CHAPTER 6 PROJECT AND GRANT AID

CHAPTER 6 PROJECT AND GRANT AID

6.1 The Subject of the Grant Aid

The foreign fund necessary for implementing this project is mainly used for equipment and materials. The breakdown of overall cost assumed is shown in Table 6.1.1.

Table 6.1.1 Breakdown of the Approximate Overall Roughly Estimated Construction Cost

	Equipment and materials		Labour expenses	Total	Ratio against overall cost
	Foreign	Local	Local		
Japan	830,000 (27,667)	-	-	830,000 (27,667)	43 (1)
Burma	293,063 (9,769)	394,544 (13,151)	408,393 (13,613)	1,096,000 (36,533)	57 (2)
Total	1,123,063 (37,435)	394,544 (13,151)	408,393 (13,613)	1,926,000 (64,200)	100 (3)
Ratio against overall cost	58.3 (2)	20.5 (0.7)	21.2 (0.7)	100 (3)	

Note: Yen in thousands
(Kyats in thousands)

As of August 1981
1 Kyat ≒ 30 yen

Out of the total construction cost of 1,926,000,000 Yen(64,200,000 Kyats), Burmas share is 1,096,000,000 Yen (36,533,000 Kyats), which accounts for approximately 57% of the total.

Burma will complete the municipal water supply systems in both Magwe and Prome by using this equipment and materials.

These equipment and materials are selected according to the following priorities, in accordance with the Minutes of Discussion, which was exchanged on 11 Aug. 1981 on the occasion of the field survey, and in consideration of the order of priority listed by the Burmese side and the various limiting factors included in the Japanese grant aid.

1) drilling machines and their attachments,

2) well facilities, such as pump,

3) machines and materials for on-ground facilities,

4) materials for conduit facilities

Table 6.1.2 illustrates the Japanese share based on the priorities.

Table 6.1.2 Break-down of the Japanese Share

Items	Magwe	Prome	Total
Drilling machine and attachment	234,360 (7,812)	234,360 (7,812)	468,720 (15,624)
Well facility, and equipment and materials for on-groaund facility	110,801 (3,693)	117,466 (3,916)	228,267 (7,609)
Materials for conduit facility	63,643 (2,121)	69,370 (2,312)	133,013 (4,434)
Total	408,804 (13,627)	421,196 (14,040)	830,000 (27,667)

Note: Yen in thousands
(Kyats in thousands)

As of August 1981
1 Kyat ≒ 30 yen

When the Burmese Government implements the project by the use of this grant aid, the followings have to be met in accordance with the Minutes of Discussion.

i) plan for implementing the water supply system construction project in detail.

ii) secure land necessary for the water supply facilities.

iii) make a budgetary arrangement the whole cost necessary for the local expenditure on the Project.

In Magwe the existing water supply facilities will be involved in the project, in Prome the existing facilities will be imporved and extended separately from this project. Therefore, measures are required to avoid creating an imbalance between the existing facilities and the new facilities. Particularly, in Magwe, since surface water and ground water are mixed and distributed, the

Burmese side has to ensure that budgetary measures are taken for prompt implementation of the improvement of the existing facilities.

6.2 Basic Specification and Quantity of Equipment and Materials

6.2.1 Guideline for Selecting Equipment and Materials

The selection of equipment and materials were made in accordance with the following policy.

1) meet the selection guideline for individual equipment and material.
2) adaptable to the national conditions of Burma.
3) products made in Japan have to be produced by reliable makers.
4) be excellent in function.
5) be sturdy and compact.
6) be easy to handle and not in need of special skills for operating but must be careful to operate and maintain.
7) be durable

6.2.2 Equipment and Materials for Drilling

6.2.2.1 Well Drilling Rig

1) Guideline for Selection

The selection was made in accordance with the followings;

- i) drilling holes of a large diameter (300 ∿ 400mm) by the direct circulation technique must be possible.
- ii) a high efficiency and easy maintenance, check and repair must be possible in Burma

iii) has to be of the same type as the well drilling rig most commonly used in Burma.

iv) has to be of a compact type easily transportable between wells and between the regions.

v) attachments, such as bits, have to be of such a type as to raise drilling efficiency as well as cost-effectiveness.

2) Specification and Number

i) In accordance with the guideline, the basic structure of the water well drilling rig is of a rotary table type which has a mechanical power transmitting mechanism, and a four-wheel-drive truck system in due consideration of easy transportation and movement. In addition, in order to reduce the points to be maintained, the motor and the truck engine are available for common use. This project requires three kinds of well drilling, that is, production well, exploration well, and observation well. Because drilling depth and diameter of each well are different, the well drilling rig has to be able to perform the functions which enable the drilling of all of the wells by the furnishing of auxiliary equipment. This also facilitates the simplification of operation and maintenance.

Judging from the geology of the project area, tricon bits with a highly efficient drilling capability and a high-cost effectiveness, and wing bits for end cutting and for fragile layers, were selected.

ii) Two water well drilling rigs in each area (4 drilling rigs in total) are required in order to complete

production wells in the two area within two years, as shown in the working schedule in 3.4.6, because common use of one drilling rig for both the production well and the exploration well is impossible.

iii) Attachments have to of such a type that common use for the production, exploration, and observation wells is possible.

6.2.2.2 Air Compressor

1) Selection guideline

- i) suitable for the cleaning of holes after drilling the production well (depth 110 ∿ 150m),
- ii) suitable for the cleaning of holes of the exploration well (depth 150 ∿ 250m) and the air lift pumping test,
- iii) easily movable.

2) Specification and number

- i) of a type with a trailer, of a low pressure type with a maximum air volume for the production well, and of a high pressure type for the exploration well,

  for production well : 7kg/cm^2, 10.53m^3/min

  for exploration well : 10.5kg/cm^2, 8.5m^3/min,

- ii) *to improve the work efficiency, one air compressor* to every well drilling rig, a total of four air compressors, need to be provided.

6.2.2.3 Vehicle

1) Selection guideline

   i) water tank lorry
   ii) cargo type heavy truck
   iii) cargo type light truck

2) Specification and number

   i) a water tank lorry of 8,000ℓ capacity, and the cargo truck made by the same maker with the well drilling rig. One tank lorry is assigned to each town (two in total).

   ii) a cargo type heavy truck with crane; crane capacity of 7m and 3,500kg for loading and unloading, and the truck made by the same maker as the well drilling rig. One truck is assigned to each town (two in total).

   iii) a cargo type light truck with crane; crane and winch, more than 2,000 litre diesel engine. Two trucks are assigned to each town (four in total).

6.2.2.4 Electrical Logging Instrument

1) Selection guideline

   i) easy to measure and of an automatic recording type.
   ii) the items to be measured have to be appropriate for ground water survey.

2) Specification and number

   i) an automatic recording type electric logging instrument which can be carried by a small vehicle and analyze electric resistivity, natural voltage, γ-logging, and water temperature.

   ii) one instrument is assigned to each town (two in total).

6.2.2.5 Other Equipment Related to Well Drilling Rig

In accordance with the guideline, other equipments related to well drilling rig is selected on the basis of high drilling efficiency, high cost-effectiveness, safety and suitability to the regional conditions. The specification and number are as follows;

1) Water level meter

   i) of a portable type for the water-level observation well for pumping test. One metre to every main well and observation well (two in total, for the two areas four in total).

   ii) of a 45-days self-winding type for water level observation. Three points in each area total 6 metres for the two areas.

2) Welder

   i) of a trolley-carrying type with specification suitable for field welding. One welder to each area (two in total).

3) Water quality analyzer

   i) of a type which easily analyzes pH, electric conductivity, iron, chlorine, etc. in pumping test. One analyzer to each area (two in total).

6.2.2.6 Spare parts

The specification and number of the spare parts for the main body of the well drilling rig and the accessories for drilling are decided, based on the requirement for the two year's working term. Approximate number of these parts accounts for 15 ∿ 20% of the main body.

6.2.3 Equipment and Materials for Well

The equipment and materials for well mainly consist of materials for well, screens, pumps, power distribution facilities, and their supply parts.

6.2.3.1 Casing Pipe

The casing pipes included end pipes which are temporarily installed to prevent collapse of surface layer in drilling and casing pipes. Since the specification of the casing pipe is consistent with JIS (the Japanese Industrial Standard), any specific guideline for selection is not made, and the detailed specification and number are omitted.

1) End pipe

The end pipe, which is used for preventing degradation of surface layer, is drawn out after completion of drilling.

Specifications: carbon steel pipe with sockets (gas pipe) with screw, JIS G3452.

Diameter: 350mm, 180mm

2) Casing pipe (for production well)

The material of the casing pipe for the production well has to be of high quality because it directly affects the life of the well.

Specifications: short screw casing with couplings, API Standard J-55.

Diameter: 250mm, 200mm

3) Casing pipe (for exploration well and water-level observation well)

As the casing pipes for the exploration well and the

water-level observation well are used temporarily in almost all of the wells, the usual steel pipes are used and connected by screw sockets.

Specifications: with screw sockets, JIS G3452

Diameter: 100mm (exploration well and water-level observation well)
50mm (observation well)

6.2.3.2 Screen

1) Selection guideline

The size of the screen is determined by the analytical data of the aquifer sample screening test. Taking account of the geological conditions of the region surveyed, a 1 mm slit commonly used for sand layer was adopted.

2) Specification and number

Specification

i) pipe diameter: 200mm

ii) V-shape continuous slot, slot size 1mm

iii) stainless steel

Number: 20m in length for both areas

6.2.3.3 Pump

1) In Burma a variety of pumps are used, but a submersible motor pump was selected for the following reasons.

i) In both Magwe and Prome, electricity is available, and transformer facilities are included in this project.

ii) The submersible motor pump can cope with an anticipated water-level drop caused by pumping.

iii) Pumping head can be chosen freely according to the selected equipment.

iv) Easy maintenance and check and excellent durability.

v) Easy water-level observation is possible.

2) Specification and number

	Pumpage ℓ/min.	Pumping head m	kW	Number	Area
i)	650	80	15	17	Magwe
ii)	950	90	30	13	Prome
iii)	950	50	15	2	Prome

6.2.4 Transformer and Power-transmission Line

1) The transformer is selected based on the location of the production well and possible voltage drop resulting from the insufficient capacity of the submersible motor pump. The 11,000V power distributed to the project area will be transformed to 400V. The location of the transformers, the specification of capacity, and the number are shown in Table 6.2.4.1.

2) Power-transmission Line

The power-transmission has to perform transmitting of the secondary voltage to the location of each motor, reducing it to 400V. The required core diameter is $22mm^2$.

Length of power-transmission line:	Magwe	11,700m
	Prome	9,300m

Table 6.2.4.1 Specifications of Transformers

Area	Well No. where electricity is used	Location of transformer	Transformer capacity	Primary voltage	Secondary voltage	Number of transformer
Magwe	1 ∿ 6	Base point No.3	300kVA	11,000V	460V 440V 420V 400V	1
	7 ∿ 17	Base point No.13	500kVA	11,000V	460V 440V 420V 400V	1
	7 ∿ 11	Base point No.13	For incresing the power 10kVA			2
Prome	1 ∿ 7	Base point No.4	600kVA	11,000V	480V 460V 440V 400V	1
	8 ∿ 13	Base point No.13	600kVA	1,000V	460V 440V 420V 400V	1
	14 ∿ 15	Middle point between No.14 and No.15	100kVA	11,000V	440V 420V 400V	1

6.3 SPECIFICATION AND QUANTITY OF GRANT AID EQUIPMENT AND MATERIALS

Description of Equipment and Materials Supplied through the Grant Aid

ITEM NO.	DESCRIPTION OF EQUIPMENT AND MATERIALS	Q'TY
	TECHNICAL SPECIFICATIONS	
A.	WATER WELL DRILLING RIGS & SUPPORTING EQUIPMENT	
1.	Truck Mounted Water Well Drilling Rig, Rotary Table Type, Complete with Accessory Equipment for Production Well	2 Units
1.1	Truck Mounted Water Well Drilling Rig	2 Units

General: The rig shall be truck mounted rotary table type, driven by truck engine P.T.O. and cable of drilling 250 to 450mm up to 200 to 300 metres deep with 2-7/8" drill pipes.

Rotary Table: The rotary table, having 133mm (5-1/4") opening dia. with hydraulic retraction of clearance for running 16" casing, driven through 4 forward and 1 reverse speed transmission and spiral bevel gears.

Pull Down: Hydraulically actuated wire rope pull down of minimum stroke of 7 meters. The rig shall be equipped with holding back system for moving the pull down swivel and kelly back into the mast, away from the centre line of the hole to give clearance of minimum 350mm.

Drawworks: Single drum type with air actuated disc clutch, having spooling capacity of minimum 85m with 25mm wireline and single line pull of 4,500kg.

Sand Reel: Single drum type with air actuated disc clutch, having spooling capacity of minimum 500m with 9mm wireline and single line pull of 3,000kg.

ITEM NO.	DESCRIPTION OF EQUIPMENT AND MATERIALS	Q'TY
	Mast: Ladder type electrically welded steel tubular construction, having total gross capacity of 20,000kg and hook load capacity of 10,000 hydraulically raised and lowered.	
	Mud Pump: 5" × 5-1/8" duplex reciprocating type, having maximum delivery capacity of 600ℓ/min. and maximum pressure of $25kg/cm^2$., driven from main compound case of the rig.	
	Compound Case: Chain drive, fully enclosed, oil bath lubricated.	
	Oil Cooler: The rig shall be equipped with radiator type air cooling system for hydraulic system.	
	Rig Frame: Fabricated steel construction, covered with non-slip plates and safety guards where necessary. A pipe rack of handling approx. 15 pcs. of 2-7/8" × 6m drill pipes shall be equipped.	
	Controls: All controls, except for those not used for drilling operation, shall be located at driller's position on one side of the rig.	
	Tubing Tongs: Built-in tubing tongs used with the hydraulic breakout cylinder for breakout power. The hydraulic breakout cylinder shall be mounted inside the mast.	

ITEM NO.	DESCRIPTION OF EQUIPMENT AND MATERIALS	Q'TY
	Trucks: One, first class maker and 4 × 4 left hand steering type with cab of latest model, tyre size of 11.00 - 20 - 14 PR. The engine of the truck shall be 4 cycle, vertical 6 cylinders in line, having maximum output of 140 HP at 2,500 rpm. The truck shall be serviceable in Burma.	
	Levelling Jacks: Four hydraulic levelling jacks with safety clevis shall be fitted.	
	Lighting: The current source for the night operation lighting shall be obtained through truck engine battery.	
1.2	Standard Accessories	2 Sets
	Standard accessories for drilling rig, such as disassembling tools, 50mm × 10m long high pressure delivery hose, 100mm × 4.5m long suction hose, wire ropes, drill pipe elevator, 305mm single sheave travelling block, 3" × 26' kelly bar, drill pipe spider, screen for gravel packing, sampling sieve, etc.	
1.3	Operating Tools	2 Sets
	Operating tools, including 2-7/8" × 6m long drill pipes, 7" × 3m long drill collars, bit stabilizers for 12-1/4" and 10-5/8" drill holes, 14-3/4" three wing bits for starting, 12-1/4" and 10-5/8" three wing bits, 14-3/4" to 10-5/8" three cutter rock roller bits, various bit subs, casing handling tools, such as casing elevators, elevator links, etc. and other necessary fishing tools.	

ITEM NO.	DESCRIPTION OF EQUIPMENT AND MATERIALS	Q'TY
1.4	Miscellaneous Tools	2 Sets
	450mm to 1,200mm pipe wrenches, super tongs, other necessary engineering tools, etc.	
1.5	Supplies for Standard Accessories and Operating Tools	1 Lot
	Supplies for standard accessories and operating tools, including spare parts for swivel, hoisting and sand reel wire ropes, 2-7/8" × 6m long drill pipes, 7" × 3m long drill collars, bit stabilizers for 12-1/4" and 10-5/8" holes, 13" and 12-1/4" three wing bits, 14-3/4" to 10-5/8" three cutter rock roller bits, bit subs, hoses, miscellaneous tools, etc.	
1.6	Air List and Test Pumping Equipment	2 Sets
1.6.1	Operating Accessories for Air-Lift	2 Sets
	Operating accessories for air-lift, such as 3" × 5.5m water pipes with coupling, 3" × 3m and 3" × 1.5m long water pipes with coupling, 1" air pipes, 1" air hoses, 3" manifold assembly, 8" × 6m dart valve bailer, and other handling tools for air-lift.	
1.6.2	Test Pumping Equipment	2 Units
1.6.2.1	Electrical submersible multistage turbine pump capacity 950ℓ/min., T.D.H. 50m, 4 nos. of stage, 8" well diameter, 2,850 rpm. revolution speed, required power of 15KW, complete with pipe clamp, discharge pipes, electric starter, electrode and other necessary accessories	2 Sets

ITEM NO.	DESCRIPTION OF EQUIPMENT AND MATERIALS	Q'TY
1.6.2.2	Diesel engine generator, having rated output of 20KVA, 3 phase, rated speed of 1,500 rpm., driven by diesel engine, having displacement of 2,530 litres, brake horsepower of 26 HP rated engine speed of 1,500 rpm., electrically started, complete with non-vibrating system, anchor bolts and all necessary accessories.	2 Units
2.	Truck Mounted Water Well Drilling Rig, Complete with Drilling Accessory Equipment	2 Units
2.1	Truck Mounted Water Well Drilling Rig	2 Units
	General: The rig shall be truck mounted rotary table type, driven by truck engine P.T.O. and capable of drilling 200mm hole up to 300 metres deep with 2-7/8" drill pipes.	
	Rotary Table: The rotary table, having 133mm (5-1/4") opening dia. with hydraulic retraction of clearance for running 16" casing, driven through 4 forward and 1 reverse speed transmission and spiral bevel gears.	
	Pull Down: Hydraulically actuated wire rope pull down of minimum stroke of 7 metres. The rig shall be equipped with holding back system for moving the pull down swivel and kelly back into the mast, away from the center line of the hole, to give clearance of minimum 350mm.	
	Drawworks: Single drum type with air actuated disc clutch, having spooling capacity of minimum 85m with 25mm wireline and single line pull of 4,500kg.	

ITEM NO.	DESCRIPTION OF EQUIPMENT AND MATERIALS	Q'TY
	Sand Reel: Single drum type with air actuated disc clutch, having spooling capacity of minimum 500m with 9mm wireline and single line pull of 3,000kg.	
	Mast: Ladder type electrically welded steel tubular construction, having total gross capacity of 20,000kg and hook load capacity of 10,000, hydraulically raised and lowered.	
	Mud Pump: 5" × 5-1/8" duplex reciprocating type, having maximum delivery capacity of 600ℓ/min. and maximum pressure of 25kg/cm^2, driven from main compound case of the rig.	
	Compound Case: Chain drive, fully enclosed, oil bath lubricated.	
	Oil Cooler: The rig shall be equipped with radiator type air cooling system for hydraulic system.	
	Rig Frame: Fabricated steel construction, covered with non-slip plates and safety guards where necessary. A pipe rack of handling approx. 15 pcs. of 2-7/8" × 6m drill pipes shall be equipped.	
	Controls: All controls except for those not used for drilling operation shall be located at driller's position on one side of the rig.	
	Tubing Tongs: Built-in tubing tongs used with the hydraulic breakout cylinder for breakout power. The hydraulic breakout cylinder shall be mounted inside the mast.	

ITEM NO.	DESCRIPTION OF EQUIPMENT AND MATERIALS	Q'TY
	Trucks: First class maker's one and 4 × 4 left hand steering type with cab of latest model, tyre size of 11.00 - 20 - 14 PR. The engine of the truck shall be 4 cycle, vertical 6 cylinders in line, having maximum output of 140 HP at 2,500 rpm. The truck shall be serviceable in Burma. Levelling Jacks: Four hydraulic levelling jacks with safety clevis shall be fitted. Lighting: The current source for the night operation lighting shall be obtained through truck engine battery.	
2.2	Standard Accessories Standard accessories for the drilling rig, including disassembling tools, 50mm × 10m high pressure delivery hose, 50mm intermediate hose, mixing and return hose, 100mm × 4.5m suction hose, hoisting and sand reel wire ropes, 2-7/8" drill pipe elevator, 305mm single sheave travelling block, 3" × 26' kelly bar, 2-7/8" drill pipe spider and other necessary lowering and lifting equipment.	2 Sets
2.3	Operating Tools Operating tools, including 2-7/8" × 6m long drill pipes, 5" × 3m long drill collars, bit stabilizers for 5-1/4" hole, 115mm × 3m long wing type guide rods, 8-1/2" three wing bits for starting, 6-1/4" and 4-3/4" three wing	2 Sets

ITEM NO.	DESCRIPTION OF EQUIPMENT AND MATERIALS	Q'TY
	bits and three cutter rock roller bits, various bit subs, casing handling tools such as casing elevators, elevator links, etc. and fishing tools.	
2.4	Miscellaneous Tools 1,200mm to 450mm pipe wrenches, super tong, engineering tools, etc.	2 Sets
2.5	Supplies for Standard Accessories and Operating Tools Including spare parts for swivel, hoisting and sand reel wire ropes, 2-7/8" × 6m long drill pipes, 5" × 3m long drill collars, bit stabilizers for 6-1/4" hole, 115m × 3m long wing type guide rods, 8-1/2" three wing bits for starting, 6-1/4" and 4-3/4" three wing bits and three cutter rock roller bits, various subs, high pressure delivery hoses, suction hoses and other necessary hoses, miscellaneous tools, etc.	1 Lot
2.6	Air-lift Equipment	2 Sets
2.6.1	Operating Accessories for Air-lift Operating accessories for air-lift, such as 3" × 5.5m, 3m and 1.5m long water pipes with coupling, 1" × 5.5m, 3m, 1.5m long air pipes with coupling, 1" air hoses, 3" manifold assembly, 6" × 6m dart valve bailers, and other necessary handling tools for air-lift.	2 Sets

ITEM NO.	DESCRIPTION OF EQUIPMENT AND MATERIALS	Q'TY
3.	Trailer Mounted Portable Air Compressor	2 Units
3.1	Air compressor, rotary sliding vane type, single-stage, portable engine compressor with tyre wheels, working pressure of 7kg/cm^2, actual free air delivery of 10.5m^3/min., rated speed of 1,800 rpm., driven by a water-cooled diesel engine of 110 PS at 1,800 rpm., complete with 0.315m^3 capacity separator receiver.	2 Units
3.2	Air compressor, screw type, single stage, portable engine compressor with tyre wheels, working pressure of 10.50kg/cm^2, actual free air delivery of 8.5m^3, rated speed of 1,500 rpm., driven by a water-cooled diesel engine of 110 PS at 1,800 rpm., complete with 0.315m^3 capacity separated receiver.	8 Units
4.	Cargo Type Heavy and Light Trubk with Crane, and Tank Lorry .	8 Units
4.1	Cargo Type Heavy Truck with Crane	2 Units
	The truck shall be of same as rig carrier truck. The truck shall be standard cargo type, left hand drive, 4 × 4, having G.V.W. rating of 13,700kg, max. speed of 83kg/h., max. gradeability of 46.9%, min. turning radius of approx. 9,700mm. The truck shall be driven by a diesel engine of 4 cycle, vertical 6 cylinders, in-line, valve-in-head, water-cooled, max. output of 140 HP at 2,500 rpm., precombustion chamber type combustion system. The truck shall be equipped with hydraulically controlled dry single plate with damper spring	

ITEM NO.	DESCRIPTION OF EQUIPMENT AND MATERIALS	Q'TY
	type clutch, five-speed transmission, two-speed constant mesh with herical gearings transfer, full-floating single-reduction single speed rear axle of 9,200kg axle capacity, 4,550kg capacity front axle, 11.00 - 20 - 14 PR tyres, 115 litres single fuel tank, welded all steel construction cab, necessary electrical equipment. The crane of truck shall be HIAB type with double telescoping hydraulic extension boom, lifting capacity of 3,500kg at 7m, hydraulic standard reach of 5.0m and hydraulic extension boom travel of 1.6m.	
4.2	Cargo Type Light Truck with Crane The truck shall be standard cargo type, left hand drive, more than 2,000 litre diesel engine of cycle, vertical 4 cylinder.	4 units
4.3	Tank Lorry for Water The truck shall be of same as rig carrier truck. The truck shall be standard cargo type, left hand drive, 4 × 4, having G.V.W. rating of 13,700kg, maximum speed of 83kg/h., maximum gradeability of 46.9% minimum turning radius of approx. 9,700mm. The truck shall be driven by a diesel engine of 4 cycle, vertical 6 cylinders, in-line, valve-in-head, water-cooled, maximum output of 140 HP at 2,500rpm., precombustion chamber type combustion system. The truck shall be equipped with hydraulically controlled dry single plate with damer spring type clutch, five-speed transmission, two-speed constant mesh with herical gearings transfer, full-floating single-reduction single speed rear	2 Units

ITEM NO.	DESCRIPTION OF EQUIPMENT AND MATERIALS	Q'TY
	axle of 9,200kg axle capacity, 4,550kg capacity front axle, 11.00 - 20 - 14 PR tyres, 115 litres single fuel tank, welded all steel construction cab, necessary electrical equipment. The water tank mounted on the truck shall be ellipse sectional cylindrical type, protected against axidation, tank volume of 8,054 litres, maximum loading capacity of 7,500 litres, inside length of 4,160mm, inside major axis of 2,200mm, inside minor axis of 1,150mm, thickness of shell of 3.2mm. The truck also shall be equipped with self-priming pump, driven by transmission P.T.O., having capacity of 300 liters min. at 3,600rpm. and pressure of 3.0kg/cm^2.	
5.	Water Testing Equipment	1 Unit
5.1	Well Logging Equipment The well logging equipment shall be light weight and compact enable to log S.P. caliper, temperature, and natural gamma-ray. Each logging shall be performed by replacing measuring module and sonde with applicable combination, complete with necessary accessories to maximum depth of 300 metres.	2 Units
5.2	Portable Water Analysis Laboratory Kit	2 Units
5.3	Water Level Indicator with Self Recording System The instrument shall detect changes in water level of ground water in the well and shall record them on a strip chart by co-axial 2 pens for a long period, having accuracy of	6 Sets

ITEM NO.	DESCRIPTION OF EQUIPMENT AND MATERIALS	Q'TY
	0.1% of maximum measuring depth, 2 pen recording system, feeding speed of 18mm/h for 45 days or 6mm/h for 100 days selectable by gear sliding, input shaft of 1m per 1 rotation, circumference of 1 metres co-axial pulley, power source from 1 pc. of UM-2 dry cell, complete with float and wire.	
5.4	Portable Water Level Indicator	4 Sets
	The instrument shall take an accurate measurement of the water level in the well and shall never work when the electrode touch the well casing or drips of water from the upper strainer while lowering it into the well, having measuring depth of 100m, accuracy of 1mm, operating range of 0 - 300KΩ of earthing resistance, power source from 2 pcs. of UM-3 dry cell, complete with an electrode and ground cord.	
6.	Other Supporting Equipment	1 Lot
6.1	Welding Equipment	2 Units
	The welding equipment shall be trolly mounted diesel engine drive D.C. arc welder and A.C. power, having non-load voltage of 60 - 80V, arc voltage of 25V, duty cycle of 40%, current range of 50 - 200A for D.C. welder and rated of 100 - 200V, single phase, 100% power factor, rated speed of 3,000 rpm. The unit shall be driven by 11 PS at 3,000 rpm. water-cooled diesel engine, complete with necessary accessories.	

ITEM NO.	DESCRIPTION OF EQUIPMENT AND MATERIALS	Q'TY
7.	Spare Parts and Supplies (Approx. 15%)	1 Lot
7.1	Spare Parts for Drill Rig	1 Lot
7.1.1	Spare Parts for Drill Unit (for 4 sets)	1 Lot
7.1.2	Spare Parts for Mud Pump (for 4 sets)	1 Lot
7.1.3	Spare Parts for Truck (for 8 sets)	1 Lot
7.1.4	Spare Parts for Lighting Set (for 4 sets)	1 Lot
7.2	Spare Parts for Air-Compressor, Rotary Type (for 2 sets)	1 Lot
7.3	Spare Parts for Air-Compressor, Screw Type (for 2 sets)	1 Lot
7.4	Spare Parts for Submersible Pump and Diesel Generator	1 Lot
7.4.1	Spare Parts for Submersible Motor Pump (for 2 sets)	1 Lot
7.4.2	Spare Parts for Diesel Generator (for 2 sets)	1 Lot
7.5	Spare Parts for Welder (for 2 sets)	1 Lot
7.6	Spare Parts for Electric Logging Equipment	1 Lot
7.7	Spare Parts for Water Level Indicator with Self Recording System	1 Lot
7.8	Spare Parts for Portable Water Level Indicator	1 Lot
7.9	Spare Parts for Electric Submersible Pump for Production Wells	1 Lot
7.10	Spare Parts for Transformer (for 4 Sets)	1 Lot

ITEM NO.	DESCRIPTION OF EQUIPMENT AND MATERIALS	Q'TY
B.	WATER WELL MATERIALS	
1.	Well Casings	
1.1	350mm temporary casing with screw and socket, JIS 3452 SGP for production wells	40 Metres
1.2	175mm temporary casing with screw and socket, JIS 3452 SGP for exploratory and observation wells	40 Metres
1.3	10-3/4" API casing pipe with coupling, 273mm O.D., 8.89mm thickness, 255.2mm I.D., J-55	1,280 Metres
1.4	8-5/8" API casing pipe with coupling, 219.1mm O.D., 772mm thickness, 203.7mm O.D., J-55	2,200 Metres
1.5	100mm casing pipe with screw and socket, 114.3mm O.D., 4.5mm thickness, 105.3mm I.D., JIS 3452 SGP	3,670 Metres
1.6	100mm strainer pipe with screw and socket, 114.3mm O.D., 4.5mm thickness, 105.3mm I.D., JIS 3452 SGP, opening area, approx. 4% slot size 1.5mm	480 Metres
1.7	50mm casing pipe with screw and socket, 60,5mm O.D., 3.8mm thickness 52.9mm I.D., JIS 3452 SGP	7,810 Metres
1.8	50mm strainer pipe with screw and socket, 60.5mm O.D., 3.8mm thickness, 52.9mm I.D., JIS 3452 SGP, opening are approx. 4% slot size 1.5mm	1,240 Metres

ITEM NO.	DESCRIPTION OF EQUIPMENT AND MATERIALS	Q'TY
2.	Well screen, size 8-5/8" with coupling stainless with V-shaped continuous slot. Opening area shall be approx. 20% and slot size shall be 1mm.	640 Metres
3.	Electrical Submersible Multistage Turbine Pump	32 Units
3.1	Capacity 650ℓ/min., T.D.H. 80m	17 Units
	(Specifications)	
A)	Pump Specifications	
	Type: Submersible motor pump shall have built-in thrust bearing which can stand up to double expected load.	
	No. of stages: 8	
	Well diameter (I.D.): 10"φ (250mm)	
	Discharge bore size: 65mm	
	Discharge capacity: 650ℓ/min.	
	Total dynamic head: 70m	
	Revolution speed: 2,850 rpm.	
	Red. power: 15KW	
	Liquid pumped: Water	
B)	Material Construction of Pump Main Parts	
	Casing: Cast iron	
	Impeller: Bronze	
	Shaft: Stainless steel	
	Sleeves: Bronze	
	Bearings (Bush): Bronze	

ITEM NO.	DESCRIPTION OF EQUIPMENT AND MATERIALS	Q'TY
C)	Submersible Motor	
	Type: Wet type water filled submersible motor.	
	Voltage × phase × cycle: 400V × 3ph. × 50Hz	
	No. of poles: 2	
	Insulation class: E	
	Starting method: Star-delta starting	
	Submersible electrical cable :2 nos. (Cores × 3.5mm sq. 85m length)	
D)	Accessories (per pump)	
	Pipe clamp w/90° bend pipe	1 set
	Discharge pipe	80 pcs.
	Electric starter	1 set
	Wall-mounting type, indoor use star-delta starting	
	Equipped with following;	
	Magnetic contacts (Thermal relay, overload, single phase protection)	
	Low voltage protection	
	Ammeter, pilot lamp, push button switch (on off)	
	Water level relay, control panel.	
	Electrode for stopping the pump at low water level	1 set
	Slide valve	1 pc.
	Check valve	1 pc.
	Compound gauge (w/cock)	1 pc.
	Cable clamp (5.5 length)	1 pc.

ITEM NO.	DESCRIPTION OF EQUIPMENT AND MATERIALS		Q'TY
3.2	Capacity, 950ℓ/min., T.D.H. 90mm		13 Units
	(Specifications)		
A)	Pump Specification		
	Type:	Submersible motor pump shall have built-in thrust bearing which can stand up to double expected load.	
	Number of stages:	4	
	Well diameter:	10"ϕ (250mm)	
	Discharge bore size:	100mm	
	Discharge capacity:	950ℓ/min.	
	Total dynamic head:	90m	
	Revolution speed:	2,850 rpm.	
	Req. power:	30KW	
	Liquid pumped:	Water	
B)	Materials Construction of Pump Main Parts		
	Casing:	Cast iron	
	Impeller:	Bronze	
	Shaft:	Stainless steel	
	Sleeves:	Bronze	
	Wearing ring:	Bronze	
	Bearing (Bush)	Bronze	
C)	Submersible Motor		
	Type:	Wet type water filled submersible motor.	
	Voltage × phase × cycle:	400V × 3ph. × 50Hz	

ITEM NO.	DESCRIPTION OF EQUIPMENT AND MATERIALS	Q'TY
	No. of poles: 2	
	Insulation class: E	
	Starting method: Star-delta starting	
	Submersible electrical cable: 2 nos. (Cores × 8mm sq. × 3 phase 95m)	
D)	Accessories	
	Pipe clamp w/90° bend pipe 1 set	
	Discharge pipe 90 pcs.	
	Electric starter 1 set	
	Well-mounting type, indoor use Star-delta starting	
	Equipped with following;	
	Magnetic contactors (Thermal relay, overload, single phase protection)	
	Low voltage protection	
	Ammeter, pilot lamp, push button switch (on off)	
	Water level relay, control panel	
	Electrode for stopping the pump at low water level 1 set	
	Slide valve 1 pc.	
	Check valve 1 pc.	
	Compound gauge (w/cock) 1 pc.	
	Cable clamp (5.5 length) 1 pc.	
3.3	Capacity 950ℓ/min., T.D.H. 50m	2 Units
	(Specifications)	
A)	Pump Specifications	
	Type: Submersible motor pump shall have built-in thrust bearing	

ITEM NO.	DESCRIPTION OF EQUIPMENT AND MATERIALS		Q'TY
		which can stand up to double expected load.	
	No. of stages:	6	
	Well diameter:	10"ϕ (250mm)	
	Discharge bore size:	100mm	
	Discharge capacity:	950ℓ/min.	
	Total dynamic head:	50m	
	Revolution speed:	2,850 rpm.	
	Req. power:	15KW	
	Liquid pumped:	Water	
B)	Materials Construction of Pump Main Parts		
	Casing:	Cast iron	
	Impeller:	Bronze	
	Shaft:	Stainless steel	
	Sleeves:	Bronze	
	Wearing ring:	Bronze	
	Bearing (Bush):	Bronze	
C)	Submersible Motor		
	Type:	Canned type, water filled submersible motor.	
	Voltage × phase × cycle:	400V × 3ph. × 50Hz	
	Number of poles:	2	
	Insulation class:	E	
	Starting method:	Star-delta starting	
	Submersible electrical cable: (Cores × 5.5mm sq. × 3 phase:	2 numbers 55m)	

ITEM NO.	DESCRIPTION OF EQUIPMENT AND MATERIALS		Q'TY
D)	Accessories		
	Pipe clamp, w/90° bend pipe	1 set	
	Discharge pipe	50 m	
	Electric starter	1 set	
	Wall-mounting type, indoor use star-delt starting		
	Equipped with following;		
	Magnetic contactors (Thermel relay, overload, single phase protection)		
	Low voltage protection		
	Ammeter, pilot lamp, push button switch (on off)		
	Water level relay, control panel		
	Electrode for stopping the pump at low water level	1 set	
	Slide valve	1 pc.	
	Check valve	1 pc.	
	Compound gauge (w/cock)	1 pc.	
	Cable clamp (5.5 length)	1 pc.	
4.	Delivery Pipes and Fittings, etc.		1 Set
5.	Transformer and Electric Wire		7 Units
5.1	Capacity 300KVA for No. 16 Wells in Magwe		1 Unit
	General:	Standard on transformer shall be according to JEC-204 (1978)	
	Type:	Oil bath, lubricated.	
	Rated capacity:	300KVA	
	Number of phases:	3	
	Frequency:	50Hz	
	Coiling:	First coil: Delta Second coil: Star	

ITEM NO.	DESCRIPTION OF EQUIPMENT AND MATERIALS		Q'TY
	Insulation:	Type E	
	Input voltage:	11,000V	
	Output voltage:	460V, 440V, 420V, 400V	
	Dimensions:	(H) 1,635 × (W) 1,520 × (L) 985mm	
	Approx. weight:	2,440kg	
5.2	Capacity 500KVA for No. 7-17 Wells in Magwe		1 Unit
	General:	Standard on transformer shall be according to JEC-204 (1978)	
	Type:	Oil bath, lubricated	
	Rated capacity:	500KVA	
	Number of phases:	3	
	Frequency:	50Hz	
	Coiling:	First coil; Star Second coil; Delta	
	Insulation:	Type A	
	Input voltage:	11,800V	
	Output voltage:	460V, 440V, 420V, 400V	
	Dimensions:	(H) 1,785 × (W) 1,520 × (L) 1,115mm	
	Approx. weight:	2,980kg	
5.3	Capacity 10KVA for No. 7 & 11 Wells in Magwe for Raising the Voltage		2 Units
	General:	Standard on transformer shall be according to JEC-204 (1978)	
	Type:	Oil bath, lubricated	
	Rated capacity:	100KVA	
	Number of phases:	3	

ITEM NO.	DESCRIPTION OF EQUIPMENT AND MATERIALS		Q'TY
	Frequency:	50Hz	
	Coiling:	First coil; Star Second coil; Delta	
	Insulation:	Type A	
	Dimensions:	(H) 680 × (W) 550 × (L) 460mm	
	Approx. Weight:	160kg	
5.4	Electric Wire, Beare conductor Wire and Insulaters 3 core, $22mm^2$ for Magwe		11,700 Meters
5.5	Capacity 600KVA for No. 1 ∿ 17 Wells in Prome		1 Unit
	General:	Standard on transformer shall be according to JEC-204 (1978)	
	Type:	Oil bath, lubricated	
	Rated capacity:	600KVA	
	Number of phases:	3	
	Frequency:	50Hz	
	Coiling:	First coil; Star Second coil; Delta	
	Insulation:	Type A	
	Input voltage:	11,000V	
	Output voltage:	480V, 460V, 440V, 420V, 400V	
	Dimensions:	(H) 1,785 × (W) 1,560 × (L) 1,205mm	
	Approx. weight:	3,160kg	
5.6	Capacity 600KVA for No. 8 ∿ 13 Wells in Prome		1 Unit
	General:	Standard on transformer shall be according to JEC-2041 (1978)	
	Type:	Oil bath, lubricated	

ITEM NO.	DESCRIPTION OF EQUIPMENT AND MATERIALS		Q'TY
	Rated capacity:	600KVA	
	Number of phases:	3	
	Frequency:	50Hz	
	Coiling:	First coil; Star Second coil; Delta	
	Insulation:	Type A	
	Input voltage:	11,000V	
	Output voltage:	460V, 440V, 420V, 400V	
	Dimensions:	(H) 1,785 × (W) 1,560 × (L) 1,205	
	Approx. weight:	3,160kg	
5.7	Capacity 100KVA for No. 14 ∿ 15 in Prome		1 Unit
	General:	Standard on transformer shall be according to JEC-204 (1978)	
	Type:	Oil bath, lubricated	
	Rated capacity:	100KVA	
	Number of phases:	3	
	Frequency:	50Hz	
	Coiling:	First coil; Star Second coil; Delta	
	Insulation:	Type A	
	Input voltage:	11,000V	
	Output voltage:	440V, 420V, 400V	
	Dimensions:	(H) 1,385 × (W) 890 × (L) 1,165mm	
	Approx. weight:	1,280KVA	

ITEM NO.	DESCRIPTION OF EQUIPMENT AND MATERIALS		Q'TY
5.8	Electric Wire, Bear Copper Conductor Wire and Insulater 3 Core, 22mm^2 for Prome		9,300 Metres
C.	Water Distribution System		1 Lot
1.	Ductile Iron Pipe		
1.1	φ150mm	TYPE A-1	3,200 Metres
1.2	φ200mm	"	6,750 Metres
1.3	φ250mm	"	4,150 Metres
1.4	φ300mm	"	2,250 Metres
1.5	φ350mm	"	100 Metres
2.	Air Valve	φ13	20 Units
3.	Sluice Valve		
3.1	φ150mm		17 Units
3.2	φ200mm		15 Units
3.3	φ250mm		2 Units
3.4	φ350mm		2 Units
4.	Specials (Reducer, Tee, Bend, and Others)		1 Set

A WATER WELL DRILLING RIGS & SUPPORTING EQUIPMENT

B WATER WELL MATERIALS

C WATER DISTRIBUTION SYSTEM

Total

CHAPTER 7 EFFECTS OF THE PROJECT

CHAPTER 7 EFFECTS OF THE PROJECT

1) This project, if completed, will be of a capacity large enough to supply sufficient service water to about 61,000 people in Magwe and about 67,000 in Prome every day. The volume of water to be supplied also will largely increase to the projected 195 litres capita per day from the present level of scores of ℓpcd.

2) The shortage of drinking water is a stumbling block to urban development, and this project, on successful completion, will encourage the start of further action to supply more drinking water to many other urban areas.

3) It is highly probable that the construction equipment and material provided through the Japanese Government in grant aid will contribute not only to the latest project, but also to other similar water projects in Burma.

4) Conventional service water supply in Magwe and Prome has been operating at capacities far below the residents' needs for drinking water, and a majority of the population of the two towns depended to a great extent on bullock carts for the water they drink.

   Much of such water has been supplied in oil drums by bullock cart dealers who pump up water from the Irrawaddy River. Prices range from 2 to 3 kyats per 181.8-litre drum in areas in the neighbourhood of the source and about 6 kyats in distant districts.

   They are equal to 90.9 litres per kyat in the areas close to the river and 30.3 litres per kyat in those far from it. With the water charge in the capital of Rangoon being 4 kyats for every 4.5 cubic metres, the city's average purchase of bullock cart water stands at 1,125 litres per kyat.

The comparative water rates are shown in the table below:

Purchasing cost

Water source / Purchasing cost		Volume of purchased water (ℓ/k)	Ratio of purchased water in all drinking water used	Expenditure for drinking water for a family of seven (kyats/month)	
				30ℓ/d	195ℓ/d
Purchased water from bullock cart dealer (surface water and others)	Nearby areas	90.9	8.1	69	448
	Distant areas	30.3	2.7	208	1,352
Current service water used in Rangoon		1,125.0	100	6	39

For an average family using about 20 cubic metres of drinking water a month, the cost for water from such dealers is somewhere between 200 kyats and 600 kyats per month in future. In Rangoon, it averages about 17.8 kyats a month.

Therefore, once the new drinking water supply facilities are completed and water charges in urban areas are cut down to the level equal to the rate in the Rangoon, the cost for water will be reduced by 1/10 to 1/30 ensuring a great saving for the urban population in expenditure for drinking water.

5) There has been a high prevalence of enteritis, diarrhoea and typhoid fever, among people who have made it a practice of buying and using the surface water of the Irrawaddy River. This situation will certainly greatly improve with the use of the purer service water from underground

6) Restrictive efforts against use of the high price purchased water would produce significant improvement in public hygiene, with a marked decrease in the prevalance of eye and other diseases, by encouraging the residents to wash their tableware and hands regularly, through the availability of cheaper and purer system water.

7) In Magwe and Prome, the profitability of public investment in service water facilities at present is shown below. At the

existing facilities, the favourable balance is considered a plus factor.

Town	Magwe	Prome
Profit from water charge (Kyats/year)	+130,928,00	+408,467,00
Cost for service water (Kyats/year)	-101,332,00	-221,077,00
Net profit	+ 29,596,00	+187,390,00

(Source: Burma Government)

To forecast the profitability of this project is not easy, because of many uncertain factors, but it is considered highly probable that the project, when completed, will bring about great public benefits, as has been the case with the existing service water systems.

8) Demand for industrial water is presently nil, or no such requirements had been forecast for the future, but when a full-scale service water supply system is furnished, it will be possible to invite new industries, thus promoting town development and stimulating the efforts to develop towns with a lot of ripple effects.

9) In many towns in Burma, service water facilities are not full-fledged now and there are many cases where the greater part of a town is reduced to ashes in a fire, and as such, it is an urgent task to make available water for fire-fighting at any moment, and to install hydrants in city areas for the benefit of a stable social life.

When viewed from the standpoint of city planning, built-up service water supply systems will prompt the residents to move from old city centres to newly developed districts and will also

promote the settlement of people who have drifted in from other areas, eventually contributing to the execution of town planning.

10) The establishment of these water supply systems in Magwe and Prome will deprive water dealers of their jobs and prompt them to switch to other employment. Also, the coverage of the entire town under this system will make it necessary to retain a considerable number of full-time and part-time workers for construction and it operation and maintenance of the system and it is possible to fully absorb manpower as the tone of business will be boosted by the new water system.

CHAPTER 8 PROBLEMS WITH THIS PROJECT

CHAPTER 8 PROBLEMS WITH THIS PROJECT

In both Magwe and Prome, this water supply project entails the following problems:

1) Project for public water supply system through ground water development

   i) Magwe: We worked out programmes to relocate productive wells for the projected areas of production wells and other areas in it and had service water facility construction plans drawn up.

      It was predicted, after investigation, that some production wells will have to be relocated, forcing us to reorganize the facility construction programmes. Special consideration should be given to this point on organizing detailed engineering procedures.

   ii) Prome: The relief of aquiclude-impermeable bed in the Prome area is so hard that electrical prospecting is unable to provide enough useful details. Under these circumstances, planning for this area should be performed in accordance with the results of the examinations of the exploration wells as in Magwe.

2) Well drilling and water facilities

   Under this project, we plan to complete drilling wells and the constructions of related facilities within two years, and distribution pipe line system are to be constructed within three years. All other facilities are scheduled to be completed in accordance with these procedures.

   However, as the project is to be finished in 10 years (1991), drilled wells and facilities will be left unused for about seven years, even after they are completed.

3) Maintenance

Since the life span of a facility is closely linked to the methods of operation and maintenance, appropriate steps should be taken with facilities that may be left idle for a long period of time.

4) Problems with existing facilities

i) Magwe: Part of the existing service water supply systems and facilities in Magwe, including the source and some pipes, will be used as they are, under the new system. The source is the surface water of the Irrawaddy River, but the facilities for treatment of the river water are not yet complete. Part of the town, therefore, will be supplied with a mixture of the Irrawaddy's water and ground water, which will deprive the residents of the chance to get high-quality ground water. To cope with this situation, the water treatment facilities should be upgraded immediately to comply with the standards for water quality.

ii) Prome: The repair and expansion of the existing water supply system will be done by the municipality and those in other areas will be carried out under the Prome Project. For this reason, the water quality may presumably be different. There is a need to process fully the water treatment of the existing water supply facilities for which the surface river water is used as the water source, and work out a system whereby water may be mutually supplied to both areas.

5) Problems with water supply projects in the future

i) Magwe: The town of Magwe now plans to develop another new area in the eastern part of the present new town centre, but it is far from the district of production wells. The water source issue will have to be taken into consideration.
When the ground water development procedures under the current project are discussed.

ii) Prome: Though the target year of this project is set at 1991, it is expected that there will be a sizeable concentration of population in the southern area after that year. However, the development of ground water in the southern area alone would be inadequate to cope with the increased population. There would presumably arise a need for the development of ground water in the northern area, where distribution of ground water conservancy is hydrogeologically more favorable.

APPENDIX

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APPENDIX 1

GENERAL DOCUMENTS

A-1.1

BURMA: URBAN WATER SUPPLY DEVELOPMENT PROJECT

MINUTES OF DISCUSSION

In response to the request by the Government of the Socialist Republic of the Union of Burma (GOB) for the provision of equipment and materials necessary for the Urban Water Supply Development Project (the Project), the Government of Japan (GOJ) has dispatched a Mission, through the Japan International Cooperation Agency (JICA) the official executing agency of the Japanese technical and economic cooperation programs, to carry out a basic design study of the Project (the Study) from 28 July to 12 September 1981.

The Mission visited the Project area and also had a series of discussions with agencies concerned of the GOB including the Foreign Economic Relations Department (FERD) under the Ministry of Planning and Finance, the General Affairs Department (GAD) and the Rangoon City Development Committee under the Ministry of Home and Religious Affairs, the Agricultural Mechanization Department under the Ministry of Agriculture and Forests, the Department of Meteorology and Hydrology under the Ministry of Transport and Communications and the Housing Department and the Construction Corporation under the Ministry of Construction. Both parties agreed with the major points of discussion included as Annex 1 to these Minutes, subject to further review and consideration of their respective Governments toward the realization of the Project.

Rangoon 11 August, 1981.

FOR THE GOVERNMENT OF THE SOCIALIST REPUBLIC OF THE UNION OF BURMA	FOR THE JICA MISSION
U TIN TUT Director-General General Affairs Department Ministry of Home and Religious Affairs	KAZUHISA MATSUOKA Leader JICA Mission

A-1.2 MAIN POINTS OF DISCUSSION

1. JICA will carry out the Study in Prome and Magwe in line with the Inception Report attached to these Minutes as Annex 2.
2. To make the Study successful, the GOB shall provide the Mission with the future land use plan, the proposed 4th Four-Year Plan of the Prome Township Development Committee and also the road and electricity development plan of Prome by 22 August 1981.
3. The GOJ's contribution to the Project after the Study will be to provide major equipment and materials necessary for the implementation of the Project in Prome and Magwe, if the GOJ approves the grant aid to the Project on the basis of the result of the Study.
4. The GOB put the following priorities on equipment and materials which will be provided by the GOJ:-
    1) Equipment for drilling;
    2) Equipment and materials for deep wells; and
    3) Pipes for water distribution system.
5. Equipment and materials will be delivered at a port in Japan.
6. The GOB will take the following measures on condition that the grant aid by the GOJ will be extended to the Project:-
    1) to carry out detailed engineering for the construction of the water distribution system;
    2) to secure lands necessary for the implementation of the Project; and
    3) to make budgetary arrangements necessary for the local expenditure on the Project.
7. The implementing agency of the Project will be the General Affairs Department of the Ministry of Home and Religious Affairs.

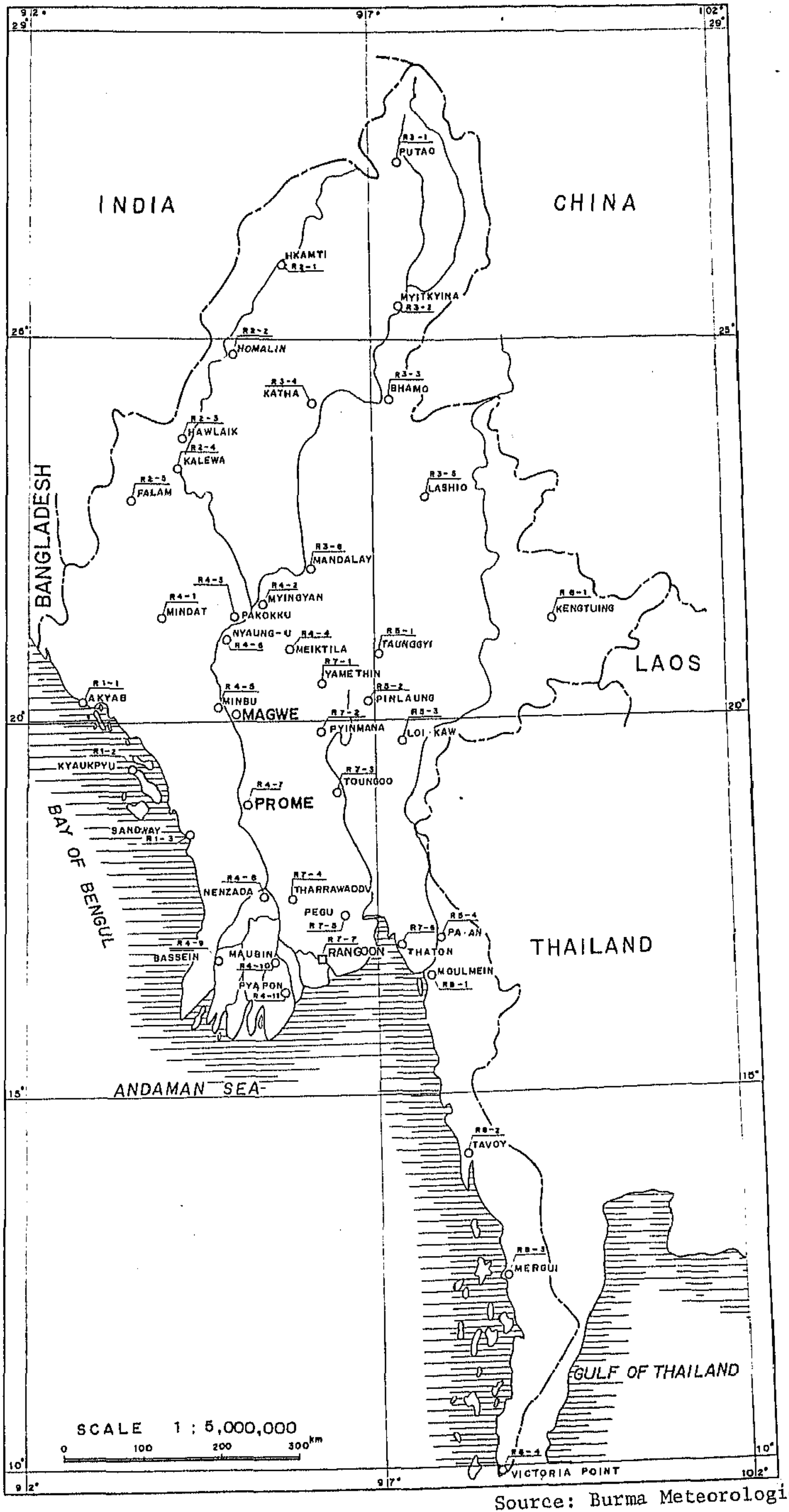
A-1.3 LIST OF MEMBERS OF JICA MISSION

Kazuhisa MATSUOKA	LEADER
Taijiro KONISHI	TECHNICAL LEADER, HYDROGEOLOGIST
Suenori ISAYAMA	WATER SUPPLY ENGINEER
Haruo KOBAYASHI	ELECTRIC PROSPECTING SPECIALIST
Takeshi SHIRANE	WATER WELL DRILLING SPECIALIST

A-1.4 LIST OF BURMES STAFFS CONCERNED

U Tin Tut	Director-General, General Affairs Department, Ministry of Home and Religious Affairs
U Seo Myint	Director, General Affairs Department, Ministry of Home and Religious Affairs
U Aung Shwe	Deputy Director, General Affairs Department, Ministry of Home and Religious Affairs
U Tin Hla	Same as above
U Aung Chan Tha	Assistant Director, General Affairs Department, Ministry of Home and Religions Affairs
U Thein Myint	Director-General, Foreign Economic Relations Department, Ministry of Planning & Finance
U Myint Htu	Chief of Section, Foreign Economic Relations Department, Ministry of Planning & Finance
U Aung Ba	Deputy Director, Agriculture Mechanization Department, Ministry of Agriculture and Forests
U Hla Tin	Deputy Director, Meteorology & Hydrology Department, Ministry of Transport and Communications (Water & Sanitation Corporation)
U Aung Kywe	Staff Officer, Ministry of Construction
U Kyaw Thein	Deputy Director, Housing Department, Ministry of Construction
U Hla Pe	Same as above
U Soe Hlaing	Manager, Pugyi Project, Rangoon City Development Committee (R.C.D.C.)
Lt. Colonel Maung Maung	Thone, Chief Executive Officer R.C.D.C
U Percy Lao	Head of Department, Water & Sewerage, R.C.D.C (now in W.H.O Sri Lanka)
U Thein Tan	Head of Department of Water and Sewerage R.C.D.C.
U Thein Naing	Deputy Head of Department of Water and Sewerage, R.C.D.C.

A－1・5 RAINFALL GAUGING STATION



Source: Burma Meteorological
Department

A-1.6 RAINFALL RECORD IN BURMA (NO. 1)

STATION NO.	LOCATION	ALTITUDE (m)	CO-ORDINATES		AVE. ANNUAL RAINFALL(mm)	MAX. ANNUAL RAINFALL(mm)	MINI. ANNUAL RAINFALL(mm)
			LATITUDE	LONGITUDE			
R1-1	AKYAB	5.49	N20°-08'	E92°-53'	5153 (60 years of record)	8219 (1918)	3064 (1951)
R1-2	KYAUKPYU	4.88	N19°-25'	E93°-33'	4723 (30 ")	5633 (1926)	3005 (1977)
R1-3	SANDWAY	10.97	N18°-28'	E94°-25'	5437 (76 ")	6933 (1918)	4301 (1912)
R2-1	HKAMTI	146.00	N26°-00'	E95°-42'	3939 (13 ")	5096 (1961)	2770 (1972)
R2-2	HOMALIN	131.00	N24°-52'	E94°-55'	2396 (46 ")	3119 (1971)	1015 (1972)
R2-3	MAWLAIN	114.00	N23°-38'	E94°-25'	1851 (10 ")	2363 (1938)	824 (1925)
R2-4	KALEWA	109.00	N23°-12'	E94°-18'	1701 (30 ")	1986 (1973)	1343 (1969)
R2-5	FALAM	1555.00	N22°-55'	E93°-41'	1969 (44 ")	2042 (1973)	1102 (1954)
R3-1	PUTAO	409.00	N27°-20'	E97°-25'	3984 (17 ")	4716 (1971)	3450 (1960)
R3-2	MYITKYINA	145.00	N25°-22'	E97°-24'	2142 (45 ")	3153 (1964)	1284 (1909)
R3-3	BHAMO	111.00	N24°-16'	E97°-12'	1855 (55 ")	2477 (1910)	1276 (1969)
R3-4	KATHA	94.00	N24°-10'	E96°-20'	1517 (53 ")	2176 (1959)	910 (1972)
R3-5	LASHIO	856.00	N22°-56'	E97°-45'	1570 (45 ")	2393 (1927)	1020 (1972)
R3-6	MANDALAY	78.00	N21°-59'	E96°-06'	871 (50 ")	1252 (1973)	493 (1924)

SOURCE: HYDROLOGICAL ANNUAL VO-2 BURMA METEOROLOGICAL DEPARTMENT

A-1.6 RAINFALL RECORD IN BURMA (NO. 2)

STATION NO..	LOCATION	ALTITUDE (m)	CO-ORDINATES		AVE. ANNUAL RAINFALL(mm)	MAX. ANNUAL RAINFALL(mm)	MINI. ANNUAL RAINFALL(mm)
			LATITUDE	LONGITUDE			
R4-1	MINDAT	1395.00	N21°-23'	E93°-57'	1696 (8 years of record)	2298 (1973)	1249 (1972)
R4-2	MYITKYINA	60.00	N21°-28'	E95°-23'	698 (54 ")	1136 (1926)	280 (-)
R4-3	RAKOKKU	57.00	N21°-20'	E95°-05'	617 (52 ")	1174 (1973)	394 (1962)
R4-4	MEIKTILA	214.00	N20°-50'	E95°-50'	896 (51 ")	1406 (1926)	562 (1952)
R4-5	MINBU	51.00	N20°-10'	E94°-35'	886 (45 ")	1406 (1938)	539 (1972)
R4-6	NYAUNG-U	59.00	N21°-12'	E94°-55'	624 (55 ")	924 (1973)	205 (1958)
R4-7	PROME	58.00	N18°-48'	E95°-13'	1207 (71 ")	1749 (1973)	816 (1972)
R4-8	HNZADA	-	N18°-40'	E95°-25'	2161 (70 ")	2844 (1961)	1789 (1957)
R4-9	BASSEIN	9.00	N16°-46'	E94°-46'	2768 (60 ")	3891 (1949)	1868 (1906)
R4-10	MAUBIN	3.00	N16°-44'	E95°-39'	2432 (62 ")	3790 (1953)	1530 (1906)
R4-11	PYPON	2.00	N16°-16'	E95°-40'	2557 (50 ")	3709 (1929)	1906 (1918)
R5-1	TAUNGGYI	1436.00	N20°-47'	E97°-03'	1692 (38 ")	2315 (1907)	1213 (1931)
R5-2	PINLAUNG	259.00	N20°-13'	E96°-47'	2276 (8 ")	2564 (1971)	1962 (1972)
R5-3	LOI-KAW	895.00	N19°-41'	E97°-13'	1169 (35 ")	1936 (1936)	815 (1931)

SOURCE: HYDROLOGICAL ANNUAL VO-2 BURMA METEOROLOGICAL DEPARTMENT

A-1.6 RAINFALL RECORD IN BURMA (NO. 3)

STATION NO.	LOCATION	ALTITUDE (m)	CO-ORDINATES		AVE. ANNUAL RAINFALL(mm)	MAX. ANNUAL RAINFALL(mm)	MINI. ANNUAL RAINFALL(mm)
			LATITUDE	LONGITUDE			
R5-4	PAAN	9.00	N16°-50'	E97°-40'	4490 (30 years of record)	5973 (1961)	3460 (1960)
R6-1	KENGTUNG	827.00	N21°-18'	E99°-37'	1129 (16 ")	1875 (1971)	816 (1962)
R7-1	YAMETHIN	199.00	N20°-25'	E96°-09'	969 (45 ")	1511 (1916)	408 (1954)
R7-2	PYINMANA	95.00	N19°-43'	E96°-13'	1401 (54 ")	1936 (1927)	846 (1958)
R7-3	TOUNGOO	50.00	N18°-55'	E96°-28'	2113 (60 ")	2836 (1907)	1419 (1957)
R7-4	THARRAWADDY	15.00	N17°-38'	E95°-48'	2212 (40 ")	2921 (1914)	1840 (1959)
R7-5	PEGU	10.00	N17°-20'	E96°-30'	3296 (50 ")	4188 (1969)	2085 (1957)
R7-6	THATON	8.00	N16°-55'	E97°-22'	5513 (50 ")	7340 (1961)	4188 (1957)
R7-7	RANGOON	14.00	N16°-46'	E96°-10'	2618 (60 ")	3261 (1974)	1940 (1951)
R8-1	MOULMEIN	24.00	N16°-30'	E97°-37'	4828 (60 ")	6748 (1961)	3567 (1927)
R8-2	TAVOY	16.00	N14°-06'	E98°-13'	5457 (50 ")	7599 (1961)	4446 (1958)
R8-3	MERGUI	37.00	N12°-26'	E98°-36'	4123 (60 ")	4841 (1948)	3216 (1958)
R8-4	VICTORIA POINT	46.00	N09°-58'	E98°-35'	1908 (30 ")	4864 (1917)	3070 (1947)

SOURCE: HYDROLOGICAL ANNUAL VO-2 BURMA METEOROLOGICAL DEPARTMENT

A-1.7 (1) Population of Cities/Towns
Furnished with Water Supply Systems

Sr. No.	State/Division	Sr. No.	City/Town	Population
1	Kachin State	1	Myitkyina	53107
2	Karen State	2	Pa-an	36565
3	Sagaing Division	3	Katha	22513
		4	Monywa	99126
		5	Myinmu	12851
4	Pegu Division	6	Gyobingauk	19542
		7	Zigon	15795
		8	Nyaunlebin	28723
		9	Daik-U	23968
		10	Nattalin	18811
		11	Pegu	149852
		12	Prome	84806
		13	Padaung	10205
		14	Paungde	29439
		15	Minhla	11531
		16	Letpadan	28182
		17	Tharrawaddy	14991
		18	Thonze	22273
		19	Okpo	12474
5	Magwe Division	20	Chauk	56411
		21	Magwe	42708
		22	Minbu	18069
		23	Yenagyaung	69857
		24	Thayet	24112
6	Mandalay Division	25	Kyaukpadaung	26253
		26	Nyaung-U	19305
		27	Taungtha	13951
		28	Mahlaing	14935
		29	Maymyo	70409
		30	Mogok	41490
		31	Meiktila	12919
		32	Mandalay	506846
		33	Myingyan	85990
		34	Yamethin	23721
			- continue -	

SOURCE: MINISTRY OF HOME AND RELIGIOUS AFFAIRS

A-1.7 (2) Population of Cities/Towns Furnished with Water Supply Systems

Sr. No.	State/Division	Sr. No.	City/Town	Population
7	Mon State	35	Moulmein	208615
8	Arakan State	36	Akyab	108735
		37	Pauktaw	10448
		38	Myauk-U	25282
9	Rangoon Division	39	Rangoon	2494665
		40	Syriam	43810
10	Shan State	41	Kalaw	18572
		42	Taungyi	91314
		43	Tachileik	8487
		44	Nanmatu	21314
		45	Loilem	11635
		46	Lashio	84399
11	Irrawaddy Division	47	Kyaiklat	28707
		48	Bassein	152868
		49	Pyapon	44530
		50	Myaungmya	38085
		51	Maubin	45477
		52	Wakema	34544
		53	Henzada	98058

SOURCE: MINISTRY OF HOME AND RELIGIOUS AFFAIRS

A-1.8 Design Criteria for Towns Water Supply

1.	Population Growth rate:-	Based on Burma Census. Overall growth rate in Burma 2.2 to 3%
2.	Water Supply (Consumption)	-(a) House Connection 40 gpcd
3.	Peak day	-1.5 to 2 times average daily consumption
4.	For Fire Fighting	-(a) Duration - 2 hrs. (b) No. of Times - 1 (c) Fire Demand - 20 1 ft sec̄' - 0.22 gal sec̄'
5.	Population Coverage	(1) 1st Stage 75% (2) 2nd Stage 90%
6.	Design Period	-25 years
7.	Implementation Period	-2 to 3 yrs.

8. Computation for Distribution main and Pumping mains used Hardy Cross Method.

9. Size or Cap. of Public used Street Hydrants -310 gals

10.	Pipe used.	(a) Distribution Net Work -	C.I Class "C" C.I Class "B" Steel Pipe G.I Pipe P.V.C Pipe
		(b) Tube Wells	G.I Pipe Seamless M S Pipe
11.	Size of Tube Wells	- Dia. of Pipes - 12"ϕ Max:	
12.	Pumps Used	- (a) Centrifugal Pump - (b) Air Compressor - (c) Submersible Pumps - (d) Vertical Turbine Pump	
13.	Size of Fire Hydrants	- 2 1/2" ϕ & 4"ϕ	

SOURCE: GENERAL AFFAIRS DEPARTMENT

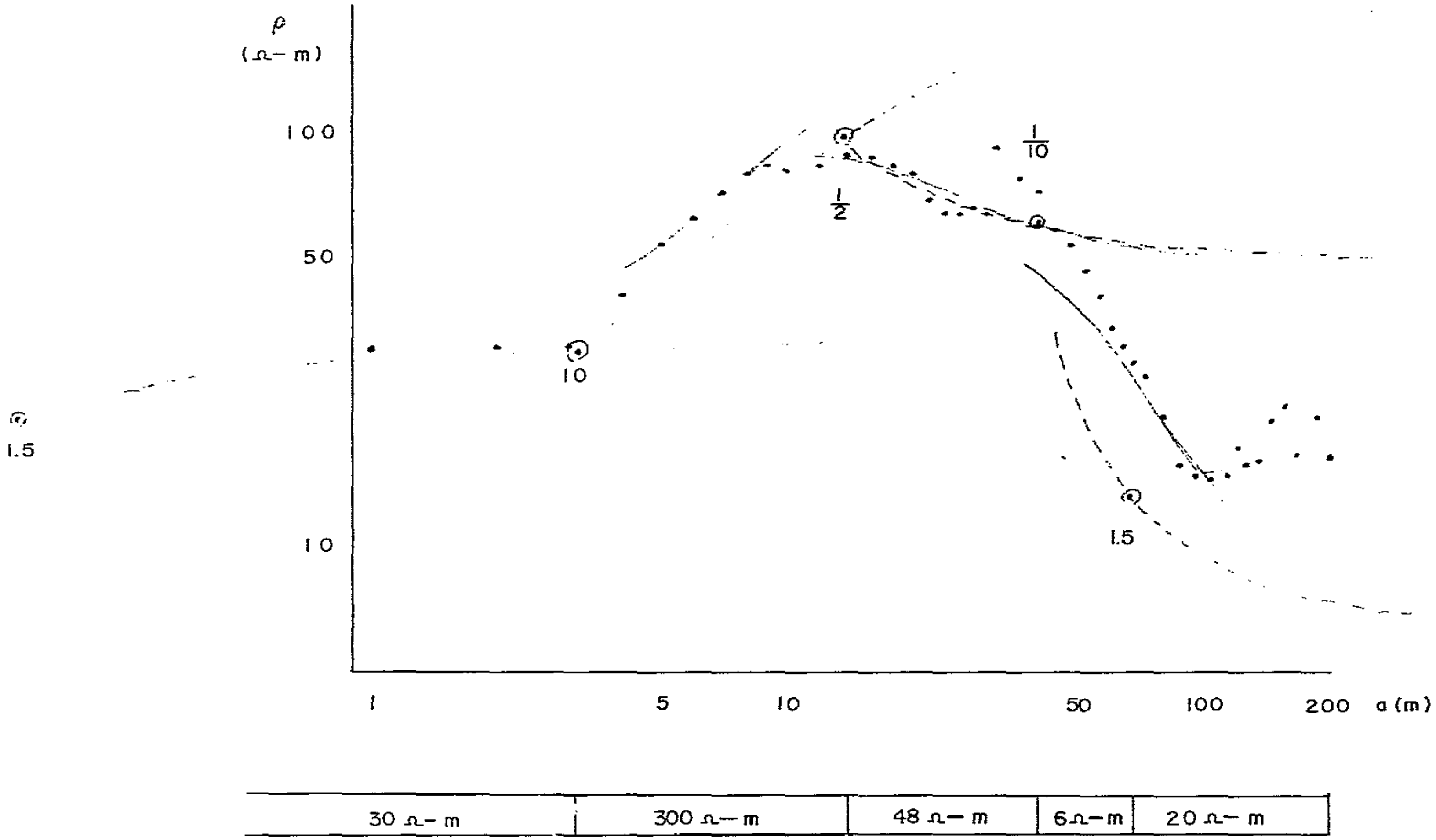
APPENDIX 2

MAGWE PROJECT

ELECTRICAL PROSPECTING RESULT

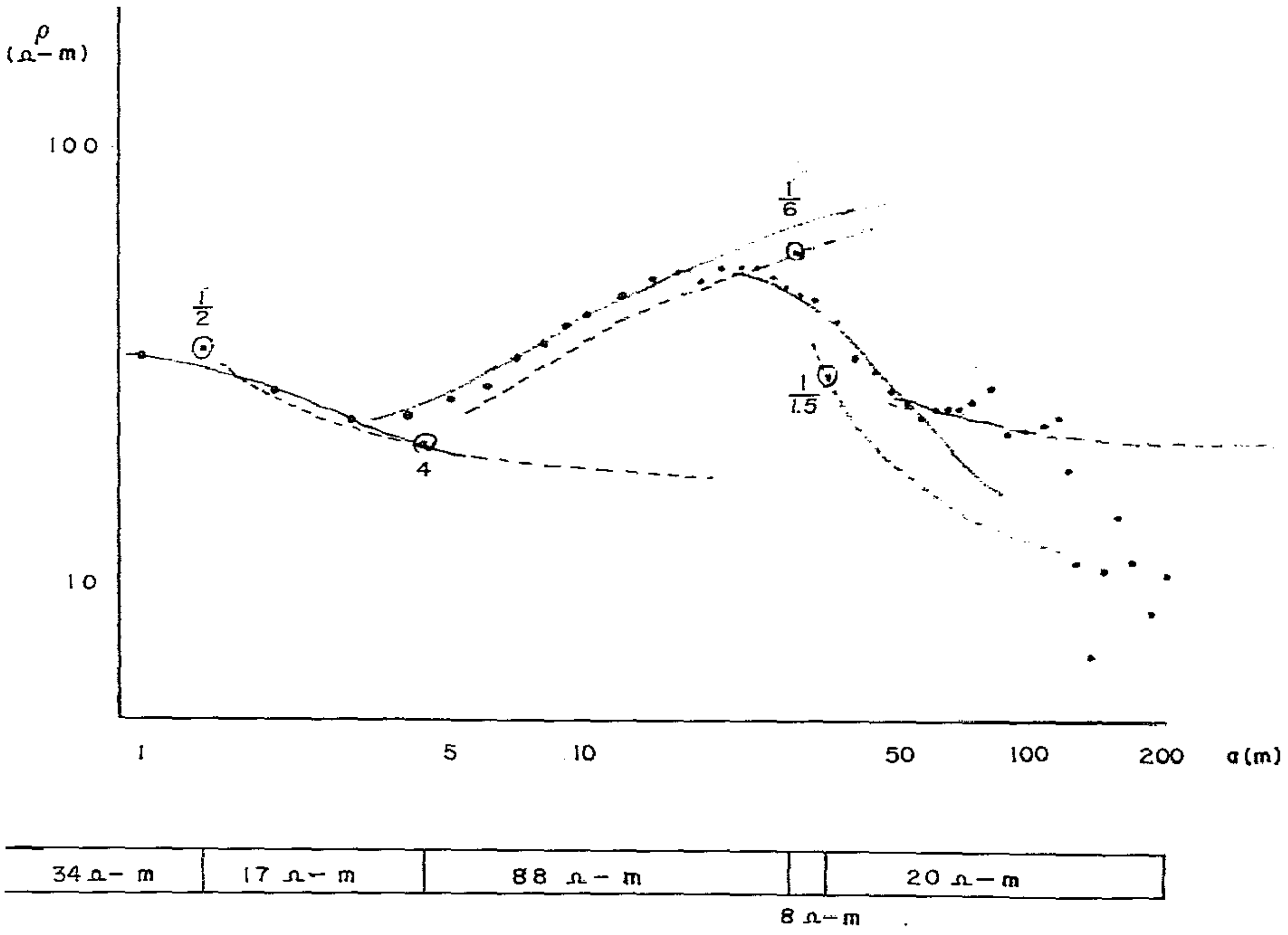
A − 2 · 1 ELECTRICAL PROSPECTING IN MAGWE

NO.1



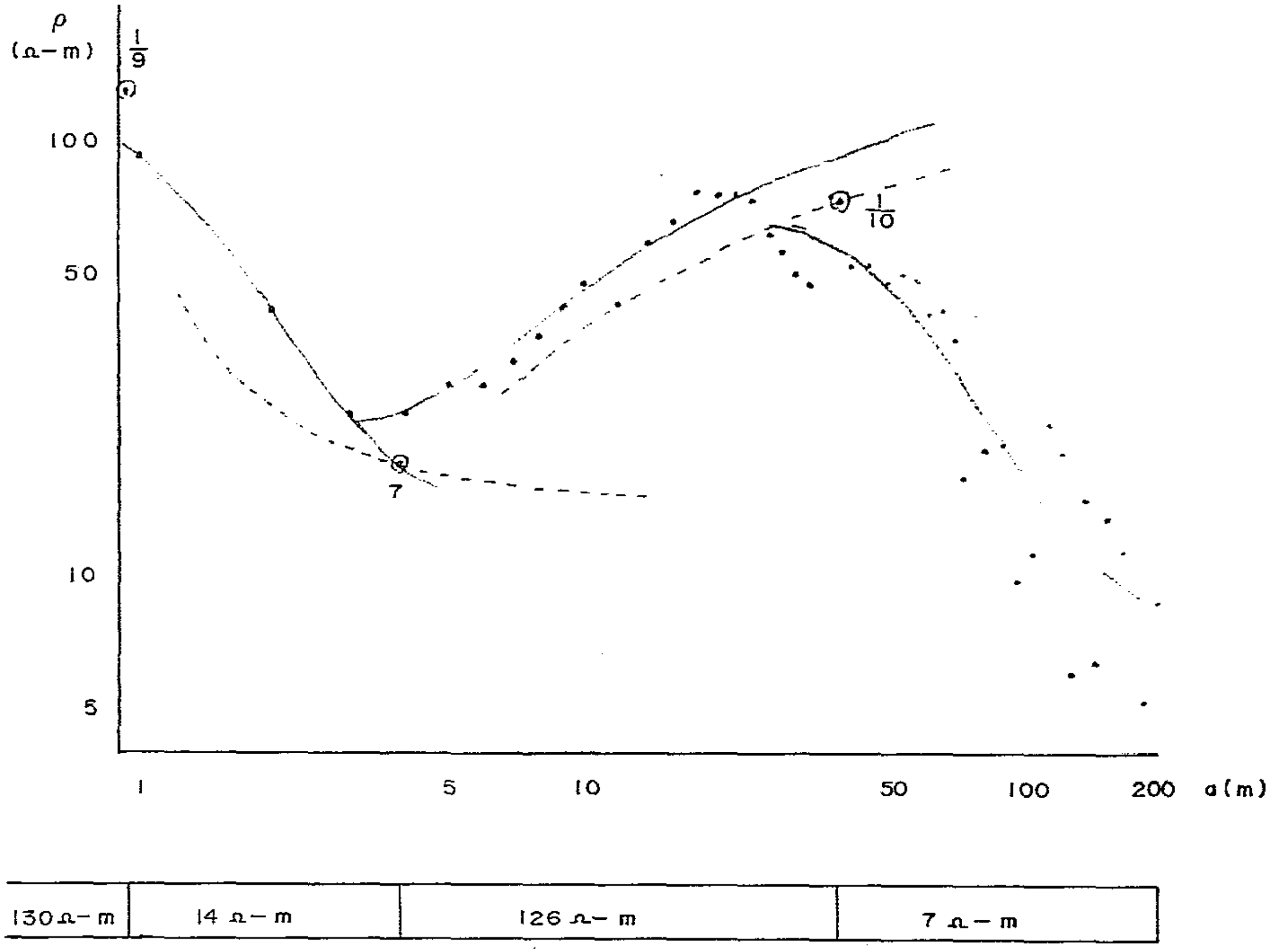
ELECTRICAL PROSPECTING IN MAGWE

NO.2



ELECTRICAL PROSPECTING IN MAGWE

NO. 3



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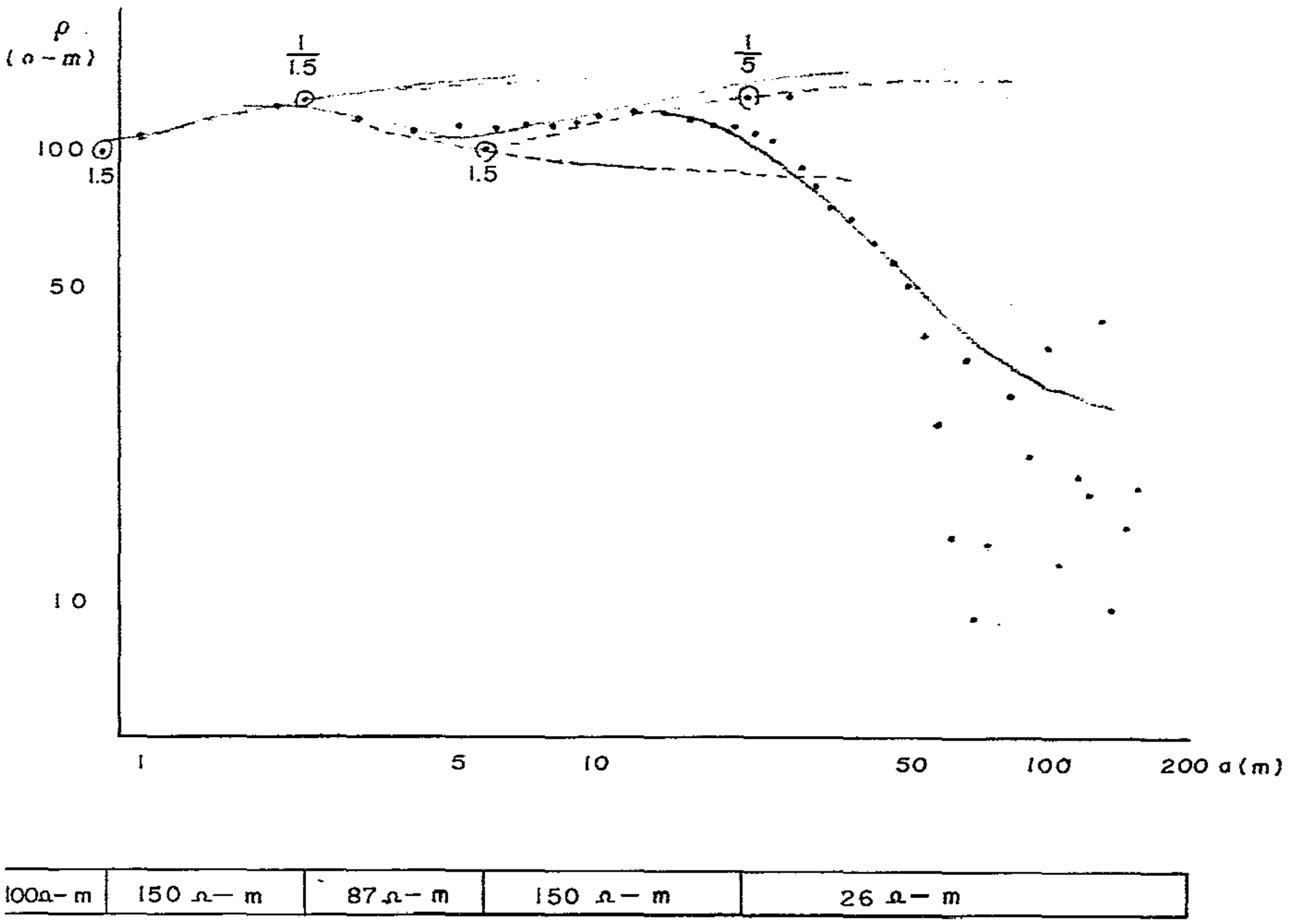
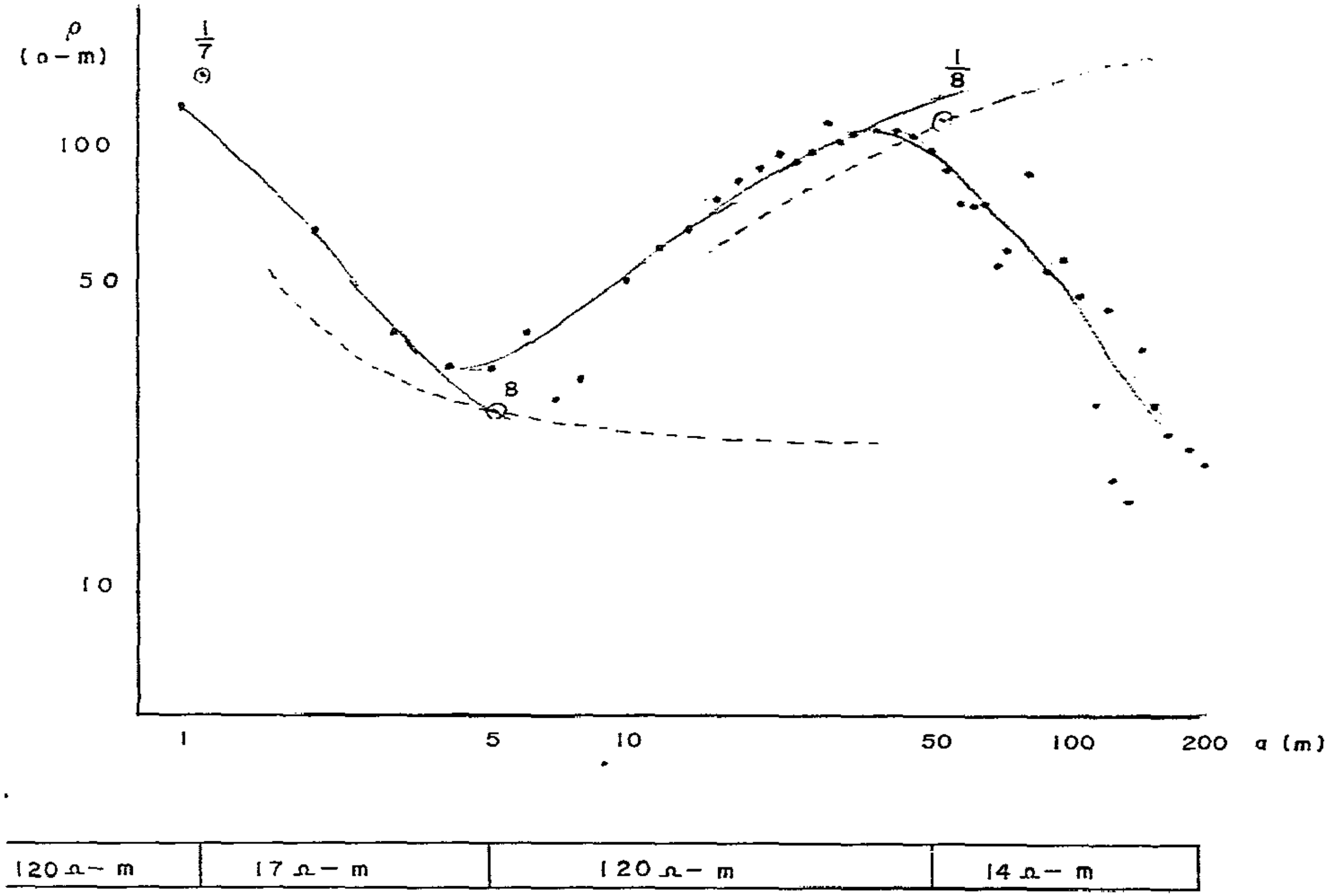


ELECTRICAL PROSPECTING IN MAGWE

NO. 5



ELECTRICAL PROSPECTING IN MAGWE

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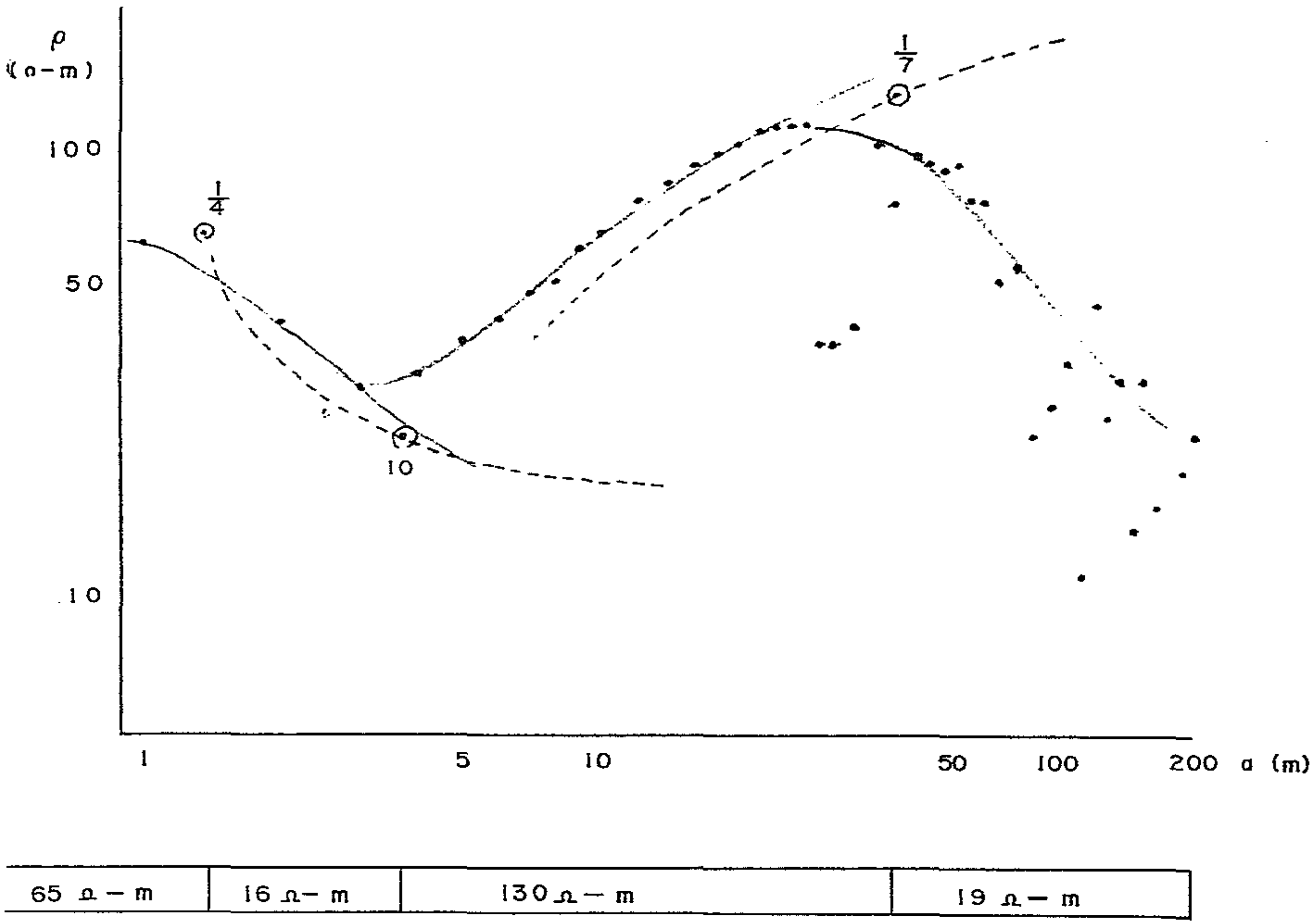

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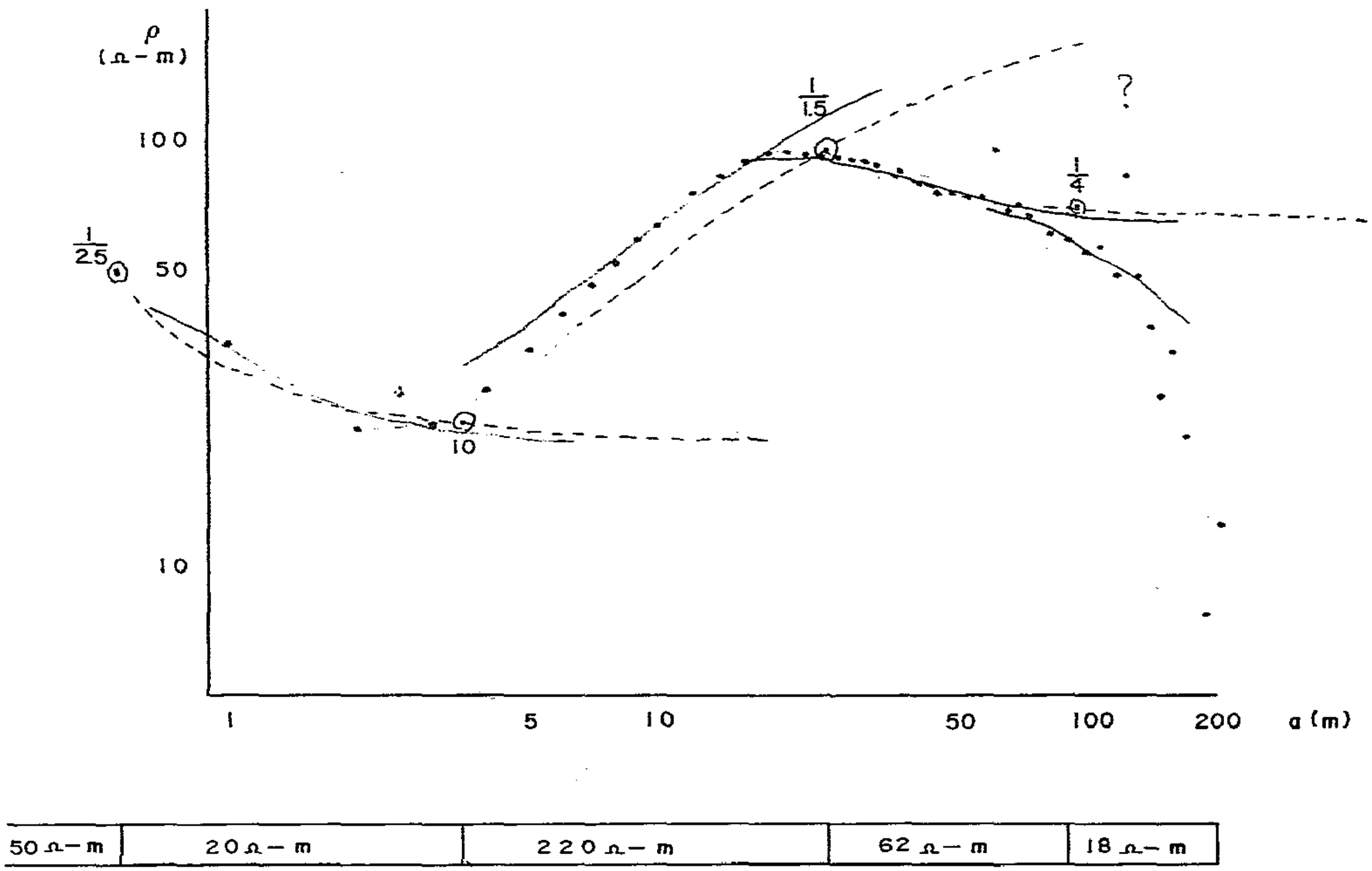

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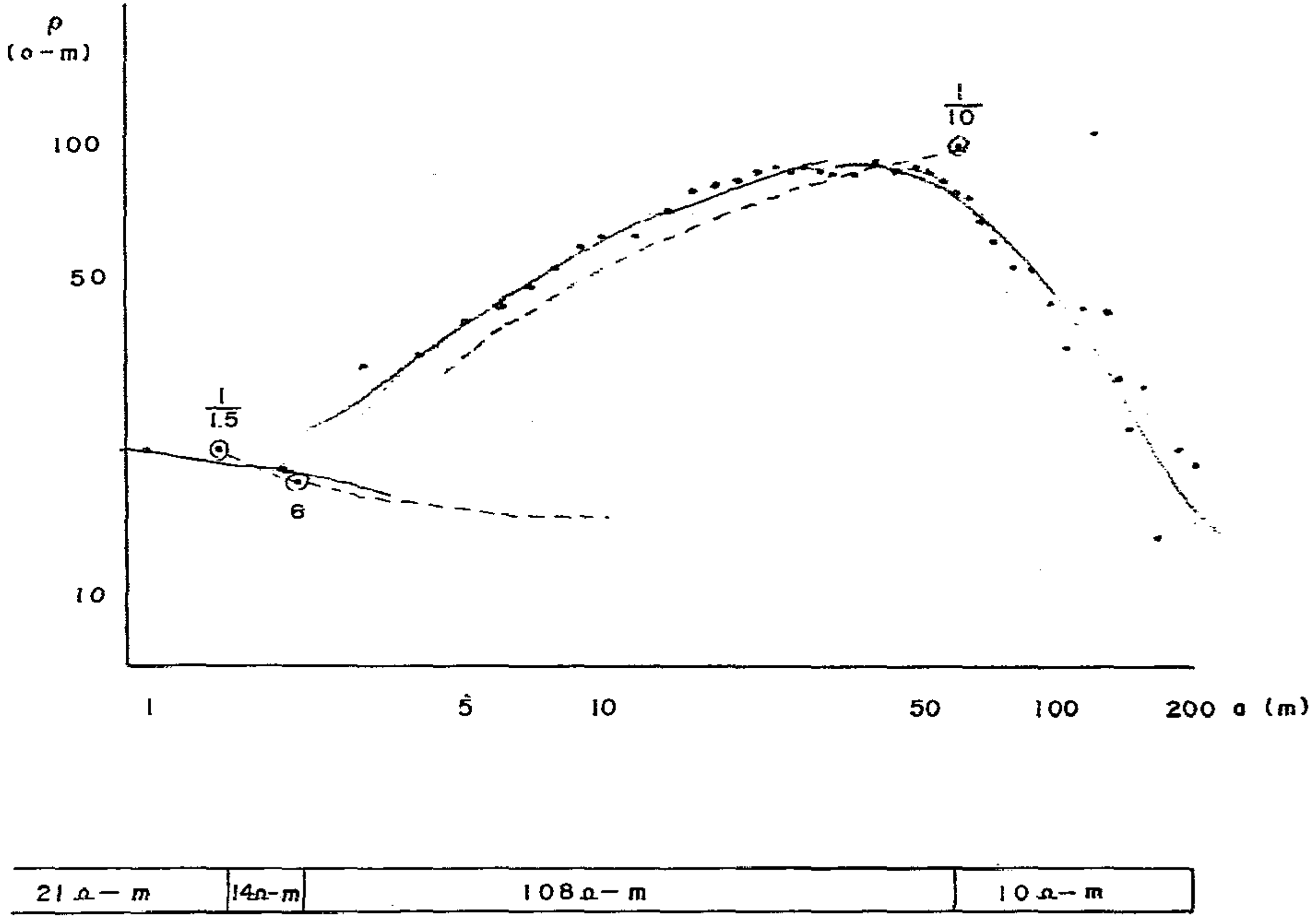
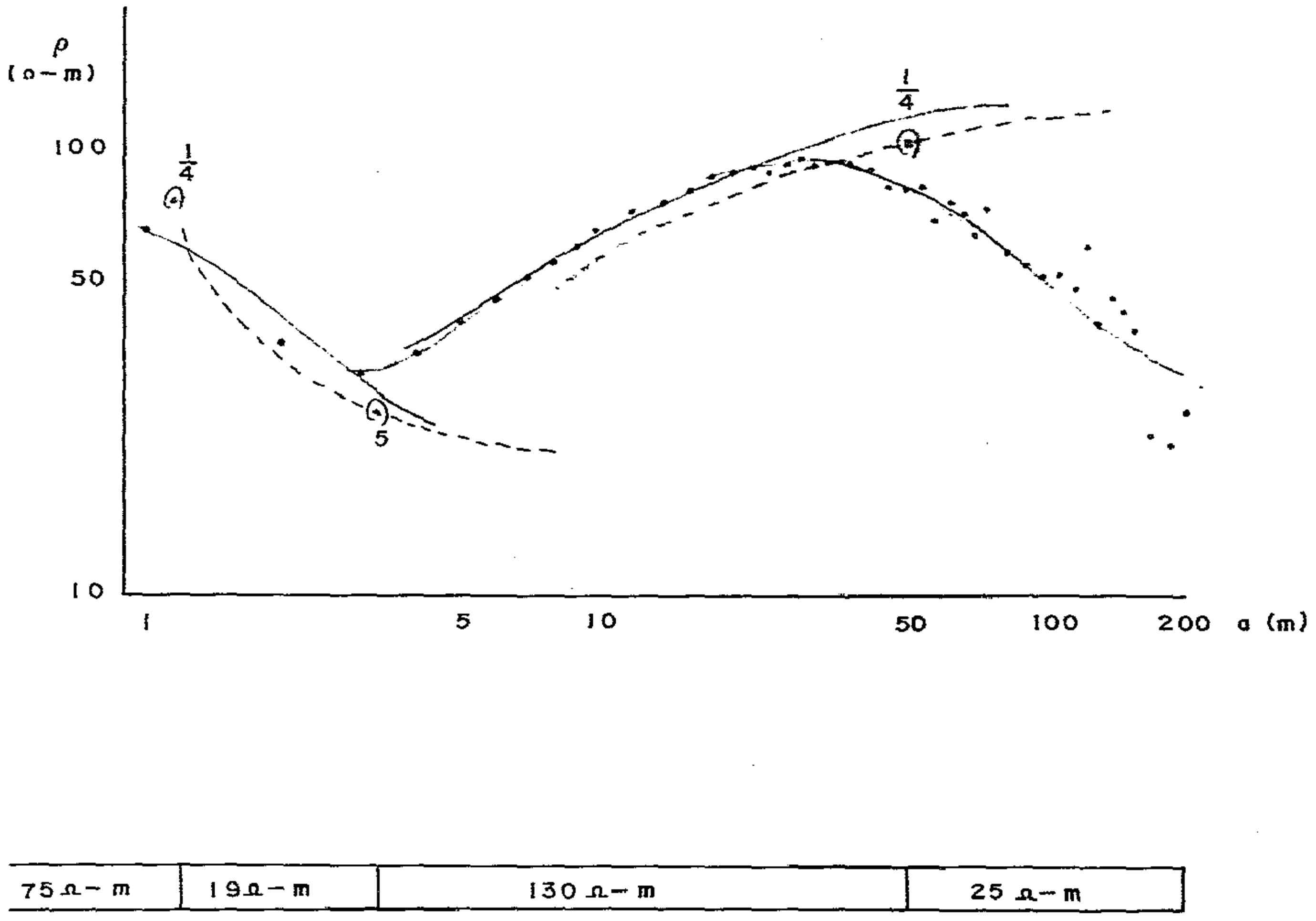


ELECTRICAL PROSPECTING IN MAGWE

NO.9



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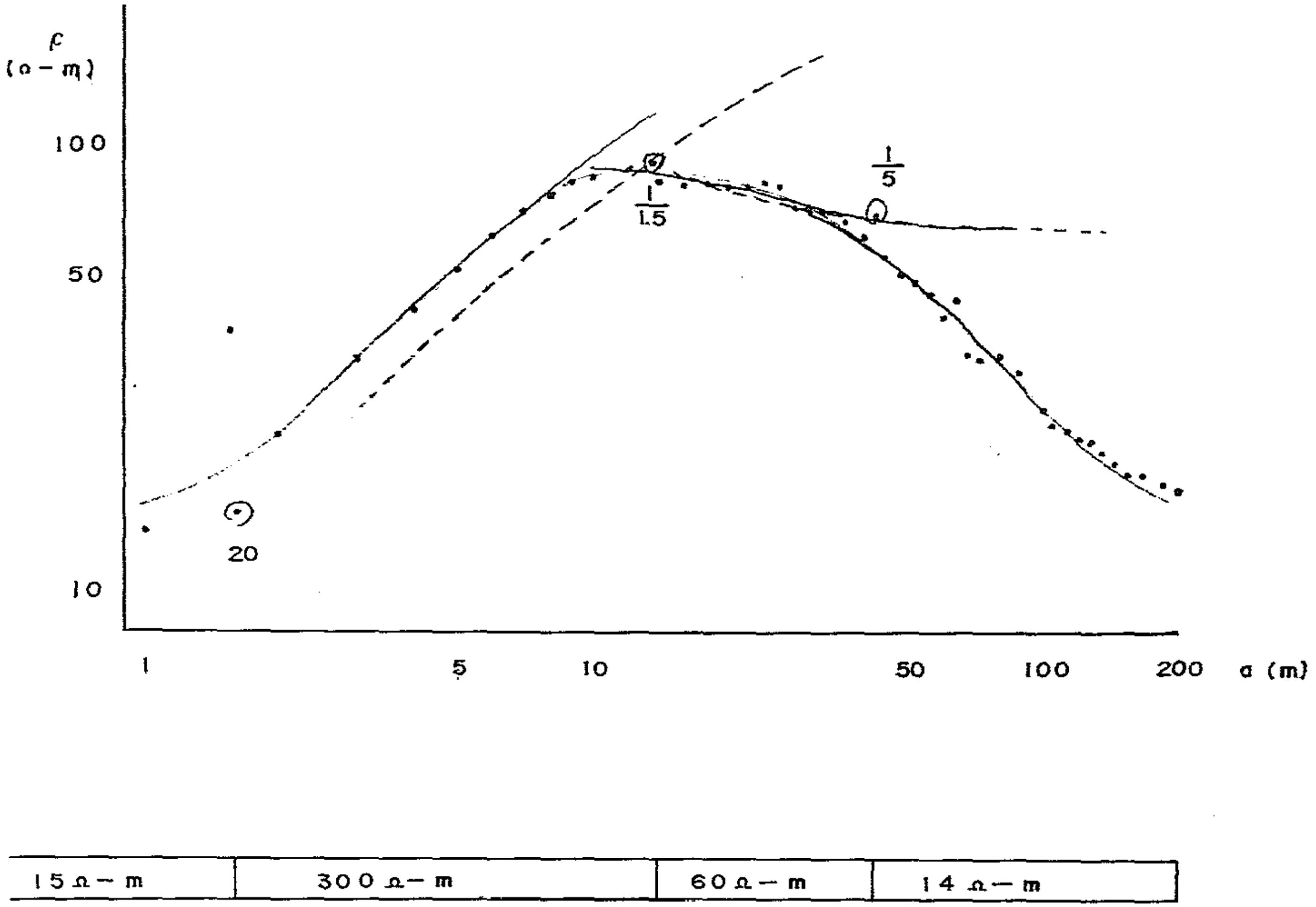

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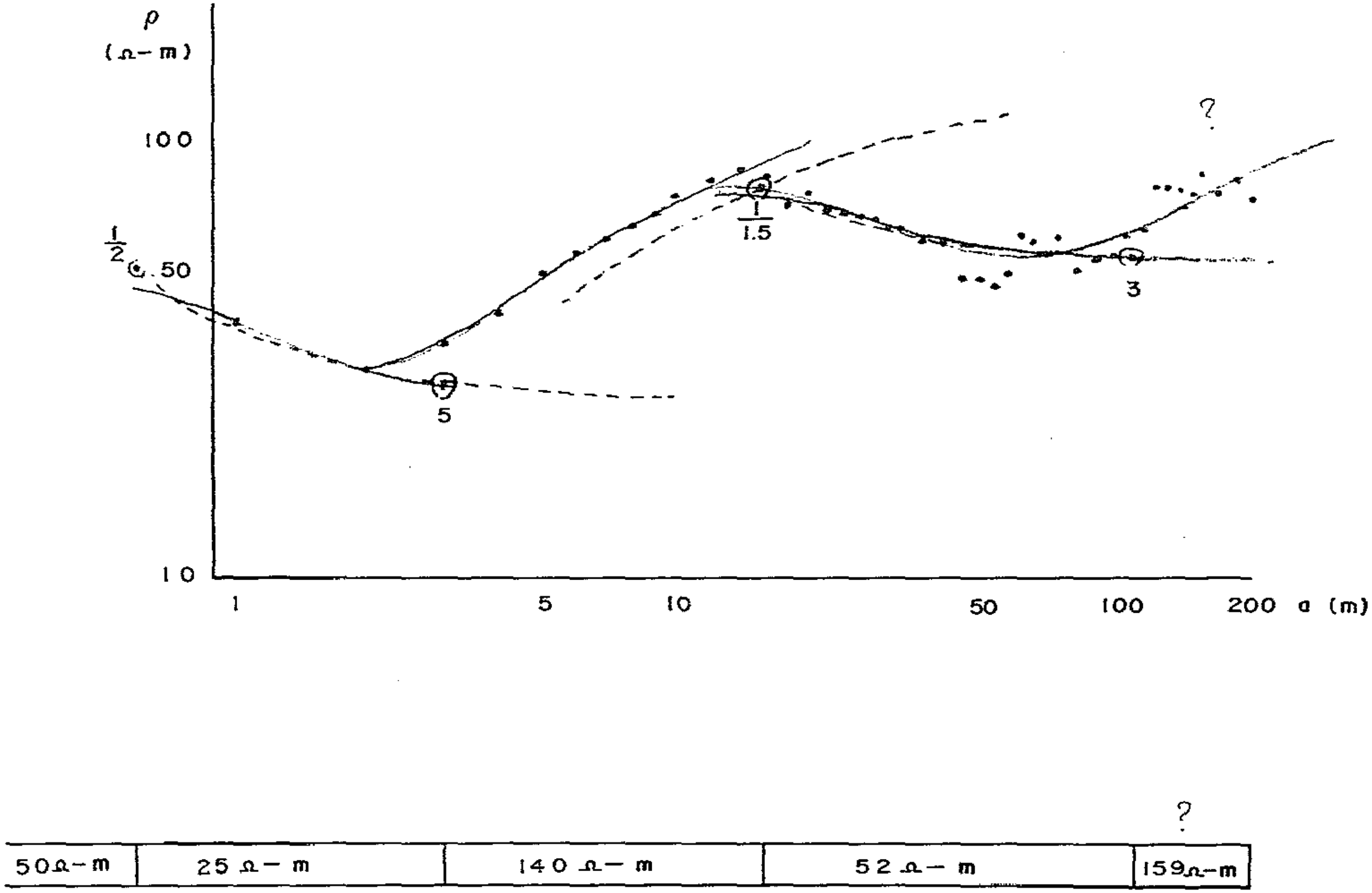
NO. II



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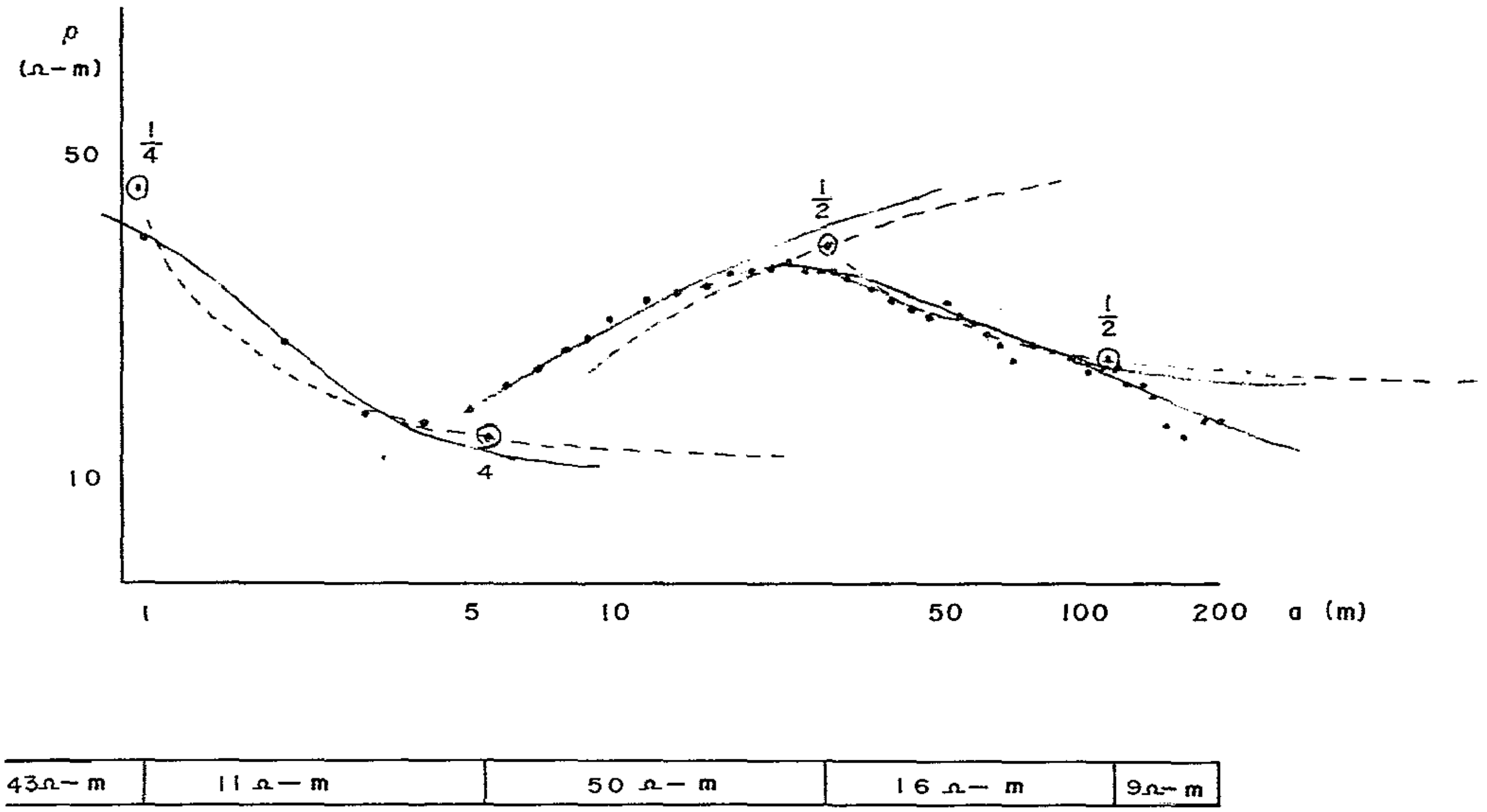

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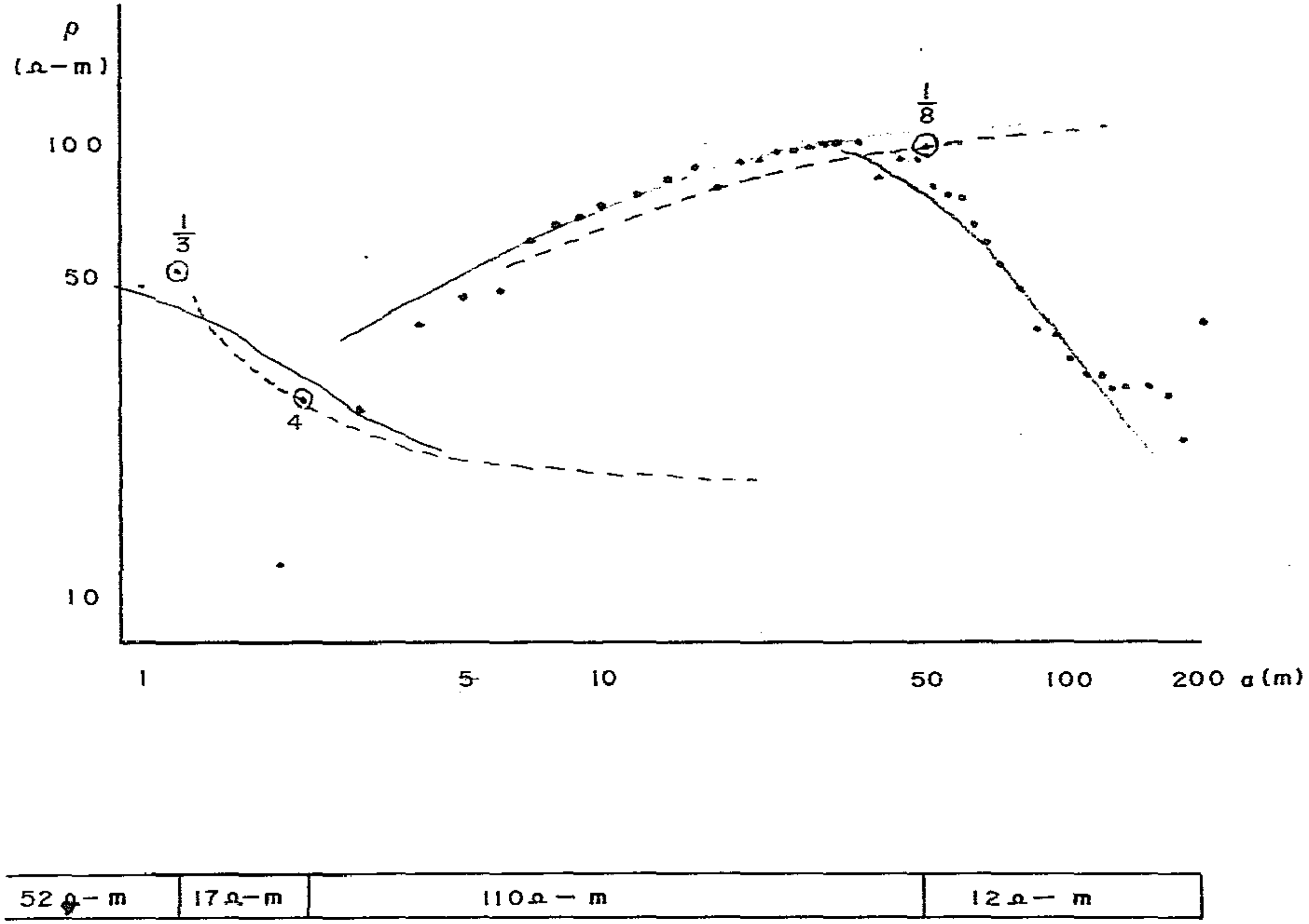
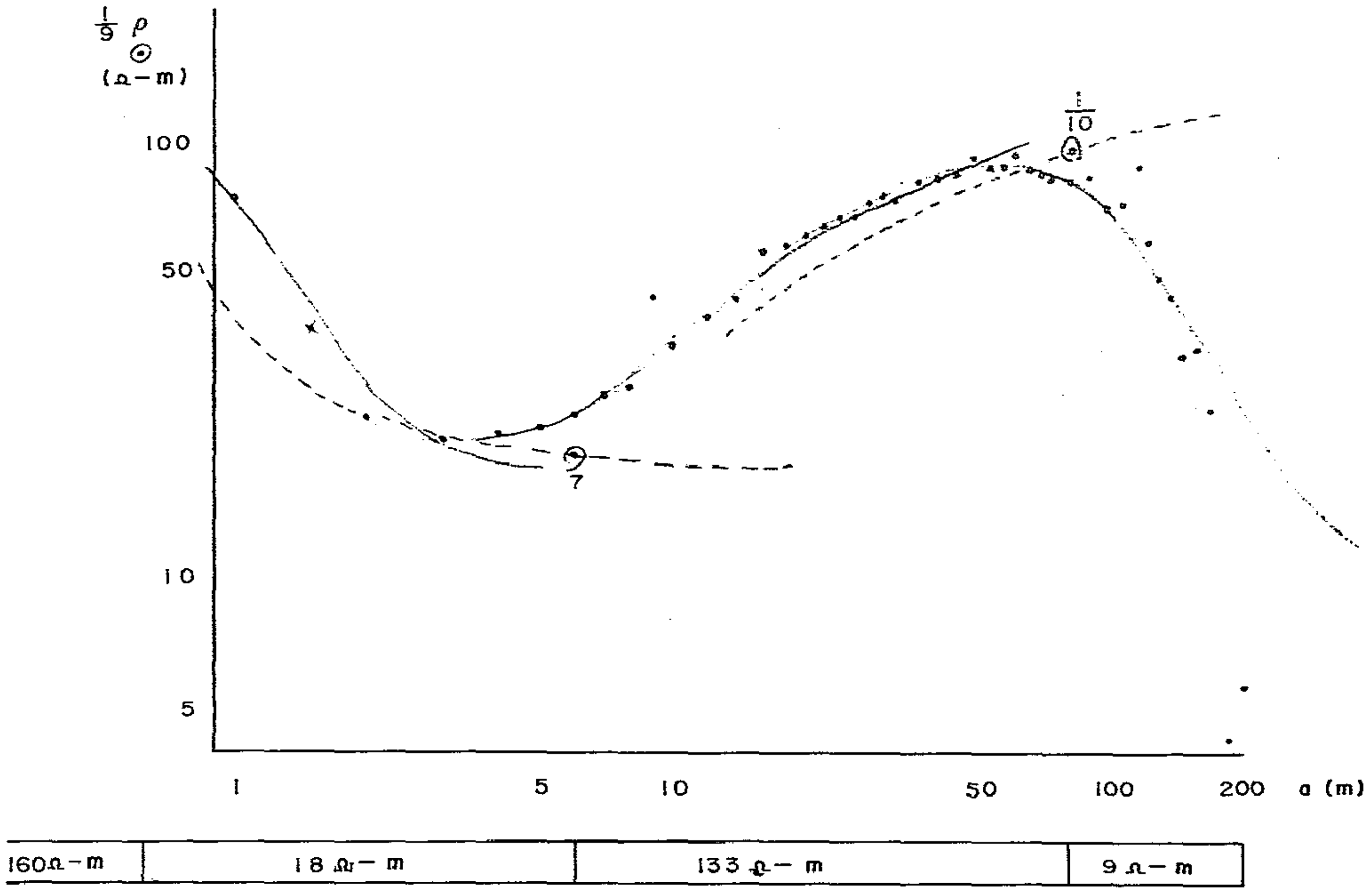


ELECTRICAL PROSPECTING IN MAGWE

NO.14



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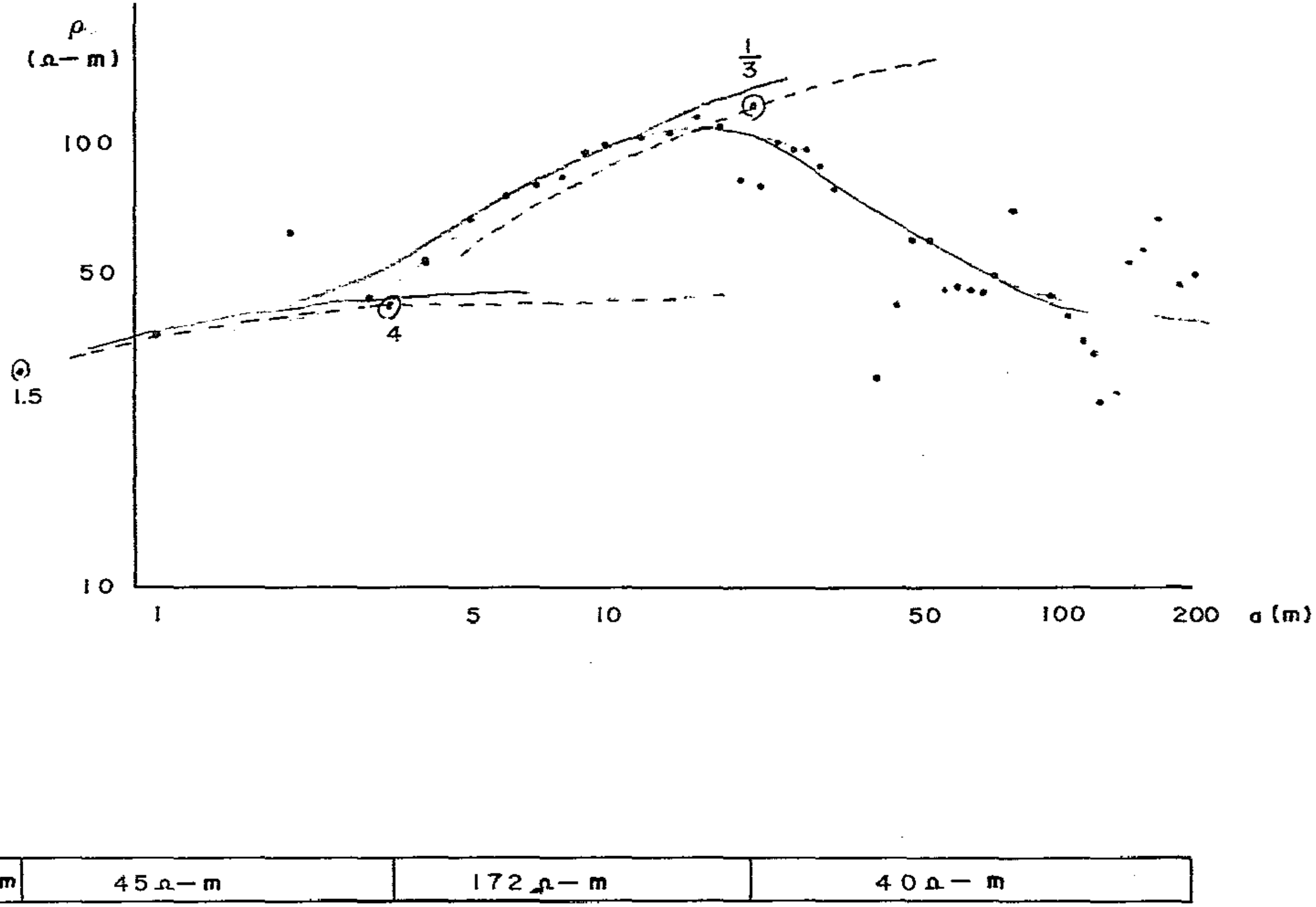

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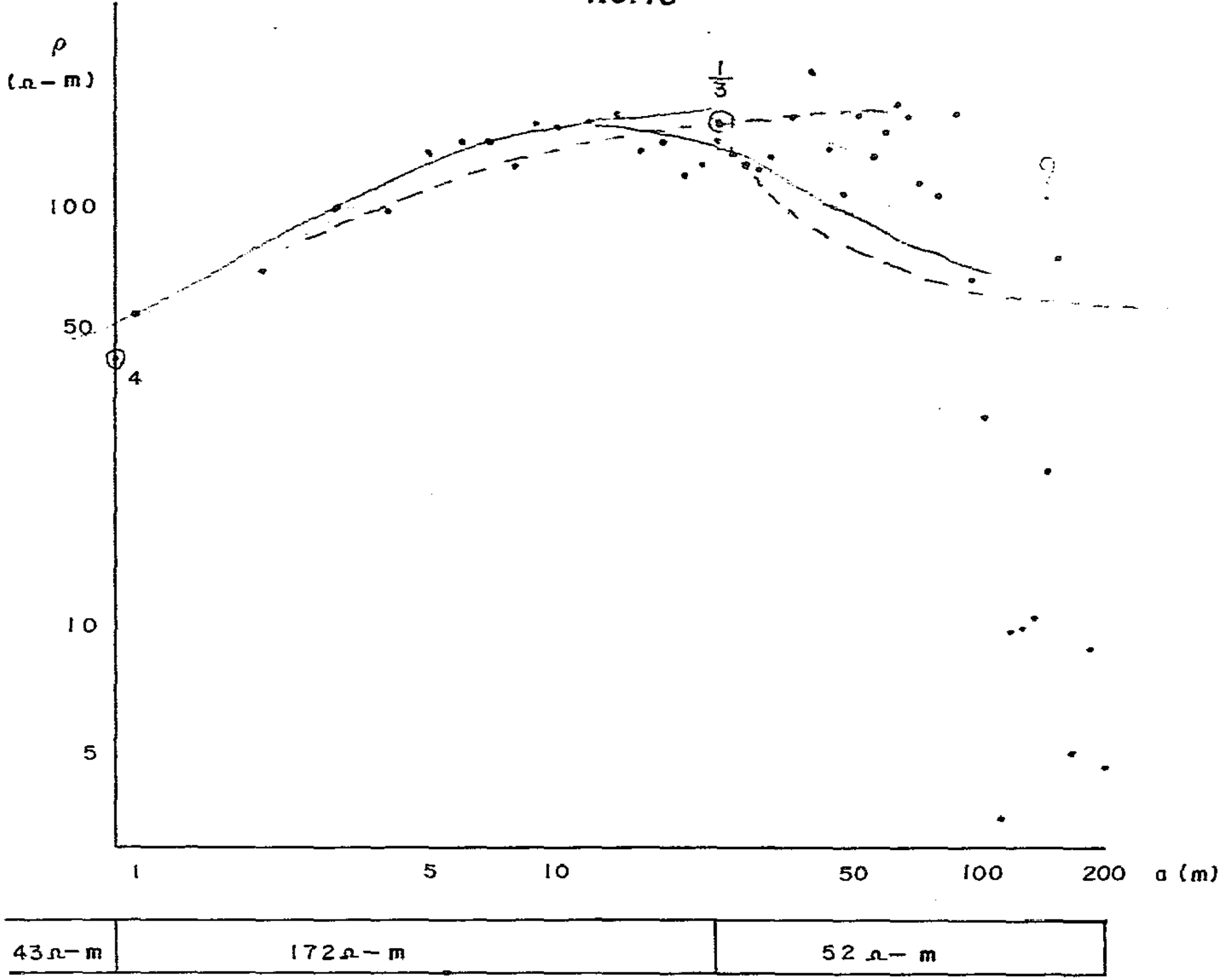
NO. 16



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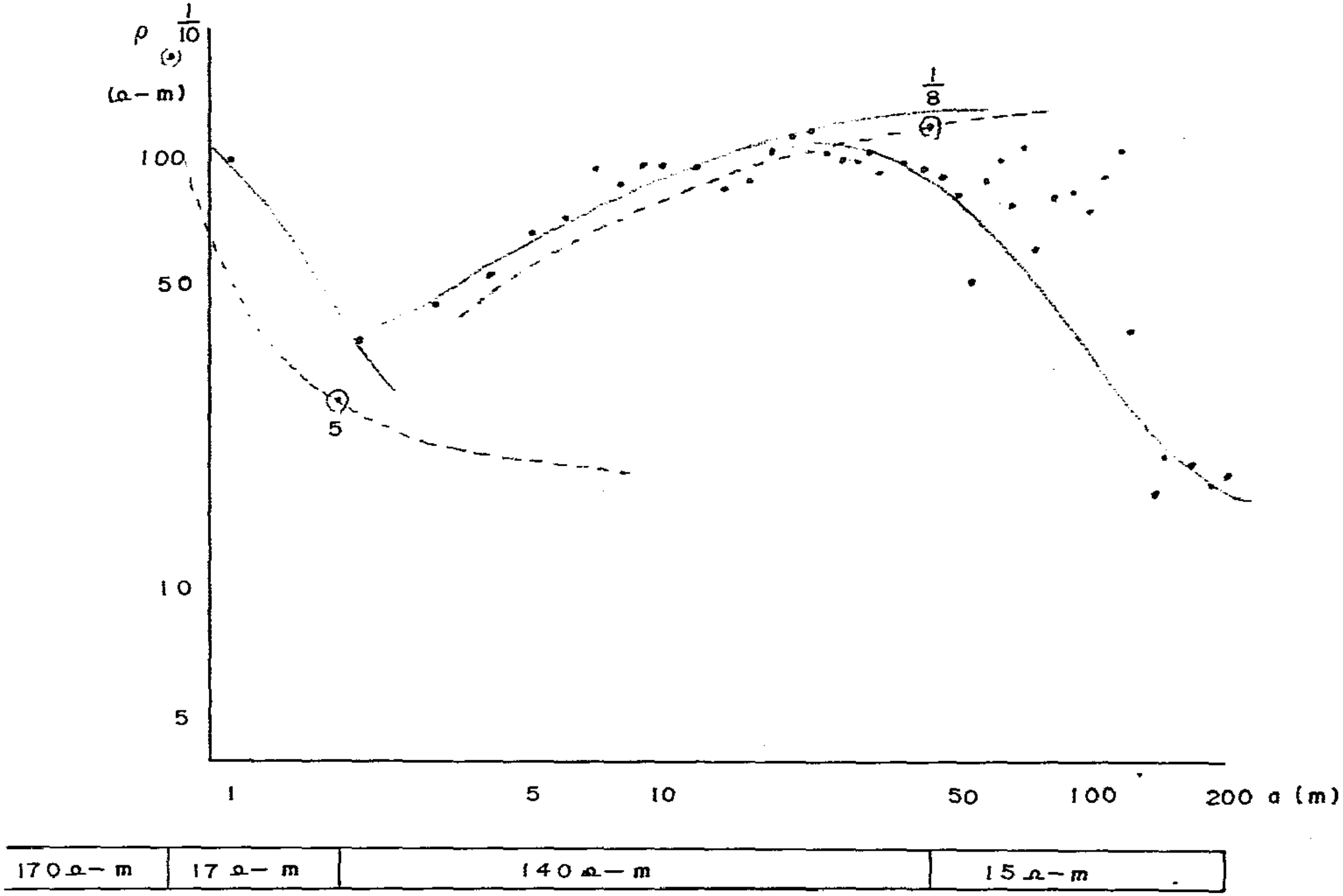

ELECTRICAL PROSPECTING IN MAGWE

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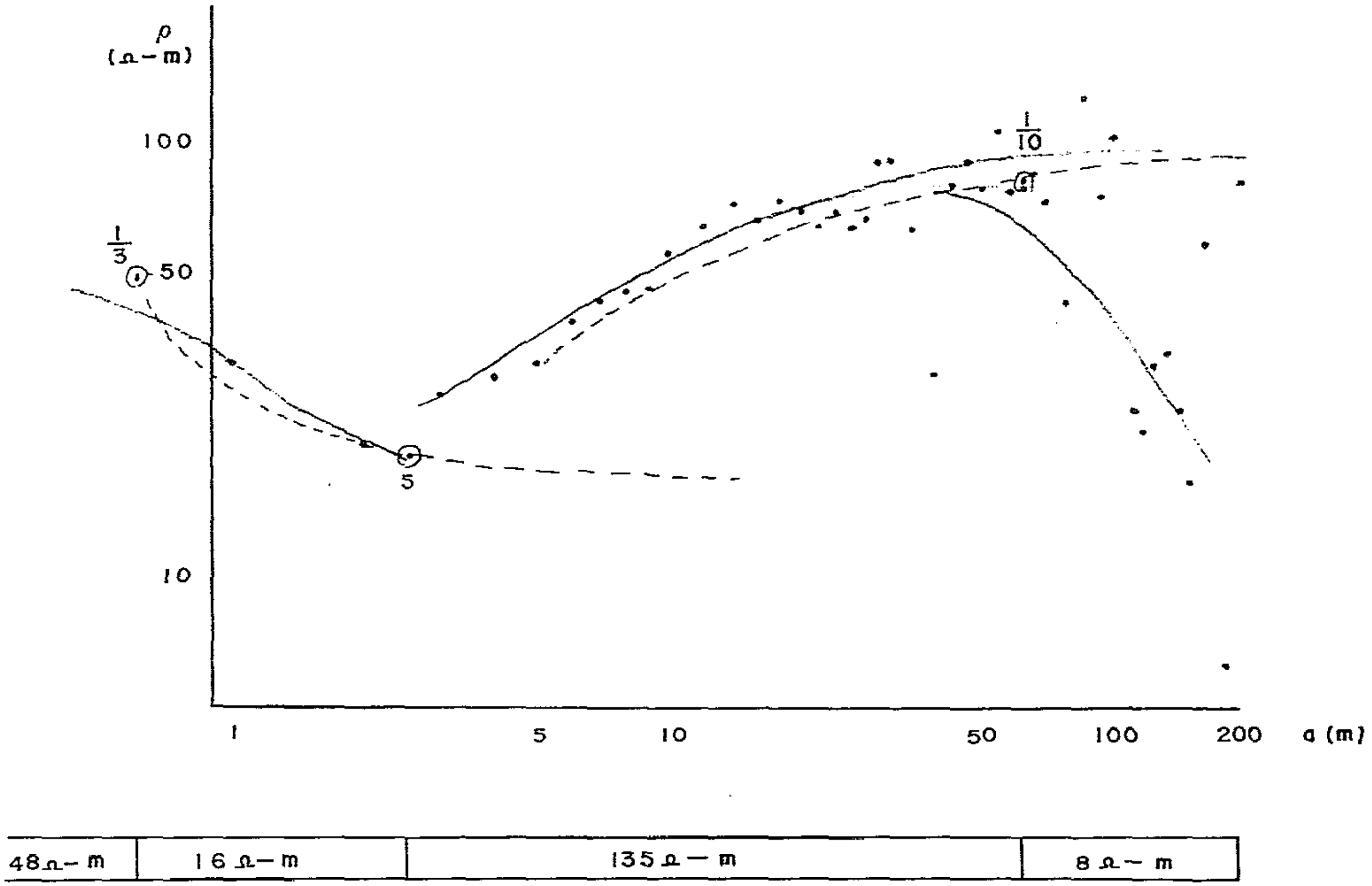

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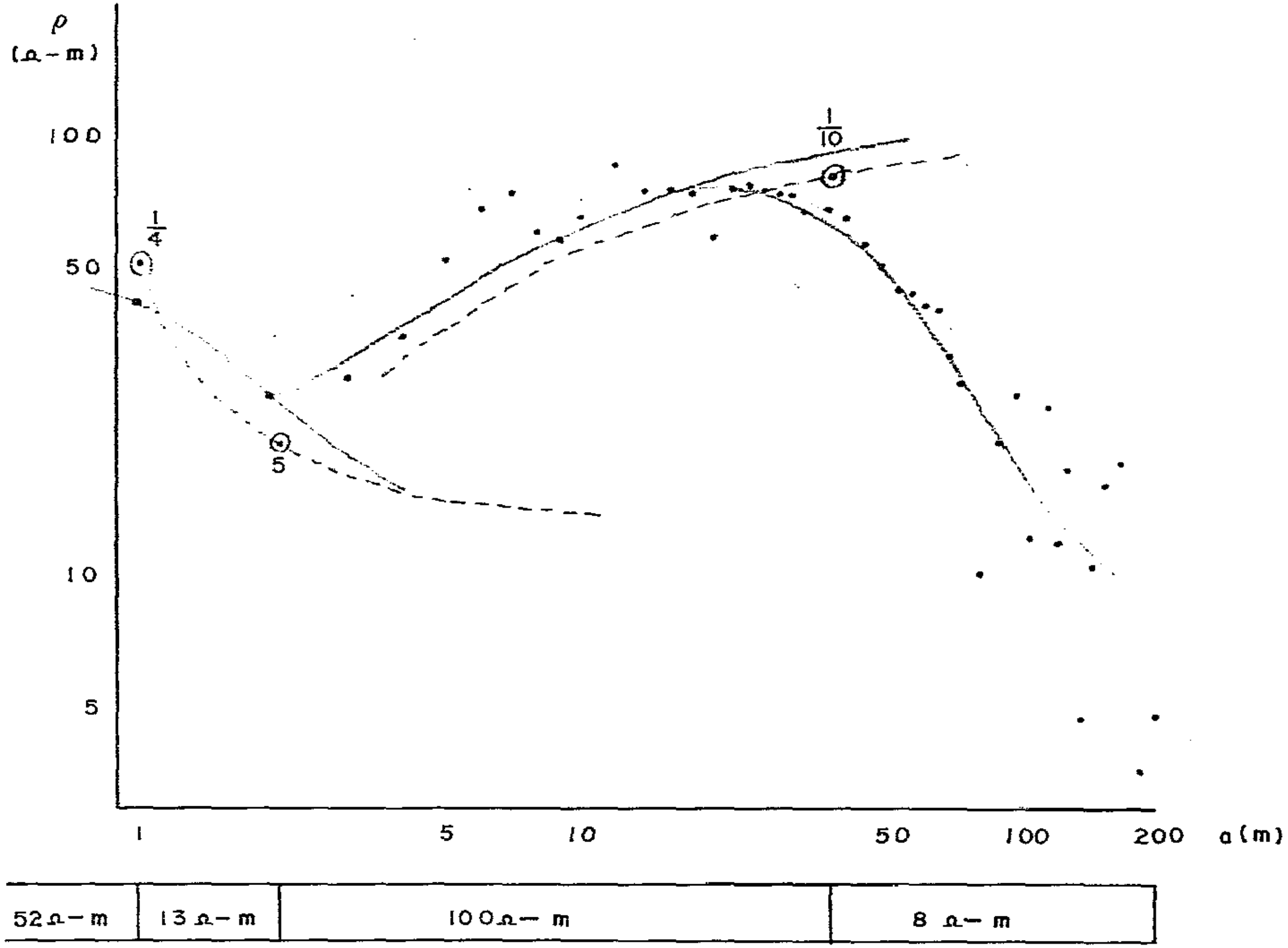
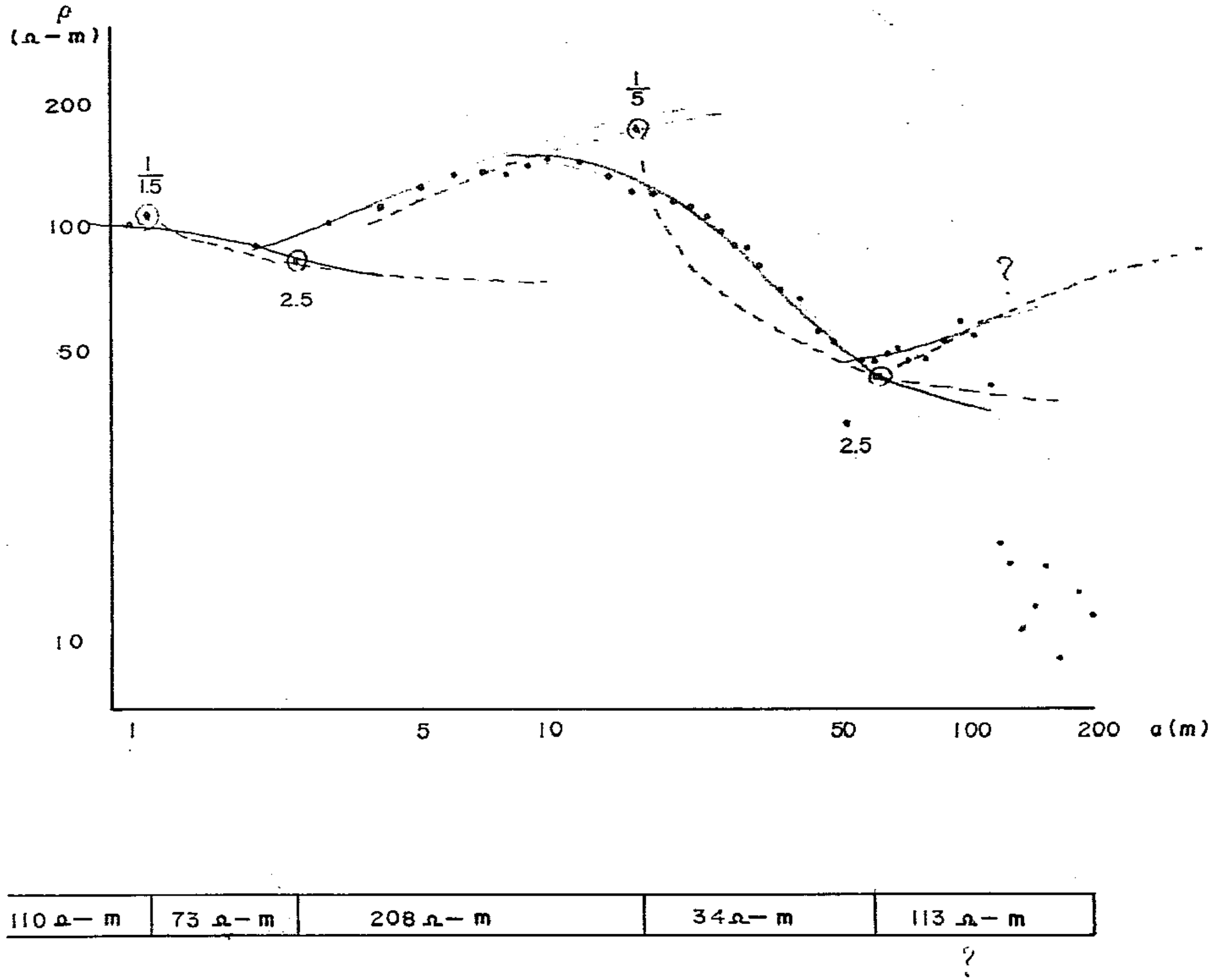


ELECTRICAL PROSPECTING IN MAGWE

NO. 20



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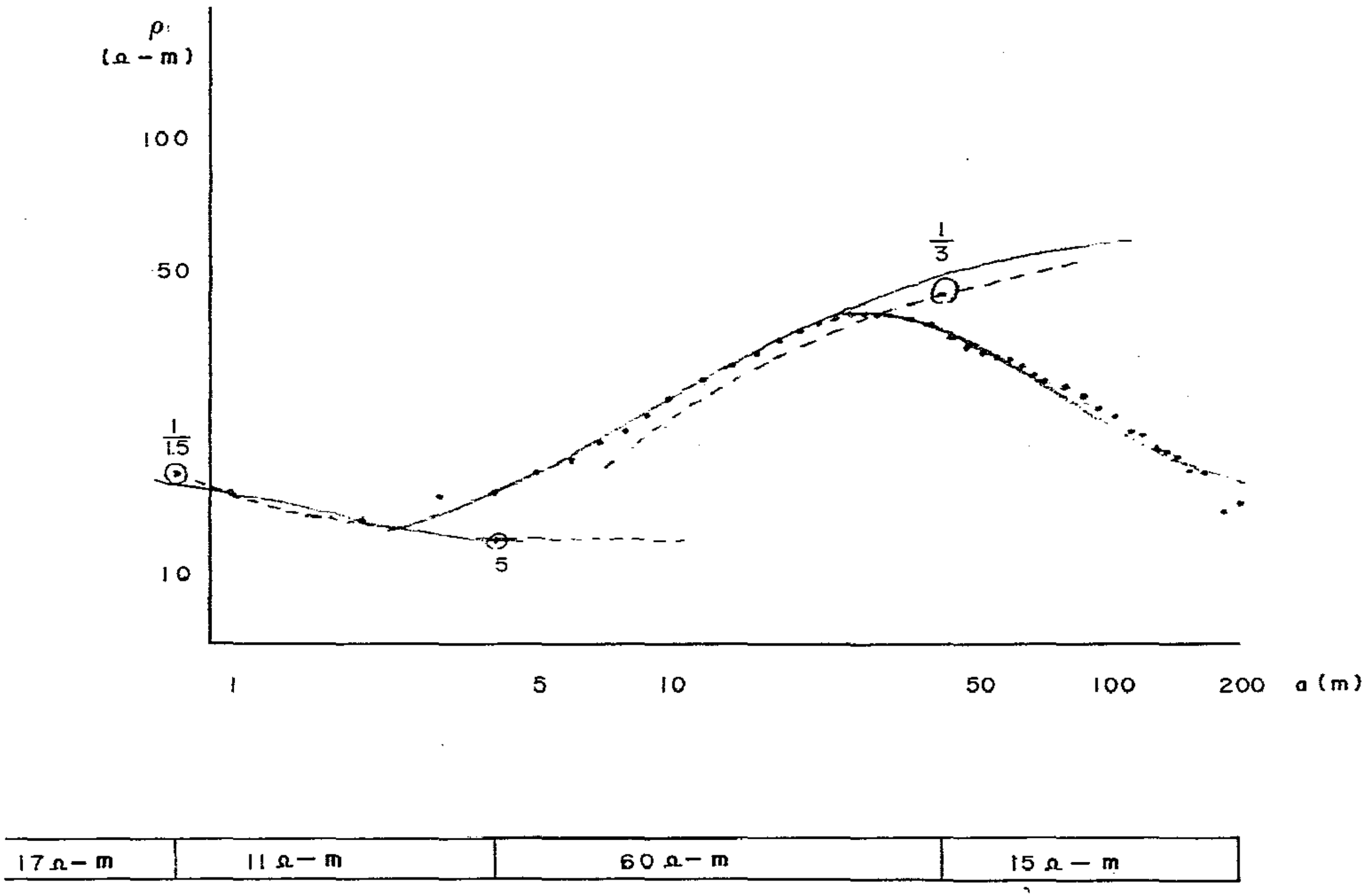

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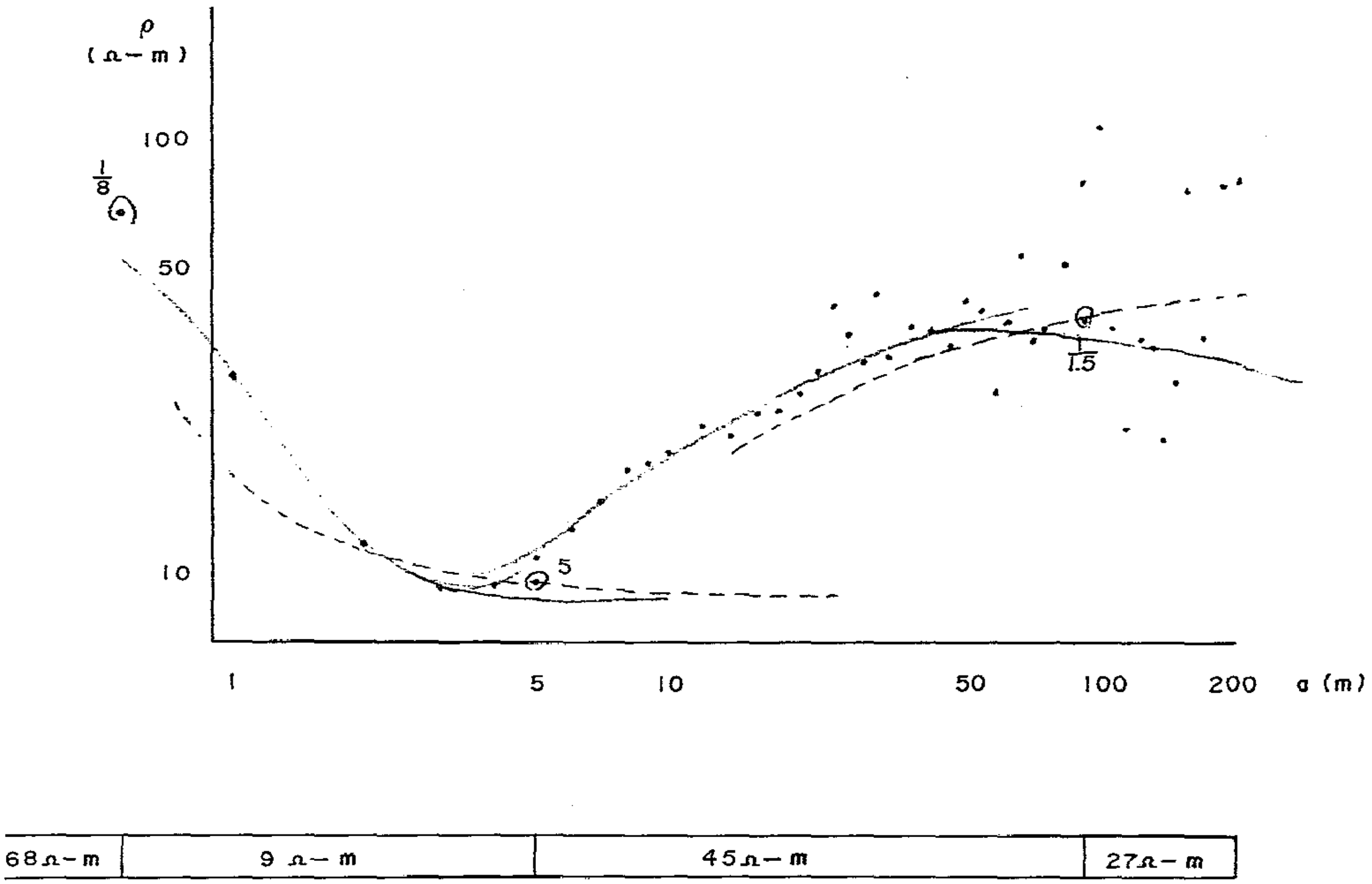

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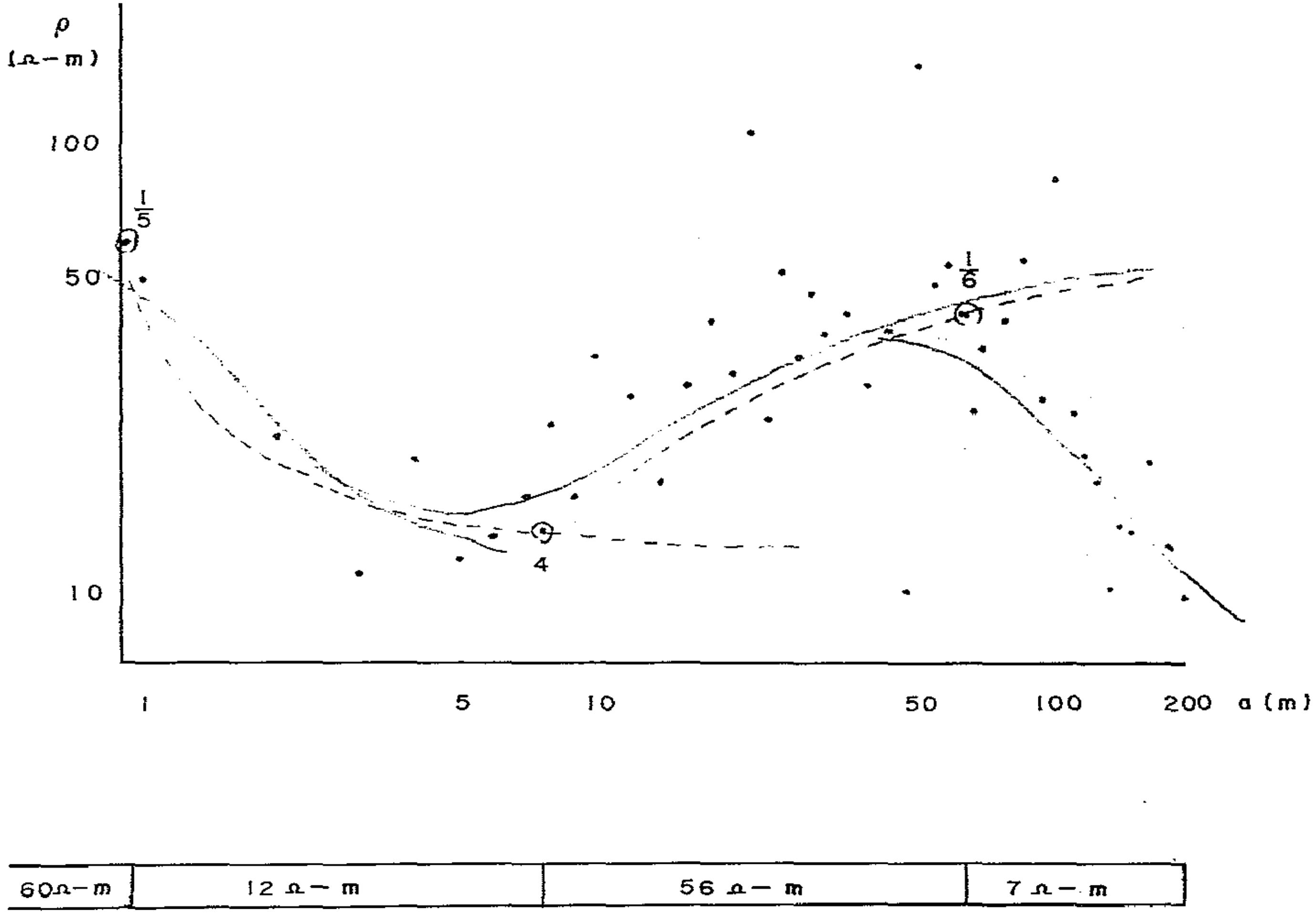

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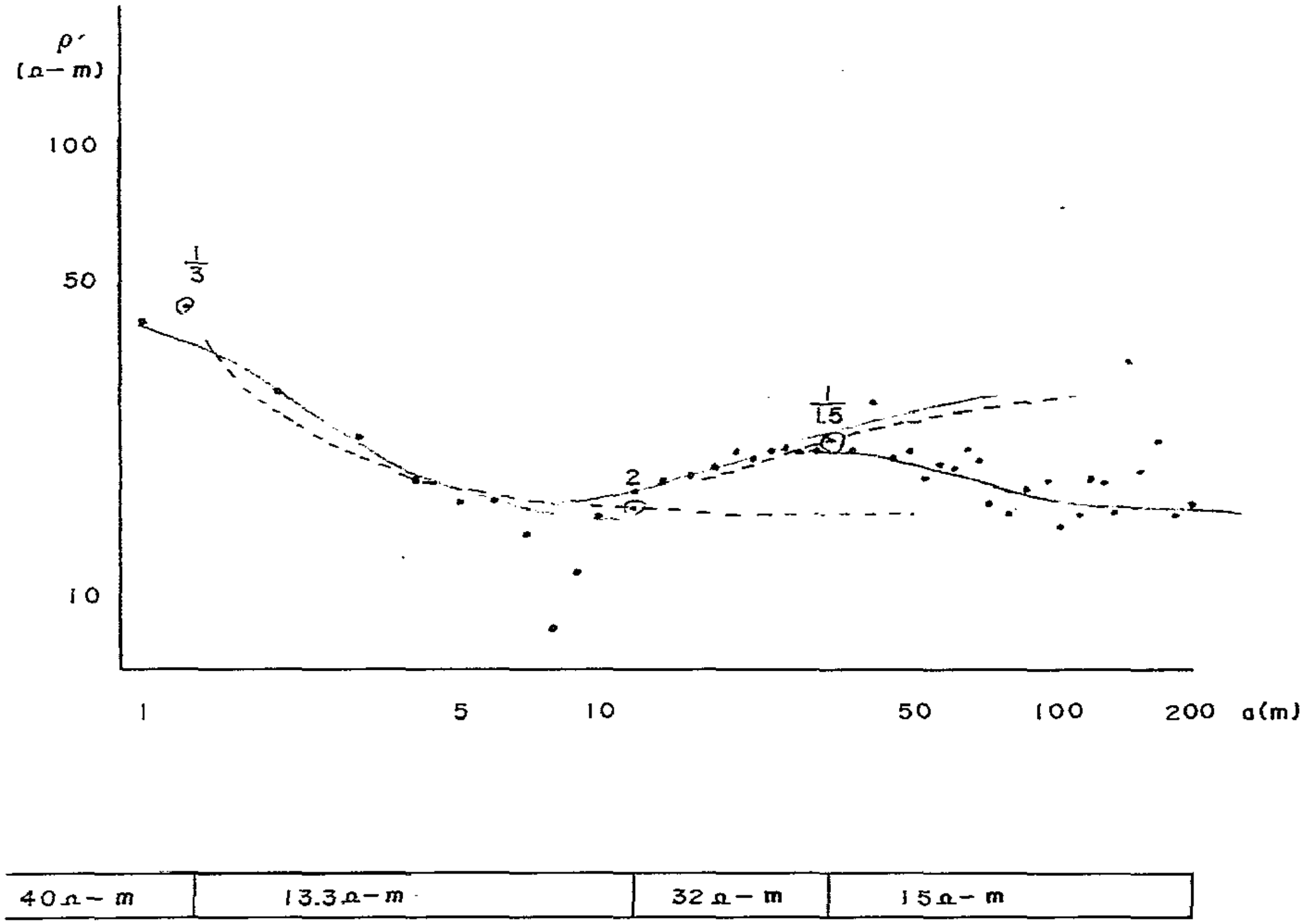

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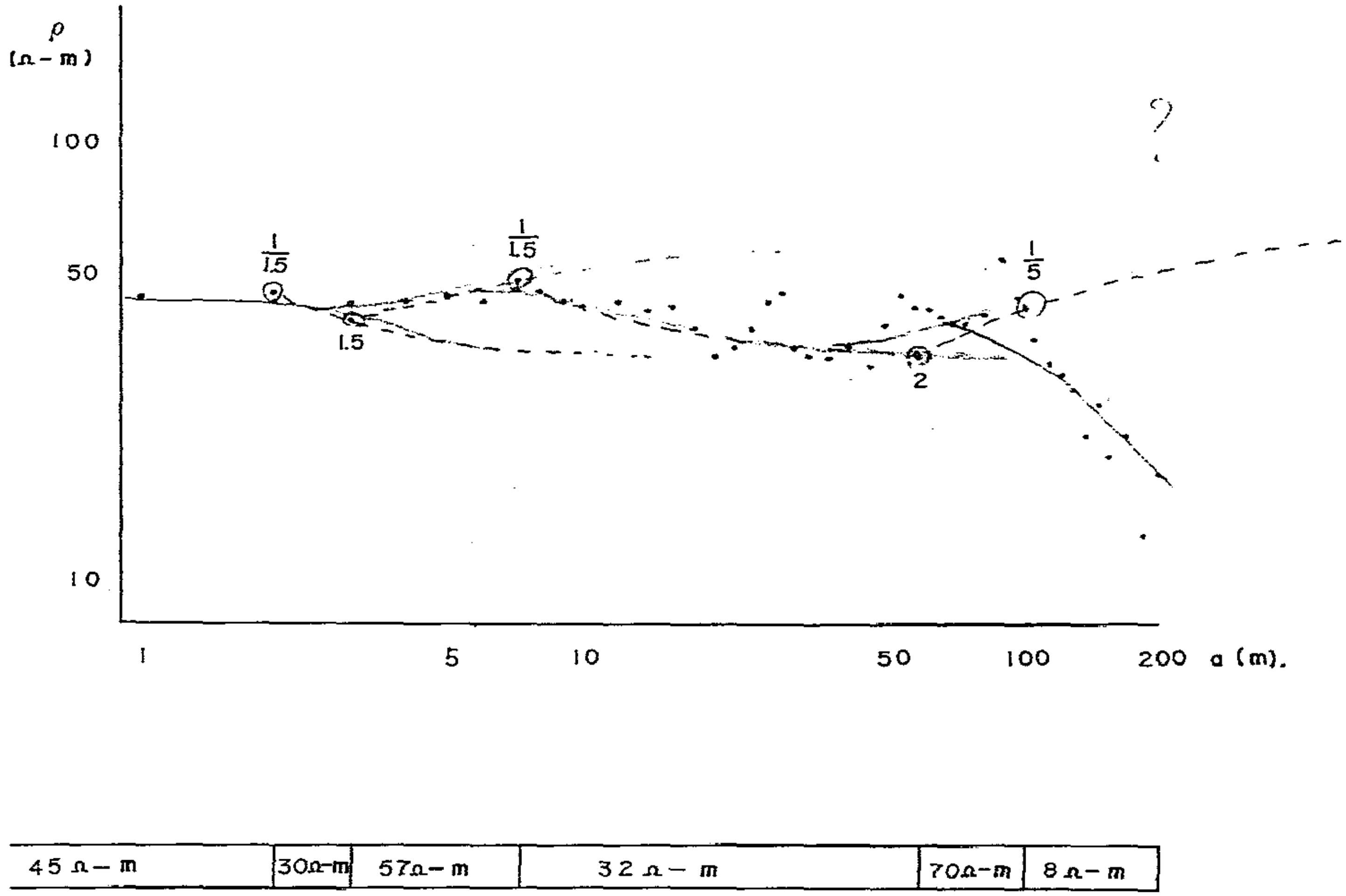

ELECTRICAL PROSPECTING IN MAGWE

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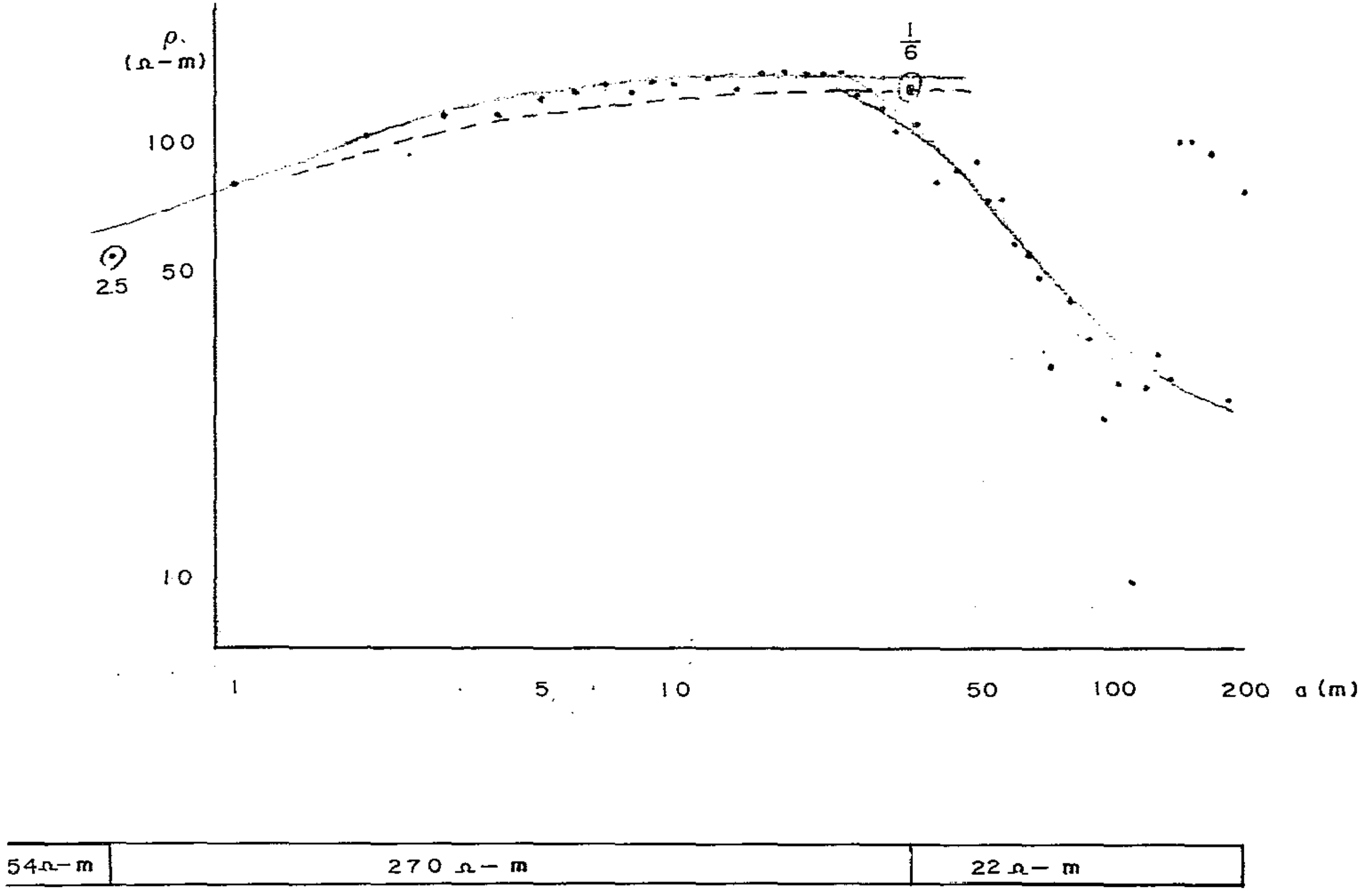
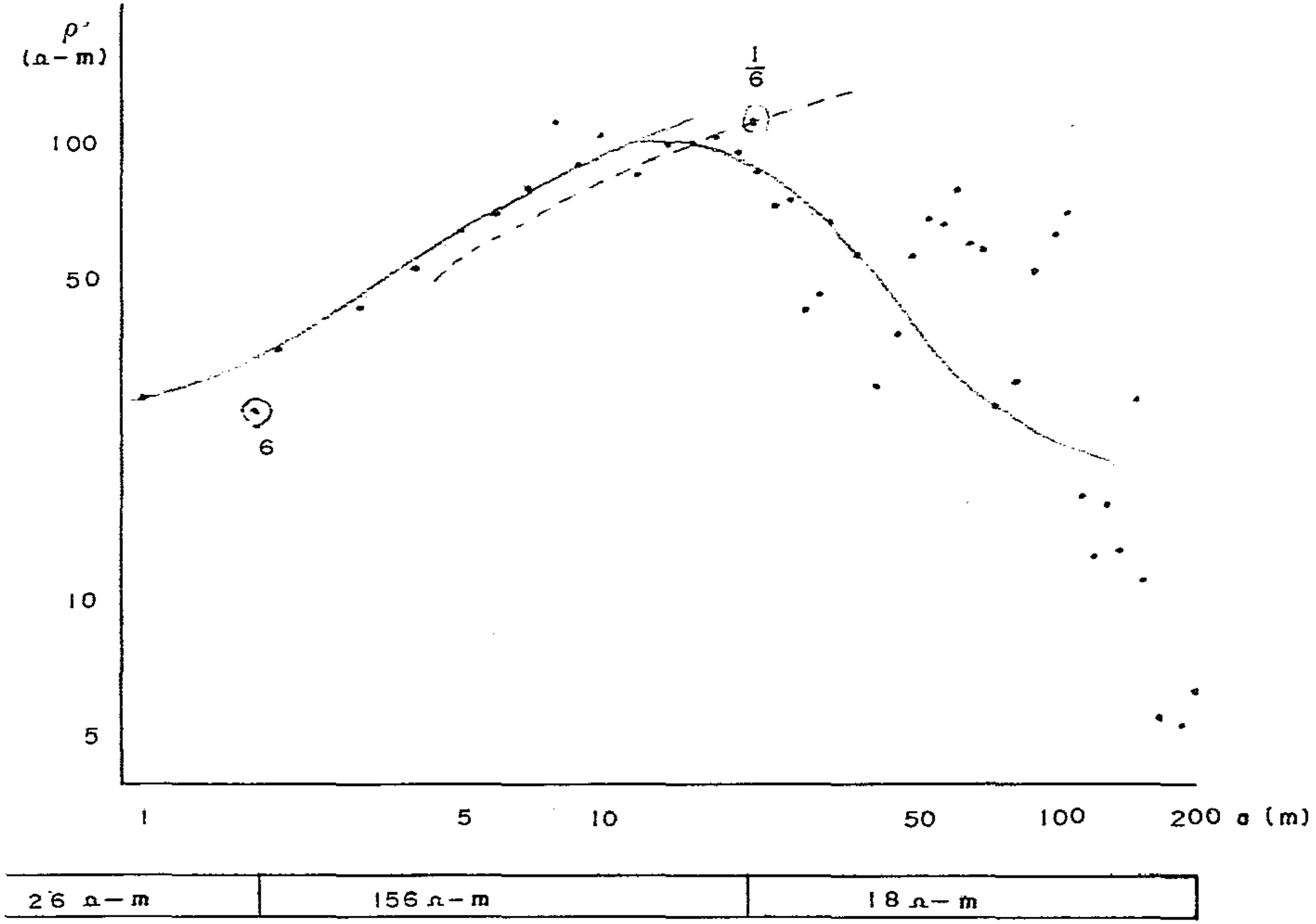


ELECTRICAL PROSPECTING IN MAGWE

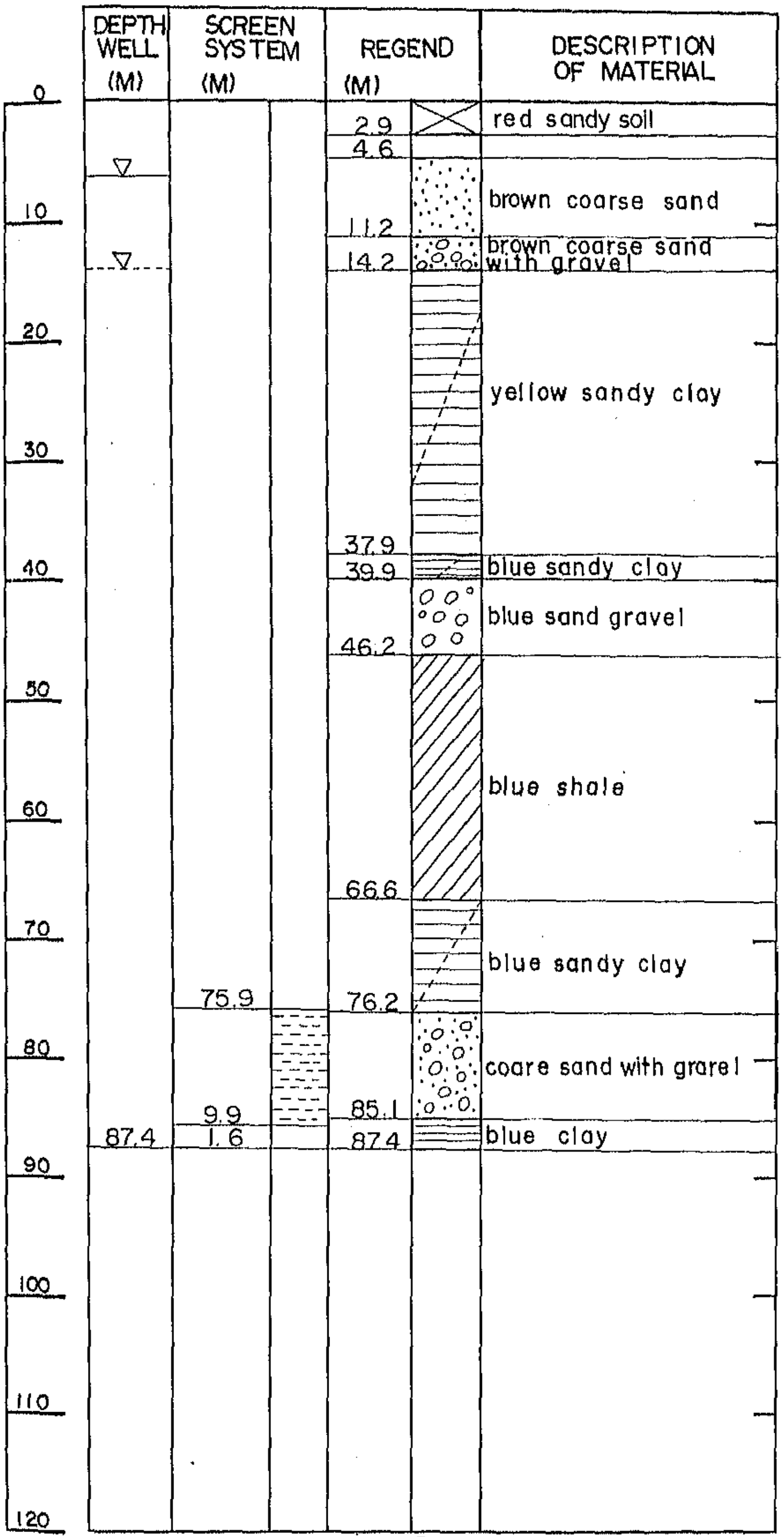
NO. 27



A－2・2 EXISTING WELL LOGS

DIVISIONAL REGIONAL PARTY COMMITTEE-MAGWE-NO. I

WELL LOG



MEMORANDUM

DRILLING MACHINE

JOY I

DATE

16·7·64—27·7·64

TOTAL WELL DEPTH

87·4m

CASING PIPE

ø100 m/m GI

CASING LENGTH

ø100 m/m x 75.9m

SCREEN LENGTH

ø100m/m x 9.9m

S.W.L ▽

6.3m

D.W.L --▽--

14.1 m

YIELD

926 L·P·M

※ REMARKS

MUD CECING

62.7m

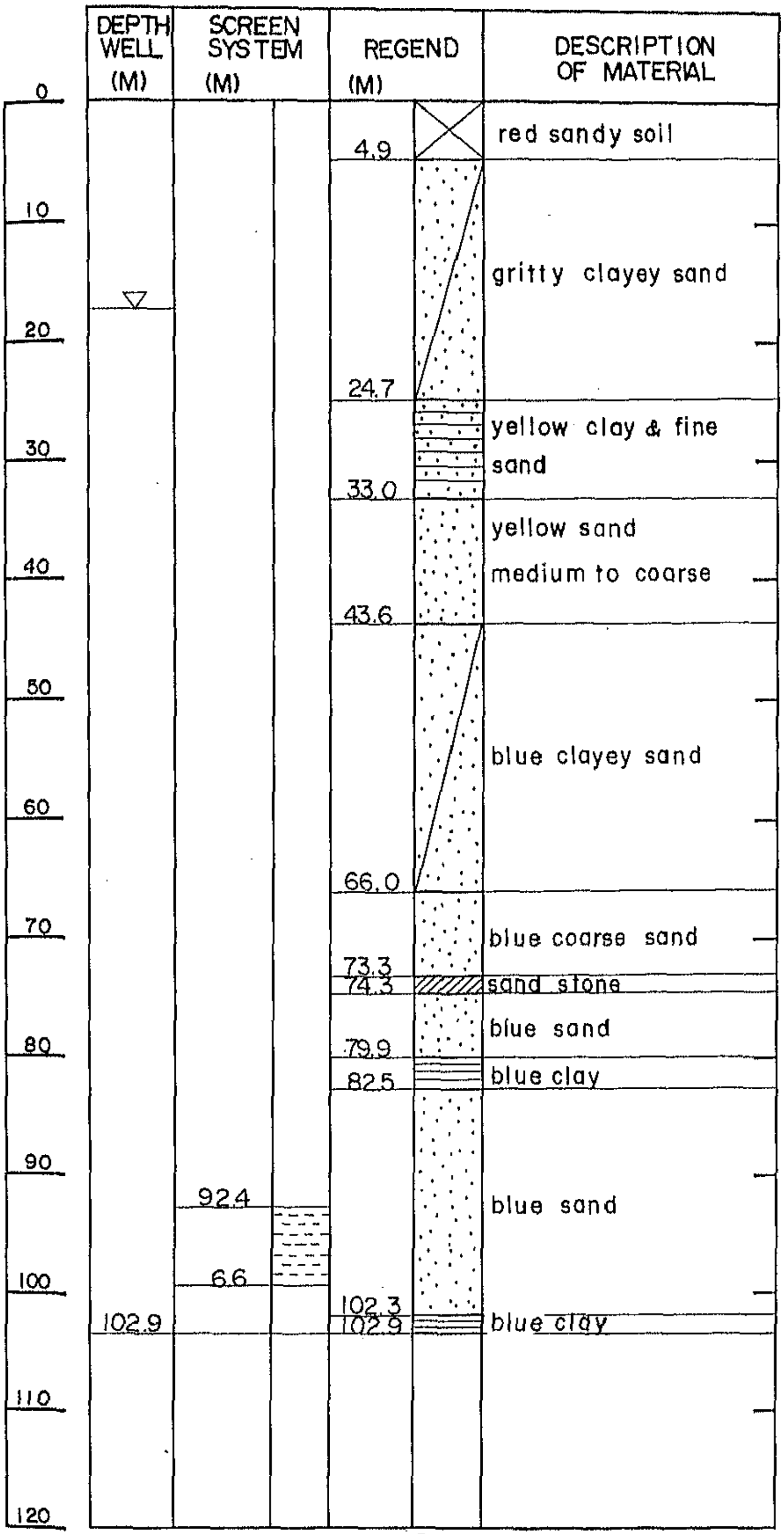
GRAVEL DACKING

24.8m

Source: Burma Government

DIVISIONAL PEOPLE'S COUNCIL, MAGWE - NO.2

WELL LOG



Source: Burma Government

MEMORANDUM

DRILLING MACHINE

PORTA

DATE

14·6·79 – 16·6·79

TOTAL WELL DEPTH

102.9 m

CASING PIPE

ø150 m/m G·I

CASING LENGTH

ø150m/m x 92.4 m

SCREEN LENGTH

ø125 x 6.6 m

S.W.L ▽

17.2 m

D.W.L ▽

—

YIELD

300 L·P·M

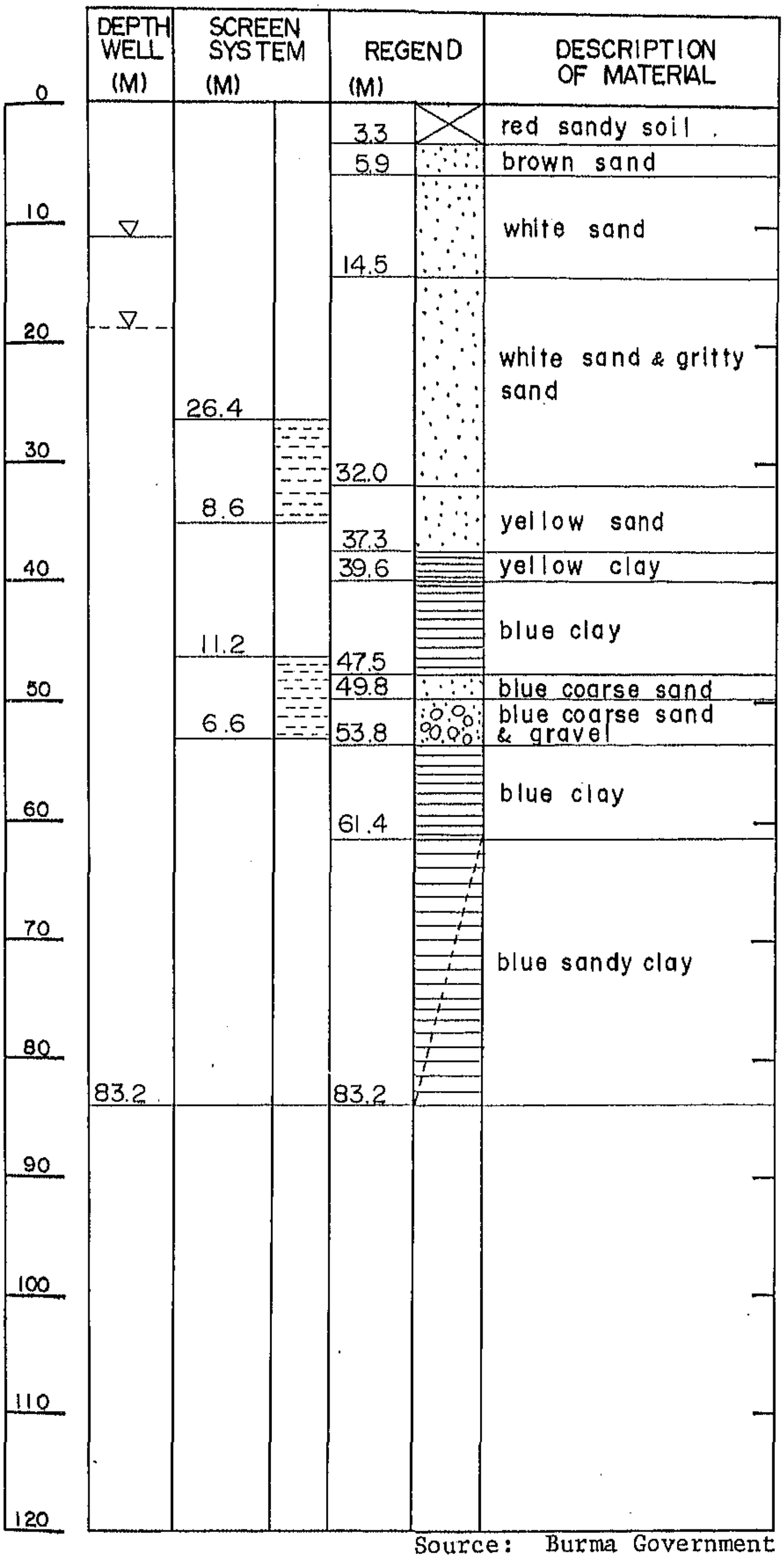
※ REMARKS

AIR PIPE

ø69 m/m x 89.1 m

DIVISIONAL SPORTS & PHPARTMENT. MAGWE NO. 3

WELL LOG



Source: Burma Government

MEMORANDUM

DRILLING MACHINE

JOY I

DATE

31.8.62 — 9.9.62

TOTAL WELL DEPTH

83.2m

CASING PIPE

ø 150 m/m GI

CASING LENGTH

ø 150 m/m x 37.6 m

SCREEN LENGTH

ø 150 m/m x 15.18 m

S.W.L ▽

10.9 m

D.W.L ▽

18.5 m

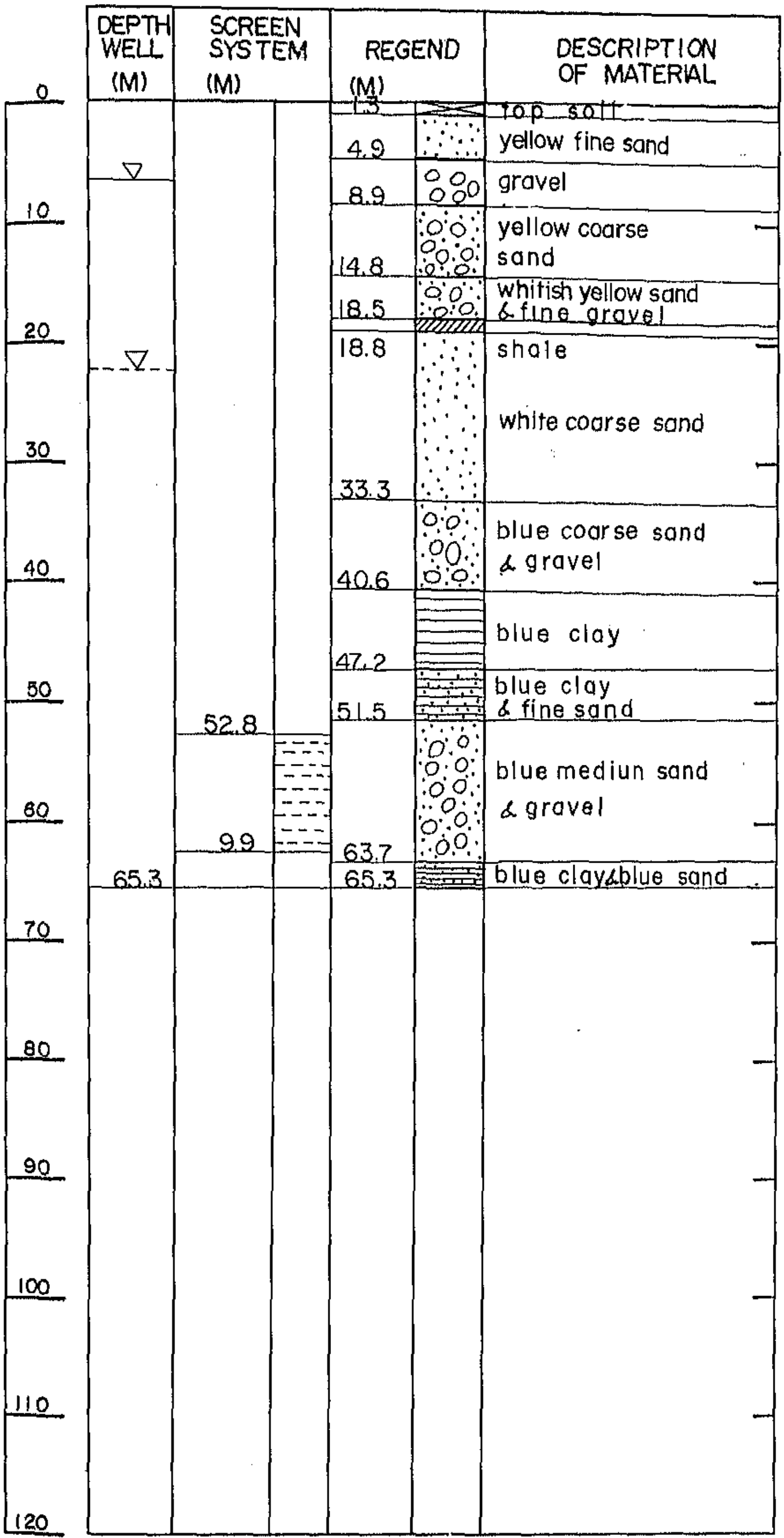
YIELD

922 L·P·M

※ REMARKS

MAGWE COLLEGE (NO.I)- NO.4

WELL LOG



REGEND (M)	DESCRIPTION OF MATERIAL
1.3	top soil
4.9	yellow fine sand
8.9	gravel
14.8	yellow coarse sand
18.5	whitish yellow sand & fine gravel
18.8	shale
	white coarse sand
33.3	
40.6	blue coarse sand & gravel
47.2	blue clay
51.5	blue clay & fine sand
63.7	blue mediun sand & gravel
65.3	blue clay&blue sand

Source: Burma Government

MEMORANDUM

DRILLING MACHINE
JOY I

DATE
—

TOTAL WELL DEPTH
63.5m

CASING PIPE
ø150m/m G·I

CASING LENGTH
ø 150m/m x 52.8m

SCREEN LENGTH
ø150m/m x 9.9m

S.W.L ▽
6.6m

D.W.L --▽--
22.4m

YIELD
472.5 L·P·M

※ REMARKS

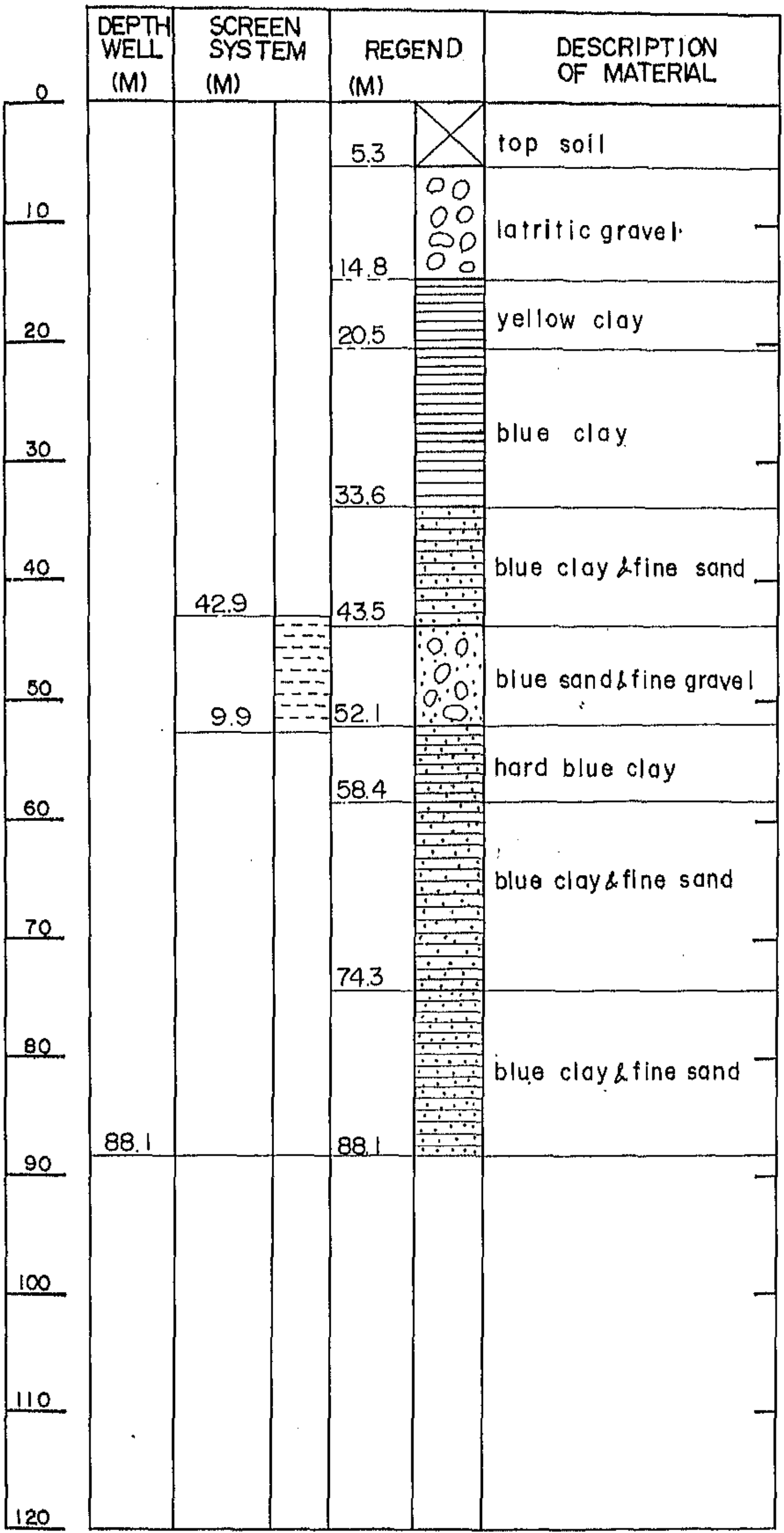
BORE HOLE
37.5m/m

CLAY SEAL
46.2m

GRAVEL·PACKING
19.1m

MAGWE COLLEGE (NO.2) – NO.4"

WELL LOG



Source: Burma Government

MEMORANDUM

DRILLING MACHINE

—

DATE

—

TOTAL WELL DEPTH

88.1 m

CASING PIPE

—

CASING LENGTH

ø200m/m x 42.9m

SCREEN LENGTH

ø200m/m x 9.9 m

S.W.L ▽

—

D.W.L ▽

—

YIELD

—

※ REMARKS

CLAY SEAL

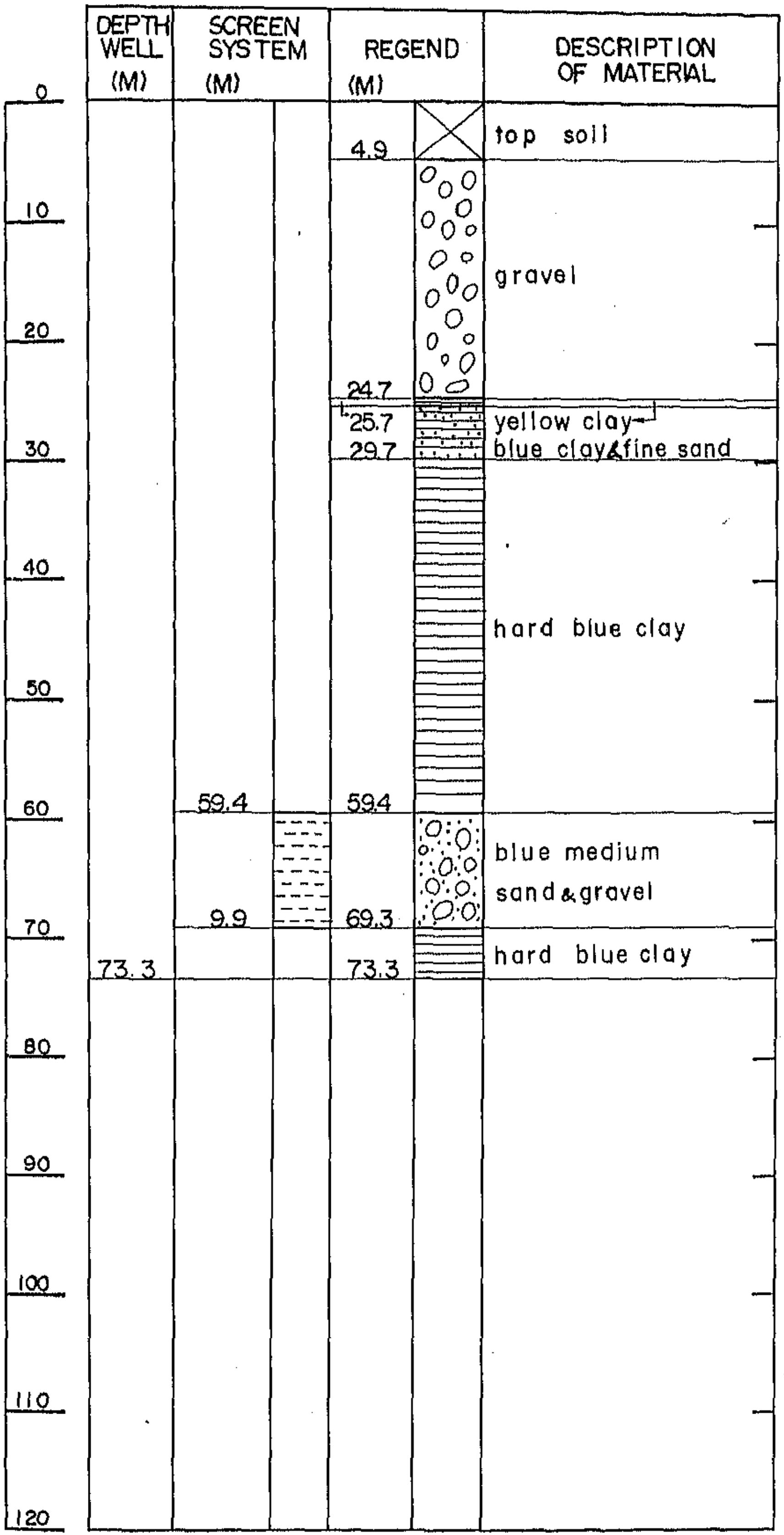
29.7m

GRAVEL PACKING

26.4 m

MAGWE COLLEGE (NO.3) - NO.4"

WELL LOG



Source: Burma Government

MEMORANDUM

DRILLING MACHINE

–

DATE

–

TOTAL WELL DEPTH

73.3 m

CASING PIPE

Ø200m/m

CASING LENGTH

Ø200m/m X 59.4m

SCREEN LENGTH

Ø200m/m X 9.9m

S.W.L ▽

–

D.W.L ▽

–

YIELD

862.5L·P·M

※ REMARKS

CLAY SEAL

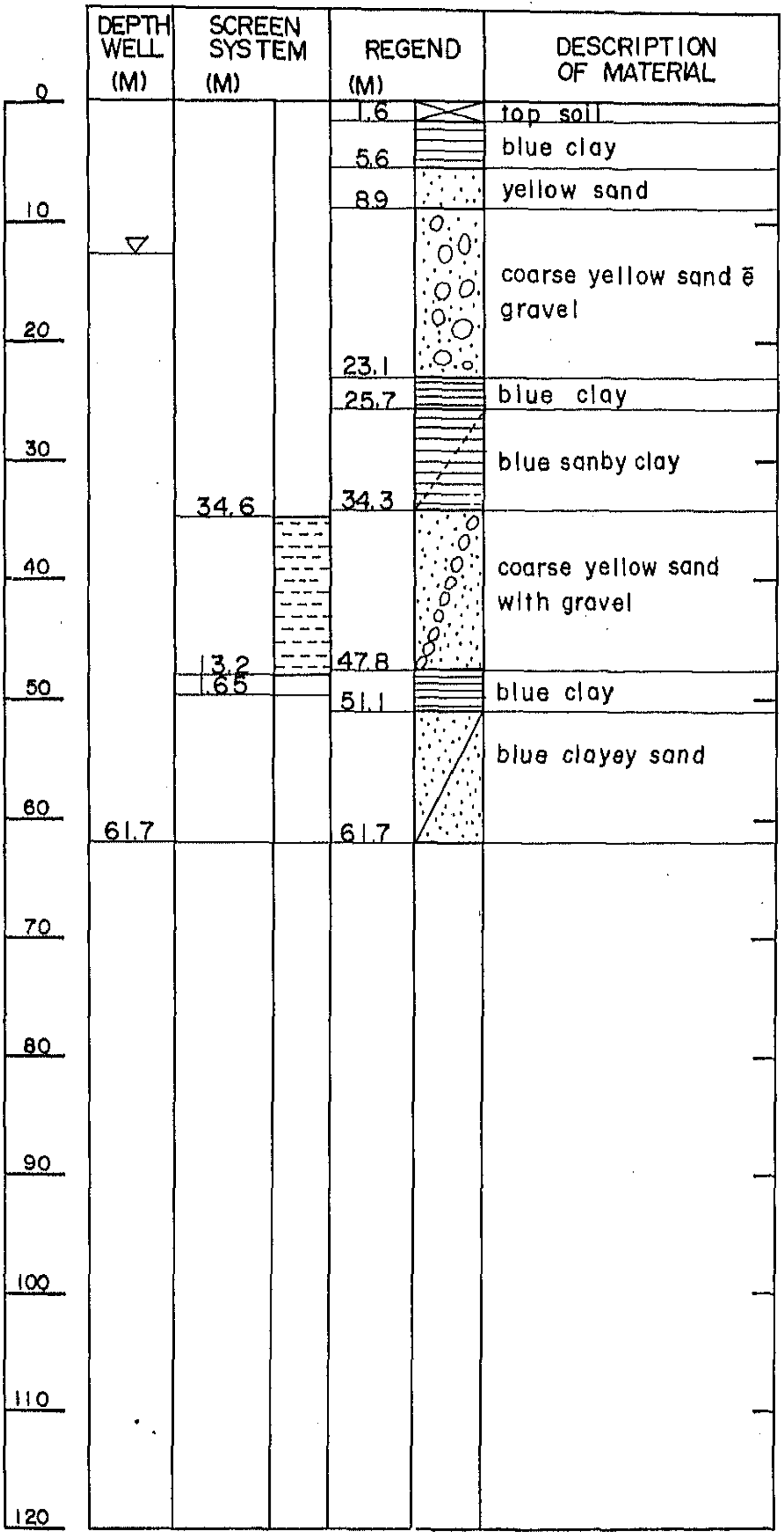
39.6 m

GRAVEL PACKING

33.6 m

MAGWE HOSPITAL - NO.5

WELL LOG



MEMORANDUM

DRILLING MACHINE

PORTA

DATE

29.7.65—5.8.65

TOTAL WELL DEPTH

61.7m

CASING PIPE

Ø150m/mGI

CASING LENGTH

Ø150m/m X36.3m

SCREEN LENGTH

150m/mX13.2m

S.W.L ▽

12.8m

D.W.L --▽--

—

YIELD

750 L·P·M

※ REMARKS

CLAY SEAL

26.4m

GRAVEL PACKING

24.1m

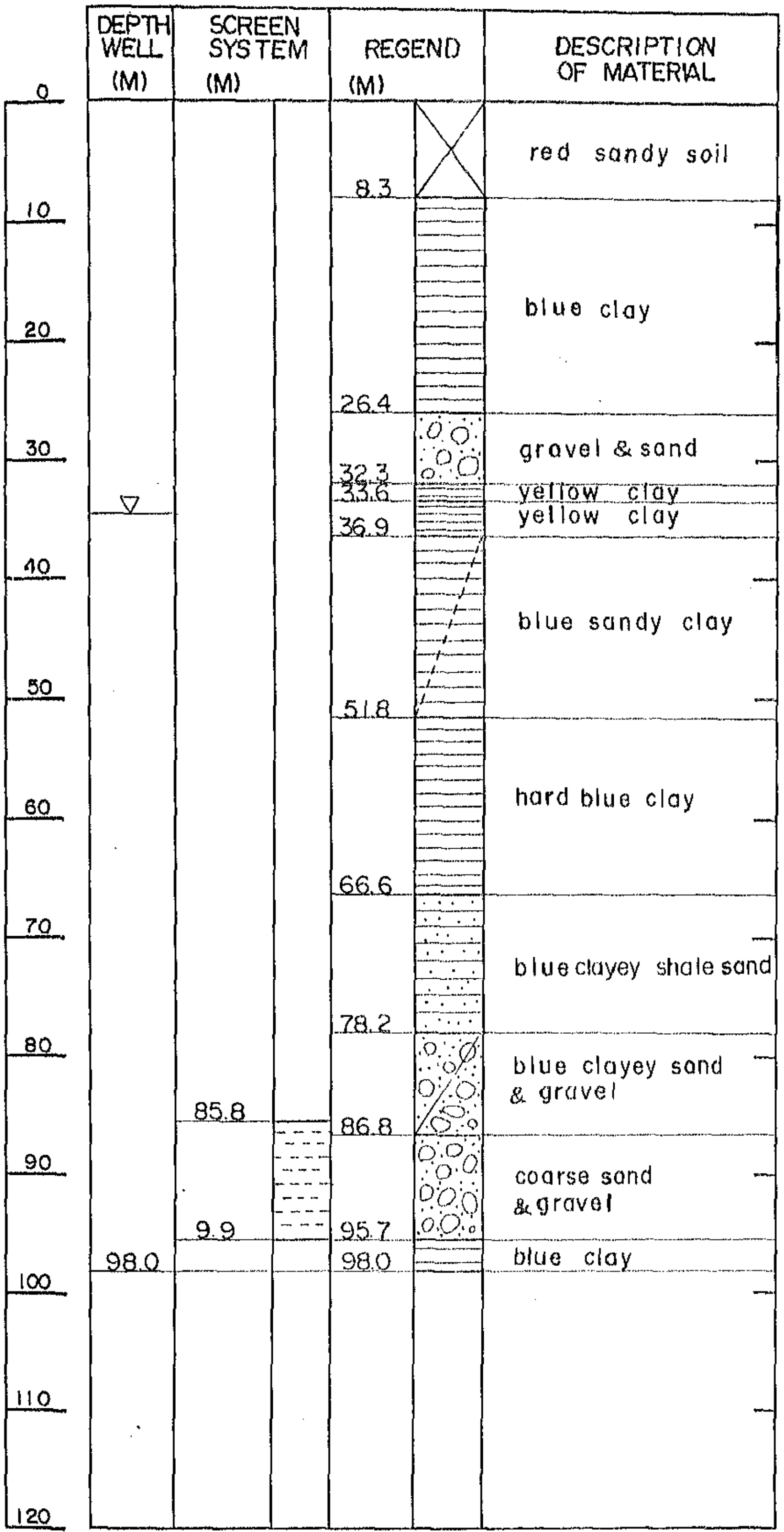
TEMPRATURE

31°C(4.8.81)

Source: Burma Government

DIVISIONAL TOWNSHIP CO-OPERATIVE SOCIATY MAGWE-NO.6

WELL LOG



Source: Burma Government

MEMORANDUM

DRILLING MACHINE

FAILING I

DATE

16.5.74—23.5.79

TOTAL WELL DEPTH

98.0m

CASING PIPE

Ø150m/m GI

CASING LENGTH

Ø150m/m X 85.8m

SCREEN LENGTH

Ø150m/m X 9.9m

S.W.L ▽

34.6m

D.W.L ▽

—

YIELD

270L·P·M

※ REMARKS

AIR PIPE

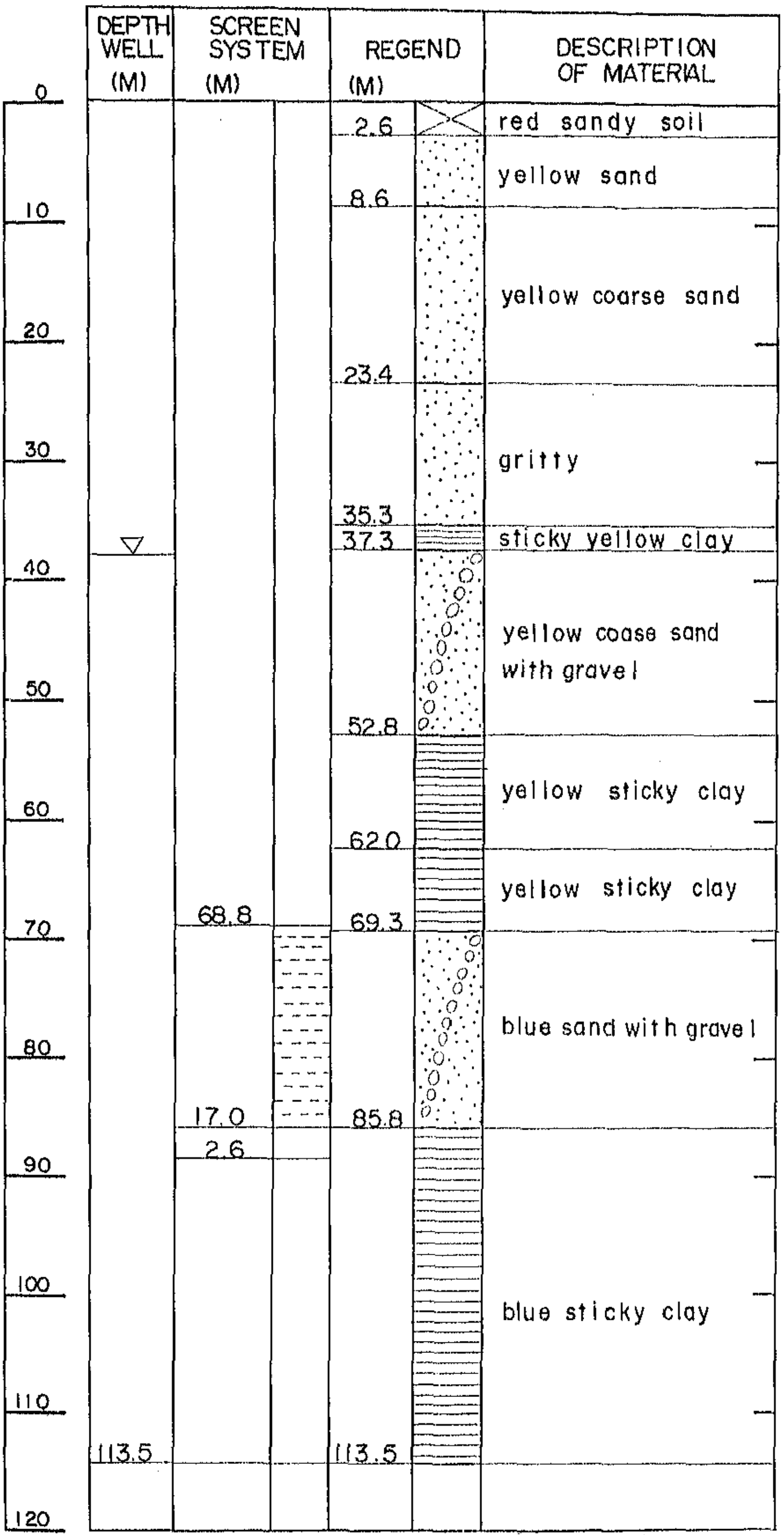
19m/m X 66m

RISER PIPE

50m/m X66m

AGRICULTURAL CORPORATION (FARM) MAGWE - NO. 8

WELL LOG



'Source: Burma Government

MEMORANDUM

DRILLING MACHINE

PORTA

DATE

11·8·65 — 20·8·65

TOTAL WELL DEPTH

113.5 m

CASING PIPE

ø150 m/m G·I

CASING LENGTH

ø150 m/m x 71.4 m

SCREEN LENGTH

ø150 m/m x 17.4 m

S.W.L ▽

37.6 m

D.W.L ▽

—

YIELD

420 L·P·M

※ REMARKS

CLAY SEAL

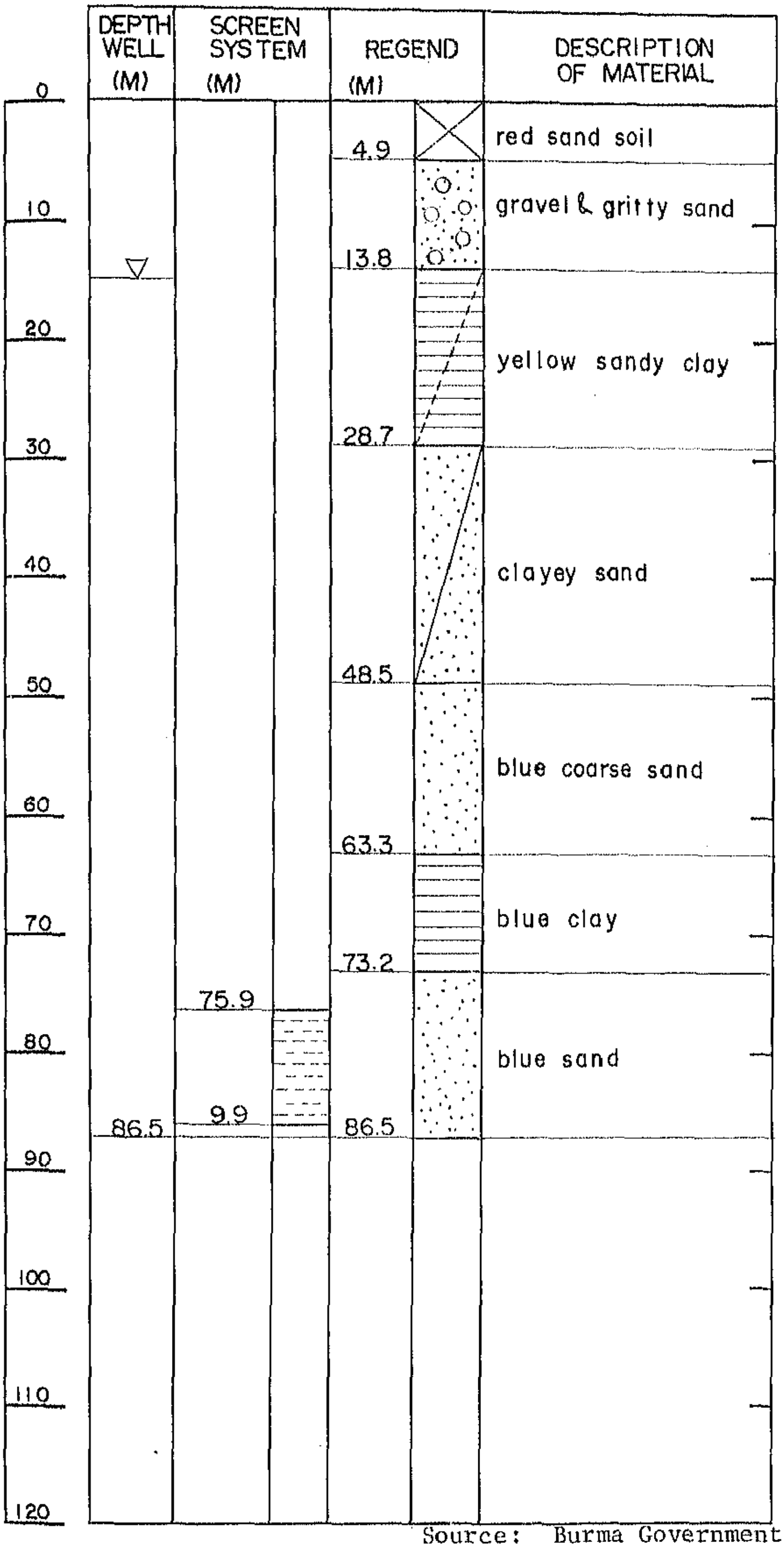
59.4 m

GRAVEL PACKING

33.6 m

TEREGRAPH OFFICE COMPOUND. MAGWE - NO.12

WELL LOG



Source: Burma Government

MEMORANDUM

DRILLING MACHINE

FAILING I

DATE

25.5.79 - 30.5.79

TOTAL WELL DEPTH

86.5 m

CASING PIPE

Ø100m/m · G·I

CASING LENGTH

Ø100m/m X75.9m

SCREEN LENGTH

Ø100m/m X 9.9 m

S.W.L ▽

14.8 m

D.W.L ▽

—

YIELD

300 L·P·M

※ REMARKS

AIR PIPE

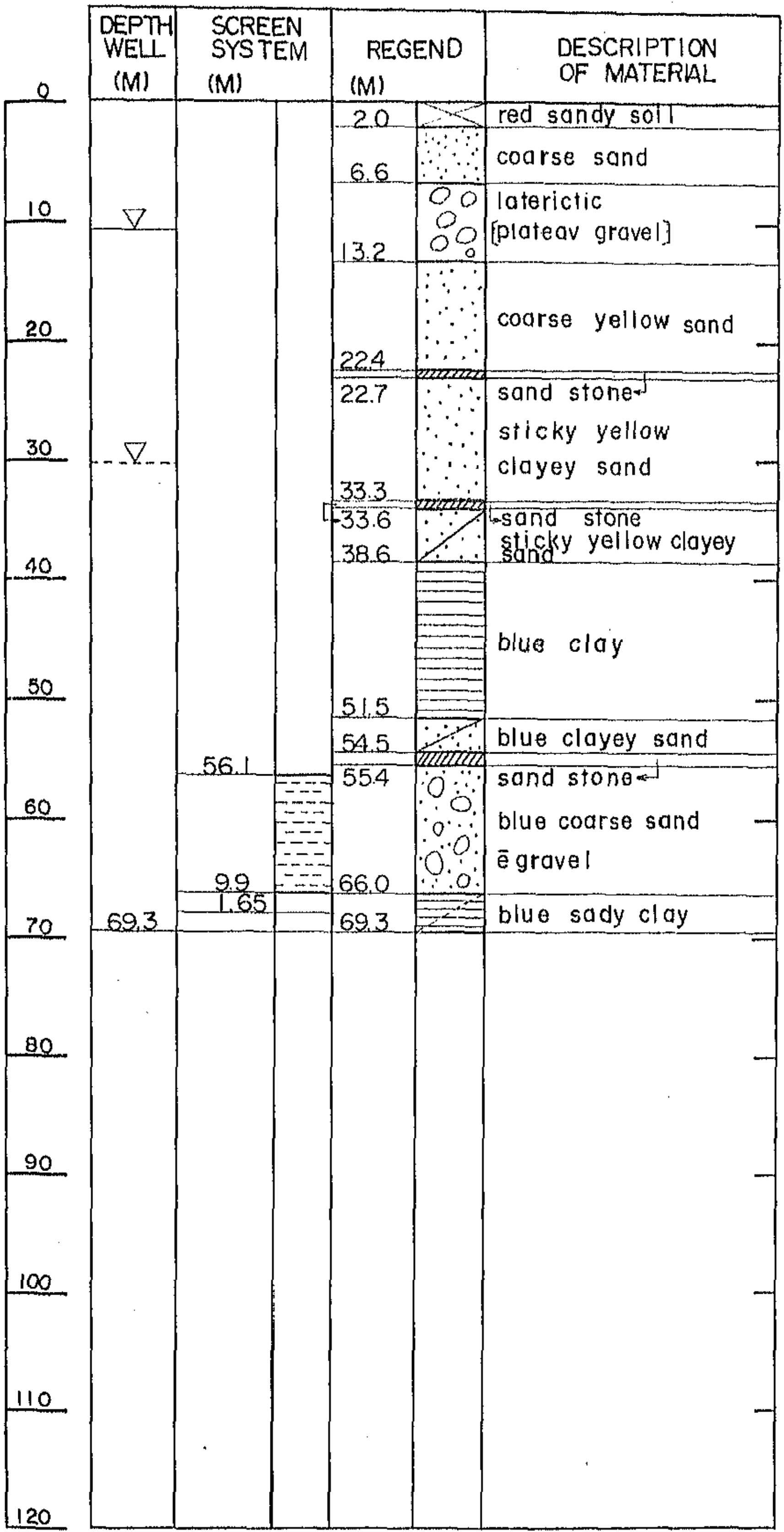
Ø19m/m X 82.5m

RISER PIPE

Ø50m/m X 82.5m

AGRICULTURAL MECHANIZATION DEPARTMENT(WATER SUPPLY)-NO.13

WELL LOG



Source: Burma Government

MEMORANDUM	
DRILLING MACHINE	PORTA
DATE	25.7.66-3.8.66
TOTAL WELL DEPTH	69.3 m
CASING PIPE	Ø150m/m G I
CASING LENGTH	Ø150m/m X 57.7m
SCREEN LENGTH	Ø150m/m X 9.9m
S.W.L ▽	10.9 m
D.W.L ▽	15.2 m
YIELD	850.5L·P·M

※ REMARKS

CLAY SEAL	42.9 m
GLAVEL PACKING	26.4 m

No. 433/81,434/81 & 435/81

A — 2 · 3 (1) REPORT OF WATER . ANALYSIS

Source	Physical Character				Chemical Tests.										
					Qualitative				Quantitative [Parts Per Million]						
	Appearance	Colour	Smell	Sediment	Sulphate	Nitrates	Nitrites	Ignition	Total Solid	Chlorine	Total hardness	Permanent hardness'	Saline ammonia	Albuminoid ammonia	Iron

	Lab.No.433/81 Sample No.Magwe(4) Tube well,Magwe College		Lab.No.434/81 Sample No. Magwe(5) Tube well,Magwe Hospital		Lab.No.435/81 Sample No.Magwe(6) Tube well,Divisional Co-op.	
1. Total solids.	660.0	mg/l	700.0	mg/l	760.0	mg/l
2. Total hardness,as $CaCO_3$	99.0	"	144.0	"	152.0	"
3. Permanent hardness,as $CaCO_3$	10.0	"	8.0	"	10.0	"
4. Calcium,as Ca	8.0	"	15.6	"	22.8	"
5. Magnesium,as Mg	19.2	"	25.5	"	23.1	"
6. Iron, as Fe	0.05	"	0.05	"	1.3	"
7. Manganese,as Mn	Nil		Nil		Nil	
8. Zinc,as Zn	Nil		Nil		0.25	"
9. Chloride,as Cl	61.0	"	94.0	"	85.0	"
10. Sulphate,as SO_4	13.7	"	169.5	"	161.7	"
11. Nitrate,as N	0.2	"	0.2	"	1.9	"
12. Carbonate,as CO_3	Nil		Nil		Nil	
13. Bicarbonate,as HCO_3	469.7	"	427.0	"	430.1	"
14. Free & saline ammonia as NH_3	0.01	"	0.01	"	0.01	"
15. Albuminoid ammonia as NH_3	0.02	"	0.01	"	0.20	"
16. pH.	7.9		8.0		7.9	

Remarks— Samples not sufficient for further tests.

DAW KHIN KHIN SOE,
M.B.B.S., D.P.H.
Asst. Director, N.H.L.

No. 436/81, 437/81 & 438/81.

A — 2 · 3 (2) REPORT OF WATER ANALYSIS

Source	Physical Character				Chemical Tests.										
					Qualitative				Quantitative [Parts Per Million]						
	Appear-ance	Colour	Smell	Sediment	Sulphate	Nitrates	Nitrites	Ignition	Total Solid	Chlorine	Total hardness	Permanent hardness'	Saline ammonia	Albuminoid ammonia	Iron

	Lab.No.436/81 Sample No.Magwe(7) Tube well, Pyidawtha Estate		Lab.No.437/81 Sample No.Magwe (8) Tube well, Agricultural Corporation, farm.		Lab.No.438/81 Sample No.Magwe(11) Tube well, Garrison Engineer.	
1. Total solids.	825.0	mg/l	826.0	mg/l	740.0	mg/l
2. Total hardness, as $CaCO_3$	150.0	"	148.0	"	120.0	"
3. Permanent hardness, as $CaCO_3$	7.0	"	8.0	"	8.0	"
4. Calcium, as Ca	29.6	"	21.6	"	18.8	"
5. Magnesium, as Mg	18.5	"	22.8	"	17.8	"
6. Iron, as Fe	0.35	"	0.05	"	0.05	"
7. Manganese, as Mn	Nil		Nil		Nil	
8. Zinc, as Zn	Nil		Nil		Nil	
9. Chloride, as Cl	82.0	"	32.0	"	74.0	"
10. Sulphate, as SO_4	140.1	"	147.0	"	132.3	"
11. Nitrate, as N	0.10	"	1.10	"	1.20	"
12. Carbonate, as CO_3	Nil		Nil		Nil	
13. Bicarbonate, as HCO_3	540.0	"	500.0	"	448.4	"
14. Free & saline ammonia, as NH_3	0.01	"	0.01	"	0.02	"
15. Albuminoid ammonia, as NH_3	0.01	"	0.01	"	0.04	"
16. pH.	7.8		7.8		7.6	

Remarks—

Samples not sufficient for further tests.

DAW KHIN KHIN SOE,
M.B., B.S., D.P.H.,
Asst. Director. H. M. I.

No. 439/81, 440/81 & 441/81.

A — 2 · 3 (3) REPORT OF WATER ANALYSIS

Source	Physical Character				Chemical Tests.										
	Appearance	Colour	Smell	Sediment	Qualitative				Quantitative [Parts Per Million]						
					Sulphate	Nitrates	Nitrites	Ignition	Total Solid	Chlorine	Total hardness	Permanent hardness'	Saline ammonia	Albuminoid ammonia	Iron
						Lab.No.439/81. Sample No.Magwe(13) Tube Well,AMB,Magwe.			Lab.No.440/81 River water Salween River,Pa-an			Lab.No.441/81 Tube well, Pa-an.			
	1. Total solids.						850.0	mg/l		1460.0	mg/l		340.0	mg/l	
	2. Total hardness,as $CaCO_3$						152.0	"		106.0	"		195.0	"	
	3. Permanent hardness,as $CaCO_3$						10.0	"		30.0	"		58.0	"	
	4. Calcium,as Ca						16.8	"		27.2	"		38.2	"	
	5. Magnesium,as Mg						26.7	"		9.25	"		23.3	"	
	6. Iron,as Fe						0.1	"		12.50	"		8.35	"	
	7. Manganese,as Mn						Nil			Nil			Nil		
	8. Zinc,as Zn						Nil			Nil			Nil		
	9. Chloride,as Cl						88.0	"		4.0	"		4.6	"	
	10. Sulphate,as SO_4						132.3	"		—			—		
	11. Carbonate,as CO_3						36.0	"		Nil			Nil		
	12. Bicarbonate,as HCO_3						503.3	"		136.0	"		249.5	"	
	13. Nitrate,as N						1.2	"		1.0	"		8.7	"	
	14. Free & saline ammonia,as NH_3						0.01	"		—			—		
	15. Albuminoid ammonia,as NH_3						0.10	"		—			—		
	16. pH.						8.4	—		7.5			7.1		

Remarks— Samples not sufficient for further tests.

DAW KHIN KHIN SOE,
M.B.,B.S., D.P.H.
Asst. Director, N.H.L.

NET WORK (PROPOSED PIPELINES)

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--- CALUCULATION OF HYDRAULIC NETWORK --- (FOR PIPE-LINE)    PIPELINE NETWORK  TYPE-2                    PAGE

LINE  JOINT NO.      C     DIA.     LENGTH     QUANTITY     VELOCITY    GRADIENT    HEAD LOSS
                          (MM)      ( M )      ( L/S )      ( M/S )     ( 0/00 )     ( M )

               *** LOOP   1 ***       SIGMA-H=  .000000

109     1- 84    150.    250.      10.00      -13.90         .283        .315       -.003
  1     1-  4    150.    250.     160.00       96.60        1.968      11.389       1.822
  2     4-  5    150.    250.     180.00       91.78        1.870      10.360       1.865

               *** LOOP   2 ***       SIGMA-H= -.000607

 55    13-  5    150.    250.     490.00      -53.98        1.100       3.882      -1.902
 54    12- 13    150.    250.     265.00      -53.98        1.100       3.882      -1.029
 53    11- 12    150.    250.      75.00      -51.53        1.050       3.561       -.267
  8    10- 11    140.    150.      70.00       -5.41         .306        .753       -.053
  7     7- 10    140.    150.     600.00       -5.41         .306        .753       -.452
  4     6-  7    140.    100.     315.00        6.53         .831       7.675       2.418
  3     5-  6    140.    150.     500.00       10.51         .595       2.570       1.285

               *** LOOP   3 ***       SIGMA-H=  .000000

  6     7-  8    140.    150.     350.00        3.98         .225        .426        .149

               *** LOOP   4 ***       SIGMA-H=  .000000

  5     7-  9    140.    100.     230.00        3.96         .507       3.072        .707

               *** LOOP   5 ***       SIGMA-H= -.006587

 37    18- 11    140.    150.     470.00       -8.10         .458       1.588       -.747
 53    11- 12    150.    250.      75.00      -51.53        1.050       3.561       -.267
 52    46- 12    140.    100.     300.00       -2.46         .313       1.258       -.377
 51    45- 46    140.    100.     365.00        1.52         .194        .520        .190
 50    44- 45    140.    100.     242.00       -3.37         .429       2.258       -.546
 49    43- 44    140.    100.      40.00       -3.37         .429       2.258       -.090
 41    81- 43    140.    150.     315.00       -4.54         .257        .545       -.172
 40    18- 81    140.    150.      20.00       -4.54         .257        .545       -.011

               *** LOOP   6 ***       SIGMA-H= -.001665

106    15- 14    150.    200.      90.00      -23.05         .734       2.383       -.214
  9    11- 14    150.    250.     340.00       34.03         .693       1.653        .562
 37    18- 11    140.    150.     470.00       -8.10         .458       1.588       -.747
 39    17- 18    140.    150.      40.00       -4.79         .271        .600       -.024
 36    16- 17    140.    150.     340.00       -4.79         .271        .600       -.204
 18    15- 16    150.    200.     168.00       15.82         .504       1.188        .200
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--- CALUCULATION OF HYDRAULIC NETWORK --- (FOR PIPE-LINE)   PIPELINE NETWORK TYPE-8  LH =  0.0 M        PAGE

LINE  JOINT NO.    C     DIA.     LENGTH     QUANTITY     VELOCITY     GRADIENT    HEAD LOSS
                         (MM)     ( M )       ( L/S )      ( M/S )     ( 0/00 )     ( M )

             *** LOOP   7 ***      SIGMA-H=  .002800

 70     6- 48    140.    150.    390.00        2.10         .119         .130        .051
 68    48- 49    140.    100.    500.00        3.15         .401        1.994        .997
 67    49- 50    140.    100.    160.00         .75         .096         .140        .022
 66    50- 51    140.    100.    270.00         .05         .007         .001        .000
 40     8- 51    140.    150.    200.00        3.33         .188         .305        .061
 41     7-  8    140.    150.    450.00        8.56         .485        1.759        .792
 40     6-  7    150.    200.    320.00       11.62         .370         .671        .215

             *** LOOP   8 ***      SIGMA-H=  .001152

 56    41- 42    140.    150.     60.00        -.96         .054         .031       -.002
 57     7- 42    140.    150.    150.00        1.66         .094         .085        .013
 41     7-  8    140.    150.    450.00        8.56         .485        1.759        .792
 59     8- 43    140.    100.    100.00        -.25         .031         .018       -.002
 58    41- 43    140.    100.    440.00        2.95         .375        1.759        .774

             *** LOOP   9 ***      SIGMA-H=  .000760

 53    40- 42    140.    100.    360.00        1.30         .166         .388        .140
 56    41- 42    140.    150.     60.00        -.96         .054         .031       -.002
 52    39- 41    140.    150.    410.00        3.39         .192         .316        .130
 54    39- 40    140.    150.     90.00       -2.07         .117         .127       -.011

             *** LOOP  10 ***      SIGMA-H=  .001591

 40     6-  7    150.    200.    320.00       11.62         .370         .671        .215
 57     7- 42    140.    150.    150.00        1.66         .094         .085        .013
 53    40- 42    140.    100.    360.00        1.30         .166         .388        .140
 55     6- 40    140.    150.    170.00        4.37         .247         .506        .086

             *** LOOP  11 ***      SIGMA-H=  .000587

 50    37- 38    140.    150.    120.00       -5.93         .335         .891       -.107
 49     5- 38    140.    150.    170.00        8.46         .479        1.721        .293
 39     5-  6    150.    200.    170.00       21.09         .671        2.021        .344
 55     6- 40    140.    150.    170.00        4.37         .247         .506        .086
 54    39- 40    140.    150.     90.00       -2.07         .117         .127       -.011
 51    37- 39    140.    150.    160.00        3.02         .171         .256        .041
```

```
--- CALUCULATION OF HYDRAULIC NETWORK --- (FOR PIPE-LINE)   PIPELINE NETWORK TYPE-8  LH =  0.0 M        PAGE

LINE  JOINT NO.    C     DIA.    LENGTH    QUANTITY    VELOCITY    GRADIENT   HEAD LOSS
                         (MM)    ( M )     ( L/S )     ( M/S )     ( 0/00 )    ( M )

               *** LOOP  12 ***     SIGMA-H=  .001606

   3      3-  4   150.   250.    270.00      42.51        .866       2.494       .673
  71      3- 48   140.   150.    480.00      11.97        .677       3.269      1.569
  70      6- 48   140.   150.    390.00       2.10        .119        .130       .051
  39      5-  6   150.   200.    170.00      21.09        .671       2.021       .344
  38      4-  5   150.   200.    130.00      29.85        .950       3.844       .500

               *** LOOP  13 ***     SIGMA-H=  .000640

  46     35- 36   140.   150.    150.00        .89        .051        .027       .004
  48     35- 38   140.   100.    350.00      -1.14        .145        .302     -.106
  50     37- 38   140.   150.    120.00      -5.93        .335        .891     -.107
  47     36- 37   140.   150.    350.00      -.51         .029        .009     -.003

               *** LOOP  14 ***     SIGMA-H=  .000931

  45     12- 35   140.   150.     90.00       1.76        .100        .094       .008
   4      4- 12   140.   150.    320.00      10.96        .620       2.777       .889
  38      4-  5   150.   200.    130.00      29.85        .950       3.844       .500
  49      5- 38   140.   150.    170.00       8.46        .479       1.721       .293
  48     35- 38   140.   100.    350.00      -1.14        .145        .302     -.106

               *** LOOP  15 ***     SIGMA-H=  .000000

   5     12- 13   140.    75.    290.00       7.50       1.698      40.270     11.678
   6     13- 14   140.    75.    750.00       5.10       1.154      19.730     14.797

               *** LOOP  16 ***     SIGMA-H=  .000000

   7      3- 15   140.   150.    340.00      31.50       1.783      19.587      6.660

               *** LOOP  17 ***     SIGMA-H= -.000208

  14     21- 22   140.    75.    180.00       1.77        .400       2.779       .500
  15     16- 22   140.    75.    310.00       2.14        .484       3.948      1.224
   8     15- 16   140.   150.    170.00      25.03       1.417      12.803      2.177
  13     15- 21   140.    75.    300.00       3.47        .785       9.666      2.900

               *** LOOP  18 ***     SIGMA-H= -.000051

  16     22- 23   140.    75.    180.00       1.21        .273       1.368       .246
  17     17- 23   140.   100.    210.00       2.33        .297       1.145       .240
   9     16- 17   140.   150.    180.00      17.83       1.009       6.832      1.230
  15     16- 22   140.    75.    310.00       2.14        .484       3.948      1.224
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.--- CALUCULATION OF HYDRAULIC NETWORK --- (FOR PIPE-LINE)    PIPELINE NETWORK TYPE-8  LH =  0.0 M         PAGE

LINE  JOINT NO.    C     DIA.    LENGTH     QUANTITY     VELOCITY    GRADIENT   HEAD LOSS
                        (MM)     ( M )      ( L/S )      ( M/S )     ( 0/00 )    ( M )

              *** LOOP  19 ***     SIGMA-H= -.000203

 18    23- 24   140.    75.     130.00       1.54         .348       2.151       .280
 19    18- 24   140.    75.     210.00       1.06         .240       1.080       .227
 10    17- 18   140.   150.     120.00      10.23         .579       2.445       .293
 17    17- 23   140.   100.     210.00       2.33         .297       1.145       .240

              *** LOOP  20 ***     SIGMA-H= -.000149

 20    24- 25   140.    75.     120.00        .90         .204        .796       .096
 21    19- 25   140.    75.     210.00        .96         .217        .899       .189
 11    18- 19   140.   150.     110.00       7.01         .397       1.215       .134
 19    18- 24   140.    75.     210.00       1.06         .240       1.080       .227

              *** LOOP  21 ***     SIGMA-H= -.000128

 22    25- 26   140.    75.     110.00        .16         .036        .033       .004
 23    20- 26   140.    75.     200.00        .84         .190        .701       .140
 12    19- 20   140.   150.     110.00       4.22         .239        .476       .052
 21    19- 25   140.    75.     210.00        .96         .217        .899       .189

              *** LOOP  22 ***     SIGMA-H= -.000239

 12    19- 20   140.   150.     110.00       4.22         .239        .476       .052
 24    20- 31   140.    75.     150.00       1.28         .290       1.532       .230
 25    30- 31   140.    75.     110.00        .12         .027        .019       .002
 26    19- 30   140.    75.     150.00       1.43         .323       1.869       .280

              *** LOOP  23 ***     SIGMA-H= -.000574

 11    18- 19   140.   150.     110.00       7.01         .397       1.215       .134
 26    19- 30   140.    75.     150.00       1.43         .323       1.869       .280
 28    29- 30   140.    75.     110.00        .09         .021        .012       .001
 27    18- 29   140.    75.     150.00       1.76         .398       2.755       .413

              *** LOOP  24 ***     SIGMA-H= -.000375

 10    17- 18   140.   150.     120.00      10.23         .579       2.445       .293
 27    18- 29   140.    75.     150.00       1.76         .398       2.755       .413
 30    28- 29   140.    75.     120.00        .99         .223        .946       .114
 33    17- 28   140.   100.     150.00       4.56         .581       3.956       .593
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---_CALUCULATION OF HYDRAULIC NETWORK --- (FOR PIPE-LINE)    PIPELINE NETWORK TYPE-8  LH =  0.0 M        PAGE

 LINE  JOINT NO.    C     DIA.     LENGTH     QUANTITY     VELOCITY     GRADIENT    HEAD LOSS
                          (MM)     ( M )      ( L/S )      ( M/S )      ( D/OO )     ( M )

                    ***_LOOP  25 ***      SIGMA-H= -.000265

   9    16- 17    140.    150.     180.00       17.83        1.009        6.832       1.230
  33    17- 28    140.    100.     150.00        4.56         .581        3.956        .593
  34    27- 28    140.     75.     170.00        1.15         .261        1.258        .214
  37    16- 27    140.     75.     150.00        3.67         .831       10.730       1.610

                    ***_LOOP  26 ***      SIGMA-H= -.000092

  34    27- 28    140.     75.     170.00        1.15         .261        1.258        .214
  32    28- 33    140.    100.     140.00        3.33         .424        2.206        .309
  35    32- 33    140.     75.     170.00         .82         .185         .667        .113
  36    27- 32    140.     75.     140.00        1.82         .411        2.925        .409

                    ***_LOOP  27 ***      SIGMA-H= -.000192

  30    28- 29    140.     75.     120.00         .99         .223         .946        .114
  29    29- 34    140.     75.     150.00        1.26         .284        1.474        .221
  31    33- 34    140.     75.     120.00         .44         .101         .217        .026
  32    28- 33    140.    100.     140.00        3.33         .424        2.206        .309
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```
--- CALUCULATION OF HYDRAULIC NETWORK --- (FOR JOINT)          PIPELINE NETWORK TYPE-8  LH =  0.0 M           PAGE

JOINT  SUM-Q   SUM-H    G.L.    W.L.    L.H.  PRESSURE      JOINT  SUM-Q   SUM-H    G.L.    W.L.    L.H.  PRESSURE
       (L/S)    (M)     (M)     (M)     (M)   (KG/CM2)             (L/S)    (M)     (M)     (M)     (M)   (KG/CM2)

   1   99.70     .00   79.20   79.20     .00     .000         2   -6.20   12.07   61.00   67.13    6.13     .613
   3    -.20   13.00   61.00   66.20    5.20     .520         4   -1.70   13.67   61.00   65.53    4.53     .453
   5    -.30   14.17   61.00   65.03    4.03     .403         6   -3.00   14.51   61.00   64.69    3.69     .369
   7   -1.40   14.73   61.00   64.47    3.47     .347         8   -2.00   15.52   61.00   63.68    2.68     .268
   9   -2.40   16.29   51.80   62.91   11.11    1.111        10   -1.40   16.78   61.00   62.42    1.42     .142
  11   -1.00   16.92   51.80   62.28   10.48    1.048        12   -1.70   14.56   61.00   64.64    3.64     .364
  13   -2.40   26.24   61.00   52.96   -8.04    -.804        14   -5.10   41.03   61.00   38.17  -22.83   -2.283
  15   -3.00   19.66   61.00   59.54   -1.46    -.146        16   -1.40   21.83   61.00   57.37   -3.63    -.363
  17    -.70   23.06   70.10   56.14  -13.96   -1.396        18    -.40   23.36   70.10   55.84  -14.26   -1.426
  19    -.40   23.49   70.10   55.71  -14.39   -1.439        20   -2.10   23.54   70.10   55.66  -14.44   -1.444
  21   -1.70   22.56   61.00   56.64   -4.36    -.436        22   -2.70   23.06   61.00   56.14   -4.86    -.486
  23   -2.00   23.30   61.00   55.90   -5.10    -.510        24   -1.70   23.58   70.10   55.62  -14.48   -1.448
  25   -1.70   23.68   61.00   55.52   -5.48    -.548        26   -1.00   23.68   61.00   55.52   -5.48    -.548
  27    -.70   23.44   70.10   55.76  -14.34   -1.434        28   -1.40   23.66   70.10   55.54  -14.56   -1.456
  29   -1.40   23.77   79.20   55.43  -23.77   -2.377        30   -1.40   23.77   79.20   55.43  -23.77   -2.377
  31   -1.40   23.77   79.20   55.43  -23.77   -2.377        32   -1.00   23.85   70.10   55.35  -14.75   -1.475
  33   -3.70   23.96   79.20   55.24  -23.96   -2.396        34   -1.70   23.99   79.20   55.21  -23.99   -2.399
  35   -2.00   14.57   61.00   64.63    3.63     .363        36   -1.40   14.57   61.00   64.63    3.63     .363
  37   -2.40   14.57   61.00   64.63    3.63     .363        38   -1.40   14.46   61.00   64.74    3.74     .374
  39   -1.70   14.61   61.00   64.59    3.59     .359        40   -1.00   14.60   61.00   64.60    3.60     .360
  41   -1.40   14.74   51.80   64.46   12.66    1.266        42   -2.00   14.74   51.80   64.46   12.66    1.266
  43   -2.70   15.51   51.80   63.69   11.89    1.189        44    -.70   13.02   61.00   66.18    5.18     .518
  45   -1.40   13.84   61.00   65.36    4.36     .436        46   -4.10   15.10   61.00   64.10    3.10     .310
  47   -3.40   14.87   61.00   64.33    3.33     .333        48   -2.40   14.57   61.00   64.63    3.63     .363
  49   -2.40   15.57   61.00   63.63    2.63     .263        50    -.70   15.59   61.00   63.61    2.61     .261
  51    -.70   15.59   61.00   63.61    2.61     .261        52   -1.00   15.61   61.00   63.59    2.59     .259
  53   -1.40   15.90   61.00   63.30    2.30     .230        54   -1.40   16.24   61.00   62.96    1.96     .196
  55   -3.10   15.56   61.00   63.64    2.64     .264        56    -.70   15.09   61.00   64.11    3.11     .311
```

TOTAL LENGTH OF PIPELINE

(   )

```
          DIA =  100      L = 4567.00
          DIA =  150      L =20903.00
          DIA =  200      L = 2662.00
          DIA =  250      L = 2555.00
*STOP*
```

NET WORK (EXISTING PIPELINES)

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---CALUCULATION OF HYDRAULIC NETWORK --- (FOR PIPE-LINE)   PIPELINE NETWORK TYPE-B  LH =  0.0 M          PAGE

        LINE  JOINT NO.    C     DIA.    LENGTH     QUANTITY    VELOCITY    GRADIENT   HEAD LOSS
                                 (MM)    ( M )      ( L/S )     ( M/S )     ( 0/00 )    ( M )

                     *** LOOP   1 ***    SIGMA-H=  .000000

           1    1- 2    150.   250.   1000.00       99.70       2.031      12.074      12.074

                     *** LOOP   2 ***    SIGMA-H=  .005440

           2    2- 3    140.   250.    100.00       86.17       1.755       9.219        .922
          78    2- 44   140.   100.    100.00        7.33        .933       9.508        .951
          74   44- 47   140.    75.    530.00        2.00        .452       3.475       1.842
          72   47- 48   140.   150.    170.00       -8.51        .482       1.741       -.296
          71    3- 48   140.   150.    480.00       11.97        .677       3.269       1.569

                     *** LOOP   3 ***    SIGMA-H=  .007938

          77   44- 45   140.   100.    200.00        4.63        .590       4.072        .814
          76   45- 46   140.   100.    600.00        3.23        .412       2.094       1.256
          75   46- 56   140.   100.     50.00        -.87        .111        .182       -.009
          73   47- 56   140.   150.    170.00        7.11        .402       1.247        .212
          74   44- 47   140.    75.    530.00        2.00        .452       3.475       1.842

                     *** LOOP   4 ***    SIGMA-H=  .004547

          72   47- 48   140.   150.    170.00       -8.51        .482       1.741       -.296
          73   47- 56   140.   150.    170.00        7.11        .402       1.247        .212
          69   55- 56   140.   150.    600.00       -5.54        .313        .787       -.472
          65   52- 55   140.   150.    370.00       -2.44        .138        .173       -.064
          61   51- 52   140.   150.    100.00        2.68        .151        .204        .020
          66   50- 51   140.   100.    270.00         .05        .007        .001        .000
          67   49- 50   140.   100.    160.00         .75        .096        .140        .022
          68   48- 49   140.   100.    500.00        3.15        .401       1.994        .997

                     *** LOOP   5 ***    SIGMA-H=  .000264

          60    8- 51   140.   150.    200.00        3.33        .188        .305        .061
          61   51- 52   140.   150.    100.00        2.68        .151        .204        .020
          62   52- 53   140.   100.     90.00        4.12        .524       3.270        .294
          63   53- 54   140.   100.    220.00        2.72        .346       1.515        .333
          64    9- 54   140.   100.    150.00       -1.32        .168        .397       -.060
          42    8- 9    140.   100.    320.00        3.48        .444       2.401        .768

                     *** LOOP   6 ***    SIGMA-H=  .000000

          43    9- 10   140.    75.    100.00        2.40        .543       4.892        .489
          44   10- 11   140.    75.    150.00        1.00        .226        .969        .145
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--- CALUCULATION OF HYDRAULIC NETWORK --- (FOR PIPE-LINE)   PIPELINE NETWORK  TYPE-2                PAGE

    LINE  JOINT NO.    C     DIA.    LENGTH    QUANTITY    VELOCITY   GRADIENT   HEAD LOSS
                             (MM)    ( M )     ( L/S )     ( M/S )    ( 0/00 )   ( M )

                 *** LOOP   7 ***     SIGMA-H= -.000602

     17   22- 21    140.   100.    370.00       .84        .107       .174       .064
     12   20- 21    140.   150.     70.00      7.01        .396      1.215       .085
     11   19- 20    140.   150.    215.00      7.01        .396      1.215       .261
     10   14- 19    140.   150.    125.00      7.01        .396      1.215       .152
    106   15- 14    150.   200.     90.00    -23.05        .734      2.383      -.214
     16   15- 22    140.   150.    170.00      7.22        .409      1.285       .213

                 *** LOOP   8 ***     SIGMA-H= -.000393

     14   23- 24    140.   150.    358.00       .11        .006       .001       .000
     13   21- 24    140.   150.    170.00      3.87        .219       .405       .069
     17   22- 21    140.   100.    370.00       .84        .107       .174       .064
     15   22- 23    140.   150.    130.00      6.38        .361      1.021       .133

                 *** LOOP   9 ***     SIGMA-H= -.000629

     18   15- 16    150.   200.    168.00     15.82        .504      1.188       .200
     19   16- 26    140.   150.    170.00      5.39        .305       .747       .127
     20   26- 25    140.   150.     98.00      4.32        .244       .496       .049
     21   25- 23    140.   150.    160.00     -2.29        .130       .154      -.025
     15   22- 23    140.   150.    130.00      6.38        .361      1.021       .133
     16   15- 22    140.   150.    170.00      7.22        .409      1.285       .218

                 *** LOOP  10 ***     SIGMA-H= -.000969

     22   25- 26    140.   150.    410.00      2.63        .149       .199       .081
     20   26- 25    140.   150.     98.00      4.32        .244       .496       .049
     27   27- 26    140.   100.    380.00     -1.07        .136       .269      -.102
     23   28- 27    140.   150.     90.00     -3.27        .185       .296      -.027

                 *** LOOP  11 ***     SIGMA-H= -.000931

     27   27- 26    140.   100.    380.00     -1.07        .136       .269      -.102
     19   16- 26    140.   150.    170.00      5.39        .305       .747       .127
     26   29- 16    150.   200.    130.00    -11.24        .358       .632      -.082
     25   30- 29    150.   200.    200.00    -11.24        .358       .632      -.126
     24   27- 30    140.   150.    140.00     -2.20        .125       .142      -.020
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--- CALUCULATION OF HYDRAULIC NETWORK --- (FOR PIPE-LINE)   PIPELINE NETWORK  TYPE-2                    PAGE

    LINE  JOINT NO.    C    DIA.    LENGTH    QUANTITY    VELOCITY   GRADIENT   HEAD LOSS
                            (MM)    ( M )     ( L/S )     ( M/S )    ( 0/00 )   ( M )

                   *** LOOP  12 ***    SIGMA-H= -.000724

     28   31- 28   140.   100.    440.00      -1.92        .244       .799      -.351
     23   28- 27   140.   150.     90.00      -3.27        .185       .296      -.027
     24   27- 30   140.   150.    140.00      -2.20        .125       .142      -.020
     31   33- 30   140.   150.    273.00      -5.06        .286       .666      -.182
     30   32- 33   140.   150.    160.00      -5.06        .286       .666      -.107
     29   32- 31   140.   100.    120.00       2.06        .262       .907       .109

                   *** LOOP  13 ***    SIGMA-H= -.008986

     25   30- 29   150.   200.    200.00     -11.24        .358       .632      -.126
     26   29- 16   150.   200.    130.00     -11.24        .358       .632      -.082
     38   16- 17   140.   150.    340.00      -4.79        .271       .600      -.204
     39   17- 18   140.   150.     40.00      -4.79        .271       .600      -.024
     36   41- 18   140.   100.    500.00      -3.88        .494      2.925     -1.463
     35   40- 41   140.   100.    170.00       -.06        .007       .001      -.000
     34   39- 40   140.   100.    270.00       3.76        .479      2.771       .745
     33   34- 39   140.   150.    210.00       -.74        .042       .019      -.004
     32   34- 32   140.   150.     10.00      -3.00        .170       .254      -.003
     30   32- 33   140.   150.    160.00      -5.06        .286       .666      -.107
     31   33- 30   140.   150.    273.00      -5.06        .286       .666      -.182

                   *** LOOP  14 ***    SIGMA-H= -.007402

     34   39- 40   140.   100.    270.00       3.76        .479      2.771       .748
     35   40- 41   140.   100.    170.00       -.06        .007       .001      -.000
     36   41- 18   140.   100.    500.00      -3.88        .494      2.925     -1.463
     40   18- 81   140.   150.     20.00      -4.54        .257       .545      -.011
     41   81- 43   140.   150.    315.00      -4.54        .257       .545      -.172
     42   43- 42   140.   150.    615.00      -5.15        .292       .688      -.423
     43   42- 38   140.   150.    370.00      12.22        .692      3.396      1.257
     44   38- 39   140.   150.    105.00       4.50        .255       .534       .056

                   *** LOOP  15 ***    SIGMA-H= -.000228

     48   35- 34   140.   100.    330.00      -3.74        .476      2.736      -.903
     33   34- 39   140.   150.    210.00       -.74        .042       .019      -.004
     44   38- 39   140.   150.    105.00       4.50        .255       .534       .056
     45   37- 38   140.   100.    100.00      -3.90        .497      2.961      -.296
     46   36- 37   140.   100.    225.00      -3.90        .497      2.961      -.666
     47   36- 35   140.   100.    170.00        .08        .010       .002       .000
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 --- CALUCULATION OF HYDRAULIC NETWORK --- (FOR PIPE-LINE)    PIPELINE NETWORK  TYPE-2                     PAGE

 LINE  JOINT NO.     C     DIA.     LENGTH     QUANTITY     VELOCITY     GRADIENT    HEAD LOSS
                           (MM)     ( M )      ( L/S )      ( M/S )      ( 0/00 )     ( M )

              *** LOOP  16 ***     SIGMA-H= -.004868

  51    45- 46   140.    100.     365.00        1.52         .194          .520        .190
  52    46- 12   140.    100.     300.00       -2.46         .313         1.256       -.377
  54    12- 13   150.    250.     265.00      -53.98        1.100         3.882      -1.029
  55    13-  5   150.    250.     490.00      -53.98        1.100         3.882      -1.902
  56     5- 47   150.    200.     192.00       27.29         .869         3.256        .625
  57    47- 48   140.    150.      70.00       22.47        1.271        10.480        .734
  61    49- 48   140.    150.     455.00       -8.79         .497         1.845       -.839
  62    49- 45   140.    150.     487.00        8.87         .502         1.880        .915

              *** LOOP  17 ***     SIGMA-H= -.004526

  49    43- 44   140.    100.      40.00       -3.37         .429         2.258       -.090
  50    44- 45   140.    100.     242.00       -3.37         .429         2.258       -.546
  62    49- 45   140.    150.     487.00        8.87         .502         1.880        .915
  77    56- 49   150.    200.     535.00        1.36         .043          .013        .007
  79    58- 56   150.    200.     440.00      -14.29         .455          .983       -.433
 104    58-  2   150.    250.     340.00      -11.49         .234          .222       -.075
 103     2- 65   150.    250.     215.00       38.43         .783         2.070        .445
 102    65- 42   140.    150.      35.00       21.20        1.199         9.407        .329
  42    43- 42   140.    150.     615.00       -5.15         .292          .688       -.423

              *** LOOP  18 ***     SIGMA-H= -.000290

 100    67- 66   140.    150.     335.00       -6.83         .387         1.160       -.388
 101    66- 65   140.    150.      90.00      -17.24         .976         6.422       -.578
 103     2- 65   150.    250.     215.00       38.43         .783         2.070        .445
 104    58-  2   150.    250.     340.00      -11.49         .234          .222       -.075
  81    59- 58   150.    200.     340.00      -21.15         .673         2.033       -.691
  83    76- 59   150.    200.     172.00      -20.86         .664         1.981       -.341
 105    76- 73   140.    150.     380.00        5.83         .330          .865        .329
  94    73- 67   140.    150.      50.00       -4.32         .244          .496       -.025

              *** LOOP  19 ***     SIGMA-H= -.000100

  93    67- 68   140.    150.     445.00        2.51         .142          .182        .081
  95    68- 69   140.    150.     100.00       -2.78         .158          .220       -.022
  96    69- 70   140.    150.     135.00       -2.78         .158          .220       -.030
  97    70- 71   140.    150.     170.00       -6.59         .373         1.086       -.185
  98    71- 72   140.    150.      65.00       -6.59         .373         1.086       -.071
  99    66- 72   140.    150.     150.00        6.59         .373         1.086        .163
 100    67- 66   140.    150.     335.00       -6.83         .387         1.160       -.388
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--- CALUCULATION OF HYDRAULIC NETWORK --- (FOR PIPE-LINE)    PIPELINE NETWORK  TYPE-2                    PAGE

LINE  JOINT NO.    C     DIA.    LENGTH    QUANTITY    VELOCITY   GRADIENT   HEAD LOSS
                         (MM)    ( M )     ( L/S )     ( M/S )    ( 0/00 )   ( M )

                *** LOOP  20 ***      SIGMA-H= -.000066

 90    74- 73    140.    150.    680.00      -6.34       .359      1.010      -.687
 91    74- 75    140.    150.    420.00      -1.49       .084       .069      -.029
 92    75- 68    140.    150.    830.00      -5.30       .300       .724      -.601
 93    67- 68    140.    150.    445.00       2.51       .142       .182       .081
 94    73- 67    140.    150.     50.00      -4.32       .244       .496      -.025

                *** LOOP  21 ***      SIGMA-H= -.000131

 90    74- 73    140.    150.    680.00      -6.34       .359      1.010      -.687
105    76- 73    140.    150.    380.00       5.83       .330       .865       .329
 84    77- 76    140.    150.    400.00     -11.22       .635      2.901     -1.160
 88    80- 77    140.    150.    470.00      -2.96       .167       .246      -.116
 89    80- 74    140.    150.    600.00      -4.02       .228       .435      -.261

                *** LOOP  22 ***      SIGMA-H= -.000013

 88    80- 77    140.    150.    470.00      -2.96       .167       .246      -.116
 85    78- 77    140.    150.    445.00      -4.45       .252       .525      -.234
 86    79- 78    140.    150.    350.00       -.64       .036       .015      -.005
 87    79- 80    140.    150.    440.00      -3.17       .179       .280      -.123

                *** LOOP  23 ***      SIGMA-H= -.000142

 81    59- 58    150.    200.    340.00     -21.15       .673      2.033      -.691
 80    57- 58    140.    150.    400.00        .20       .011       .002       .001
 72    60- 57    140.    150.    350.00      -7.44       .421      1.357      -.475
 82    60- 59    140.    150.    400.00       4.53       .256       .542       .217

                *** LOOP  24 ***      SIGMA-H= -.000586

 79    58- 56    150.    200.    440.00     -14.29       .455       .983      -.433
 78    55- 56    150.    200.    395.00      20.46       .651      1.912       .755
 73    57- 55    140.    150.    337.00     -12.46       .705      3.522     -1.187
 80    57- 58    140.    150.    400.00        .20       .011       .002       .001
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--- CALUCULATION OF HYDRAULIC NETWORK --- (FOR PIPE-LINE)    PIPELINE NETWORK  TYPE-2                    PAGE

 LINE  JOINT NO.    C    DIA.    LENGTH    QUANTITY   VELOCITY   GRADIENT   HEAD LOSS
                         (MM)     ( M )     ( L/S )    ( M/S )   ( 0/00 )    ( M )

              *** LOOP  25 ***     SIGMA-H= -.000502

  67    64-  3   140.   150.    770.00     -11.55       .654      3.060     -2.357
  68    64- 63   140.   150.    170.00       6.73       .381      1.127       .192
  69    63- 62   140.   150.    130.00       6.73       .381      1.127       .146
  70    62- 61   140.   150.    140.00       6.73       .381      1.127       .158
  71    61- 60   140.   150.    100.00       1.91       .108       .109       .011
  72    60- 57   140.   150.    350.00      -7.44       .421      1.357     -.475
  73    57- 55   140.   150.    337.00     -12.46       .705      3.522     -1.167
  76     3- 55   150.   250.    440.00      44.65       .910      2.732      1.202

              *** LOOP  26 ***     SIGMA-H= -.000429

  74    55- 50   140.   150.    530.00       6.91       .391      1.182       .627
  75    54- 50   140.   150.    440.00       3.11       .176       .271       .119
  66     3- 54   140.   150.    530.00      11.88       .672      3.226      1.710
  76     3- 55   150.   250.    440.00      44.65       .910      2.732      1.202

              *** LOOP  27 ***     SIGMA-H= -.000539

  77    56- 49   150.   200.    535.00       1.36       .043       .013       .007
  60    50- 49   140.   150.    395.00       3.55       .201       .345       .136
  74    55- 50   140.   150.    530.00       6.91       .391      1.182       .627
  78    55- 56   150.   200.    395.00      20.46       .651      1.912       .755

              *** LOOP  28 ***     SIGMA-H= -.001143

  61    49- 48   140.   150.    455.00      -8.79       .497      1.845      -.839
  58    48- 51   140.   150.    395.00       8.86       .501      1.874       .740
  59    50- 51   140.   150.    455.00       1.65       .093       .084       .038
  60    50- 49   140.   150.    395.00       3.55       .201       .345       .136

              *** LOOP  29 ***     SIGMA-H= -.000175

  59    50- 51   140.   150.    455.00       1.65       .093       .084       .038
  63    51- 52   140.   150.     55.00       5.69       .322       .827       .045
  64    52- 53   140.   150.    440.00        .87       .049       .026       .011
  65    54- 53   140.   150.    510.00       3.95       .223       .420       .214
  75    54- 50   140.   150.    440.00       3.11       .176       .271       .119

              *** LOOP  30 ***     SIGMA-H=  .000000

 107    82-  2   150.   250.     20.00      53.73      1.095      3.847       .077
```

```
--- CALUCULATION OF HYDRAULIC NETWORK --- (FOR PIPE-LINE)   PIPELINE NETWORK  TYPE-2                    PAGE

LINE  JOINT NO.    C    DIA.    LENGTH    QUANTITY    VELOCITY    GRADIENT   HEAD LOSS
                        (MM)    ( M )     ( L/S )     ( M/S )     ( 0/00 )    ( M )

              *** LOOP  31 ***     SIGMA-H=  .000000

108     83-  3   150.   250.    20.00      72.90       1.485       6.766       .135
```

```
      --- CALUCULATION OF HYDRAULIC NETWORK --- (FOR JOINT)      PIPELINE NETWORK  TYPE-2                            PAGE

   JOINT  SUM-Q   SUM-H    G.L.     W.L.     L.H.  PRESSURE     JOINT  SUM-Q   SUM-H    G.L.     W.L.     L.H.  PRESSURE
          (L/S)    (M)     (M)      (M)      (M)   (KG/CM2)            (L/S)    (M)     (M)      (M)      (M)   (KG/CM2)

     1    82.70     .00    88.30   100.30   12.00    1.200         2   -3.81    6.26    61.00    94.04   33.04    3.304
     3    -4.82    3.94    70.10    96.36   26.26    2.626         4   -4.82    1.83    79.20    98.47   19.27    1.927
     5      .00    3.69    79.20    96.61   17.41    1.741         6   -3.98    4.98    79.20    95.32   16.12    1.612
     7    -3.98    7.39    70.10    92.91   22.81    2.281         8   -3.98    7.54    61.00    92.76   31.76    3.176
     9    -3.98    8.10    61.00    92.20   31.20    3.120        10     .00    6.94    61.00    93.36   32.36    3.236
    11    -3.98    6.89    61.00    93.41   32.41    3.241        12     .00    6.62    61.00    93.68   32.68    3.268
    13      .00    5.59    70.10    94.71   24.61    2.461        14   -3.98    7.45    61.00    92.85   31.85    3.185
    15      .00    7.67    61.00    92.63   31.63    3.163        16   -3.98    7.67    61.00    92.43   31.43    3.143
    17      .00    7.66    61.00    92.64   31.64    3.164        18   -3.98    7.63    61.00    92.67   31.67    3.167
    19      .00    7.60    61.00    92.70   31.70    3.170        20     .00    7.66    61.00    92.44   31.44    3.144
    21    -3.98    7.95    61.00    92.35   31.35    3.135        22     .00    7.88    61.00    92.42   31.42    3.142
    23    -3.98    8.02    61.00    92.28   31.28    3.128        24   -3.96    8.02    61.00    92.28   31.28    3.128
    25    -3.98    8.04    61.00    92.26   31.26    3.126        26     .00    7.99    61.00    92.31   31.31    3.131
    27      .00    8.10    51.80    92.20   40.40    4.040        28   -3.98    8.12    51.80    92.18   40.38    4.038
    29      .00    7.95    61.00    92.35   31.35    3.135        30   -3.98    8.08    61.00    92.22   31.22    3.122
    31    -3.98    8.45    51.80    91.85   40.05    4.005        32     .00    8.34    51.80    91.96   40.16    4.016
    33      .00    8.24    51.80    92.06   40.26    4.026        34     .00    8.35    51.80    91.95   40.15    4.015
    35    -3.82    9.25    51.80    91.05   39.25    3.925        36   -3.82    9.25    61.00    91.05   30.05    3.005
    37      .00    8.58    61.00    91.72   30.72    3.072        38   -3.82    8.29    61.00    92.01   31.01    3.101
    39      .00    8.34    61.00    91.96   30.96    3.096        40   -3.82    9.09    61.00    91.21   30.21    3.021
    41    -3.82    9.09    61.00    91.21   30.21    3.021        42   -3.82    7.03    61.00    93.27   32.27    3.227
    43    -3.98    7.45    61.00    92.85   31.85    3.185        44     .00    7.36    61.00    92.94   31.94    3.194
    45    -3.98    6.81    61.00    93.49   32.49    3.249        46   -3.98    7.00    61.00    93.30   32.30    3.230
    47    -4.82    4.33    79.20    95.97   16.77    1.677        48   -4.82    5.07    79.20    95.23   16.03    1.603
    49    -4.82    5.91    70.10    94.39   24.29    2.429        50   -4.82    5.77    70.10    94.53   24.43    2.443
    51    -4.82    5.81    88.30    94.49    6.19     .619        52   -4.82    5.85    88.30    94.45    6.15     .615
    53    -4.82    5.87    88.30    94.43    6.13     .613        54   -4.82    5.65    79.20    94.65   15.45    1.545
    55    -4.82    5.14    70.10    95.16   25.06    2.506        56   -4.82    5.90    61.00    94.40   33.40    3.340
    57    -4.82    6.33    61.00    93.97   32.97    3.297        58   -4.82    6.33    61.00    93.97   32.97    3.297
    59    -4.82    7.02    61.00    93.28   32.28    3.228        60   -4.82    6.80    61.00    93.50   32.50    3.250
    61    -4.82    6.79    61.00    93.51   32.51    3.251        62     .00    6.64    61.00    93.66   32.66    3.266
    63      .00    6.49    61.00    93.81   32.81    3.281        64   -4.82    6.30    70.10    94.00   23.90    2.390
    65      .00    6.70    61.00    93.60   32.60    3.260        66   -3.81    7.28    61.00    93.02   32.02    3.202
    67      .00    7.67    61.00    92.63   31.63    3.163        68     .00    7.75    61.00    92.55   31.55    3.155
    69      .00    7.73    61.00    92.57   31.57    3.157        70   -3.81    7.70    61.00    92.60   31.60    3.160
    71      .00    7.51    61.00    92.79   31.79    3.179        72     .00    7.44    61.00    92.86   31.86    3.186
    73    -3.81    7.69    61.00    92.61   31.61    3.161        74   -3.81    8.38    61.00    91.92   30.92    3.092
    75    -3.81    8.35    61.00    91.95   30.95    3.095        76   -3.81    7.36    61.00    92.94   31.94    3.194
    77    -3.81    8.52    61.00    91.78   30.78    3.078        78   -3.81    8.76    70.10    91.54   21.44    2.144
    79    -3.81    8.76    70.10    91.54   21.44    2.144        80   -3.81    8.64    61.00    91.66   30.66    3.066
    81      .00    7.62    61.00    92.68   31.68    3.168        82   53.73    6.18    61.00    94.12   33.12    3.312
    83    72.90    3.81    79.20    96.49   17.29    1.729        84   13.90     .00    88.30   100.30   12.00    1.200
```

TOTAL LENGTH OF PIPELINE

```
                DIA =   75      L = 5460.00
                DIA =  100      L = 4410.00
                DIA =  150      L = 6200.00
                DIA =  200      L =  620.00
                DIA =  250      L = 1370.00
*STOP*
```

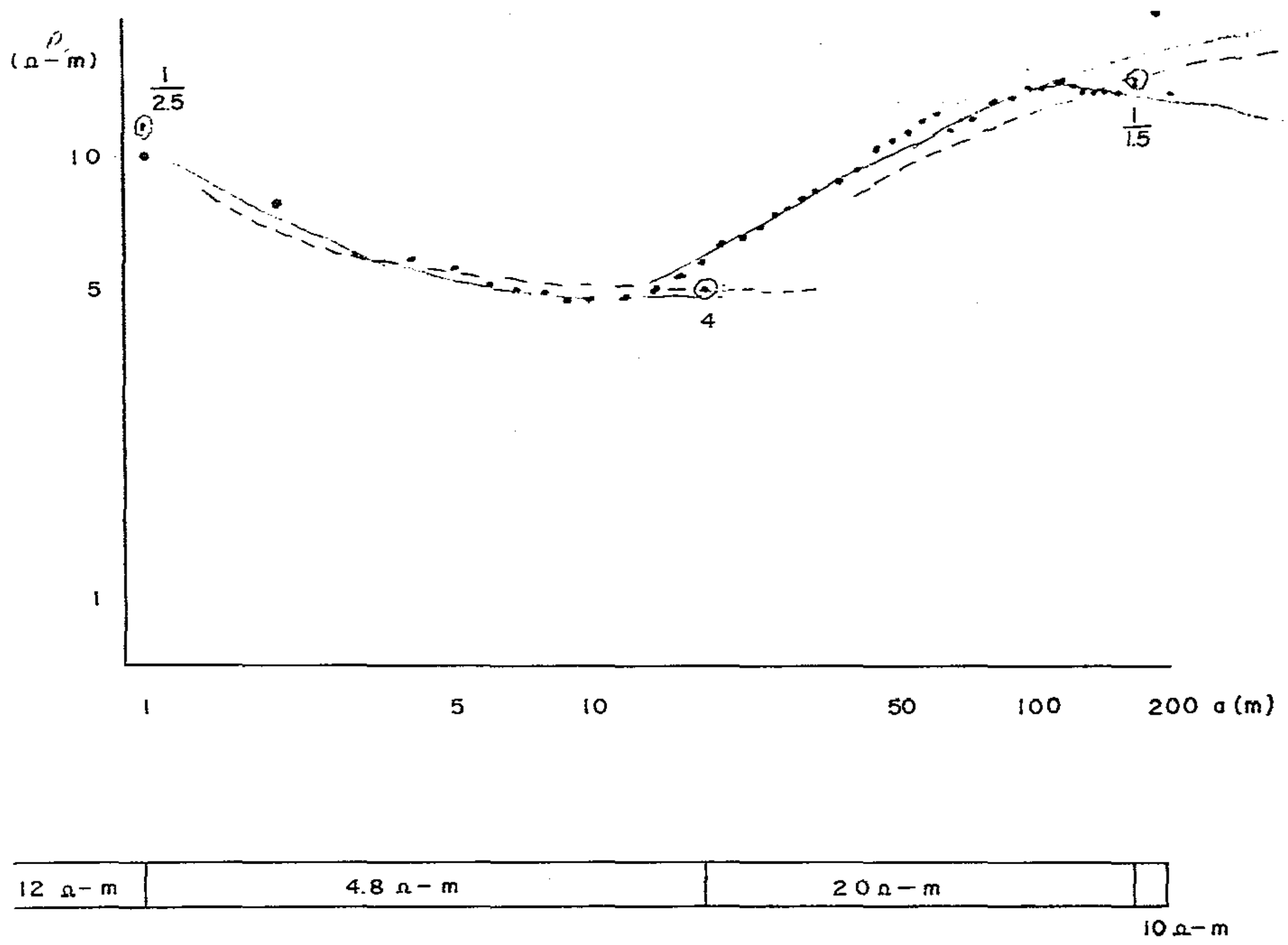
APPENDIX 3

PROME PROJECT

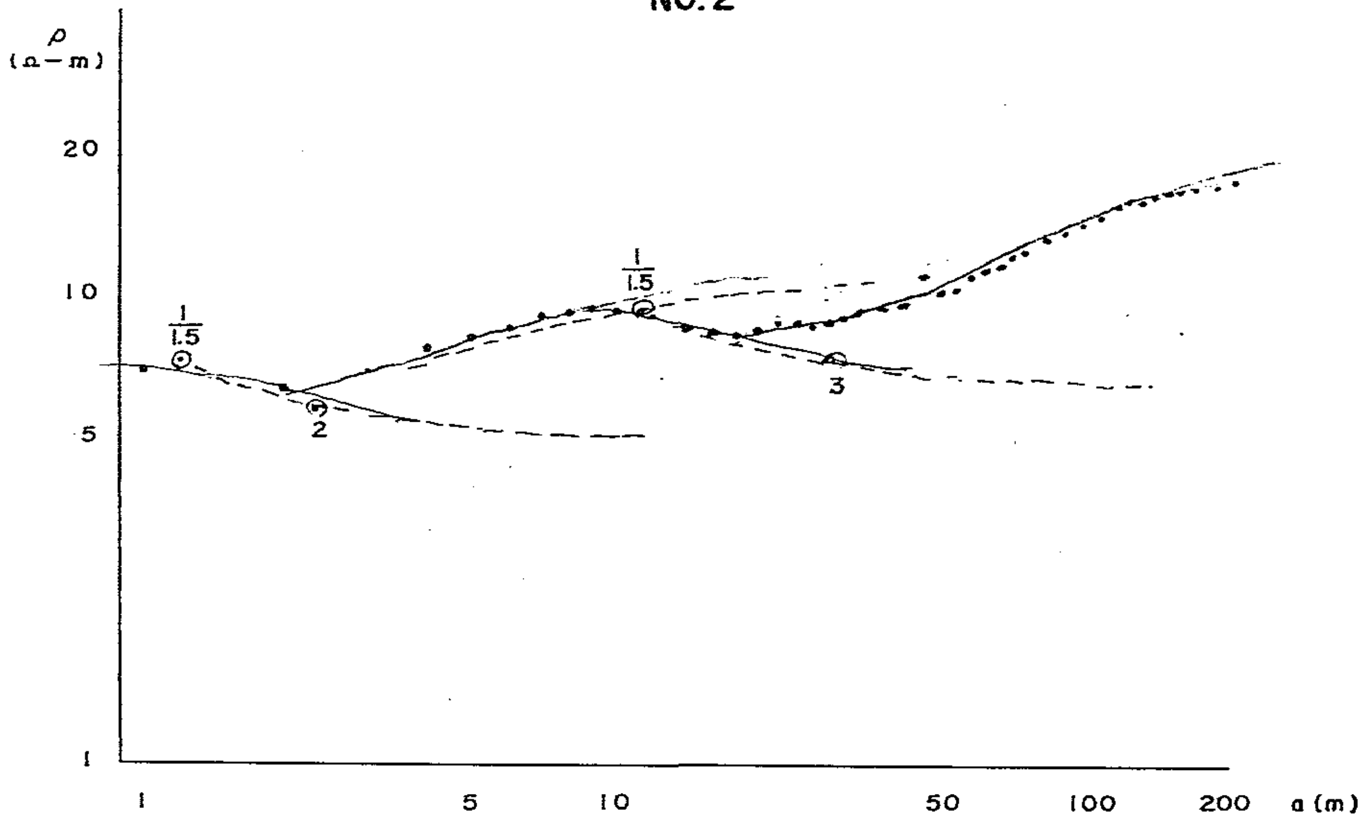
ELECTRICAL PROSPECTING RESULT

A — 3 · 1 ELECTRICAL PROSPECTING IN PROME

NO. I

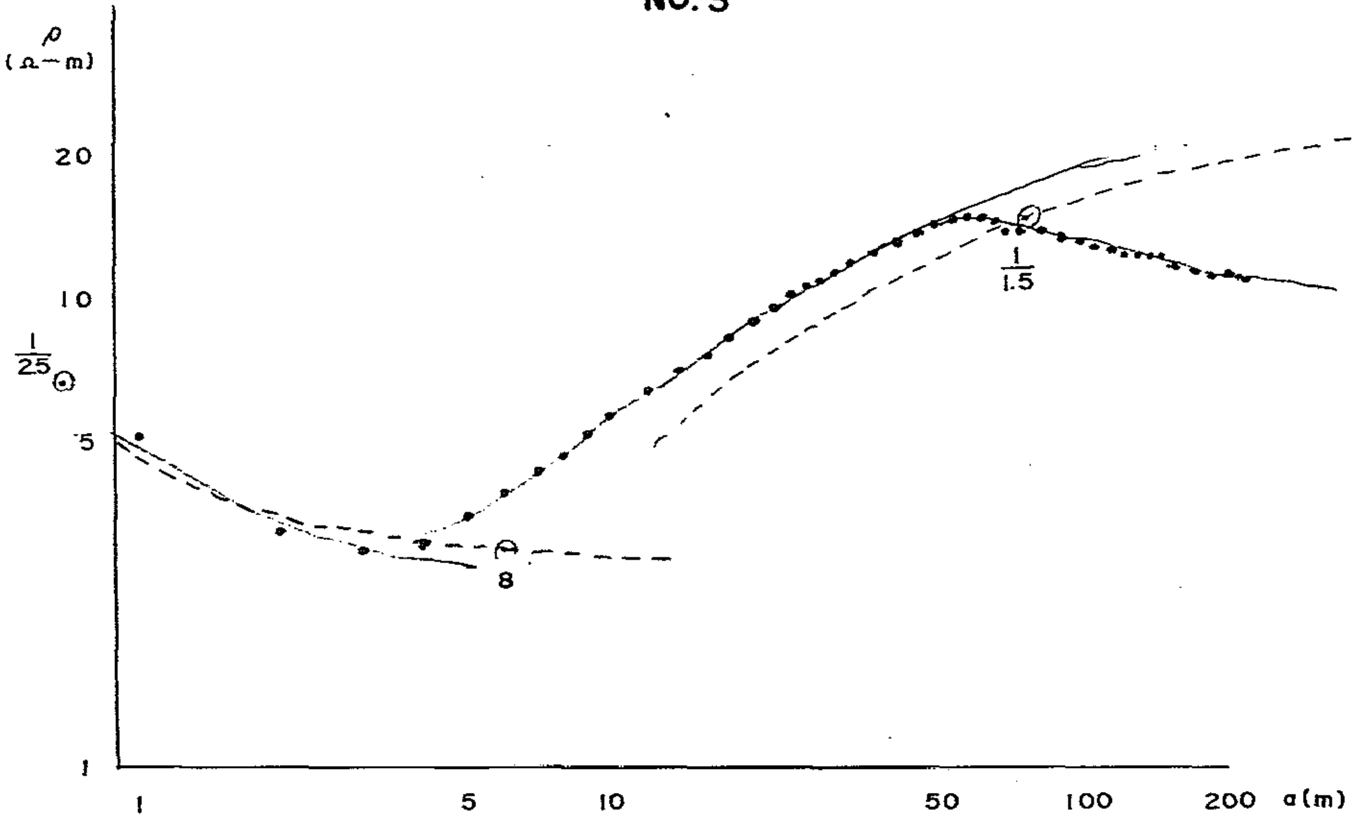


ELECTRICAL PROSPECTING IN PROME
NO. 2



7.2 Ω − m	4.8 Ω − m	12 Ω − m	6.3 Ω − m	22 Ω − m

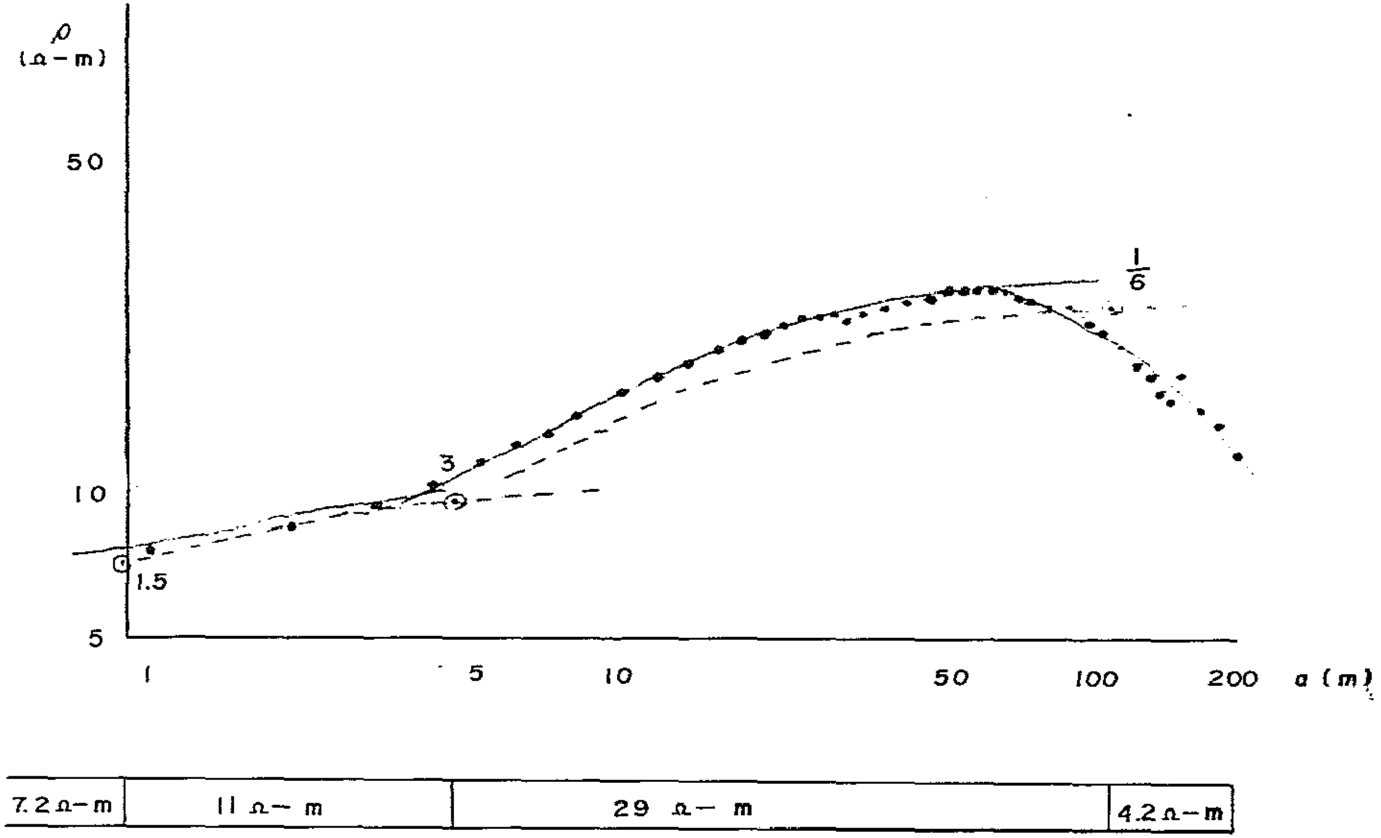
ELECTRICAL PROSPECTING IN PROME
NO. 3



6.5 Ω−m	2.5 Ω−m	24 Ω−m	9.7 Ω−m

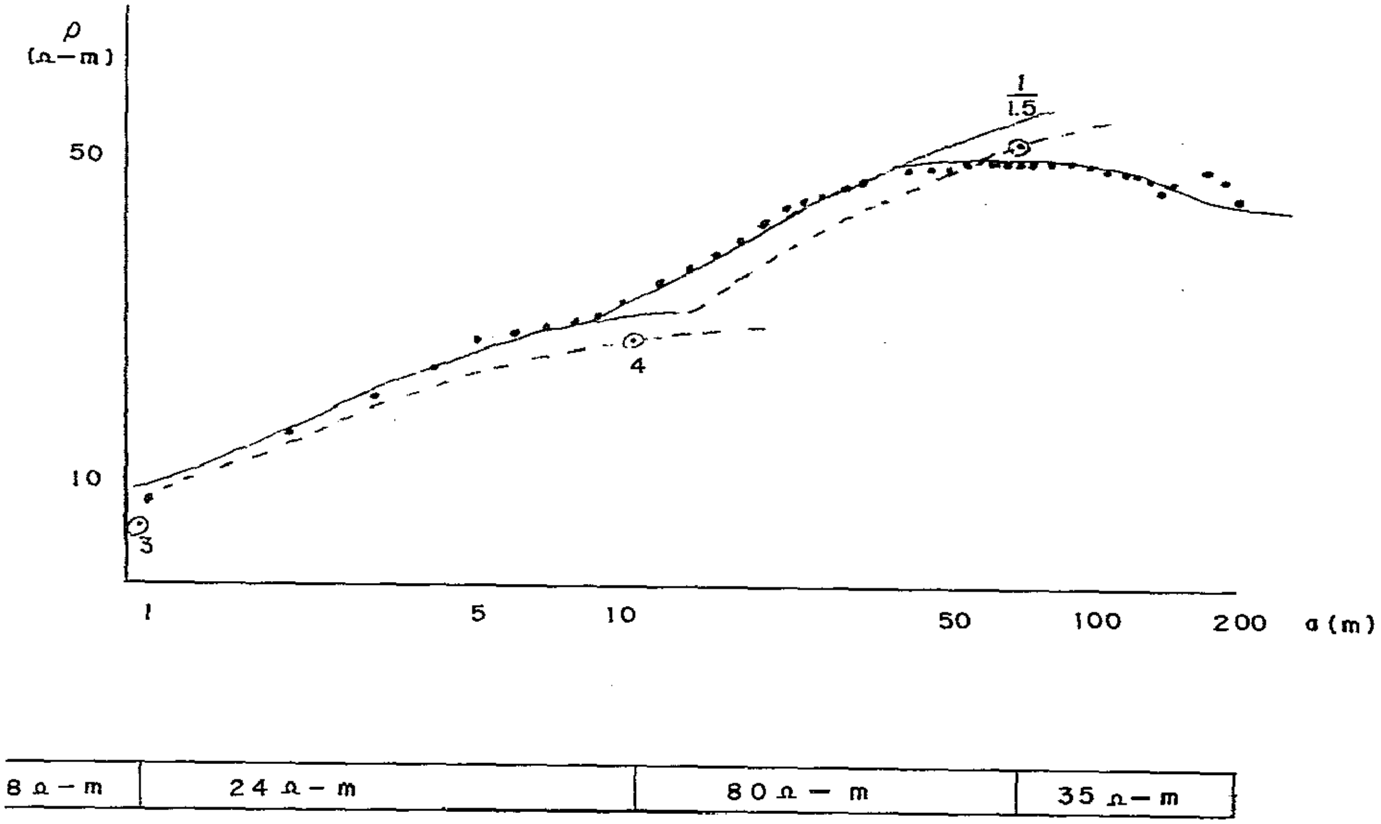
ELECTRICAL PROSPECTING IN PROME

NO.4



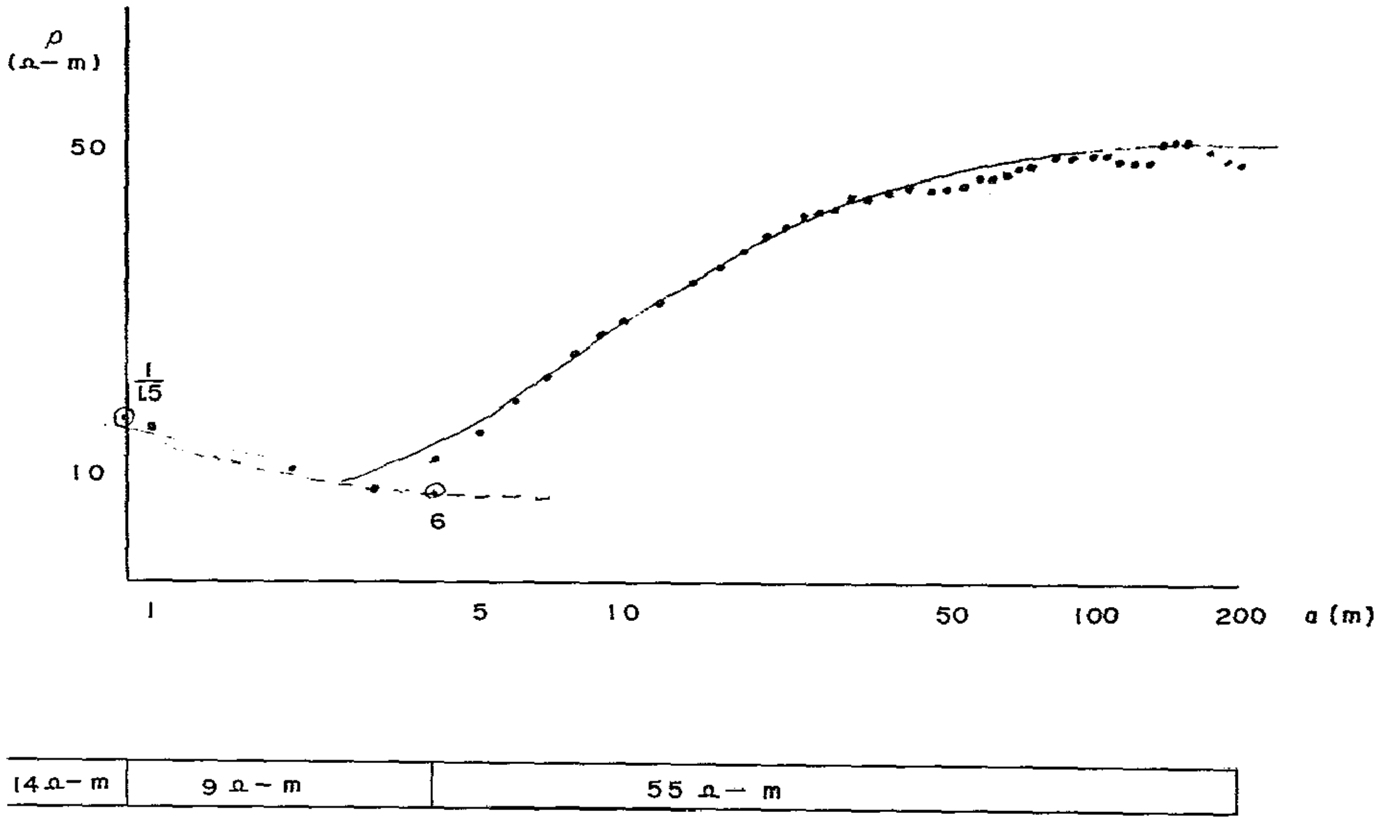
ELECTRICAL PROSPECTING IN PROME

NO. 5



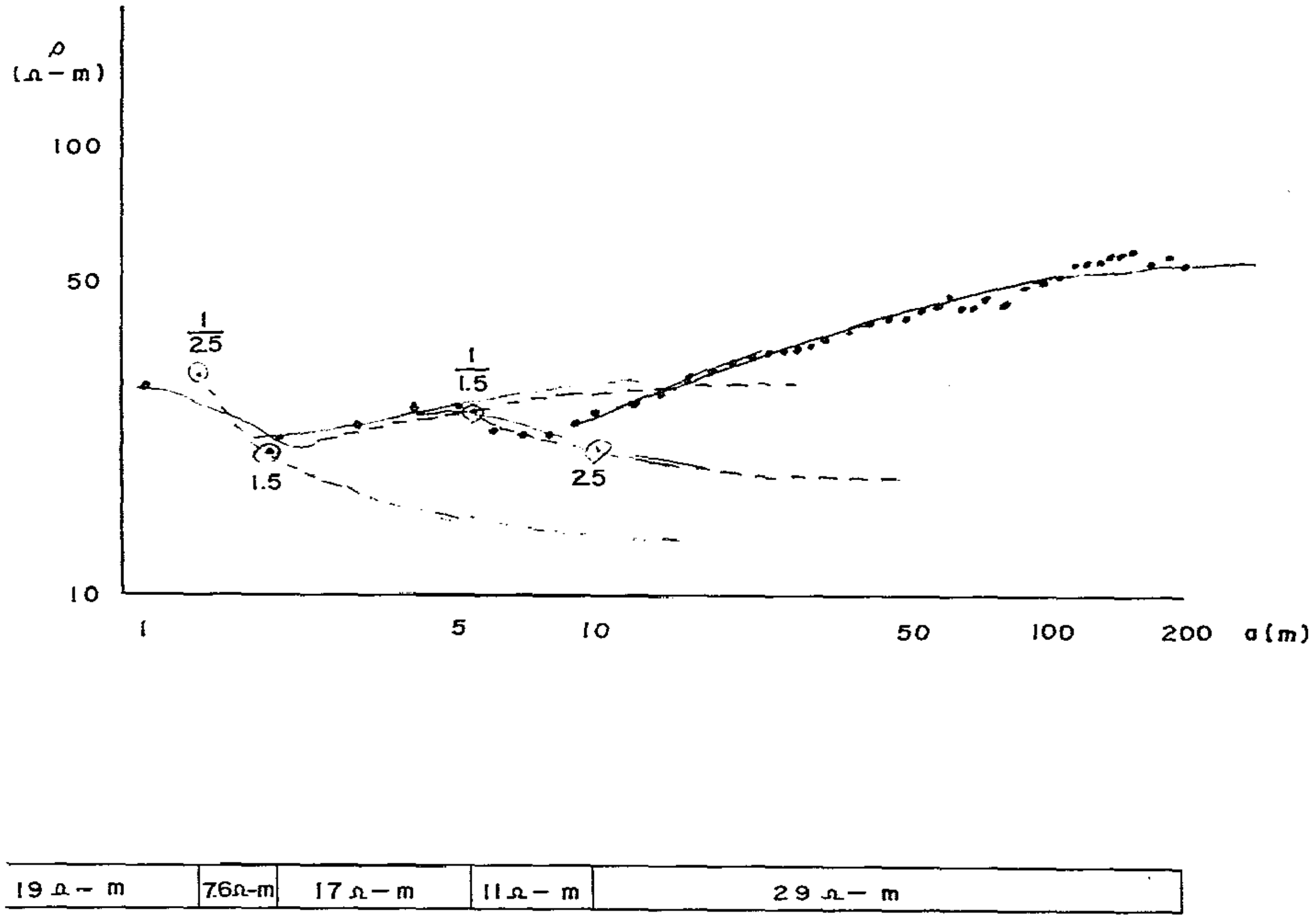
ELECTRICAL PROSPECTING IN PROME

NO. 6



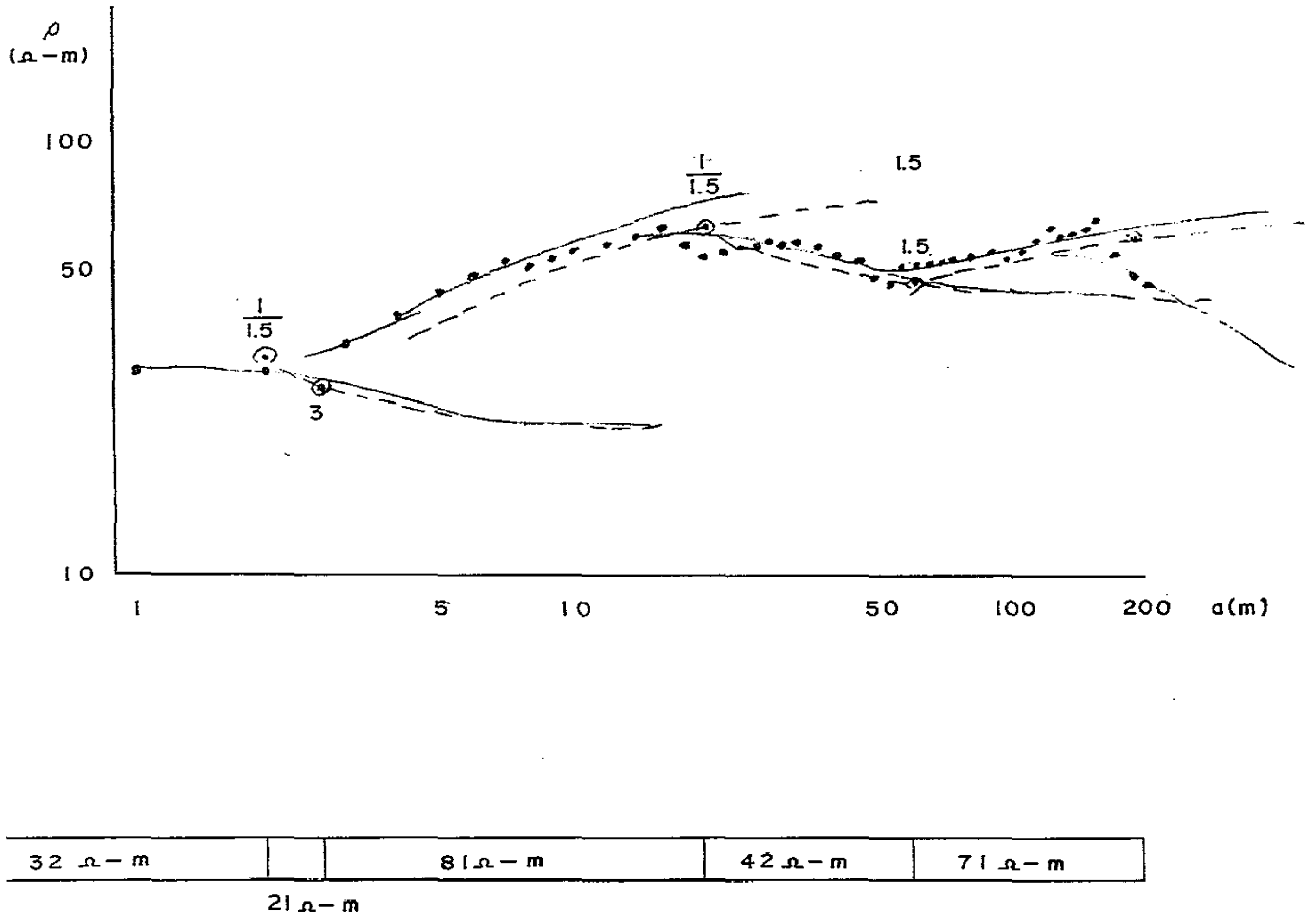
ELECTRICAL PROSPECTING IN PROME

NO. 7



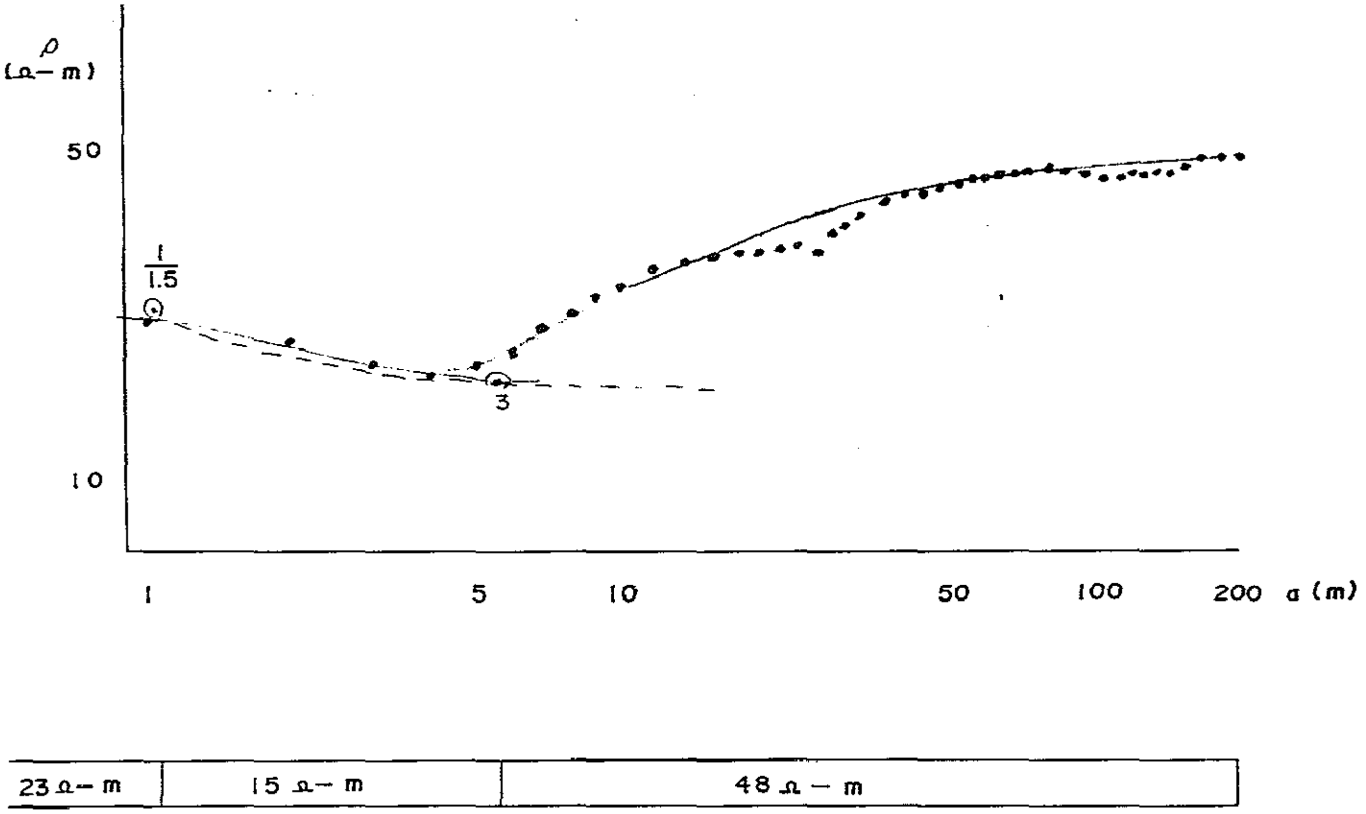
ELECTRICAL PROSPECTING IN PROME

NO.8



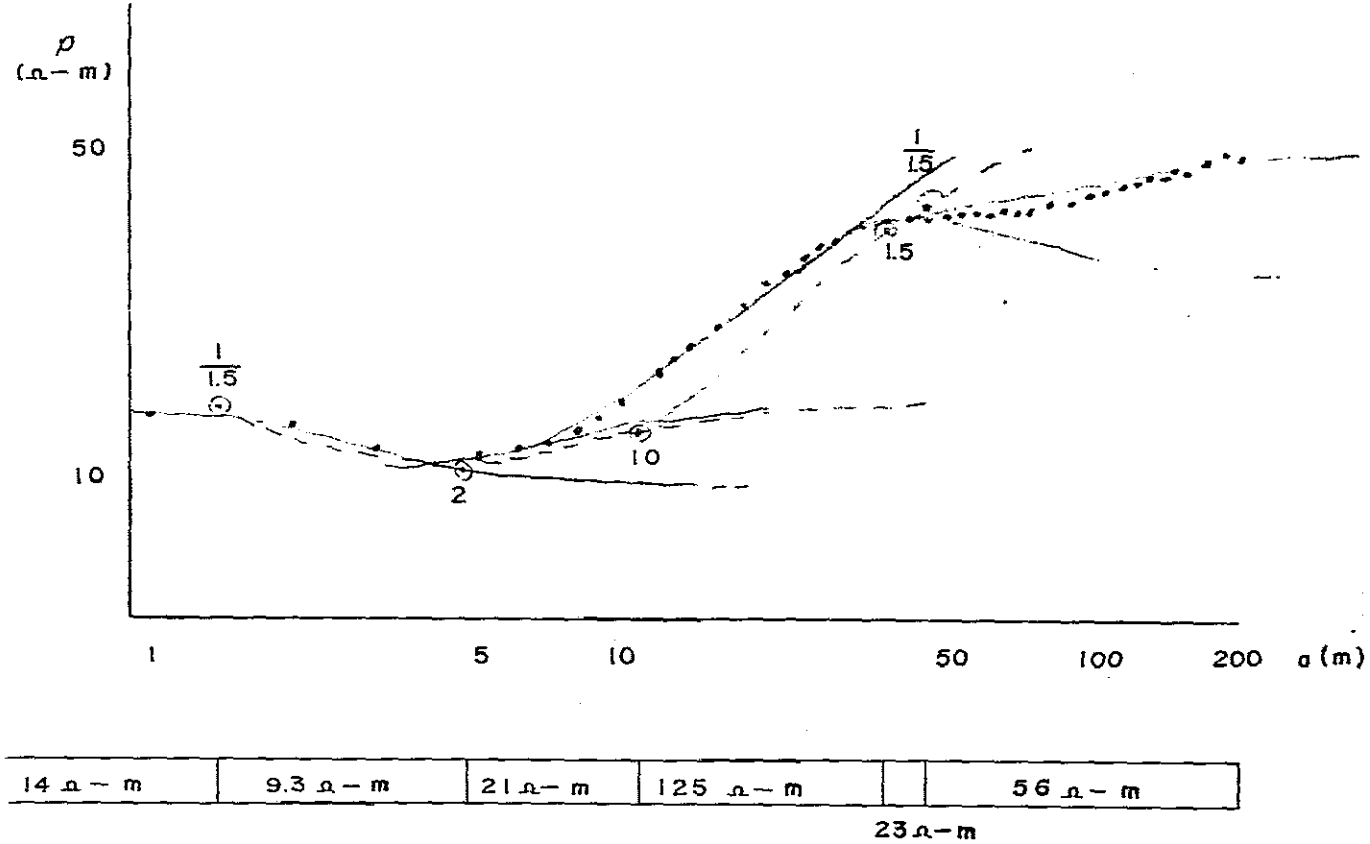
ELECTRICAL PROSPECTING IN PROME

NO.9



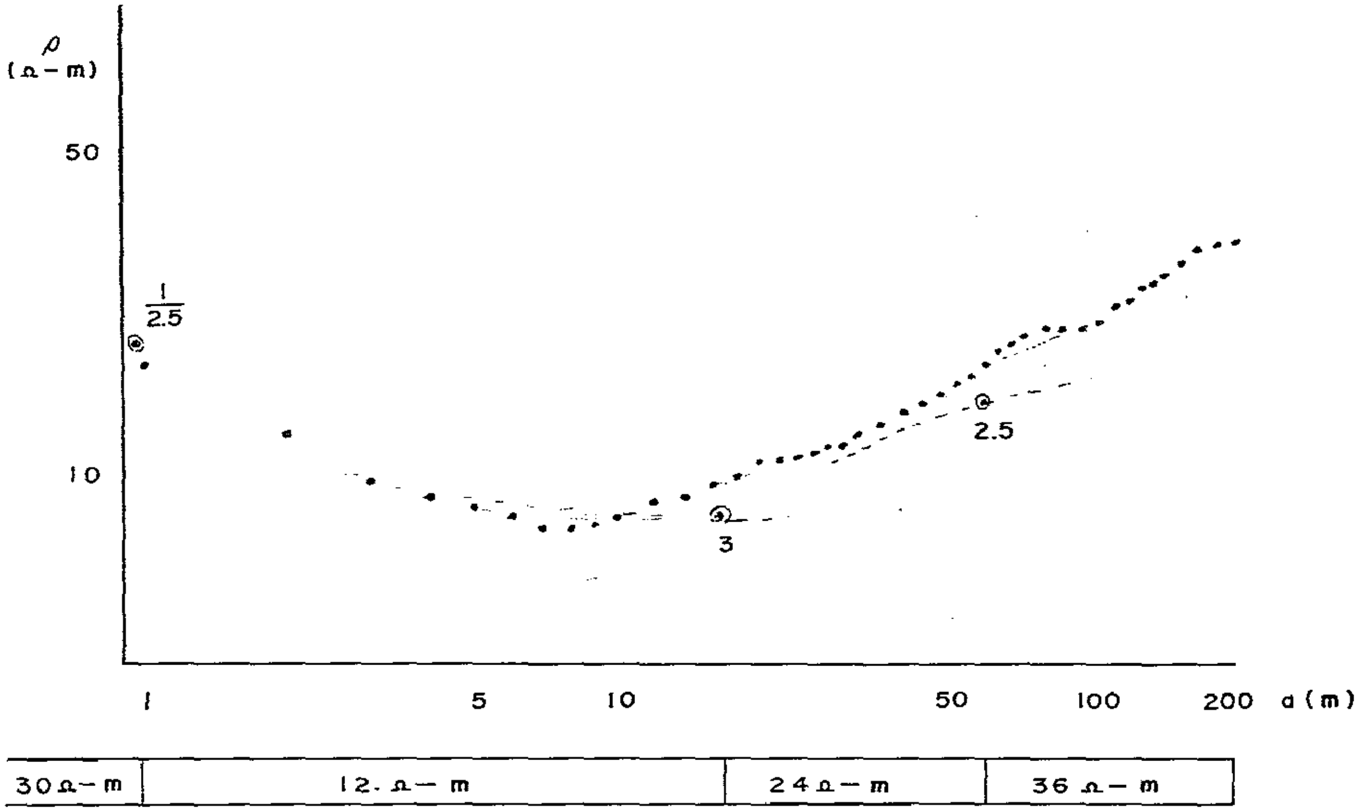
ELECTRICAL PROSPECTING IN PROME

NO. 10



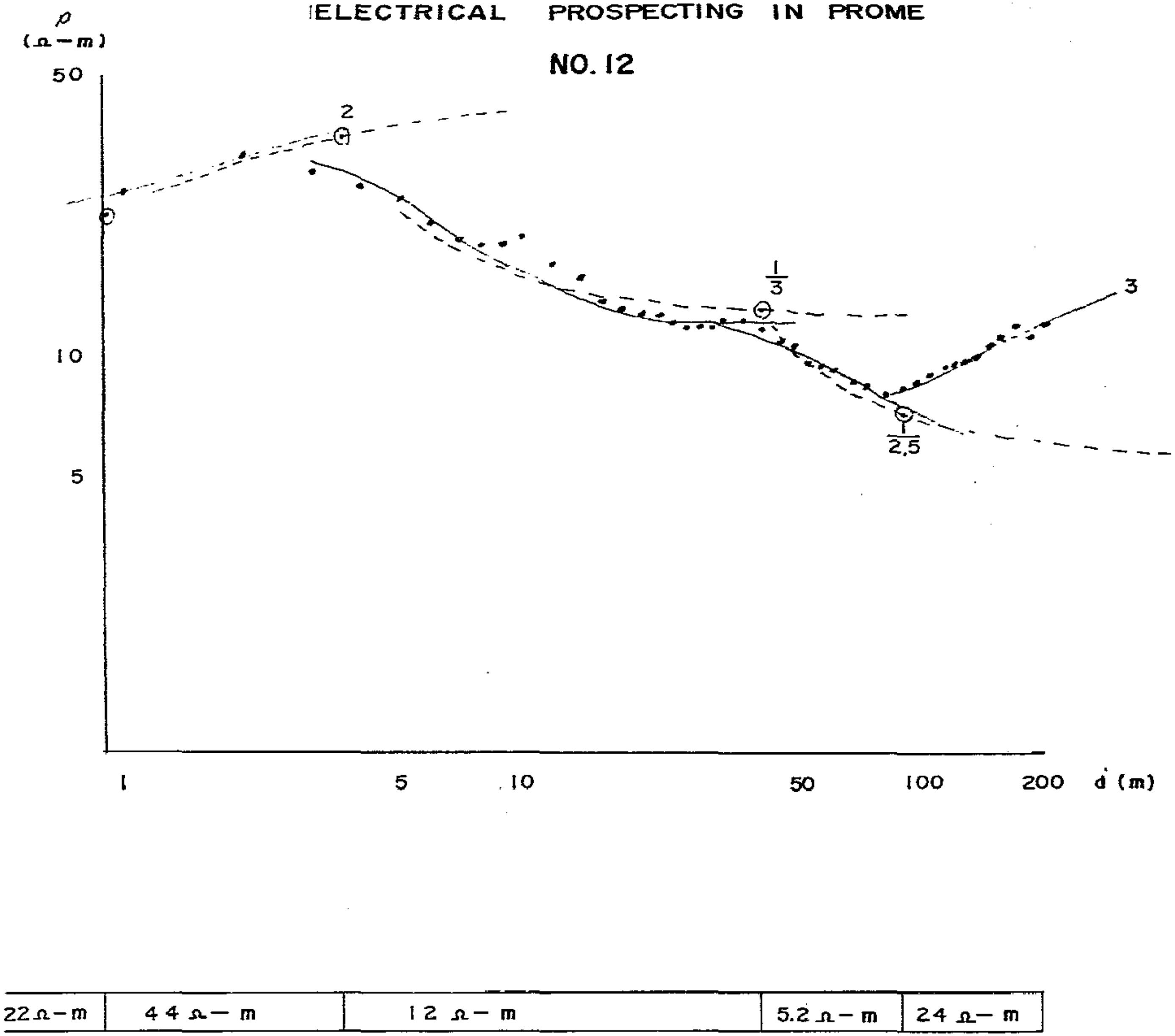
ELECTRICAL PROSPECTING IN PROME

NO. 11

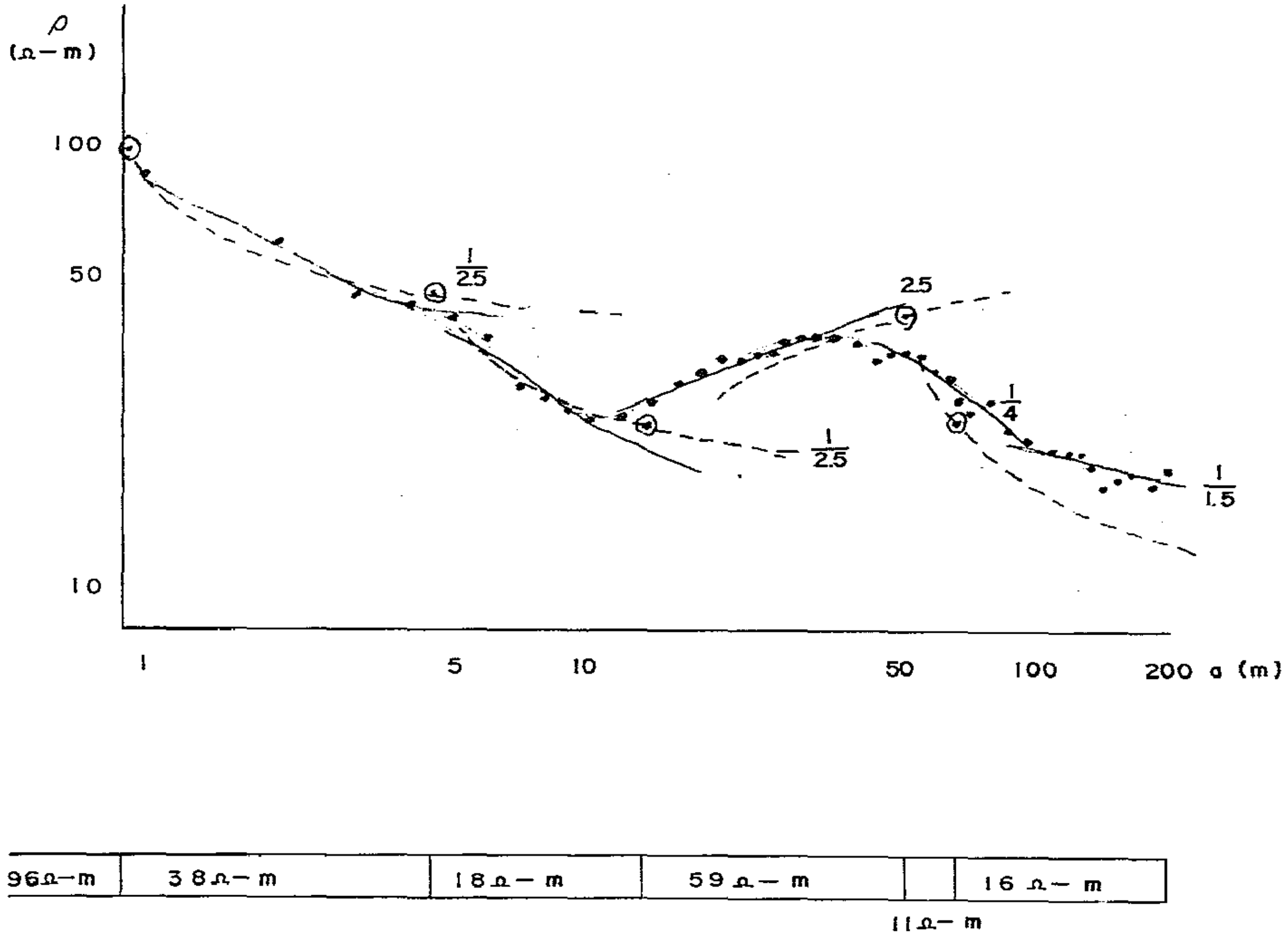


ELECTRICAL PROSPECTING IN PROME

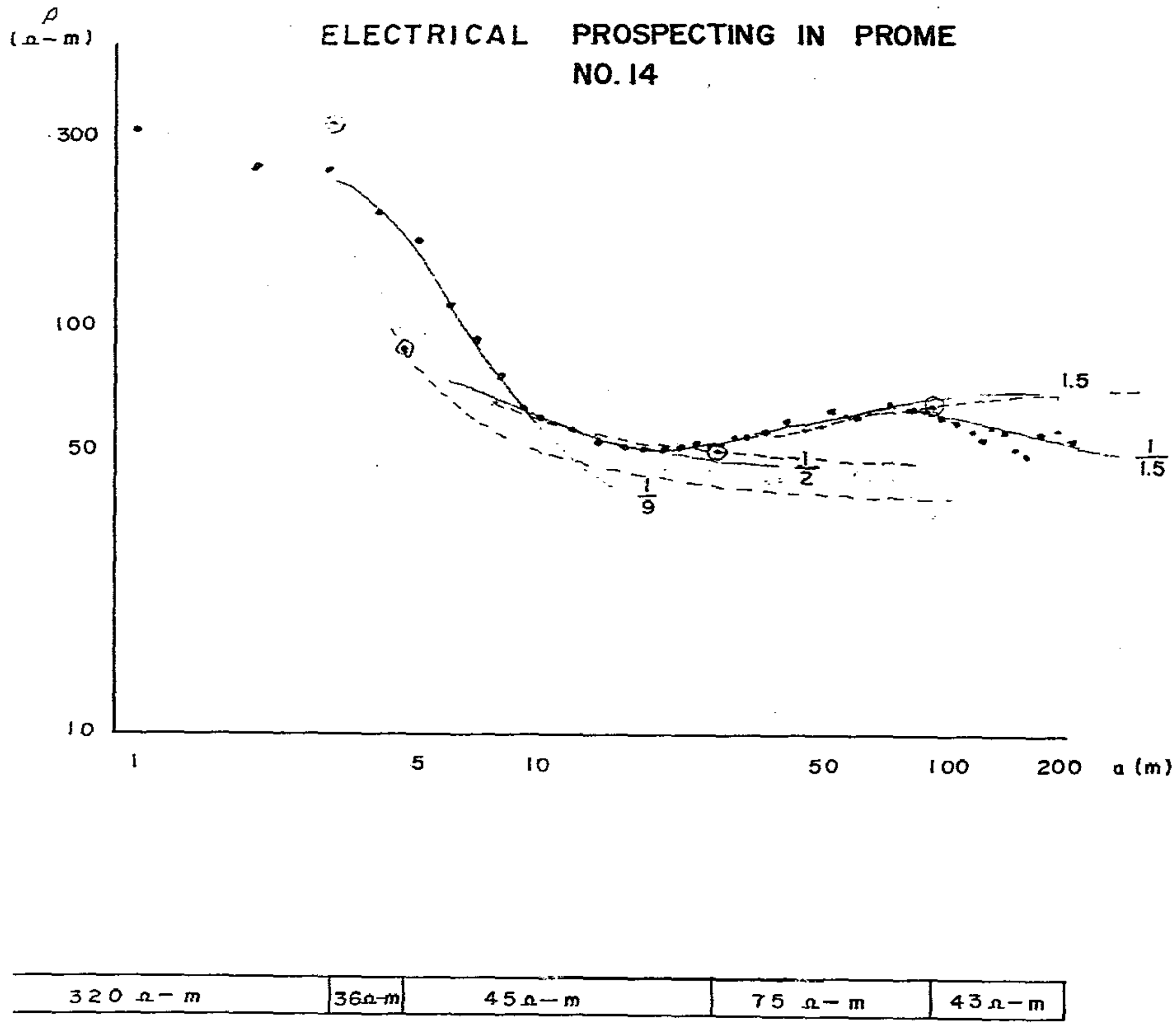
NO. 12



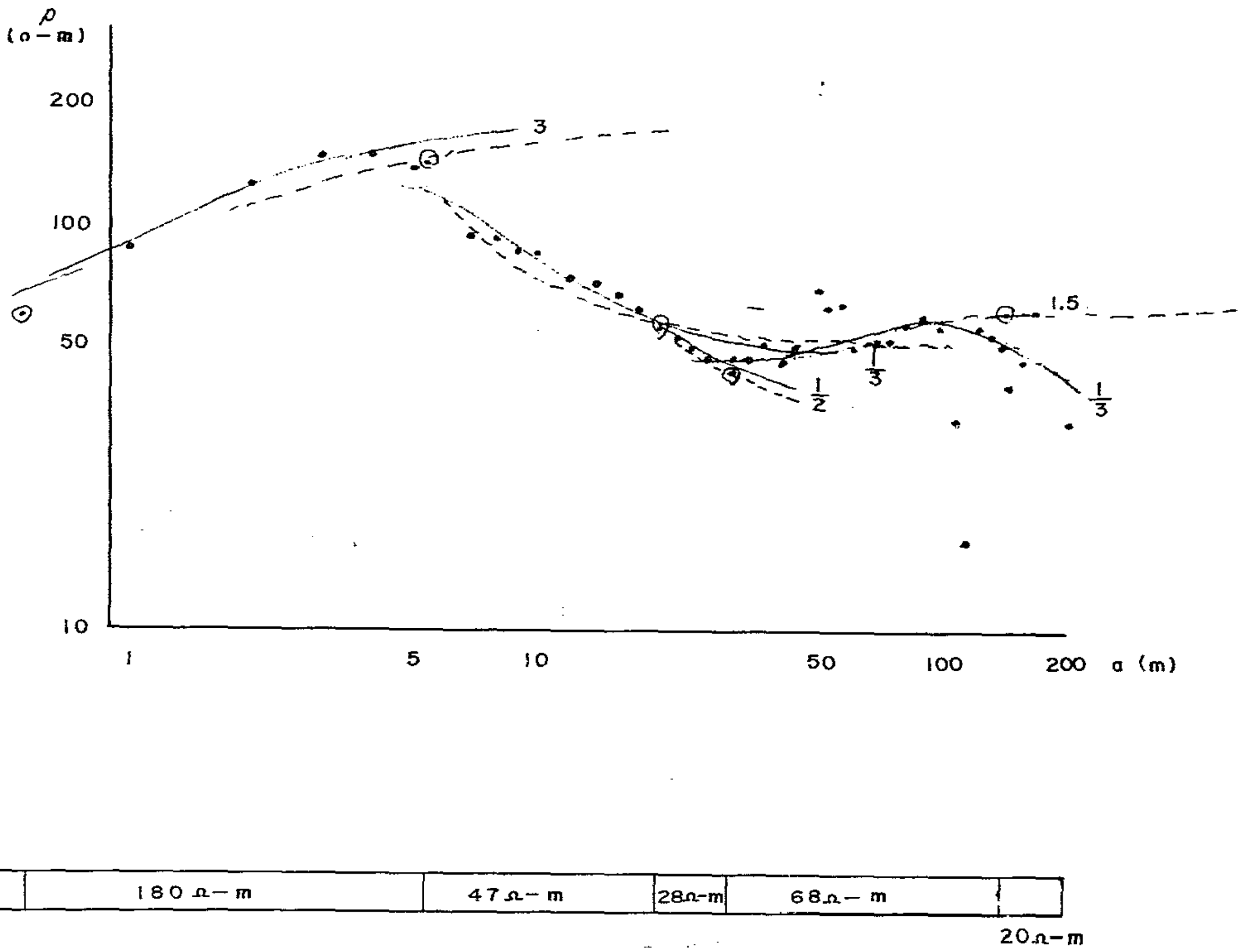
ELECTRICAL PROSPECTING IN PROME
NO. 13



ELECTRICAL PROSPECTING IN PROME
NO. 14

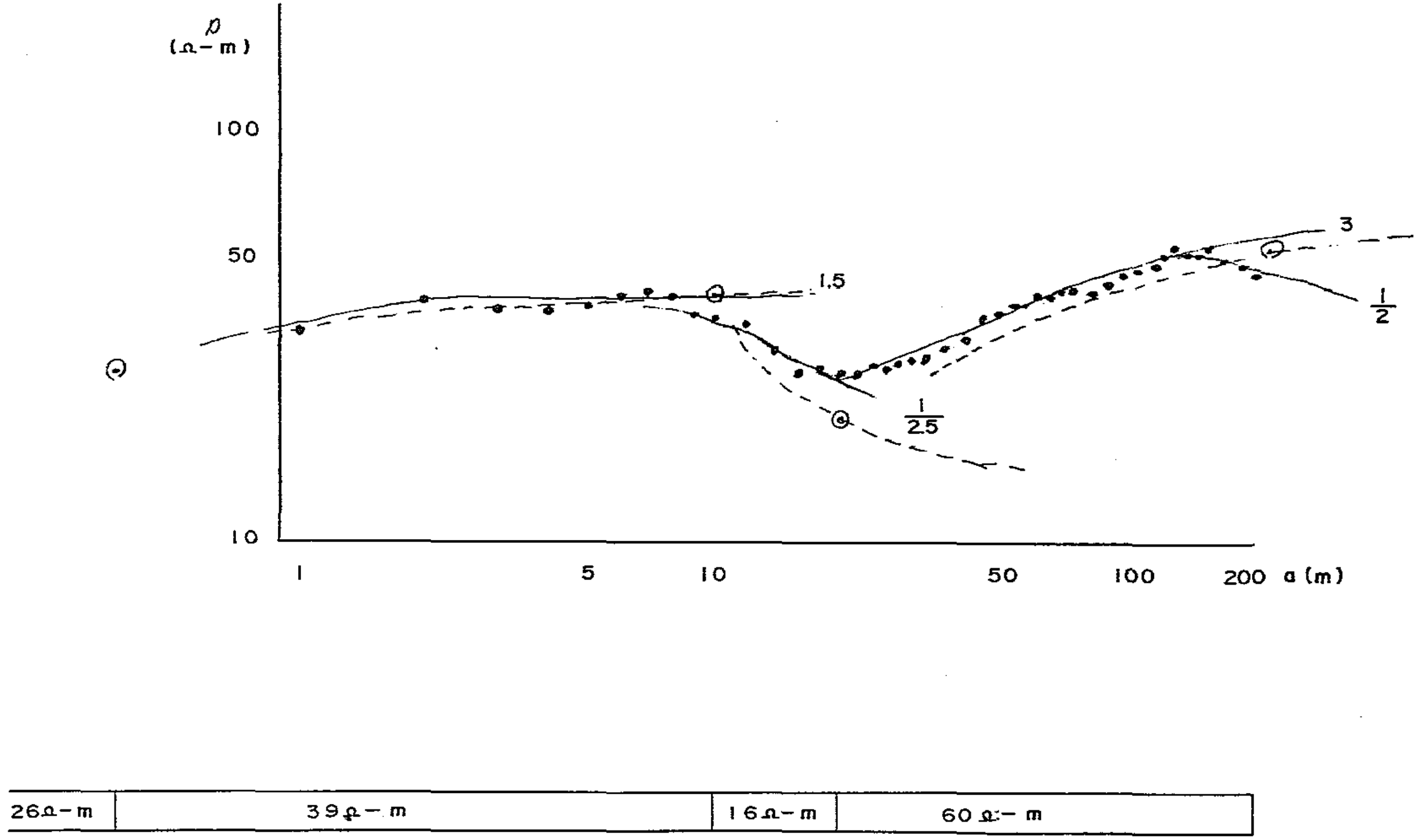


ELECTRICAL PROSPECTING IN PROME
NO. 15



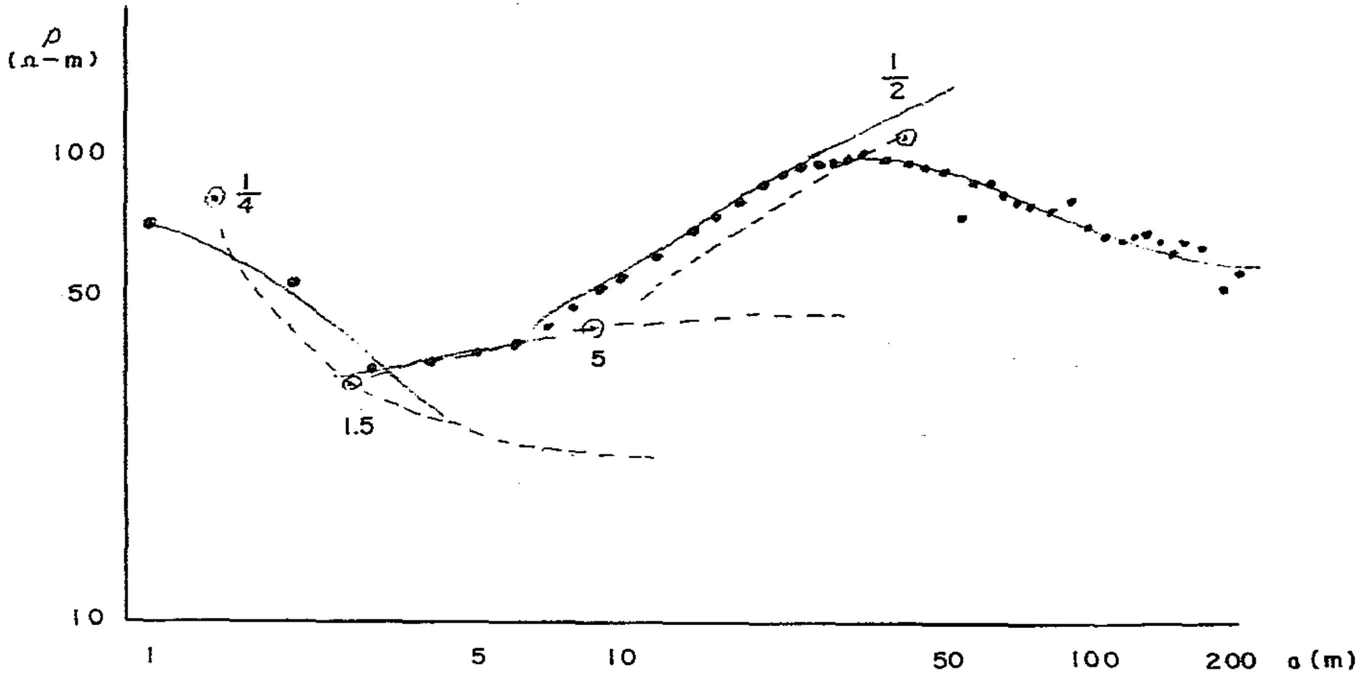
ELECTRICAL PROSPECTING IN PROME

NO. 16



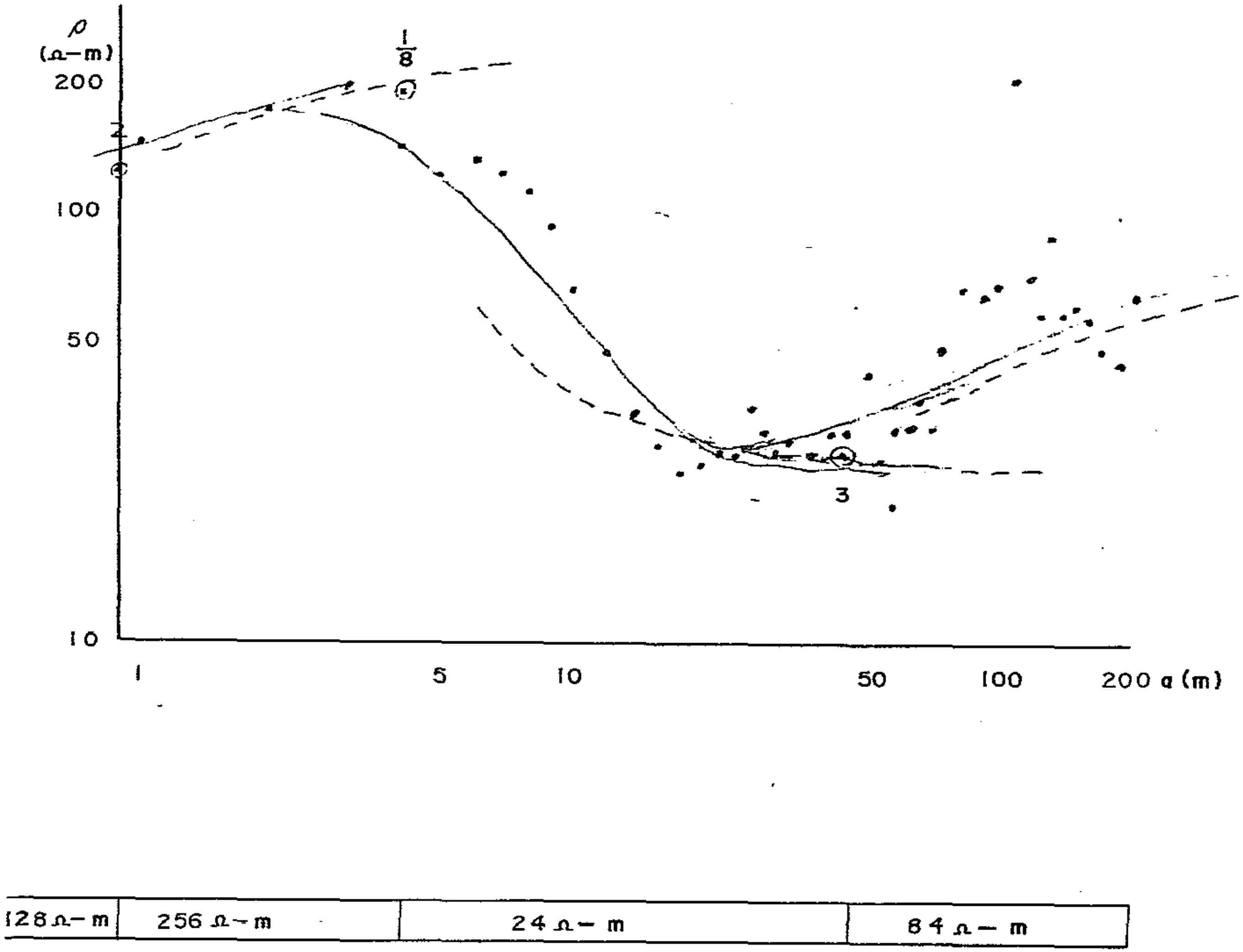
ELECTRICAL PROSPECTING IN PROME

NO. 17



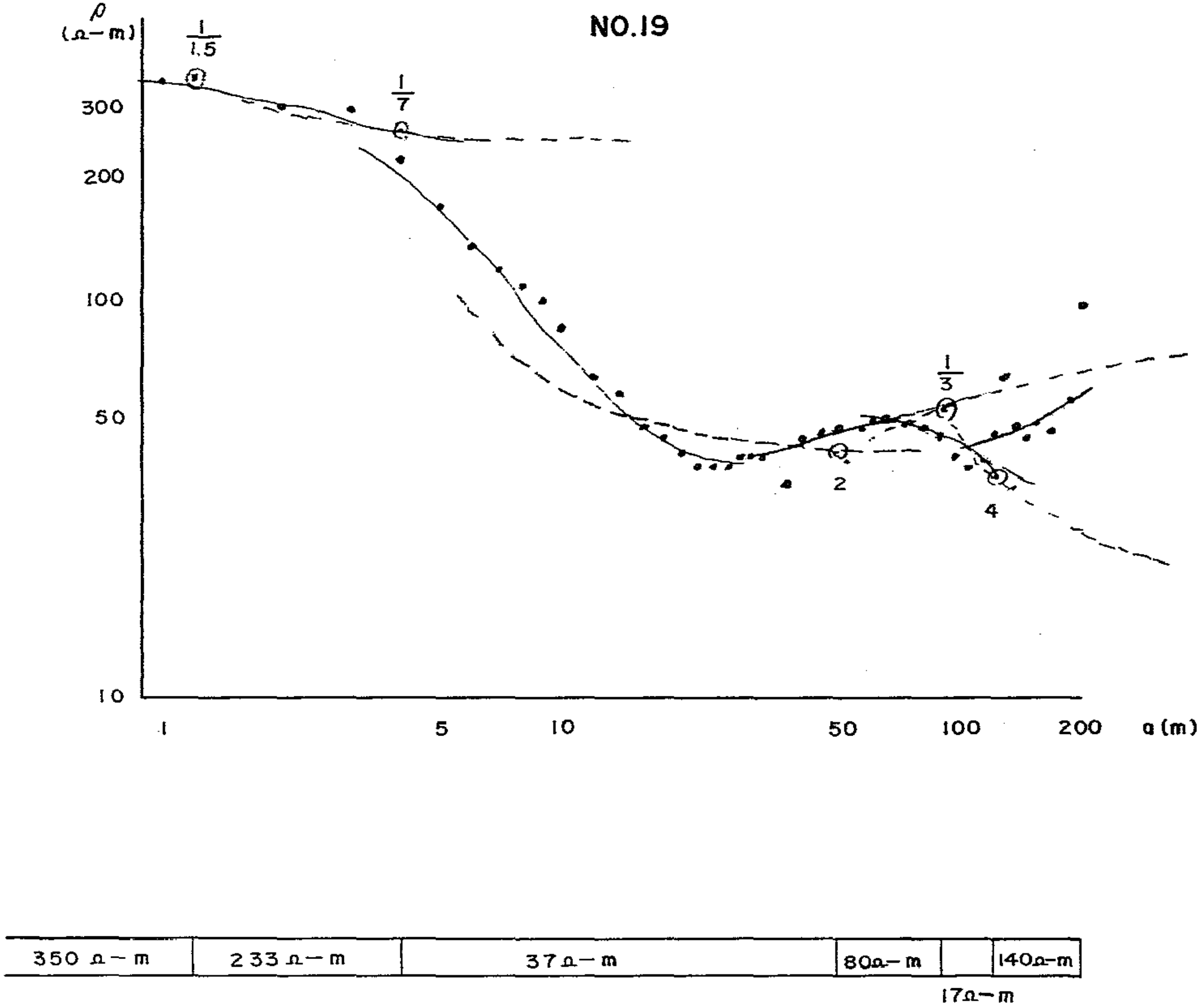
80 Ω − m	20 Ω − m	51 Ω − m	210 Ω − m	55 Ω − m

ELECTRICAL PROSPECTING IN PROME
NO.18



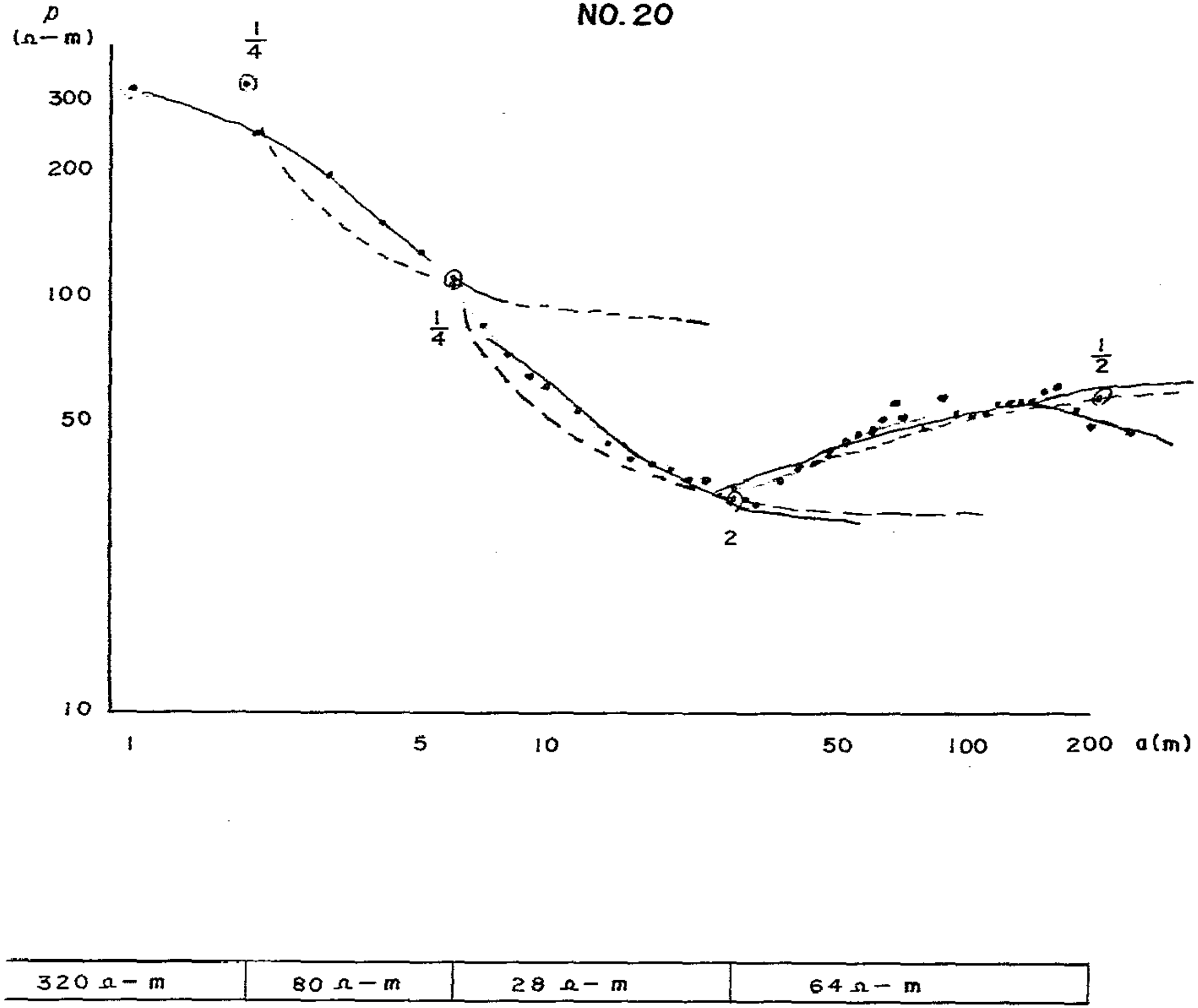
ELECTRICAL PROSPECTING IN PROME

NO.19



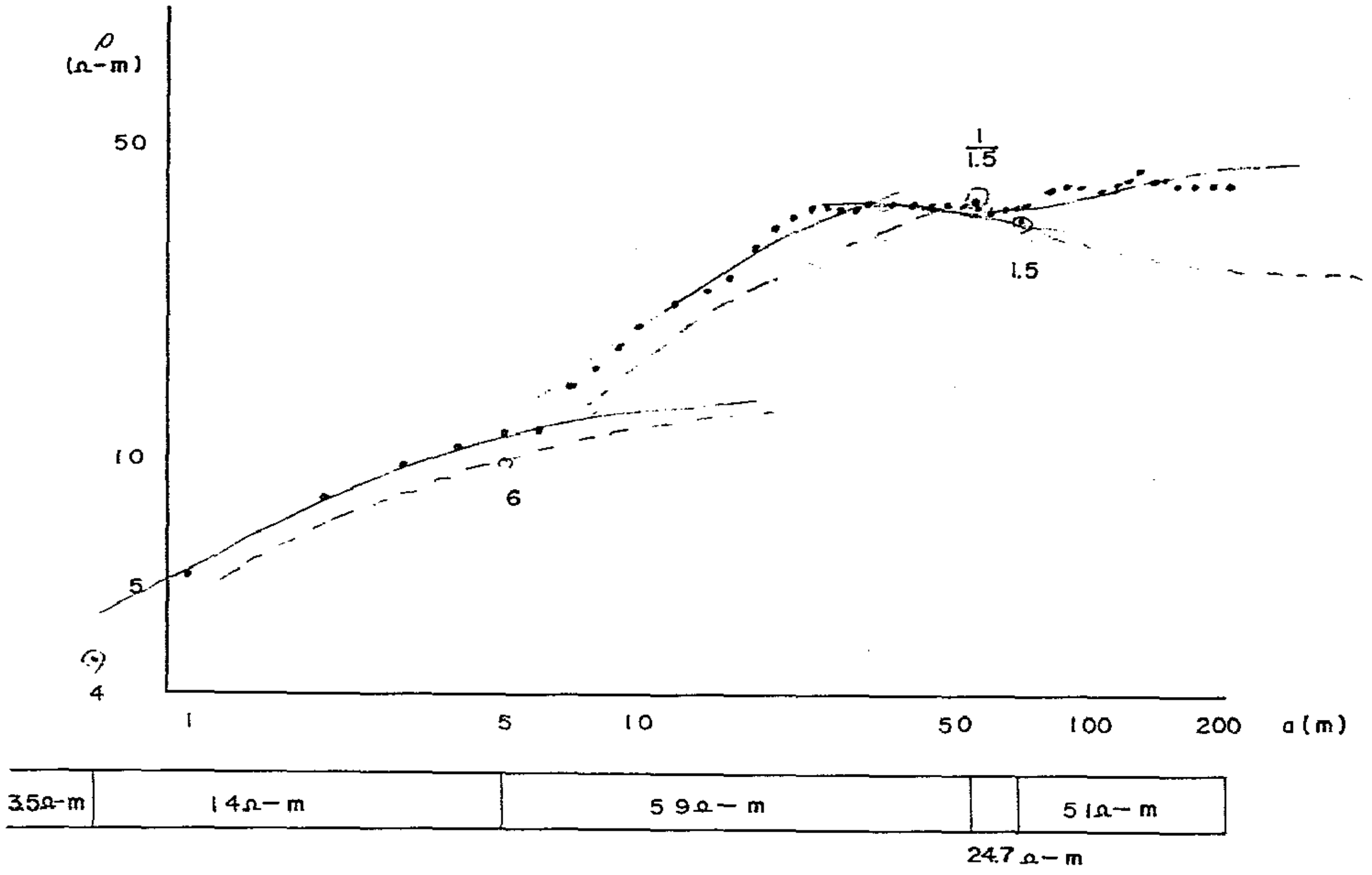
ELECTRICAL PROSPECTING IN PROME

NO. 20



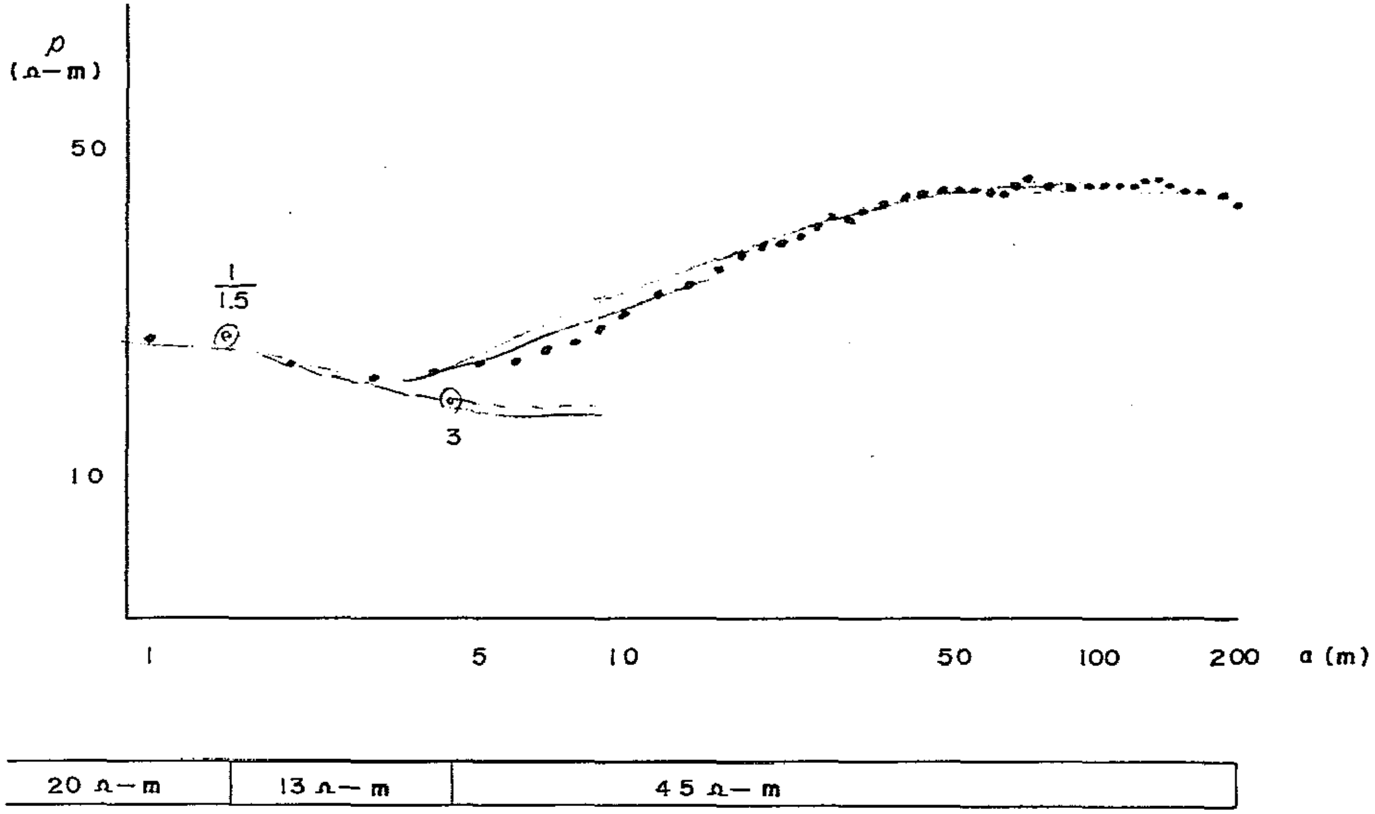
ELECTRICAL PROSPECTING IN PROME

NO. 21



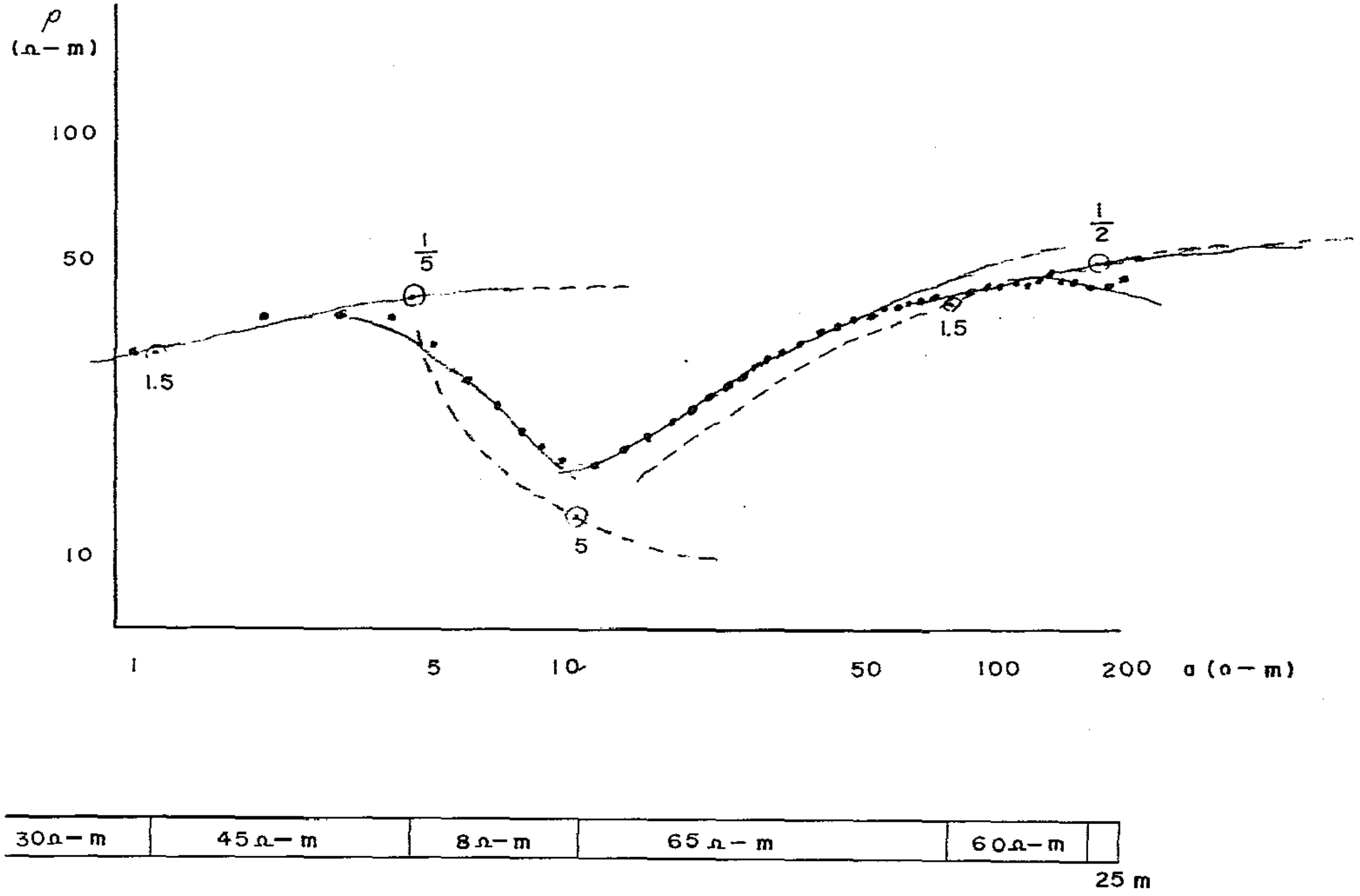
ELECTRICAL PROSPECTING IN PROME

NO. 22

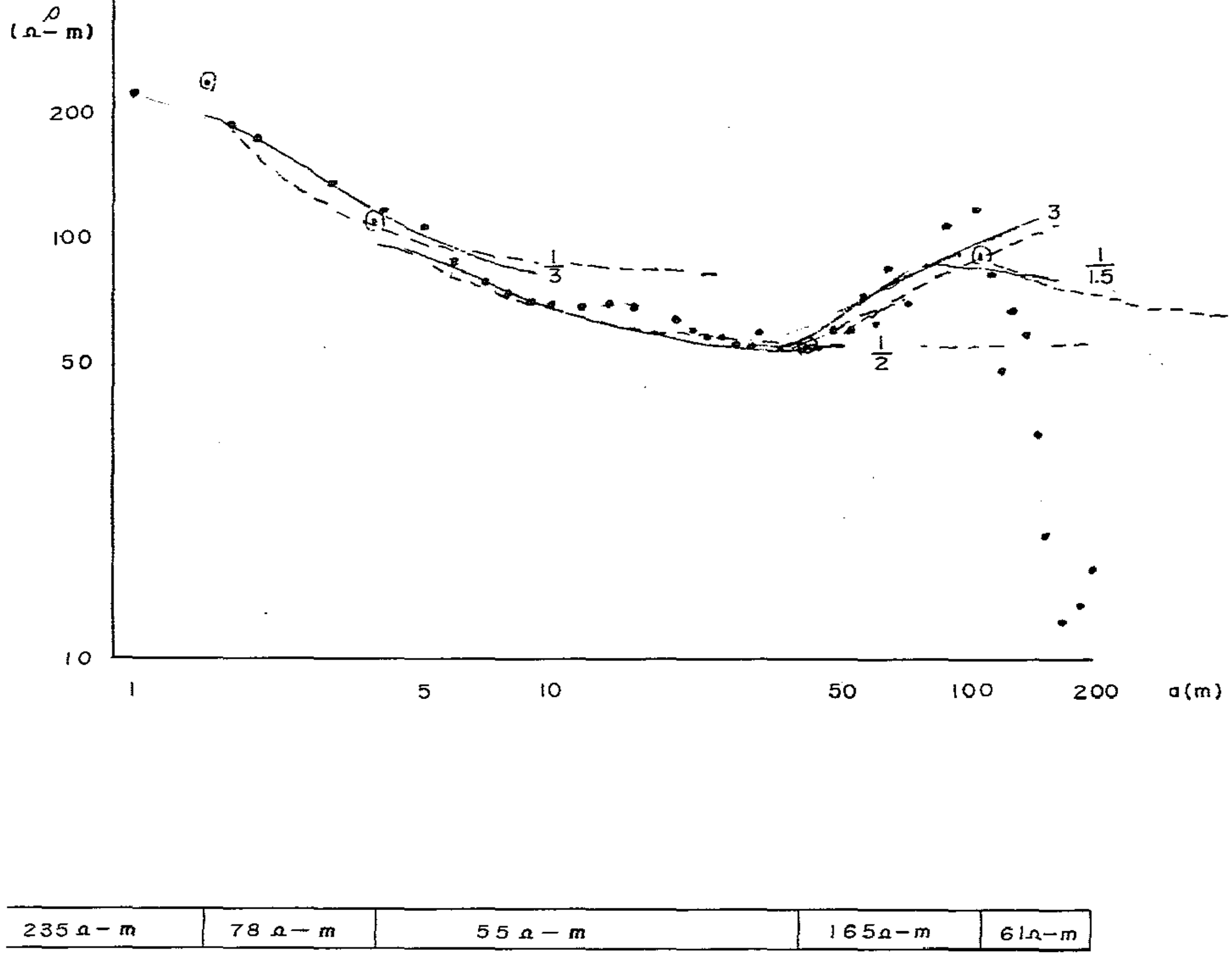


ELECTRICAL PROSPECTING IN PROME

NO.23



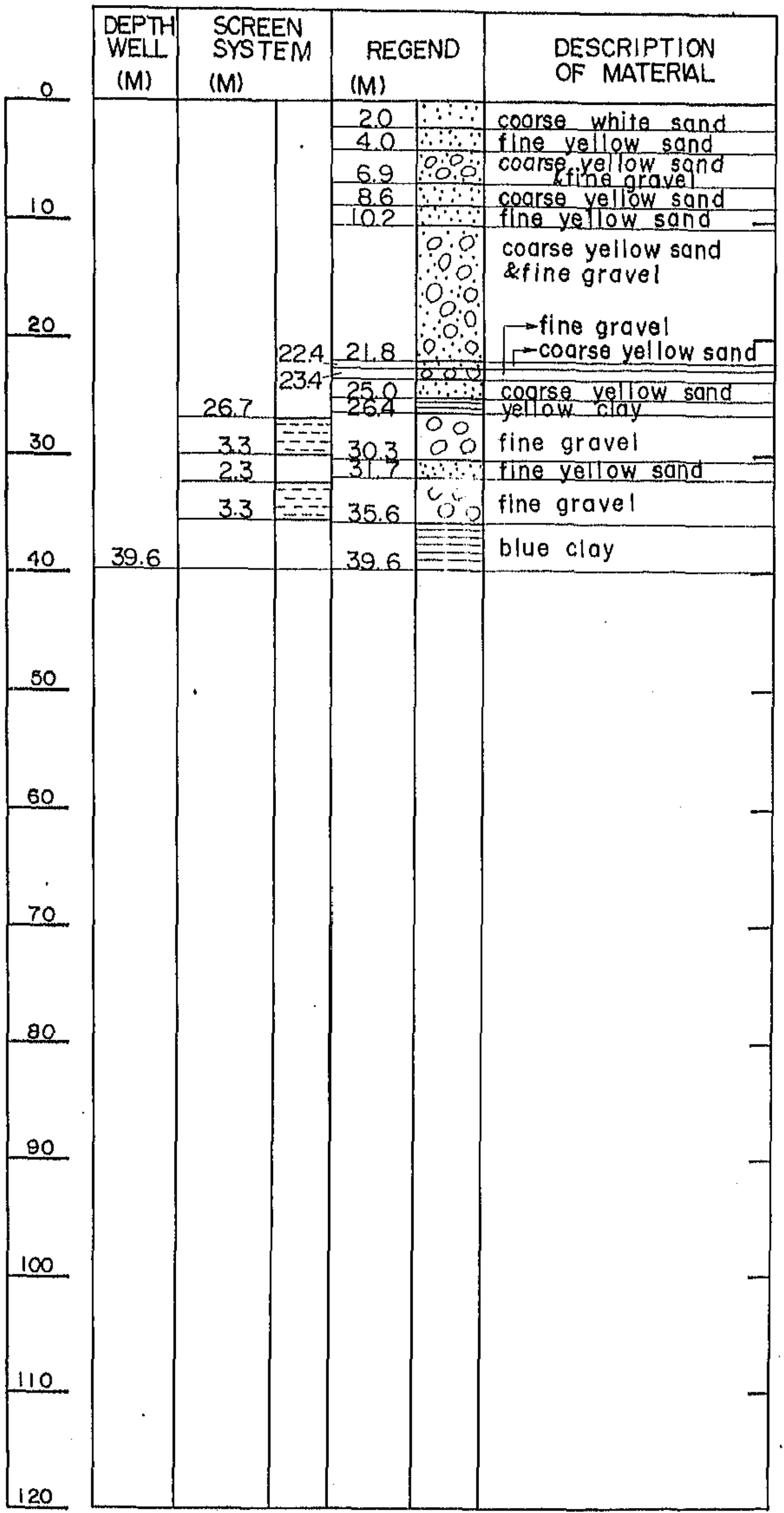
ELECTRICAL PROSPECTING IN PROME
NO.24 (TAHAL 30)



A－3・2 EXISTING WELL LOGS

CONSTRUCTION CORPORATION DIVISIONAL STORES-NO. PROME4

WELL LOG



Source: Burma Government

MEMORANDUM

DRILLING MACHINE

—

DATE

—

TOTAL WELL DEPTH

39.6m

CASING PIPE

ø100m/m

CASING LENGTH

ø100m/m X29.0m

SCREEN LENGTH

ø100m/m X6.6m

S.W.L ▽

—

D.W.L ▽

—

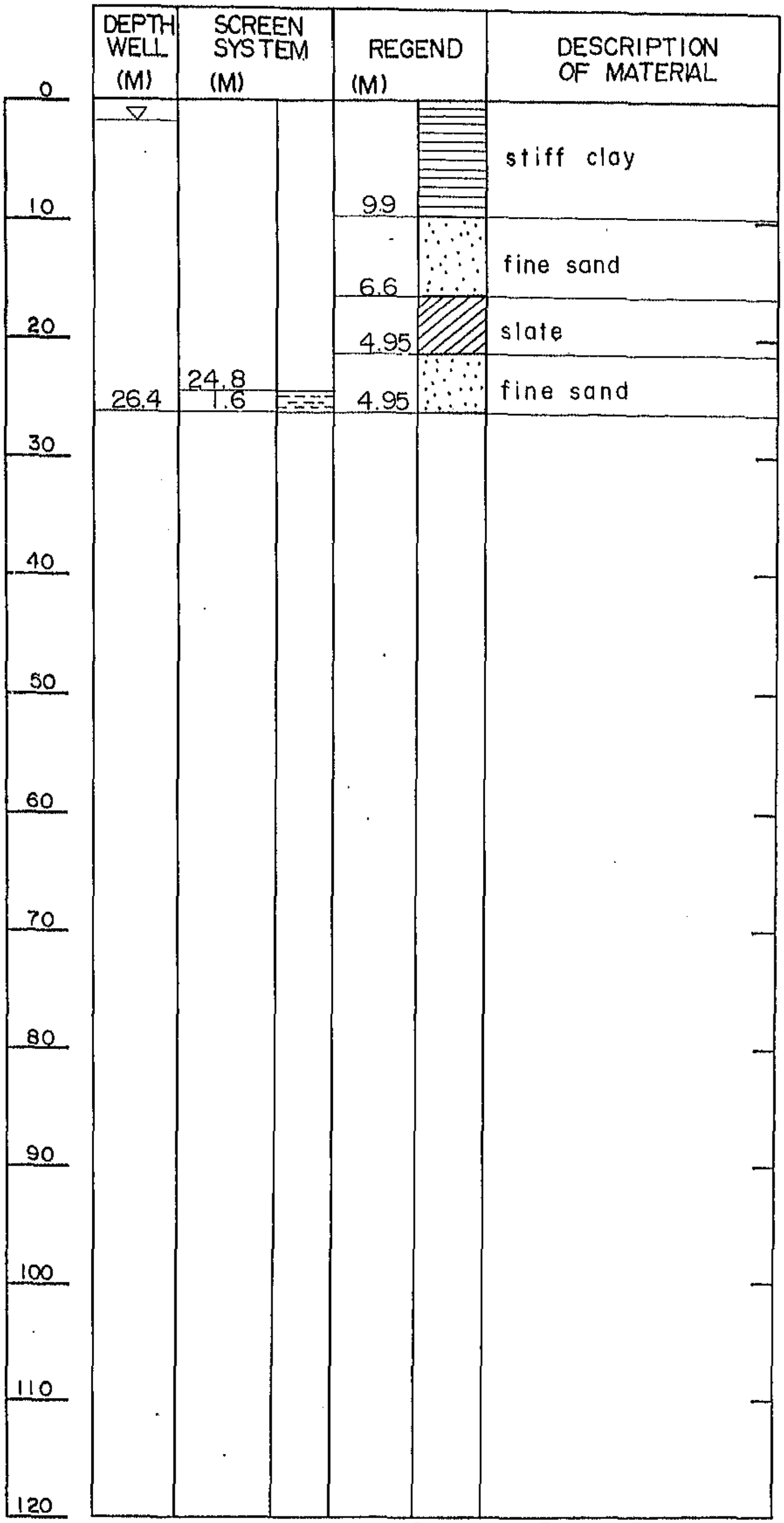
YIELD

300 L·P·M

※ REMARKS

PROME HOUSING SITE-NO.14

WELL LOG



Source: Burma Government

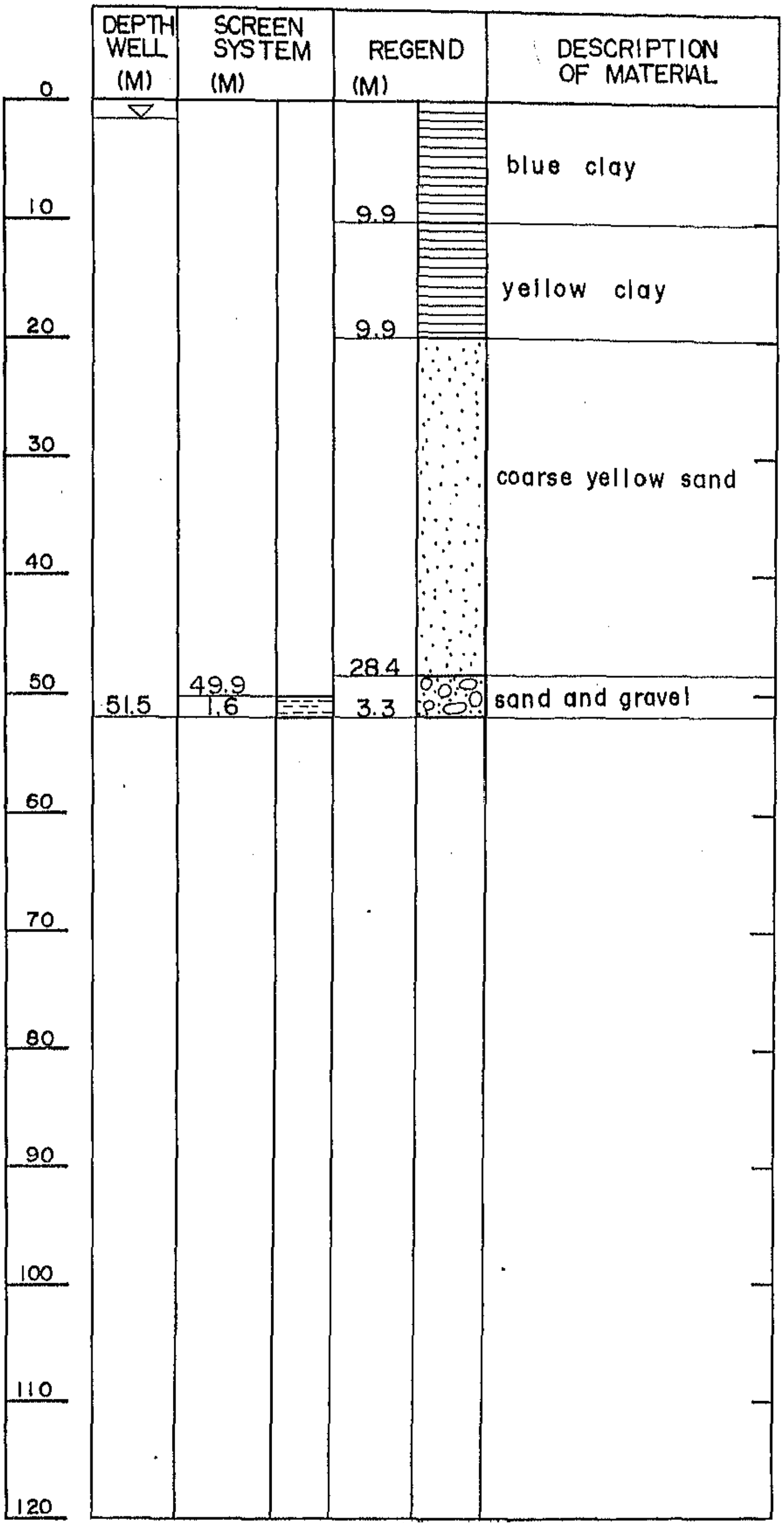
MEMORANDUM

DRILLING MACHINE	—
DATE	—
TOTAL WELL DEPTH	29.0 m
CASING PIPE	—
CASING LENGTH	27.4 m
SCREEN LENGTH	1.6 m
S.W.L ▽	3.9 m
D.W.L ▽	9.9 m
YIELD	300 L·P·M

※ REMARKS

PROME JAIL - NO. 15

WELL LOG



Source: Burma Government

MEMORANDUM

DRILLING MACHINE

——

DATE

COMPLETED ON 21.9.61

TOTAL WELL DEPTH

53.1m

CASING PIPE

——

CASING LENGTH

49.9m

SCREEN LENGTH

1.6 m

S.W.L ▽

1.0m

D.W.L ▽

——

YIELD

375L·P·M

※ REMARKS

STARTING PRESSURE

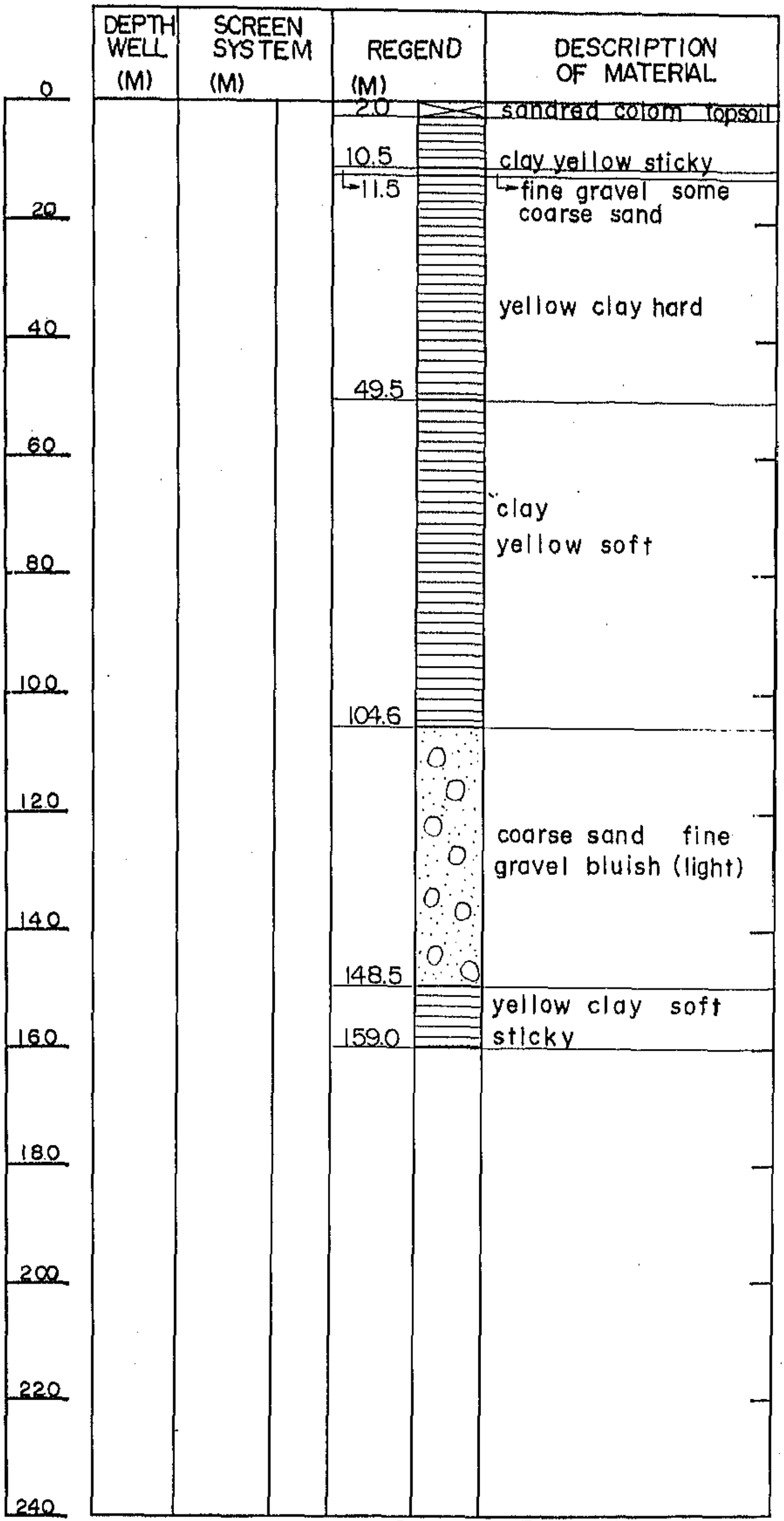
45 LBS

WORKING PRESSURE

35 LBS

NATIONAL CATTLE BREEDING & RESEARCH CENTER

WELL LOG



MEMORANDUM

DRILLING MACHINE

PORTA

DATE

TOTAL WELL DEPTH

CASING PIPE

CASING LENGTH

SCREEN LENGTH

S.W.L ▽

D.W.L ▽

YIELD

※ REMARKS

Source: Burma Government

No. 448/81,449/81 and 450/81.

A — 3 · 3 (1) REPORT OF WATER ANALYSIS

Source	Physical Character				Chemical Tests.										
					Qualitative				Quantitative [Parts Per Million]						
	Appear-ance	Colour	Smell	Sediment	Sulphate	Nitrates	Nitrites	Ignition	Total Solid	Chlorine	Total hardness	Permanent hardness	Saline ammonia	Albuminoid ammonia	Iron
							Lab.No.448/81 Sample No.Prome(12) Tube well, Jail,Prome			Lab.No.449/81 Sample No:Prome(11) Hot Spring, Prome.			~~Lab.No.450/81~~ ~~Sample No.A~~ ~~Tube well,~~ ~~17A,Aung Theikdi,Mayangon.~~		
	1. Total solids.						480.0	mg/1		340.0	mg/1		~~335.0~~	~~mg/1~~	
	2. Total Hardness,as $CaCO_3$						23.0	"		103.0	"		~~113.0~~	~~"~~	
	3. Permanent hardness,as $CaCO_3$						7.0	"		7.0	"		~~6.0~~	~~"~~	
	4. Calcium,as Ca						7.2	"		22.8	"		~~14.8~~	~~"~~	
	5. Magnesium,as Mg						1.3	"		11.2	"		~~18.5~~	~~"~~	
	6. Iron,as Fe						0.03	"		0.03	"		~~2.2~~	~~"~~	
	7. Manganese,as Mn						Nil			Nil			~~Nil~~		
	8. Zinc,as Zn						Nil			Nil			~~Nil~~		
	9. Copper,as Cu						Nil			Nil			~~Nil~~		
	10. Lead,as Pb.						Nil			Nil			~~Nil~~		
	11. Sulphate,as SO_4						14.7	"		Trace			~~Trace~~		
	12. Chloride,as Cl						8.0	"		5.0	"		~~17.0~~	~~"~~	
	13. Nitrate,as N						1.0	"		0.2	"		~~8.5~~	~~"~~	
	14. Carbonate,as CO_3						Nil			Nil			~~Nil~~		
Remarks—	15. Bicarbonate,as HCO_3						327.4	"		280.6	"		~~247.1~~	~~"~~	
	16. Free & saline ammonia,as NH_3						0.01	"		0.01	"		~~3.12~~	~~"~~	
	17. Albuminoid ammonia,as NH_3						0.02	"		0.01	"		~~0.028~~	~~"~~	
	18. pH.						8.0			7.4			~~7.6~~		

DAW KHIN KHIN SOE,
M.B.,B.S., D.P.H.
Asst. Director. N.H.L.

No. 430/81, 431/81 & 432/81.

A — 3 · 3 (2) REPORT OF WATER ANALYSIS

Source	Physical Character				Chemical Tests.											
					Qualitative				Quantitative [Parts Per Million]							
	Appear-ance	Colour	Smell	Sediment	Sulphate	Nitrates	Nitrites	Ignition	Total Solid	Chlorine	Total hardness	Permanent hardness'	Saline ammonia	Albuminoid ammonia	Iron

	Lab.No.430/81 Sample No.Prome (7) Tube Well, Prome.		Lab.No.431/81 Sample No.Prome(8) Tube well, Prome.		Lab.No.432/81 Sample No.Prome(9) Tube well, Irrigation Compound, Prome.	
1. Total solids	155.8	mg/l	165.0	mg/l	215.0	mg/l
2. Total hardness, as $CaCO_3$	57.0	"	52.0	"	68.0	"
3. Permanent hardness, as $CaCO_3$	14.0	""	32.0	"	17.0	"
4. Calcium, as Ca	14.8	"	12.8	"	16.0	"
5. Magnesium, as Mg	4.8	"	4.8	"	6.7	"
6. Iron, as Fe	0.05	"	0.05	"	0.06	"
7. Manganese, as Mn	Nil		Nil		Nil	
8. Zinc, as Zn	Trace		Nil		Nil	
9. Carbonate, as CO_3	Nil		Nil		Nil	
10. Bicarbonate, as HCO_3	94.6	"	91.5	"	115.9	"
11. Chloride, as Cl	8.0	"	6.0	"	9.0	"
12. Sulphate, as SO_4	Trace		Trace		Trace	
13. Nitrate, as N	0.60	"	0.60	"	0.70	"
14. Free & saline ammonia, as NH_3	0.01	"	0.01	"	0.01	"
15. Albuminoid ammonia, as NH_3	0.20	"	0.20	"	0.08	"
16. pH.	7.8		6.8		7.0	

Remarks—

Samples not sufficient for further tests.

DAW KHIN KHIN SOE,
M.B.,B.S., D.P.H.
Asst. Director, N.H.L.

No. 445/81,446/81 and 447/81.

A — 3 · 3 (3) REPORT OF WATER ANALYSIS

Source	Physical Character				Chemical Tests.										
					Qualitative					Quantitative [Parts Per Million]					
	Appearance	Colour	Smell	Sediment	Sulphate	Nitrates	Nitrites	Ignition	Total Solid	Chlorine	Total hardness	Permanent hardness'	Saline ammonia	Albuminoid ammonia	Iron

	Lab.No.445/81 Sample No.Prome(4) Tube well G.C.Divisional Stores, Prome		Lab.No.446/81 Sample No.Prome(5) Tube well Kaittayar Garden, Prome		Lab.No.447/81 Sample No.Prome(6) Tube well Shwehintha Qr: Prome	
1.Total solids	259.0	mg/l	270.0	mg/l	180.0	mg/l
2.Total Hardness,as CaCO$_3$	80.0	"	52.0	"	72.0	"
3Permanent Hardness,as CaCO$_3$	7.0	"	28.0	"	35.0	"
4.Calcium,as Ca	12.0	"	12.4	"	16.0	"
5.Magnesium,as Mg	8.6	"	5.2	"	7.8	"
6.Iron,as Fe	0.63	"	0.16	"	0.03	"
7.Manganese,as Mn	1.37	"	0.11	"	0.25	"
8.Zinc,as Zn	Nil		Nil		Nil	
9.Copper,as Cu	Nil		Nil		Nil	
10.Lead,as Pb.	Nil		Nil		Nil	
11.Sulphate,as SO$_4$	Trace		Trace		Trace	
12.Chloride,as Cl	8,0	"	16.0	"	21.0	"
13.Nitrate,as N	0.3	"	0.5	"	0.7	"
14.Carbonate,as CO$_3$	Nil		Nil		Nil	
15.Bicarbonate,as HCO$_3$	219.6	"	85.4	"	106.8	"
16.Free & saline ammonia,as NH$_3$	0.01	"	0.01	"	0.01	"
17.Albuminoid ammonia,as NH$_3$	0.01	"	0.04	"	0.026	"
18.pH.	7.0		6.6		6.9	

Remarks—

DAW KHIN KHIN SOE,
M.B.,B.S., D.P.H.
Asst. Director. N.H.L

No. 442/81,443/81 and 444/81

A — 3 · 3 (4) REPORT OF WATER ANALYSIS

Source	Physical Character				Chemical Tests.											
					Qualitative				Quantitative [Parts Per Million]							
	Appearance	Colour	Smell	Sediment	Sulphate	Nitrates	Nitrites	Ignition	Total Solid	Chlorine	Total hardness	Permanent hardness'	Saline ammonia	Albuminoid ammonia	Iron	

	Lab.No.442/81 Sample No.Prome(1) Tube well,Timber Corporation.		Lab.No.443/81 Sample No.Prome(2) Tube well (1) G.T.I.,Prome.		Lab.No.444/81 Sample No.Prome(3) Tube well(2), G.T.I.,Prome.	
1. Total solids.	230.0	mg/1	230.0	mg/1	230.0	mg/1
2. Total hardness,as $CaCO_3$	95.0	"	74.0	"	92.6	"
3. Permanent hardness, as $CaCO_3$	11.0	"	8.0	"	6.0	"
4. Calcium,as Ca	21.6	"	15.0	"	19.6	"
5. Magnesium,as Mg	9.9	"	9.6	"	10.5	"
6. Iron,as Fe	0.35	"	0.08	"	0.62	"
7. Manganese,as Mn	1.60	"	6.44	"	0.11	"
8. Zinc,as Zn	Nil		Nil		Nil	
9. Copper,as Cu	Nil		Nil		Nil	
10. Lead,as Pb.	Nil		Nil		Nil	
11. Sulphate,as SO_4	2.9	"	Trace		Trace	
12. Chloride,as Cl	11.0	"	7.0	"	5.0	"
13. Nitrate,as N	0.1	"	0.2	"	0.2	"
14 Carbonate,as CO_3	Nil		Nil		Nil	
15. Bicarbonate,as HCO_3	149.5	"	152.5	"	183.0	"
16. Free & saline ammonia, NH_3	0.01	"	0.01	"	0.021	"
17. Albuminoid ammonia,as NH_3	0.01	"	0.03	"	0.028	"
18. pH.	6.6		6.6		7.5	

Remarks—

DAW KHIN KHIN SOE,
M.B.,B.S., D.P.H.
Actg. Director, N.H.L.

NET WORK (PROPOSED PIPELINES)

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           --- CALUCULATION OF HYDRAULIC NETWORK --- (FOR PIPE-LINE)                                                  PAGE

    LINE  JOINT NO.     C     DIA.     LENGTH    QUANTITY    VELOCITY   GRADIENT  HEAD LOSS
                              (MM)      ( M )     ( L/S )    ( M/S )   ( 0/00 )    ( M )

                    *** LOOP   1 ***      SIGMA-H= -.000010

       1   43- 45   150.    150.     400.00      -2.78        .157       .193      -.077      JIS G 5526
       3   45- 44   150.    150.     375.00       -.24        .013       .002      -.001      JIS G 5526
       2   43- 44   150.    150.     700.00      -2.06        .117       .111      -.078      JIS G 5526

                    *** LOOP   2 ***      SIGMA-H= -.000021

       3   45- 44   150.    150.     375.00       -.24        .013       .002      -.001      JIS G 5526
       4   45- 48   150.    150.     375.00      -7.38        .418      1.176      -.441      JIS G 5526
       6   48- 47   150.    150.     350.00       -.63        .035       .012      -.004      JIS G 5526
       7   47- 46   150.    150.     375.00       3.03        .171       .226       .085      JIS G 5526
       5   44- 46   150.    150.     325.00      -7.14        .404      1.107      -.360      JIS G 5526

                    *** LOOP   3 ***      SIGMA-H= -.000056

       7   47- 46   150.    150.     375.00       3.03        .171       .226       .085      JIS G 5526
       8   47- 50   150.    150.     275.00      -8.53        .482      1.536      -.423      JIS G 5526
      12   50- 51   150.    150.     450.00       1.95        .110       .100       .045      JIS G 5526
       9   46- 51   150.    150.     275.00      -8.95        .507      1.682      -.462      JIS G 5526

                    *** LOOP   4 ***      SIGMA-H= -.000099

       6   48- 47   150.    150.     350.00       -.63        .035       .012      -.004      JIS G 5526
      10   48- 49   150.    150.     350.00     -11.62        .658      2.726      -.954      JIS G 5526
      11   49- 50   150.    150.     550.00       6.61        .374       .958       .527      JIS G 5526
       8   47- 50   150.    150.     275.00      -8.53        .482      1.536      -.423      JIS G 5526

                    *** LOOP   5 ***      SIGMA-H= -.000200

      11   49- 50   150.    150.     550.00       6.61        .374       .958       .527      JIS G 5526
      15   49- 54   150.    150.     300.00     -18.55       1.050      6.475     -1.943      JIS G 5526
      16   54- 53   150.    150.     550.00      13.23        .749      3.465      1.906      JIS G 5526
      13   50- 53   150.    150.     300.00      -9.51        .538      1.879      -.564      JIS G 5526

                    *** LOOP   6 ***      SIGMA-H= -.000093

      12   50- 51   150.    150.     450.00       1.95        .110       .100       .045      JIS G 5526
      13   50- 53   150.    150.     300.00      -9.51        .538      1.879      -.564      JIS G 5526
      17   53- 52   150.    150.     500.00       4.45        .252       .462       .231      JIS G 5526
      14   51- 52   150.    150.     325.00      -7.33        .415      1.162      -.378      JIS G 5526
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--- CALUCULATION OF HYDRAULIC NETWORK --- (FOR PIPE-LINE)                                                   PAGE

 LINE  JOINT NO.     C     DIA.    LENGTH    QUANTITY    VELOCITY    GRADIENT   HEAD LOSS
                           (MM)    ( M )     ( L/S )     ( M/S )     ( 0/00 )    ( M )

                 *** LOOP   7 ***     SIGMA-H= -.000158

  16    54- 53   150.    150.    550.00       13.23        .749       3.465       1.906      JIS G 5526
  18    54- 55   150.    150.    300.00       16.66        .943       5.307       1.592      JIS G 5526
  21    55- 56   150.    150.    550.00        4.90        .278        .552        .304      JIS G 5526
  19    53- 56   150.    150.    300.00       -1.05        .060        .032       -.010      JIS G 5526

                 *** LOOP   8 ***     SIGMA-H= -.000044

  17    53- 52   150.    150.    500.00        4.45        .252        .462        .231      JIS G 5526
  19    53- 56   150.    150.    300.00       -1.05        .060        .032       -.010      JIS G 5526
  22    56- 57   150.    150.    550.00        3.53        .200        .300        .165      JIS G 5526
  20    57- 52   150.    150.    300.00        3.20        .181        .251        .075      JIS G 5526

                 *** LOOP   9 ***     SIGMA-H= -.000069

 100    76- 54   150.    150.    140.00       48.77       2.760      38.706       5.419      JIS G 5526
 101    76- 59   150.    150.    115.00       57.03       3.227      51.693       5.945      JIS G 5526
  24    58- 59   150.    150.    175.00      -20.77       1.176       7.981      -1.397      JIS G 5526
  23    55- 58   150.    150.    125.00       11.43        .647       2.644        .330      JIS G 5526
  18    54- 55   150.    150.    300.00       16.66        .943       5.307       1.592      JIS G 5526

                 *** LOOP  10 ***     SIGMA-H= -.000050

  26    60- 59   150.    150.    350.00      -32.69       1.850      18.470      -6.464      JIS G 5526
  27    61- 60   150.    150.    175.00        1.11        .063        .036        .006      JIS G 5526
  25    61- 58   150.    150.    350.00      -28.65       1.621      14.461      -5.062      JIS G 5526
  24    58- 59   150.    150.    175.00      -20.77       1.176       7.981      -1.397      JIS G 5526

                 *** LOOP  11 ***     SIGMA-H=  .000000

  29    62- 63   150.    150.    300.00        8.57        .485       1.553        .466      JIS G 5526
  31    61- 62   150.    150.    300.00       23.97       1.356      10.401       3.120      JIS G 5526
  27    61- 60   150.    150.    175.00        1.11        .063        .036        .006      JIS G 5526
  28    60- 66   150.    150.    150.00       30.25       1.712      15.995       2.399      JIS G 5526
  32    63- 66   150.    150.    300.00      -14.18        .802       3.936      -1.181      JIS G 5526

                 *** LOOP  12 ***     SIGMA-H= -.000046

  33    68- 67   150.    150.    300.00       -8.95        .507       1.682       -.505      JIS G 5526
  38    68- 63   150.    150.    300.00       -6.27        .355        .871       -.261      JIS G 5526
  32    63- 66   150.    150.    300.00      -14.18        .802       3.936      -1.181      JIS G 5526
  37    67- 66   150.    150.    300.00      -12.51        .708       3.125       -.937      JIS G 5526
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--- CALUCULATION OF HYDRAULIC NETWORK --- (FOR PIPE-LINE)                                          PAGE

LINE  JOINT NO.    C     DIA.    LENGTH    QUANTITY    VELOCITY    GRADIENT   HEAD LOSS
                         (MM)    ( M )     ( L/S )     ( M/S )    ( 0/00 )    ( M )

            *** LOOP  13 ***      SIGMA-H= -.000010

 30    65- 64    150.    150.    300.00      -8.28        .468       1.454      -.436      JIS G 5526
 34    64- 62    150.    150.    350.00     -11.84        .670       2.819      -.987      JIS G 5526
 29    62- 63    150.    150.    300.00       8.57        .485       1.553       .466      JIS G 5526
 35    65- 63    150.    150.    325.00     -12.12        .686       2.945      -.957      JIS G 5526

            *** LOOP  14 ***      SIGMA-H= -.000019

 36    69- 68    150.    150.    325.00     -11.67        .660       2.744      -.892      JIS G 5526
 39    69- 73    150.    150.    200.00       8.11        .459       1.399       .280      JIS G 5526
 40    73- 65    150.    150.     88.00     -16.83        .953       5.409      -.476      JIS G 5526
 35    65- 63    150.    150.    325.00     -12.12        .686       2.945      -.957      JIS G 5526
 38    68- 63    150.    150.    300.00      -6.27        .355        .871      -.261      JIS G 5526

            *** LOOP  15 ***      SIGMA-H=  .000000

 41    70- 73    150.    150.    150.00     -21.38       1.210       8.417     -1.263      JIS G 5526

            *** LOOP  16 ***      SIGMA-H= -.000016

 44    72- 33    150.    150.    200.00       3.70        .210        .328       .066      JIS G 5526
 46    33- 74    150.    150.    200.00      15.62        .884       4.711       .942      JIS G 5526
 45    74- 71    150.    150.    250.00      -7.00        .396       1.066      -.267      JIS G 5526
 43    70- 71    150.    150.    400.00      10.56        .597       2.282       .913      JIS G 5526
 42    70- 72    150.    150.    150.00       7.26        .411       1.142       .171      JIS G 5526

            *** LOOP  17 ***      SIGMA-H= -.000030

 47     4- 33    150.    150.    300.00      15.48        .876       4.631      1.389      JIS G 5526
 51     4-  8    150.    150.    325.00      27.79       1.573      13.677      4.445      JIS G 5526
 50     8-  9    150.    150.    250.00     -13.69        .775       3.690      -.922      JIS G 5526
 49    10-  9    150.    150.     75.00      19.06       1.079       6.806       .510      JIS G 5526
 48    74- 10    150.    150.    100.00      19.06       1.079       6.806       .681      JIS G 5526
 46    33- 74    150.    150.    200.00      15.62        .884       4.711       .942      JIS G 5526

            *** LOOP  18 ***      SIGMA-H= -.000019

 51     4-  8    150.    150.    325.00      27.79       1.573      13.677      4.445      JIS G 5526
 52     5-  4    150.    150.    250.00     -48.72       2.757      38.624     -9.656      JIS G 5526
 55     5-  6    150.    150.    200.00      11.87        .671       2.832       .566      JIS G 5526
 54     6-  7    150.    150.    225.00     -11.07        .626       2.490      -.560      JIS G 5526
 53     7-  8    150.    150.    225.00     -36.97       2.092      23.189     -5.217      JIS G 5526
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--- CALUCULATION OF HYDRAULIC NETWORK --- (FOR PIPE-LINE)                                                  PAGE

LINE  JOINT NO.    C     DIA.    LENGTH   QUANTITY    VELOCITY    GRADIENT   HEAD LOSS
                         (MM)    ( M )    ( L/S )     ( M/S )     ( O/OO )   ( M )

               *** LOOP  19 ***     SIGMA-H= -.000005

  71   17-  6   150.    150.    200.00    -18.42      1.043       6.391     -1.278      JIS G 5526
  75   16- 17   150.    150.    275.00     -3.12       .177        .239      -.066      JIS G 5526
  74   16-  7   150.    150.    350.00    -16.89       .956       5.440     -1.904      JIS G 5526
  54    6-  7   150.    150.    225.00    -11.07       .626       2.490      -.560      JIS G 5526

               *** LOOP  20 ***     SIGMA-H= -.000004

  70   18- 17   150.    150.    400.00    -10.79       .611       2.377      -.951      JIS G 5526
  72   15- 18   150.    150.    250.00      1.97       .111        .102       .025      JIS G 5526
  73   15- 16   150.    150.    350.00    -10.99       .622       2.456      -.860      JIS G 5526
  75   16- 17   150.    150.    275.00     -3.12       .177        .239      -.066      JIS G 5526

               *** LOOP  21 ***     SIGMA-H=  .000000

  77   13- 16   150.    150.    150.00     -4.51       .255        .473      -.071      JIS G 5526

               *** LOOP  22 ***     SIGMA-H=  .000000

  76   14- 15   150.    150.    170.00     -4.51       .255        .473      -.080      JIS G 5526

               *** LOOP  23 ***     SIGMA-H= -.000034

  69   77- 18   150.    150.    360.00     -8.25       .467       1.446      -.520      JIS G 5526
  70   18- 17   150.    150.    400.00    -10.79       .611       2.377      -.951      JIS G 5526
  71   17-  6   150.    150.    200.00    -18.42      1.043       6.391     -1.278      JIS G 5526
  55    5-  6   150.    150.    200.00     11.87       .671       2.832       .566      JIS G 5526
  56   19-  5   150.    150.    150.00    -32.34      1.830      18.101     -2.715      JIS G 5526
  58   20- 19   150.    150.    200.00    -14.19       .803       3.944      -.789      JIS G 5526
  68   21- 20   150.    150.    200.00     -4.31       .244        .435      -.087      JIS G 5526
  61   22- 21   150.    150.    250.00       .20       .011        .001       .000      JIS G 5526
 103   77- 22   150.    150.    190.00      8.25       .467       1.446       .275      JIS G 5526

               *** LOOP  24 ***     SIGMA-H= -.000011

  59   23- 24   150.    150.    225.00     -1.82       .103        .089      -.020      JIS G 5526
  60   23- 20   150.    150.    225.00     -5.37       .304        .654      -.147      JIS G 5526
  58   20- 19   150.    150.    200.00    -14.19       .803       3.944      -.789      JIS G 5526
  57   19- 24   150.    150.    250.00     13.64       .772       3.664       .916      JIS G 5526
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--- CALUCULATION OF HYDRAULIC NETWORK --- (FOR PIPE-LINE)                                              PAGE

LINE  JOINT NO.    C     DIA.     LENGTH     QUANTITY     VELOCITY     GRADIENT    HEAD LOSS
                         (MM)     ( M )      ( L/S )      ( M/S )      ( 0/00 )     ( M )

                 *** LOOP  25 ***      SIGMA-H= -.000010

 67    22- 23    150.    150.    200.00       3.54         .200         .302         .060      JIS G 5526
 61    22- 21    150.    150.    250.00        .20         .011         .001         .000      JIS G 5526
 68    21- 20    150.    150.    200.00      -4.31         .244         .435        -.087      JIS G 5526
 60    23- 20    150.    150.    225.00      -5.37         .304         .654        -.147      JIS G 5526

                 *** LOOP  26 ***      SIGMA-H= -.000012

 66    26- 25    150.    150.    275.00      -2.79         .158         .195        -.054      JIS G 5526
 63    26- 23    150.    150.    375.00      -6.23         .352         .859        -.322      JIS G 5526
 59    23- 24    150.    150.    225.00      -1.82         .103         .089        -.020      JIS G 5526
 62    25- 24    150.    150.    250.00      -7.30         .413        1.154        -.288      JIS G 5526

                 *** LOOP  27 ***      SIGMA-H=  .000000

 65    27- 26    150.    150.    200.00      -4.51         .255         .473        -.095      JIS G 5526
 64    27- 22    150.    150.    500.00        .00         .000         .000         .000      JIS G 5526
 67    22- 23    150.    150.    200.00       3.54         .200         .302         .060      JIS G 5526
 59    23- 24    150.    150.    225.00      -1.82         .103         .089        -.020      JIS G 5526

                 *** LOOP  28 ***      SIGMA-H=  .000000

 78     7- 12    150.    150.    175.00       4.51         .255         .473         .083      JIS G 5526

                 *** LOOP  29 ***      SIGMA-H=  .000000

 79    29- 30    150.    150.    350.00      -2.03         .115         .108        -.038      JIS G 5526

                 *** LOOP  30 ***      SIGMA-H=  .000000

 99     3- 76    150.    200.    125.00     105.80        3.368       39.950        4.994      JIS G 5526

                 *** LOOP  31 ***      SIGMA-H=  .000012

 90    41- 40    150.    150.    325.00       -.76         .043         .018        -.006      JIS G 5526
105    40- 79    150.    150.    115.00       3.44         .195         .286         .033      JIS G 5526
 88    79- 42    150.    150.    610.00       3.44         .195         .286         .175      JIS G 5526
 87    41- 42    150.    150.    650.00       3.59         .203         .311         .202      JIS G 5526
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--- CALUCULATION OF HYDRAULIC NETWORK --- (FOR PIPE-LINE)                                    PAGE

LINE  JOINT NO.    C     DIA.    LENGTH    QUANTITY    VELOCITY    GRADIENT   HEAD LOSS
                         (MM)    ( M )     ( L/S )     ( M/S )     ( O/OO )    ( M )

                *** LOOP  32 ***     SIGMA-H=  .000022

 91    39- 38   150.    150.    400.00     -1.97        .111        .102      -.041     JIS G 5526
 89    38- 40   150.    150.    450.00      8.23        .466       1.439       .648     JIS G 5526
 90    41- 40   150.    150.    325.00      -.76        .043        .018      -.006     JIS G 5526
 86    39- 41   150.    150.    550.00      7.16        .405       1.114       .612     JIS G 5526

                *** LOOP  33 ***     SIGMA-H=  .000034

 92    37- 36   150.    150.    350.00    -13.45        .761       3.572     -1.250     JIS G 5526
 93    36- 78   150.    150.    310.00     14.23        .805       3.961      1.228     JIS G 5526
104    78- 38   150.    150.    175.00     14.23        .805       3.961       .693     JIS G 5526
 91    39- 38   150.    150.    400.00     -1.97        .111        .102      -.041     JIS G 5526
 85    37- 39   150.    150.    400.00      9.23        .522       1.779       .712     JIS G 5526

                *** LOOP  34 ***     SIGMA-H=  .000000

 83     9- 11   150.    150.    250.00      -.19        .011        .001      -.000     JIS G 5526
 84    11- 37   150.    150.    250.00      -.19        .011        .001      -.000     JIS G 5526

                *** LOOP  35 ***     SIGMA-H=  .000000

 95    75- 34   150.    150.    150.00     15.76        .892       4.786       .718     JIS G 5526
 97    34- 35   150.    150.    225.00      2.03        .115        .108       .024     JIS G 5526

                *** LOOP  36 ***     SIGMA-H=  .000000

 82    32- 34   150.    150.    500.00    -10.15        .575       2.123     -1.062     JIS G 5526
 96    32- 31   150.    150.    175.00      2.03        .115        .108       .019     JIS G 5526

                *** LOOP  37 ***     SIGMA-H=  .000000

 81    30- 32   150.    150.    450.00     -6.09        .345        .825      -.371     JIS G 5526
 80    28- 30   150.    150.    300.00     -2.03        .115        .108      -.032     JIS G 5526

                *** LOOP  38 ***     SIGMA-H=  .000000

 98     1-  4   150.    200.    265.00     96.50       3.072      33.697      8.930     JIS G 5526

                *** LOOP  39 ***     SIGMA-H=  .000000

102     2- 75   150.    150.     35.00     49.49       2.801      39.773      1.392     JIS G 5526
 94    75- 36   150.    150.    200.00     31.71       1.794      17.450      3.490     JIS G 5526
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--- CALUCULATION OF HYDRAULIC NETWORK --- (FOR JOINT)

 JOINT   SUM-Q   SUM-H    G.L.    W.L.    L.H.  PRESSURE      JOINT   SUM-Q   SUM-H    G.L.    W.L.    L.H.  PRESSURE
         (L/S)    (M)     (M)     (M)     (M)   (KG/CM2)              (L/S)    (M)     (M)     (M)     (M)   (KG/CM2)

    1    96.50   13.60   61.00   59.40   -1.60    -.160          2    49.49   19.92   45.00   53.08    8.08     .808
    3   105.80     .00   73.00   73.00     .00     .000          4    -4.51   22.53   45.00   50.47    5.47     .547
    5    -4.51   32.18   30.00   40.82   10.82    1.082          6    -4.51   32.75   28.00   40.25   12.25    1.225
    7    -4.51   32.19   28.00   40.81   12.81    1.281          8    -4.51   26.97   29.00   46.03   17.03    1.703
    9    -5.56   26.05   30.00   46.95   16.95    1.695         10      .00   25.54   32.00   47.46   15.46    1.546
   11      .00   26.05   32.00   46.95   14.95    1.495         12    -4.51   32.27   25.00   40.73   15.73    1.573
   13    -4.51   34.16   26.00   38.84   12.84    1.284         14    -4.51   35.03   28.00   37.97    9.97     .997
   15    -4.51   34.95   29.00   38.05    9.05     .905         16    -4.51   34.09   27.00   38.91   11.91    1.191
   17    -4.51   34.03   28.00   38.97   10.97    1.097         18    -4.51   34.98   33.00   38.02    5.02     .502
   19    -4.51   34.90   33.00   38.10    5.10     .510         20    -4.51   35.69   31.00   37.31    6.31     .631
   21    -4.51   35.77   28.00   37.23    9.23     .923         22    -4.51   35.77   32.00   37.23    5.23     .523
   23    -4.51   35.83   32.00   37.17    5.17     .517         24    -4.51   35.81   32.00   37.19    5.19     .519
   25    -4.51   36.10   32.00   36.90    4.90     .490         26    -4.51   36.16   32.00   36.84    4.84     .484
   27    -4.51   36.25   32.00   36.75    4.75     .475         28    -2.03   23.49   24.00   49.51   25.51    2.551
   29    -2.03   23.50   28.00   49.50   21.50    2.150         30    -2.03   23.46   26.00   49.54   23.54    2.354
   31    -2.03   23.11   22.00   49.89   27.89    2.789         32    -2.03   23.09   24.00   49.91   25.91    2.591
   33    -3.56   23.92   35.00   49.08   14.08    1.408         34    -3.57   22.03   29.00   50.97   21.97    2.197
   35    -2.03   22.05   30.00   50.95   20.95    2.095         36    -4.03   24.80   29.00   48.20   19.20    1.920
   37    -4.03   26.05   32.00   46.95   14.95    1.495         38    -4.03   26.72   27.00   46.28   19.28    1.928
   39    -4.03   26.76   31.00   46.24   15.24    1.524         40    -4.03   27.37   27.00   45.63   18.63    1.863
   41    -4.33   27.37   30.00   45.63   15.63    1.563         42    -7.03   27.57   28.00   45.43   17.43    1.743
   43    -4.84   13.83   53.00   59.17    6.17     .617         44    -4.84   13.75   49.00   59.25   10.25    1.025
   45    -4.84   13.75   53.00   59.25    6.25     .625         46    -4.84   13.39   43.00   59.61   16.61    1.661
   47    -4.87   13.30   49.00   59.70   10.70    1.070         48    -4.87   13.31   51.00   59.69    8.69     .869
   49     -.32   12.36   51.00   60.64    9.64     .964         50    -5.64   12.88   46.00   60.12   14.12    1.412
   51     -.32   12.93   40.00   60.07   20.07    2.007         52     -.32   12.55   35.00   60.45   25.45    2.545
   53     -.32   12.32   40.00   60.68   20.68    2.068         54     -.32   10.41   55.00   62.59    7.59     .759
   55     -.32   12.01   49.00   60.99   11.99    1.199         56     -.32   12.31   35.00   60.69   25.69    2.569
   57     -.32   12.47   30.00   60.53   30.53    3.053         58    -3.56   12.34   47.00   60.66   13.66    1.366
   59    -3.56   10.94   55.00   62.06    7.06     .706         60    -3.56   17.40   48.00   55.60    7.60     .760
   61    -3.56   17.40   40.00   55.60   15.60    1.560         62    -3.56   20.52   38.00   52.48   14.48    1.448
   63    -4.36   20.98   40.00   52.02   12.02    1.202         64    -3.56   21.50   38.00   51.50   13.50    1.350
   65    -3.56   21.94   40.00   51.06   11.06    1.106         66    -3.56   19.80   48.00   53.20    5.20     .520
   67    -3.56   20.74   47.00   52.26    5.26     .526         68    -3.56   21.24   43.00   51.76    8.76     .876
   69    -3.56   22.14   43.00   50.86    7.86     .786         70    -3.56   23.68   40.00   49.32    9.32     .932
   71    -3.56   24.59   38.00   48.41   10.41    1.041         72    -3.56   23.85   42.00   49.15    7.15     .715
   73    -3.56   22.42   43.00   50.58    7.58     .758         74    -3.56   24.86   33.00   48.14   15.14    1.514
   75    -2.03   21.31   30.00   51.69   21.69    2.169         76      .00    4.99   61.00   68.01    7.01     .701
   77      .00   35.50   32.00   37.50    5.50     .550         78      .00   26.03   28.00   46.97   18.97    1.897
   79      .00   27.40   27.00   45.60   18.60    1.860
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TOTAL LENGTH OF PIPELINE

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( JIS G 5526 )

          DIA =  150      L =30433.00
          DIA =  200      L =  390.00
 *STOP*
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JICA