INSTRUCTION MANUAL
FOR
EBARA VERTICAL MIXED FLOW PUMPS

MODEL : Z

EBARA MANUFACTURING CO., LTD.

TOKYO, JAPAN

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FOREWORD

This manual covers the handling instructions of the Ebara Vertical-Shaft Mixed-Flow Pump (opening of less than 300 mm and referred as below to VY and VZs. If the pump is handled with fail, it will not be enabled to function as specified and an accident will result.

Throughly read this manual to efficiently use the pump.

Section 1. CHECK IN RECEPTION

When the pump is received, immediately check for the following points:

1) Make sure that the machine name on the nameplate, capacity, head, the number of revolutions, output, voltage and frequency are as specified by you.

2) Make sure that any damage is not noted in the machine during transportation. Make sure that bolts and nuts are not loosened.

3) Make sure that accessories are all furnished.

If improper problems are noted, contact your dealer.

Section 2. INSTALLATION

The pump is in principle shipped as a unit which was completely assembled in our plant. But note that it may be shipped with it disassembled into some blocks due to the following reasons:

1) The pump having a length (size L in the overall dimensions) which requires disassembly for carrying and transportation.

2) A sufficient lifting margin cannot be taken due to a low ceiling of an installation site.

If your pump is shipped with disassembly, reassemble it at an installation site. For the reassembly procedure, see Section (7), "ASSEMBLY". This section describes only installation.

Carefully lift the pump, gradually lower it from an insertion hole and mount the base on the foundation not to damage the BOTTOM casing SUCTION strainer (it is recommendable to remove the strainer until the pump is lifted) and piping.

Drive two metal wedges in a gap between the base and foundation as shown in Fig. 1. Provide a mortar margin. Then level the base by adjusting the wedges. After leveling the base, weld to fix the wedges. The wedges must be placed at each side of each anchor bolt.

To check the base for levelness, put a level on the upper flange surface of the motor frame in principle. An allowable value of base levelness is 5/100 mm a 1 m.

After accomplishing base levelness, place mortar. Place mortar in anchor bolt holes, beneath the base and evenly do it over the entire range. With mortar solidified, tighten anchor bolt nuts, and recheck the base for levelness.

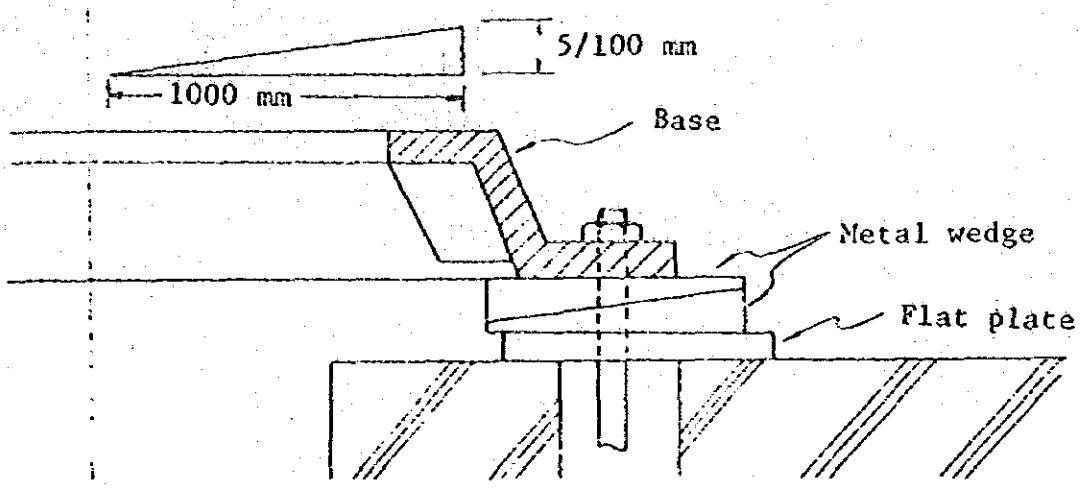


Fig. 1

Section 3. CENTERING

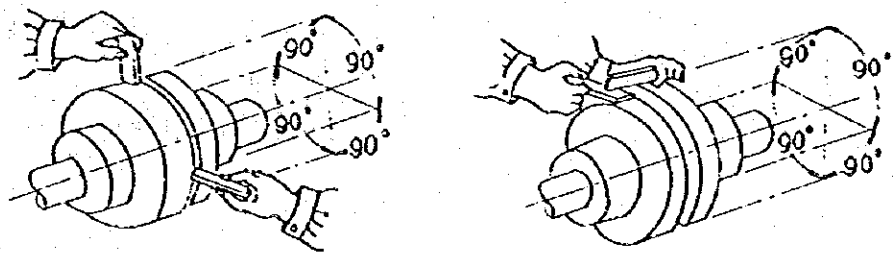
After base levelness adjustment has completed, install the motor on the motor frame. (Be careful to prevent entry of foreign matter into the upper surface of the motor frame and flange surface.) Adjust to center the motor with machine bolts. To check the pump and motor for centering, measure run-out and face run-out of the coupling. Remove coupling bolts. Completely remove paint from the coupling periphery with solvent. As shown in Fig. 2, measure the run-out at four positions of the coupling having a 90° distance each with a rule and thickness gauge or dial indicator.

The required values are as follows:

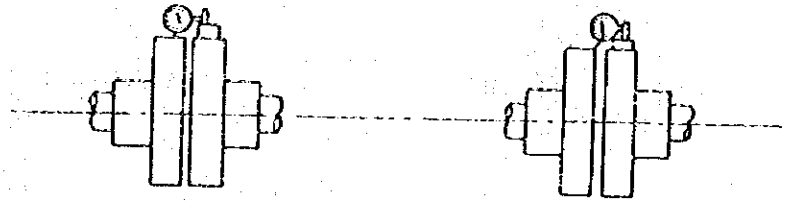
Coupling periphery	:	5/100 mm	Note 1
Coupling end face	:	10/100 mm	Note 2

Notes: (1) The value of run-out shows an eccentricity. (Reading of a dial indicator becomes twice as large as this value.)

(2) The value of face run-out shows the difference between the maximum and minimum measured values.



Centering with a rule and thickness gauge



Centering with a dial indicator

Fig. 2

Section 4. PIPING

Piping fabrication, since its quality level greatly affects performance, must carefully be performed.

1) Adjust a flange to be connected to a correct position to prevent pump shaft centering error. Do not unreasonably fix a flange with tightening bolts.

2) Perform piping to prevent the influence of expansion and shrinkage of piping due to temperature and abnormal exertion of piping and valve weights on the pump.

3) Fully clean the piping inside.

Section 5. OPERATION

5-1. Preliminary Instructions

Carry out preparation for operation in accordance with the following order:

1) Remove large obstacles such as wood blocks and wires and dust if found in a cistern where the pump sucks water. This must also be observed during operation of the pump.

2) Check to make sure that a water tank maintains the lowest level or higher. The lowest level where the pump can operate normally is shown in the overall dimensions. If water is sucked at less than the valve and a cistern is improper in its shape, the pump may vibrate due to formation of eddy and suction of air. Check for level with a level gauge.

3) Check the prime mover for a turning direction by comparing it with an arrow mark nameplate or cast letters. The pump rotates to the right as viewed from the top. In this case, remove coupling bolts of the prime mover. Operate the prime mover in individually.

4) Check to make sure that the thrust bearing case is filled with lubrication oil to the level of the red line of the oil level gauge. Also check to make sure that oil is not fouled to somewhat sewage. Use JIS K 2213 turbine oil #140 as lubrication oil.

5) Turn the pump by hand, making sure that it rotates smoothly. For this check, turn it by holding the coupling by hand.

6) Check through the flow sight to make sure that water is circulated to the sleeve bearings-intermediate.

Note: In the case of a self-lubrication type, water is not circulated unless the pump is operated.

7) When checking for electric connections, be in accordance with the electric specifications.

8) In the case of an engine-driven type;

For engine operation, check the engine for operating condition in accordance with the separate engine instruction manual before test run of the pump. Concerning the gear head, check it for condition in accordance with the separate gear head instruction manual.

5-2. Starting Operation

After finishing par. 5-1, "Preliminary Instructions", recheck for the following points and then start the pump.

1) Make sure that cistern level is normal.

2) Make sure that lubrication water is ready to be circulated.

3) Make sure that the discharge valve closes fully.

However, a pump where shaft power is maximized under cut-off operation of the pump as shown in Fig. 3 must be started with the discharge valve opened.

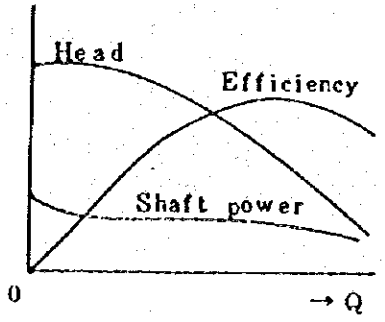


Fig. 3

4) Make sure that the protective relay does not operate before start.

Note: This means that if any pump provides a device of the protective relay, it is not faulty.

5-2-1. Starting and Stopping Orders

Generally, start and stop the pump in each following order:

o Starting Order

		Manual Operation	Automatic Operation
①	Starting condition completion	Check for par. 5-2-1.	Check to make sure that the lamp on the operation panel comes on.
②	Opening the circulation valve	Open the circulation valve.	Start water circulation by opening the solenoid valve.
③	Detecting lubrication water	Check for the circulation through the flow sight.	The flow switch detects that water is circulated.
④	Circulating water for a given period of time	Circulate water for approx. 10 sec.	Water is circulated by the adjustable timer.
⑤	Starting the main pump	Turn on the switch.	The start switch is automatically turned on and the start lamp lights up.

		Manual Operation	Automatic Operation
⑥	Bleeding air from the pump (when air vent is required)	Air is automatically vented from the bleeder valve.	Vent air for a given period of time by the adjustable timer.
⑦	Opening the discharge valve	Open the discharge valve. Start is completed.	Open the discharge valve. Then the valve opening lamp will come on. Start is completed.

Note: In the case of self water circulation and oil lubrication, an order of ①→⑤→⑥→⑦ is taken.

o Stopping Order

		Manual Operation	Automatic Operation
①	Fully closing the discharge valve	Close the discharge valve.	Close the discharge valve by setting the stop switch to "ON". With the valve fully closed, the valve cut-off valve lights up. After the valve has fully been closed, the main pump stops.
②	Stopping the main pump	Stop the pump by operating the stop switch.	The pump stop lamp comes on.

		Manual Operation	Automatic Operation
(3)	Closing the circulation valve	Check to make sure that the pump stops completely by reversing it. Close the circulation valve.	Give a period of time until the pump stops completely by using the adjustable timer.

5-2-2. Precautions in Starting Operation

When starting operation for the first time after installation of the pump, inch-move it first by momentarily turning on and off the switch. Then perform intermittent operation (approx. 3 minutes), checking for the following points:

1) Make sure that any abnormal vibration and sound are not noted. If vibration and/or sound are excessively high, immediately stop the pump and thoroughly check it. Measure vibration at the upper bearing of the motor. If the full amplitude is less than 40μ, this is normal.

2) Check for current and discharge output

   If these data do not differ greatly from the plant performance test data in comparison, it is acceptable. Also watch meter pointer deflection. If any excessive defection is not noted in the pointer, this is normal.

3) Make sure that abnormal condition is not found in the discharge piping system ahead the pump discharge port.

4) Check the thrust bearings for temperature

   If the bearings are abnormal, those will be heated in a short period of time too much to touch them.

Section 6. MAINTENANCE

6-1. Maintenance under Operation

1) Leave off cut-off operation in a short period of time if performed. If cut-off operation is performed for a long period of time, provide a by-pass valve and set it to a minimum flow rate.

2) Watch excessive vibration and noise.

3) It is desirable that the operation point is near the specification.

4) Measure thrust bearing temperature. For this measurement, proceed as follows: Install a bar thermometer onto the thrust bearing cover by using putty. Measure and record temperature every 10 minutes until temperature becomes steady. If the steady temperature is less than room temperature plus (+) 40°C or less than 80°C, this is acceptable.

5) Adjust gland tightness by tightening gland bolts to an extent that a small amount of water leakage is noted without splash. The optimum leakage is 40 to 100 cc/min under continuous drips.

6) Operate the spare (back-up) pump for approx. 20 minutes once a week. If the pump is under long outage, rust will be formed and any failure will result.

7) For an engine-driven pump, an engine is operated as scheduled in accordance with the related instruction manual. Also operate the pump whenever the engine is operated.

6-2 As-scheduled Check

Perform checks as scheduled in the following manner unless abnormal condition is noted.

Table 1

Check Point	Description	Period		
		Every Three Months	Every One Year or 8000 Hours	Every Two Year or 15000 Hours
Ball-and-roller bearing	Apply oil. Notes: 1. and 2.	o		
	Check the inner and outer race surfaces and ball surfaces for pealing. Replace any ones if any.			o
Under-water sliding bearing	Check its sliding surface for contact and scores or scratched marks. Measure the inside diameter and take a remedy in accordance with the manufacturer's standard if required.		o	
Gland packing	Check the packing for seating condition and water leakage rate. If excessive leakage is noted, replace the packing.	o		
Mechanical seal	Check its sliding surface for condition.		o	
	Replace the seal with a new one.			o

Table 1 (Cont'd)

Check Point	Description	Period		
		Every Three Months	Every One Year or 8000 Hours	Every Two Year or 15000 Hours
Shaft sleeve	Check the shaft sleeve for contact and scores or scratched marks of parts which come in contact with packings and bearings, and measure its outside diameter. Remedy it in accordance with the manufacturer's standard if required.		o	
Shaft	Check its sliding surface for contact, scores or scratched marks and bending.			o
O-ring	Check it for scores or scratched marks and solidificating condition of the surface. Replace it if any distortion is noted.		o	
	Replace it with a new one.			o
Casing wear ring	Check the ring for contact, excessive wear and corroding condition of its sliding surface. Measure the I.D. Remedy it in accordance with the manufacturer's standard if required.		o	
Impeller	Check the entire impeller for excessive wear and corroding condition.		o	

Table 1 (Cont'd)

Check Point	Description	Period		
		Every Three Months	Every One Year or 8000 Hours	Every Two Year or 15000 Hours
Impeller	Measure the sliding surface between the impeller and casing wear ring. Remedy the impeller in accordance with the manufacturer's standard if required.			
Coupling bolts and rubber rings	Check them for wearing condition. Replace any ones if necessary.		o	

Note: (1) Lubrication oil must be in accordance with the instruction shown in the list of par. 9-3, "Lubrication Oil".

(2) Renew lubrication oil at the first time after one week operation.

6-3 Troubleshooting

If any failure occurs, immediately locate its cause and take a remedy. For possible causes and remedies, see the following troubleshooting table.

Table 2.

Symptom		Cause	Remedy
Pump does not start operation.		o Prime mover is faulty o Pump is seized. o Electricity is not supplied. o Impeller is clogged.	o Repair prime mover. o Repair pump. o Check electric system for condition. o Clean it.
PUMP STARTS, BUT	Water is not discharged.	o Valve is not opened. o Valve does not open. o Air is sucked. o Intake pipe and strainer are clogged. o Impeller is clogged.	o Open valve. o Repair valve. o Check intake system for condition. o Clean them. o Clean it.
	Lift of specified water flow rate cannot be obtained	o Air is sucked. o The number of revolutions drops. o Discharge head is too high. o In-take pipe and strainer are clogged. o Impeller is clogged. o Casing wear ring is worn out. o Cavitation occurs. o Measuring instrument is improper. o Turning direction is is reverse.	o Check in-take system for condition. o Recorrect power supply. o Check piping ahead water circulation for condition. o Clean them. o Clean it. o Replace it with a new one. o Throttle valve of discharge side. o Replace it with a new one. o Check for the direction, making sure of an arrow mark.

Table 2. (Cont'd)

Symptom		Cause	Remedy
PUMP STARTS, BUT	Water is supplied at the begining, but it is immediately not supplied.	o Air is sucked.	o Check in-take pit for level.
	Motor is overloaded	o The number of revolutions is too high.	o Recorrect power supply.
		o Abnormal contact occurs inside.	o Remove contact.
		o Coupling is improper.	o Perform centering.
		o Packing is over-tightened.	o Loosen gland.
		o Shaft is bent.	o Replace it with a new one.
		o Casing is warped.	o Check foundation and piping for condition.
		o Discharge rate is too high.	o Throttle valve of discharge side.
		o Head is too low.	o Throttle valve of discharge side.
		o Specific gravity and viscosity of liquid are too high.	o Check plan.
	Bearing is overheated	o Lubrication oil is deficient.	o Add lubrication oil.
		o Lubrication oil is too much.	o Remove lubrication oil properly.
		o Coupling is improper.	o Perform centering.
		o Scores or scratched marks and rust are formed in ball-and-roller bearing.	o Replace it with new one.
		o Shaft is bent.	o Replace it with new one.

Table 2. (Cont'd)

Symptom		Cause	Remedy
	Bearing is overheated.	o Thrust increases.	o Check to make sure whether or not uneven wear is noted and whether or not impeller balance hole is clogged. Reassemble it if necessary.
	Pump is vibrates.	o Coupling is improper.	o Perform centering.
		o Shaft is bent.	o Renew it.
		o Installation is improper.	o Correct installing condition.
		o Foundation is weak.	o Reinforce it.
		o Other vibrations are transmitted.	o Reinforce piping.
		o Cavitation occurs.	o Throttle valve of discharge side.
		o Bearings are worn out.	o Renew ball bearing and under-water bearings.
		o Impeller is clogged.	o Clean it.

Section 7. ASSEMBLY

Since the pump which has completely been assembled and adjusted in our plant is shipped, there is no part to be re-machied on site. Understand the construction through the assembly sectional views and then refer to this manual. Reassemble the pump without fail of the order.

7-1. General Assembly Precautions

a) Before assembly, set each part, making sure that any shortage and damage are not noted in parts.

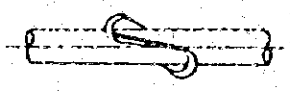
b) Thoroughly clean the contact surfaces and installing surfaces in oil. Remove dust, rust and scores or scratched marks if any. Especially, clean bearings, fitted parts of couplings, threaded parts of screw joints, sleeve surfaces and liner rings.

c) Completely lock threaded parts.

d) If fitted parts are provided with matching marks, align the marks each other and then assemble the parts. When the number of shafts is numerous, shafts and couplings are provided with matching marks. Numbers of 1, 2, 3, ..., are provided from bottom to top.

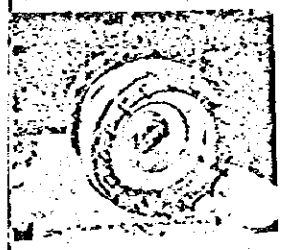
e) The mechanical seals must carefully be handled. Do not damage the sliding surfaces and O-rings.

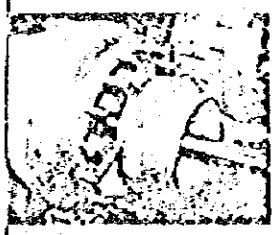
f) Insert a gland packing one by one in good order with its cut part shifted each other 90° or 120°. In this case, mount it on a shaft as shown.



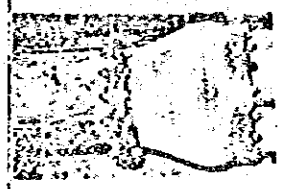
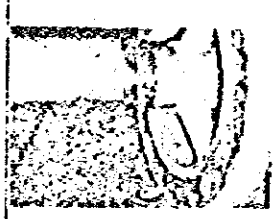
g) After assembly completion, manually turn the pump, making sure that unevenness is not noted in rotation.

Assembly Procedure

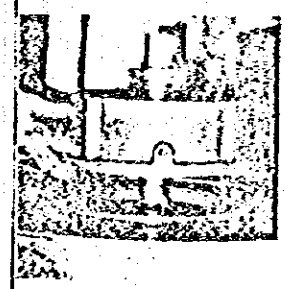
Procedure	Precaution	Parts No.	Reference Picture
Preliminary assembly of each part			
(1) Check each part with sectional views, making sure that any shortage is not noted.			
(2) Clean and check each part.	Especially, the contact surface must elaborately be cleaned.		
(3) Check sliding parts for setting, screw locking and punching conditions.			
(4) Check driving sections, contacting surfaces and sliding surfaces for damage and rust. Repair or remove any ones.			
(5) Install the liner rings to the top, (intermediate) and bottom casings.	Do not forget tightening lock screws.		
(6) Install bearings to the top and (intermediate) casings.	If those are made of stainless steel, coat them with seizure-proof agent and install them. Since bearings are fragile, be careful of handling.		

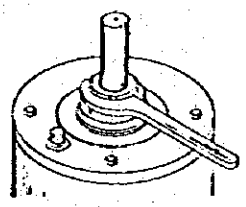
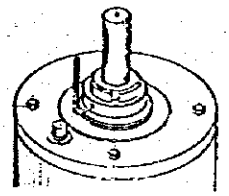
Procedure	Precaution	Parts No.	Reference Picture
(7) Attach sleeves to the pump shaft, and attach O-rings and sleeve to the top shaft and then tighten lock screw.			
Insert the pump shaft into the top casing.	Do not damage the bearing metal surfaces.	004 032	
(In the case of model VZ)			
Install back side plate and then install mechanical seals (fixing side) to lock holes in accordance with the size.	Attach O-rings to back side plate. Mechanical seals are easy to insert if their inserting sections are coated with grease.	270 115-4 111	
Install keys and then insert the impeller. (When using mechanical seals, install the seals with the seals of the sliding side aligned with lock screws of the impeller and then insert the impeller.)	If the fitted part is made of easy-to-bite material, apply seizure-proof agent (Molykote or Locall Paste).	039-4	
(In the case of the multi-stage type) Attach distance pieces and sleeves to the pump shaft and then install the intermediate casing to the top casing.	Do not forget seating gaskets.	045 041-2	

No.	Procedure	Precaution	Parts No.	Reference Picture
6	(In the case of the multi-stage type) Install keys to the pump shaft and then insert the impeller.		021	
7	Repeat steps 5 and 6 as the number of stages of the impeller.	Do not forget seating gaskets.		
8	Insert the first-stage impeller and then tighten impeller nuts.		048	
9	Install the bottom casing.	Do not forget seating gaskets.	006	
10	Install the sleeve bearings-intermediate to the top casing.	When inserting the bearings into the shaft, do not damage bearing metal surface.	052-1	
11	Turn the pump shaft by hand, making sure that no contact is noted. Also check for stroke (see par. 9-2) in an axial direction. If no abnormal condition is noted, tighten impeller lock screws and then caulk them with a punch.	Do not forget punching lock screws.		

No.	Procedure	Precaution	Parts No.	Reference Picture
12	Connect the intermediate shaft.	When fixing socket couplings, tighten lock screws in keys and then caulk them with a punch.	034-1	
13	Connect the intermediate tube.	The tube is easy to insert if grease is applied to O-rings to be attached to bearings.	172	
14	Install the intermediate column pipe.	Do not forget seating gaskets. Do not forget seating washers. Bolt heads must face the casing side and bolts must not be unevenly tightened. After tightening bolts and nuts, recheck.	171-2	
15	Install the intermediate sleeve bearings-intermediate to the intermediate bearing supports. Inserting the sleeve bearings-intermediate into the intermediate tube, install the intermediate bearing supports to the intermediate column pipe.	O-rings are easy to insert if grease is applied.	052-1 057	

No.	Procedure	Precaution	Parts No.	Reference Picture
16	Repeat steps 12. to 15. in accordance with the number of the intermediate shafts, intermediate tubes and intermediate column pipes.	Place gaskets on between the column pipes and intermediate bearing supports. Bolt heads must all face the casing side and bolts must not be unevenly tightened.		
17	Connect the upper shafts and upper tube.		033 172-1	
18	Install the upper column pipes to the discharge casing. In the case of dividing type, install the discharge bend to the pedestal and then perform the installation mentioned above.		177 or 003 171-1 167	
19	Install the base to the discharge casing.	After tightening bolts, recheck bolts for tightening condition.	168	
20	Assemble the discharge casing and then couple the upper column pipe with the intermediate column pipe.	Do not forget seating gaskets. After tightening bolts and nuts, recheck for tightening condition.		

No.	Procedure	Precaution	Parts No.	Reference Picture
21	Install the stuffing box.	Do not forget O-ring.	008	
22	Insert gland packings.	Shift cut parts of gland packings every 120°.	041-1	
23	Install packing glands.	Tighten packing gland tightening nuts not to over-tighten gland packings.	091	
24	Install V-rings to the top shaft.		064	
25	Install the oil reservoir to the bearing casing. Install the assembly to the discharge casing.		277-2	
26	Install ball bearing to the bearing adaptor. Insert snap ring into them to support the bearing.	Be careful to prevent entry of dust into ball bearing.	044 056 274	
27	Install key and then assemble the bearing to the bearing casing.	Be careful to prevent entry of dust into the bearing casing.	039-2 051	
28	Assemble oil seal and then install the bearing cover.	Do not forget seating gasket. Install V-ring.	114	

No.	Procedure	Precaution	Parts No.	Reference Picture
29	Attach shaft nut and temporarily tighten setscrew.		129 120	
30	Install key and then insert coupling of the pump side.		039-1 147	
31	Model VY: Measure a moving distance of the impeller in an axial direction. Retighten shaft nuts to position the impeller as the mid-point of a moving distance.	After positioning, tighten setscrews. See par. 9-2.		
	Model VZ: Lower the impeller to the bottom, i.e., until it comes in contact with the side plate and then lift it approx. 1 mm above the bottom.	See par. 9-2.		
32	Install the motor frame.			
33	Insert a coupling into the motor. Install coupling bolts.			

No.	Procedure	Precaution	Parts No.	Reference Picture
33	Insert the assembled motor frame.			
34	Insatll the oil level gauge, oil cap, plugs and other small parts.		255 285	
35	Carry out lubrication piping.			
36	Total check	Check to be sure that bolts are tightened. Check to be sure that installation of small parts is not forgotten. Turn the pump by hand, making sure that abnormal condition is not noted.		

Note: When any good crane (truck) is not provided on a site and the pump cannot be installed at a pit after assembly, reassemble it in accordance with the instructions shown in Fig. 4. Perform the work in accordance with the instructions of steps 1. to 35.

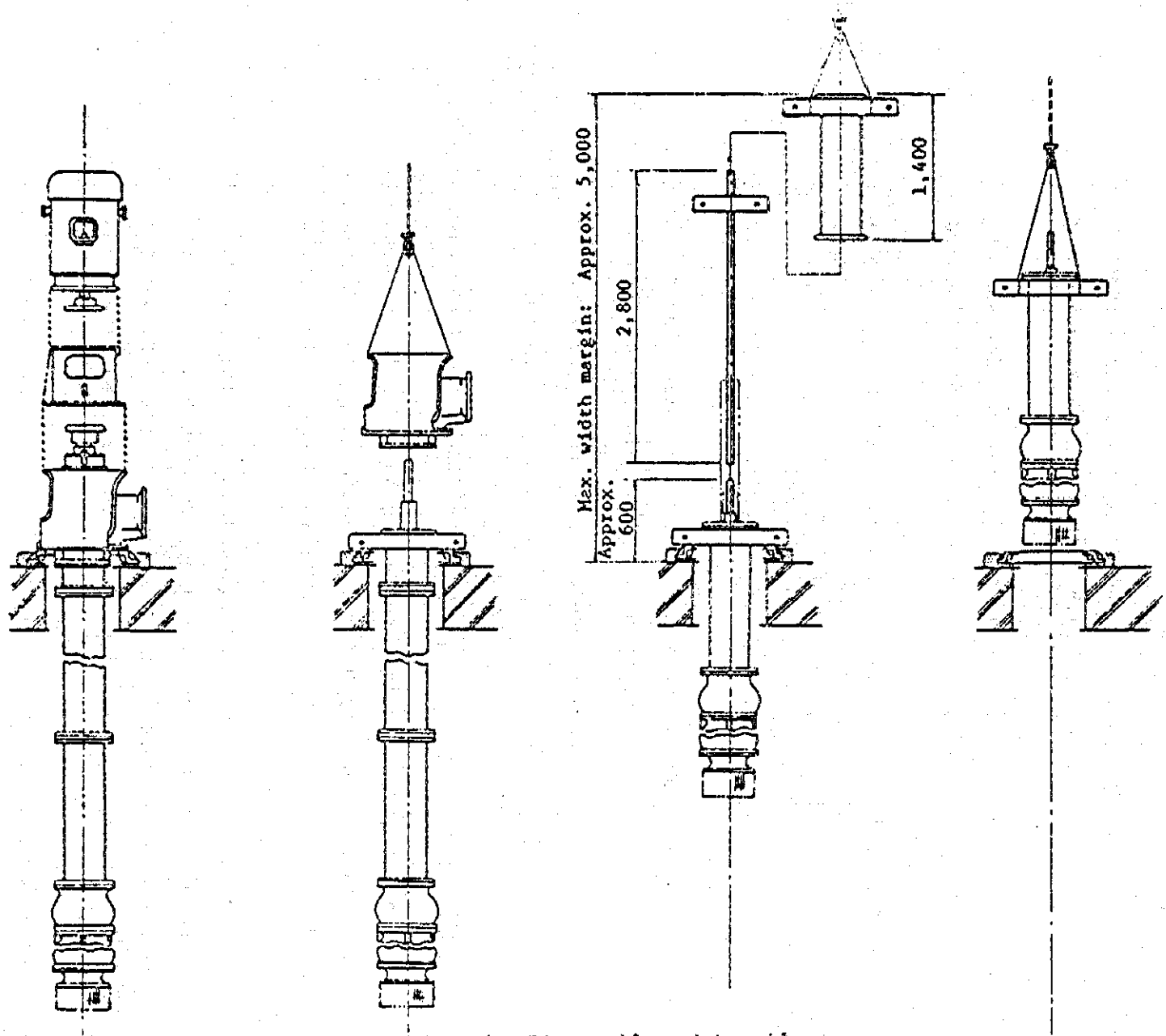


Fig. 4 Disassembly and Assembly

Section 8. DISASSEMBLY

For disassembly, take the reversal of the assembly procedure. When disassembling the pump, thoroughly understand the construction in advance referring to the assembly sectional views.

8-1. Preliminary Instructions for Disassembly

1) Determine cases and positions for disassembled parts to prevent missing of parts. Place bolts in a bag as a set.

2) Provide solvent and diluent type rust-proof oil which will be applied to the finish surfaces such as shafts.

3) Provide wires which cover the weight of an object to be lifted.

4) Remove oil from the thrust bearing case.

5) Since the following parts cannot be re-used for reassembly in many cases, provide them in advance.

   Gaskets, gland packings and O-rings

8-2 Precautions for Disassembly

1) When removing brazed parts and matched parts, use a machine bolt and mallet. Do not unreasonably remove them with a chisel and screwdrive.

2) When removing a turning body, be careful to prevent formation of scores or scratched marks on the sliding surface and machined surface. Especially, do not damage the sliding surface of shaft bearings and mechanical seals.

3) When removing a turning body from the shaft, completely

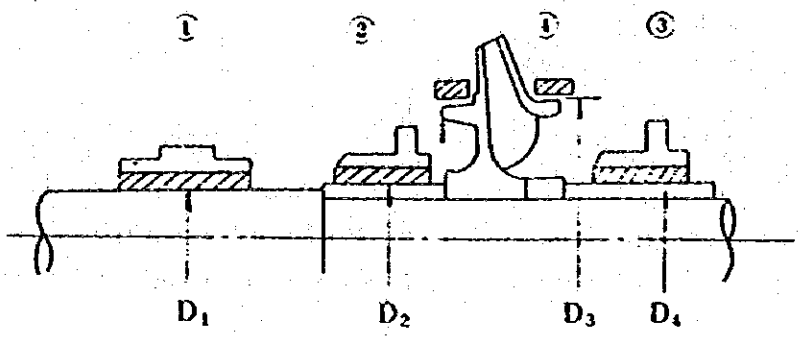
remove lock washers, nuts and bolts and then reasonably remove it.

4) When removing long parts such as shafts, carefully handle them to prevent bending of them.

5) Place parts on paper or cloth as a set in good order and also gently handle them.

Section 9. DATA

9-1. Design Clearance of Sliding Parts and Parts Replacement Schedule.



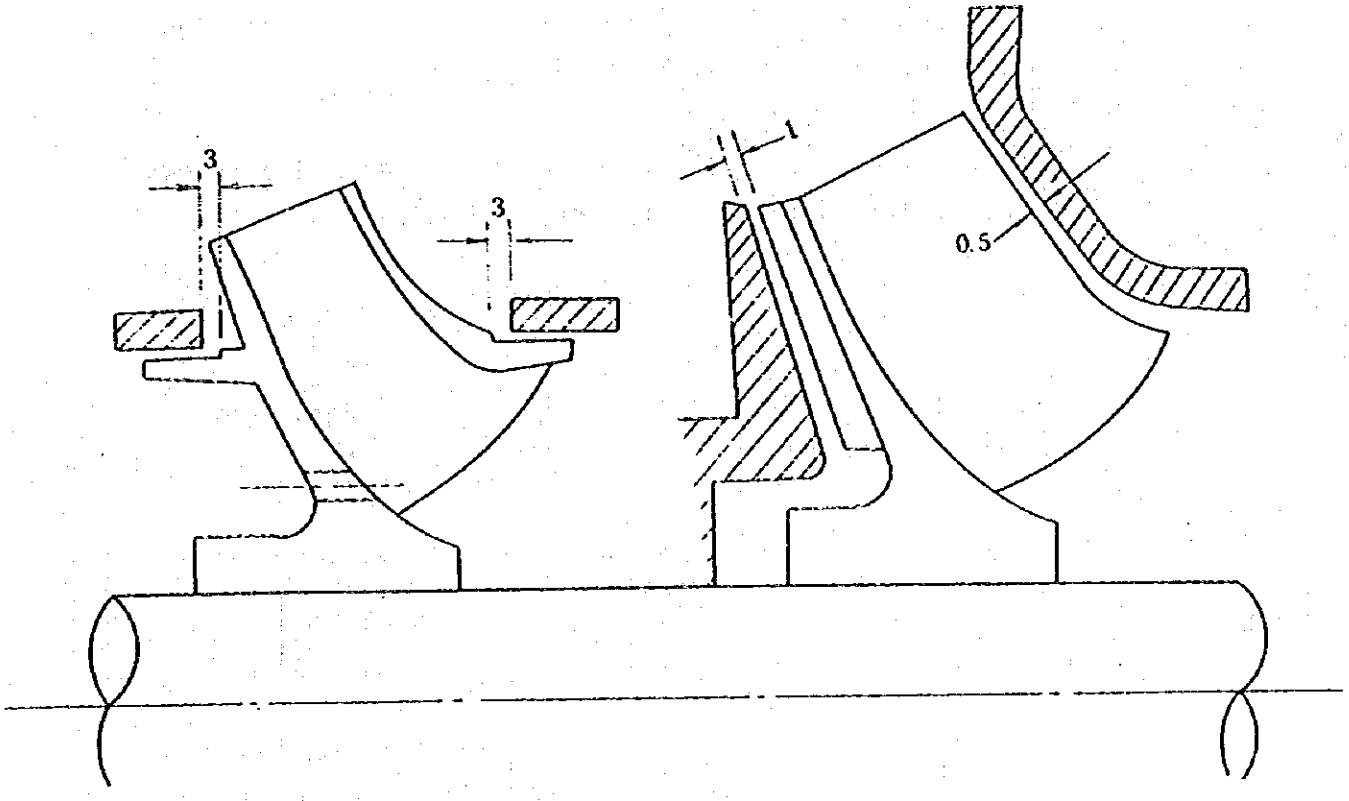
No.	Sliding Parts	Basic Size Di	Clearance	
			Std.	Stainless Steel
1	Sleeve-bearing-intermediate (052-1) and shafts (034-1 and 034-2)	40 60	0.212 to 0.142 0.249 to 0.190	
2	Shaft sleeve (041-2) and sleeve bearing-top casing (052-2)	60 64 42	0.249 to 0.190 0.249 to 0.190 0.205 to 0.147	
3	Shaft sleeve (041-2) and Sleeve bearing-casing (052-3)	64	0.249 to ~~0.180~~ 0.190	
4	Impeller (021) and liner ring (107)	148 168 212	0.403 to 0.28 0.433 to 0.31 0.522 to 0.38	0.533 to 0.41 0.563 to 0.44 0.652 to 0.51

No.	Sliding Parts	Basic Size Di.	Clearance	
			Std.	Stainless Steel
		236	0.562 to 0.42	0.692 to 0.55
		264	0.641 to 0.41	~~0.711~~ 0.761 to 0.60

When sliding parts are worn twice as large as the maximum clearance shown in the design clearance table, replace them.

When liner rings are worn three times as large as the maximum clearance shown in the design clearance table, replace them.

9-2 Impeller End Play



(1) Model VY

The end play is approx. 6 mm.

Lower the impeller until it comes in contact with the liner ring and then lift the impeller 4 mm above the ring.

The shaft top nut pitch is 1.5 mm. Give 2.7 left turns to the nut.

(2) Model VZ

The end play is approx. 2 mm.

Lower the impeller until it comes in contact with the side plate. Then lift the impeller 0.8 mm above the plate for model 200 VZ.

The shaft top nut pitch is 1.5 mm. Give a 0.54 left turn approx. 200° to the nut.

For other models of VZs, lift the impeller 1.0 mm and give a 0.67 left turn approx. 240° to the nut.

9-3 Lubrication Oil

Application : (a) For ball bearing
(b) For sleeve bearings

Proper oil name : JIS K 2213, turbine oil No. 2 or the like (#140 turbine oil)

Typical oil company product list

Company / Oil	Nippon Sekiyu	Mitsubishi Sekiyu	Showa Sekiyu	Maruzen Sekiyu
140 turbine oil	140 turbine oil, FBK oil 60 R and O	Mitsubishi 140 turbine oil	Shoseki J - H 1060	Tsubame brand 140 special turbine oil

Company / Oil	Idemitsu Kosan	Esso Std. Sekiyu	Mobile Oil	Shell Sekiyu
140 turbine oil	Daphne Mechanic oil ~~44~~ 52	Turbine oil No. 2 Power-ex 52	Pegasus turbine oil No. 2	140 turbine oil Shell Terrace 33

Lubrication volume: (a) Bearing casing (OSL)
Approx. 1.8 ℓ for the pump of 40 mm shaft dia.

2.8 ℓ for the pump of 60 mm shaft dia.

(b) For oil lubrication
$Q = 2.4 \times L' + 5$
where L' is total column pipe length (m) and Q is oil volume (ℓ)

WATER SUPPLY PROJECT FOR CAMBODIAN REFUGEE CAMPS IN THE KINGDOM OF THAILAND
(SAKAEO DIVERSION FACILITIES)

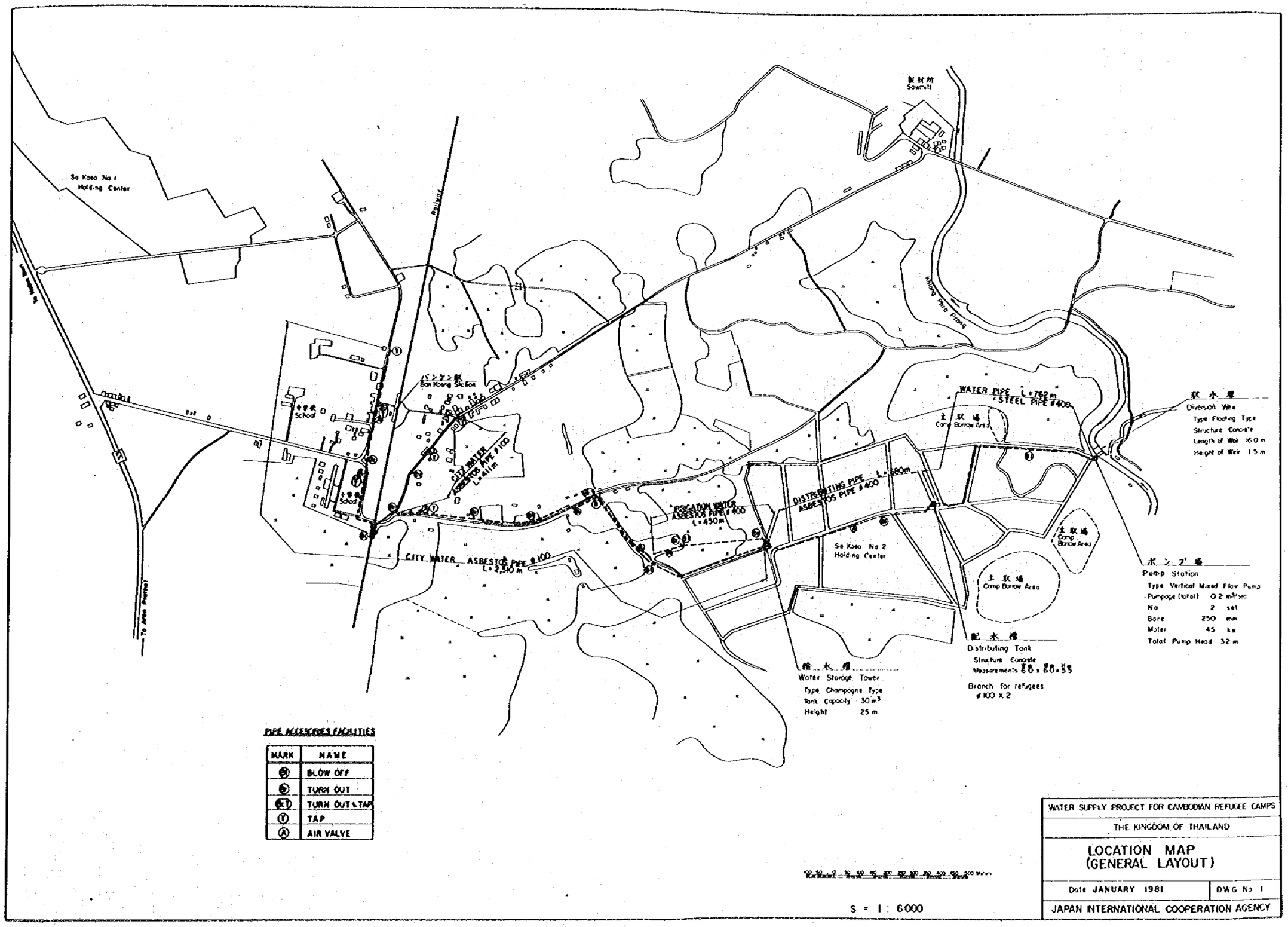
FINAL DRAWING

JANUARY 1981

JAPAN INTERNATIONAL COOPERATION AGENCY

DWG No.	DRAWING NAME
1	LOCATION MAP
2	WEIR, GENERAL PLAN
3	" , PLAN AND LONGITUDINAL SECTION
4	" , ELEVATION
5	" , CROSS SECTION (1/2)
6	" , " (2/2)
7	" , INTAKE FACILITIES AND PUMP
8	PUMP HOUSE
9	REVETMENT WORKS
10	EMBANKMENT WORKS IN BRANCH RIVER
11	TEMPORARY WORKS, PLAN
12	COFFERDAM, PROFILE AND CROSS SECTION
13	TEMPORARY DIVERSION CHANNEL, PROFILE
14	" , CROSS SECTION (1/3)
15	" , " (2/3)
16	" , " (3/3)
17	WATER PIPE, PLAN AND PROFILE (1/2)
18	" , " (2/2)
19	WATER PIPE, APPURTENANT FACILITIES
20	DISTRIBUTING TANK
21	DISTRIBUTING PIPE, PLAN AND PROFILE (1/7)
22	" , " (2/7)
23	" , " (3/7)
24	" , " (4/7)
25	" , " (5/7)
26	" , " (6/7)

DWG No.	DRAWING NAME
27	DISTRIBUTING PIPE, PLAN AND PROFILE (7/7)
28	DISTRIBUTING PIPE, WATER TOWER AND PUMP
29	DISTRIBUTING PIPE, APPURTENANT FACILITIES (1/4)
30	" , " (2/4)
31	" , " (3/4)
32	" , " (4/4)
33	IRRIGATION PIPE, PLAN AND PROFILE
34	" " , APPURTENANT FACILITES (1/2)
35	" " , " " (2/2)
36	WEIR, REINFORCEMENT (1/2)
37	" (2/2)
38	INTAKE AND SLUICEWAY REINFORCEMENT
39	SUCTION WELL REINFORCEMENT
40	PUMP HOUSE REINFORCEMENT
41	DISTRIBUTING TANK REINFORCEMENT (1/3)
42	" (2/3)
43	" (3/3)
44	INTAKE TANK REINFORCEMENT (1/2)
45	INTAKE TANK REINFORCEMENT (2/2) WATER TOWER FOOTING REINFORCEMENT
46	WATER PIPE FACILITIES, BLOW OFF AND THRUST BLOCK REINFORCEMENT
47	DISTRIBUTING PIPE, BLOW OFF REINFORCEMENT (1/2)
48	" , " (2/2)
49	" , TURNOUT REINFORCEMENT
50	" , TAP BOX REINFORCEMENT
51	" , TURNOUT AND TAP BOX REINFORCEMENT
52	IRRIGATION PIPE, TURN OUT · BLOW OFF AND VALVE BOX REINFORCEMENT



WATER SUPPLY PROJECT FOR CAMBODIAN REFUGEE CAMPS

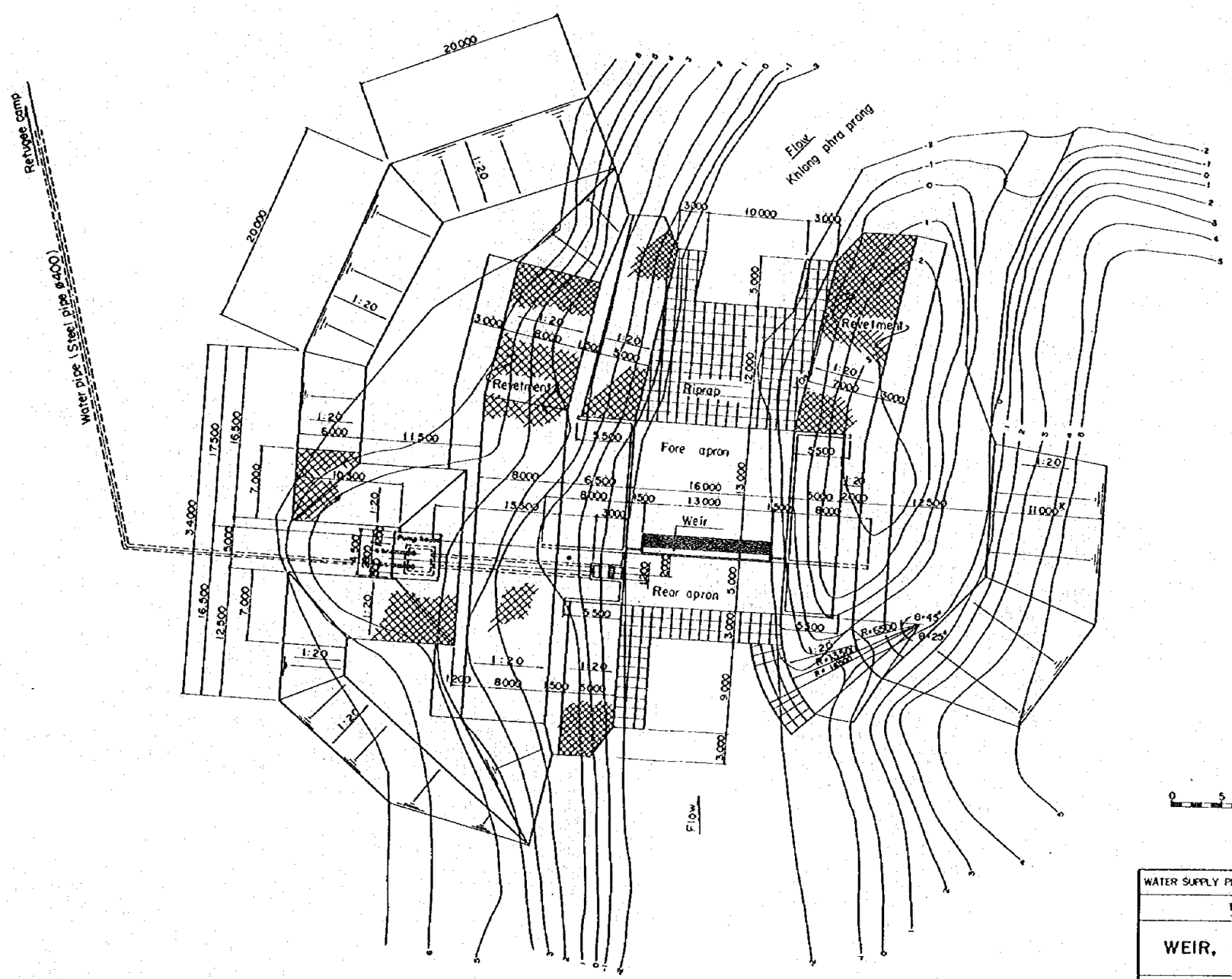
THE KINGDOM OF THAILAND

LOCATION MAP (GENERAL LAYOUT)

Date JANUARY 1981 | DWG No 1

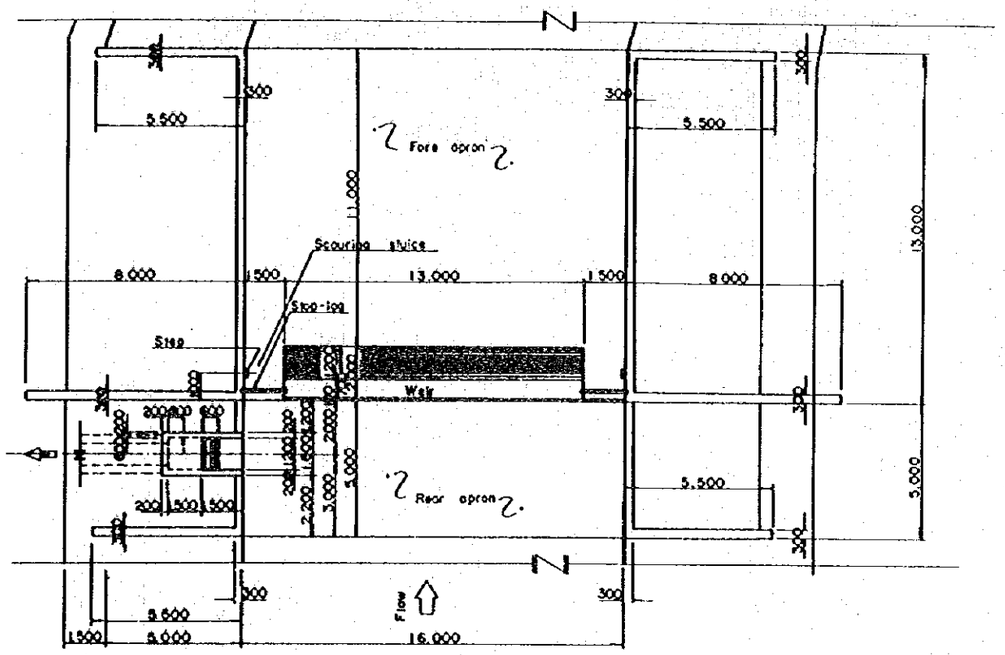
JAPAN INTERNATIONAL COOPERATION AGENCY

PLAN

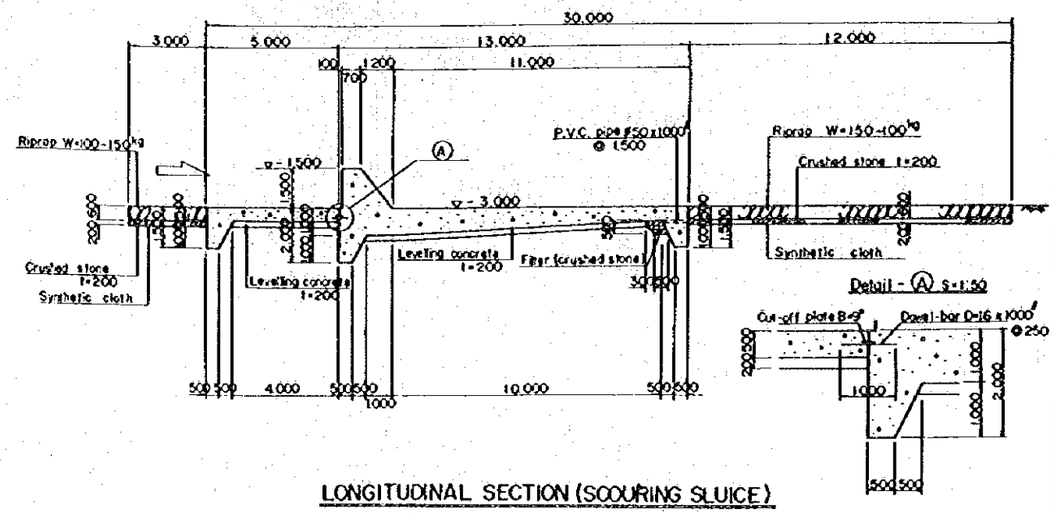


WATER SUPPLY PROJECT FOR CAMBODIAN REFUGEE CAMPS	
THE KINGDOM OF THAILAND	
WEIR, GENERAL PLAN	
Date JANUARY 1981	DWG. No 2
JAPAN INTERNATIONAL COOPERATION AGENCY	

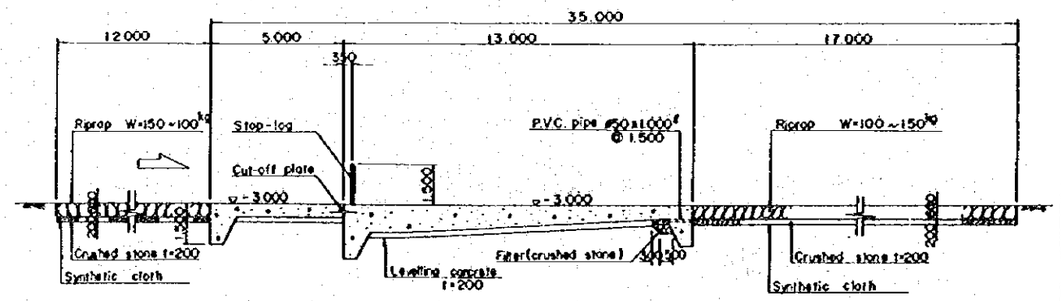
PLAN



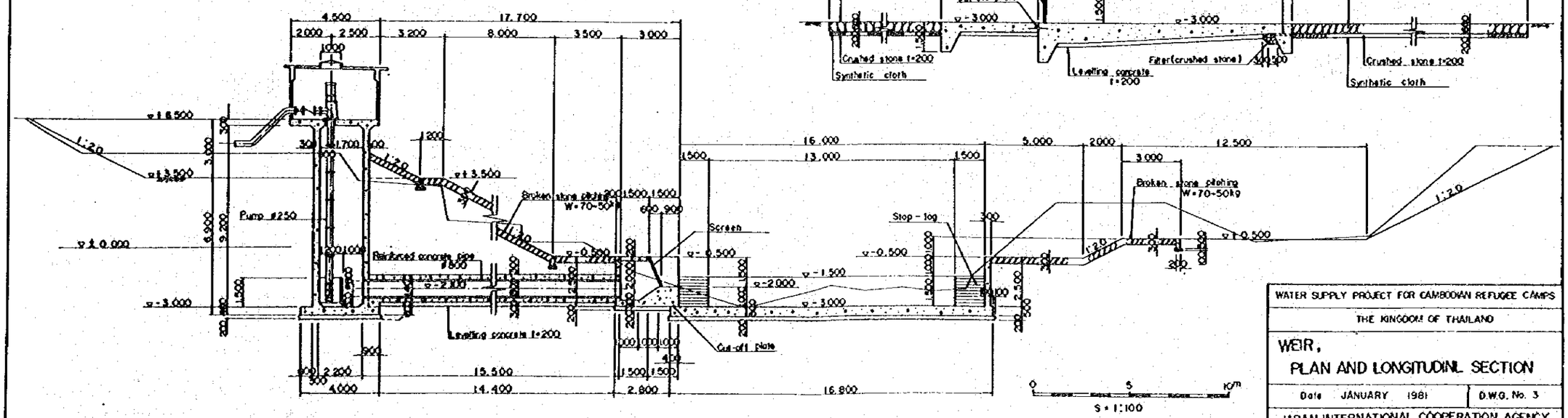
TYPICAL LONGITUDINAL SECTION



LONGITUDINAL SECTION (SCOURING SLUICE)

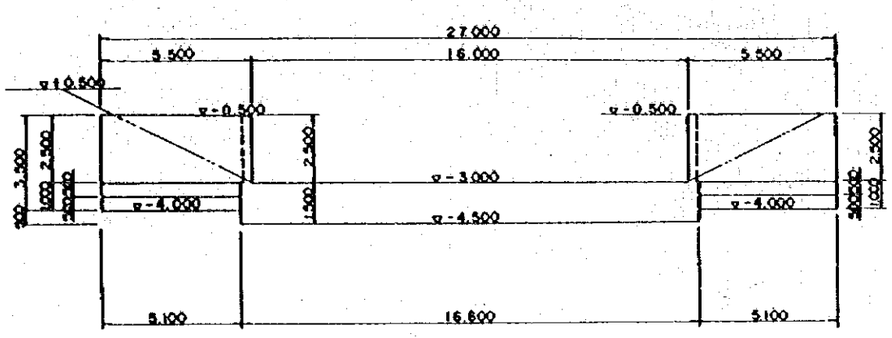


CROSS SECTION (INTAKE)

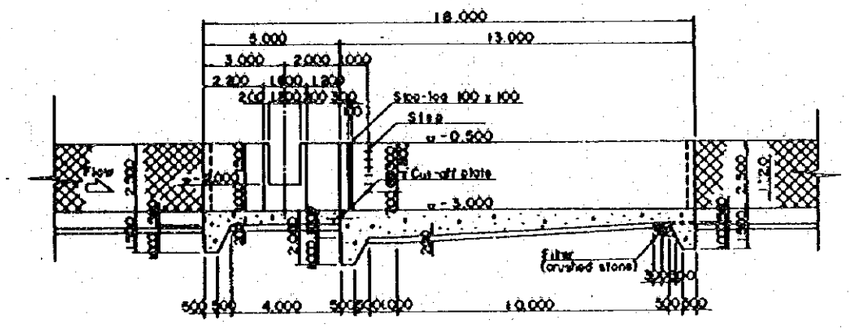


WATER SUPPLY PROJECT FOR CAMBODIAN REFUGEE CAMPS	
THE KINGDOM OF THAILAND	
WEIR, PLAN AND LONGITUDINL SECTION	
Date JANUARY 1981	D.W.G. No. 3
JAPAN INTERNATIONAL COOPERATION AGENCY	

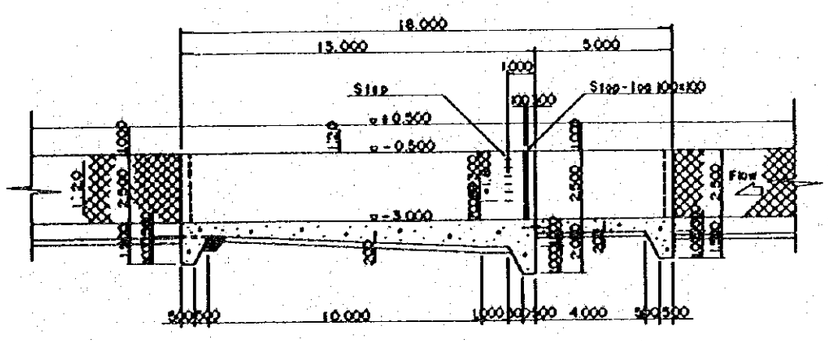
REAR ELEVATION S=1:100



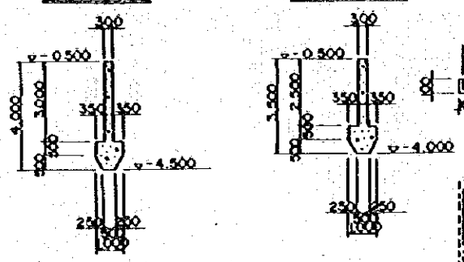
SIDE ELEVATION (LEFT BANK) S=1:100



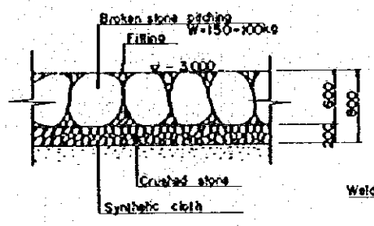
SIDE ELEVATION (RIGHT BANK) S=1:100



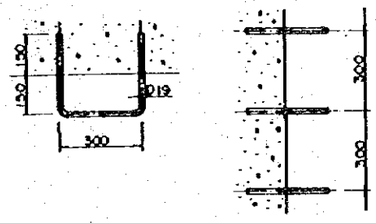
CUTOFF WALL S=1:100



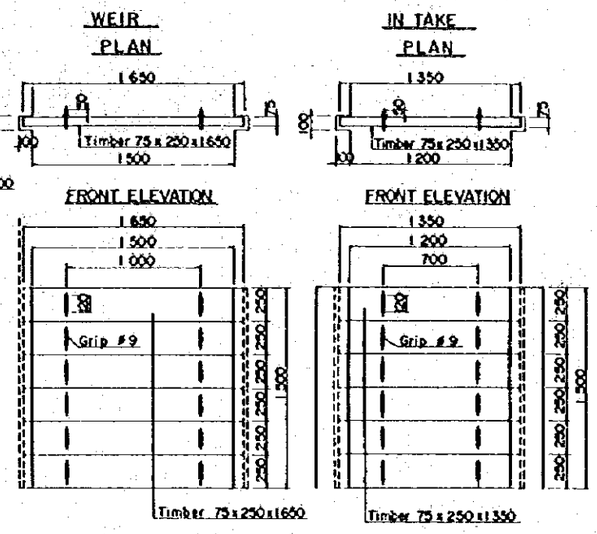
RIPRAP S=1:30



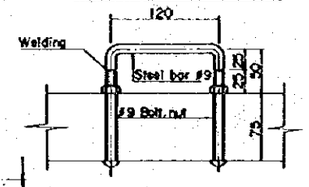
STEP S=1:10

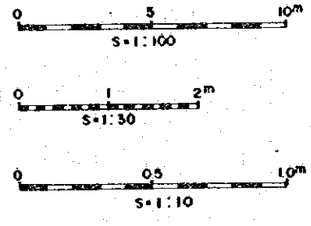


STOP LOG S=1:20

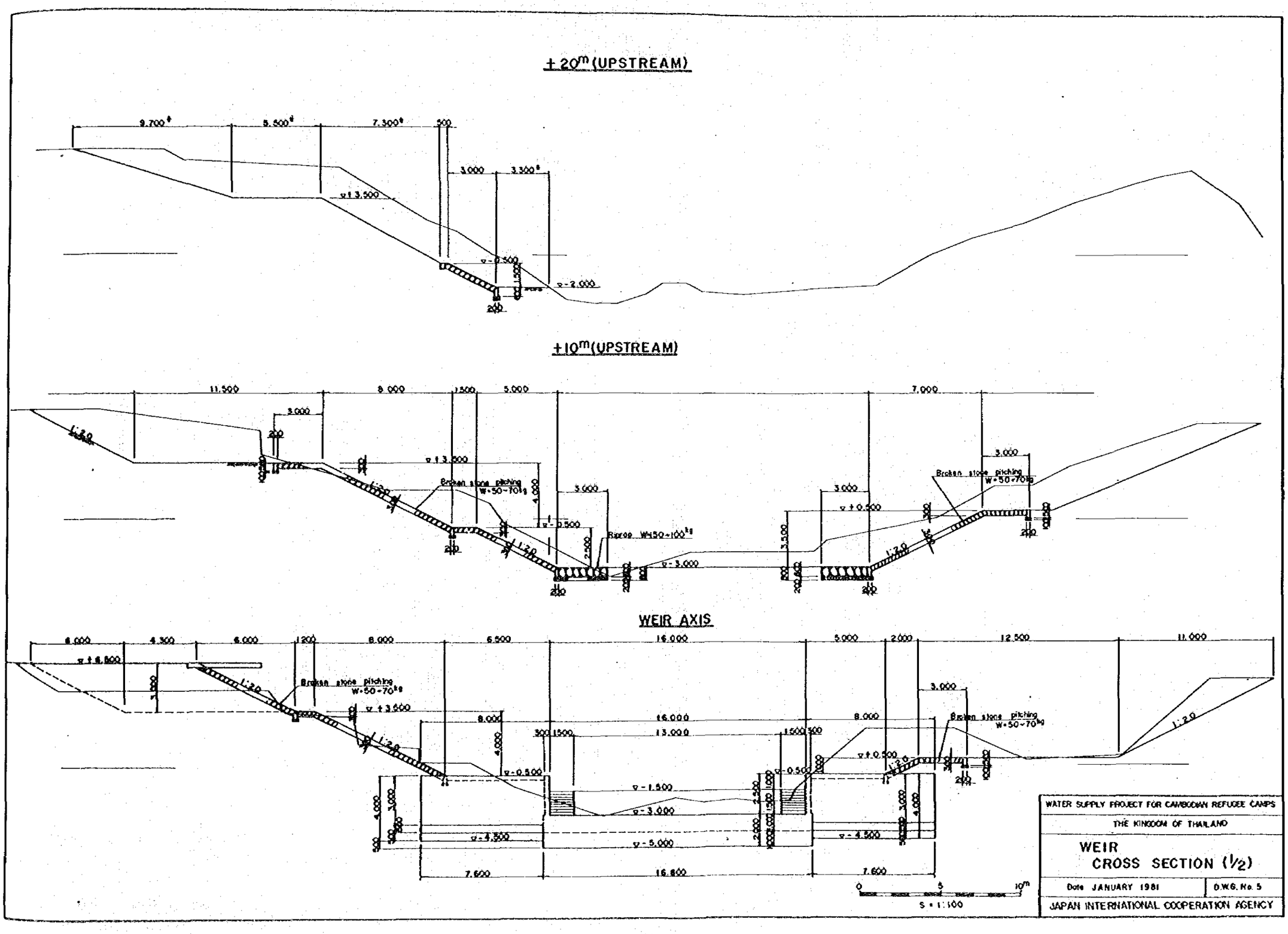


DETAIL OF GLIP S=1/3

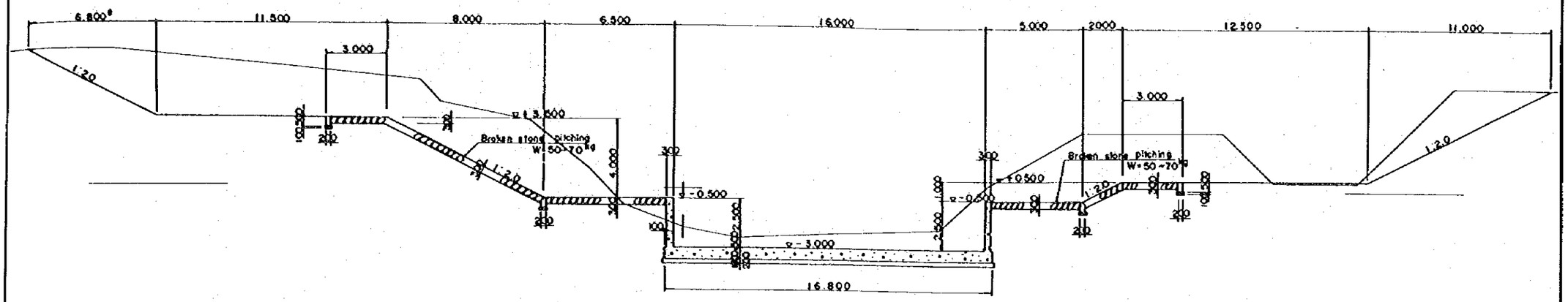




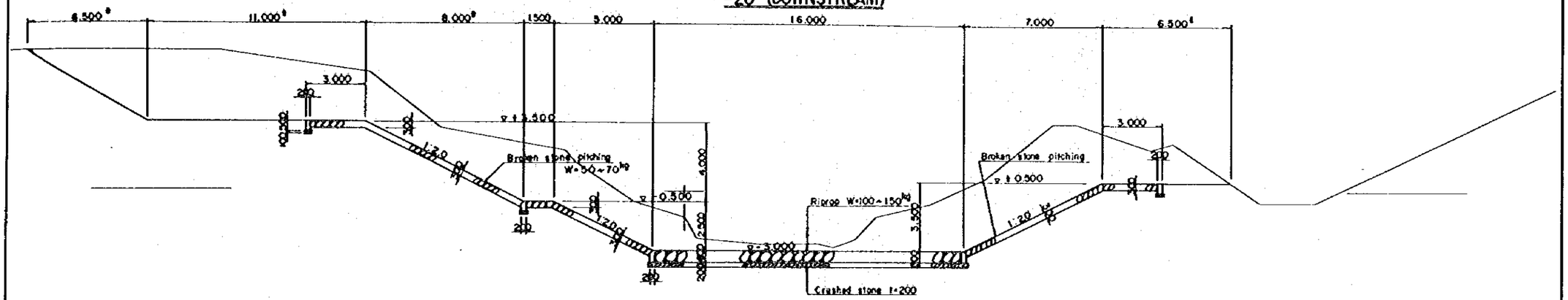
WATER SUPPLY PROJECT FOR CAMBODIAN REFUGEE CAMPS	
THE KINGDOM OF THAILAND	
WEIR ELEVATION	
Date JANUARY 1981	D.W.G. No. 4
JAPAN INTERNATIONAL COOPERATION AGENCY	


+20m (UPSTREAM)
+10m (UPSTREAM)
WEIR AXIS
Broken stone pitching W=50~70kg
Riprap W=50~100kg
S = 1:100
WATER SUPPLY PROJECT FOR CAMBODIAN REFUGEE CAMPS
THE KINGDOM OF THAILAND
WEIR
CROSS SECTION (1/2)
Date JANUARY 1981
D.W.G. No. 5
JAPAN INTERNATIONAL COOPERATION AGENCY

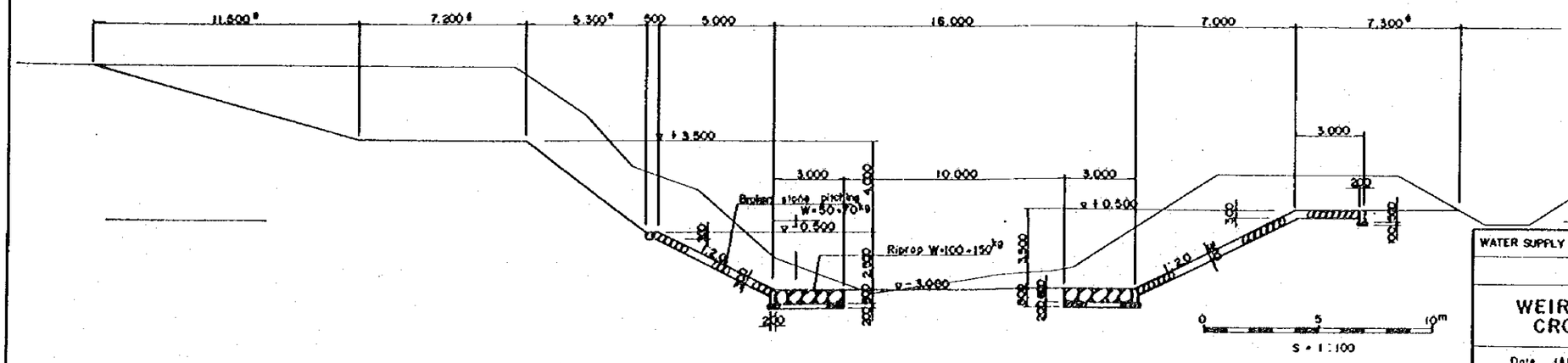
-10m (DOWNSTREAM)



-20m (DOWNSTREAM)



-30m (DOWNSTREAM)



WATER SUPPLY PROJECT FOR CAMBODIAN REFUGEE CAMPS

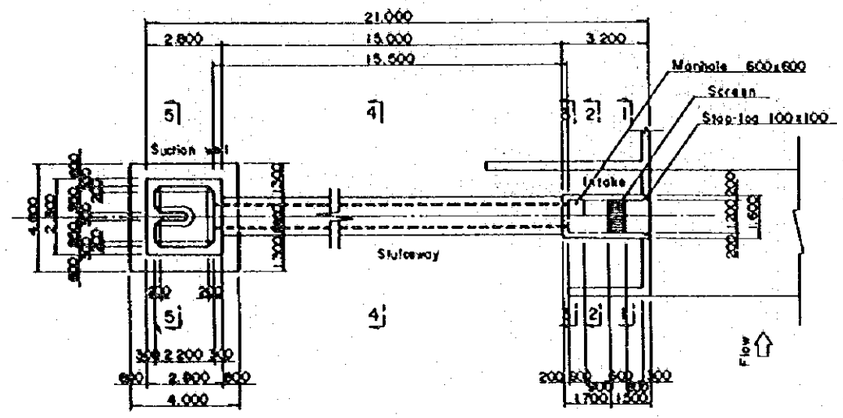
THE KINGDOM OF THAILAND

WEIR CROSS SECTION (2/2)

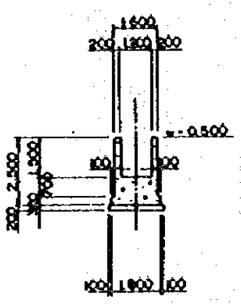
Date JANUARY 1981 | D.W.G. No. 6

JAPAN INTERNATIONAL COOPERATION AGENCY

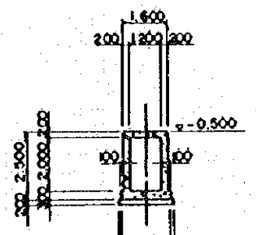
INTAKE FACILITIES S=1:100



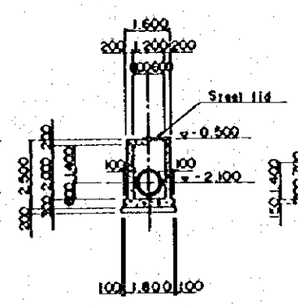
SECTION 1-1



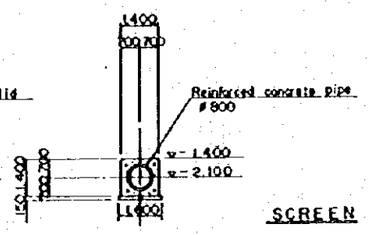
SECTION 2-2



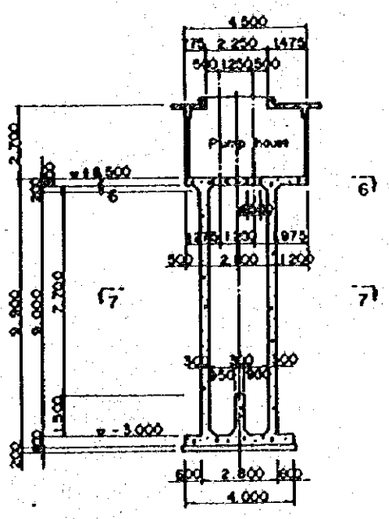
SECTION 3-3



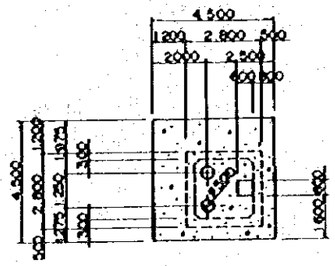
SECTION 4-4



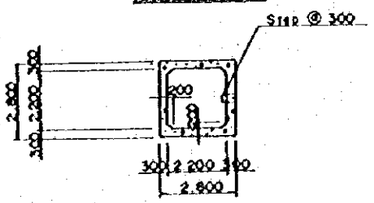
SECTION 5-5



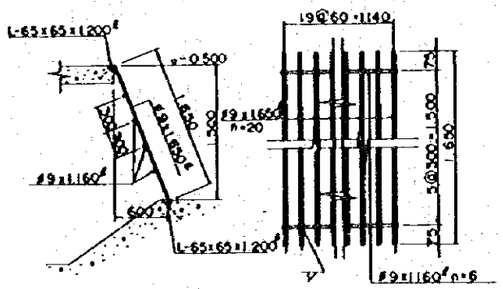
SECTION 6-6



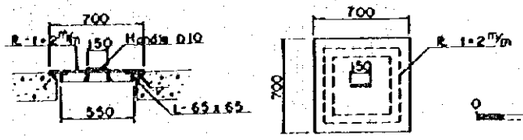
SECTION 7-7



SCREEN

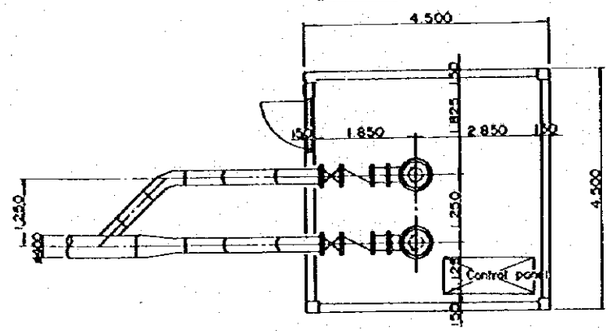


MAN HOLE LID S=1:20

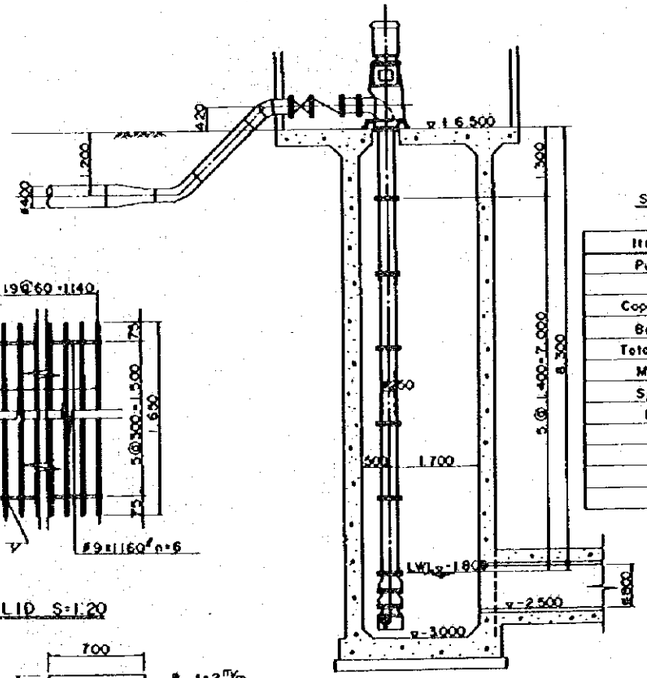


PUMP STATION S=1:50

PLAN



SECTION



Specifications of pump

Item	Spec
Pump	Vertical mixed flow pump
Capacity	0.1 m³/sec (6 m³/min)
Bore	250 m/m
Total head	32 m
Motor	45 kw 4 poles 380V 50Hz
Speed	1450 rpm
Nos.	2 Sets

0 5 10m
S = 1:100

0 1 2 3 4 5m
S = 1:50

WATER SUPPLY PROJECT FOR CAMBODIAN REFUGEE CAMPS

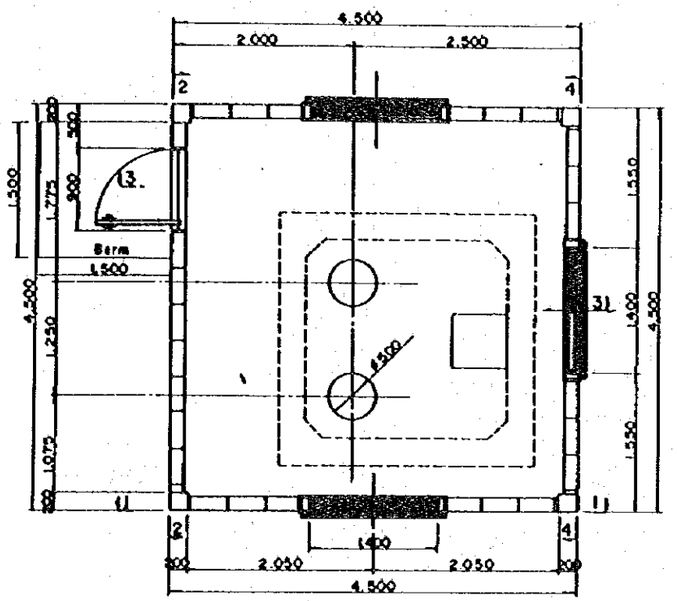
THE KINGDOM OF THAILAND

WEIR INTAKE FACILITIES AND PUMP

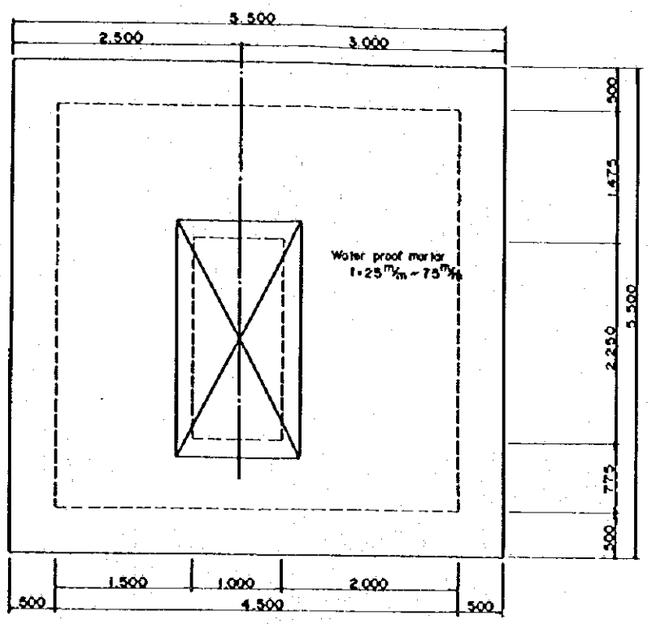
Date JANUARY 1981 | D.W.G. No. 7

JAPAN INTERNATIONAL COOPERATION AGENCY

PLAN S=1:30



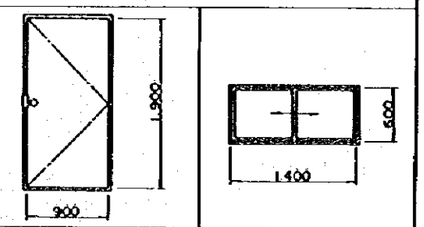
ROOF



Outline of construction	
Floor area	20.250 m²

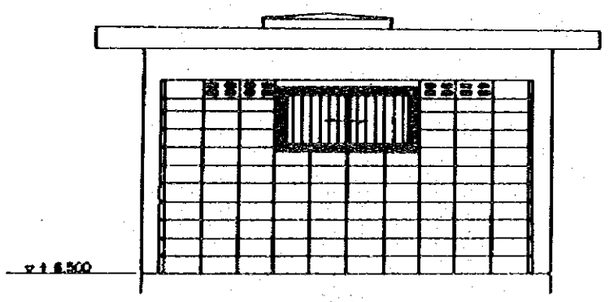
Exterior finish		Interior finish	
Roof	Water proof mortar over concrete t=25~75m/m	Floor	Exposed concrete
Exterior wall	Concrete block	Wall	Exposed concrete block
	Mortar finish t=20m/m	Ceiling	Exposed concrete
Sash	Steel door, Steel sash		

Schedule of sash

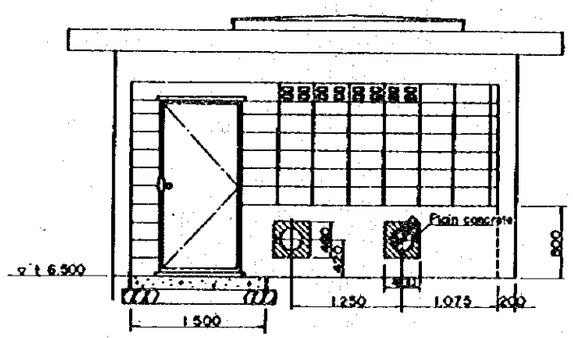


Type		
Symbol	1 set	3 sets
Item	Steel door	Steel sash
Material	Steel flash t 0.5	Steel
Gloss		Rough wire 6.8 m/m
Finish	O.P	
Mono Key	Mono lock type cylinder key	Necessary accessories
Mono Hinge	Pivot hinge	
Mono Others	Panel strip for crime prevention t 3×40×100	Aluminium drip mold

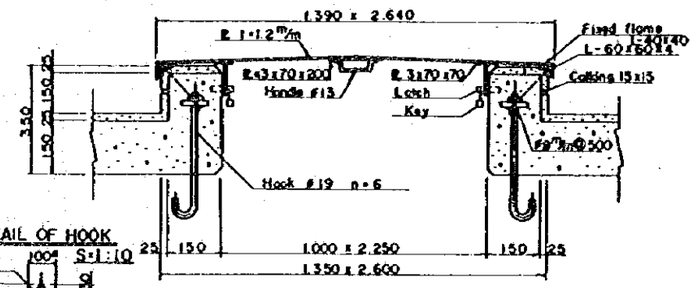
ELEVATION 1-1



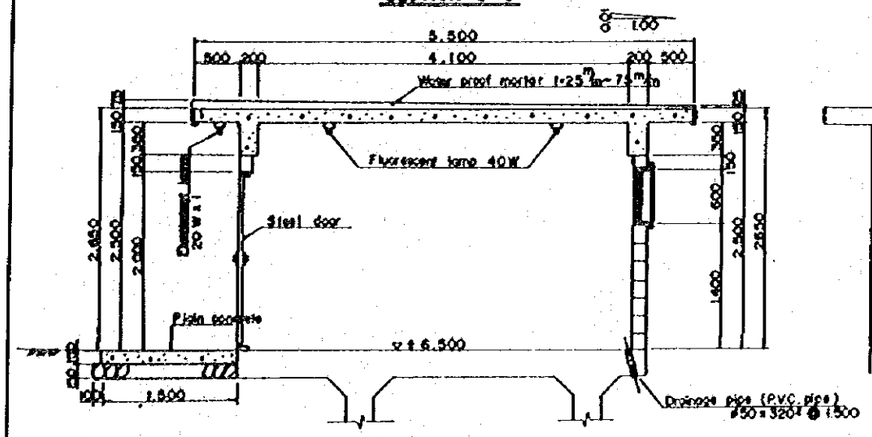
ELEVATION 2-2



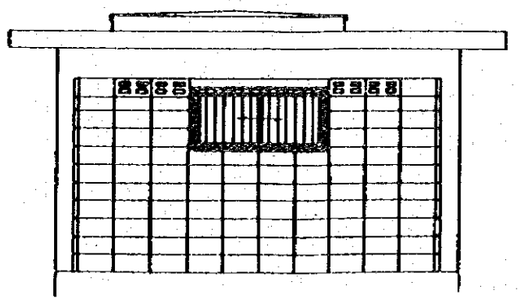
DETAIL OF MANHOLE S=1:10



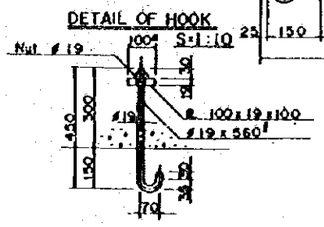
SECTION 3-3

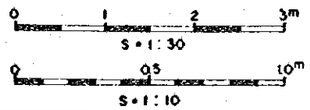


ELEVATION 4-4



DETAIL OF HOOK S=1:10





WATER SUPPLY PROJECT FOR CAMBODIAN REFUGEE CAMPS

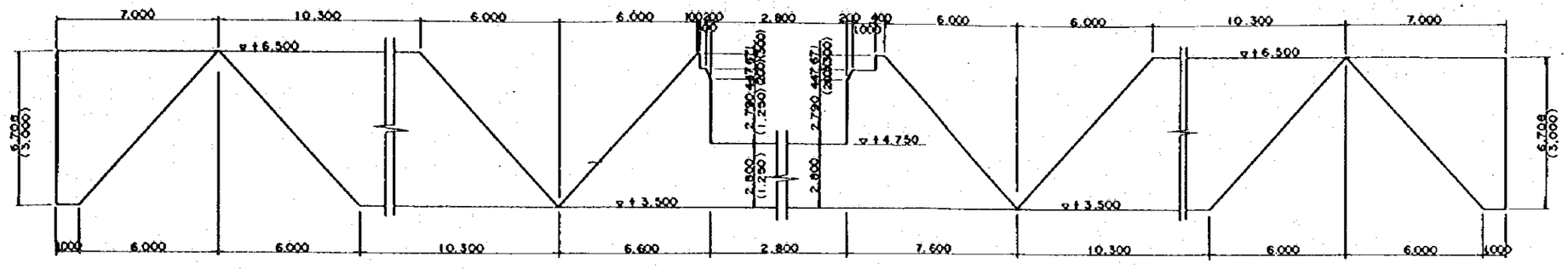
THE KINGDOM OF THAILAND

PUMP HOUSE

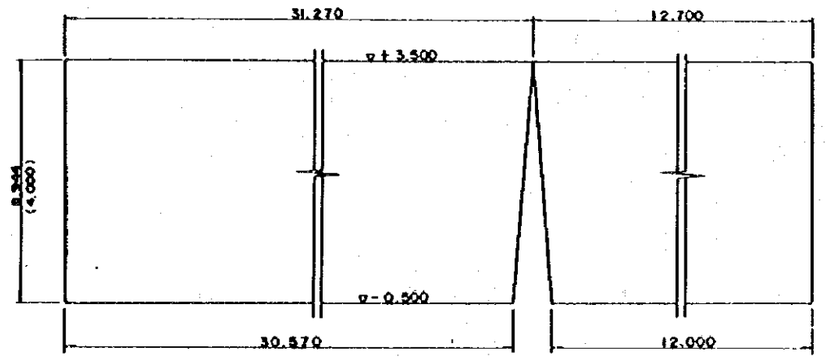
Date JANUARY 1981 | D.W.G. No. 8

JAPAN INTERNATIONAL COOPERATION AGENCY

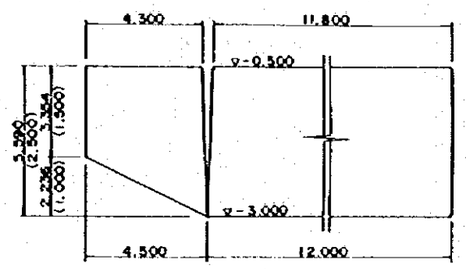
ACCESS ROAD TO THE PUMPING STATION S=1:100



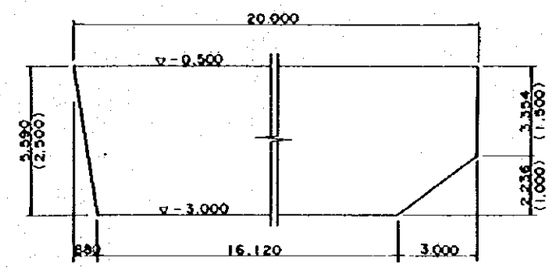
LEFT SIDE MAJOR BED



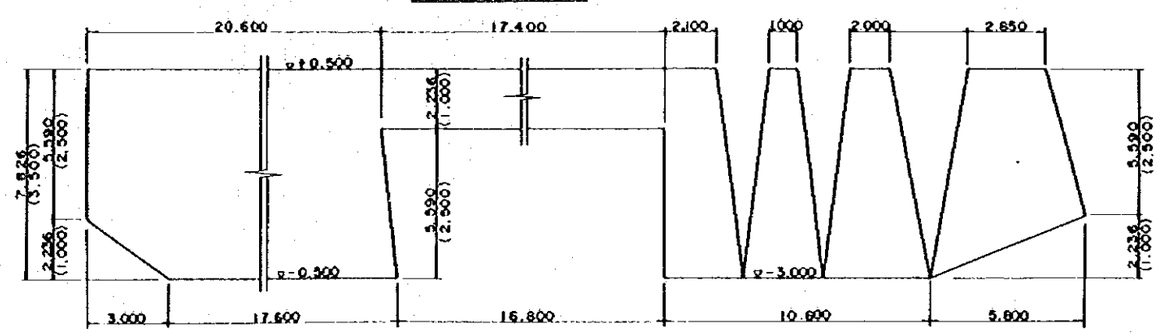
LEFT SIDE MINOR BED (UPSTREAM)



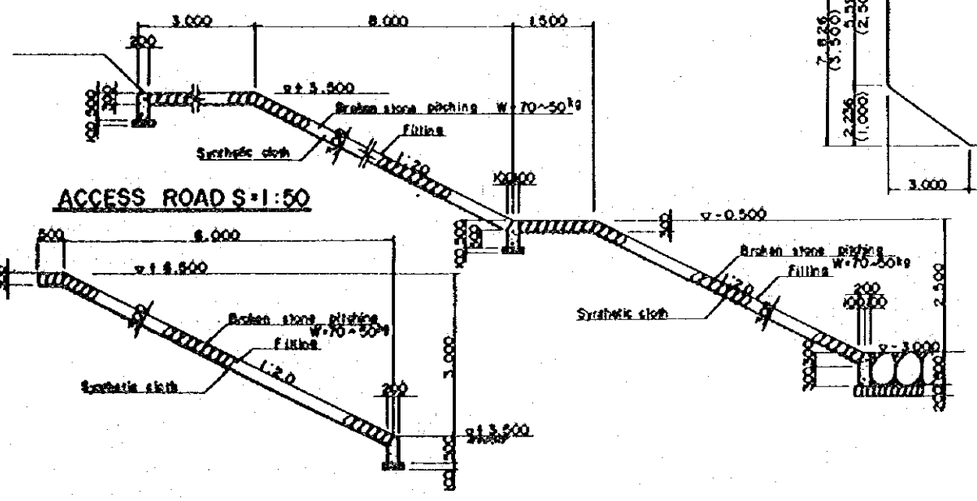
LEFT SIDE MINOR BED (DOWNSTREAM)



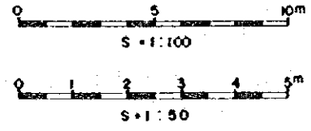
RIGHT BANK



STANDARD SECTION S=1:50

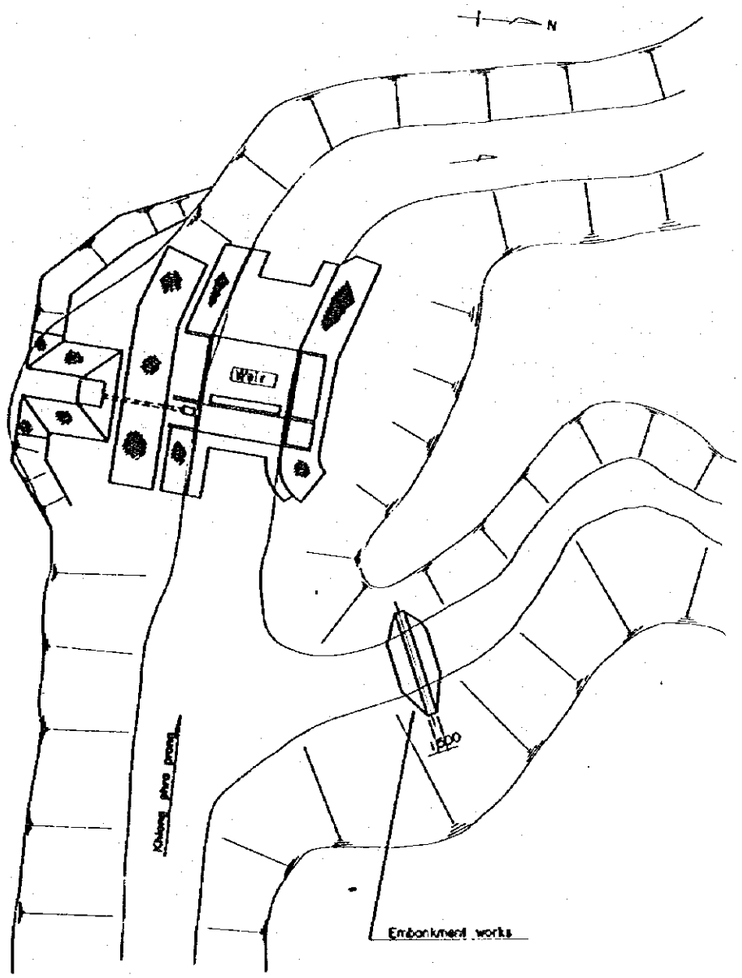


ACCESS ROAD S=1:50

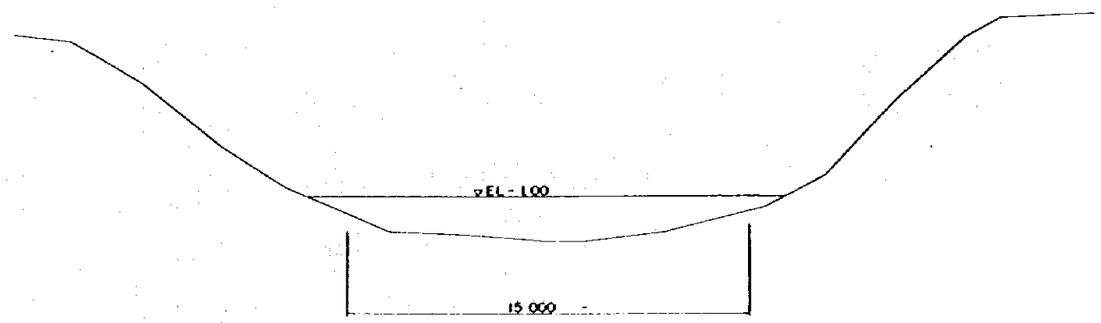


WATER SUPPLY PROJECT FOR CAMBODIAN REFUGEE CAMPS	
THE KINGDOM OF THAILAND	
REVETMENT WORKS	
Date JANUARY 1981	D.W.G. No 9
JAPAN INTERNATIONAL COOPERATION AGENCY	

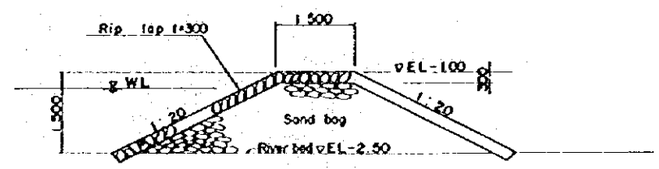
PLAN S=1:500

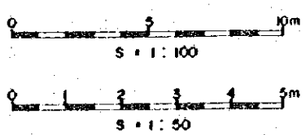


PROFILE S=1:100

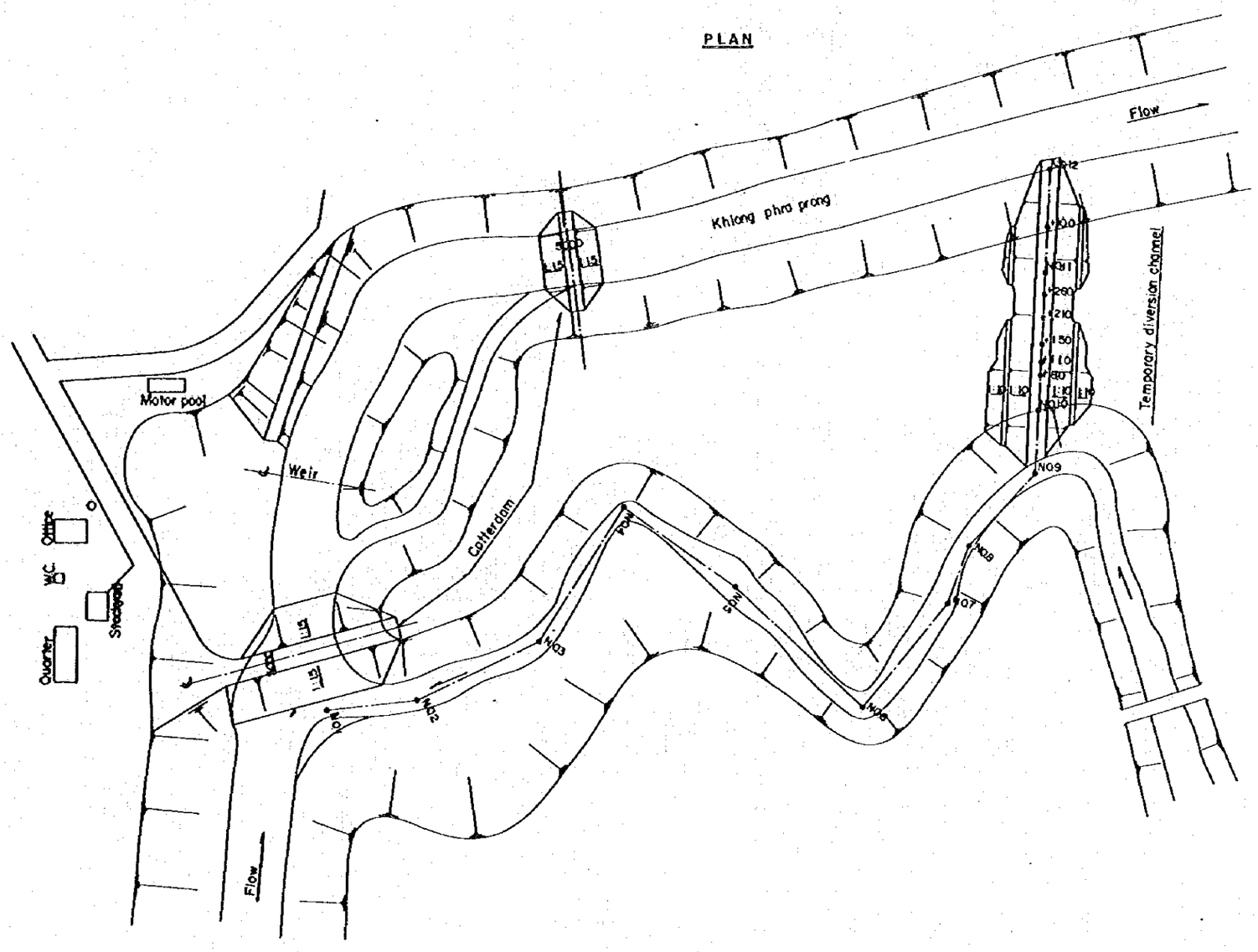


CROSS SECTION S=1:50



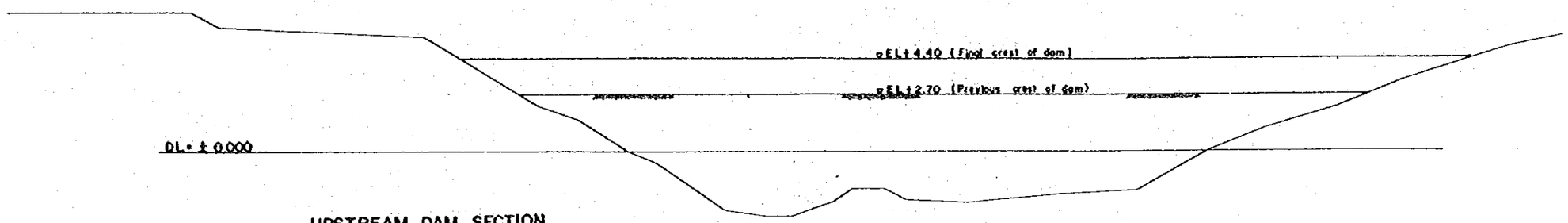


WATER SUPPLY PROJECT FOR CAMBODIAN REFUGEE CAMPS	
THE KINGDOM OF THAILAND	
EMBANKMENT WORKS IN BRANCH RIVER	
Date JANUARY 1981	D.W.G. No. 10
JAPAN INTERNATIONAL COOPERATION AGENCY	

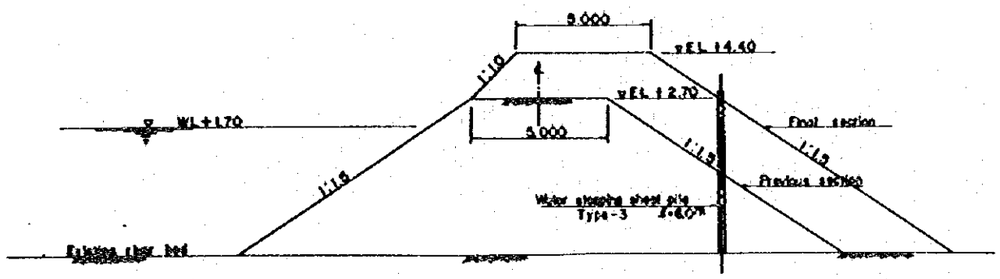


WATER SUPPLY PROJECT FOR CAMBODIAN REFUGEE CAMPS	
THE KINGDOM OF THAILAND	
TEMPORARY WORKS PLAN	
Date JANUARY 1981	D.W.G. No. 11
JAPAN INTERNATIONAL COOPERATION AGENCY	

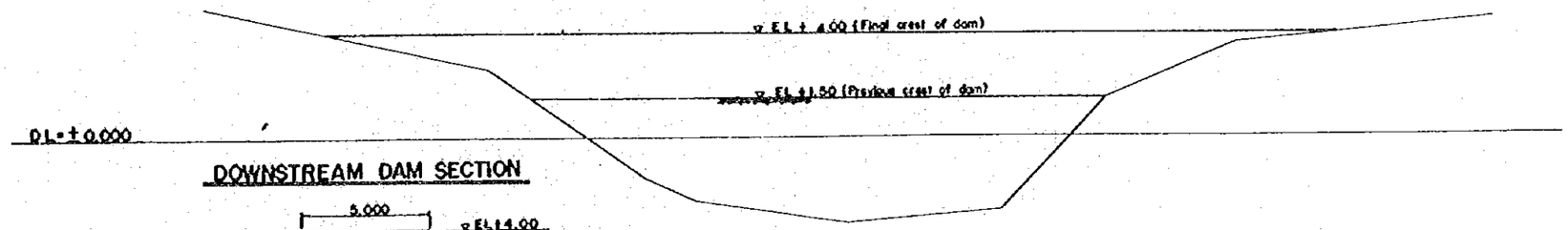
UPSTREAM DAM PROFILE



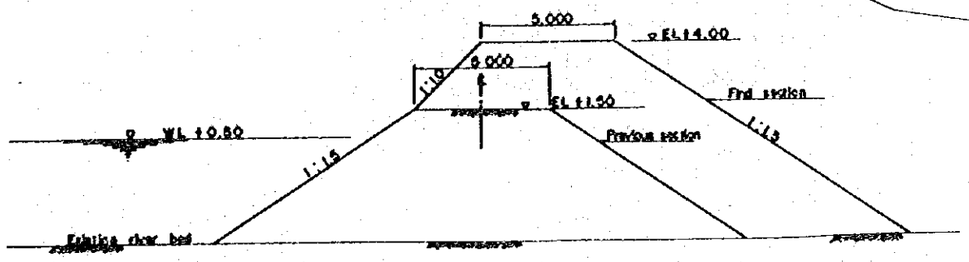
UPSTREAM DAM SECTION



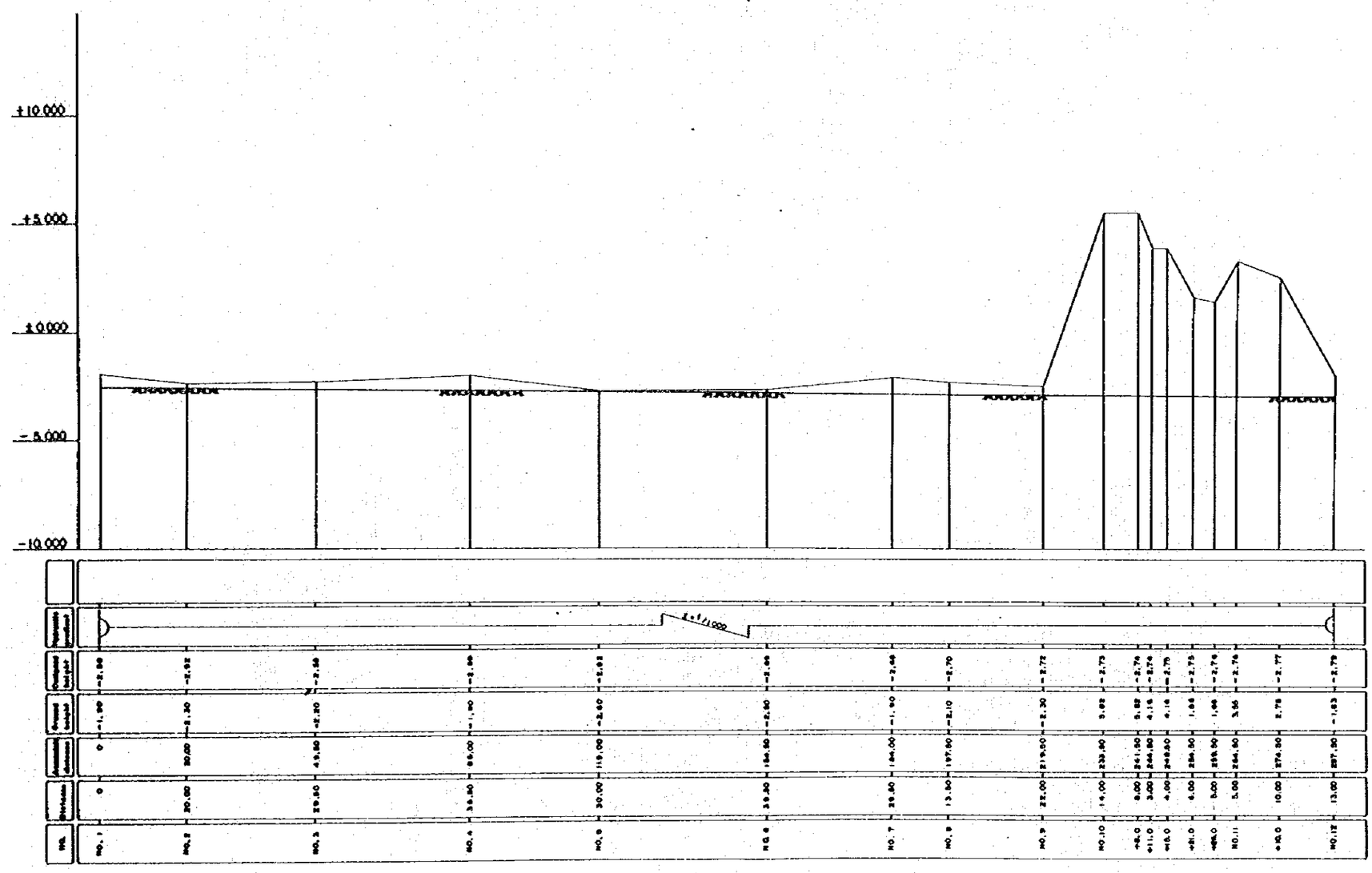
DOWNSTREAM DAM PROFILE



DOWNSTREAM DAM SECTION



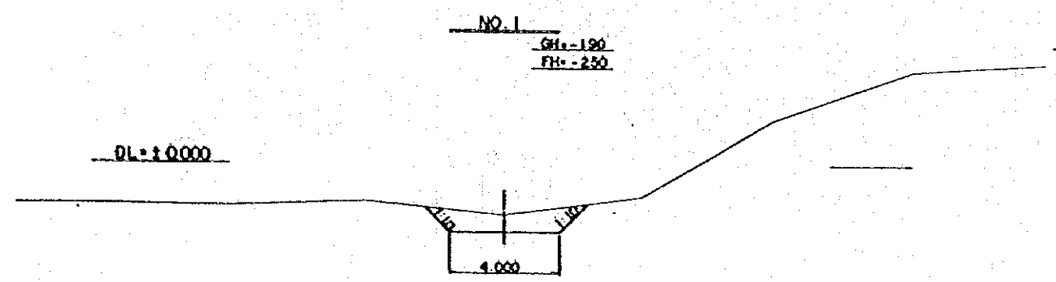
WATER SUPPLY PROJECT FOR CAMBODIAN REFUGEE CAMPS	
THE KINGDOM OF THAILAND	
COFFERDAM PROFILE AND CROSS SECTION	
Date JANUARY 1981	D.W.G. No 12
JAPAN INTERNATIONAL COOPERATION AGENCY	

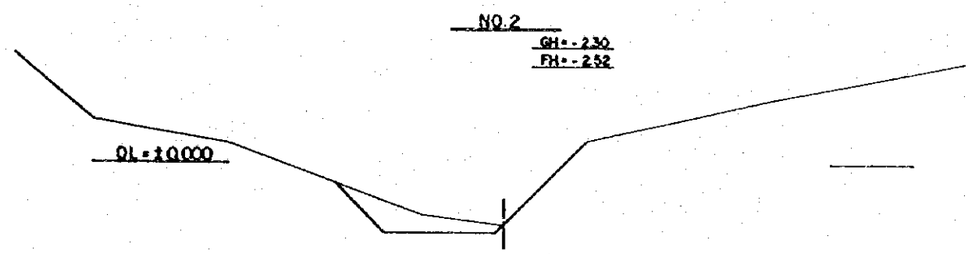


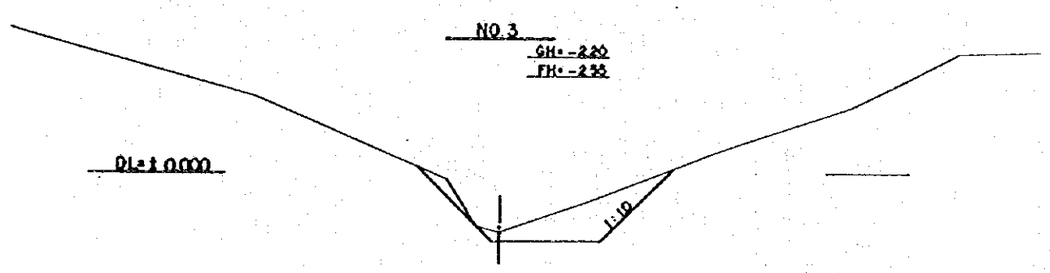
0 10 20 30 40 50m
Sx = 1: 500

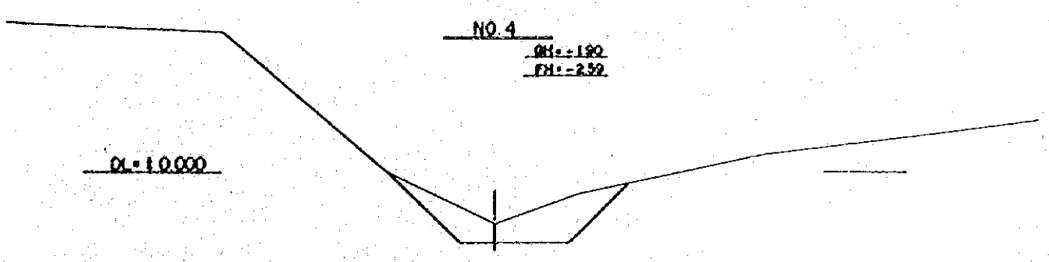
0 5 10m
Sy = 1: 100

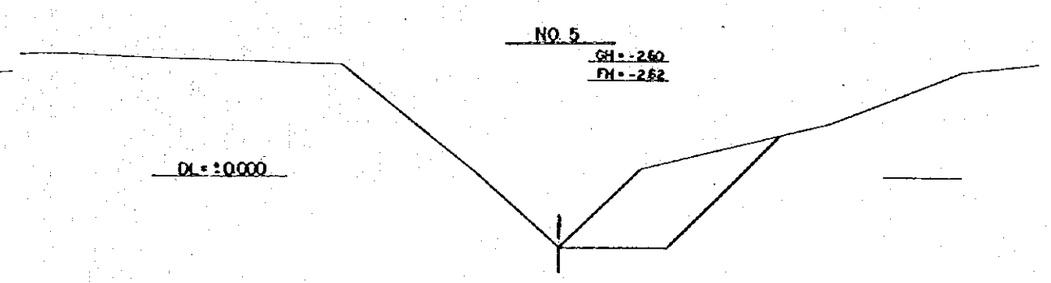
WATER SUPPLY PROJECT FOR CAMBODIAN REFUGEE CAMPS	
THE KINGDOM OF THAILAND	
TEMPORARY DIVERSION CHANNEL PROFILE	
Date JANUARY 1981	D.WG No. 13
JAPAN INTERNATIONAL COOPERATION AGENCY	

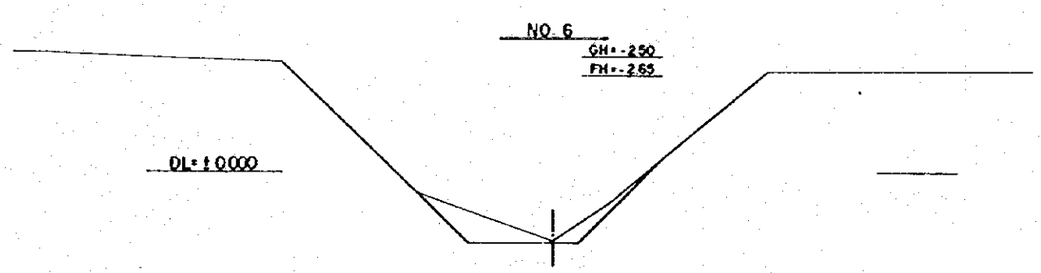


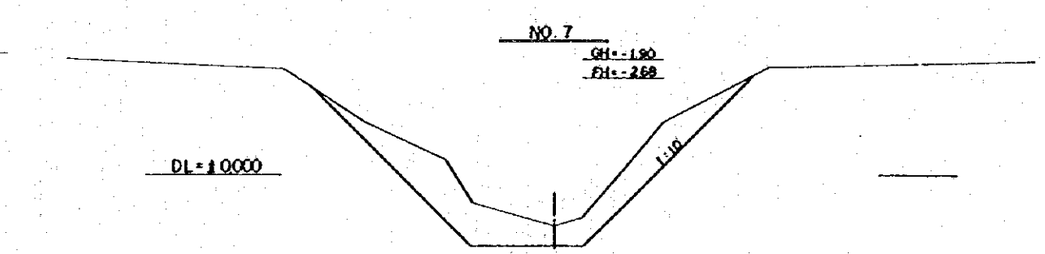


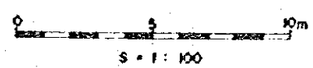












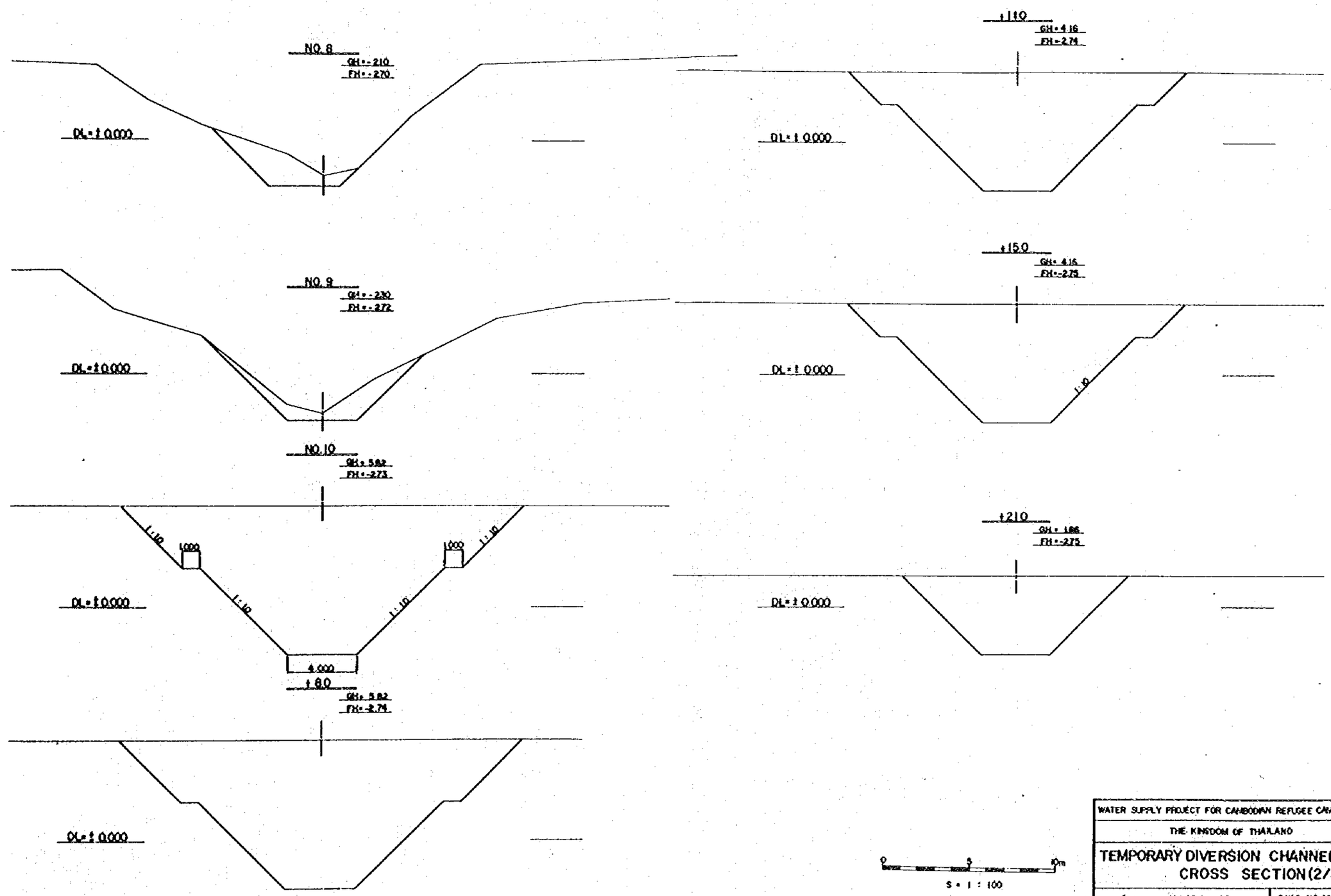
WATER SUPPLY PROJECT FOR CAMBODIAN REFUGEE CAMPS

THE KINGDOM OF THAILAND

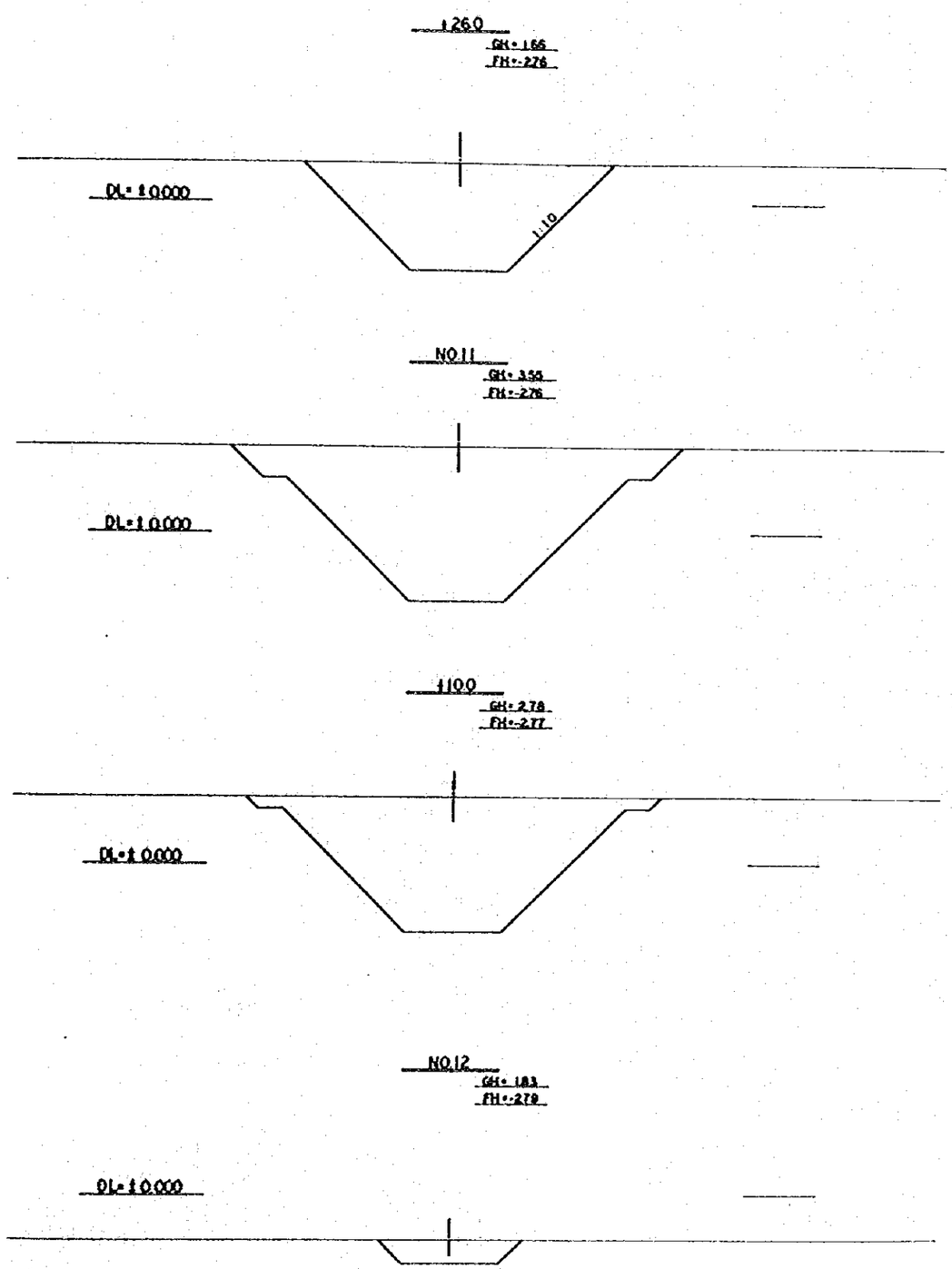
TEMPORARY DIVERSION CHANNEL CROSS SECTION (1/3)

Date JANUARY 1981 | D.W.G. No. 14

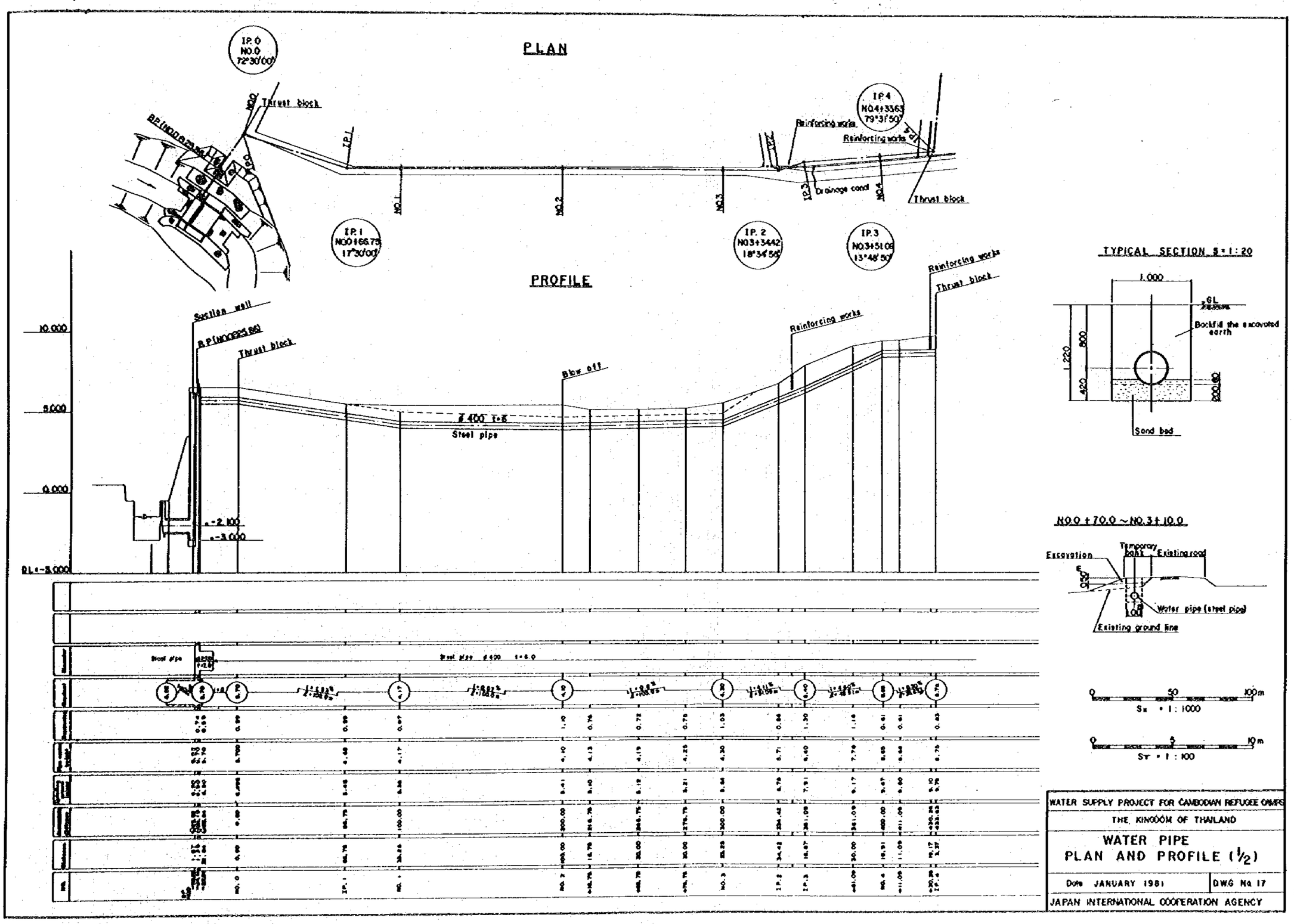
JAPAN INTERNATIONAL COOPERATION AGENCY

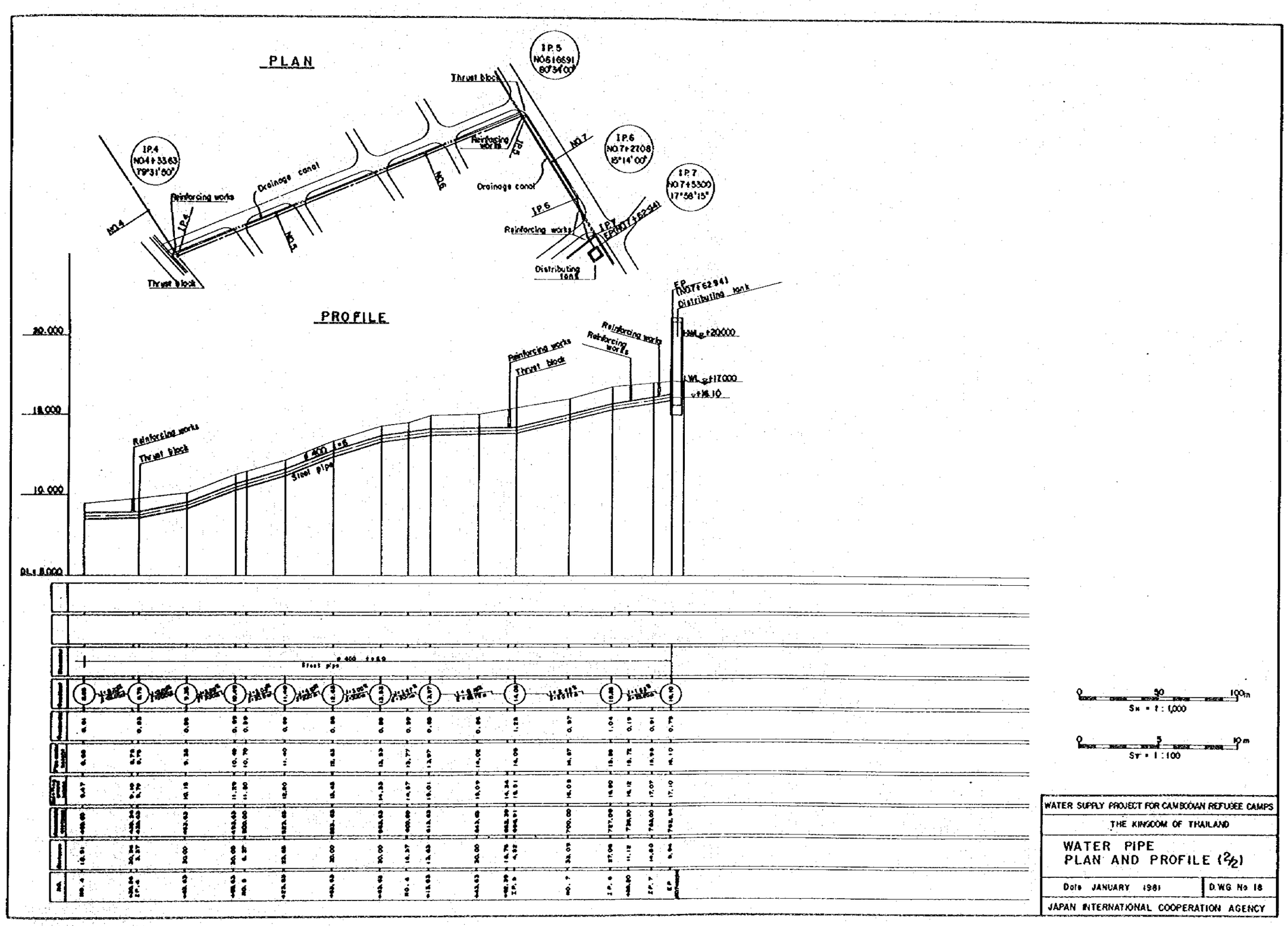


WATER SUPPLY PROJECT FOR CAMBODIAN REFUGEE CAMPS	
THE KINGDOM OF THAILAND	
TEMPORARY DIVERSION CHANNEL CROSS SECTION (2/3)	
Date JANUARY 1981	D.W.G. NO. 15
JAPAN INTERNATIONAL COOPERATION AGENCY	



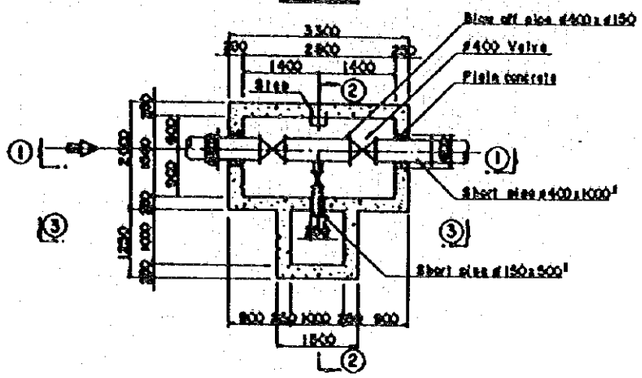
WATER SUPPLY PROJECT FOR CAMBODIAN REFUGEE CAMPS	
THE KINGDOM OF THAILAND	
TEMPORARY DIVERSION CHANNEL CROSS SECTION (3/3)	
Date JANUARY 1981	D.W.G. No. 16
JAPAN INTERNATIONAL COOPERATION AGENCY	


PLAN
I.P. 0
NO.0
72°30'00"
Thrust block
B.P.(NO.0+23.86)
I.P. 1
NO.1
NO.2
NO.3
I.P. 1
NO.0+66.75
17°30'00"
I.P. 2
NO.3+34.42
18°34'56"
I.P. 3
NO.3+51.06
13°48'50"
I.P. 4
NO.4+33.63
79°31'50"
Reinforcing works
Drainage cond
Thrust block
PROFILE
Suction wall
B.P.(NO.0+23.86)
Thrust block
Blow off
Reinforcing works
Thrust block
Reinforcing works
Steel pipe
10.000
5.000
0.000
-2.100
-3.000
DL=-3.000
TYPICAL SECTION S=1:20
1,000
GL
Backfill the excavated earth
1,220
800
420
200
Sand bed
NO.0+70.0 ~ NO.3+10.0
Excavation
Temporary road
Existing road
Water pipe (steel pipe)
Existing ground line
0 50 100m
Sx = 1 : 1000
0 5 10m
Sy = 1 : 100
WATER SUPPLY PROJECT FOR CAMBODIAN REFUGEE CAMPS
THE KINGDOM OF THAILAND
WATER PIPE
PLAN AND PROFILE (1/2)
Date JANUARY 1981
DWG No. 17
JAPAN INTERNATIONAL COOPERATION AGENCY

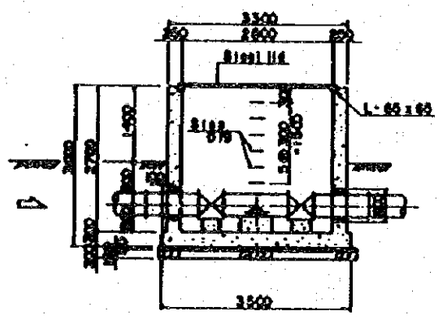

PLAN
I.P.4
NO.4+3363
79°31'50"
I.P.5
NO.5+6691
80°34'00"
I.P.6
NO.7+2708
15°14'00"
I.P.7
NO.7+5300
17°58'15"
Thrust block
Reinforcing works
Drainage canal
NO.4
NO.5
NO.6
NO.7
I.P.4
I.P.6
I.P.7
E.P.
Distributing tank
PROFILE
20.000
15.000
10.000
DL=8.000
Reinforcing works
Thrust block
Steel pipe
E.P.
(NO.7+62.941)
Distributing tank
HWL=+20.000
LWL=+17.000
+16.10
Sh = 1 : 1,000
Sv = 1 : 100
WATER SUPPLY PROJECT FOR CAMBODIAN REFUGEE CAMPS
THE KINGDOM OF THAILAND
WATER PIPE
PLAN AND PROFILE (2/2)
Date JANUARY 1981
D.WG No 18
JAPAN INTERNATIONAL COOPERATION AGENCY

BLOW OFF S=1:50

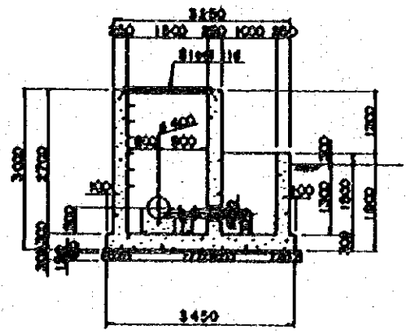
PLAN



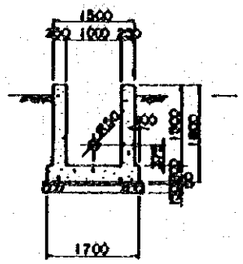
SECTION ① – ①



SECTION ② – ②

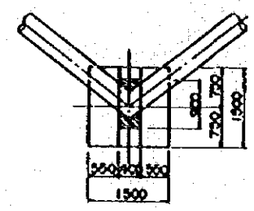


SECTION ③ – ③

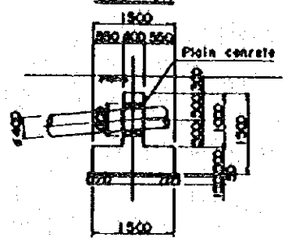


THRUST BLOCK S=1:50
n = 4

PLAN

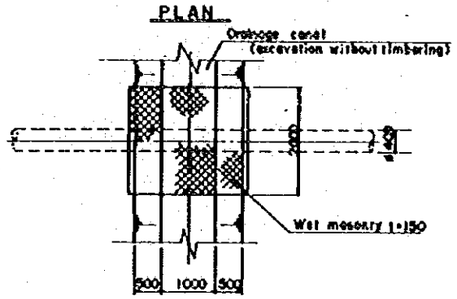


SECTION

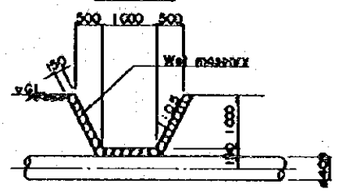


REINFORCING WORKS S=1:50
n = 3

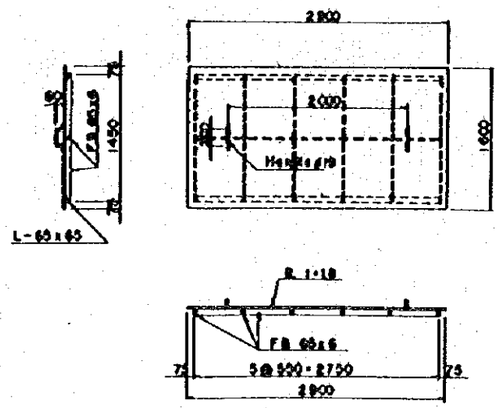
PLAN



SECTION



DETAIL OF STEELLID S=1:30



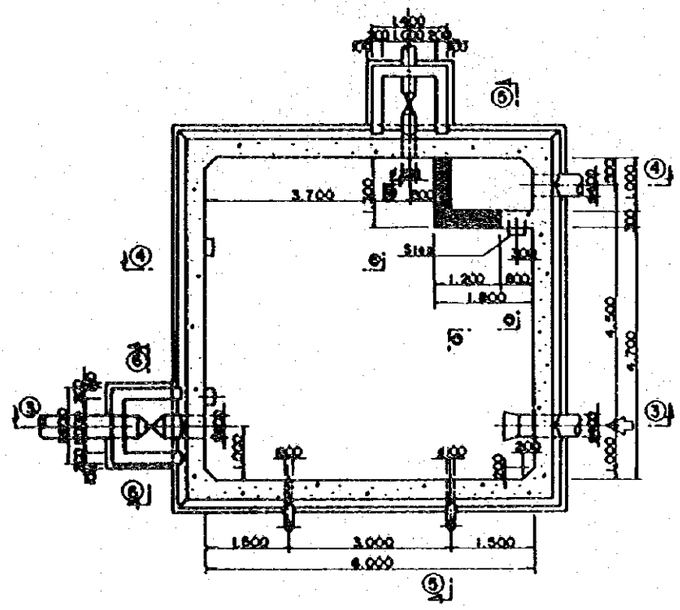
S = 1 : 50

S = 1 : 30

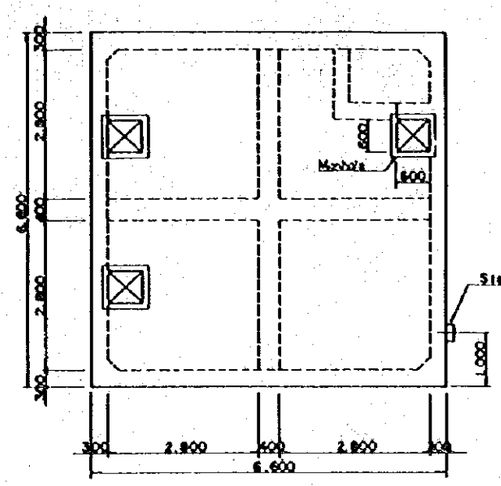
WATER SUPPLY PROJECT FOR CAMBODIAN REFUGEE CAMPS	
THE KINGDOM OF THAILAND	
WATER PIPE APPURTENANT FACILITIES	
Date JANUARY 1981	D.W.G. No. 19
JAPAN INTERNATIONAL COOPERATION AGENCY	

DISTRIBUTING TANK

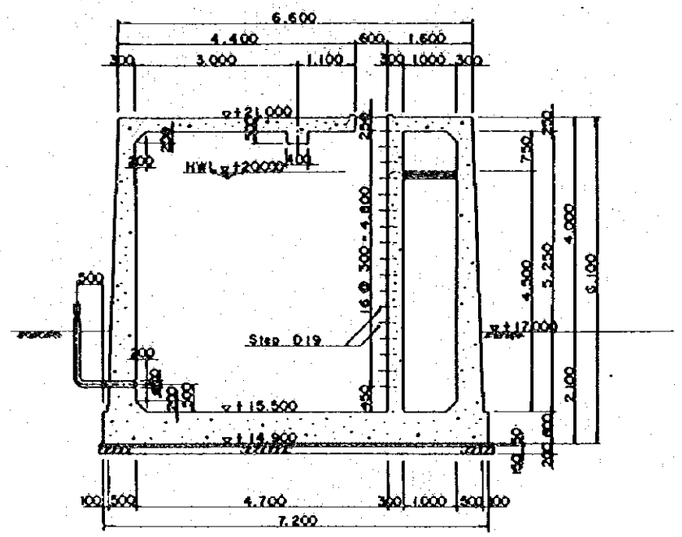
SECTION ②-②



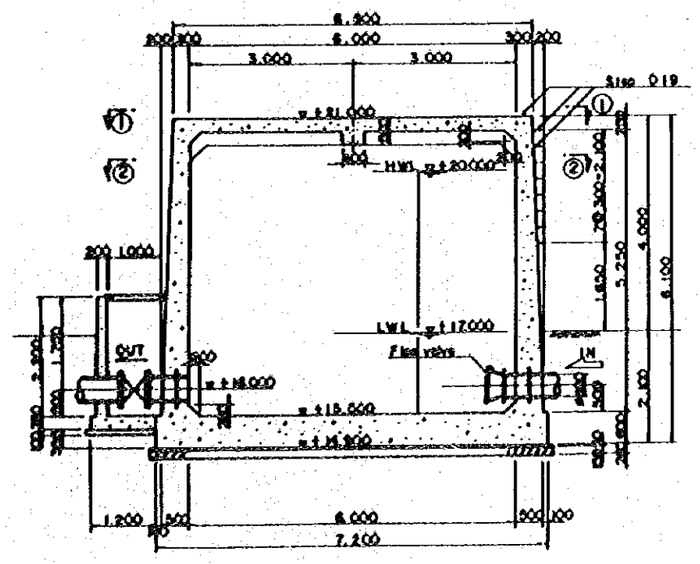
SECTION ①-①



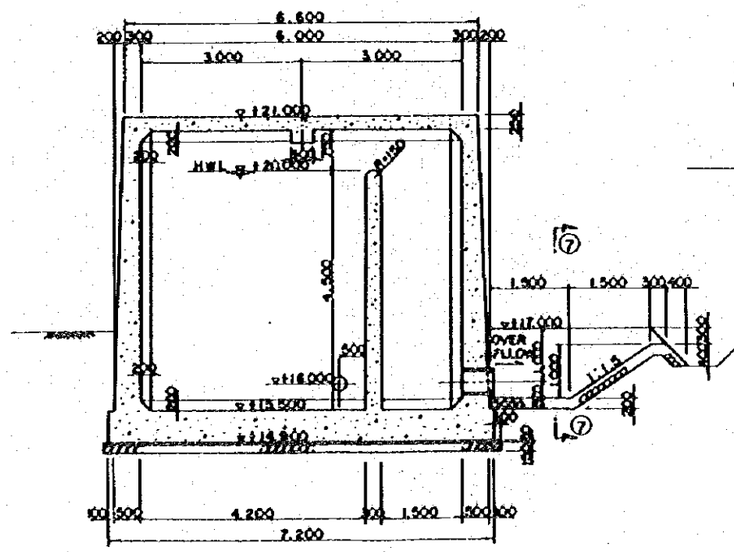
SECTION ⑤-⑤



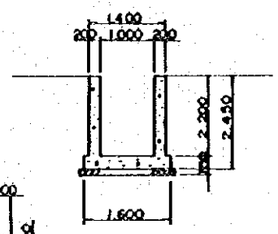
SECTION ③-③



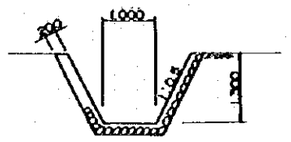
SECTION ④-④



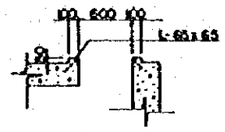
SECTION ⑥-⑥

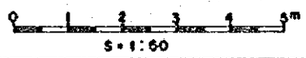


SECTION ⑦-⑦

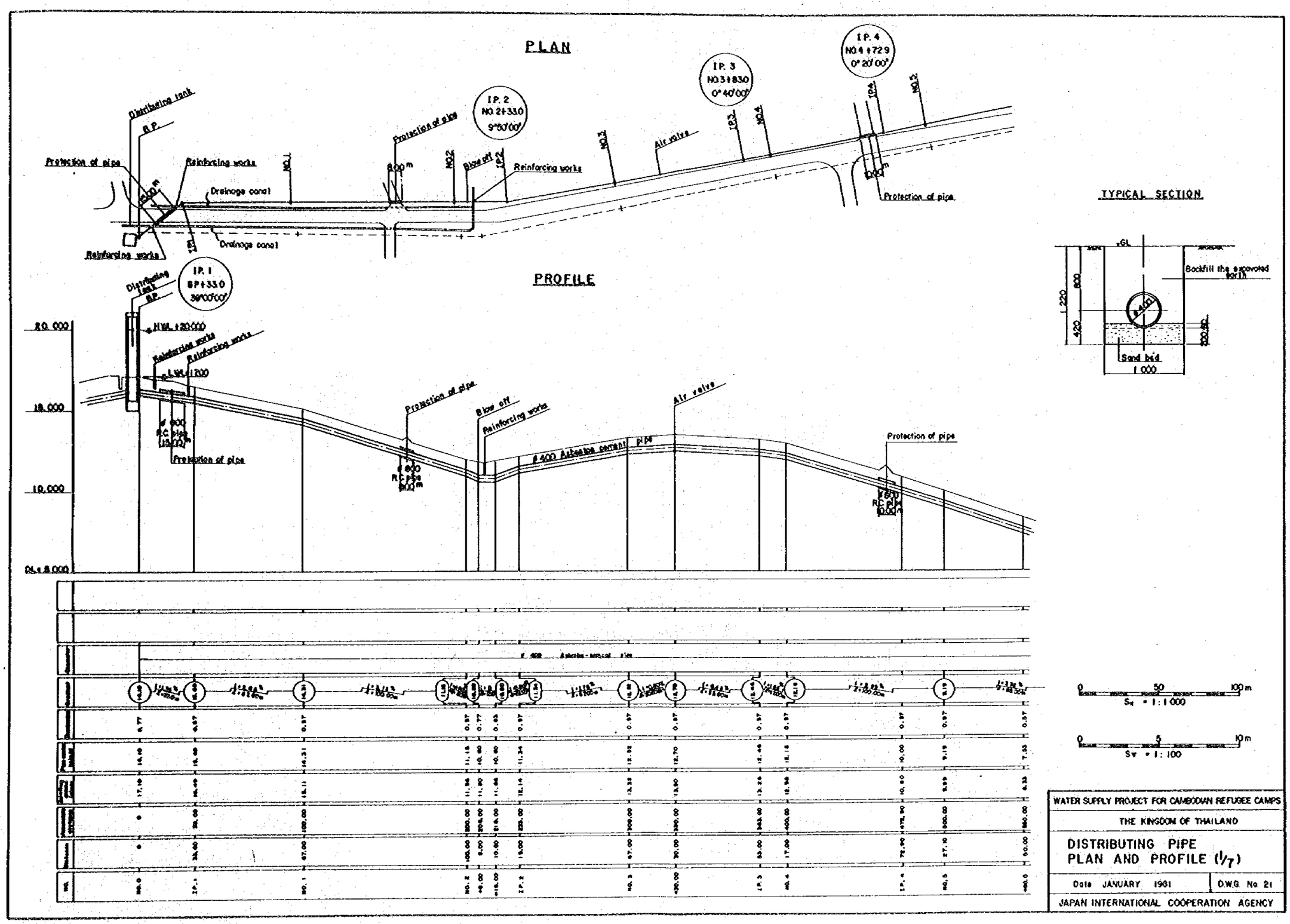


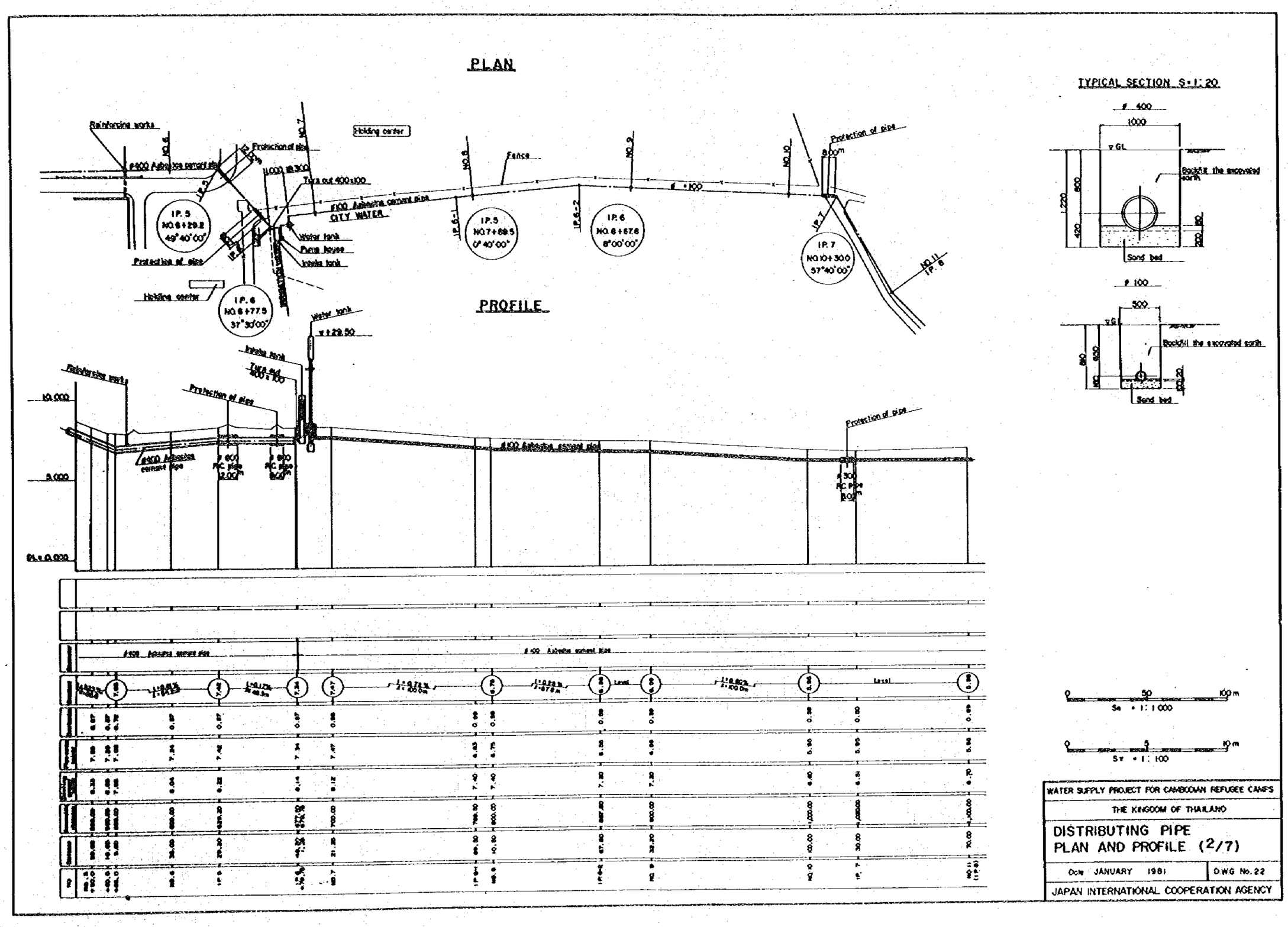
MANHOLE S=1:30

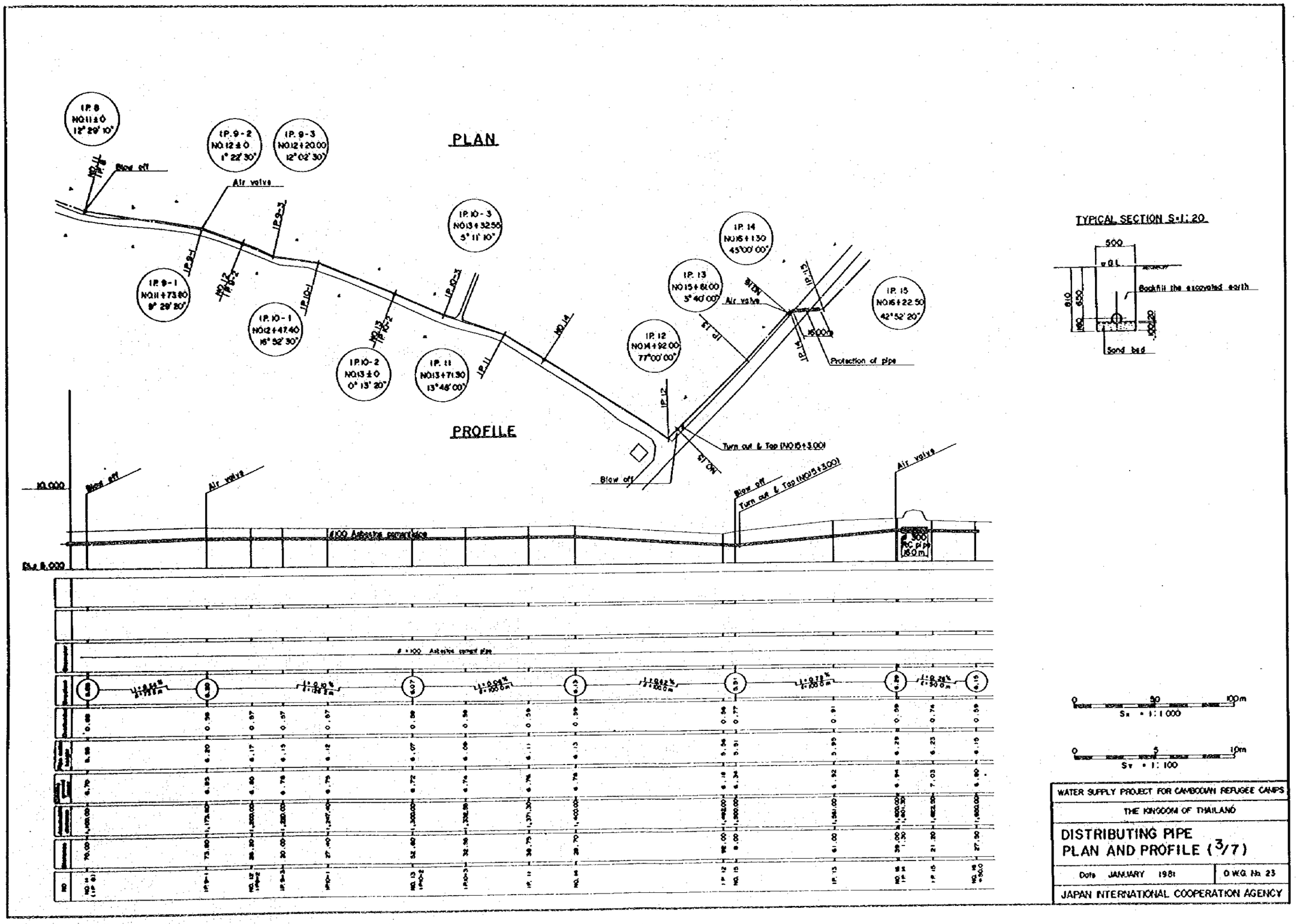




WATER SUPPLY PROJECT FOR CAMBODIAN REFUGEE CAMPS	
THE KINGDOM OF THAILAND	
DISTRIBUTING TANK	
Date JANUARY 1981	D.W.G. No. 20
JAPAN INTERNATIONAL COOPERATION AGENCY	


PLAN
PROFILE
TYPICAL SECTION
Distributing tank
B.P.
Protection of pipe
Reinforcing works
Drainage canal
Blow off
Air valve
I.P. 1
BP+33.0
39°00'00"
I.P. 2
NO.2+33.0
9°50'00"
I.P. 3
NO.3+83.0
0°40'00"
I.P. 4
NO.4+72.9
0°20'00"
NO.1
NO.2
NO.3
NO.4
NO.5
HWL +20.000
LWL +17.00
80.000
18.000
10.000
DL+8.000
Backfill the excavated earth
Sand bed
1.000
GL
Sh = 1:1000
Sv = 1:100
WATER SUPPLY PROJECT FOR CAMBODIAN REFUGEE CAMPS
THE KINGDOM OF THAILAND
DISTRIBUTING PIPE
PLAN AND PROFILE (1/7)
Date JANUARY 1981
D.W.G. No. 21
JAPAN INTERNATIONAL COOPERATION AGENCY


PLAN
PROFILE
TYPICAL SECTION S=1:20
Reinforcing works
Holding center
Protection of pipe
Fence
Water tank
Pump house
Intake tank
CITY WATER
Sand bed
Backfill the excavated earth
Sa = 1:1000
Sv = 1:100
WATER SUPPLY PROJECT FOR CAMBODIAN REFUGEE CAMPS
THE KINGDOM OF THAILAND
DISTRIBUTING PIPE
PLAN AND PROFILE (2/7)
Date JANUARY 1981
DWG No. 22
JAPAN INTERNATIONAL COOPERATION AGENCY



WATER SUPPLY PROJECT FOR CAMBODIAN REFUGEE CAMPS

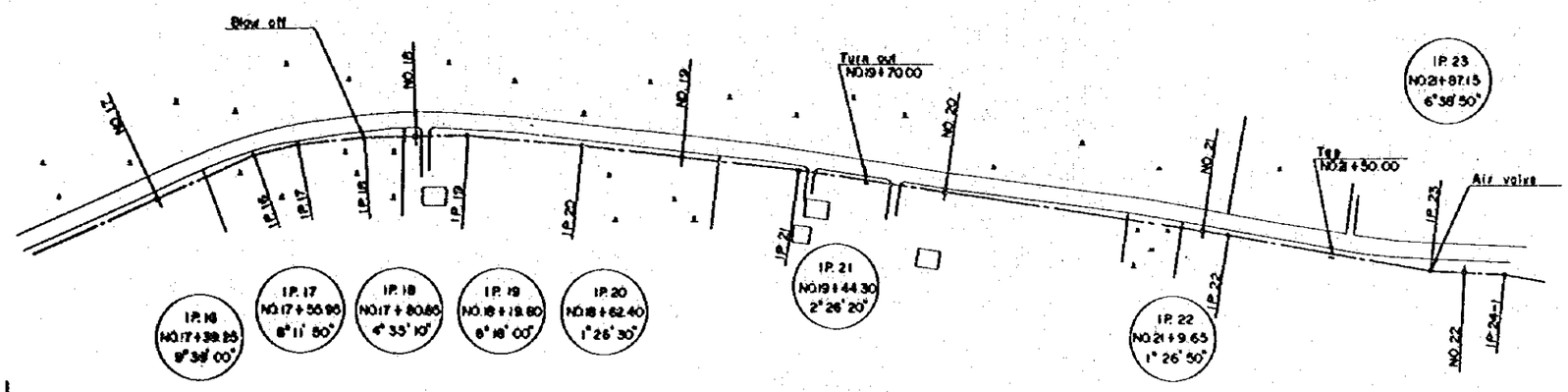
THE KINGDOM OF THAILAND

DISTRIBUTING PIPE PLAN AND PROFILE (3/7)

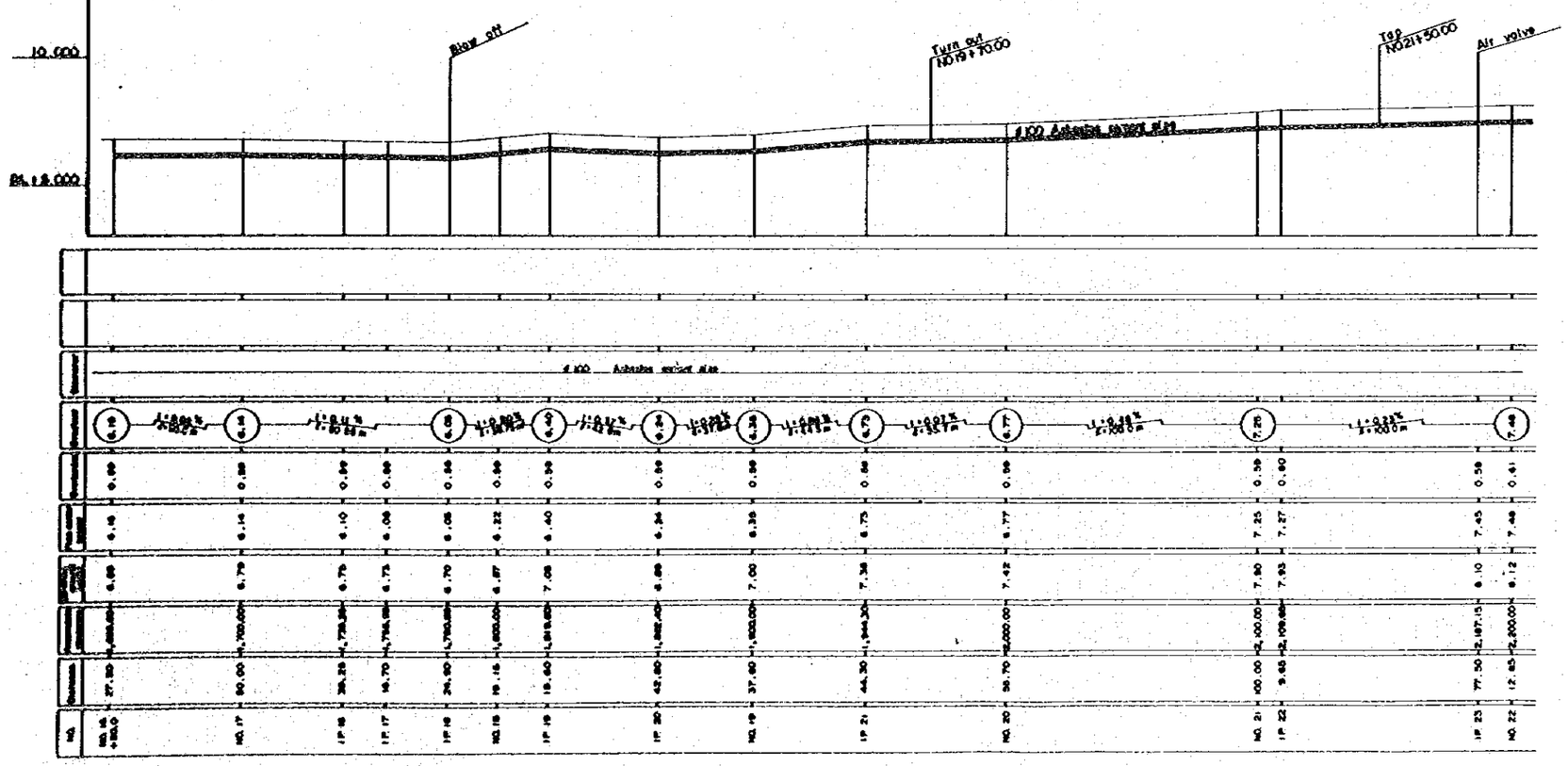
Date JANUARY 1981 | D.W.G. No. 23

JAPAN INTERNATIONAL COOPERATION AGENCY

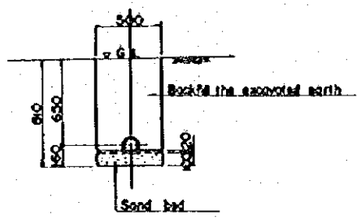
PLAN



PROFILE



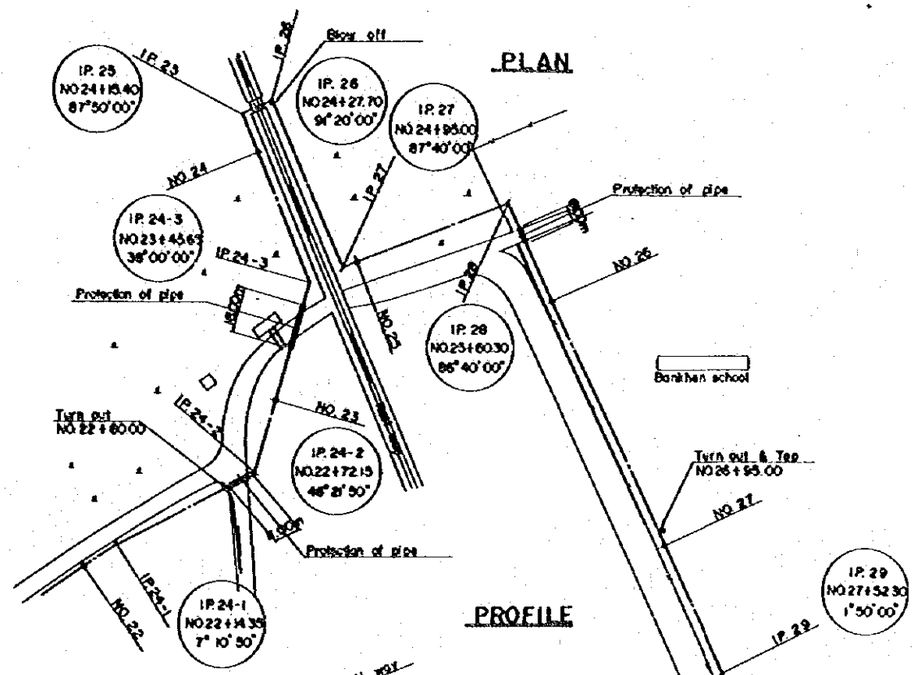
TYPICAL SECTION S=1:20



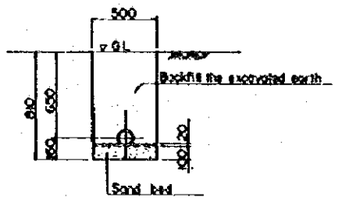
0 50 100m
Sv = 1 : 1000

0 5 10m
Sv = 1 : 100

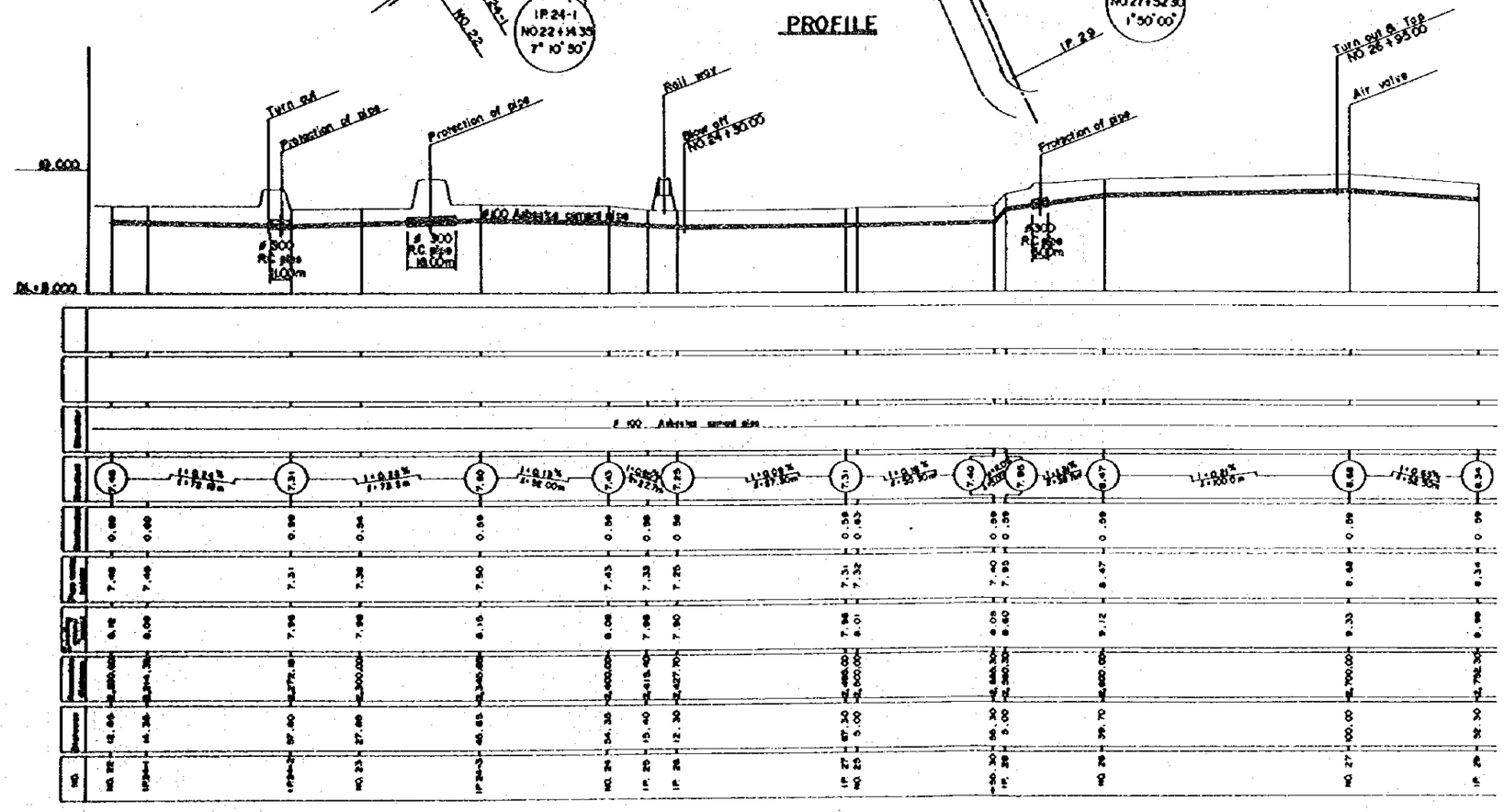
WATER SUPPLY PROJECT FOR CAMBODIAN REFUGEE CAMPS
THE KINGDOM OF THAILAND
DISTRIBUTING PIPE PLAN AND PROFILE (4/7)
Date JANUARY 1981 — D.W.G. No 24
JAPAN INTERNATIONAL COOPERATION AGENCY

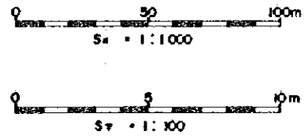


TYPICAL SECTION S=1:20



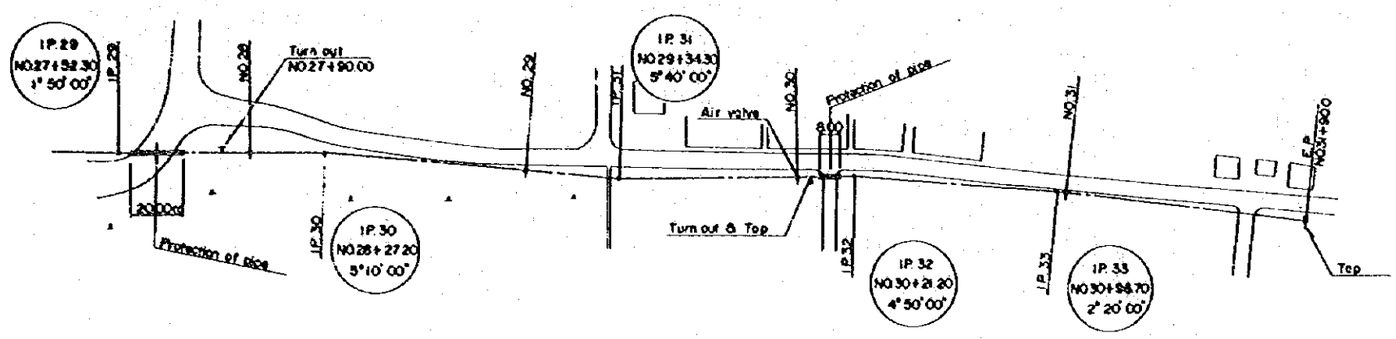
PROFILE



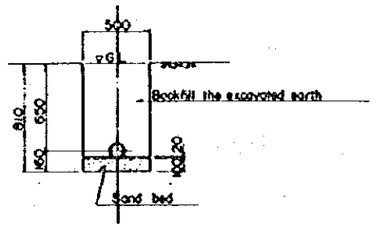


WATER SUPPLY PROJECT FOR CAMBODIAN REFUGEE CAMPS
THE KINGDOM OF THAILAND
DISTRIBUTING PIPE PLAN AND PROFILE (5/7)
Date JANUARY 1981 — D.W.G. No. 25
JAPAN INTERNATIONAL COOPERATION AGENCY

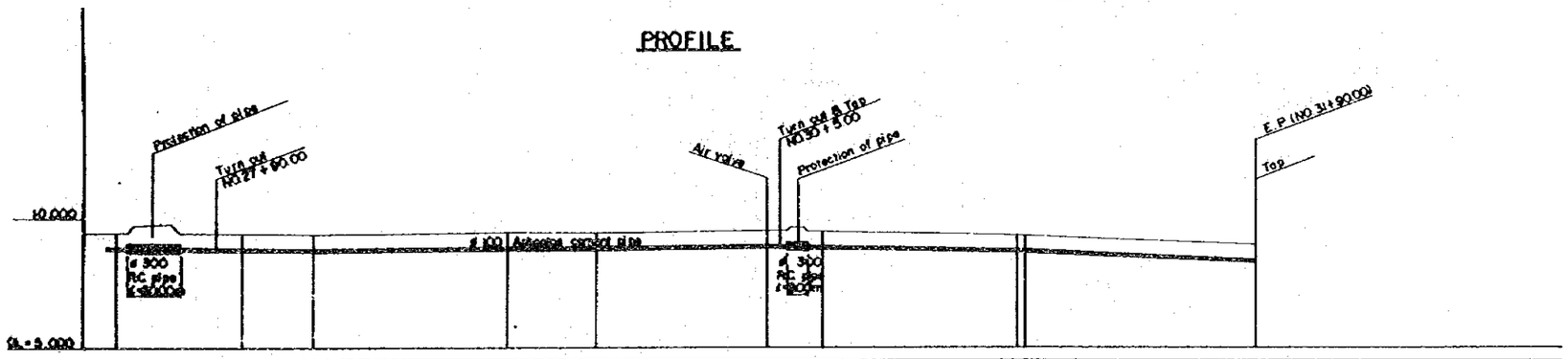
PLAN

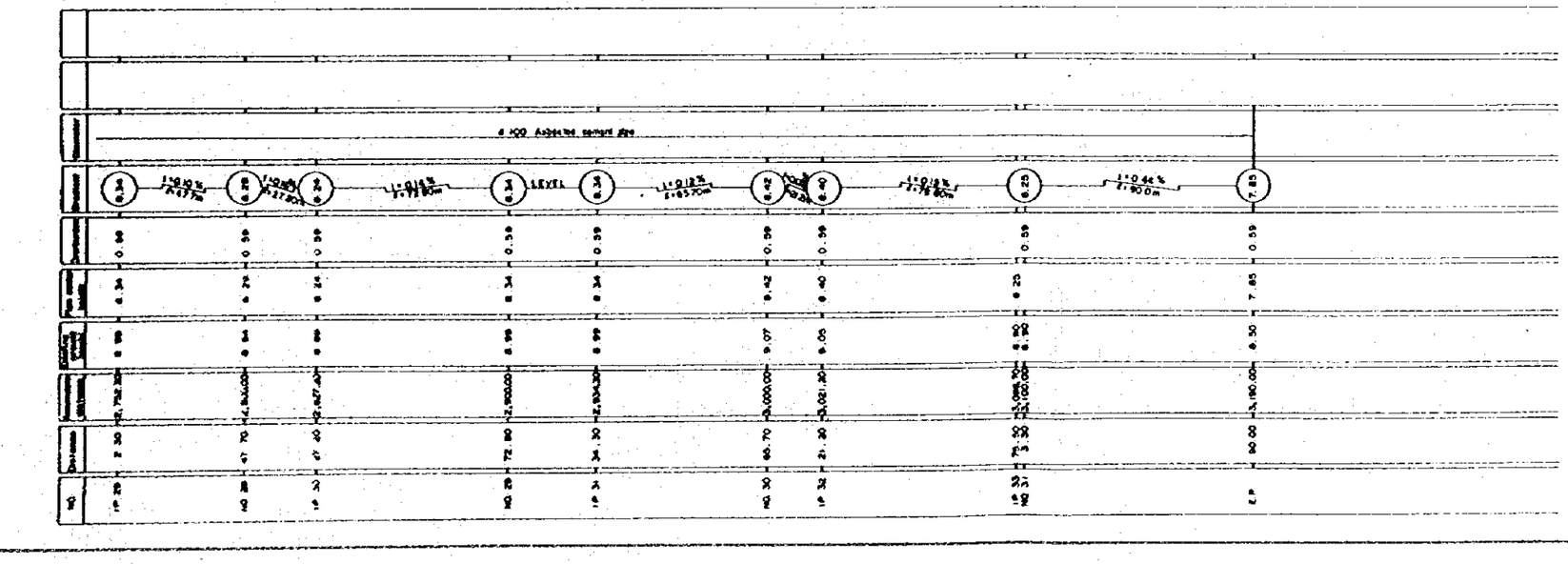


TYPICAL SECTION S=1:20

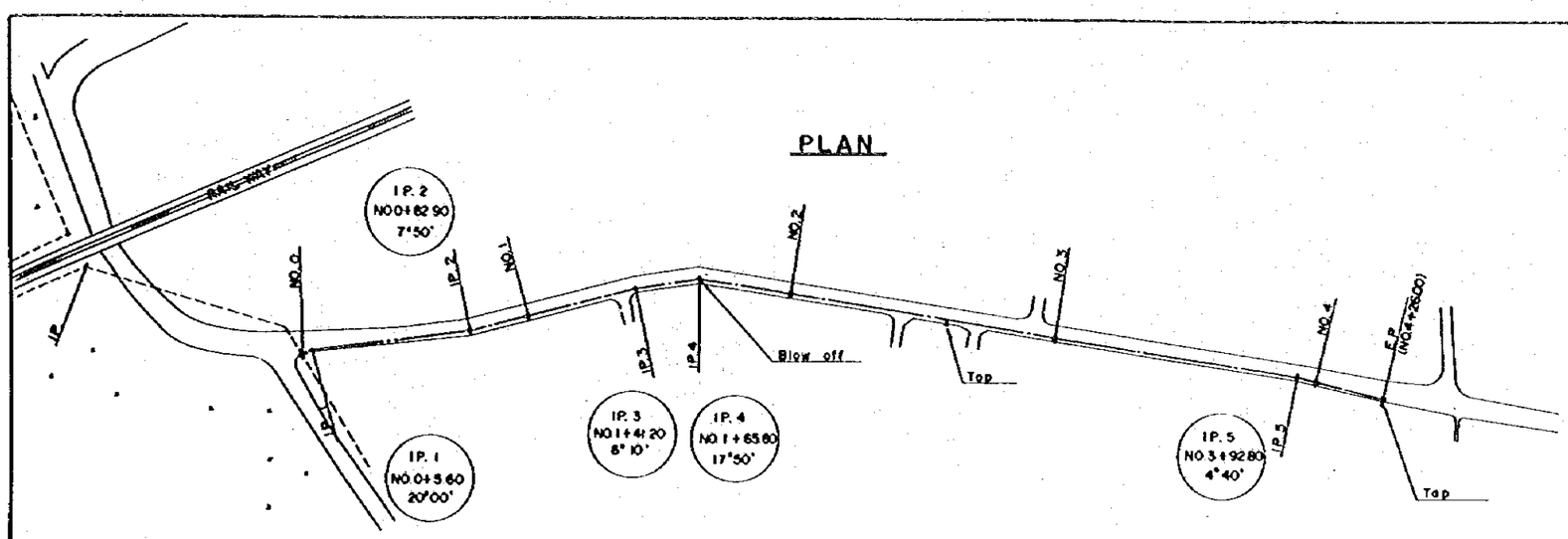


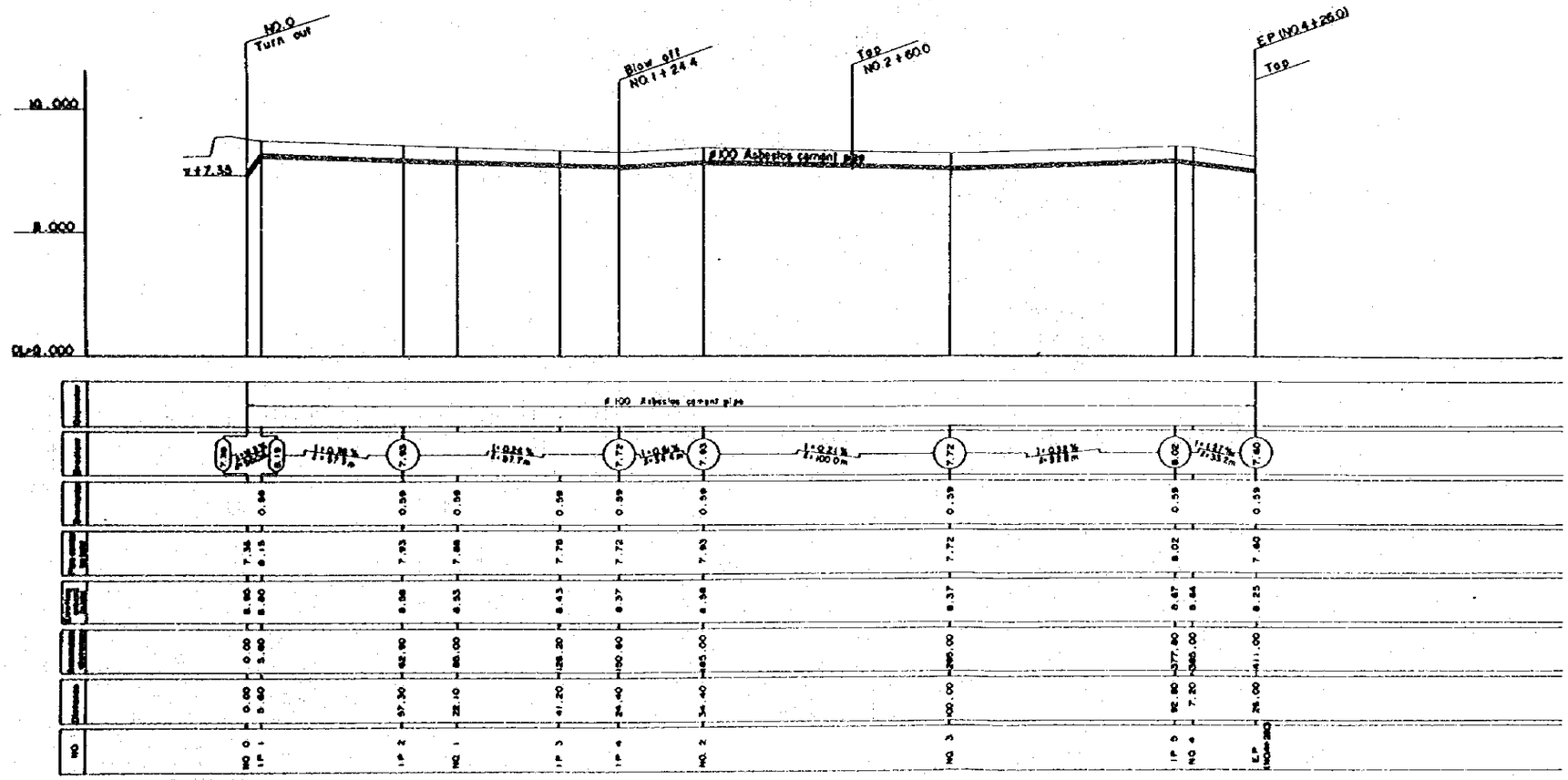
PROFILE

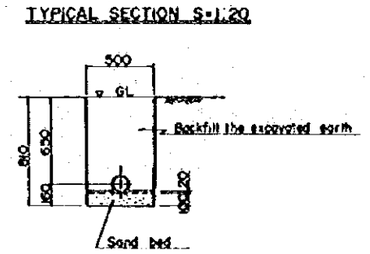




WATER SUPPLY PROJECT FOR CAMBODIAN REFUGEE CAMPS	
THE KINGDOM OF THAILAND	
DISTRIBUTING PIPE PLAN AND PROFILE (6/7)	
Date JANUARY 1981	D.W.G. No 26
JAPAN INTERNATIONAL COOPERATION AGENCY	



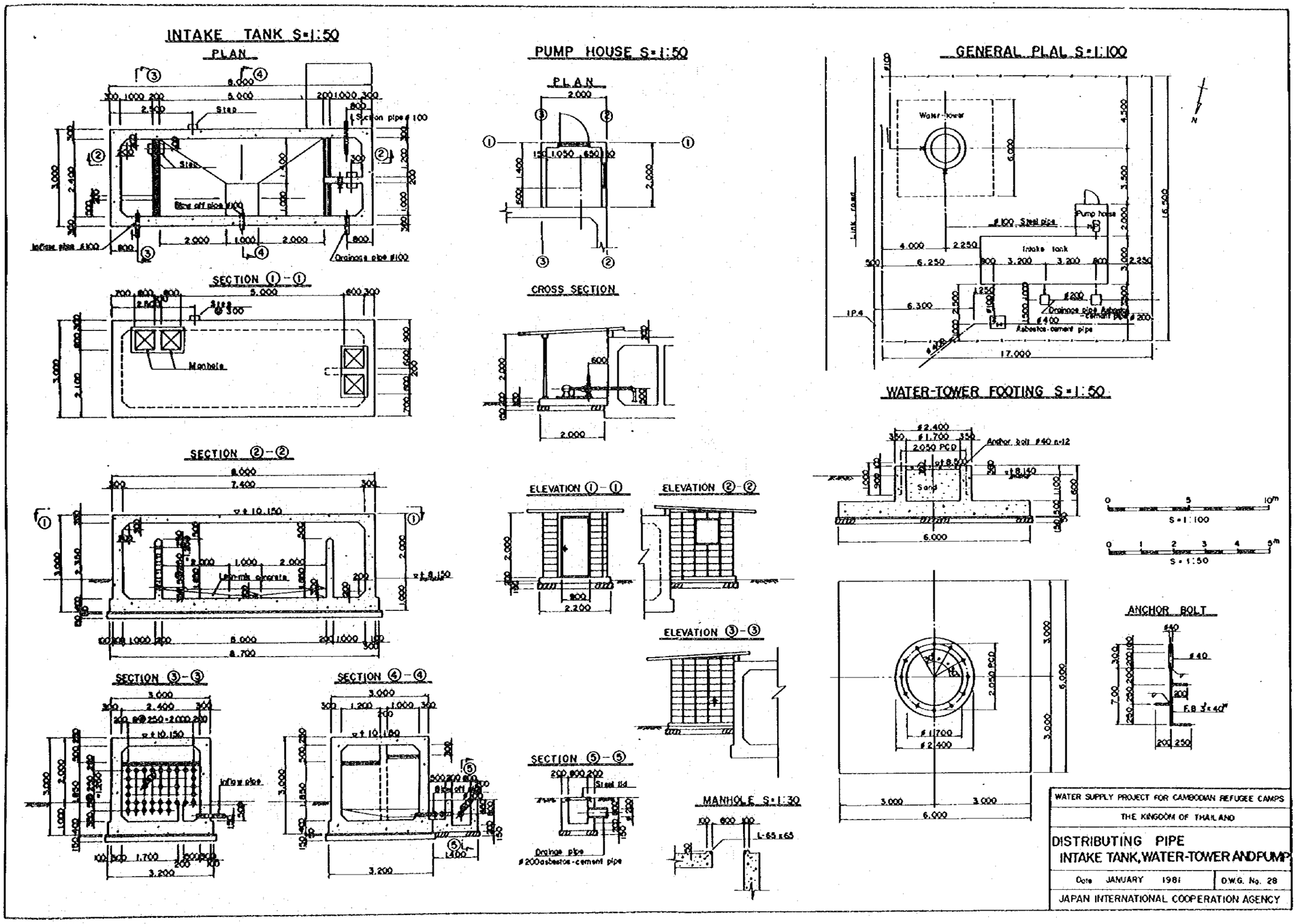




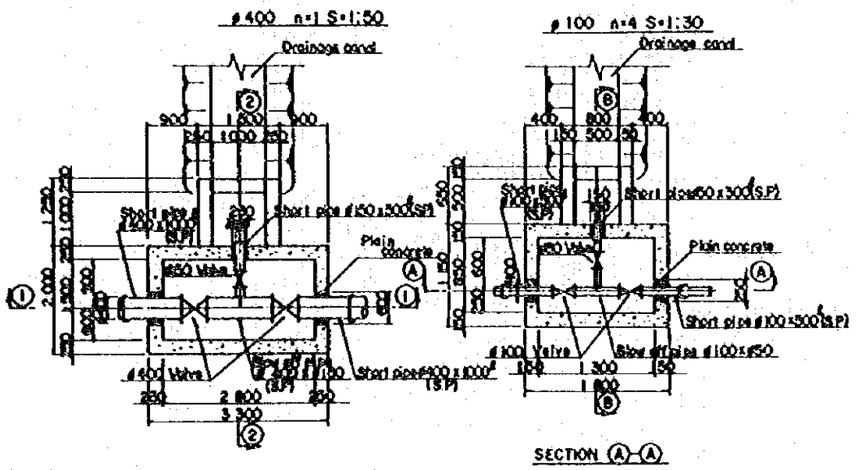
0 50 100m
Sh = 1:1,000

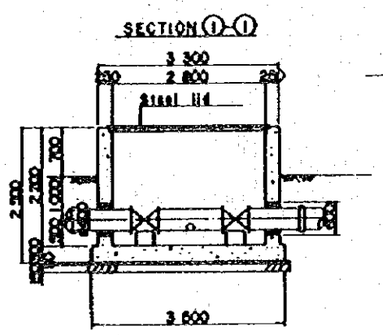
0 5 10m
Sv = 1:100

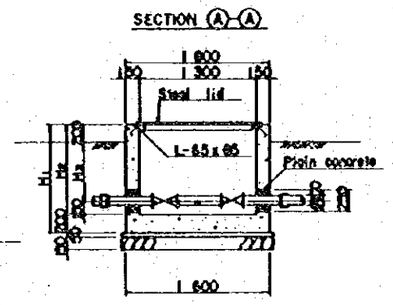
WATER SUPPLY PROJECT FOR CAMBODIAN REFUGEE CAMPS	
THE KINGDOM OF THAILAND	
DISTRIBUTING PIPE PLAN AND PROFILE (7/7)	
Date JANUARY 1981	D.WG. No. 27
JAPAN INTERNATIONAL COOPERATION AGENCY	

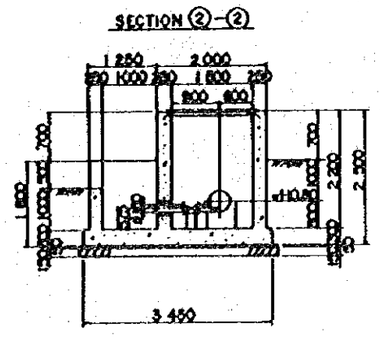

INTAKE TANK S=1:50
PLAN
Step
Suction pipe ϕ100
Blow off pipe ϕ100
Inflow pipe ϕ100
Drainage pipe ϕ100
SECTION ①-①
Manhole
SECTION ②-②
Lean-mix concrete
SECTION ③-③
Inflow pipe
SECTION ④-④
PUMP HOUSE S=1:50
PLAN
CROSS SECTION
ELEVATION ①-①
ELEVATION ②-②
ELEVATION ③-③
SECTION ⑤-⑤
Steel lid
Drainge pipe
ϕ200 asbestos-cement pipe
MANHOLE S=1:30
L-65x65
GENERAL PLAN S=1:100
Water tower
Link road
ϕ100 Steel pipe
Pump house
Intake tank
Drainage pipe
Asbestos-cement pipe
WATER-TOWER FOOTING S=1:50
Anchor bolt ϕ40 n=12
Sand
S=1:100
S=1:50
ANCHOR BOLT
F.B 3"x40"
WATER SUPPLY PROJECT FOR CAMBODIAN REFUGEE CAMPS
THE KINGDOM OF THAILAND
DISTRIBUTING PIPE
INTAKE TANK, WATER-TOWER AND PUMP
Date JANUARY 1981
D.W.G. No. 28
JAPAN INTERNATIONAL COOPERATION AGENCY

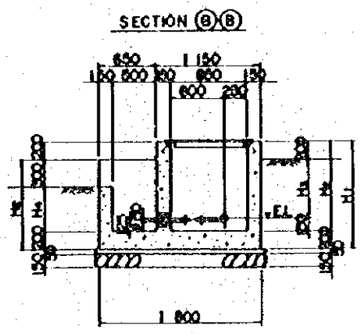
BLOW OFF





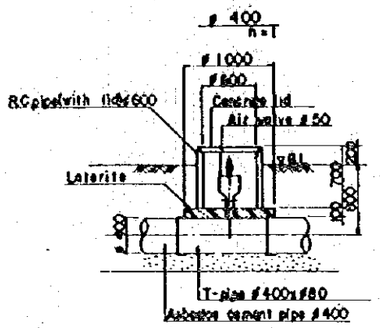


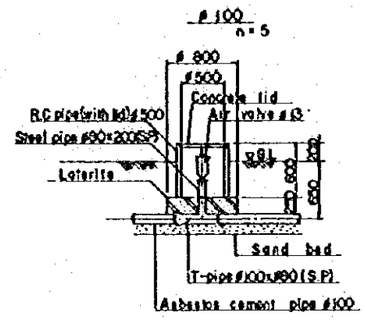




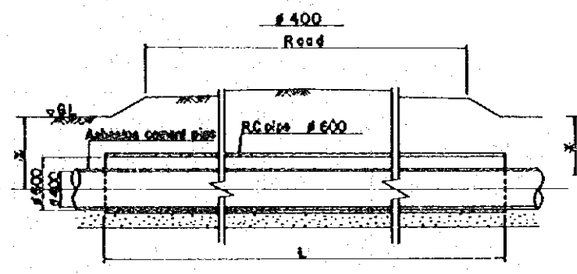
DIMENSION LIST					
	H_1	H_2	H_3	H_4	EL
No.11	1 300	1 100	750	600	+5.95
No.15	1 380	1 180	830	680	+5.51
No.17+80.5	1 200	1 000	650	500	+6.05
No.24+30	1 200	1 000	650	500	+7.25

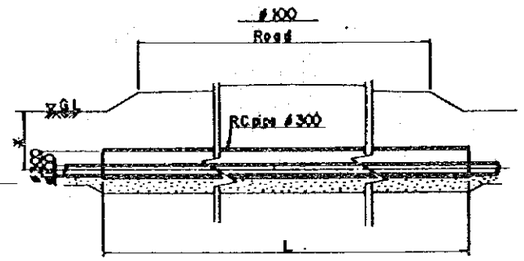
AIR VALVE S=1:30

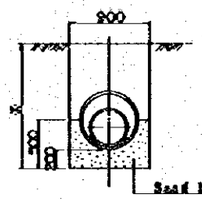




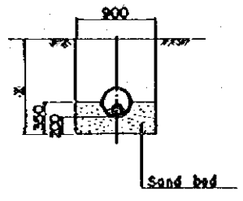
PROTECTION OF PIPE S=1:30





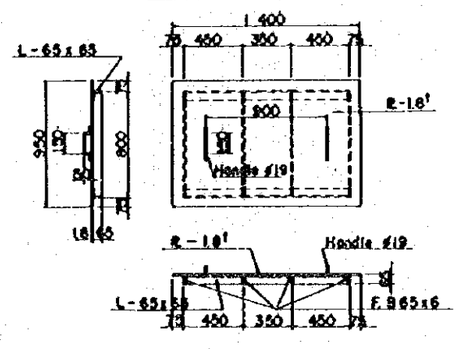


Station	L
No.0 + 19.5	15 000
No.1 + 64.0	8 000
No.4 + 63.0	10 000
No.6 + 35.5	12 000
No.6 + 65.5	8 000



Station	L
No.10 + 25.0	8 000
No.16 + 112.5	16 000
No.22 + 67.5	11 000
No.23 + 27.5	18 000
No.25 + 74.0	6 000
No.27 + 66.0	20 000
No.30 + 11.5	8 000

DETAIL OF STEEL LID S=1:20



0 1 2 3 4 5 m
S = 1 : 50

0 1 2 3 m
S = 1 : 30

0 1 2 m
S = 1 : 20

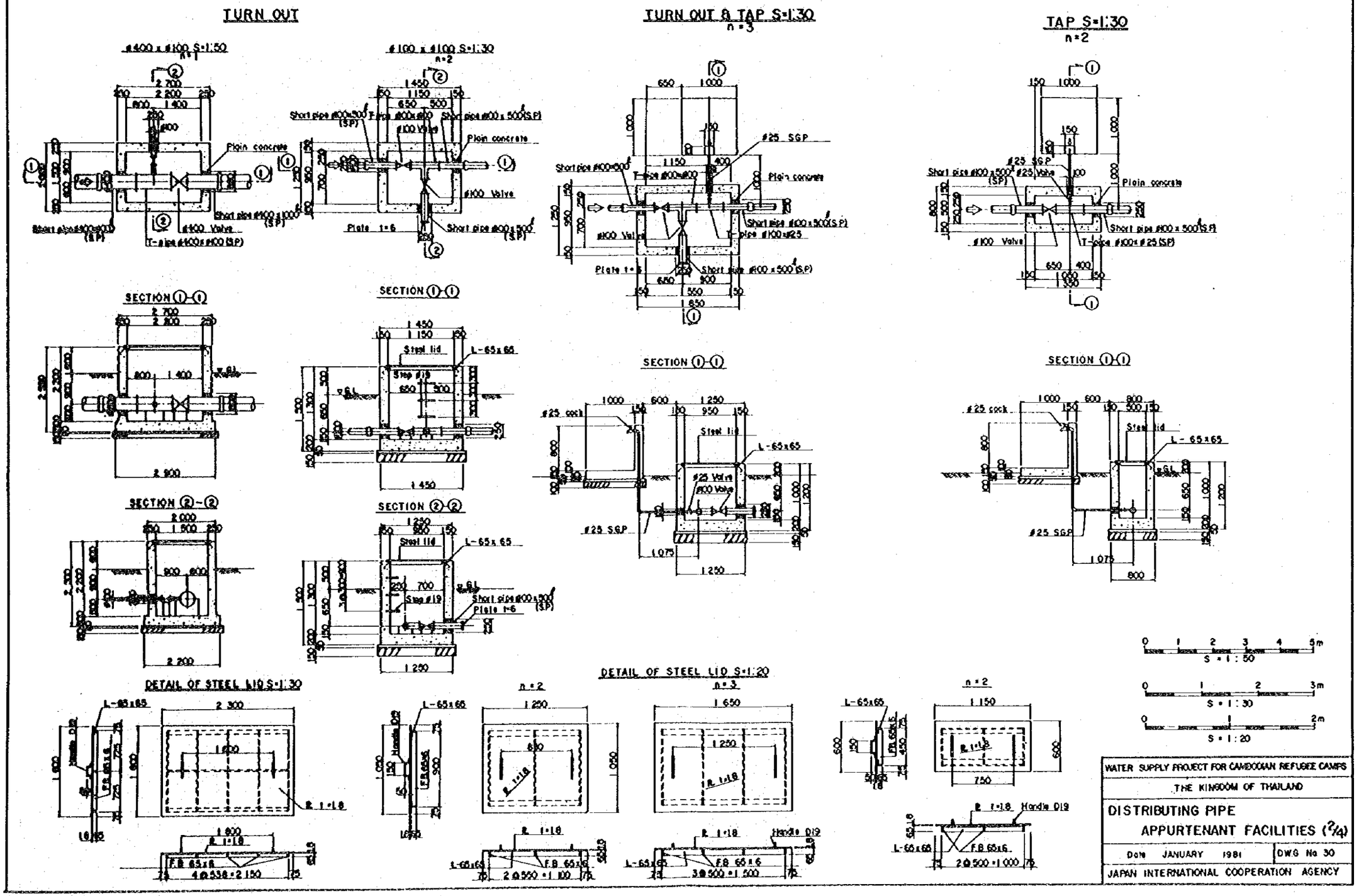
WATER SUPPLY PROJECT FOR CAMBODIAN REFUGEE CAMPS

THE KINGDOM OF THAILAND

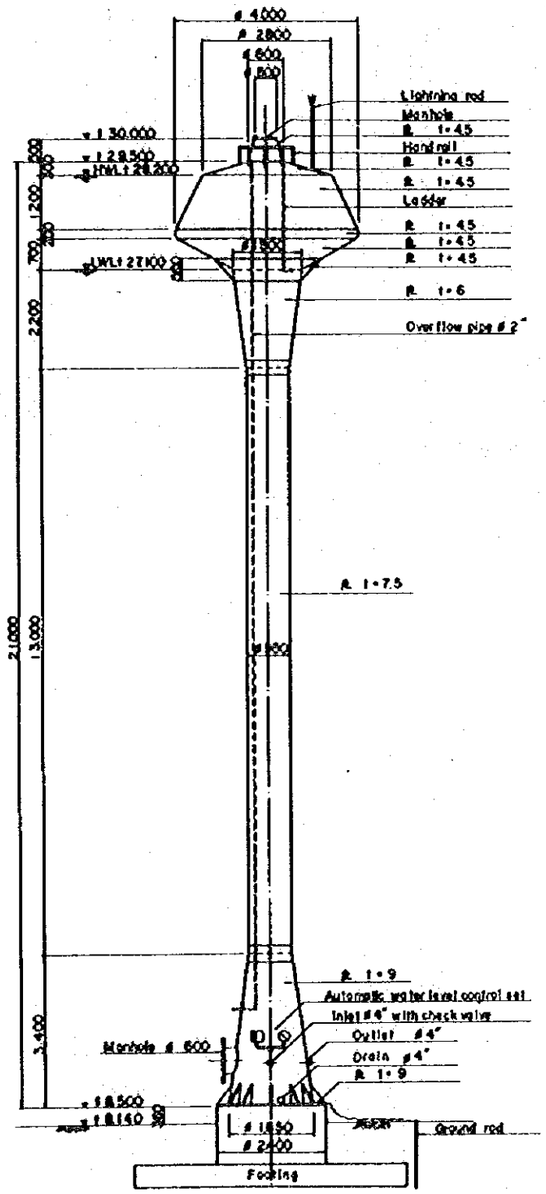
DISTRIBUTING PIPE APPURTENANT FACILITIES (1/4)

Date JANUARY 1981 | D.W.G No. 29

JAPAN INTERNATIONAL COOPERATION AGENCY


TURN OUT
TURN OUT & TAP S=1:30
n=3
TAP S=1:30
n=2
SECTION ①-①
SECTION ②-②
DETAIL OF STEEL LID S=1:30
DETAIL OF STEEL LID S=1:20
Plain concrete
Steel lid
Short pipe
Valve
S = 1 : 50
S = 1 : 30
S = 1 : 20
WATER SUPPLY PROJECT FOR CAMBODIAN REFUGEE CAMPS
THE KINGDOM OF THAILAND
DISTRIBUTING PIPE
APPURTENANT FACILITIES (2/4)
Date JANUARY 1981
DWG No 30
JAPAN INTERNATIONAL COOPERATION AGENCY

WATER TANK S=1:60

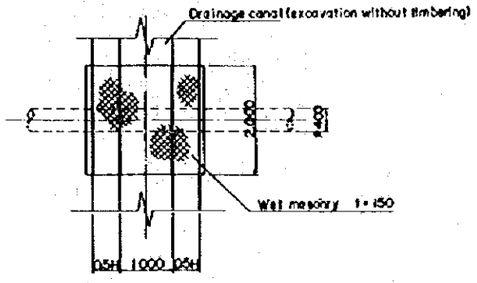


Capacity 30 m³

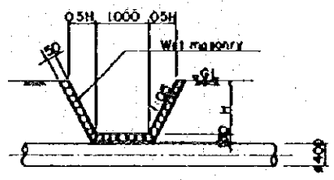
REINFORCING WORKS S=1:50

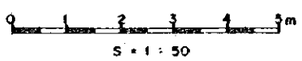
n = 4

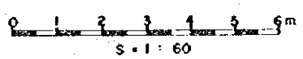
PLAN



CROSS SECTION



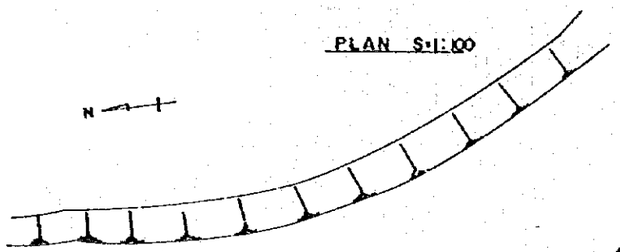


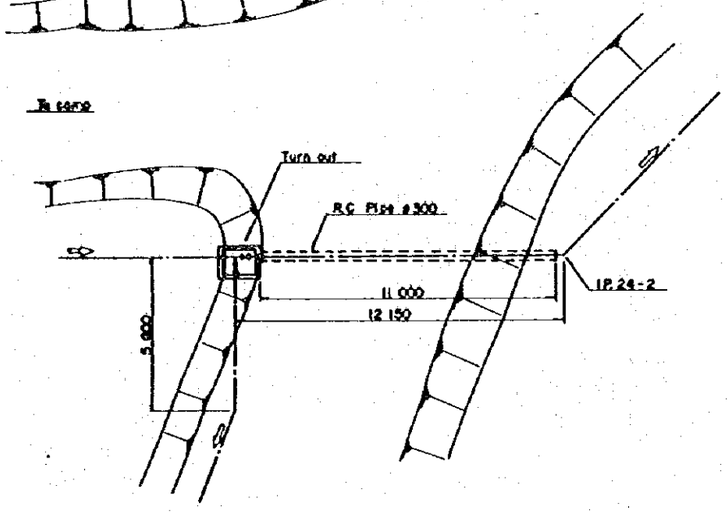


WATER SUPPLY PROJECT FOR CAMBODIAN REFUGEE CAMPS	
THE KINGDOM OF THAILAND	
DISTRIBUTING PIPE APPURTENANT FACILITIES(3/4)	
Date JANUARY 1981	D.W.G. No.31
JAPAN INTERNATIONAL COOPERATION AGENCY	

TURN OUT

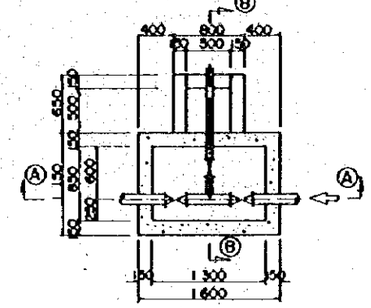
PLAN S=1:100



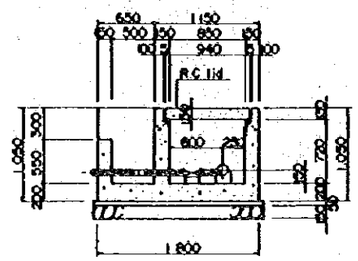


BLOW OFF (NO.1+24.40)
S= 1:30

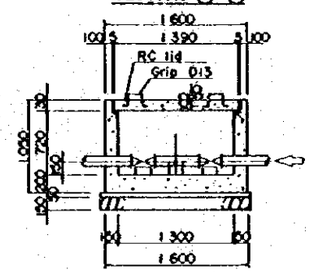
PLAN



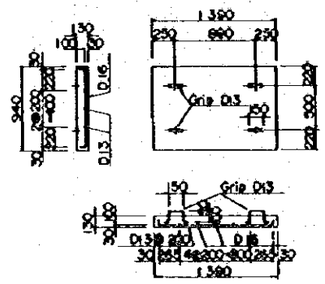
SECTION Ⓑ-Ⓑ



SECTION Ⓐ-Ⓐ

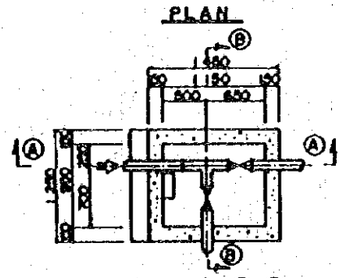


DETAIL OF LID

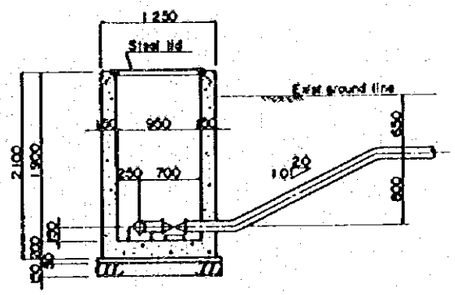


TAP (NO.2+600 NO.4+260)
S=1:30

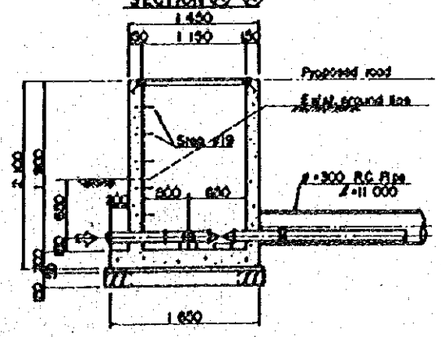
PLAN

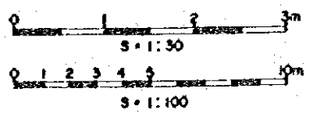


SECTION Ⓑ-Ⓑ

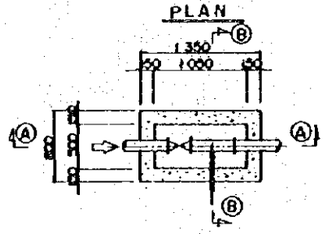


SECTION Ⓐ-Ⓐ

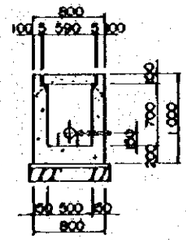




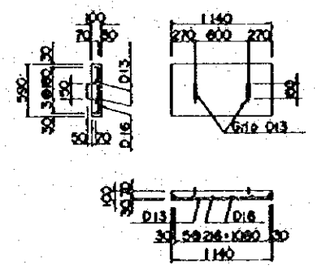
PLAN



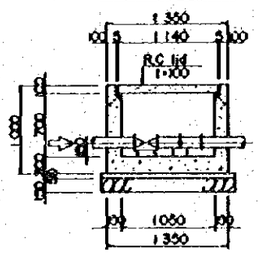
SECTION Ⓑ-Ⓑ



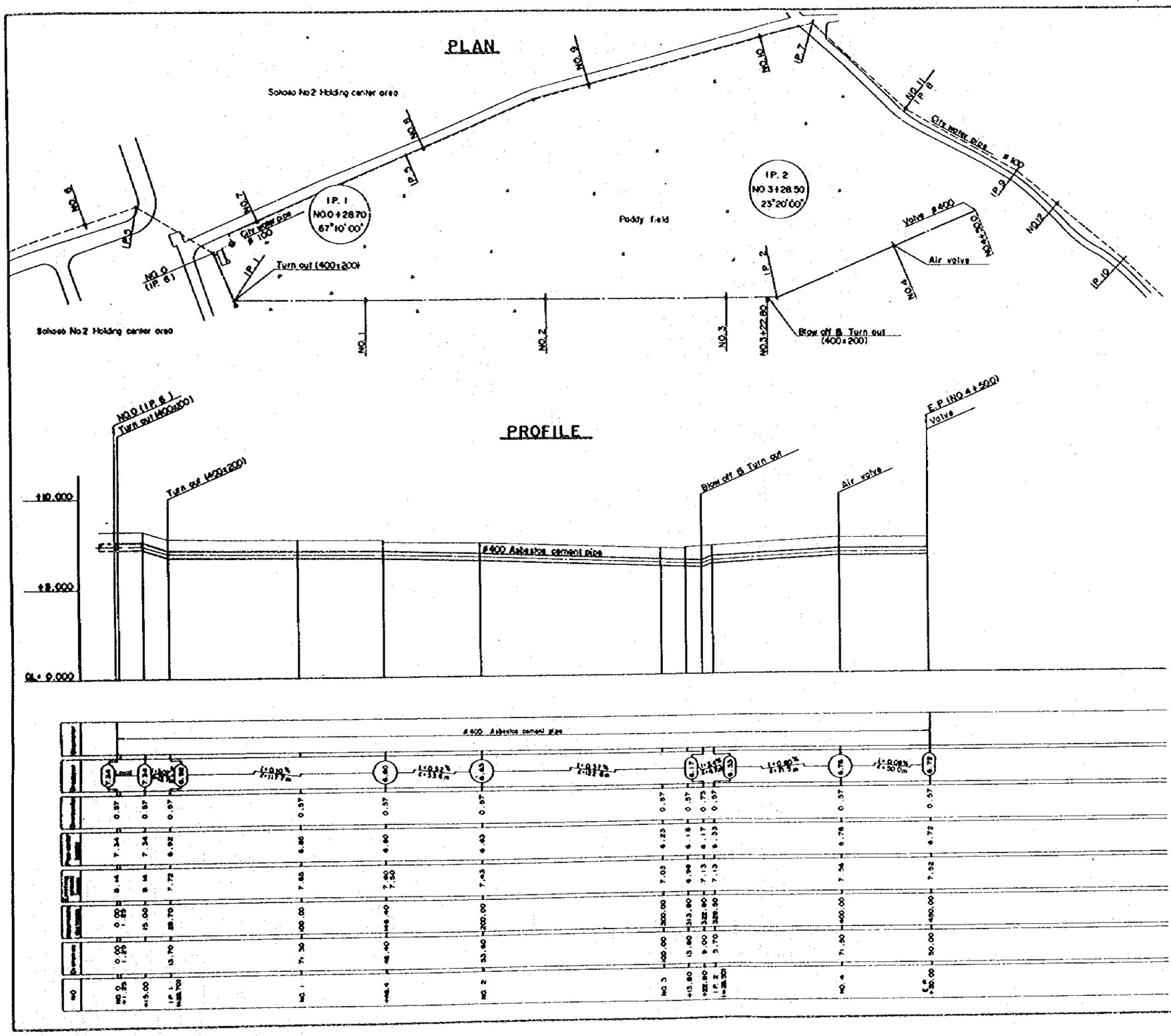
DETAIL OF LID

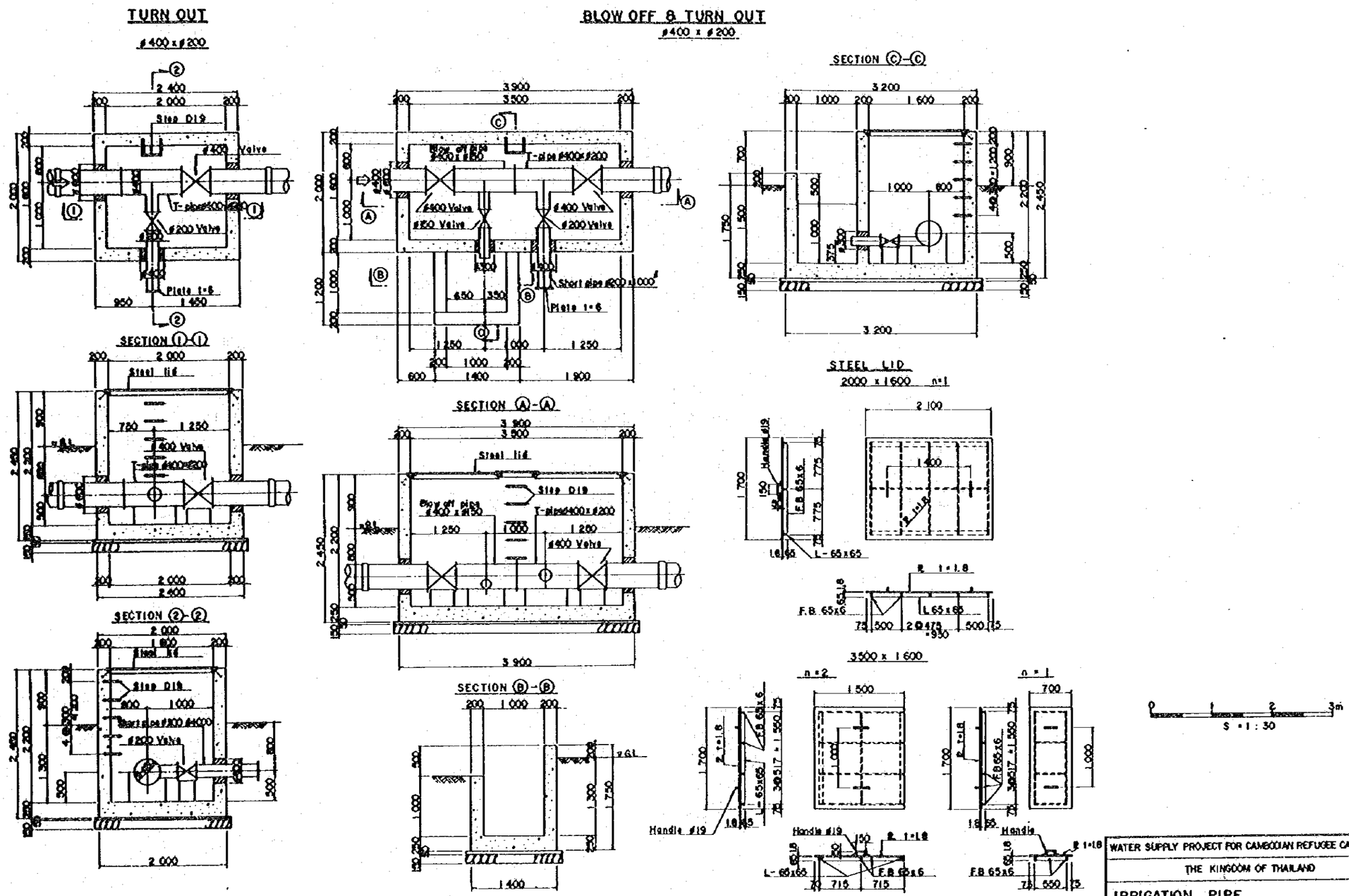


SECTION Ⓐ-Ⓐ

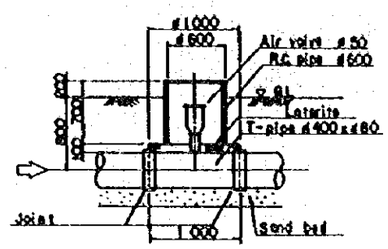


WATER SUPPLY PROJECT FOR CAMBODIAN REFUGEE CAMPS
THE KINGDOM OF THAILAND
DISTRIBUTING PIPE APPURTENANT FACILITIES (4/4)
Date JANUARY 1981 — D.WG. No. 32
JAPAN INTERNATIONAL COOPERATION AGENCY


PLAN
Sokoto No 2 Holding center area
Sokoto No 2 Holding center area
Paddy field
I.P. 1
NO.0+28.70
67°10'00"
I.P. 2
NO.3+28.50
23°20'00"
Turn out (400×200)
Air valve
Valve φ400
Blow off & Turn out
(400×200)
NO.0
(I.P. 6)
NO.1
NO.2
NO.3+22.80
NO.4
NO.9
NO.10
NO.11
NO.12
I.P. 1
I.P. 2
I.P. 5
I.P. 7
I.P. 8
I.P. 9
I.P. 10
PROFILE
NO.0 (I.P. 6)
Turn out (400×200)
Turn out (400×200)
Blow off & Turn out
Air valve
E.P (NO.4+50.0)
Valve
110.000
108.000
GL+0.000
φ400 Asbestos cement pipe
φ400 Asbestos cement pipe
TYPICAL SECTION S=1:20
1000
GL
Backfill the excavated earth
220
800
420
100
Sand bed
0 50 100m
Sh = 1:1000
0 5 10m
Sv = 1:100
WATER SUPPLY PROJECT FOR CAMBODIAN REFUGEE CAMPS
THE KINGDOM OF THAILAND
IRRIGATION PIPE
PLAN AND PROFILE
Date JANUARY 1981
DWG. NO. 33
JAPAN INTERNATIONAL COOPERATION AGENCY

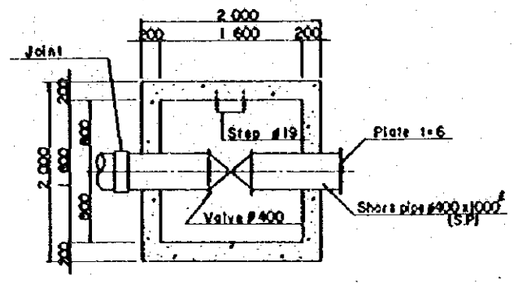

TURN OUT
φ400 x φ200
BLOW OFF & TURN OUT
φ400 x φ200
SECTION Ⓒ-Ⓒ
SECTION Ⓘ-Ⓘ
SECTION Ⓐ-Ⓐ
SECTION Ⓑ-Ⓑ
SECTION Ⓙ-Ⓙ
STEEL LID
2000 x 1600 n=1
3500 x 1600
n=2
n=1
Steel lid
Step D19
φ400 Valve
φ200 Valve
T-pipe φ400x φ200
Plate t=6
Handle φ19
F.B. 65x6
L-65x65
S = 1 : 30
WATER SUPPLY PROJECT FOR CAMBODIAN REFUGEE CAMPS
THE KINGDOM OF THAILAND
IRRIGATION PIPE
APPURTENANT FACILITIES (1/2)
Date JANUARY 1981
D.W.G. No. 34
JAPAN INTERNATIONAL COOPERATION AGENCY

AIR VALVE

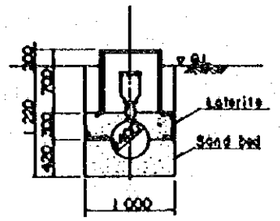


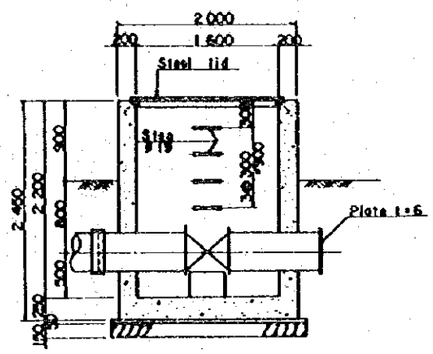
VALVE BOX

PLAN

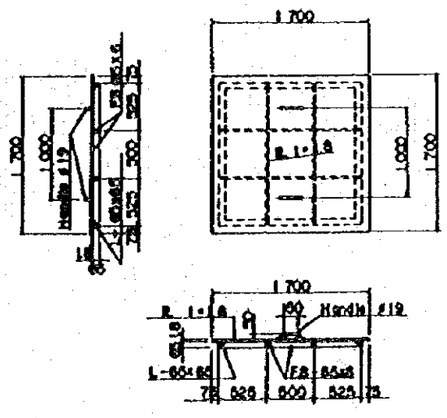


CROSS SECTION



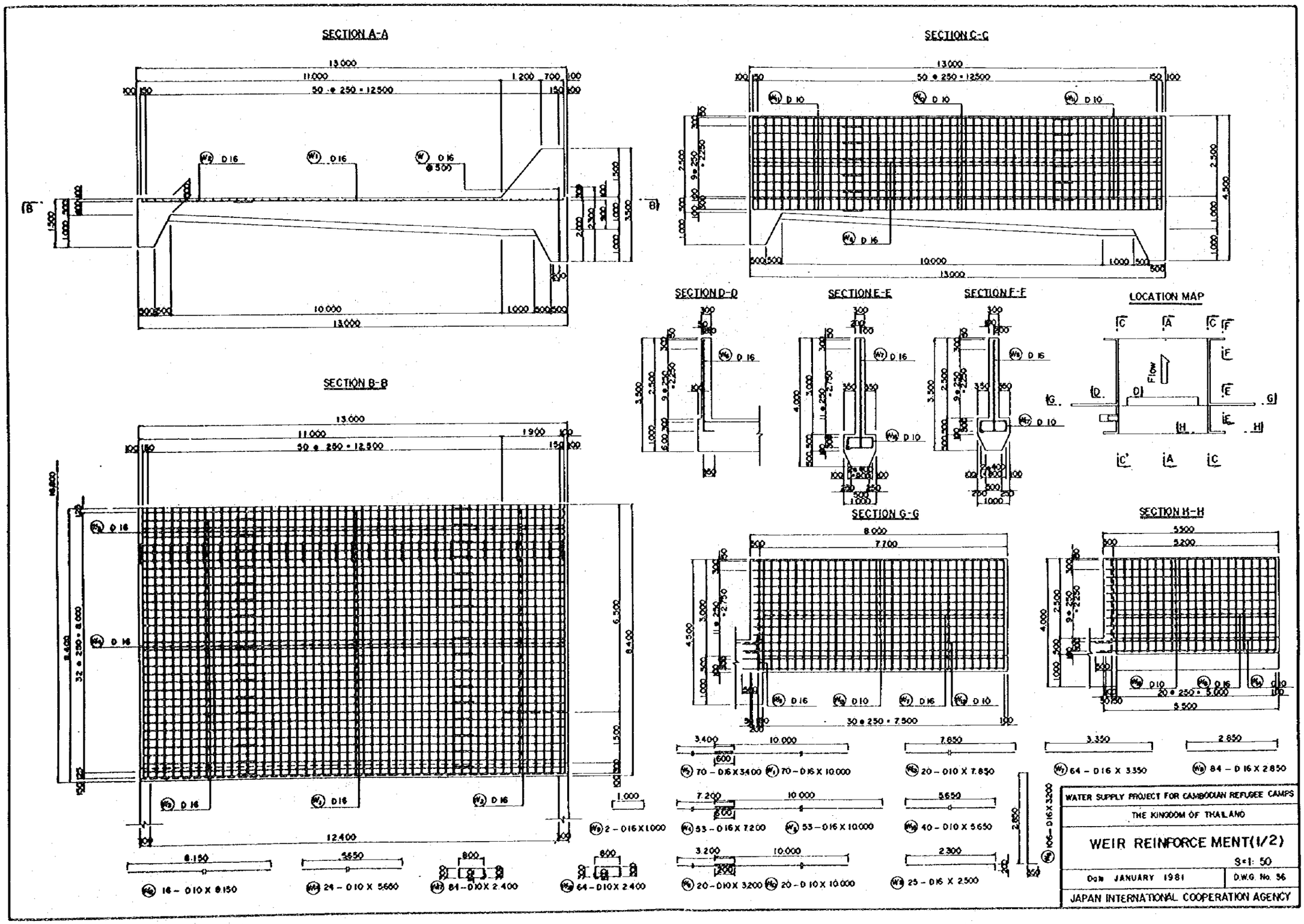


DETAIL OF STEEL LID



0 1 2 3m
S = 1 : 30

WATER SUPPLY PROJECT FOR CAMBODIAN REFUGEE CAMPS	
THE KINGDOM OF THAILAND	
IRRIGATION PIPE APPURTENANT FACILITIES (2/2)	
Date JANUARY 1981	DWG No. 35
JAPAN INTERNATIONAL COOPERATION AGENCY	


SECTION A-A
SECTION B-B
SECTION C-C
SECTION D-D
SECTION E-E
SECTION F-F
SECTION G-G
SECTION H-H
LOCATION MAP
Flow
WATER SUPPLY PROJECT FOR CAMBODIAN REFUGEE CAMPS
THE KINGDOM OF THAILAND
WEIR REINFORCE MENT(1/2)
S=1: 50
Date JANUARY 1981
D.W.G. No. 56
JAPAN INTERNATIONAL COOPERATION AGENCY