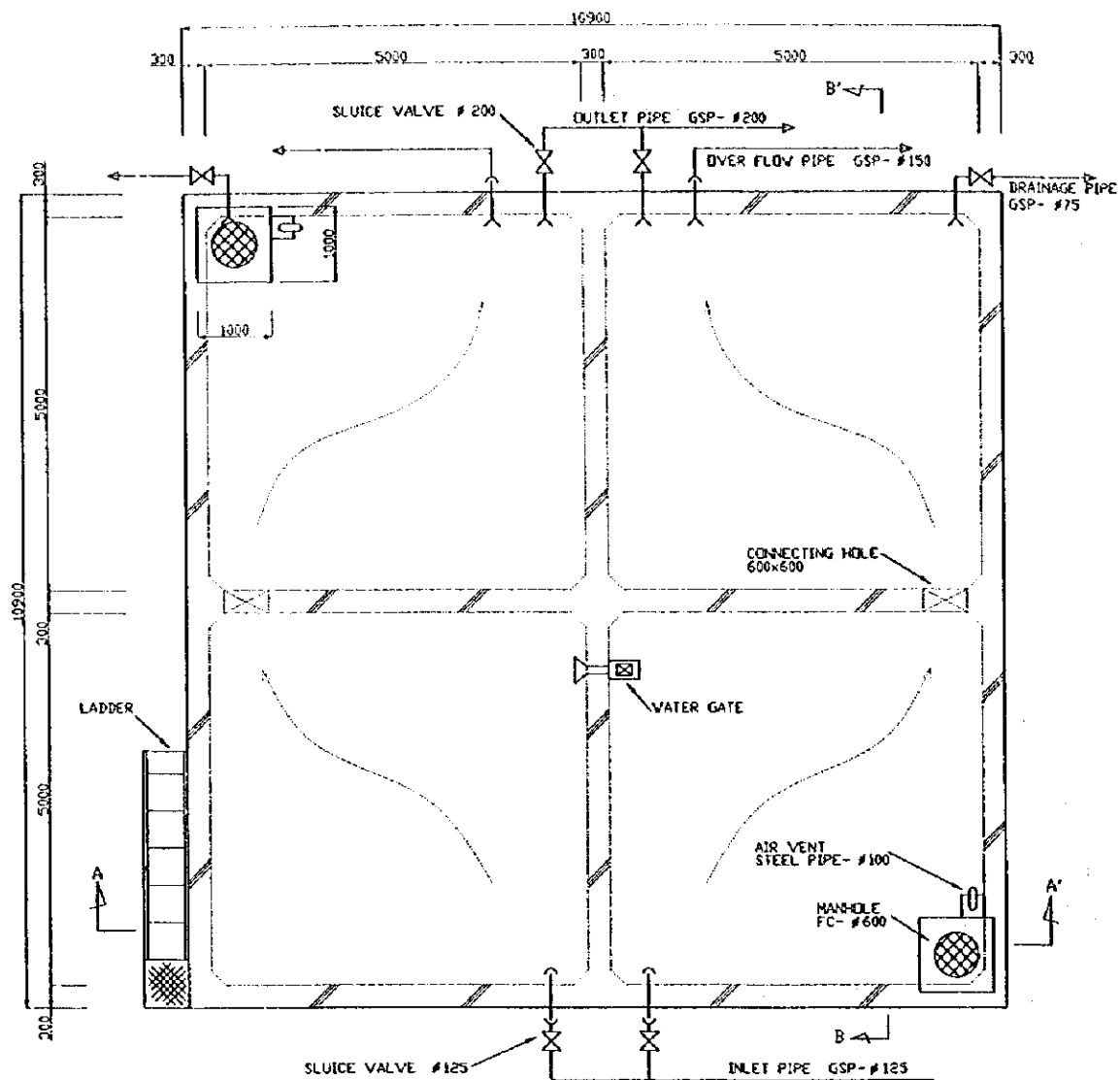


SECTION B-B'

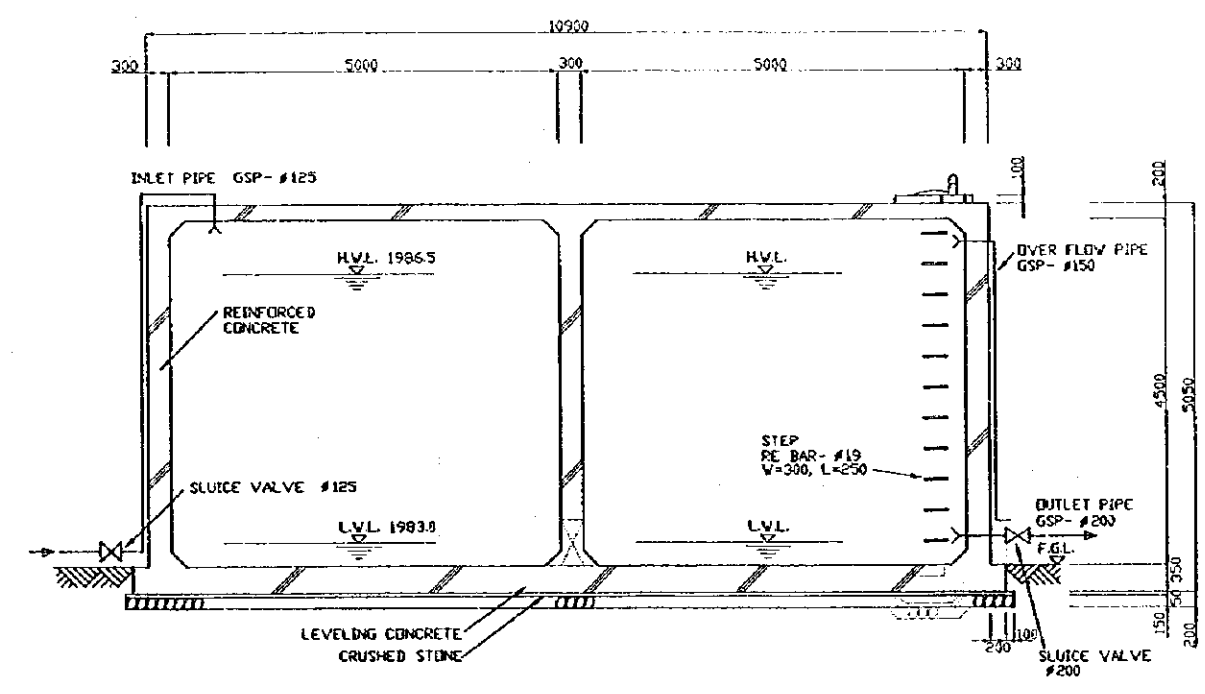


PLAN

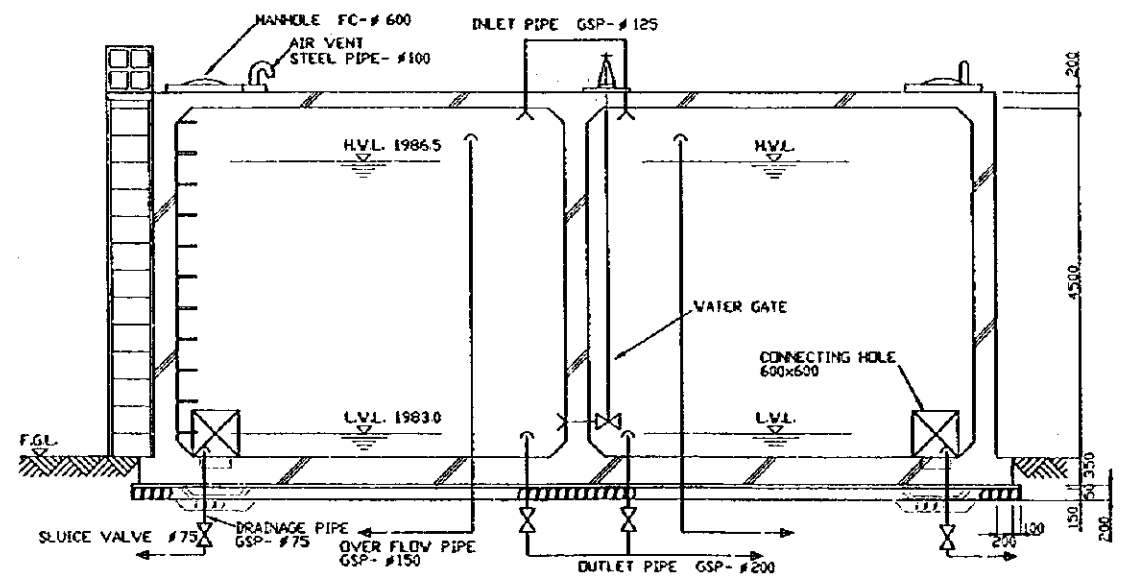
STATE OF ERITREA MINISTRY OF LAND, WATER & ENVIRONMENT	
JAPAN INTERNATIONAL COOPERATION AGENCY	
STUDY ON GROUNDWATER DEVELOPMENT & WATER SUPPLY FOR SEVEN TOWNS IN SOUTHERN REGION	
15m <sup>3</sup> RECEIVING TANK MENDEFERA	
WATER RESOURCES DEPARTMENT SANYU CONSULTANTS INC. (JAPAN) 1999	Drawing No 14/22



PLAN

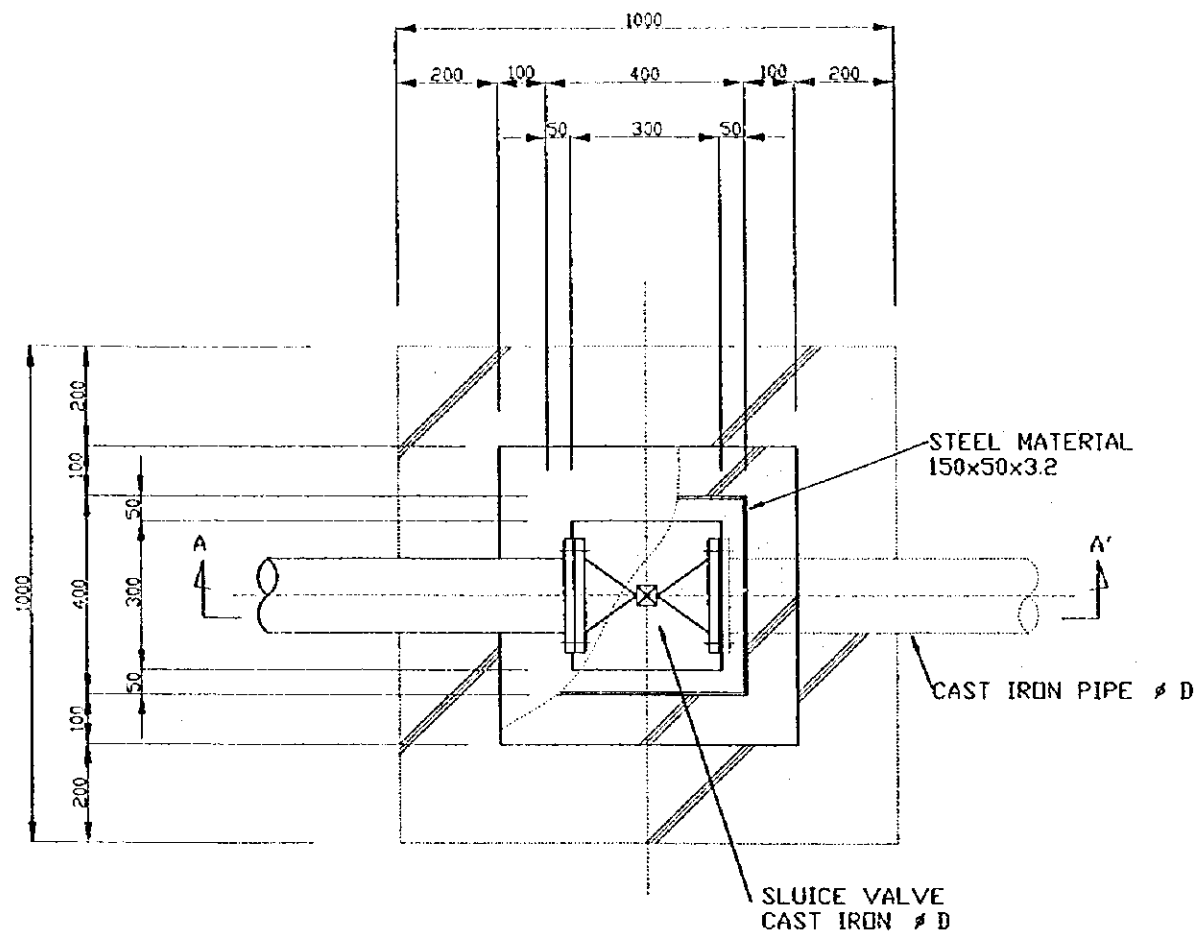


SECTION B-B'

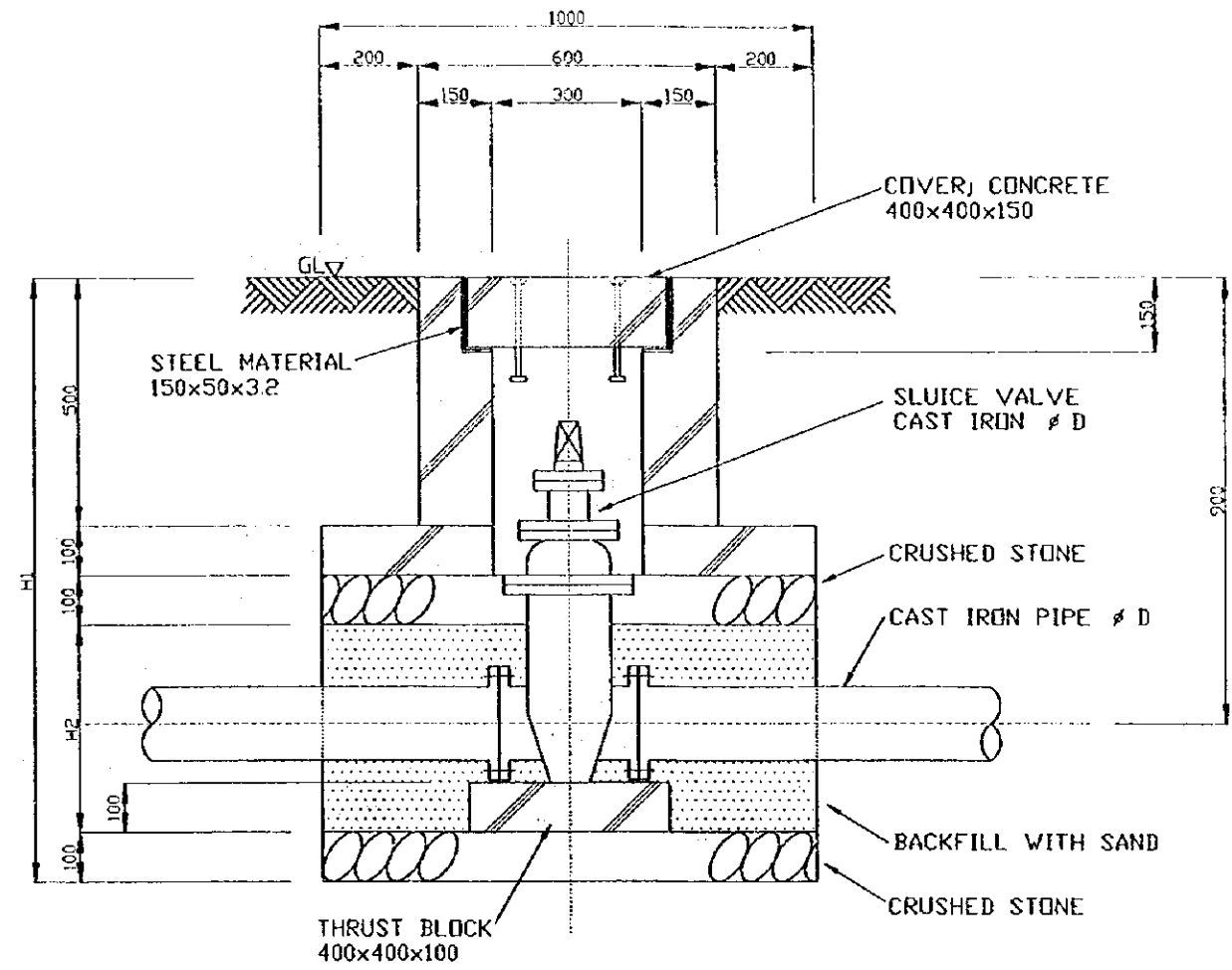


SECTION A-A

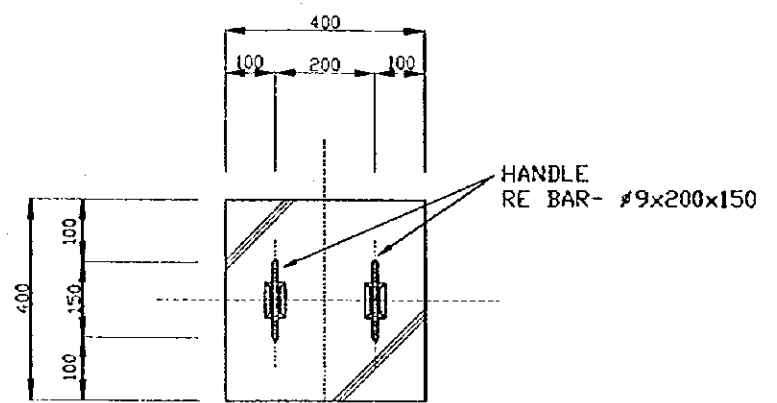
STATE OF ERITREA MINISTRY OF LAND, WATER & ENVIRONMENT	
JAPAN INTERNATIONAL COOPERATION AGENCY	
STUDY ON GROUNDWATER DEVELOPMENT & WATER SUPPLY FOR SEVEN TOWNS IN SOUTHERN REGION	
340m <sup>3</sup> RESERVOIR MENDEFERA	
WATER RESOURCES DEPARTMENT SANYU CONSULTANTS INC. (JAPAN) 1999	Drawing No 15/22



PLAN



SECTION A-A'



COVER

$\phi$ D	H1	H2
50	1180	380
80	1200	400
100	1220	420
125	1250	450
150	1280	480
200	1330	530

STATE OF ERITREA  
MINISTRY OF LAND, WATER &  
ENVIRONMENT

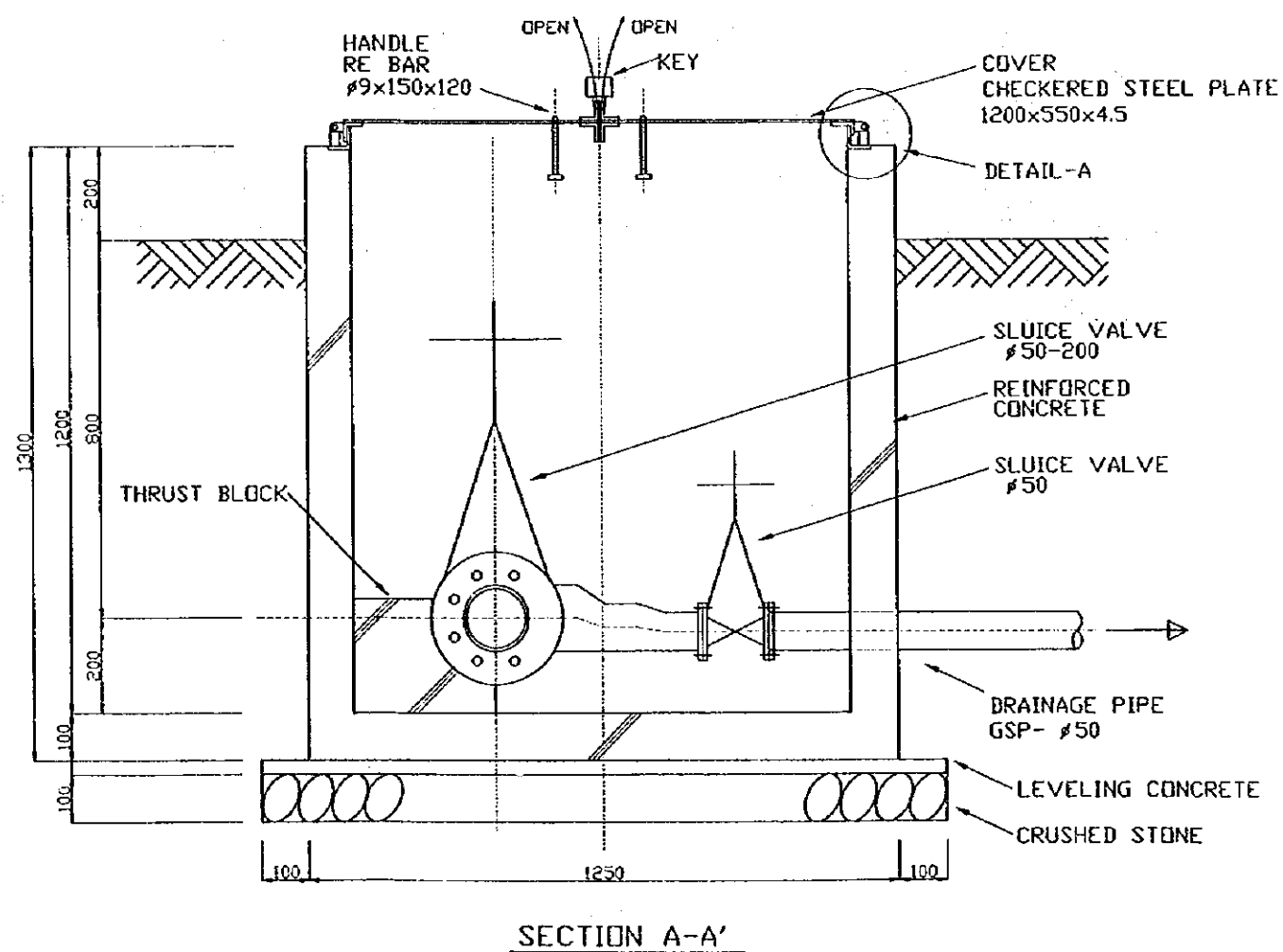
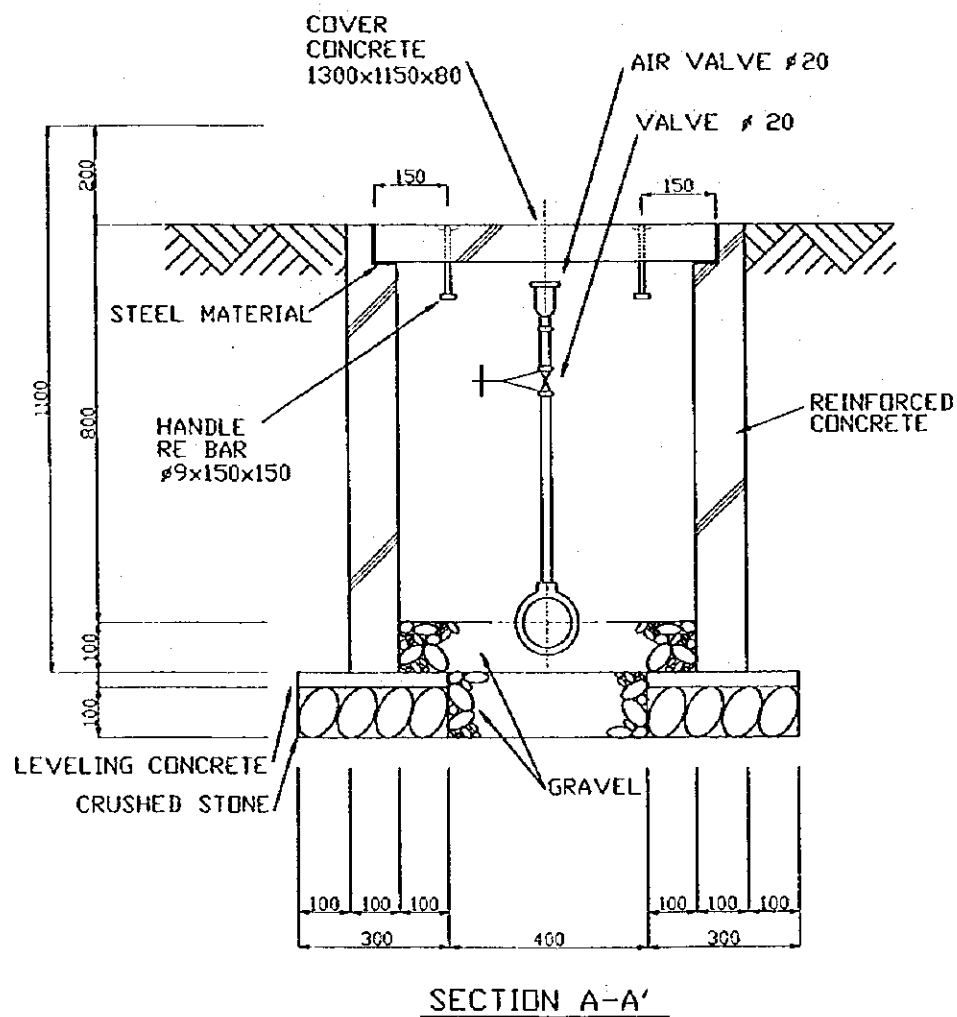
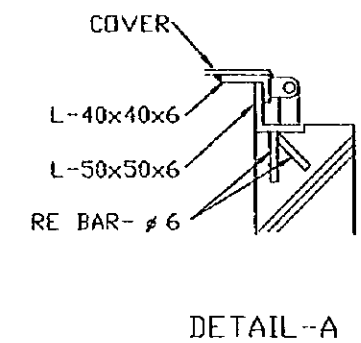
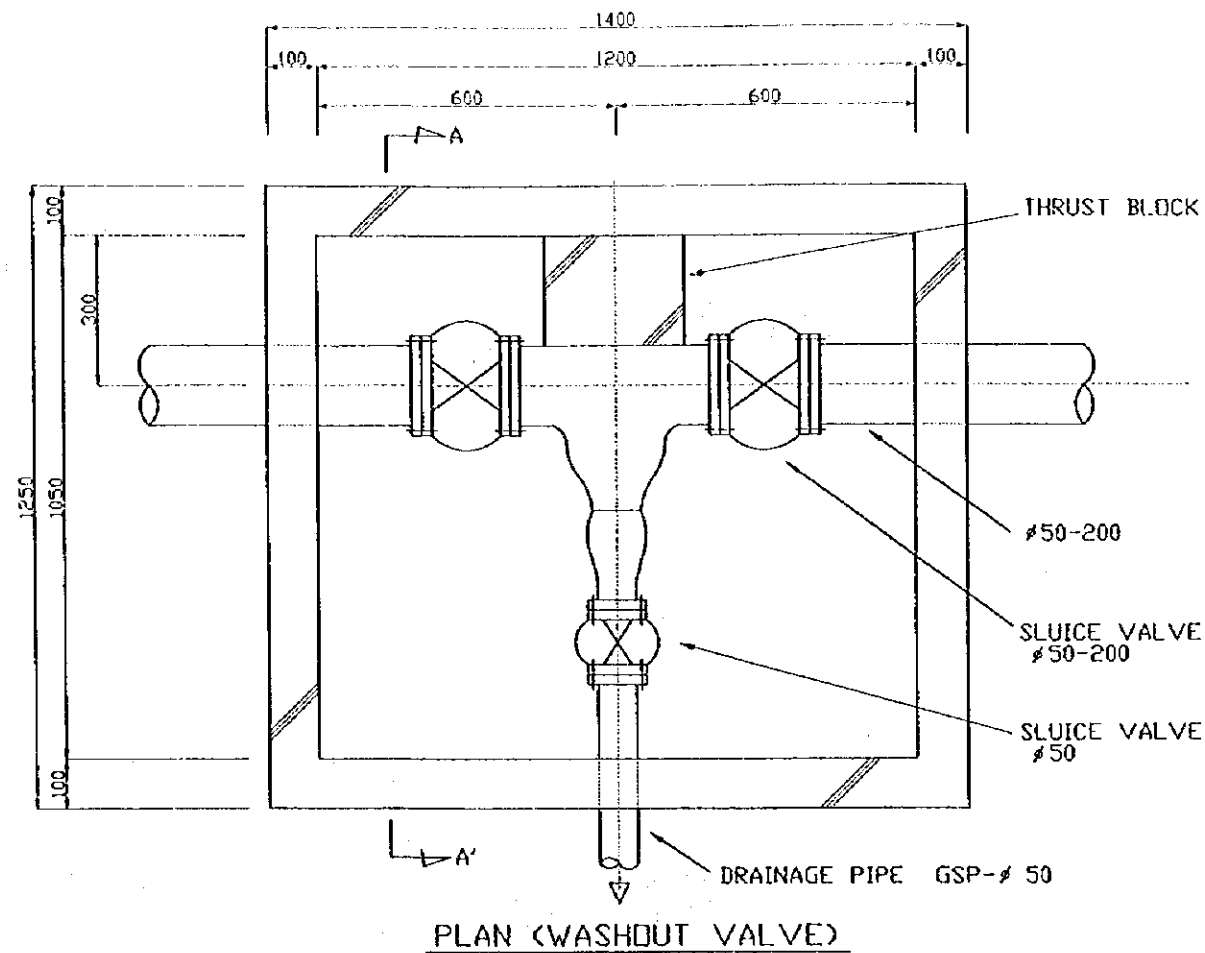
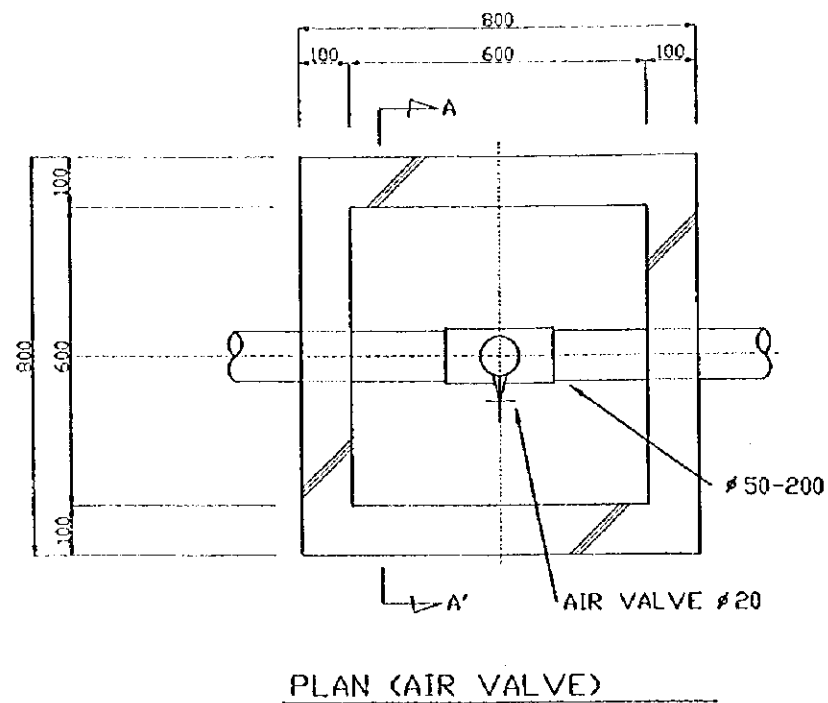
JAPAN INTERNATIONAL  
COOPERATION AGENCY

STUDY ON GROUNDWATER  
DEVELOPMENT & WATER SUPPLY  
FOR  
SEVEN TOWNS IN SOUTHERN REGION

TYPICAL VALVE BOX

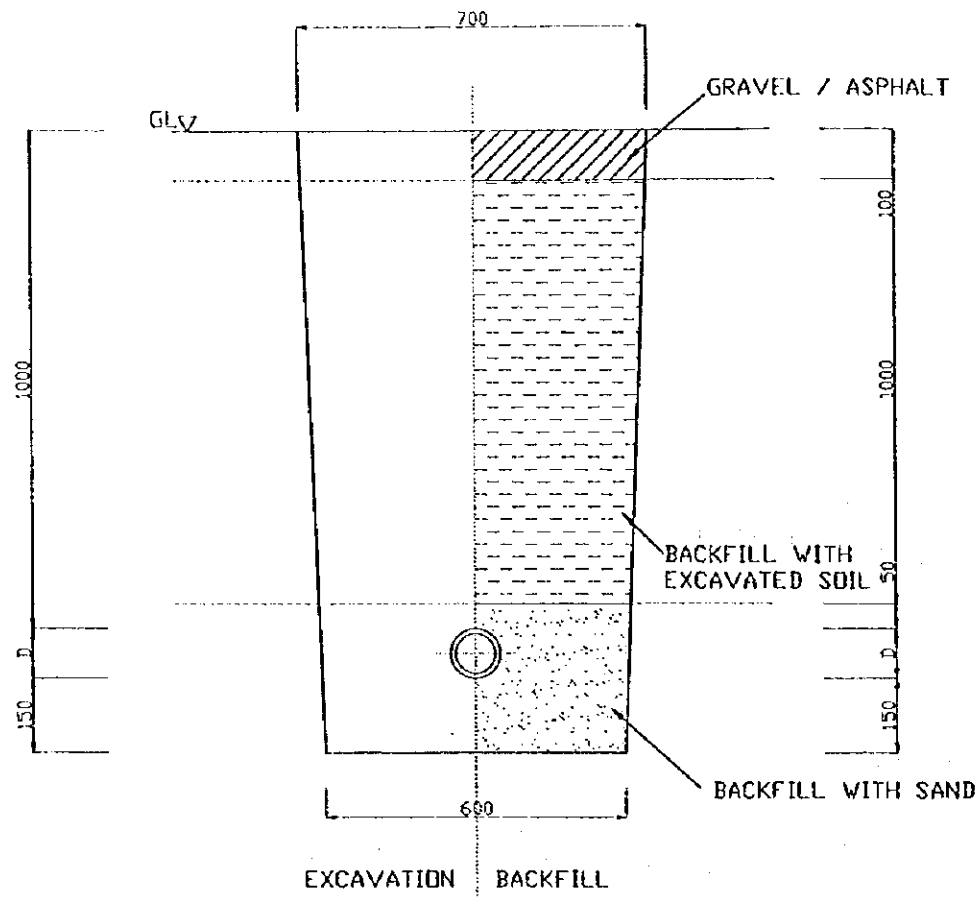
WATER RESOURCES DEPARTMENT SANYU CONSULTANTS INC. (JAPAN) 1999	Drawing No 16/22
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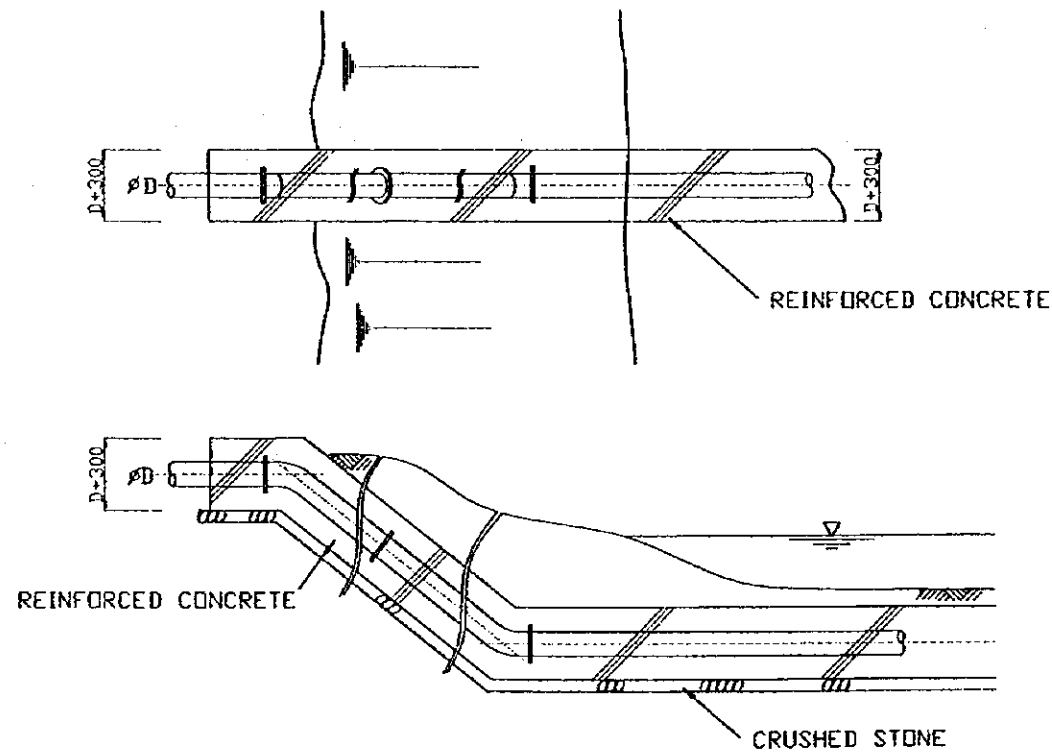


STATE OF ERITREA MINISTRY OF LAND, WATER & ENVIRONMENT	
JAPAN INTERNATIONAL COOPERATION AGENCY	
STUDY ON GROUNDWATER DEVELOPMENT & WATER SUPPLY FOR SEVEN TOWNS IN SOUTHERN REGION	
TYPICAL AIR VALVE AND WASHOUT VALVE	
WATER RESOURCES DEPARTMENT SANYU CONSULTANTS INC. (JAPAN) 1999	Drawing No 17/22

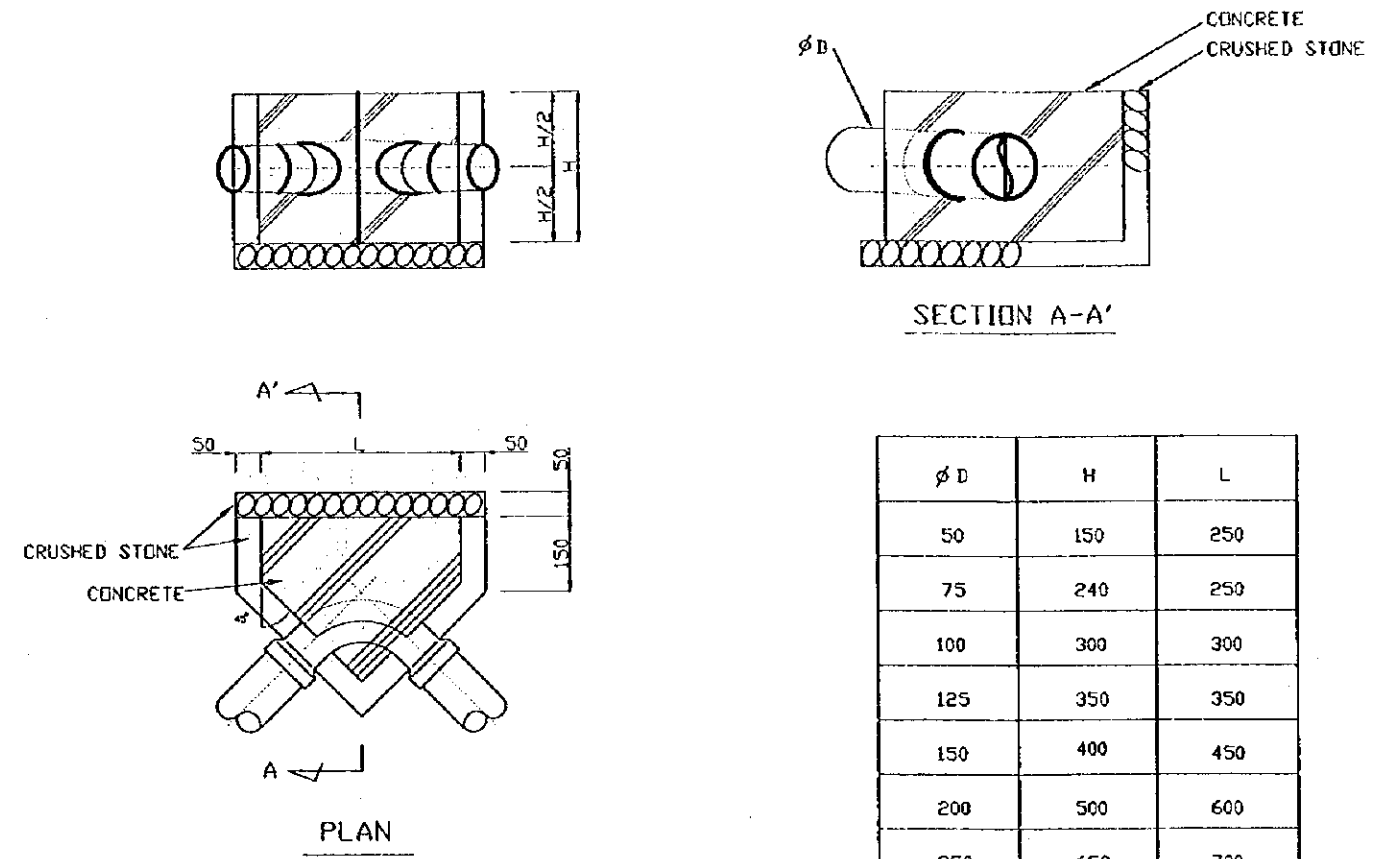
EXCAVATION FOR PIPE LINE



TYPICAL RIVER CROSSING WORK



JOINT PROTECTION



$\phi D$	H	L
50	150	250
75	240	250
100	300	300
125	350	350
150	400	450
200	500	600
250	650	700
300	700	800

REMARKS • THRUST CONCRETE SHALL BE CASTED AT THE HORIZONTAL BENDS, VERTICAL BENDS, TEES, END POINTS OF PIPE.

STATE OF ERITREA  
 MINISTRY OF LAND, WATER &  
 ENVIRONMENT

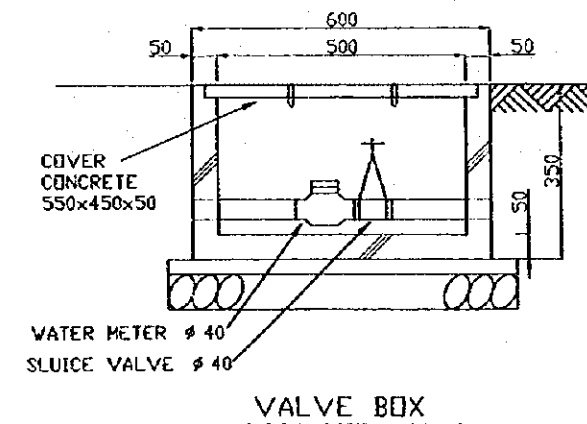
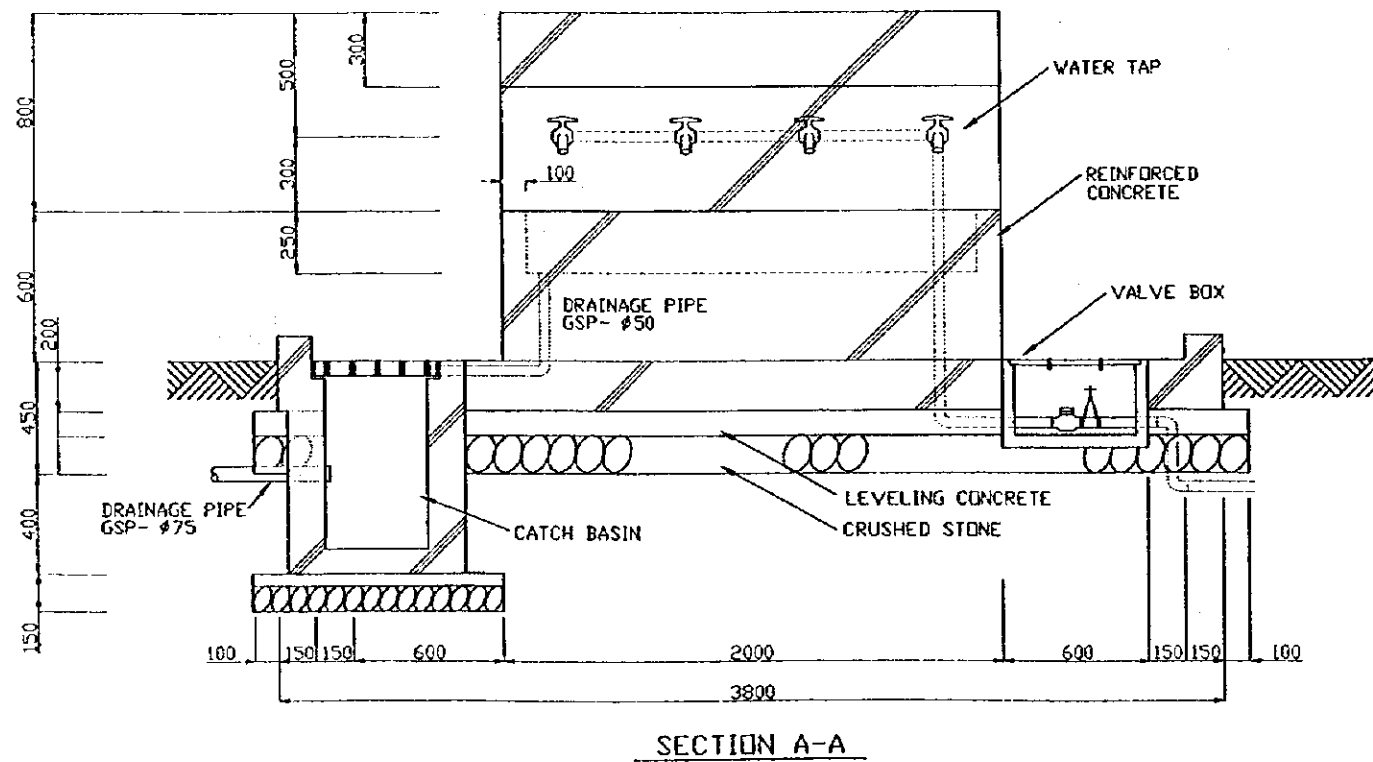
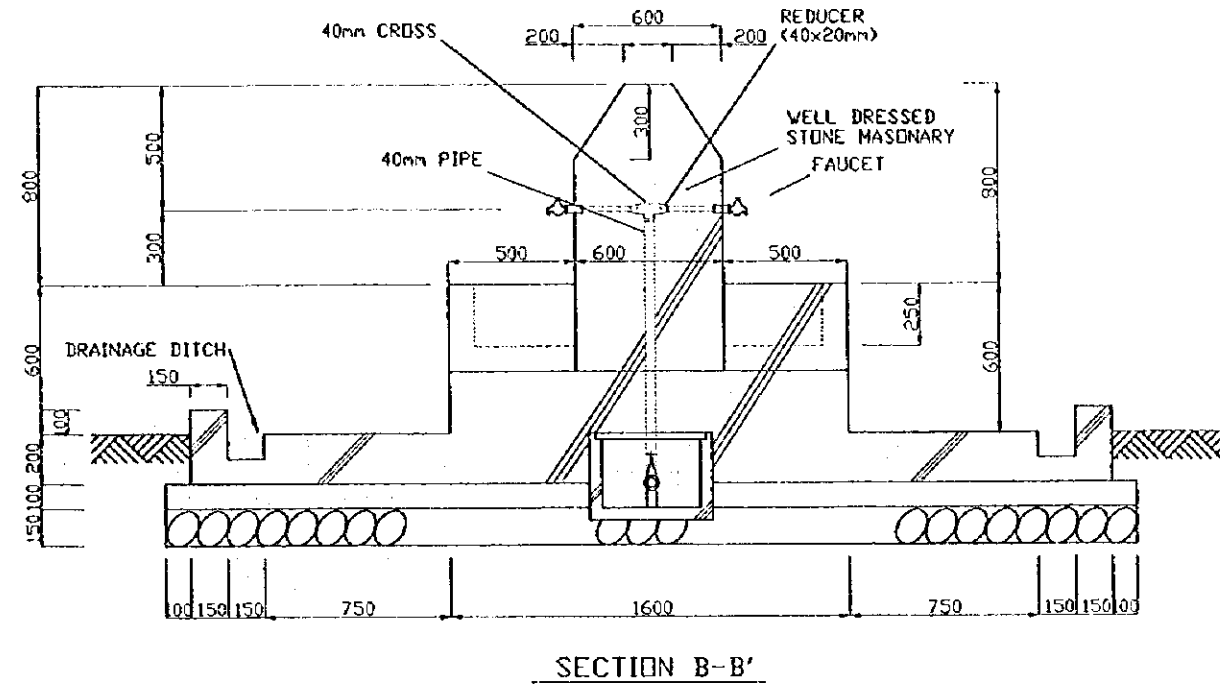
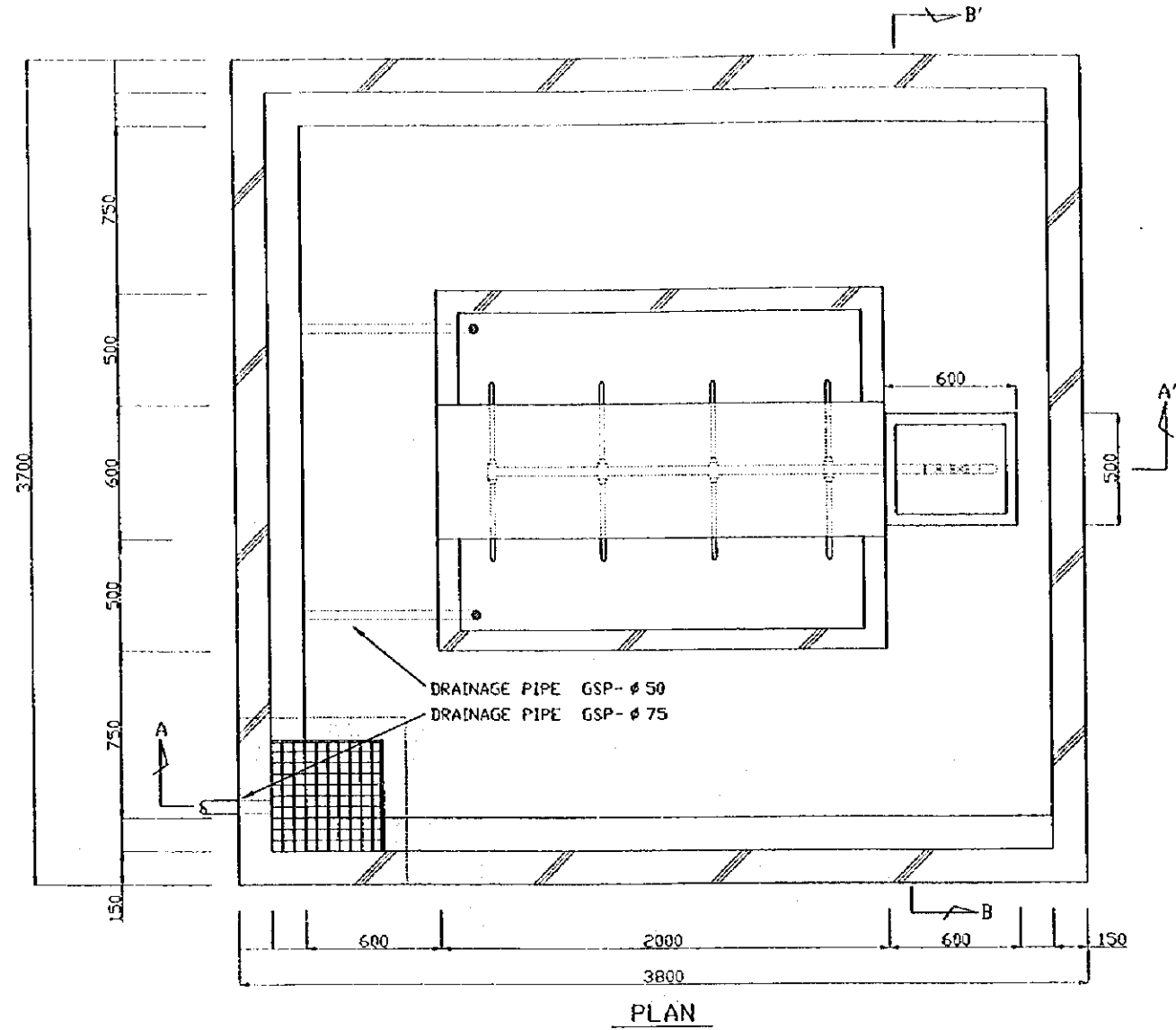
JAPAN INTERNATIONAL  
 COOPERATION AGENCY

STUDY ON GROUNDWATER  
 DEVELOPMENT & WATER SUPPLY  
 FOR  
 SEVEN TOWNS IN SOUTHERN REGION

TYPICAL EXCAVATION,  
 JOINT PROTECTION & CROSSING RIVER

WATER RESOURCES DEPARTMENT  
 SANYU CONSULTANTS INC.  
 (JAPAN) 1999

Drawing No  
 18/22



STATE OF ERITREA  
MINISTRY OF LAND, WATER &  
ENVIRONMENT

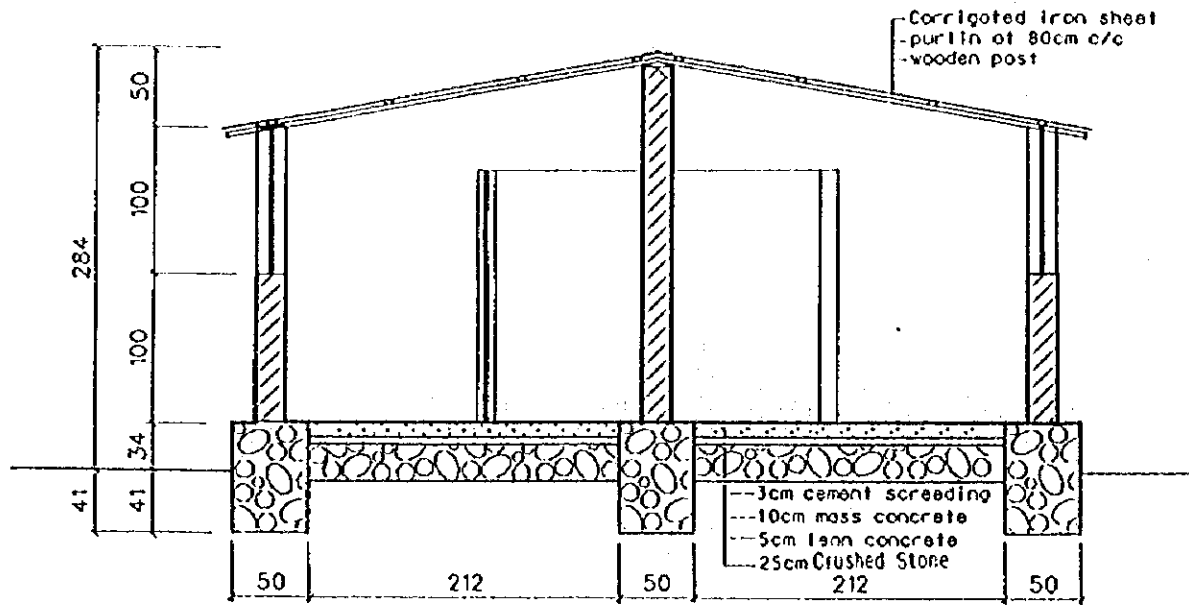
JAPAN INTERNATIONAL  
COOPERATION AGENCY

STUDY ON GROUNDWATER  
DEVELOPMENT & WATER SUPPLY  
FOR  
SEVEN TOWNS IN SOUTHERN REGION

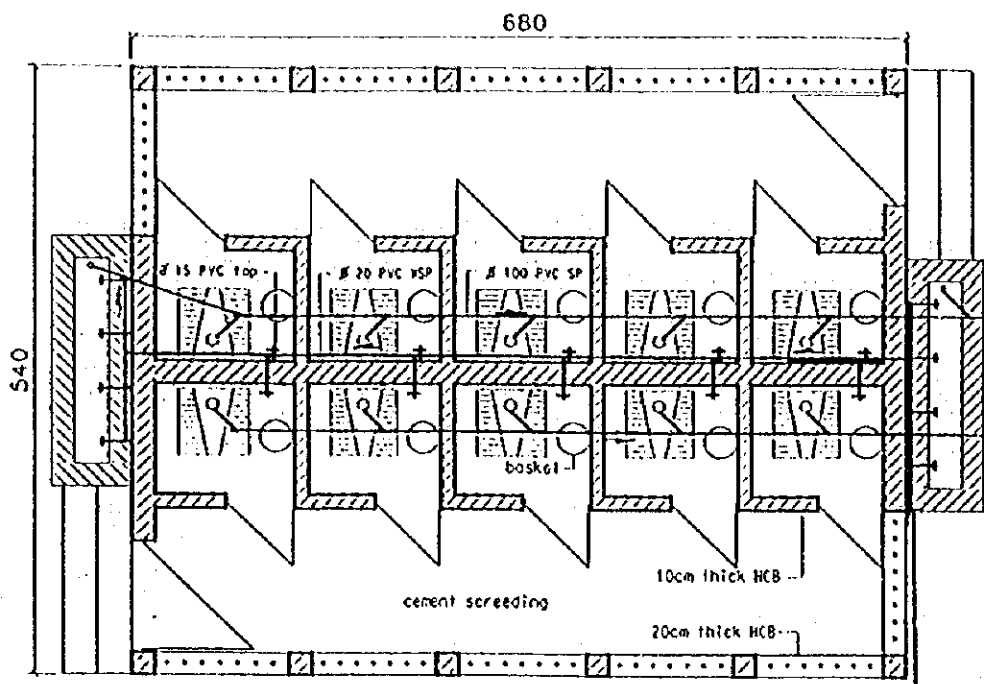
PUBLIC FAUCET

WATER RESOURCES DEPARTMENT | Drawing No.  
SANYU CONSULTANTS INC. | 19/22  
(JAPAN) 1999

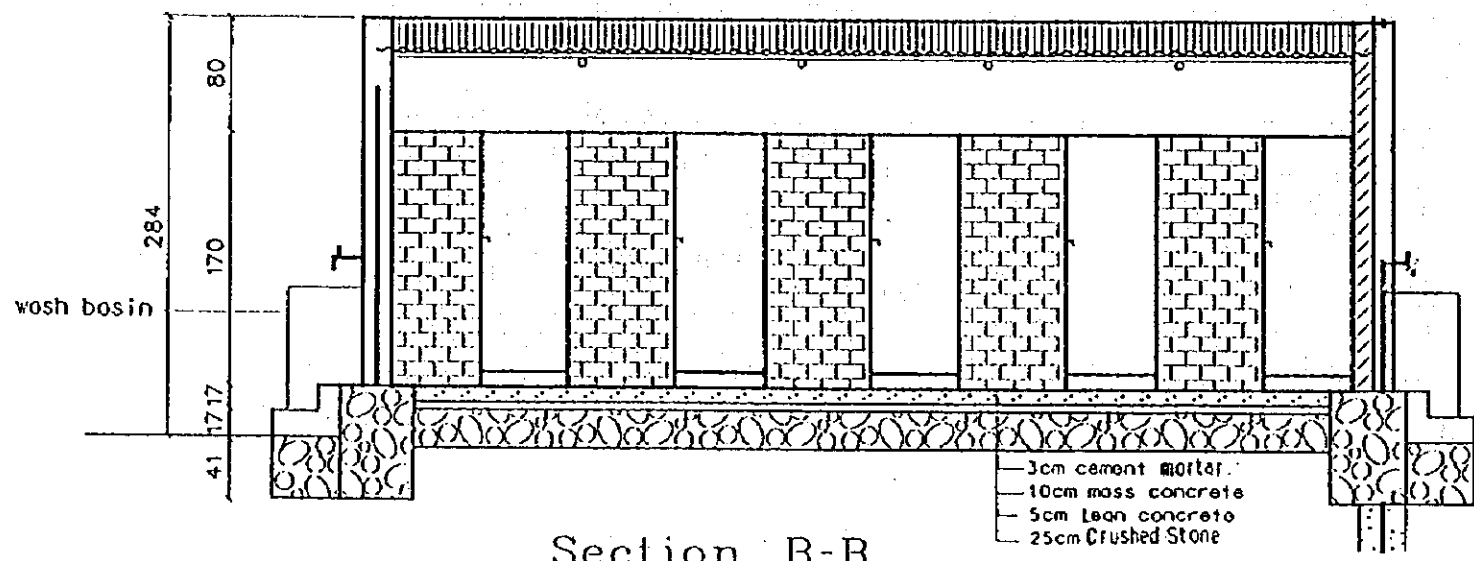




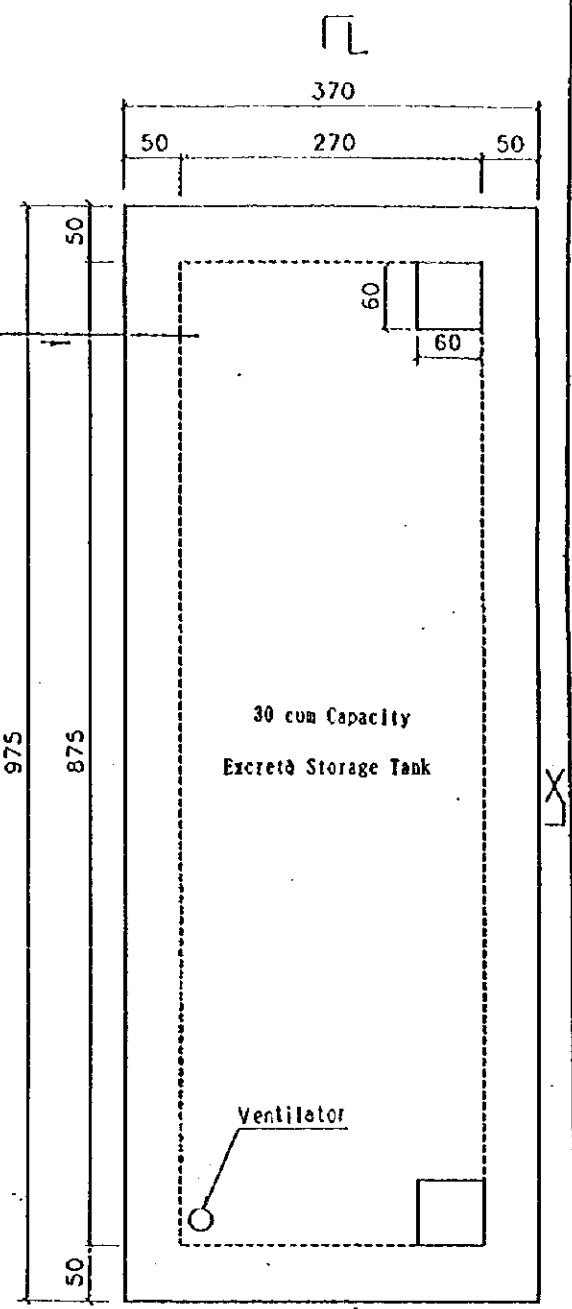
Section A-A  
Scale 1:50



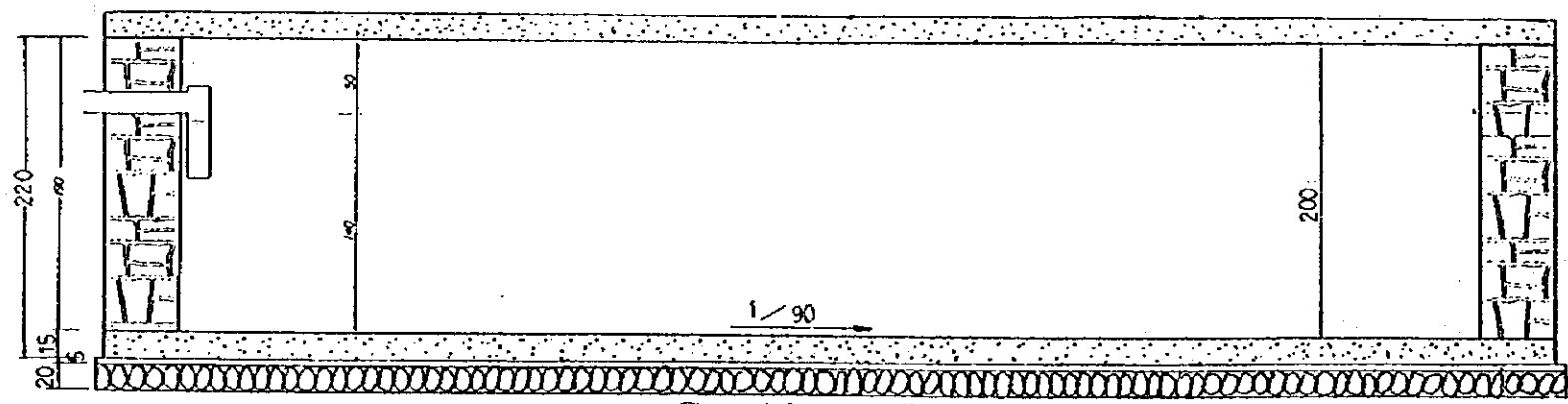
Pipe line layout  
Scale 1:75



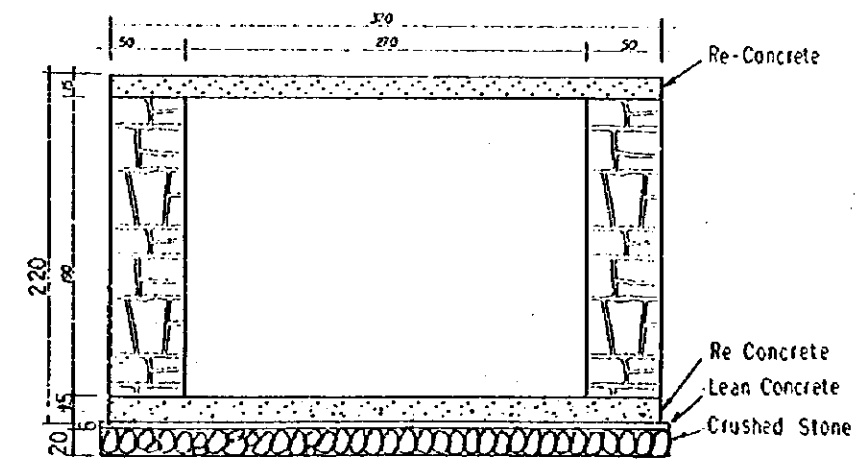
Section B-B  
Scale 1:50



30 cum Capacity Excreta Storage Tank



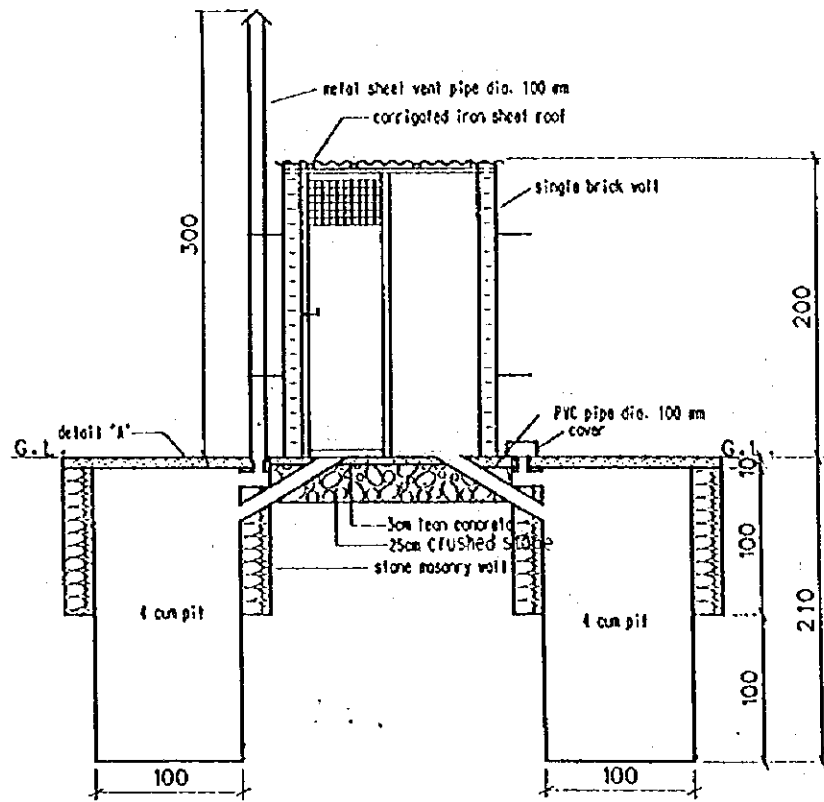
Section L-L



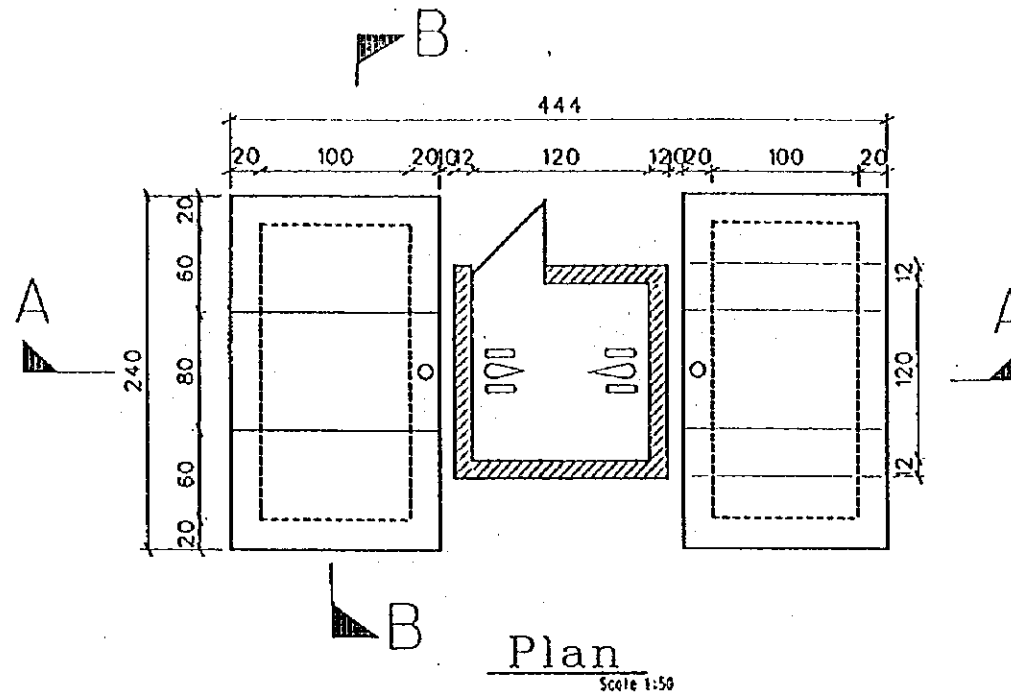
Section X-X

STATE OF ERITREA MINISTRY OF LAND, WATER & ENVIRONMENT	
JAPAN INTERNATIONAL COOPERATION AGENCY	
STUDY ON GROUNDWATER DEVELOPMENT & WATER SUPPLY FOR SEVEN TOWNS IN SOUTHERN REGION	
School Latrine (2/2)	
WATER RESOURCES DEPARTMENT (ASMARA, ERITREA)	Drawing No.
RANTU CONSULTANTS INC. (JAPAN) 1999	21/22

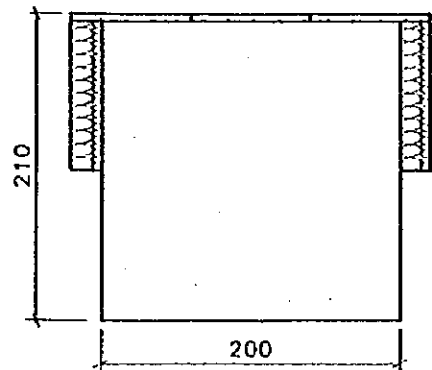
# DOUBLE PIT VIP LATRINE



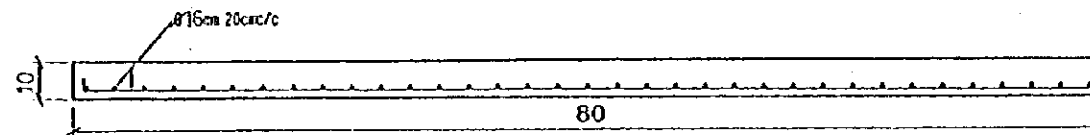
Section 'A-A'  
Scale 1:50



Plan  
Scale 1:50



Section 'B-B'  
Scale 1:50



Pit roof slab (140x80)  
Detail 'A'  
Scale 1:20

STATE OF ERITREA MINISTRY OF LAND, WATER & ENVIRONMENT	
JAPAN INTERNATIONAL COOPERATION AGENCY	
STUDY ON GROUNDWATER DEVELOPMENT & WATER SUPPLY FOR SEVEN TOWNS IN SOUTHERN REGION	
DOUBLE PIT VIP LATRINE	
WATER RESOURCES DEPARTMENT (ASMARA, ERITREA)	Drawing No.
SANTU CONSULTANTS INC. (JAPAN) 1999	22/22







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