3-5 Facilities and Equipment

The facilities and equipment that will be provided under the Project for the conduct of the training programs and other activities will be as follows:

(1) Facilities

1) Buildings:

Main building, workshops, dormitories and related facilities, including building installations

2) Exterior facilities:

On-premise roads, parking area, outdoor water supply and drainage facilities, on-premise electrical facilities

3) Training plants

Indoor and outdoor training plants

(2) Equipment

1) Training equipment

General training equipment, laboratories-related equipment, equipment for practical training, vehicles, furniture for training use

2) General purpose equipment

Furniture for the dormitories, dining room, conference room

Under the above classification, "facilities" designate installed objects such as the grounds, buildings, and building installations, including installed training plant and laboratories table.

"Equipment" refers to movable machinery, tools, and furniture which can function independently, including materials such as pipes, reagents, and certain expendables.

3-5-1 Facilities

(1) The Buildings

1) Buildings for training:

a) Lecture rooms

Lectures, exercises, and training with audio-visual equipment are provided in the general training courses. The AV equipment used therein will be simple equipment, such as slide projectors, overhead projectors, and video tape recorders which can be used in general lecture rooms. Therefore, while the center will not be furnished with a special AV room, the air-conditioned lecture rooms will be equipped with this equipment.

b) Exercise room

Planning and design exercises and report-writing exercises related to the various training materials require considerably bigger desks than those for the lecture rooms. An exercise room is, therefore, needed for this purpose. This room requires air conditioning.

c) Computer training room

Computerization is quite developed in Indonesia in the water supply and environmental sanitation sectr. Personal computers are widely used for bill collection and other customer-oriented operations, administration planning, budgetary planning, and design of facilities.Accordingly, instruction in computer usage will be incorporated n both the general and advanced courses. A dedicated computer room will be required for this purpose.It is essential that the computer room be air-conditioned.

d) Analytical laboratories

Laboratories will mainly be used for water quality analysis. Two separate laboratories are required for the conduct of biological and physio-chemical analyses. A storage area for laboratory equipment and supplies as well as an instructors room should be located adjacent to the laboratories. Since training preparations can be done in the laboratory itself, no special preparation room is needed. The laboratories must be air-conditioned and equipped with laboratory tables and draft chambers.

e) Library

A library is needed for study and reference purposes by both students and instructors. This library should contain 5,000 books and must be air-conditioned.

f) Water treatment workshop

This facility will be used primarily for the advanced courses of the water supply division and will comprise a small-scale water treatment plant for training purposes.

Water treatment requires checks of changes in water quality at various stages of treatment and the proper establishment of water parameters for the treatment plant. In order to provide training for these activities, a corner will be reserved in this facility for water parameter examinations, to be attached to the water treatment plant. Space should also be provided for lecture and instructor rooms and a storage area for materials and supplies.

g) Workshop for electrical/mechanical equipment and pumps

This facility is to be utilized for training in the operation and maintenance of pumps and electrical/mechanical equipment. This workshop will comprise essentially a pump operation

training room and a work area for electrical mechanical equipment. The pump training room will be furnished with a training plant which will be used for training in methods of reading flow meters and water-level gauges, operating various types of pumps, and installing pumps. This plant will include a section which breaks out water hammers. The control panel of the plant and generator will be located in special rooms adjacent to the pump operating room.

The work area for electrical and mechanical equipment will be used for training in the basic principles of electrical and mechanical equipment in water supply facilities and skills for the maintenance of such equipment. The work area should be furnished with work tables and tool space.

h) Piping workshop

This will be used for practical training on piping and water meters. The training room will comprise a single large area containing areas for the jointing of distribution and service pipes and water meter testing. This workshop will also contain a storage area for materials and equipment that are used in the outdoor training facilities for leakage detection and pipe laying. In addition, a lecture room, faculty room and materials storage room will be provided adjacent to the training room.

i) Environmental sanitation workshop

This workshop will consist of such indoor facilities as an analysis room and an instructor room; the outdoor facilities will include sanitary land fill tanks, septic tanks, and a sampling yard for composition analysis of solid waste. The sampling yard requires a roof to keep out the rain, since the moisture content of solid waste changes when wet.. It would also be desirable to locate the main septic tank close to the environmental sanitation workshop in the interest of convenience in gathering specimens of night soil and excrement. The analysis room and instructors' room must be air-conditioned

to prevent unpleasant odors, since the windows will normally be closed.

2) Administration Building

a) Director's office:

The Director's office will be an independent room with a reception corner for guests. Out of consideration for Indonesian customs, independent offices will also be provided for the Deputy Director and the Public Relations Officer but, in the interest of working efficiency, simple partitioned areas in a corner of the General Affairs Section can also be considered.

b) Offices:

Offices are required to house the various administrative sections at the Center: viz., the Training Program, Instructional Affairs, General Affairs, and Maintenance and Logistics Sections. Whether these sections are to be housed in individual offices or grouped together in one large room will depend on the building design; the choice will have little impact on operating efficiency. A special area should be provided in the Training Program Section for use by full-time instructors and Section personnel in drafting training programs and developing instructional materials.

c) Instructors' room:

The staff instructors will all be assigned to the laboratories or workshops, so there is no need for a separate instructors' room within the administration area.

d) Seminar room:

In addition to its regular training programs, the Center will run seminars and conferences on water supply and environmental sanitation which will be attended by employees of water supply

enterprises and local government officers concerned with environmental sanitation services around the country. Seminar topics could include implementation methods and scheduling for training programs, techniques of conducting customers relations programs in these fields, and the like.

This seminar room will also be used for group discussions during the exercise phases of the general courses as well as for the opening and closing ceremonies for each course. For this purpose, a seminar room will be needed that is capable of being partitioned into several small rooms. A storage room will have to be added for tables and chairs, including folding chairs. Other equipment will include air-conditioning and loudspeakers.

The maximum capacity of this room is set at 80 persons, considering the requirements for opening ceremonies.

e) Instructors' room for part-time instructors:

Five (5) courses are scheduled per day, and each course is separated into 2-4 classes in the morning and afternoon respectively. Thus, on any given day, the number of instructors on the premises will total 10-20 persons. Eleven of these instructors will be full-time staff members, but it is unlikely that all will be engaged in training at the same time; thus, the capacity of the instructors' room can be set at 10-12 persons. This room should be air-conditioned.

f) Meeting room:

Frequent conferences can be anticipated at the Center for such purposes as curriculum revision and meetings on Center management. The capacity of this room should be set at about 15 persons, and air-conditioning will be required.

g) Printing room

A printing room will be required for preparing instructional materials; it will be equipped with an offset printing machine and cutters.

h) Rest area for support personnel:

Rest areas should be provided for individuals involved in cleaning, guard-duty, housekeeping, dining room and other support operations, including drivers.

i) Storage of sundries:

It will be necessary, in support of Center activities, to provide storage areas for supplies in the workshops, maintenance equipment for outdoor facilities, cleaning utensils, office supplies and other expendables.

3) Lodging Facilities

a) Dormitory for Trainees:

Since the Center will be operated exclusively on a full-boarding bases, a dormitory will be required to house all of the trainees studying at a given time.

The trainees will include persons from a wide range of social levels-- from plumbers to executives of water supply enterprises. Thus, it would not be appropriate, under Indonesian customs, to house director-level trainees with technicians in a multi-bed room. 2-bed rooms are, therefore, required for director-level trainees.

Also, as may be seen in many of the lodging facilities at training centers in Indonesia, it is necessary to provide a toilet with a bathing corner in each room. In addition to the beds, each occupant will require a lockable locker and desk.

b) Lodging for instructors:

The part-time teaching staff will include university professors and specialists from such outlying areas as Bandan, Surabaya, and Jog-Jakarta, and these instructors will require looking after during their stay at the Center. They are to be given single rooms with bath and toilet.

c) Dormitory master's room:

Staff members of the Instructional Affairs Section should serve alternately as housemasters to look after the needs of the students during their stay at the Center. Such individuals should be required to live on premises during this assignment. A one-bedroom apartment is, therefore, required as temporary living quarters for the designated individual and his spouse.

d) Canteen:

Since there are no restaurants in the Center vicinity, a canteen will have to serve trainees, instructors, and the Center staff.

e) Other rooms:

Additional rooms will be needed to store linens, cleaning equipment, and other necessities.

(2) Exterior Facilities

The buildings and other facilities are to be located on a relatively small plot (16,700 m^2), and they are to be organically linked to each other in their operations. In this connection, the outdoor areas between the buildings must also be used efficiently. The following outside facilities are planned:

1) Parking area for training vehiecles and private cars of staff, visitors, instructors

2) On-premise road for receipt and removal of goods to and from the various buildings

3) Outdoor facilities for water supply and drainage such as water-ways for rainwater, septic tanks, overhead water tank

4) Outdoor electrical facilities for power, telephone, and lighting

3-5-2 Training Plants

(1) Indoor Training Plants

1) Compact Water Treatment Plant for Training Purposes:

A compact-type water treatment plant will be installed at the Center to give trainees a practical understanding and experience with the structure, operation, and maintenance of water treatment facilities. Generally speaking, water treatment plants are not common in treating processes, such as chemical dosing, sedimentation, and filtration. The treatment systems for this plant should incorporate those in general use in Indonesia so as to provide diversified training in this area.

2) Training Plant for Pump Operations:

In order to provide training in the functions, structure, operation, and maintenance of pumps, which are a key facility in water transmission and distribution, a water circulation circuits plant will be required, equipped with pumps, pipes, and a pump well. Several types of pumps must be installed to familiarize trainees with differences in methods of start-up, flow measurement, and power sources.

Since water supply facilities incorporate various types of electrical and mechanical equipment, the pump training plant will also be used for electrical and mechanical training purposes.

3) Inspection Equipment for Water Meters:

This type of facility is required to acquaint trainees with devices, functions, structure and precision in water measurement and in inspection of water meters.

(2) Outdoor Training Facilities

1) Leakage Survey Training Yard:

In order to provide training in the techniques of detecting points of leakage in underground water distribution and service pipe networks, an underground piping network which can create leakage by the use of pressure water will be installed.

2) Pipelaying Training Yard:

This will be a training area to provide repetitive training in actual pipe laying and removal as a part of the piping training program.

3) Experimental Cells for Sanitary Landfill:

To give trainees a clear understanding of the methods and effectiveness of sanitary landfill for solid waste, experimental cells are required to permit the conduct of actual fill operations.

3-5-3 Equipment

(1) Training Equipment

The training equipment is comprised of the following, based on the intended use:

1) General training equipment
2) Equipment for developing course materials
3) Laboratory equipment
4) Equipment for the water treatment workshop
5) Equipment for the electrical, mechanical and pump workshop
6) Equipment for the piping workshop
7) Equipment for the environmental sanitation workshop
8) Vehicles for training use
9) Furniture for training use

Following is a brief description of the required equipment:

1) Equipment for General Training:

Audio-visual equipment (slide projectors, overhead projectors, VTRs), training panels, and personal computers for general training use.

2) Equipment for Teaching Materials Development

Printing machine, cutters, binders, photocopy machines, equipment to make slides and film for the overhead projectors, personal computers (including software)

3) Laboratory Equipment:

Measuring equipment--

spectrophotometer, thermometer, pH meter, conductivity meter, atomic absorption flame spectrophotometer, gas chromatography, microscope, balances

Experimental equipment--

low temperature incubator, drying oven, incubator, autoclave, centrifuge, absorbent filters, distiller

Expendables--

Glass and plastic utensils, chemicals

4) Equipment for the Water Treatment Workshop:

Jar testers, distiller, centrifuge, water sampler, chemicals

5) Equipment for the Electrical, Mechanical and Pump Workshop:

Electrical measuring instruments, mechanical measuring instruments, tools, pump for resolution and assembly training, cut models

6) Equipment for the Piping Workshop:

Various types of pipes, joints, piping tools, welders, compressor, mobile crane, leakage detecting equipment, water meter testing equipment, water meter, pipe locator, pressure gauge, portable flow meter

7) Environmental Sanitation Workshop

a) Analytical equipment for solid waste and night soil

Solid waste analysis:

platform scale, drying oven, calorimeter, component analyzer

Solid waste collection:

wheelbarrows, home composting apparatus

Water waste analysis:

pH meter, COD and BOD devices, DO meters, other expendables

b) Equipment for sanitary landfill :

belt conveyor, tampers, shovels, and other equipment used in garbage landfill

8) Vehicles for Training Use

Microbus and jeeps for field work, garbage collection vehicles

9) Furniture for training use

Desks and chairs for trainees and instructors in lecture and exercise rooms, work tables and stools for laboratories and workshops, shelves and cabinets, library furniture

(2) Equipment for General Use

1) For Conference Use:

overhead projectors, conference tables and chairs, folding chairs for seminars and ceremonies

2) For the Dormitories and Canteen:

beds, lockers, study desks, chairs, dining tables and chairs

3-6 Conditions at the Project Site

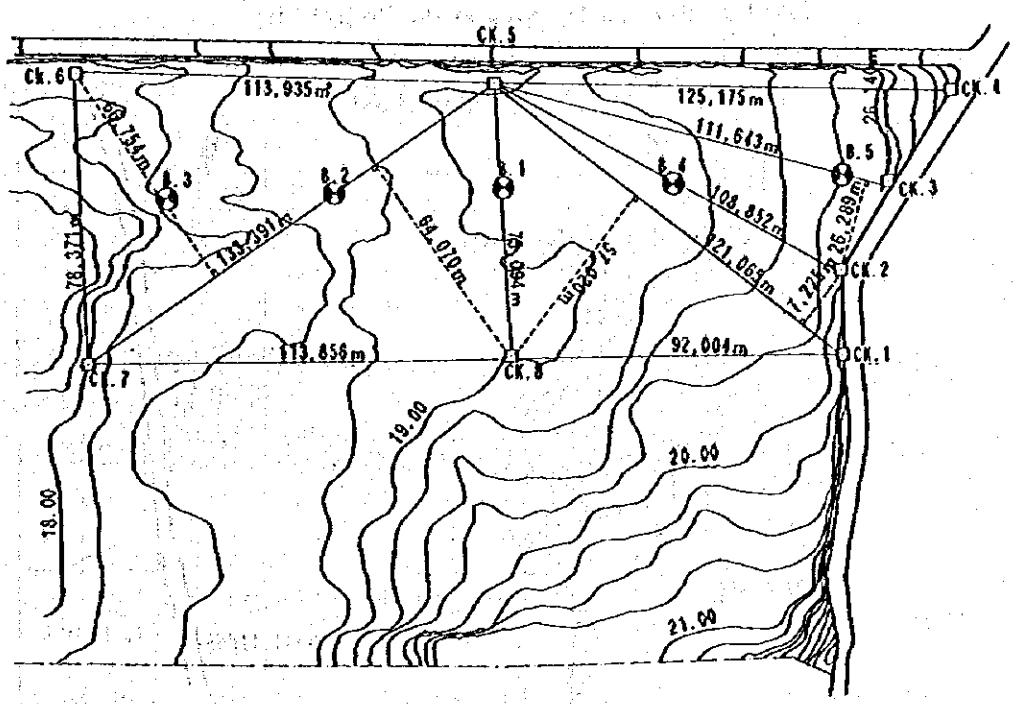
3-6-1 The Project Site and Surrounding Area

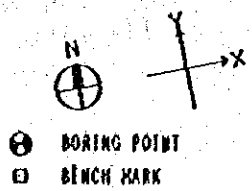
(1) Location and Present Condition

The planned construction site for the Center is located on the outskirts of the city of Bekasi, which is on Jakarta's eastern border about 30 km from the city center. The total site area is 1.67 hectares, and the land is owned by the Directorate General of Water Resource Development of the Department of Public Works.

The site configuration, as shown in Figure 3-6 following, is trapezoidal, running about 200 m in an east-west direction and about 75m from north to south. The land is 18-20m above sea level and slopes slightly to the west but is essentially flat. However, the roads in the surrounding area are 0.5-1.0m higher than the site. The site was formerly used as farmland but is presently grassland.

Fig. 3-6 Topographical Survey Drawing





No	X	Y	Z	No	X	Y	Z
Ck.1	-60.331	-66.135	+20.250	Ck.5	-123.207	+22.117	+19.175
Ck.2	-37.078	-44.446	+19.949	Ck.6	-235.356	+42.211	+18.046
Ck.3	-20.993	-22.789	+20.144	Ck.7	-243.922	-35.669	+17.887
Ck.4	00.000	00.000	+21.008	Ck.8	-131.322	-32.537	+19.227

(2) The Surrounding Area

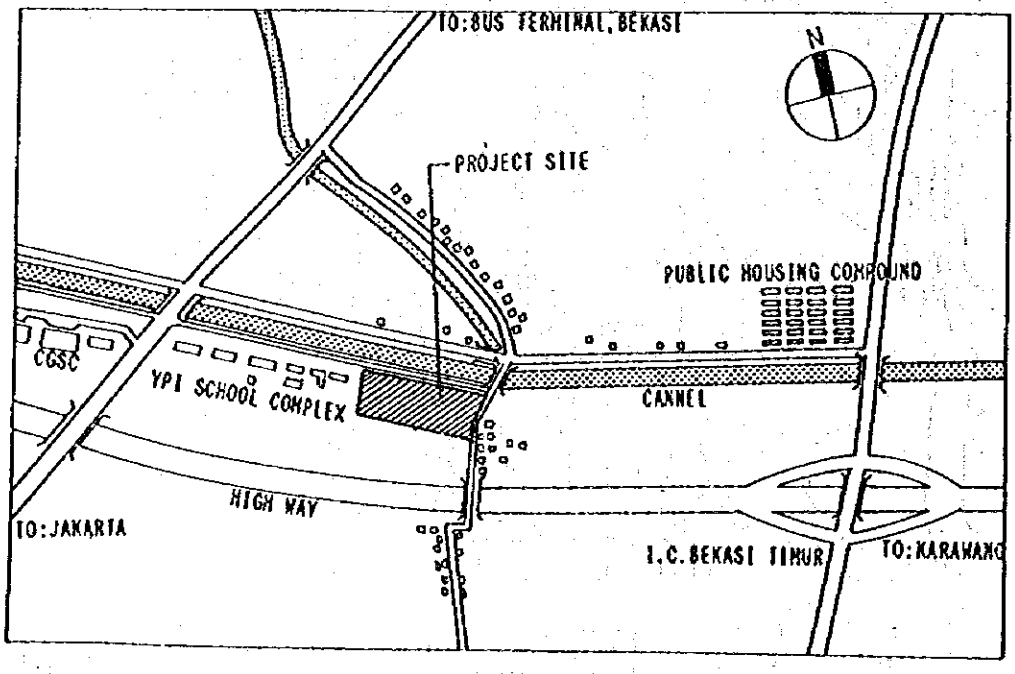
To the west of the Project site is land used by the Islamic Educational Foundation (Yoyasan Pedidikan Islam: YPI) for a primary school, orphanage, and university. The Foundation leases the land from the Department of Public Works.

The Project site was also formerly a part of the land to be used by the Foundation, and so the south side also borders on Foundation land. The south side of the YPI land is slightly depressed, lying along the expressway route which links Jakarta and Bekasi.

On the west side of the YPI, straddling a road, is the Construction Guidance Service Center (GSC), which was built in 1980 under a grant-aid from Japan. A 4.8 m road borders the north side of the site and paralleling this road is an irrigation canal from the Jatiluhur Dam.

On the eastern side,a private home stands along a 5 m wide road. (Cf. Figure 3-7 following)

Fig. 3-7 Surrounding Area at the Project Site



3-6-2 Natural Conditions

(1) Climate

Java Island is located in a tropical rain forest zone with high temperature and humidity. Annual climatic variations are small but the months of April-November comprise the dry season and December-March the rainy season.

According to climatic data for Halim in Jakarta, the mean temperature is about 27 centigrade throughout the year, with the relative humidity also quite stable, running about 75-80%. Rainfall is lowest in July and August; during the dry season, it averages about 50-60 mm/month but, in January, exceeds 400 mm. Total annual precipitation is about 2,000 mm. The area belongs to one of the world's few calm belts and, as a consequence, the winds are very gentle throughout the year. Wind direction at the site is from the southwest.

The following tables summarize climatic data at Halim, the closest weather observation station to the Project site.

Climatic Factors	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Mean Total
Temperature													
Max. Temperature of Month	32.5	33.1	33.7	33.7	33/9	33.8	33.6	33.9	34.6	34.9	34.2	33.8	-
Average of Daily Max. Temp.	30.2	30.8	31.6	32.6	32.7	32.5	32.4	32.7	32.8	33.0	32.5	31.5	32.1
Mean Temperature of Month	26.2	26.5	26.9	27.6	27.7	27.5	27.2	27.4	27.5	27.7	27.4	27.0	27.2
Average of Daily Min. Temp.	23.5	23.7	23.9	24.2	24.3	23.8	23.4	23.4	23.7	24.0	24.0	23.9	23.8
Min. Temperature of Month	22.3	22.4	22.6	23.1	23.0	22.3	22.1	22.2	22.3	22.7	22.8	22.5	-
Relative Humidty (%)	83	82	81	79	78	76	74	72	73	74	77	79	77.4
Rainfall (mm)	423.6	291.8	237.7	116.1	110.7	87.5	52.4	5.4	20.5	108.5	126.0	232.7	1922.9
Number of Rainfall(day)													
Over 30 mm	4.6	3.1	2.6	1.2	1.0	0.9	0.5	0.7	0.5	1.2	1.3	2.4	20.0
20 mm	2.4	1.9	1.4	0.9	0 8	0.9	0.2	0.3	0.4	0.9	0.4	1.1	11.8
10 mm	4.1	3.1	3.3	1.7	1.7	1.5	0.8	0.8	1.4	1.1	1.7	2.8	23.6
5 mm	4.0	3.1	2.7	2.0	1.9	0.8	1.4	1.0	1.2	1.7	2.2	2.6	24.6
0.1 mm	7.7	7.3	8.0	7.8	6.9	3.3	2.8	2.7	3.4	5.7	8.2	7.2	71.0
Total	22.9	18.5	18.1	13.6	12.3	7.1	5.8	5.6	6.9	10.7	13/9	16.1	151.5
Non-rain day	8.1	9.5	12.9	16.4	18.7	22.9	25.2	25.4	23.1	20.3	16.1	14.9	231.5
Wind													
Average Velocity (m / sec)	1.8	1.8	1.8	1.7	1.7	1.8	1.9	1.9	1.8	1.8	1.6	1.8	1.8
Max. Velocity of Month	10.5	12.0	12.5	11.5	12.5	12.0	12.5	10.0	12.5	12.5	13.0	14.0	-
Direction (0-North, 90-E.)	213	282	278	171	165	156	159	136	159	207	251	268	204

(2) Geology

The Directorate General of Human Settlements conducted a boring survey at the Project site, on the basis of which the site geology may be described as follows:

1) The surface soil is a brown silt clay, partly mixed with sand. The soil is generally similar down to 1.5-2m below the surface.

2) The lower layer is a grayish brown clay, mixed with sand and silt down to a depth of 5-6m. The layers progressively harden with depth.

3) At the lowest layer, there seems to be a sandy layer mixed with gravel and a silt layer containing sand.

The results of the Dutch Corn Penetration Tests conducted during the boring survey are shown in Table 3-17 following.

Table 3-18 N. Value of the Site

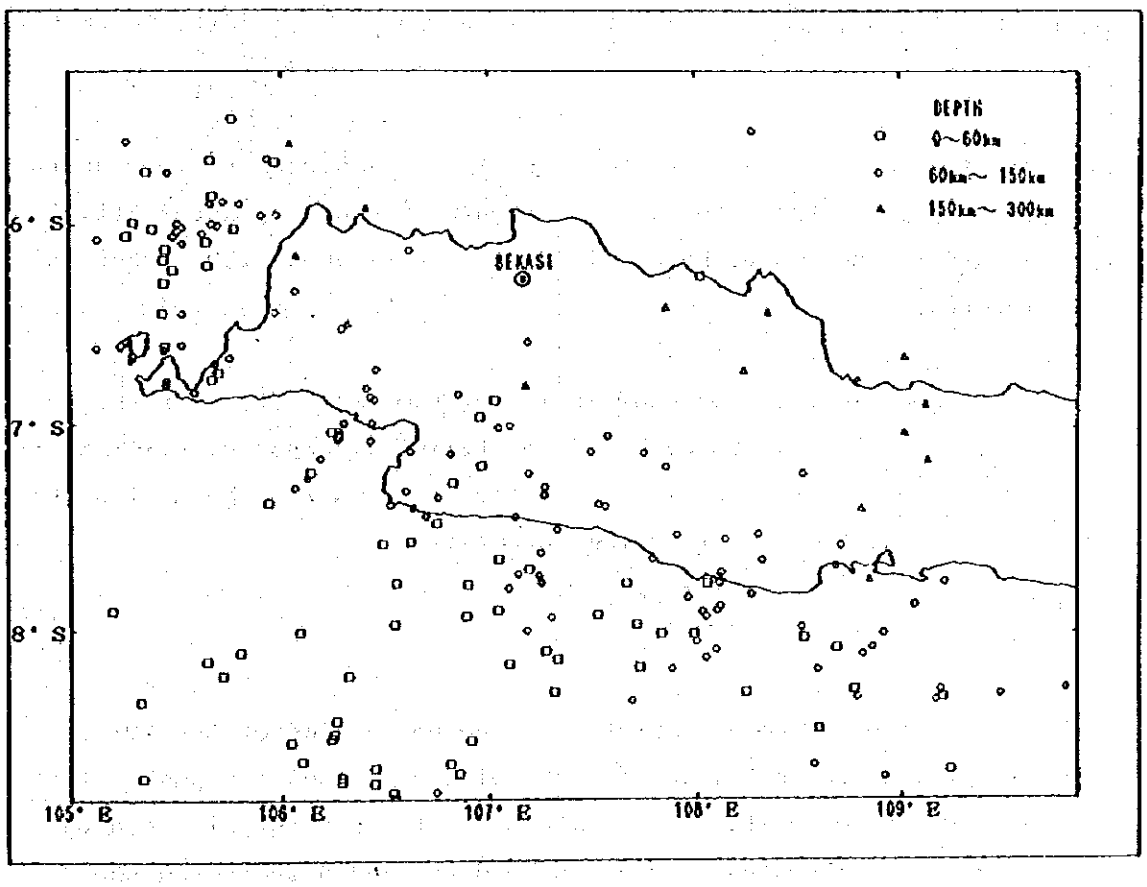
Depth	Boring Point				
	B-1	B-2	B-3	B-4	B-5
1.00- 1.45	4	12	8	8	9
2.00- 2.45	5	12	19	25	10
3.00- 3.45	9	10	17	7	10
4.00- 4.45	5	12	16	9	4
5.00- 5.45	12	8	16	15	5
6.00- 6.45	12	10	44	21	32
7.00- 7.45	28	26	Over 50	37	19
8.00- 8.45	Over 50	50	Over 50	Over 50	39
9.00- 9.45	-	-	41	42	44
10.00-10.45	Over 50	4	49	Over 50	33
11.00-11.45	-	42	47	Over 50	Over 50
12.00-12.45	Over 50	Over 50	48	Over 50	46
13.00-13.45	Over 50	41	Over 50	39	37
14.00-14.45	Over 50	45	Over 50	Over 50	43

(3) Natural Disasters

There have been virtually no natural disasters in the Jakarta area. This is because of its stable climate and generally good drainage (the land being flat, with a natural gradient of about 5/1000) and because, although the island of Java is in an earthquake zone, the epicenters are distributed to the south of the island. The only natural disaster that could be cited is lightning damage.

Characteristic of tropical areas, lightning strikes almost every day and so, unless lightning rod are installed, the area will inevitably suffer lightning damage.

Fig. 3-8 Epicenter Distribution



Indonesia lies astride the Trans-Asia earthquake belt, and epicenters are distributed over a wide area in the southern and western parts of Java Island. Based on 1976-1986 data, about 10-20 earthquakes occur per year with a ML of about 5.0. The biggest quake on record during this period had a ML of 6.1.

3-6-3 Infrastructure

(1) Water Supply

At the present time, the main water pipes in the Project site vicinity have no excess capacity. As shown in Chart 3-8 following, at a point some 2.5 km to the west, along the irrigation canal, is the water treatment plant of the Bekasi PDAM. A trunk distribution pipe (ϕ 6") has been laid from here, through the opposite shore of the CGSC to a public housing development, but there is no surplus capacity in that pipe.

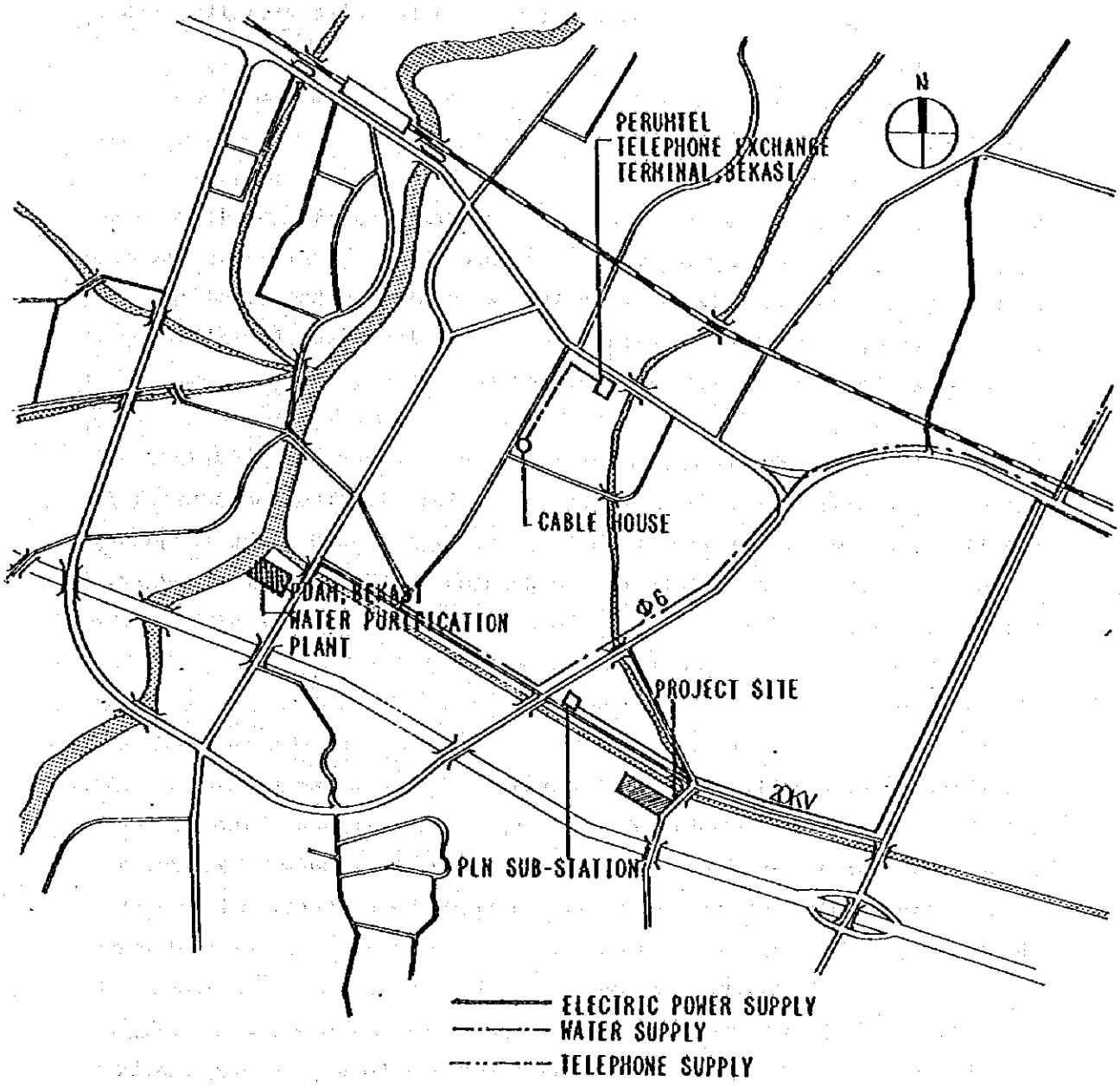
Accordingly, to bring water to the Center, it is necessary to construct a separate pipe to the site from the treatment plan or, alternatively, utilize underground water by digging a deep well about 120 m deep on the property.

The irrigation canal can be used as a source of raw water for the treatment plant that is to be build for training purposes. Prior to the construction of intake facilities, discussions must be held with the office of the West Taru Irrigation Authority.

(2) Drainage

A drainage ditch has been completed on the north side of the YPI property, which passes below the irrigation canal and extends as far as the river on the opposite bank. Drainage at the Project site can be accomplished by extending this drainage ditch and discharging the treated waste water and rainwater into it.

Fig. 3-9 Location of Infrastructural Facilities



(3) Gas Facilities

Since there are no municipal gas facilities in the site vicinity, LPG will be used.

(4) Power

Power is provided by the the Bekasi Regency Office of the National Corporation of Power Supply (PLN). Power supply to the Project site can be brought in from a 20 KV overhead line extending to the opposite bank. However, it will be necessary to secure land from the PLN sub-station at the site to receive power for the Center.

Based on the power requirements for the Center, power of 380V/220V 3-phase 4-line will be supplied by PLN. The power distribution network is excellent, but voltage varies with the daily load factor. The frequency of power failure in the area varies depending on the time of the year, but in peak seasons the average is once a week.

(5) Telephone

Telephone service is handled by the Bekasi branch of the Public Telephone Corporation(PERUMTEL). However, since telephone lines in the Project site area are already at full capacity, to receive service, a special line would have to be brought in from the connection house at the telephone exchange some 4 km away.

Not only would the construction cost for a special line be extremely high but one must also consider PERUMTEL's plans to expand service in the area. Thus, it is clear that there is little point now in bringing in a special line.

PERUMTEL plans to expand service in the Project site area during the Fifth 5-Year Plan, and so steps should be taken to bring this plan to fruition at the earliest possible time.

3-6-4 Appropriateness of the Project Site

(1) Size and Attributes

The Project site area was originally 1.2 hectares, but the depth was expanded by 15 m and private homes were relocated to create a total usable area of 1.67 ha. While the site may not be of an ideal size to accommodate the facilities discussed in the previous sections, it can absorb the required facilities without creating any functional problems. However, there can be little hope of generating space for future expansion or for the installation of additional facilities. So long, then, as there is no major future expansion of the Center, the proposed site presents no problems in terms of size.

Although the site is owned by the Department of Public Works, usage rights belong to the YPI, and so procedures have been initiated to transfer these rights. Since a certificate with respect to the acquisition of the land will be required in the application for a building permit for the facilities, the transfer of usage rights should be completed before the exchange of Official Documents. Assuming, however, that the current procedures are successfully completed, this legal problem would be eliminated.

(2) Site Configuration

The site area is lower than the surrounding roads, raising the danger of flooding, and so it was suggested that reclamation might be necessary. However, according to information obtained from people around the site , even if the site area were to be flooded by heavy rain, the water would disappear in just a few hours. This is because the site slopes downward (to the west) toward the YPI property, permitting the rainwater to be discharged into the river via the YPI drainage canal. As a result, if a rainwater drainage facility is built, there need be no concern over flooding. It is clear, therefore, that no large reclamation will be required.

(3) Infrastructure

There are a few problems with respect to telephone service and city water supply, but the water problem can be resolved by digging a deep well on the site, while the telephone requirements can be met for the time being via radio telephone communication with the Department of Public Works.

(4) Location

Although the Project site is 30 km from Jakarta, the one-way travel time from the city center is only 30 minutes via the expressway.

The site is located in a quiet environment, with only scattered homes in addition to the CGSC and YPI school. The expressway shoulders are quite wide and so, even if traffic were to increase in the future, no major noise problem is expected to develop

Based on the conclusions reached in (1) to (4) above, the Project site has been found to be appropriate as the location for the Water Supply and Environmental Sanitation Training Center.

3-7 Technical Cooperation

The Project is to construct facilities and procure equipment for the Water Supply and Environmental Sanitation Training Center under a grant-aid from Japan. However, after completion, consideration may be given to the possibility of extending technical cooperation for the Center's future operations. Such assistance is particularly needed in connection with the implementation of advanced courses. The objectives of technical cooperation program would be to develop training programs and instructional methods and materials and to train instructors of the Center. It would also aim at technical transfer to Indonesian counterparts through the dispatch of Japanese experts to Indonesia and of Indonesian trainees to Japan.

CHAPTER 4 BASIC DESIGN

CHAPTER 4 BASIC DESIGN

4-1 Basic Concept of the Design

The facilities and the equipment necessary for the activities of the Center have already been described in the previous chapter. This chapter will describe the basic concepts of design, so that the functions of these facilities and equipment can function to their objectives. The applied basic concepts are as follows:

1) Coordination with the purpose of use
2) Suitability to the natural conditions
3) Considerations with respect to operation and maintenance
4) Positive utilization of the national products of Indonesia
5) Considerations with respect to nearby residents

(1) Coordination with the Purpose of Use

Clear room layout plan and facility layout plan will be made taking the relationship between the purpose of use of each facility and the functional relationship among all facilities into due consideration. In addition, the numbers of equipment will be decided and the type of equipment will be selected in consideration of the ripple effect of the Project.

(2) Suitability to the Natural Conditions

The building will be designed so as to be suitable for the high temperatures, heavy rainfall and humidity characterizing the tropical climate of Indonesia. Ventilation, sunlight control and drainage system will carefully be designed.

(3) Considerations with respect to Operation and Maintenance Cost

After its opening, the Center will be managed with the budget of the Government of Indonesia. Facilities will therefore be designed with consideration so that the expenses required for the operation and

maintenance of the Center will not be excessive. This will be achieved by designing facilities so as to use maintenance free materials and construction methods as much as possible. This will also require designing facilities for which easy repair is possible using local materials and labor.

(4) Positive Utilization of the National Products of Indonesia

The Government of Indonesia is promoting the use of domestically produced products as part of a drive to activate the country's industries. Out of respect for the intentions of the government, and also to facilitate the procurement of materials for repair or remodeling, local products will be used for all cases except where some functional impediment is foreseen. In addition to this, the facility will be designed so that it can be constructed using construction methods generally practised in Indonesia.

(5) Considerations with respect to Nearby Residents

The Center is to be provided with a sanitary landfill plant for which odors may be generated. This plant is to be placed so that odors will produce the least discomfort to nearby residents. To achieve this, this plant shall be located in consideration of the winds prevailing at the site.

4-2 Facility plan

4-2-1 Facilities for the Project

(1) Facilities to be Constructed

The following facilities will be constructed under the Project:

1) Building Facilities

A main building, workshop buildings, dormitories and other ancillary buildings

2) Training Facilities

Indoor training plants, outdoor training plants

3) Exterior Facilities

On-premise roads, parking lots, outdoor water supply, drainage and electrical facilities

(2) Composition of Buildings

In consideration of the volumes and functions of each facility, under the conditions and restrictions of the site, such as the shape of the land and the access to the site, the most simple and easiest operation and maintenance of the Center will be realized by the following building composition.

1) Administration and Training Building (Main building)

This building is the central building of the Center, and comprises the rooms for administration, the lecture rooms, the exercise room, the computer training room, the library and resources room, etc.

2) Electrical, Mechanical, Pump / Water Treatment Workshop Building

This building comprise the electrical, mechanical and pump workshop, and the water treatment workshop. The pump operation training room, the practical training room for electrical and mechanical equipment, the water treatment plant room, the lecture room, the instructors' rooms, and so on, are included in the layout.

3) Piping/Environmental Sanitation Workshop Building

This building combines the piping workshop and the environmental sanitation workshop, and comprises the pipe processing and connection training room, the room for the analysis of solid waste and night soil, instructors rooms, and so on.

4) Dormitory (A)

Bedrooms for four persons, an interview room, linen rooms, etc.

5) Dormitory (B)

Twin-bed rooms, single-bed rooms (for part time instructors)

6) Canteen

Dining room, kitchen

7) Other Ancillary Buildings

Connecting corridor, storerooms, garages, building for dormitory master's room and changing rooms for drivers, security guards and sweepers.

4-2-2 Determining the Size of the Facilities

(1) Method for Determining the Size

The floor areas of the principal rooms are set by the following method.

1) With respect to the principal rooms of the Center such as the administrative offices, the lecture rooms, the instructors' rooms, the library and other general-purpose spaces, the floor areas are set on the basis of the results of a comparative study for the size of similar facilities, the standards indicated in the Building Design Data Book compiled by the Architectural Institute of Japan, and the Indonesian standards (as laid down in "Government Building Areas Standard 024/KPS/CK/1982, Directorate General of Human Settlements, Department of Public Works). Since there are no general floor area standards laid down for the exercise rooms, the workshop spaces, the laboratories, the respective floor areas are determined by setting required unit areas for each part of the

room from the size of activity space required by ergonomic theory, and summing up the unit areas. In this process, the method of use in each of the spaces, and the number of persons using them are taken into consideration.

2) To sum up the floor areas of the principal rooms obtained by the methods as described above

3) To calculate the floor area of common use by spaces such as the entrance hall and corridors, multiplying 2) above, and an area ratio for common space set for each. The ratios to be applied for each building are as follows.
   a) Administration and training building: approx. 35%
   b) Workshops: approx. 20%
   c) Dormitories: approx. 30%
   d) No consideration was made for other buildings

4) To totalize 2) and 3) above, this gives a total floor area of each building for design.

5) Based on the analysis above, to make the plan of building and adjust the areas in accordance with the conditions imposed by the span divisions, the room divisions, the activity flow and other architectural conditions.

6) To determine the total area for each building in accordance with the above procedures and consequently, the scale of the facility.

(2) Size of Facilities

The sizes determined by the above method for each the buildings, are listed below:

1) Administration and Training Building 1,940m^2
2) Electrical, Mechanical, Pump/Water Treatment Workshop Building 702m^2

3)	Piping/Environmental Sanitation Workshop Building	702m^2
4)	Dormitory (A)	903m^2
5)	Dormitory (B)	417m^2
6)	Dining Room Building	130m^2
7)	Other Ancillary Building	509.5m^2
	TOTAL FLOOR AREA	5,303.5m^2

4-2-3 Setting the Grade of the Facility

Since the Center is to be constructed under the Grant-aid Scheme of Japan, the following are considered in setting the grade of the facilities and equipment.

1) To select a structure and materials that are safe and tough, having a high degree of aseismicity, non-inflammability and durability.

2) To select methods of construction that are not difficult to apply in Indonesia in the light of the actual condition of construction.

3) To use domestic products wherever they pose no functional impediment, giving respect to the government policy.

4) To use materials and products that are not difficult to procure. In particular, building equipment is to be selected to facilitate the operation and maintenance of the facilities considering that the maintenance and management expenses will not become excessive.

4-2-4 Facility Layout Plan

The layout of the facilities of the Center takes the following points into consideration.

1) An axis to run east-west is introduced to the layout plan in order to layout the facilities along this axis to clarify the activity flows for each of the facilities.
Buffer zones are also planned along this axis so as to separate buildings with different functions, and at the same time to link them in an organic whole, so that the entire facility gives an appearance of unity.

2) Adequate space is placed between adjacent buildings so that natural ventilation is not obstructed.

3) The buildings are aligned east-west so as to reduce the thermal load generated by the sun on the walls.

4) The site is well exposed to winds coming from the south and west. On the east side of the site are houses and a housing area for employees of the Directorate General of Water Resources Development (under construction). The sanitary landfill plant shall be placed at a location where the odors will produce the least discomfort to the nearby residents.

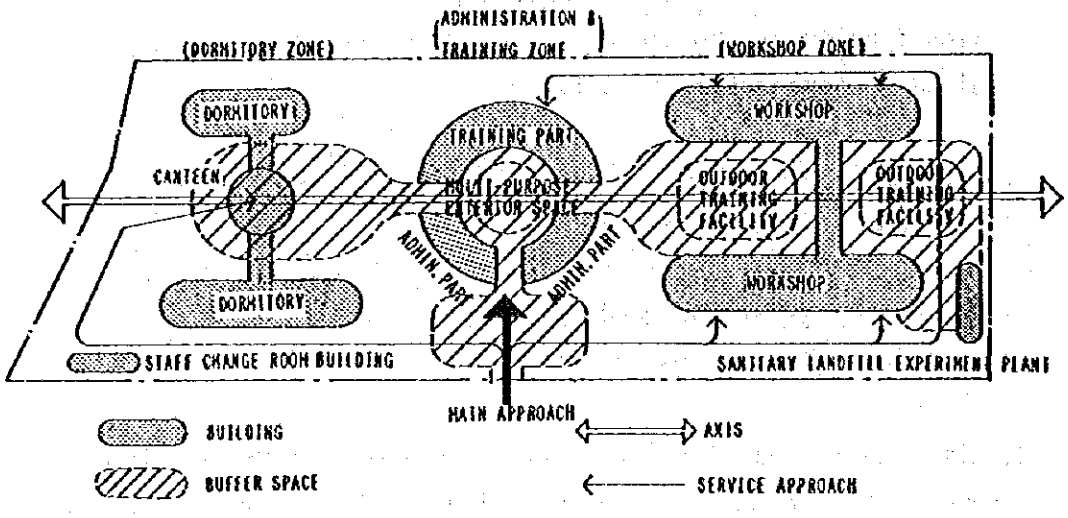
5) Each workshop, the laboratories, the canteen and the dormitories are to be located so as to permit easy goods access.

6) Green zones and multi-purpose outdoor spaces are also to be provided.

The premises of the Center comprise the administration and training zone, the workshop zone and the dormitory zone. These will be laid out along the east-west axis so as to efficiently utilize the long, east-west shape of the site. Buffer spaces are also placed along this axis and a couple of buildings or parts of buildings are laid out facing each other with a buffer space between. These buffer spaces therefore function as an internal court, and form a multi-purpose exterior space.
Placing the canteen and the outdoor training facility in the middle of the buffer space, will intensify the flow of activity between the

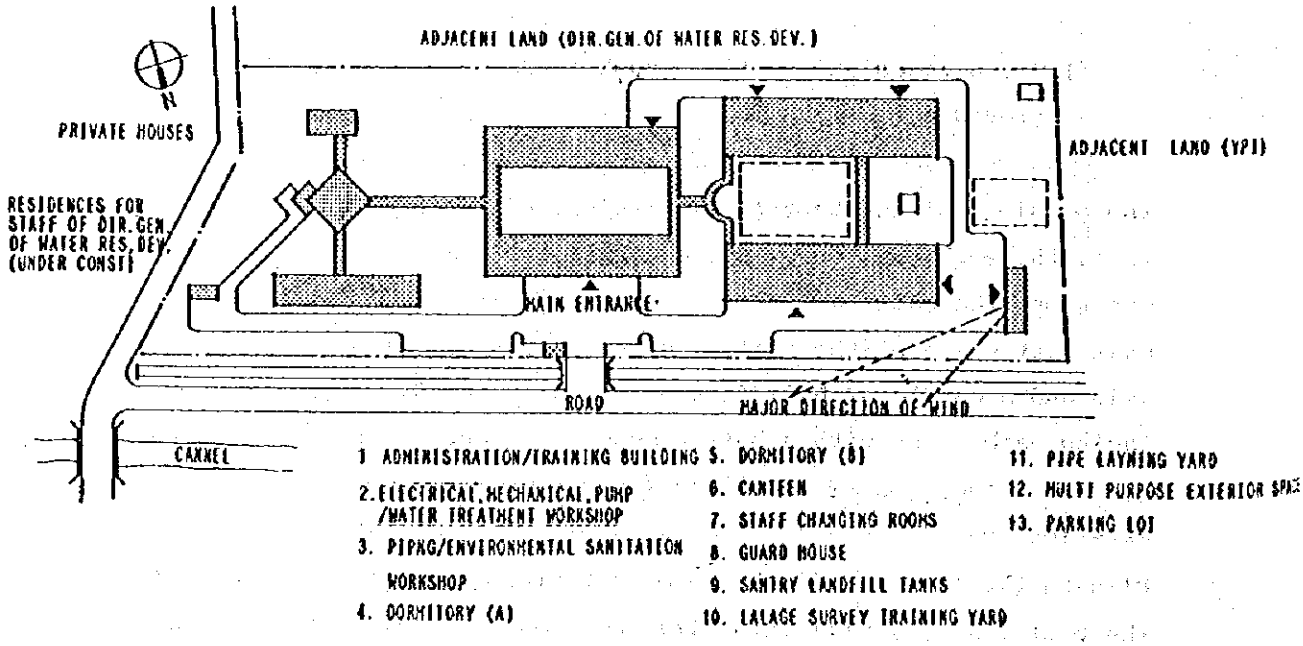
surrounding buildings. This will therefore link them organically in function and consequently produce an image of compound facilities.

Fig. 4-1 Layout Plan Basic Concept



Plotting each of the buildings on the basis of this concept gives the layout shown in Fig. 4-2.

Fig. 4-2 Site Layout Plan



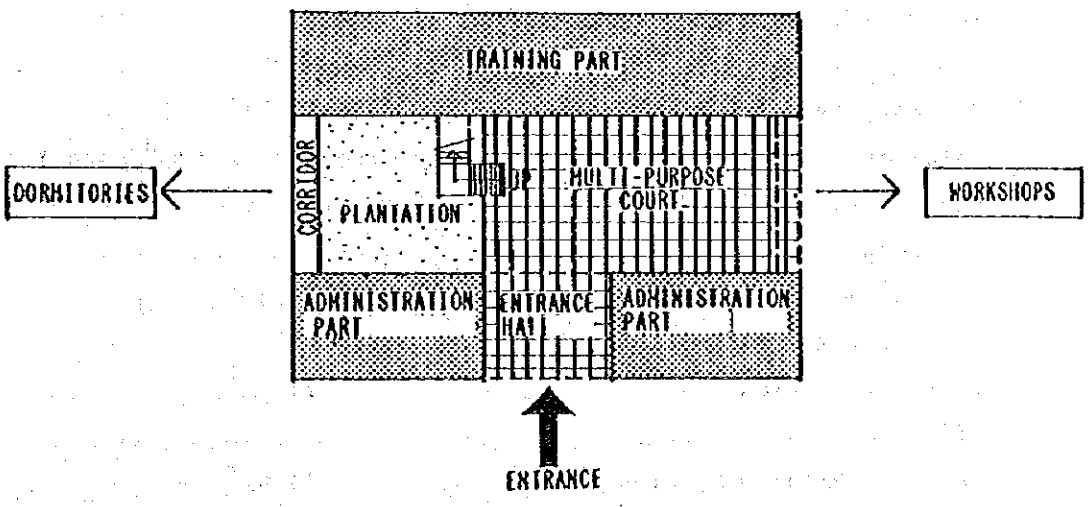
4-2-5 Building Plan

(1) Administration and Training Building (Main Building)

This building consists of two parts: an administration part made up of the director's room, the office rooms, the part-time instructors' rooms, and a training part made up of lecture rooms, the exercise room, the computer training room, the laboratories, the library, the seminar rooms and so on.

The building is to have two storeys, and the above two blocks for the administration section and training setion are connected by corridors. The central court formed by these ring corridors becomes a buffer zone positioned in the center of the facility axis, and will serve as traffic spaces, but also as a multi-purpose space for meeting, panel displays and soon.

Fig. 4-3 Zoning Concept for Administration / Training Building



The column layout is to be based on a 7m module considering on effective floor use and cost efficiency.

The major rooms comprising the Administration and Training Building are as described below:

1) Rooms for Administration

a) Director's room

This is the office for the director of the Center and includes a small reception space for guests. The floor area is 24.5m^2 being allotted a half unit space of 7m by 7m, as derived from the Indonesian standards and examples of similar facilities.

b) Office spaces

These spaces include the office rooms for the General Administration Section, the Instructional Affairs Section, the Training Program Section, the Maintenance and Logistics Section, and for document storage. The rooms for the General Administration Section include two deputy directors' rooms partitioned with light panels. The Training Program Section has an extra room for the preparation of training programs and materials.

The office spaces are as follows.

General Administration Section (10 persons x 4.95m^2/pers., 2 Deputy directors x 12m^2/pers.)	73.5m^2
Instructional Affairs Section (5 pers. x 4.9m^2/pers.)	24.5m^2
Maintenance and Logistics Section (5 pers. x 4.9m^2/pers.)	24.5m^2
Training Section (5 pers. x 4.9m^2/pers.)	24.5m^2
Training Program Section (5 pers. x 4.9m^2/pers.)	24.5m^2
Document storage	24.5m2
TOTAL	196.0m^2

c) Printing room

This room requires spaces for a set of printing equipment, a working table and a storage space for printer paper and printed materials. Its size is 31.5m^2.

d) Part-time instructors' rooms

On the assumption that there will be twelve part-time instructors at any given time, a total of 98m^2 is given to this room, allotting 8.2m^2 to each.

e) Meeting room

This will be frequently used for meetings concerning the operation of training and other overall management of the Center. A floor area of 24.5m^2 is to be provided to allow meetings of a maximum of 12 persons.

2) Rooms for Training

a) Lecture rooms (for 20 persons)

The lecture rooms and exercise room in the administration and training building will be used mainly by general course and the advanced courses in Water Quality. The maximum number of these courses to be held at the same time is three. Subjects that may require the exercise room account for less than one third of all of the subjects and so one is sufficient. Therefore, two lecture rooms are necessary if the exercise room can also be used for lectures. Performing lectures in the exercise room requires to be furnished with equipment necessary for lectures such as audio-visual equipment.

b) Exercise rooms

One exercise room is provided, as described above.
The exercise room is to be used for planning and design, report making and other training using charts and reference materials. For this purpose, 20 desks measuring 90cm x 60cm are provided. Its area is 73.5m^2, allotting one and a half unit space of 7m by 7m.

c) Computer training room (20 persons)

Each trainee is allotted 2.45m^2 according to the standard derived from layout of necessary computer set. This gives a

total of 49m^2. Computer consumables, training software and other items will be stored in the preparation room used jointly with the exercise room.

d) Preparation rooms

Two preparation rooms are provided for joint use of two lecture rooms, and the exercise room and the computer training room. They will be used for the storage of audio-visual equipment and materials for these rooms

e) Laboratories

The laboratories consist of a physio-chemical analysis laboratory, a biological analysis laboratory, a instructors' room and an the experimental equipment storeroom located between the two analysis rooms. The physio-chemical analysis laboratory is equipped with a gas chromatograph, an atomic absorption flame spectrometer and precision scales and other precision measuring equipment. The space where these instruments are kept will be partitioned so that dust and gas generated from the testing room does not interfere with their operation.

The major experimental facilities for the biological analysis laboratory includes experiment benches for 10 trainees, two sinks, while the physio-chemical analysis laboratory has benches (with sinks) for 10 trainees, two sinks, and two draft chambers.

The floor areas of the analysis laboratories are as follows.

Chemical analysis laboratory	134.3m^2
Biological analysis laboratory	84.0m^2
Experimental equipment storeroom	24.2m^2
Instructor's room	20.0m2
TOTAL	262.5m^2

f) Library

The library will be of an open stack system, and contain 5,000 books. Reading space for 12 persons is to be provided. The floor area of the library is to be as follows.

Storage space	$20m^2$	(200 books/m)
Reading space	$18m^2$	($1.5m^2$/person)
Reception, corridors	$11m^2$	
TOTAL	$49m^2$	

g) Seminar room

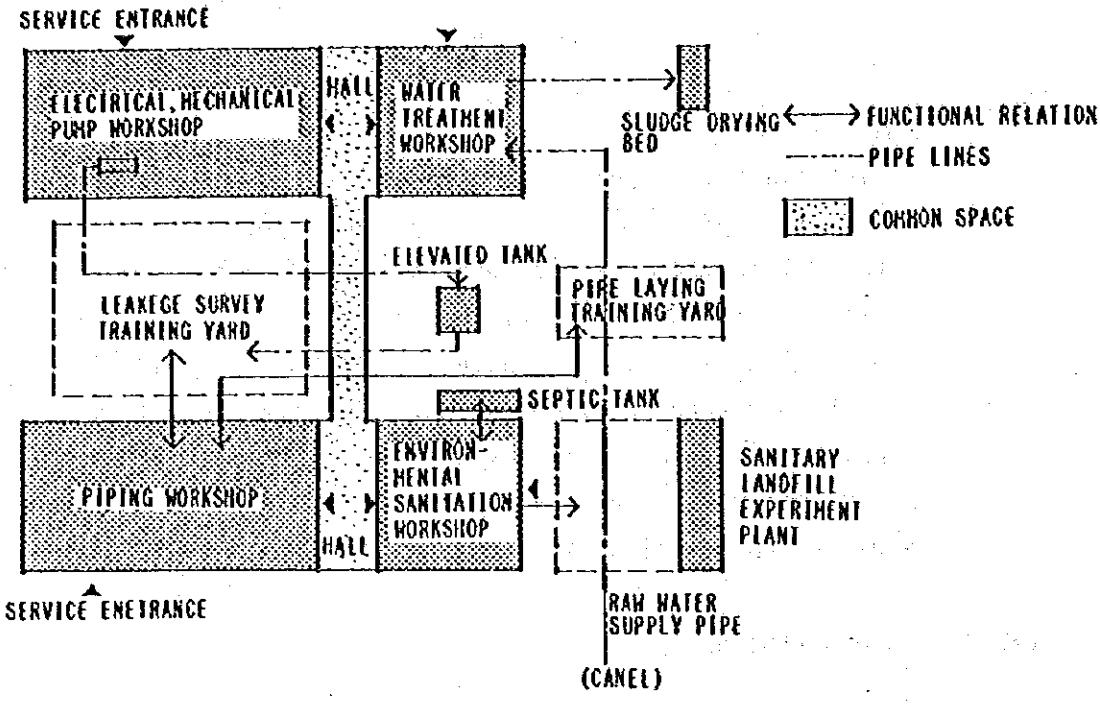
This space is to be for an audience of 80 persons, with an unit area of $1.2m^2$ per person giving a total of $98m^2$. It will be used for seminars, lectures and the opening and closing ceremonies, etc., but is to be divided by movable partitions into three spaces so that it can be used for small seminars and group debates performed as part of practical exercises in the general course. It is to be provided with an adjacent storeroom to house the desks and chairs that will be used for the respective purposes.

(2) Workshop Buildings

The workshops will comprise the four sections of the electrical, mechanical and pump facility workshop, the water treatment workshop, the piping workshop and the environmental sanitation workshop. The former two are combined into one building: namely, the electrical, mechanical and pump/water treatment workshop building, and the latter two are also combined into another building called the piping/environmental sanitation workshop building. These two workshop buildings are single-storey buildings laid out parallel to each other and connected by a corridor. A joint hall is provided between the two workshops of a building. This hall will be used as an access space to each of the workshops.

One lecture room is provided to each building to be used jointly by two workshops, An instructor's room is provided in each section since instructors will be assigned to be responsible for the operation of the respective workshops.

Fig. 4-4 Workshop Layout



The following are the major spaces comprising the respective workshop buildings.

1) Electrical, Mechanical, Pump/Water Treatment Workshop Building

a) Pump operation exercise room

This is equipped with one set of pump operation training plant, with a pump well underground. The pump control room is placed adjacent to the pump operation exercise room, with its floor level raised by 50-60cm. The room is separated by a glass window so that the status of operation of the pumps can be observed during the training for pump control. In addition, a generator is located in a generator room adjacent to the pump control room. The generator room will be soundproof.

b) Electrical and mechanical facilities operation training room
This will have two work tables for 6 persons, storage space for teaching materials and tools, as well as storage space for cut-models of pumps and valves, etc.

c) Water treatment training room
This will have the space for a small-sized water treatment plant for training purpose, as well as a space for testing water purification parameters, in which two experiment benches for six persons each, one table for analyzers, and two sinks are to be installed.

d) Instructor's rooms
One room for the instructors of pump operation, electrical and mechanical trainings, and one room for water treatment training instructors are provided. These two rooms are each for four persons. Each person will be allotted $5m^2$ to give a total of $20m^2$.

e) Lecture room
One room will be provided for 10 persons. The floor area is $25m^2$ ($2.5m^2$ per person).

2) Piping and Environmental Sanitation Workshop Building

a) Pipe processing and connection training room
This is a large room with spaces for various trainings such as supply pipe connection, distribution pipe arrangement and water meter testing. The water pipes to be used for training have lengths of 4m and 5m. A space is required to be sufficiently wide and high so that the processing and connection work will not be obstructed.

b) Analysis room for solid waste and night soil
This is provided with experiment benches for ten trainees, and one sink as the experimental facilities.

c) Working pilotis

This is to be used as a part of the workshop building covered with a roof, but open to the air as it is without walls. It is to be used for preparing test samples for solid waste component analysis.

d) Instructors' rooms

Two rooms are provided for the pipe laying instructors and the environmental sanitation instructors. Each of these rooms will be for four persons, and have $5m^2$ per person to give a total of $20m^2$.

(3) Dormitories

The dormitory facilities are to be divided into two buildings, with the dormitory (A) being for general trainees, and dormitory (B) being for directors. Both of these buildings are three storeys. Each of the rooms has a toilet with bathing corner. The dormitory (A) includes largely four-person rooms, with a meeting hall and linen storage rooms. The dormitory (B) consists of two bed rooms and single bed rooms for part-time instructors. Adoption of the stairwell type floor plan which is to lay out rooms on both sides of a stairwell, ensures cross-ventilation to all rooms and at the same time, reduce the floor area required for corridors.

The maximum number of trainees who will be present at this Center at any one time is 80. The configuration of the dormitories is therefore as indicated below.

For trainees:

Dormitory (A) 4-person rooms x 15		for 60 persons
Dormitory (B) 10 x 2-person rooms		for 20 persons
	TOTAL	for 80 persons

For instructors:

2 x 1-person rooms = 2 persons

The areas for each of the rooms are as follows.

4-person rooms	38.25m^2	(9.60m^2/person)
2-person rooms	24.50m^2	(12.25m^2/person)
1-person rooms	15.75m^2	

(4) Canteen

The space for dining is decided so as to provide lunch for a total of 130 persons by the two shift system, and so for 65 persons. On the basis of examples of similar facilities, the area of the dining room will be 1.5m^2 per person, and that for the kitchen will be 0.5m^2 per person, to give a total of 130m^2. This will be a single-storey building and other than the kitchen, will be an open structure consisting of only a roof and columns. The kitchen will be provided with a sink, stove and cooking tables.

(5) Other Ancillary Buildings

The Center also contains the following buildings.

1) Staff Changeroom Building

This building will comprise a dormitory master's room; change rooms for the use of the drivers, cleaners, cooking staff, housekeepers, gardeners and other staff; male and female toilets; and a storeroom for cleaning tools. The total floor area of this building is 99m^2.

2) Security Guard House

This will have the security office as well as a rest place and a changeroom for eight persons. The floor area is 15m^2.

3) Sanitary Landfill Equipment Store

This is for storing the equipment used for training on sanitary landfill of solid waste and will be located adjacent to the

sanitary landfill plant. Belt conveyors, hand carts and other relatively large equipment will be stored in a floor, area of 5m x 4m = 20m^2.

4) Connecting Passage

A passage sheltered against sun and rain will be provided between buildings. The structure will consist of only columns and a roof, and will have a width of 2.0m.

5) Garages

To house training vehicles, covered spaces of 475m^2 are required. The structure will be of steel structure and doors should be lockable.

4-2-6 Structural Design

The main structures of all proposed buildings except the garages are of reinforced concrete, while all the roof structures are of steel. The structures of wall are also of reinforced concrete for exterior walls and some seismic walls, while interior partition walls are of brick or wooden frame as generally used in Indonesia.

The project site is located on an alluvial deposit of which N-values of layers near the surface range from 4 to 8. Because of this, the applicable bearing capacity of soil is anticipated to be 5 ton/m^2 if due consideration is given to avoiding differential settlements caused by consolidation. Accordingly, pile foundation should be applied to the dormitories (3 storeys), the main building (2 storeys) and workship buildings (1 storey), due to comparative heavy load. A bearing subsoil is found at GL-10m with N-values of 40-50. The canteen and the ancillary other buildings have relatively small loads and so the upper structures will be directly supported by spread foundation.

The structural calculations will be based on the Indonesian standards of the PBI (reinforced concrete structure design guidelines), the PPI (load regulations for structural design) and the PTI (regulations for aseismic design) but Japanese regulations will also be incorporated as required. The roof structure will be designed based on Japanese regulations, since there are no relevant Indonesian standards.
The structural materials will be those that are available in Indonesia. The concrete is to be K225 (Fc = 210kg/cm^2 approx.) and the steel reinforcing will be U39 (SD30-SD35) or similar.
The major structural methods to be applied for the Center are as shown in the table below.

Building name	Number of storeys	Foundation	Main structure to beams of highest floor	Roof structure
Administration and Training Building	2	Piles	Reinforced concrete	Steel frame
Electrical, Mechanical, Pump/Water Treatment Building	1	Direct	Reinforced concrete	Steel frame
Piping/Environmental Sanitation Workshop	1	Direct	Reinforced concrete	Steel frame
Dormitory (A)	3	Piles	Reinforced concrete	Steel frame
Dormitory (B)	3	Piles	Reinforced concrete	Steel frame
Dining Room Building	1	Direct	Reinforced concrete	Steel frame
Vehicle garage	1	Direct	Steel	Steel frame
Elevated water tank	-	Piles	Reinforced concrete	Steel frame

Table 4-1 Floor Areas of Rooms by Building

A. Administration and Training Building

Area = m^2

Number	Name of space	Number of rooms	Unit Area	Room area	Notes
1	Director's room	1		24.5	
2	Offices				
	a. General Administration Section	1	49.0 + 24.5	73.5	10 persons, two vice-directors' rooms
	b. Instructional Affairs Section	1		24.5	5 persons, (4.9 m^2/person)
	c. Maintenance & Logistics Section	1		24.5	5 persons, (4.9 m^2/person)
	d. Training Program Section	1		49.0	5 persons, included in work corner
3	Seminar room	1		98.0	80 persons, (1.2 m^2/person)
4	Printing room	1		31.5	
5	Meeting room	1		24.5	14 persons, (1.8 m^2/person)
6	Lecture room	2	49.0	98.0	20 persons, (2.5 m^2/person)
7	Exercise room	1		73.5	20 persons, (3.6 m^2/person)
8	Computer training room	1		49.0	20 persons, (2.5 m^2/person)
9	Preparation room	2	24.5	49.0	
10	Analysis and testing rooms				
	a. Chemical analysis & testing room	1		134.3	
	b. Biological analysis & testing room	1		84.0	
	c. Equipment and materials storeroom	1		24.2	With 3.2 m^2 cool room
	d. Instructors' rooms	1		20.0	

Number	Name of space	Number of rooms	Unit Area	Room area	Notes
11	Library	1		49.0	12 persons, 5,000 volumes
12	Part-time instructor's room	1		98.0	12 persons, (8.2 m^2/person)
13	Furniture storeroom for seminar room	1		24.5	
14	Instructors' washroom	1		24.5	Including kitchenet
15	Trainees' washroom	1		73.5	
	Subtotal			1,176.0	
16	Corridors, stairs, halls, etc.			674.0	34.7% of overall area
17	Canopy			56.0	
18	External stairs			34.0	
	TOTAL			1,940.0	

B. Electrical, Mechanical, Pump/Water Treatment Building

Number	Name of space	Number of rooms	Unit Area (m^2)	Room area (m^2)	Notes
1	Pump operator training room	1		156.0	
2	Pump control room	1		20.0	
3	Generator room	1		20.0	
4	Elec/Mechanical equipment training room	1		60.0	
5	Water treatment plant training room	1		170.0	
6	Lecture room	1		30.0	10 persons, (2.5 m^2/person)
7	Instructors' rooms	7	20.0	40.0	4 persons, (5 m^2/person)

Number	Name of space	Number of rooms	Unit Area (m^2)	Room area (m^2)	Notes
8	Storeroom	2	20.0 + 10.0 + 5.0	35.0	For materials, miscellaneous goods
9	Washroom	1		20.0	
	Subtotal			546.0	
10	Corridors, halls, etc.			156.0	22.2% of total area
	TOTAL			702.0	

C. Piping/Environmental Sanitation Workshop

Number	Name of space	Number of rooms	Unit Area (m^2)	Room area (m^2)	Notes
1	Pipe processing and connection training room	1		312.0	
2	Analytical training room	1		96.0	
3	Working pilotis	1		78.0	
4	Lecture room	1		25.0	10 persons, (2.5 m^2/person)
5	Instructor's room	2	20.0	40.0	4 persons, (5 m^2/person)
6	Storeroom	2	10.0 + 10.0 + 5.0	25.0	For material
7	Washroom	1		30.0	
	Subtotal			606.0	
8	Corridors, halls, etc.			96.0	13.7% of total area
	TOTAL			702.0	

D. Dormitory (A)

Number	Name of space	Number of rooms	Unit Area	Room area	Notes
1	4-person rooms	15	38.3	547.5	Including toilets
2	Meeting hall	1		54.0	
3	Toilet	1		5.0	
4	Electric Room	1		5.5	
5	Linen storeroom	2	8.0	16.0	
	Subtotal			655.0	
6	Corridors, Staris			248.0	
	Total			903.0	

E. Dormitory (B)

Number	Name of space	Number of rooms	Unit Area	Room area	Notes
1	2-person rooms	10	24.5	245.0	Including toilets
2	1-person room	2	15.75	31.5	
	Subtotal			276.5	
3	Corridors, Stairs			140.5	
	Total			417.0	

F. Canteen 1 130.0

G. Other ancillary buildings

Number	Name of space	Number of rooms	Unit Area (m^2)	Room area (m^2)	Notes
1	Staff changing room building				
	a. Dormitory Moster's room	1		38.0	1-LDK Type
	b. Storage	1		16.0	
	c. Changing room	1	15.0	45.0	Include $15m^2$ of toilet
2.	Security guard house	1		15.0	
3.	Sanitary landfill equipment store	1		20.0	
4.	Connecting passage	-		300.0	Width 2.0m
5.	Garage	2		75.5	
	Total			509.5	
GRAND TOTAL (A+B+C+D+E+F+G)				$5,303.5m^2$	

4-2-7 Building Installations Design

(1) Air Conditioning and Ventilation

The plan for the entire Center utilizes natural ventila- tion to the greatest extent possible and in addition to the installation of ceiling fans for some rooms, air con- ditioning will be installed only for those rooms where it is essential.

1) Air Conditioning

Independent type air conditioning units will be installed only for those spaces where air conditioning is indispensable considering the purpose of the use. The temperature and humidity conditions to be applied for determining the capacities of air conditioners are as follows.

Outdoor: temp. 35°C hum. 70%
Indoor: temp. 27±2°C hum. 50±10%

Air conditioning is necessary for the following spaces.
Administration and training building:
Director's room, part-time instructor's room, seminar room, lecture rooms, exercise room, computer training room, library, physio-chemical and biological analysis laboratories
Environmental sanitation workshop
Analysis laboratory, instructors' rooms

The air conditioning system is to be made up of independent units that can be operated for each room. The units are to be ceiling-suspended so that the positioning does not conflict with the layout of furniture, test benches and sinks, etc.

2) Ventilation

Ventilation facilities which exhaust odors, moisture and combustible gases and other vapors are to be installed in the analysis laboratories, toilets, boiler room, storerooms and the printing room.
In addition, ventilation fans will be provided for forced ventilation in the electrical room, the generator room and the power distribution board room to prevent the possible electrical deterioration of equipment that may occur due to the natural temperature rise if there is only natural ventilation.
The chemical testing and analysis room is to be provided with a draft chamber.

3) Ceiling Fan

The following continuously used rooms are to be provided with ceiling fans to create a comfortable environment by producing a forced flow of air.
Administration and training building building:
Vice-directors' offices, media room, offices

Workshop building:

Exercise rooms, instructors' rooms

Dormitories:

Bed rooms

(2) Water Supply and Drainage Facilities

1) Water Supply Facilities

Pipeline work to intake water to the Center from the adjacent water treatment plant would require more expensive construction cost than digging well in the site. Water supply will therefore rely on ground water. The groundwater lifted from the wells will be conducted into a receiving tank through a sedimentation tank. It will then be pumped to an elevated tank and supplied by gravity to the place of use. The capacity of the water supply facilities is designed according to the following conditions:

Number of persons to be supplied: 150

Supply volume: $15m^3$/day (100 littre/person/day)

Capacity of receiving tank: $20m^3$ (including sedimentation tank)

Capacity of elevated tank: $4m^3$

2) Drainage Facilities

There will be four types of drainage which the Center discharges; sewage, miscellaneous wastewater, water discharged from the analysis laboratories, and rainwater.

a) Sewage and miscellaneous wastewater

These will be treated in a merged type septic tank and discharge into drains.

b) Laboratory wastewater

Since the wastewater from the sinks and test benches of laboratories may contain acids and alkalis, pH treatment is required in neutralization tank before it is discharged. In

addition, wastewater that is thought to contain heavy metals is to be treated by a heavy-metal processing device before being discharged.

c) Rainwater

The rainwater and the other treated wastewater will be combined before being discharged into open drain.

3) Sanitary Fixture

The required sanitary fixture will be provided in the toilets, washrooms, analysis rooms and practical training and other rooms. The closets will be of a type that is in general use in Indonesia, while some will be Western-style. The fittings used in conjunction with sanitary fixture will be an exposed type that is easy to maintain and repair.

4) Soil Water Treatment Facilities (Septic Tanks)

The soil water treatment facilities of the Center will also be used for the training provided in the environmental sanitation courses. Trainee will understand the functions and structure of treatment facilities through observing various treatment systems and conditions of treatment process and analizing different samples. For this purpose, soil water generated in the center will be treated by the following three type of treatment facilities

Simplex septic tank: 10 person capacity
(Ready made Indonesian product)
Merged type septic tank: 10 person capacity
(FRP, BOD 20 ppm, imported)
Merged type treatment plant: 150 person capacity
(In-situ concrete structure, BOD 20 ppm, open type)

5) Gas Facilities

Propane gas will be used as the fuel for the kitchen and kitchnette. Cylinders will be placed outside and piping led to where the gas is to be used.

6) Experimental Gas Supply Facilities

The special gases to be used in testing (LPG gas, hydrogen, oxygen, nitrogen, etc.) will have cylinders placed outdoors and piping led to where the gas is to be used.

7) Fire Extinguish Facilities

Indoor fire hydrants and fire extinguishers will be provided in accordance with the installation standards of Indonesia.

(3) Electrical Facilities

1) Power Receiving System

Low-voltage 3-phase 4W 380V/220V 50Hz power will be supplied at the substation of the National Corporation of Electricity (PLN) which is to be located in the site. The receiving capacity is estimated to be 230KVA.

2) Trunk Line

The lines from the PLN substation to the power distribution room, and the lines from the power distribution room to the power distribution boards of each building will be wired below the roof of connecting passages and buildings, and above ceilings. The power distribution is to be of 3-phase 4W (380V/220V) power.

3) Power Distribution

Wiring in conduit tube will be provided to supply power to the pumps and the various types of training equipment. The voltage is 380V/220V (3-phase 4W). Low-voltage condensers will be incorporated to improve the power factor for equipment where this is necessary.

4) Lights and Receptacles

The lighting fixtures are mainly of flourescent lamp, but those of incandescent lamp and mercury vapor lamp are also to be used where necessary. The average illumination to the major spaces is as follows.

a) Offices, conference rooms, seminar rooms :	200 - 300 lx
b) Exercise rooms, laboratories:	300 - 400 lx
c) Corridors, stairs, toilets:	50 - 100 lx
d) Storerooms:	30 - 100 lx

Receptacles will be earthed according to necessity.

5) Telephone Facilities

The Center needs at least two or three lines which will be provide the exchange station of the Bekasi Telephone Office. These lines will be led to the telephone exchange installed in the administration and training building. There will be approximately 35 extension lines within the compound, which will also be used for intercom system among the facilities of the Center.

6) Public Address System

A public address system which consists of a microphone and an amplifier located in the administration at training building, and speakers installed in the main rooms and corridors will be

provided for general information and paging. The seminar room will be furnished with an exclusive system specified for seminar purpose.

7) TV-receiving System

TV antennas will be installed on the roof of the administration and training building, and the dormitory, and outlet terminals will be provided in the main rooms of each building.

8) Fire Alarm

A main receiver of 30 line capacity will be provided in the administration and training building and a sub-receiver in the dormitory master's room. Detectors will be placed in the rooms of each building as necessary. Fire detection will be performed for the entire building.

9) Emergency Power Supply System

A diesel generator of 50KVA is to be installed in the electrical mechanical equipment and pump operation workshop for practical training of operation. During power failures, this generator will be used to supply power to the water supply pump, and the fire hydrants, thereby ensuring the safety of the entire Center.

4-2-8 Indoor Training Plant

(1) Compact Water Treatment Plant for Training Use

At the Center, a compact water treatment plant will be installed for the purpose of instructing trainees knowledge concerning the theory of water treatment, and structure and functions of water treatment facilities, as well as techniques of facilities operation and treatment control.

Currently, the most popular water treatment method in Indonesia, is the rapid sand filtration system. This system consists of the five processes of coagulation, flocculation, sedimentation, rapid sand filtration and sterilization, aiming to exclude colloidal solids and render the water harmless.

Coagulation is the process whereby flocs are formed in a rapid flocculation basin by feeding inorganic metallic salts (coagulants) such as an aluminum sulfate that collect the colloidal solids in the raw water. The reaction usually ends in several minutes. After this occurs, the water led to the flocculation process is slowly mixed for about 20 - 40 minutes, and the small flocs are changed into large flocs. It is then led to the sedimentation basin for sedimentation to the flocs. The retention time differs from one to four hours, depending upon the type of structure.

The carried over flocs from in the sedimentation basin, then, enters into the rapid sand filter at a filtration speed of 120 - 150m/day, and practically all of the turbid components are removed. Disinfection using chlorine is finally performed to ensure that the water is safe as regards microbacteria.

This process requires the following techniques for its operation.

1) In the mixing basin, it is necessary to have techniques to control the amounts of chemicals added as the coagulants and the coagulant aids of alkaline chemicals in accordance with changes in the quality of the raw water, so that the optimum conditions for the coagulation reaction can be maintained.

2) In the flocculation basin, it is necessary to have techniques to adjust the strength of the flocculation in accordance with the quality of the floc.

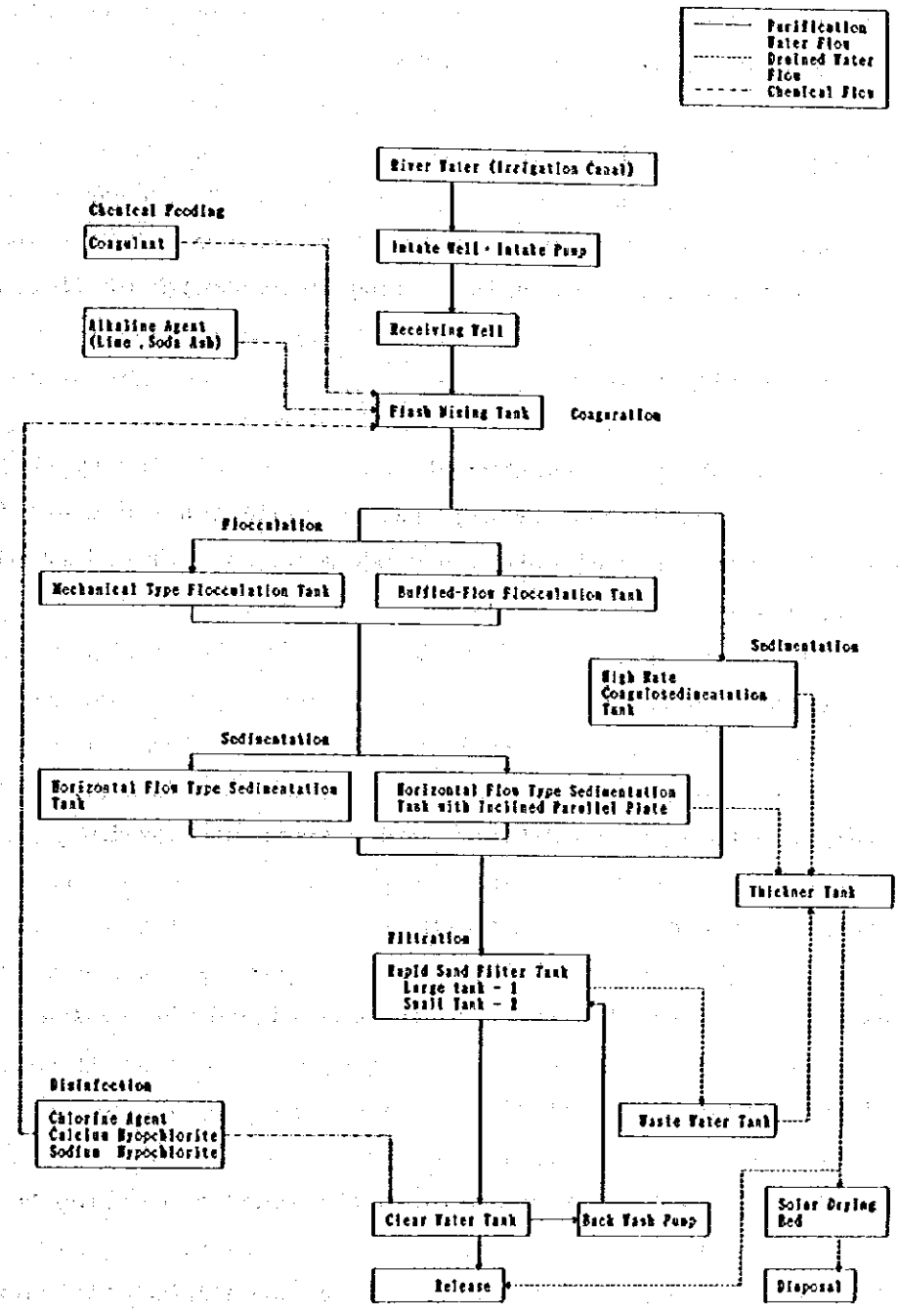
3) In the sedimentation basin, it is necessary to have sludge removal techniques to remove the stagnant sludge so that it does not create an impediment to the sedimentation process.

4) In the rapid sand filtration basin, the quality of the filtered water will be deteriorated by the clogging of the filter media, after filtration has been continued for a certain period of time (usually 24 to 48 hours). When this occurs, the water fed to the filter is stopped, and water is made to flow in reverse (back washing), so that the water washes away the clogging layer of turbids. The techniques to do this are also necessary.

5) Disinfection process involves management and control of chlorine amount to be fed in the water since the amount of chlorine consumption will differ due to the amount of ammonia and other dissolved components present in the water. Because of this, it is necessary to have the techniques to manage the dosing amount in accordance with the water quality so that the optimum disinfection is performed.

At the Center, the equipment in the diagram below will be provided in order to enable the trainees to acquire the above techniques necessary for the operation of actual water treatment plants. Water treatment equipment using various methods will be incorporated for use in training for each of the processes of coagulation, flocculation, sedimentation and rapid sand filtration.

Fig. 4-5 Compact Water Treatment Plant Flow



The use of the compact water treatment plant will enable training in the following processes.

1) Mixing Basin

Training in adding the suitable amounts of coagulant and alkaline chemicals in accordance with the water quality.

2) Flocculation Basin

Training in the operation of both mechanical flocculators and hydraulic flocculators, and in setting the strength of flocculation

3) Sedimentation Basin

Training in both the operation of the horizontal-flow type of sedimentation basin and the high-rate coagulation sedimentation basin, training in sedimentation process using inclined parallel plates, and in sludge removal.

4) Filtration

Training in the operation and management of the filtration of different filtration conditions, and also in back washing

5) Chlorine Dosing

Training in determining the chlorine demand and the dosing amount.

6) Sludge Treatment Facilities

Training in sludge treatment using a thickener and drying beds

A plant commonly used in universities and research laboratories for instruction and training in this basic knowledge of the various types of water treatment processes has a capacity of 10 lit./min to 30 lit./min (14 m^3/day to 43 m^3/day).

The scale of the plant at this Center will have a capacity of 16.7 lit./min (24/m^3day). This figure was determined as the result of an investigation into the minimum size that poses no obstruction to either the function of the processes or the performance of training. If the plant becomes any smaller than this, it would become necessary to introduce a system with devices that differed from those used in actual water treatment plants, even if the actual principles employed in the water treatment process are the same. For example, in the case of the flocculation basin using mechanical flocculators, although the actual plants use a horizontal flow system, an upward flow system will have to be introduced so that sedimentation of the floc will not occur. The source water is to be taken from the agricultural irrigation channels at the front of the site. The water inlet is to have a concrete structure, and the water is to be led via an 50mm underground gravity flow piping to the raw water tank to be installed nearby the water treatment workshop.

(2) Pump Operation Training Plant

In watersupply facilities, pump operation must be provided to transport water from geographically low places to high places. It therefore plays an important role in the supply of water and suitable operation is necessary to secure stable supply. The pump facilities comprise mechanical facilities of pumps, pipes and valves, etc., and electrical facilities such as panels for power and instrumentation systems. It is necessary to acquire the knowledge to perform suitable operation and management of these facilities. In addition, since the pump facilities are set to have specifications and a status of operation in accordance with the amount of water to be supplied and the hydraulic pressure conditions, the knowledge of hydraulics is also indispensable for suitable pump facility planning and operation.

At the Center there will be a training facility with which pump operation can be actually performed, so that the pump operation techniques, fundamental hydraulic knowledge relating to pumps, and the recognition of the types of facilities relating to pumps can be obtained. In addition, various types of electrical and mechanical

facilities associated with the pumps will also be used in the performance of fundamental training with respect to the electrical and mechanical facility technology.

The training devices to be installed so as to accomplish objectives afore-mentioned will consist of pumps, associated facilities such as pipes and valves, measuring equipment such as flow meters, pressure gauges, instrumentation, electrical facilities such as power panels and instrumentation panels, and water tanks, all combined in a forced water circulation system. This system will be used to perform the following training:

1) Pump Operation Techniques

Single, parallel and series operation; Operation with suction lift, operation with intake head; Operation when the lift and the pipe losses are different; Flow control by delivery valve open-close adjustment; Creation of pump characteristic curves

2) Knowledge relating to Pump Facilities

Knowledge of the functions and structures of the various types of pumps, flow meters, pressure gauges, etc. and techniques concerning the use thereof

3) Knowledge of Hydraulics

Knowledge relating to pump cavitation and water hammer phenomenon

4) Others

Knowledge concerning the various devices (vibration indicators, rotation indicators, pressure gauges, ammeters, voltmeters, etc.) and operation method of emergency power supply unit

In order to perform this training, there will be provided two centrifugal pumps of the same type so that both series and parallel operation can be realized . In addition, there will also be provided an engine-driven centrifugal pump, and a submersible pump which are often used in Indonesia. Space for an extra pump will also be secured so that training in (centrifugal) pump installation can also be performed.

The capacity of each of the pumps is to be 0.5 m^3 so that the size of the delivery pipe of the pump will be about 100mm. The lift is to be about 25m, in view of supply of water to the water leakage survey training facility.

4-2-9 Outdoor Training Facilities

(1) Water Leakage Training Facility

The basic purpose of the water leakage survey training facility is to provide training in detecting water leaks in pipes, in determining their degree, and in taking suitable countermeasures against to them. In order to accomplish this, it is planned that the Center will be provided with a water leakage training facility which will have a model underground pressure pipe network in which leaks will be actually caused. The distribution pipes(Note) used in the model pipe network will be of four types, ductiled cast iron (DIP), the galvanized steel (GIP), the polyvinyl chloride (PVC), and the asbestos cement (ACP) pipes commonly used in Indonesia. The diameters will be 100mm which is the size generally used for underground pipes in urban areas. Also, the polyvinyl chloride pipes with diameter 20mm will be used for service pipes.

Note: Water is to be conveyed by water supply from the intake facility to the water treatment plant (conveyance), transmitted from the water treatment plant to a distribution reservoir (transmission), and then distributed from the distribution reservoir (distribution) in a water supply system. These pipes will be known as the conveyance pipes, the transmission pipes and the distribution pipes, respectively. Furthermore, pipes which branch from distribution pipes and connected to each household are called service pipes.

The model pipe network will be used to provide training in detecting leaks in each type of piping. Leak will be provided at two places for each type of pipe (a total of ten places). Each of these "leaks" will be able to be individually set by valve operation. These leaks will have to be located at distances of at least four meters from each other so that the noise from adjacent leaks does not interfere.

It will therefore be necessary to have a training ground of at least 20m x 30m ($600m^2$) to form this pipe network. This training ground will enable the following types of training to be practiced.

1) Using detectors to confirm the position of underground pipes

2) Using amplifier type leak noise detectors to detect leaks in distribution pipes and service pipes

3) Confirming differences in the sound of leaks for different types of pipes

4) Installing and reading portable flow meters in order to determine the amount of leakage

5) Confirming differences in the sound of leaks for the size of the leak holes

6) Installing and reading pressure gauges for the measurement of the pressure which is related to the amount of leakage

7) Performing water pressure measurement training using fire hydrant assuming actual or existing installations

The leak survey training is to be performed outdoors and requires considerable concentration of attention. A simple sunshade and rest place are to be provided at the training site.

(2) Pipe Laying Training Yard

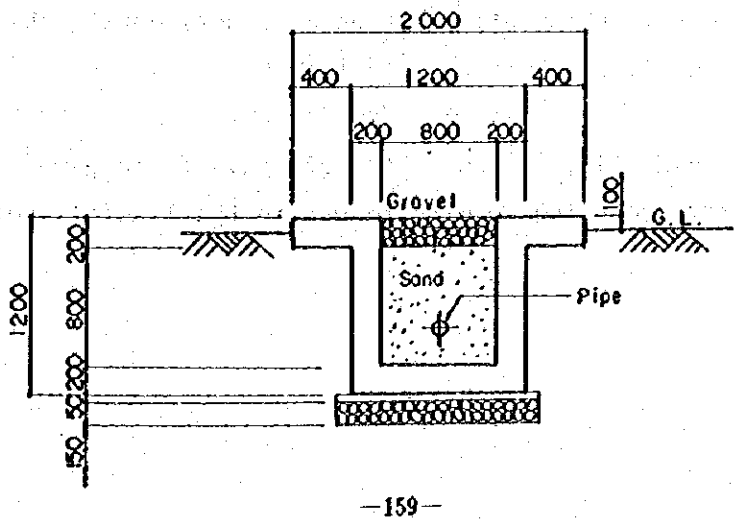
In the water supply system, the transmission and distribution pipe network is one of the major facilities. Pipe laying techniques are very important in order to achieve the efficient utilization of water by preventing leakage from the laid pipes.

The basis of pipe laying is to lay pipes freely in accordance with the planned route, and the actual work involves processing work such as the cutting and jointing of pipes and civil work such as excavation and backfilling of soils in accordance with the principle of water supply piping, that is, underground pipe laying.

For the pipe processing the basic training is practiced at the indoor pipe laying training room, while pipe laying work including the excavation and backfilling of soils will take place outdoors as practical training at the pipe laying training yard.

Fig. 4-6 illustrates the structure of the training facility. The trenches for the pipes are made of concrete and are backfilled with sand that has gravel laid over it.
The training will be completely performed by manual labor for everything from the removal of the grave, the pipe laying, backfilling and recovering but the pipe laying work will use tripods and chain blocks as are used in actual practice.
The ten trainees will be divided into two teams of five and two piping trenches will be provided for simultaneous training of both teams.

Fig. 4-6 Piping Trench Section for Pipe Laying Training Yard



(3) Sanitary Landfill Experiment Plant

Methods for sanitary landfill using garbage can be classified into aerobic landfill and anerobic landfill. Aerobic landfill stabilizes the garbage through the activities of aerobic bacteria. This method can achieve a relatively quick stabilization, and the use of the reclaimed land is easy. On the other hand, the anerobic landfill method uses the activities of anerobic bacteria. Although the stabilization of garbage by this method is relatively slow, resource recovery (methane gas recovery) becomes possible.

At this training center, both methods of landfill will be performed. For this purpose, two types of concrete cells will be provided and the following training will be given by using these cells:

1) Actual training in the aerobic landfill method (involving waste dumping, compaction, covering and carrying out)

2) Actual training in the anaerobic landfill method (involving waste dumping, compaction, covering and carrying out)

3) Water quality analysis for the leachate for each landfill method and the understanding the difference of water quality by method

4) Understanding the types of gases generated for each landfill method

5) Understanding the degree of stabilization (confirmation of differences in the quality of the leachate) during the various landfill periods

6) Understanding differences of the quality of the gases generated, according to differences in the landfill period

The test at the sanitary landfill experiment cells will involve only manual landfill using the garbage actually collected by garbage collection trucks. Thus, the area for landfill will not be large, but a minimum area of 2 m x 3 m is necessary in order to secure the testing effect and the workability. Also, it is necessary that the landfill have a minimum depth of 3 meters so that there can be provided a landfill layer of waste (1 meter) + covering soil + waste (1 meter) + covering soil. The dimensions of the experiment cell will therefore be 2 m ^{L} x 3 m ^{W} x 3 m ^{H}.

It is effective to conduct comparative testing in order to understand the relationship between the degree of stabilization and the landfill period, namely, for the tests 5) and 6) mentioned above. For this purpose, two landfill cells will be provided for each landfill method. While the leachate and gas sample is taken from the garbage landfilled in the first cell in the course of the previous training, the other cell is used to abstract the sample immediately after landfilling. Therefore, a total of four tanks will be provided.

4-2-10 External Facilities

(1) On-premise Roads, Parking Spaces

On-premise read is to be constructed to communicate and transport various to and from each of the workshops, laboratories, the dining room and the dormitories. Car parking lots will be provided along the inner road for the use by personnel and visitors. A turning space is provided for garbage collection trucks. The on-premise roads will have a width of 4.5m laid out to connect the places required. The parking area will be for personnel and visitors, and will provide a total of 15 spaces. There will also be eight more spaces for vehicles that are used for training and other official purposes. The turning space for the garbage collection trucks will be 15 m x 20 m.

(2) External Water Supply and Drainage Facilities

1) Elevated Water Tank

A 4 m^3 elevated water tank is to be located at a height of GL + 20 m which will serve to supply water to the entire facilities. In addition to this, there will also be 5 m^3 tanks provided at heights of GL + 5 m and GL + 10 m in oder to give the necessary head to the water circulation system of the pump training plant. In order to install the elevated tanks a reinforced concrete tower, with a width and length of 4 m, and a height of approximately 25 m, is required to be constructed.

2) External Drainage Facilities

The on-pressure roads will be provided with L-shaped channels to collect and conduct rain water, through underground pipes, to the drainage channels to be constructed by the Government of Indonesia. At the court yards, rain water will be collected by gravity into samp pits, while at the green area, by open ditches and conducted into underground pipelines. The wastewater that requires to be treated before discharge will be led to the water treatment facilities via underground pipelines.

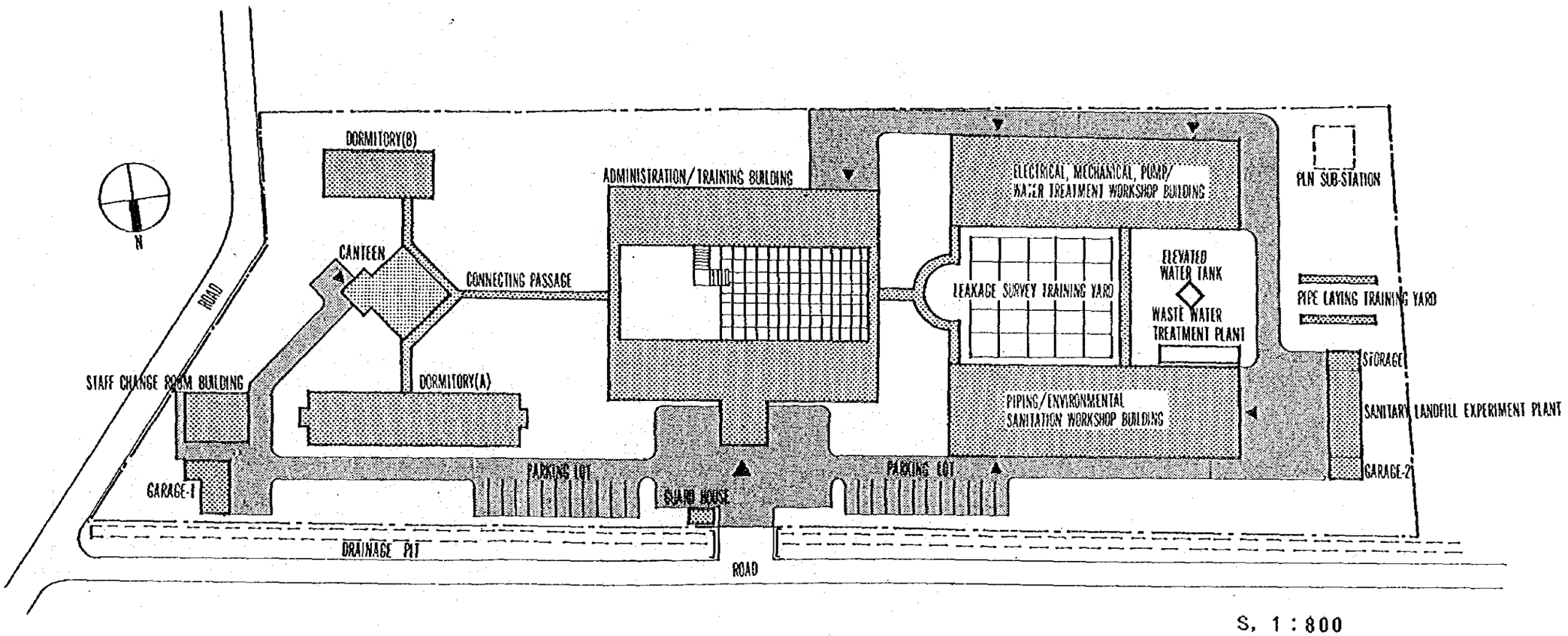
3) Water Supply Facilities

Water will be supplied by underground pipes, to the places where it is required.

(3) Electrical Facilities

The main line from the PLN's substation will be installed underground using buried cable. The external electrical facilities will include external lighting fixtures of mercury vapor lamp for a total of 12 places on the site.

BASIC DESIGN DRAWINGS



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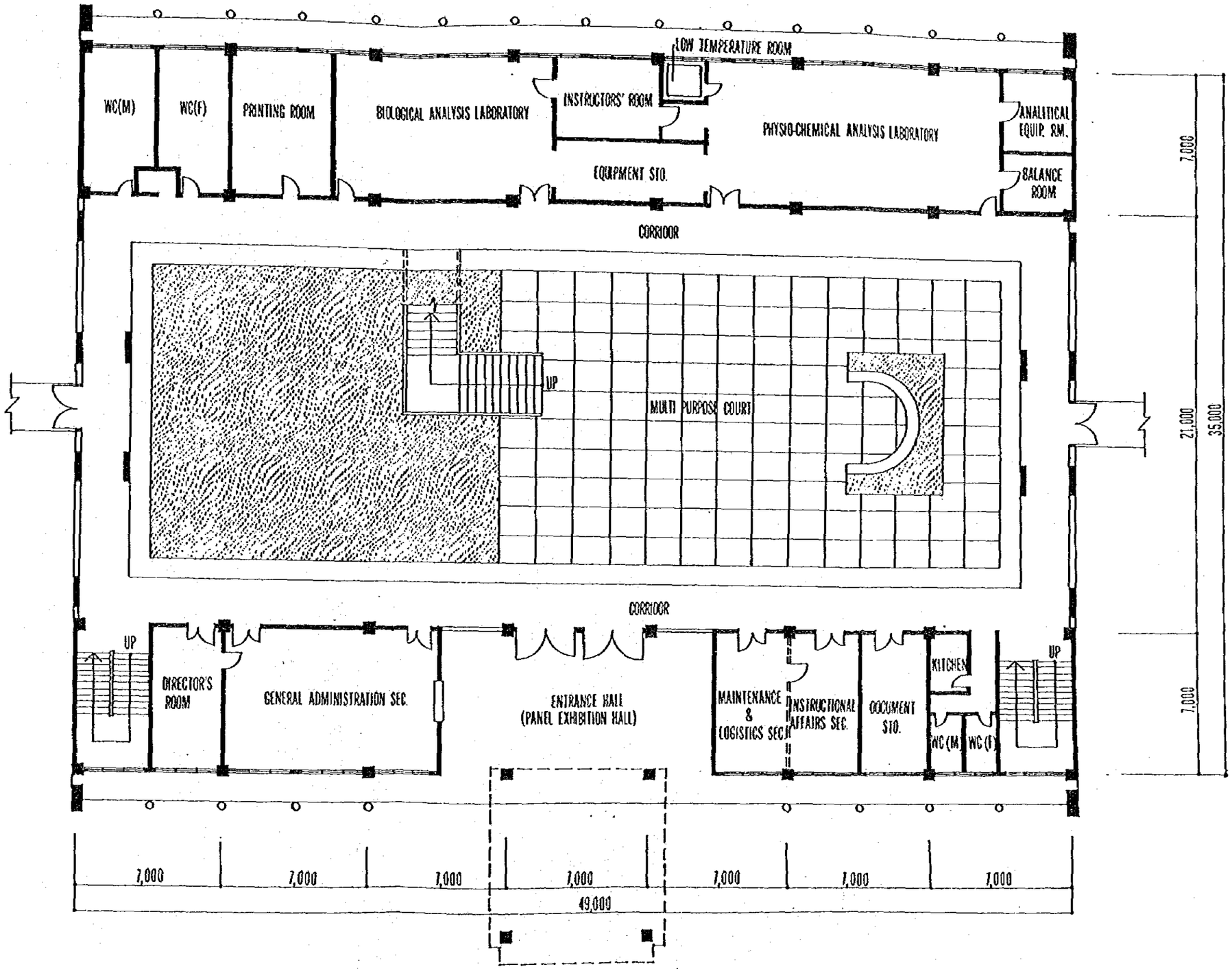
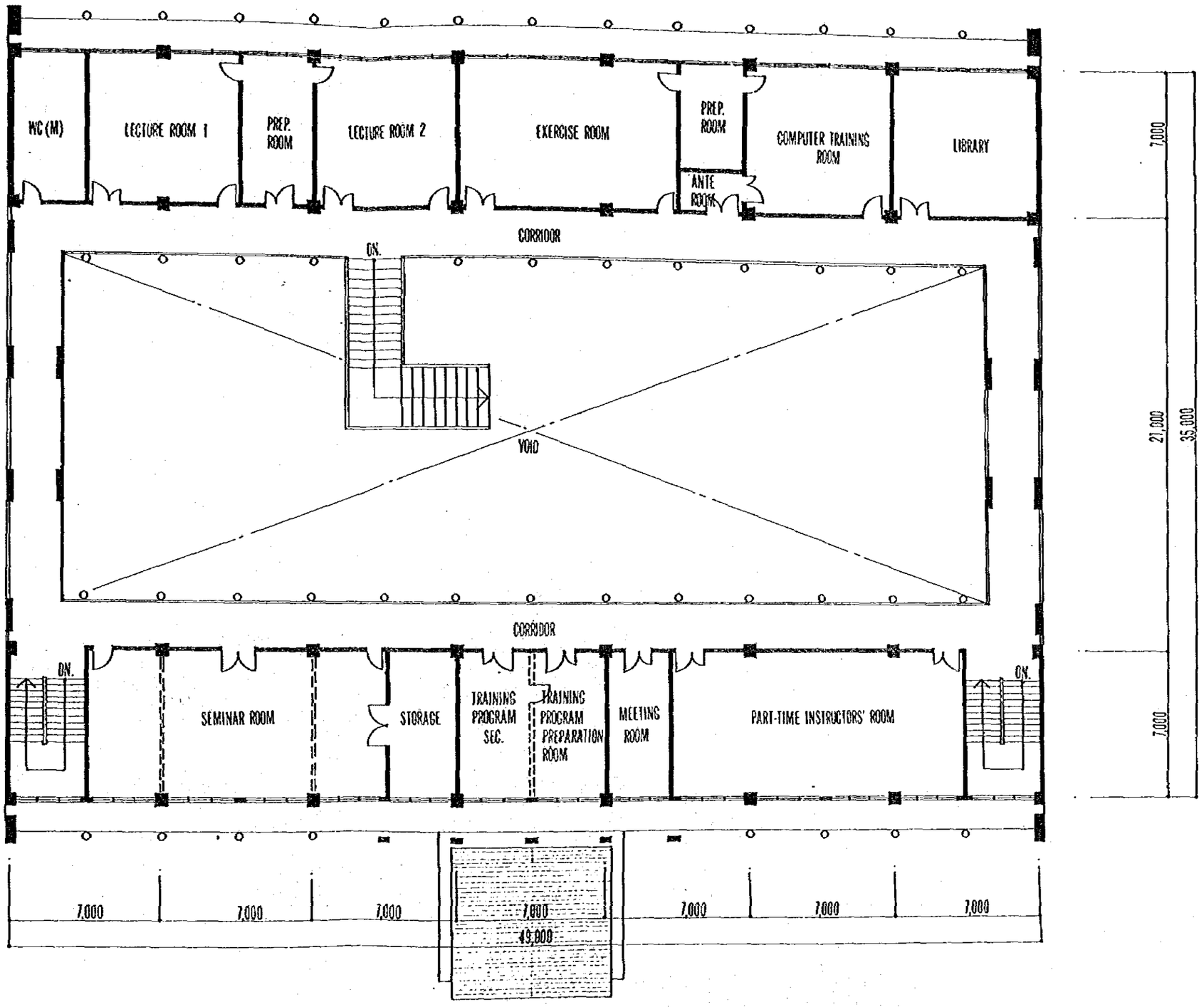
FACILITY LAYOUT PLAN



ADMINISTRATION/TRAINING BUILDING 1F PLAN S, 1:200



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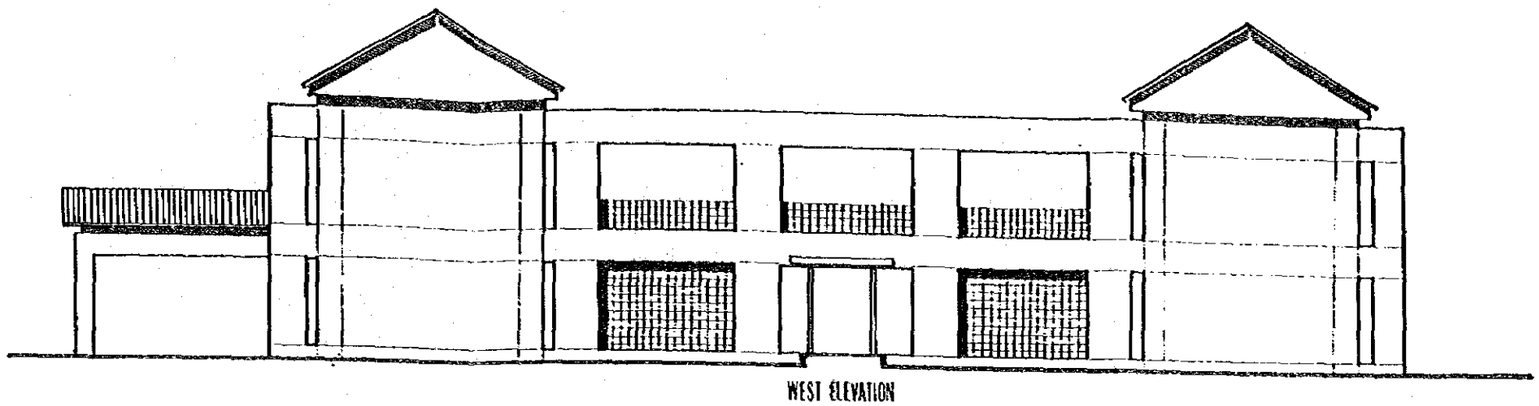
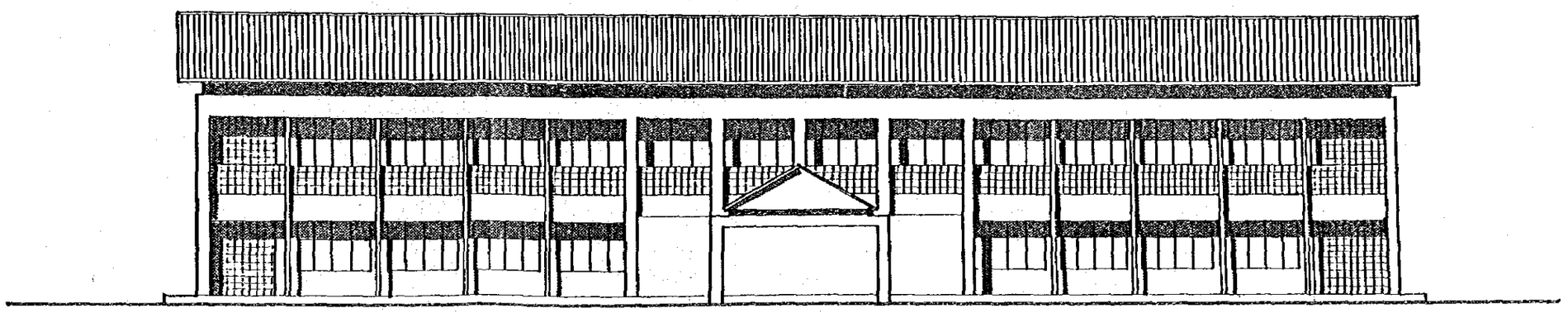
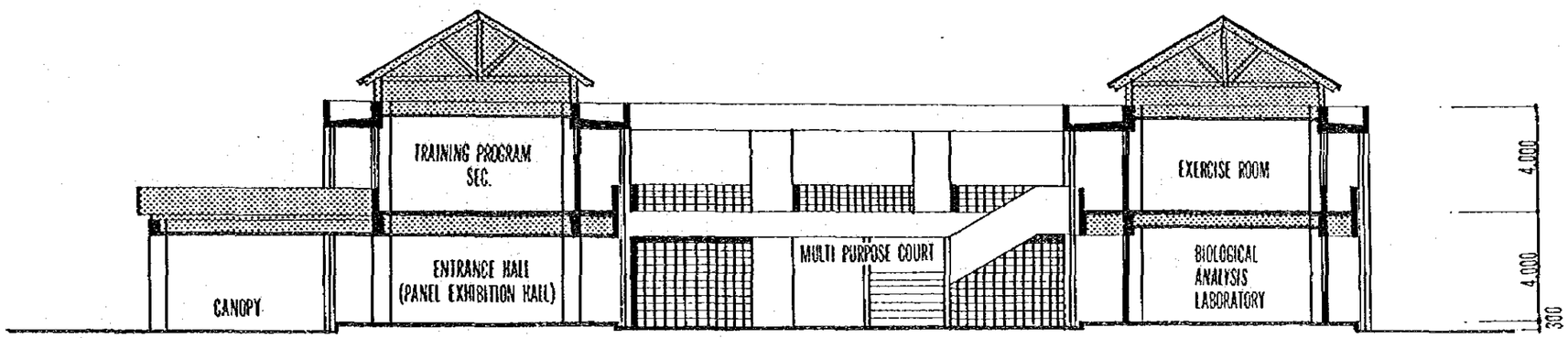


WEST ELEVATION

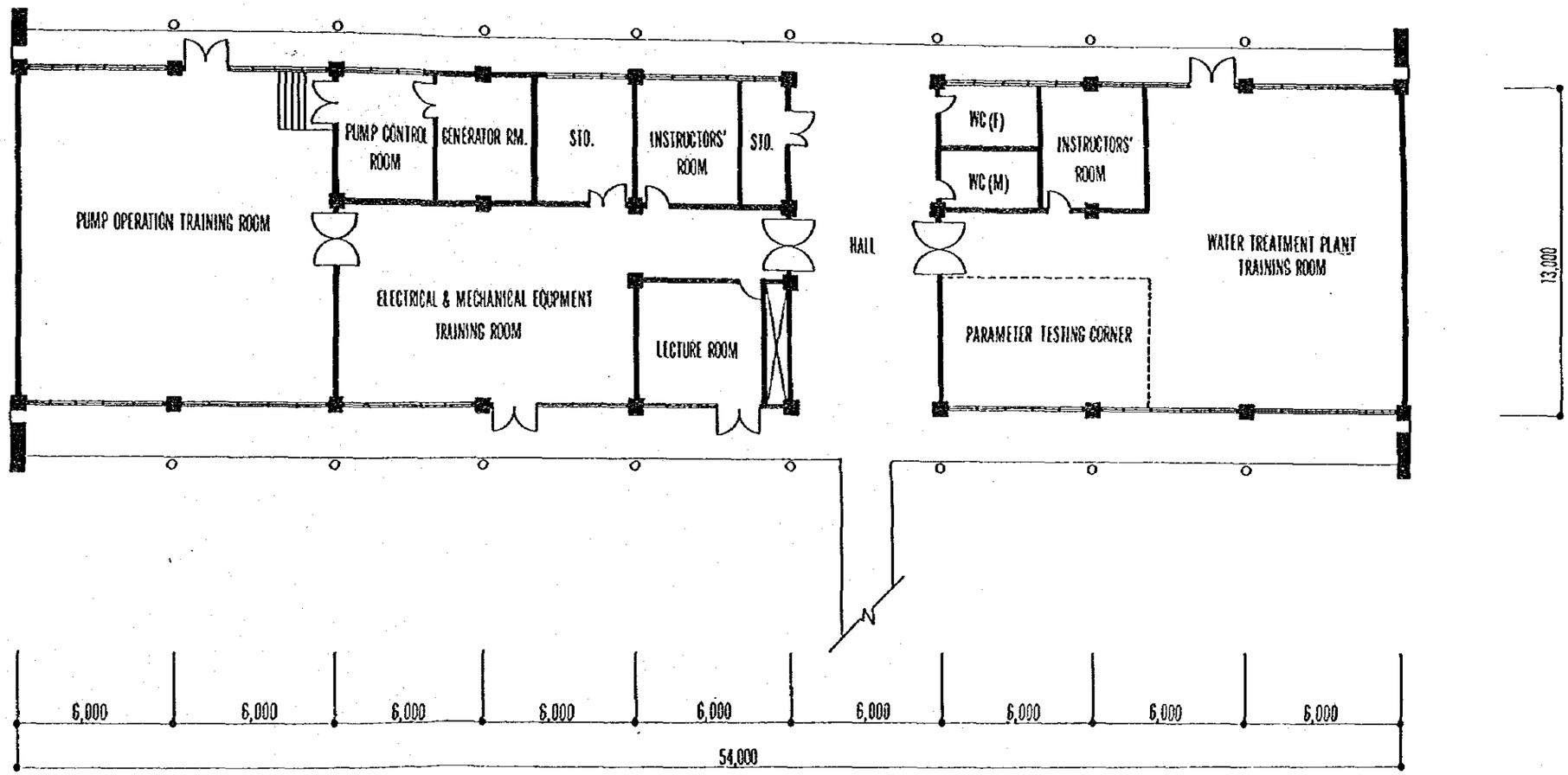


NORTH ELEVATION

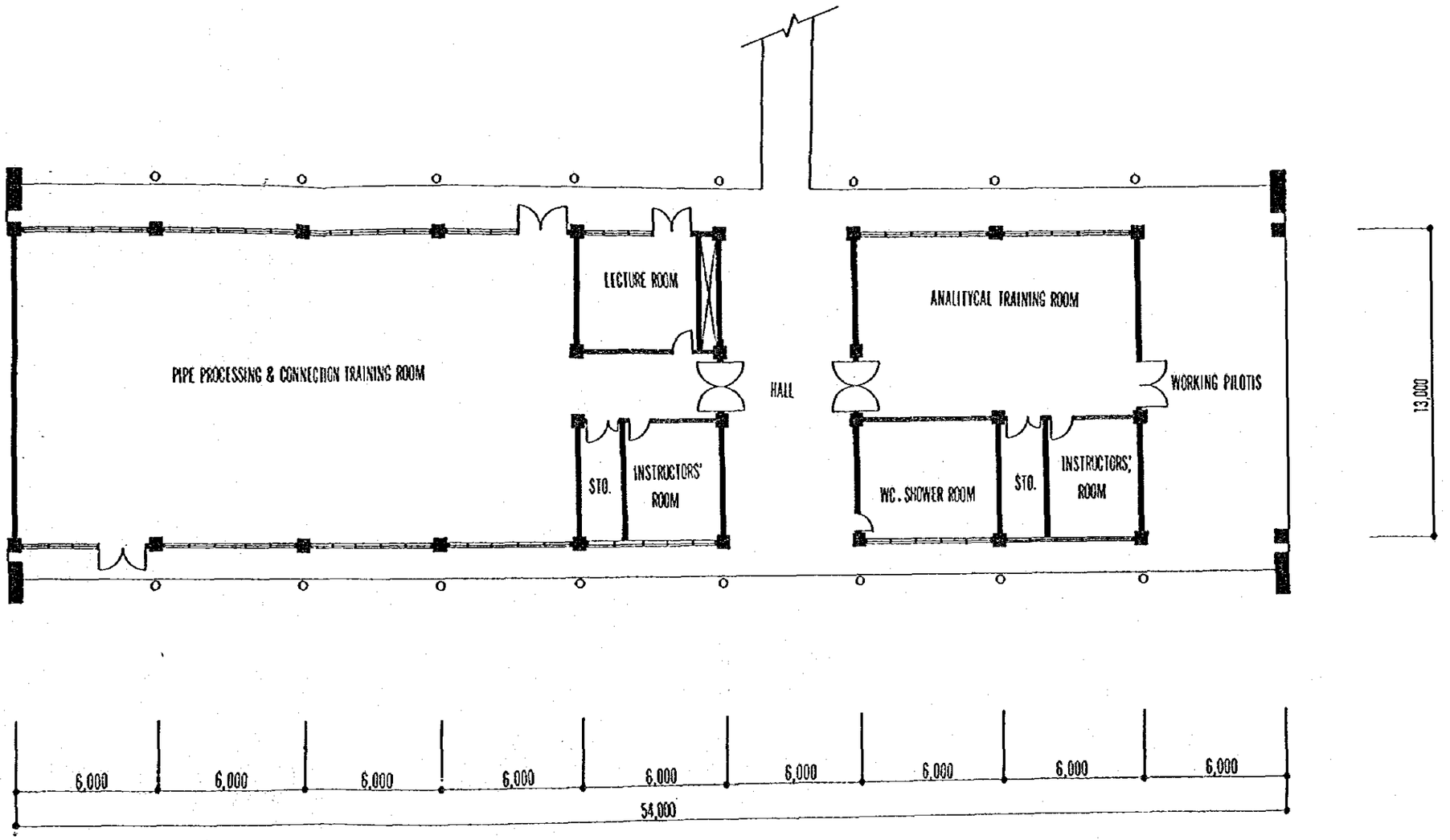
ADMINISTRATION/TRAINING BUILDING ELEVATIONS S, 1:200



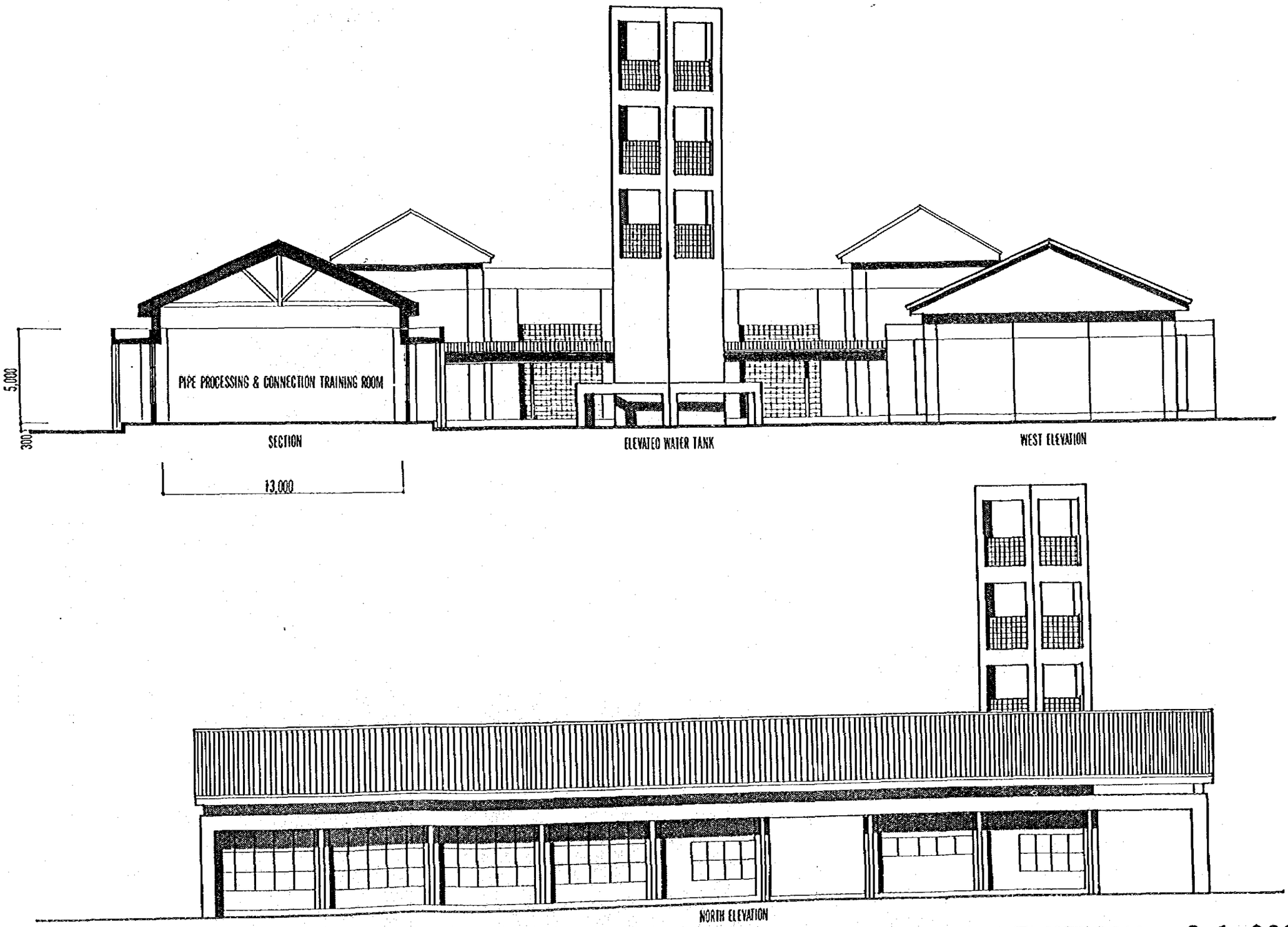
ADMINISTRATION/TRAINING BUILDING SECTION S, 1:200



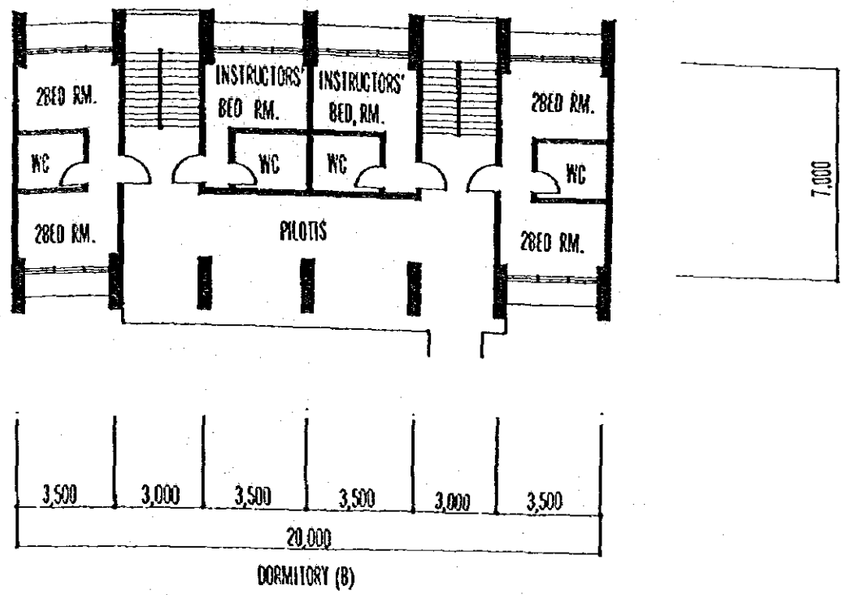
MECHANICAL·ELECTRICAL·PUMP/ WATER TREATMENT WORKSHOP BUILDING PLAN S, 1:200



PIPING/ENVIRONMENTAL SANITATION WORKSHOP BUILDING PLAN S, 1:200



WORKSHOP BUILDINGS SECTION & ELEVATIONS S, 1:200



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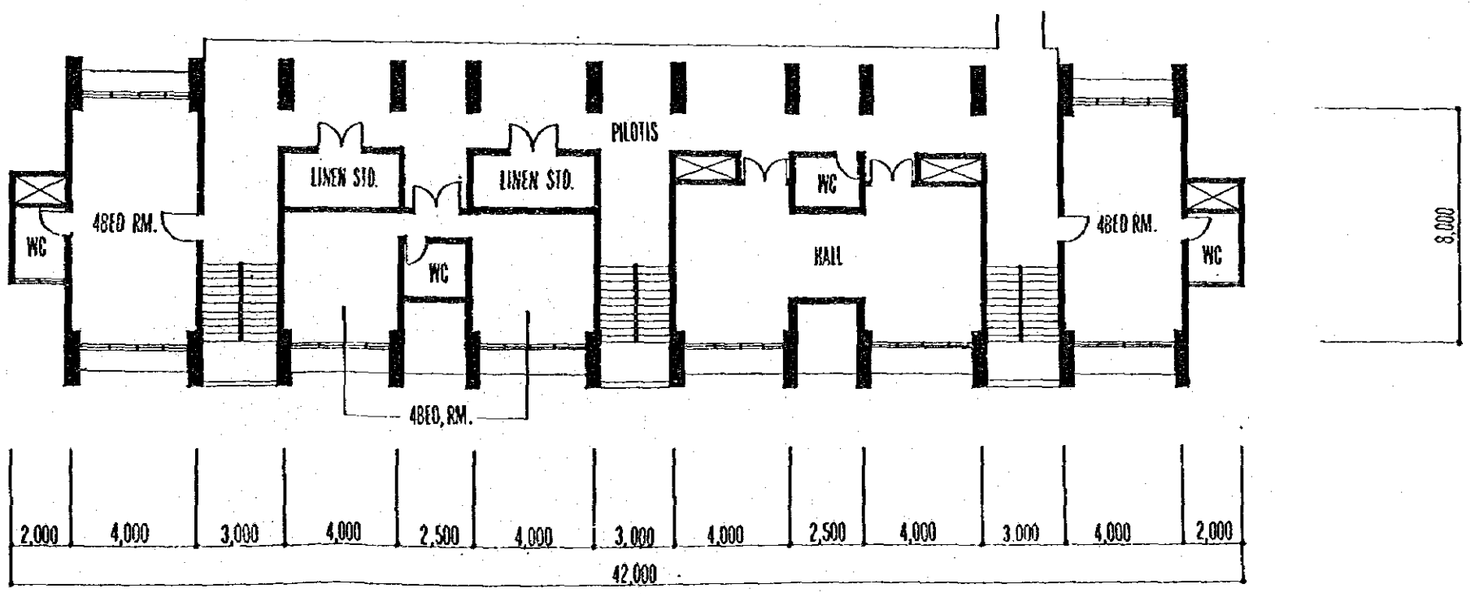
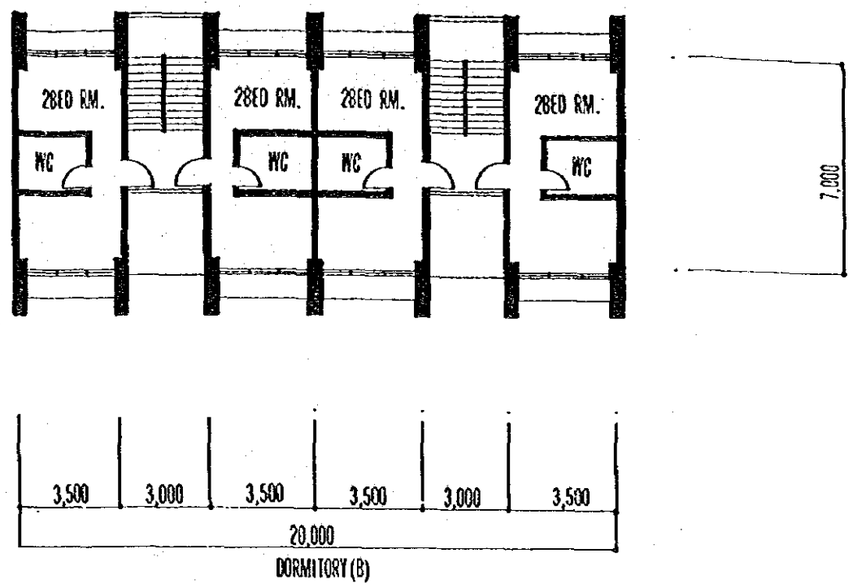
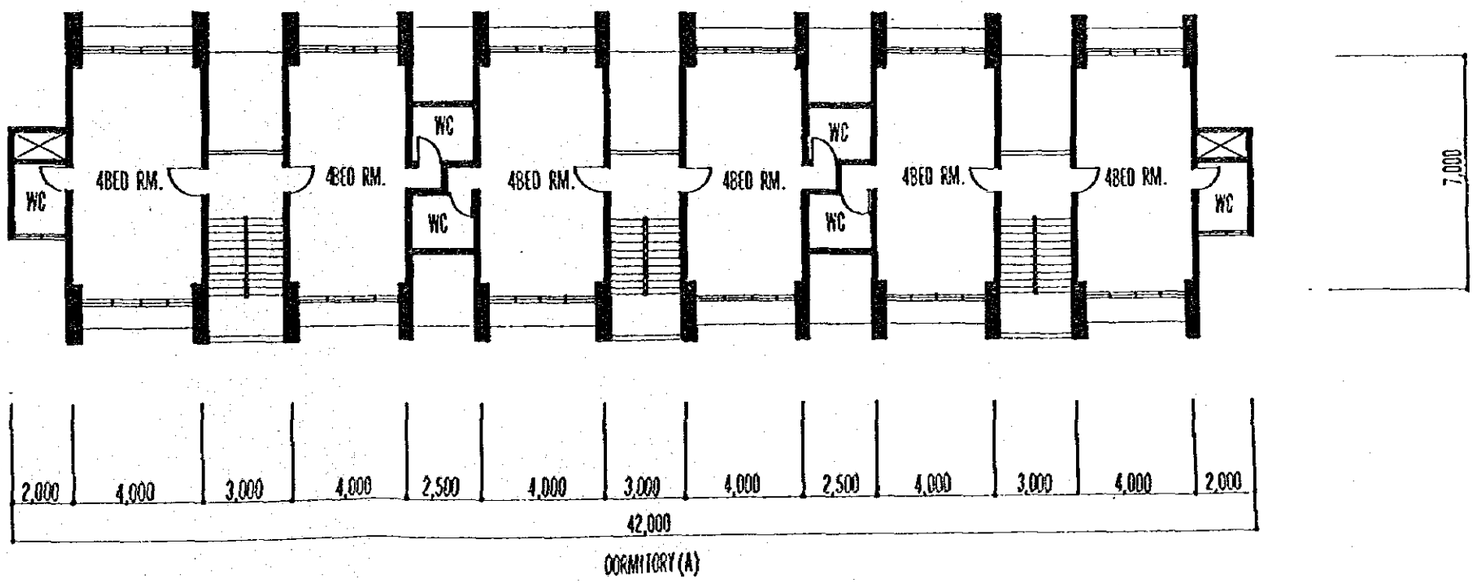


DORMITORY (A)

DORMITORIES 1F PLANS S, 1:200

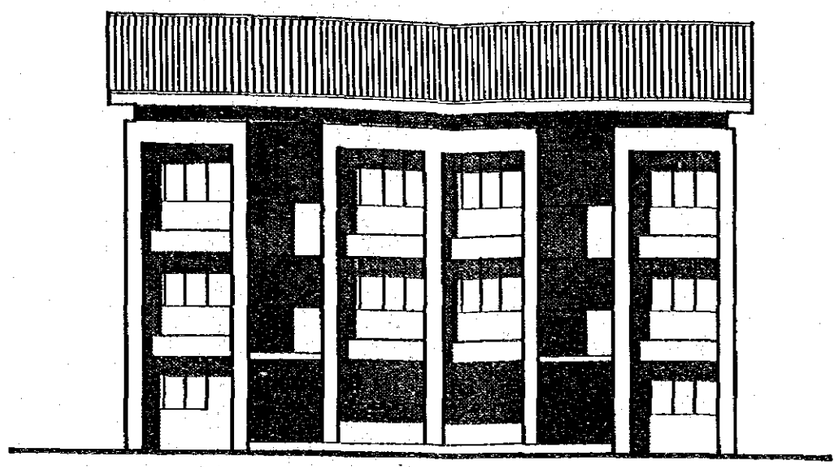


DORMITORY (B)

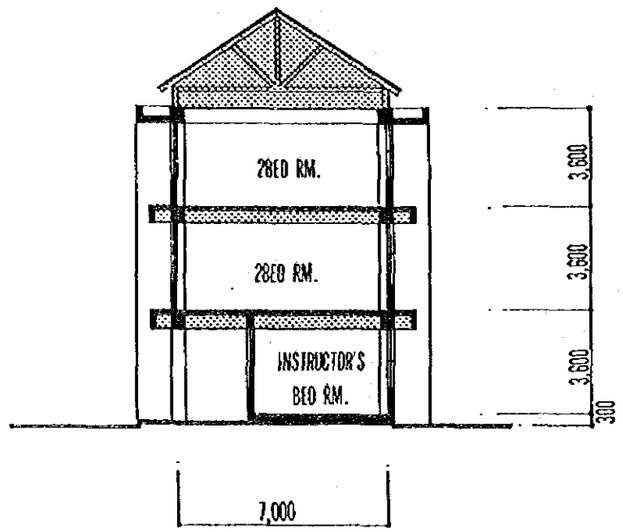


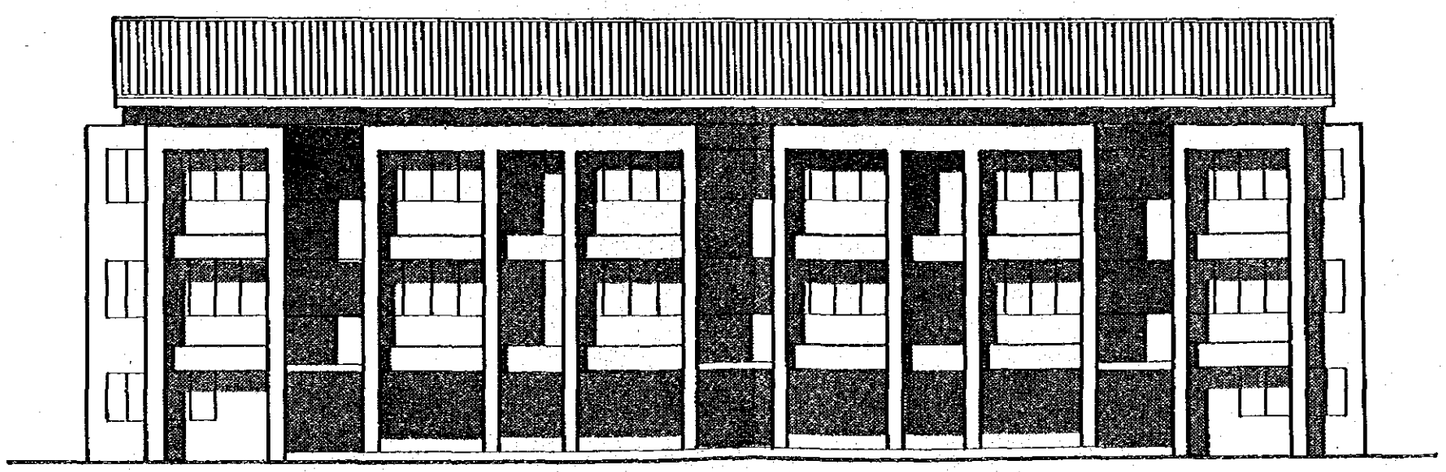
DORMITORY (A)

DORMITORIES 2F, 3F PLANS S, 1:200

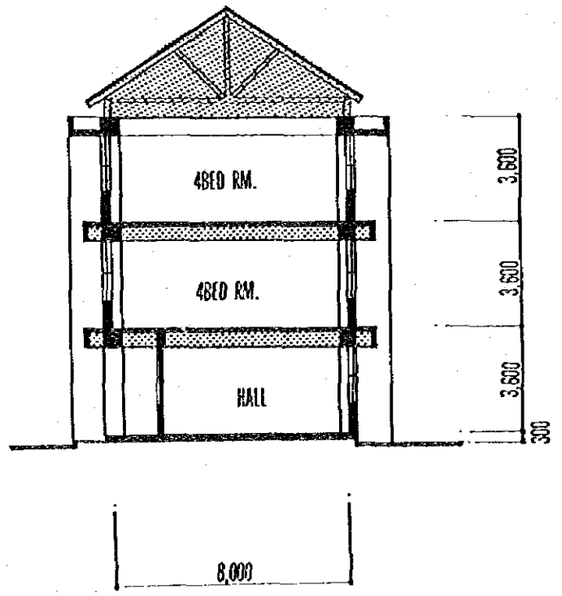


DORMITORY (B)

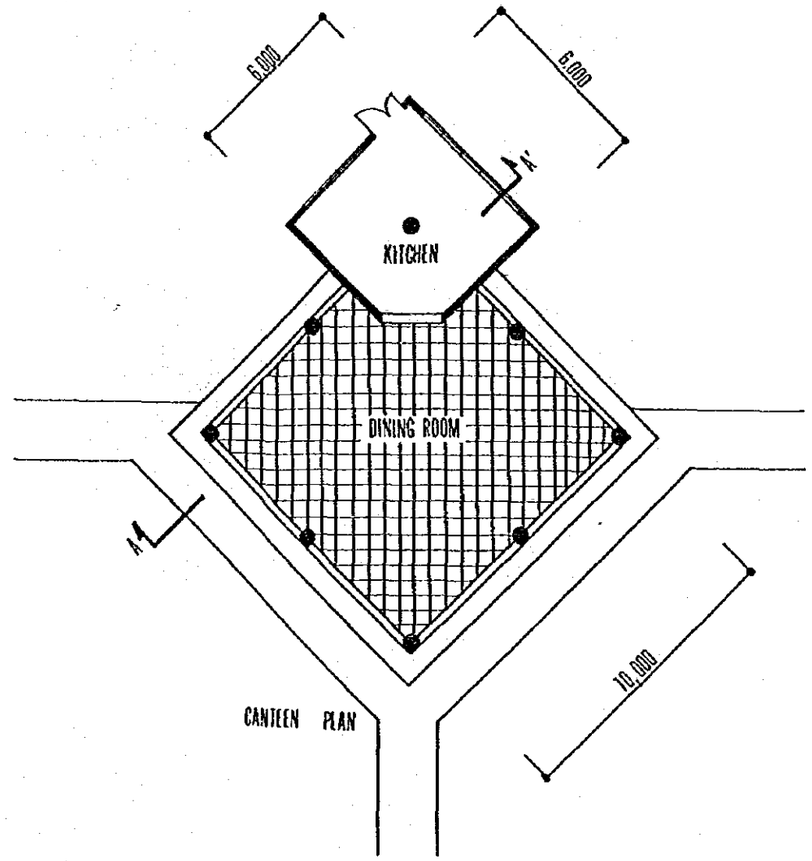


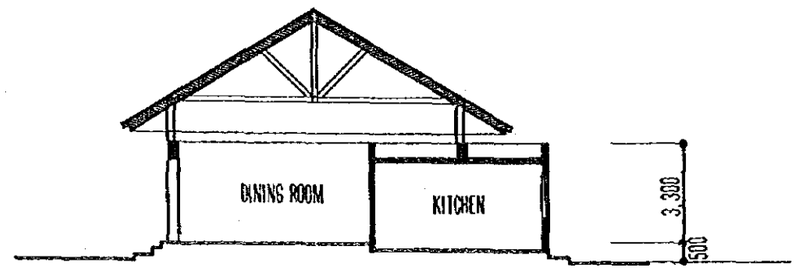


DORMITORY (A)

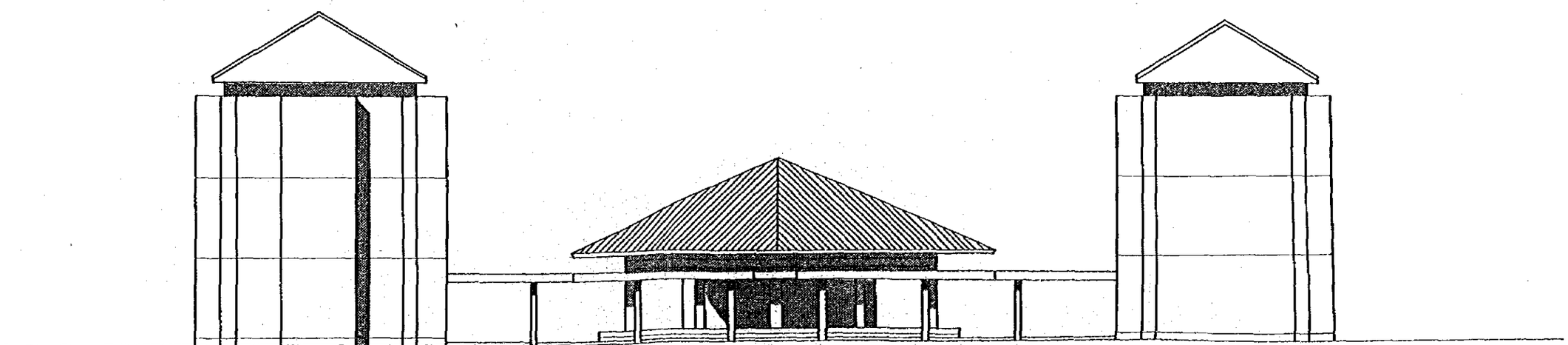


DORMITORIES ELEVATIONS & SECTIONS S, 1:200





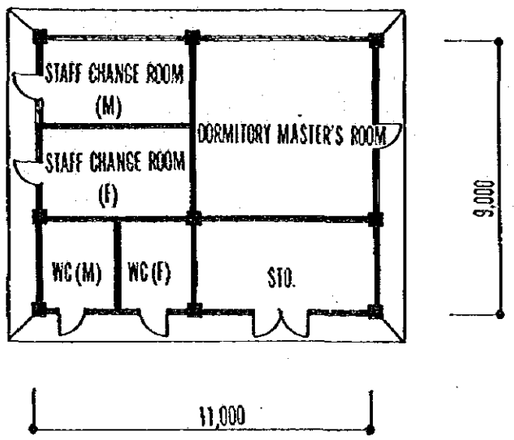
A-A' SECTION



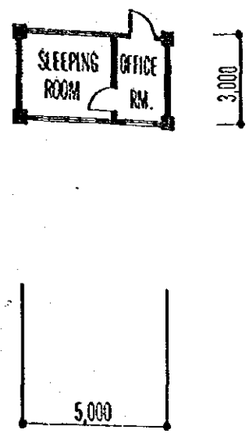
WEST ELEVATION

CANTEEN PLAN, ELEVATION & SECTION S, 1:200

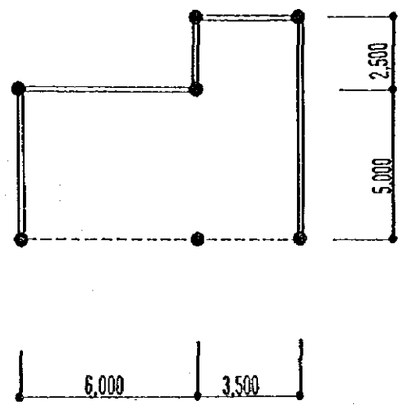
STAFF CHANGE ROOM BUILDING



GUARD HOUSE

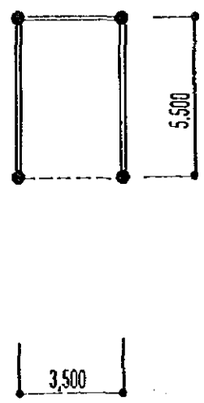


GARAGE 1 (1 MICRO-BUS, 2 JEEPS)

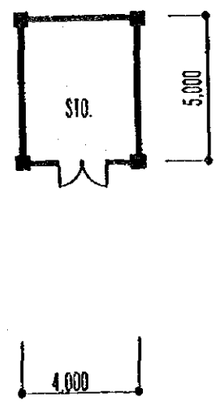


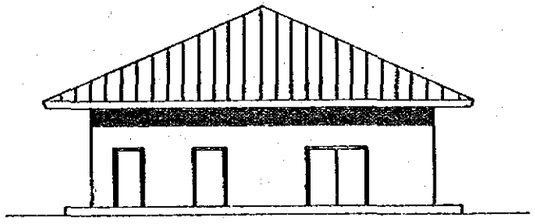
PLANS

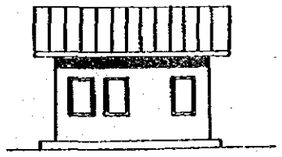
GARAGE 2 (1 PACKER TRUCK)

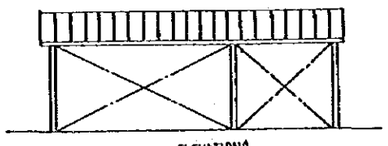


SANITARY LANDFILL EQUIPMENT STORAGE

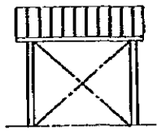


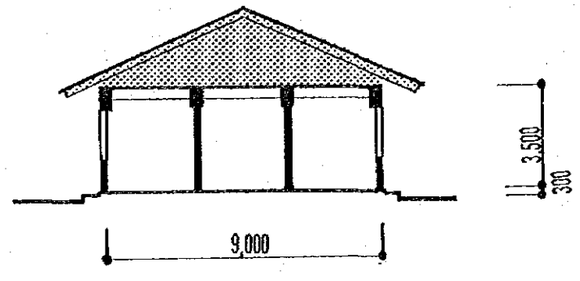


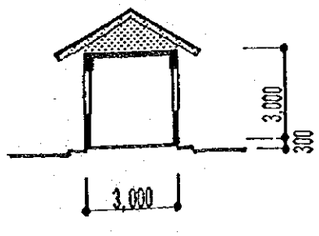


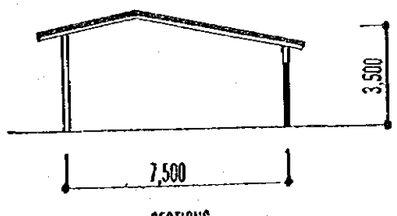


ELEVATIONS

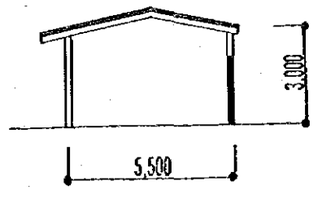


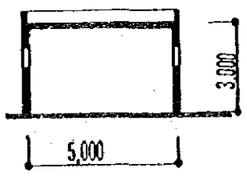




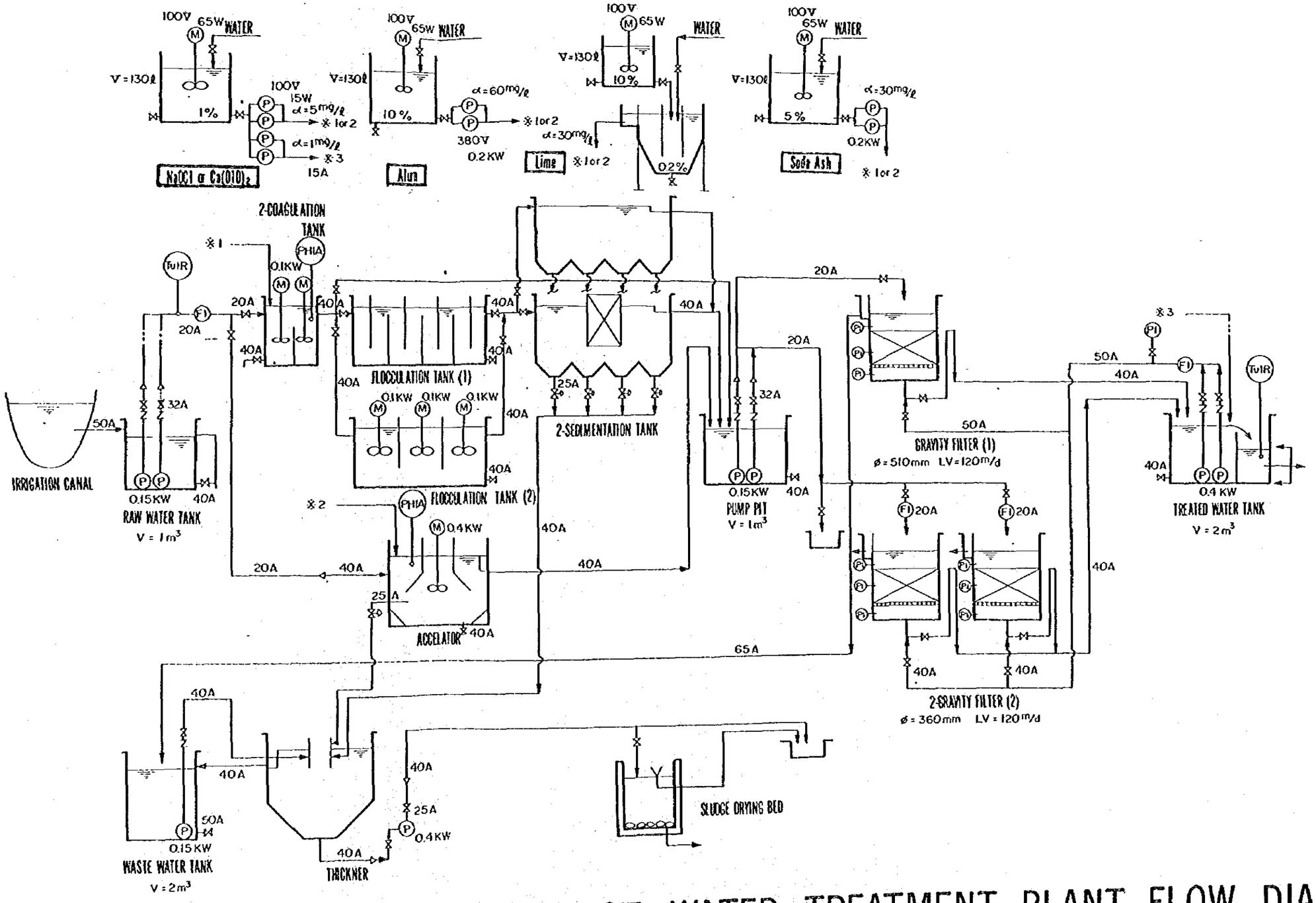


SECTIONS

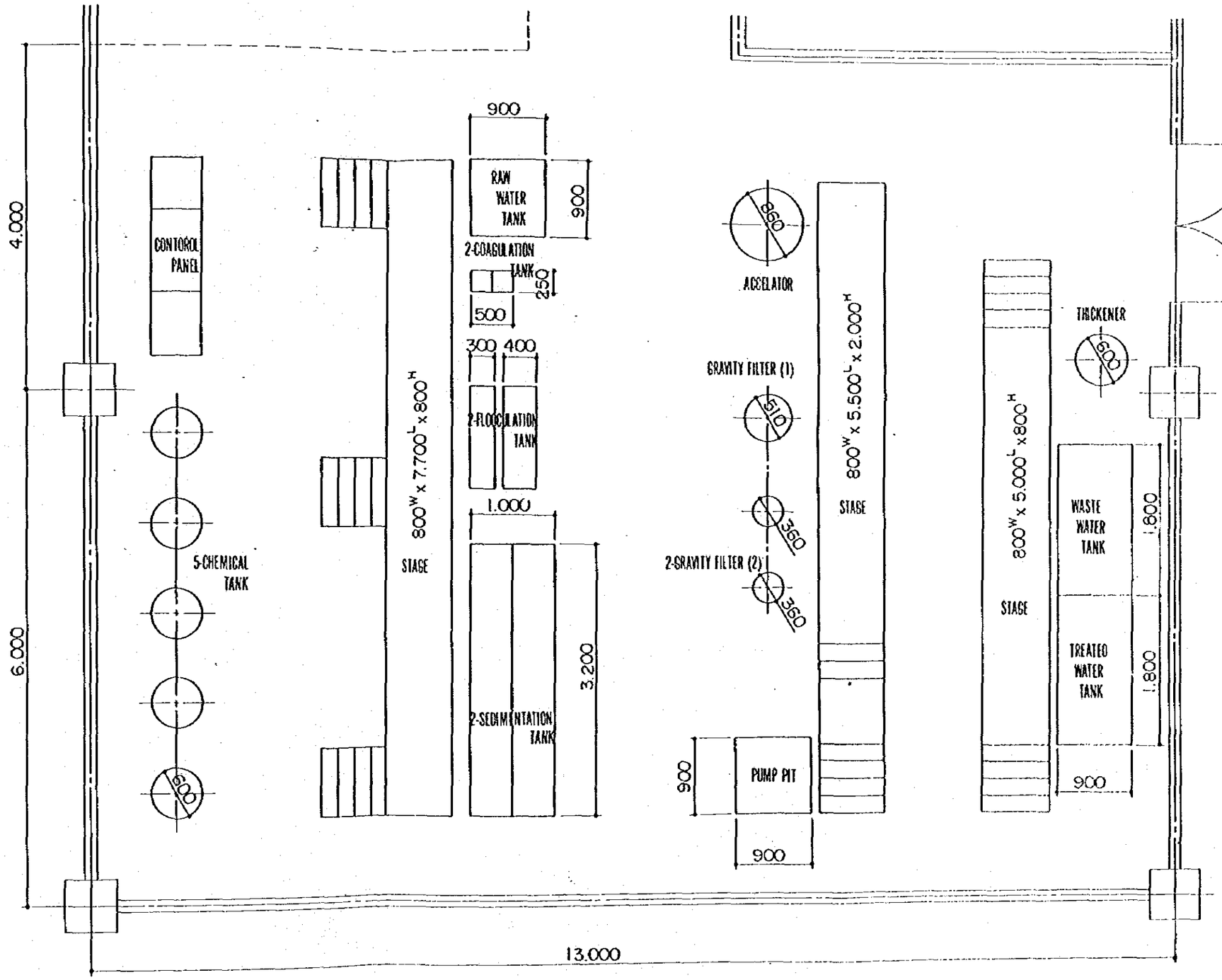




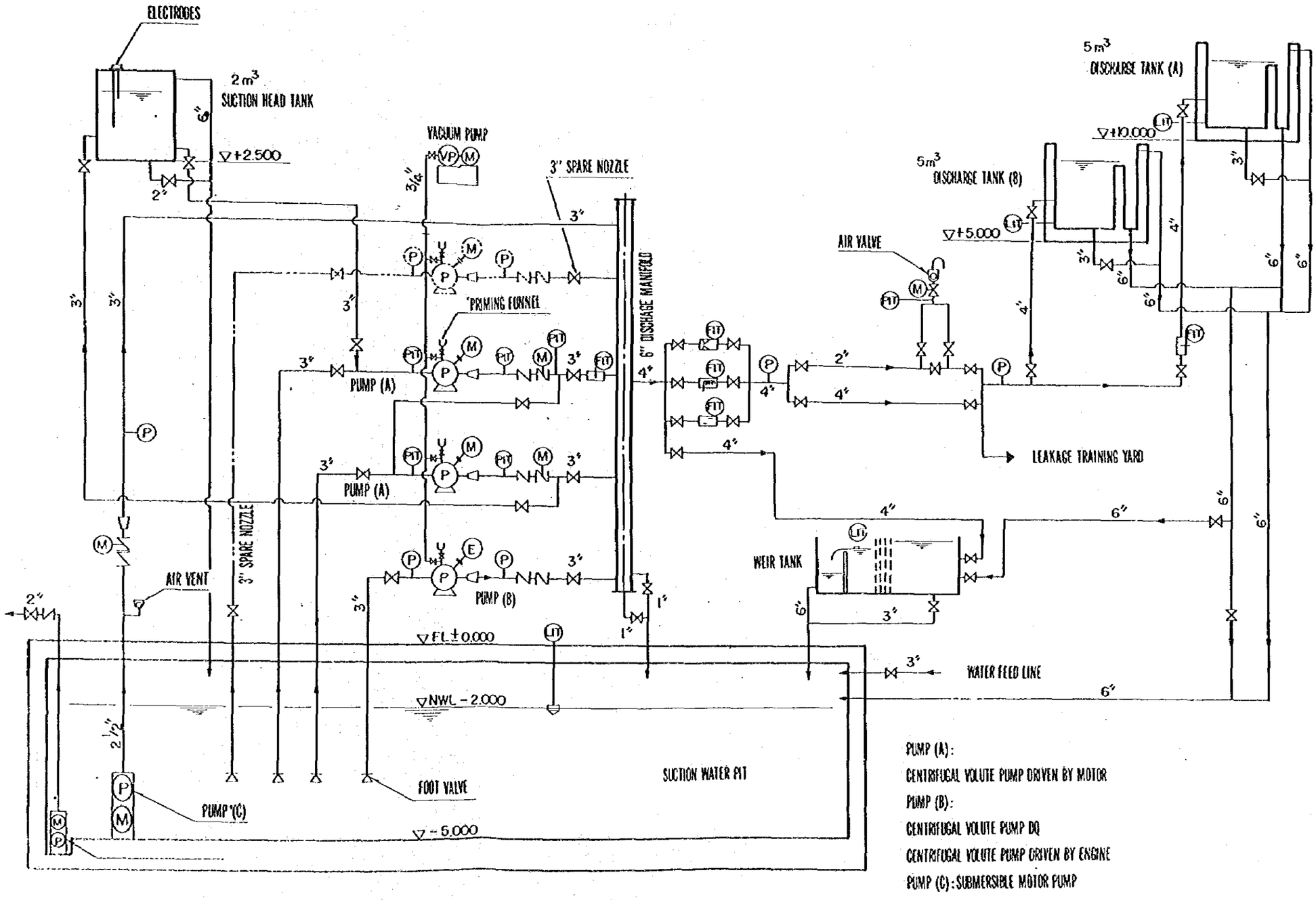
OTHER BUILDINGS PLANS, ELEVATIONS & SECTIONS S, 1:200



COMPACT WATER TREATMENT PLANT FLOW DIAGRAM

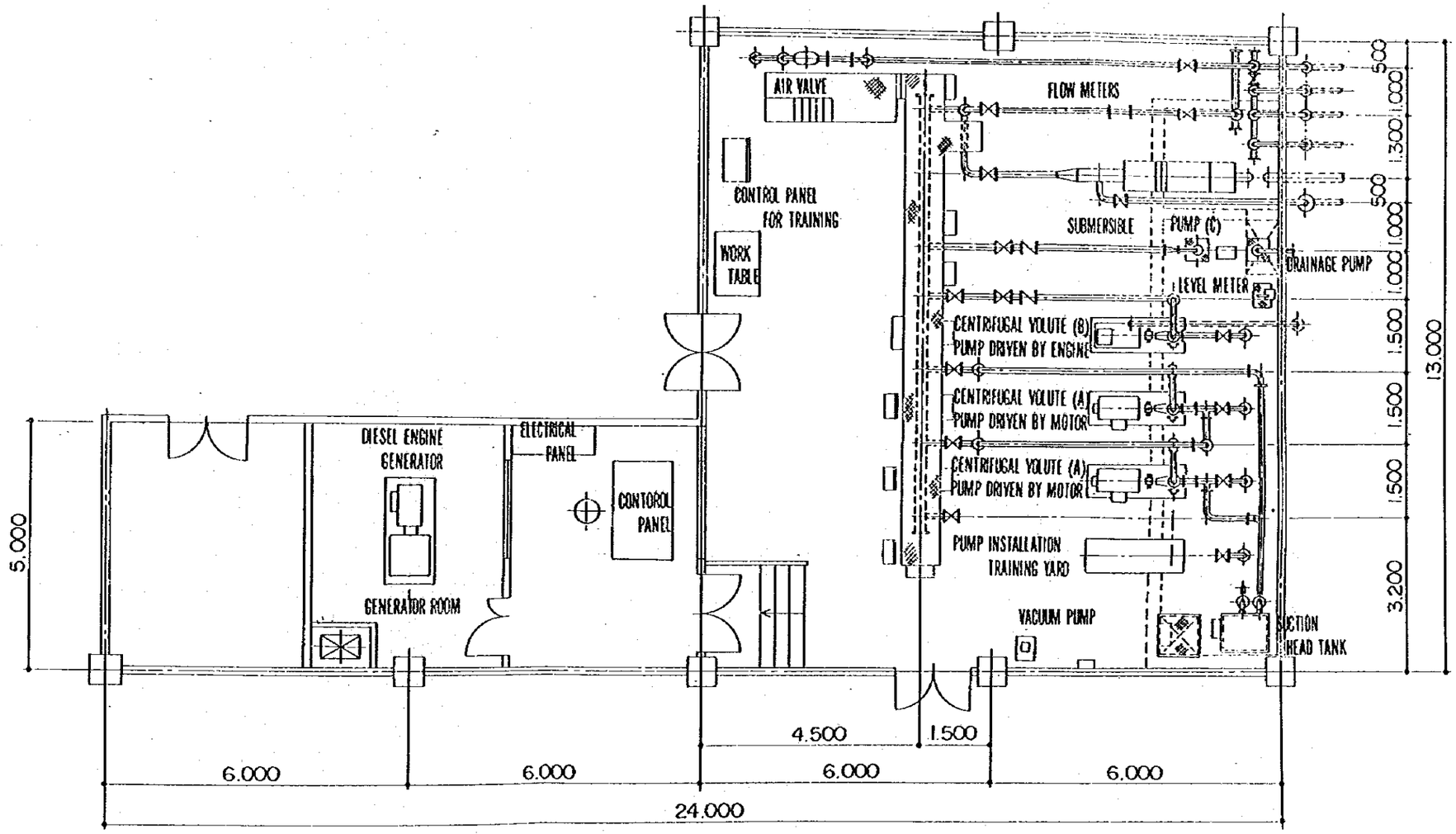


COMPACT WATER TREATMENT PLANT LAYOUT PLAN S, 1:50

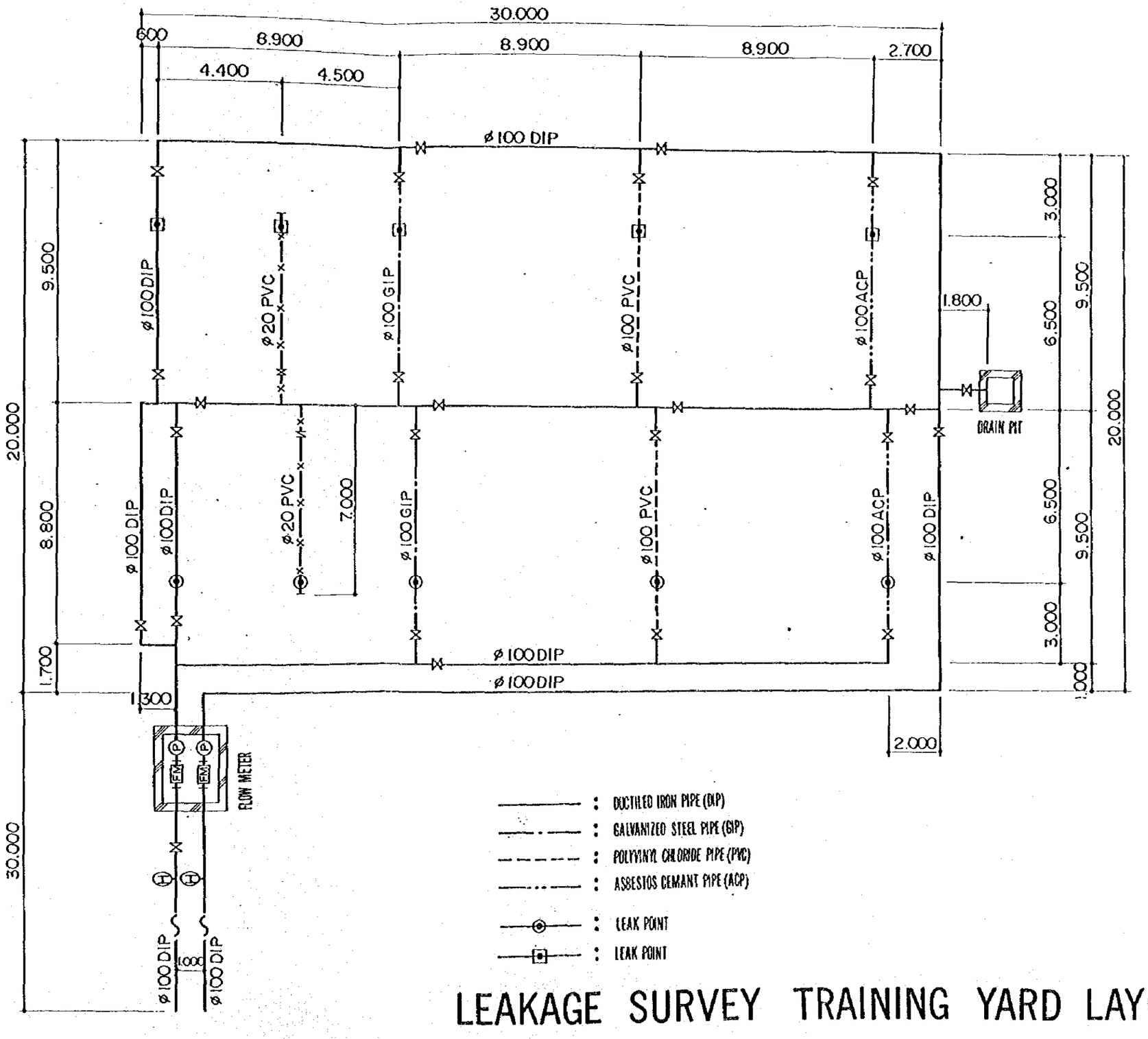


PUMP (A):
CENTRIFUGAL VOLUTE PUMP DRIVEN BY MOTOR
PUMP (B):
CENTRIFUGAL VOLUTE PUMP DO
CENTRIFUGAL VOLUTE PUMP DRIVEN BY ENGINE
PUMP (C): SUBMERSIBLE MOTOR PUMP

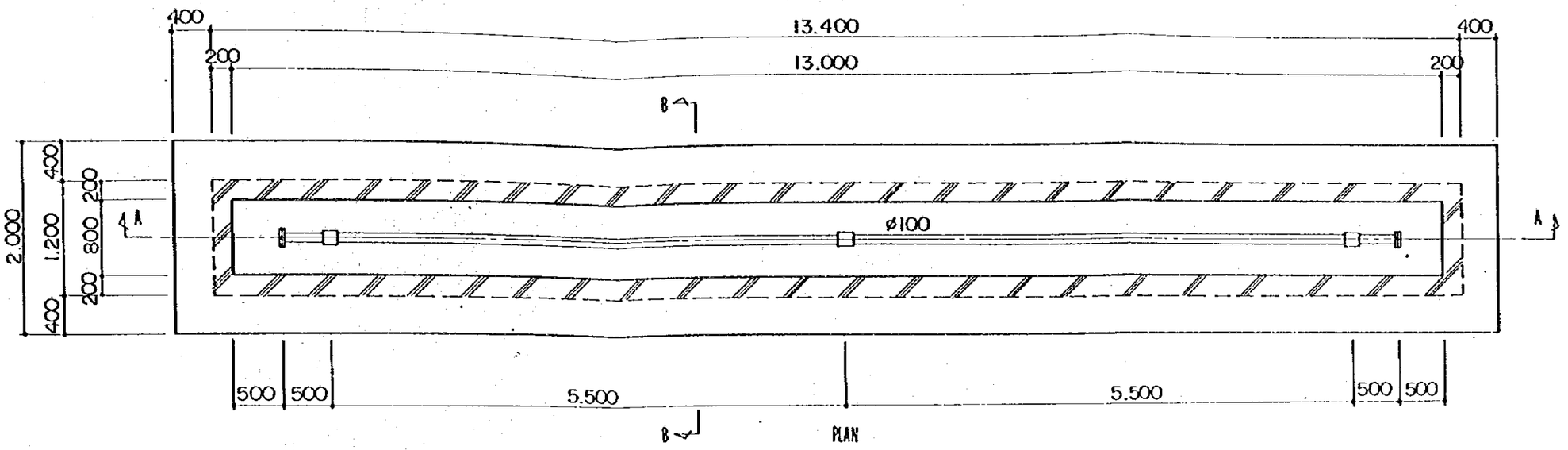
PUMP OPERATION TRAINING FACILITY FLOW DIAGRAM

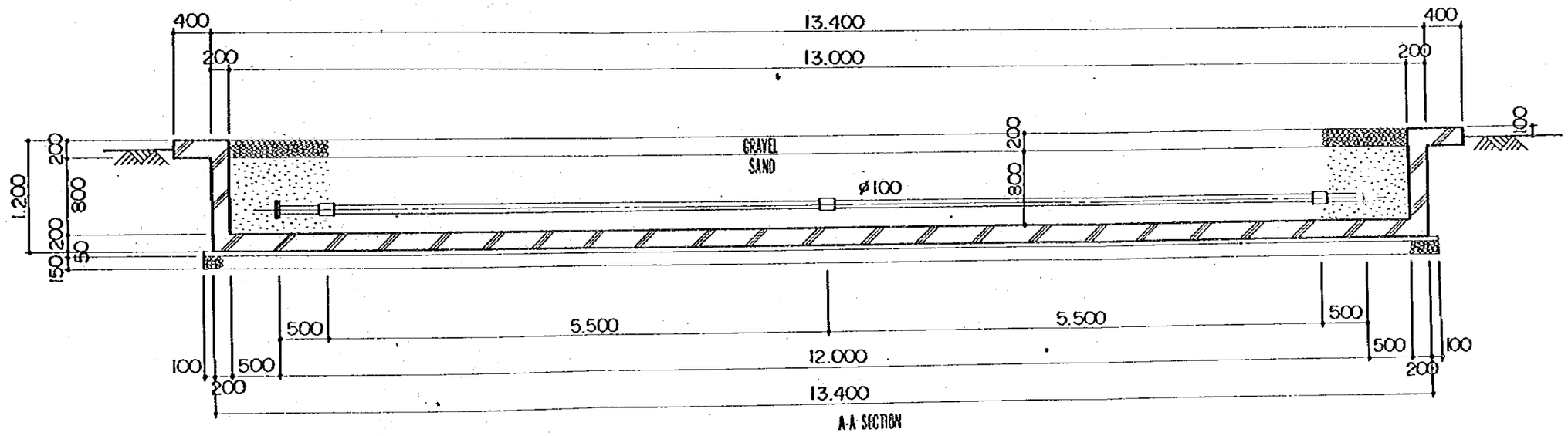


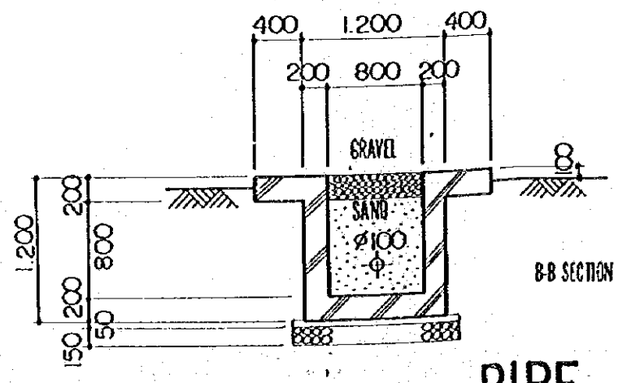
PUMP OPERATION TRAINING FACILITY LAYOUT PLAN S,:100



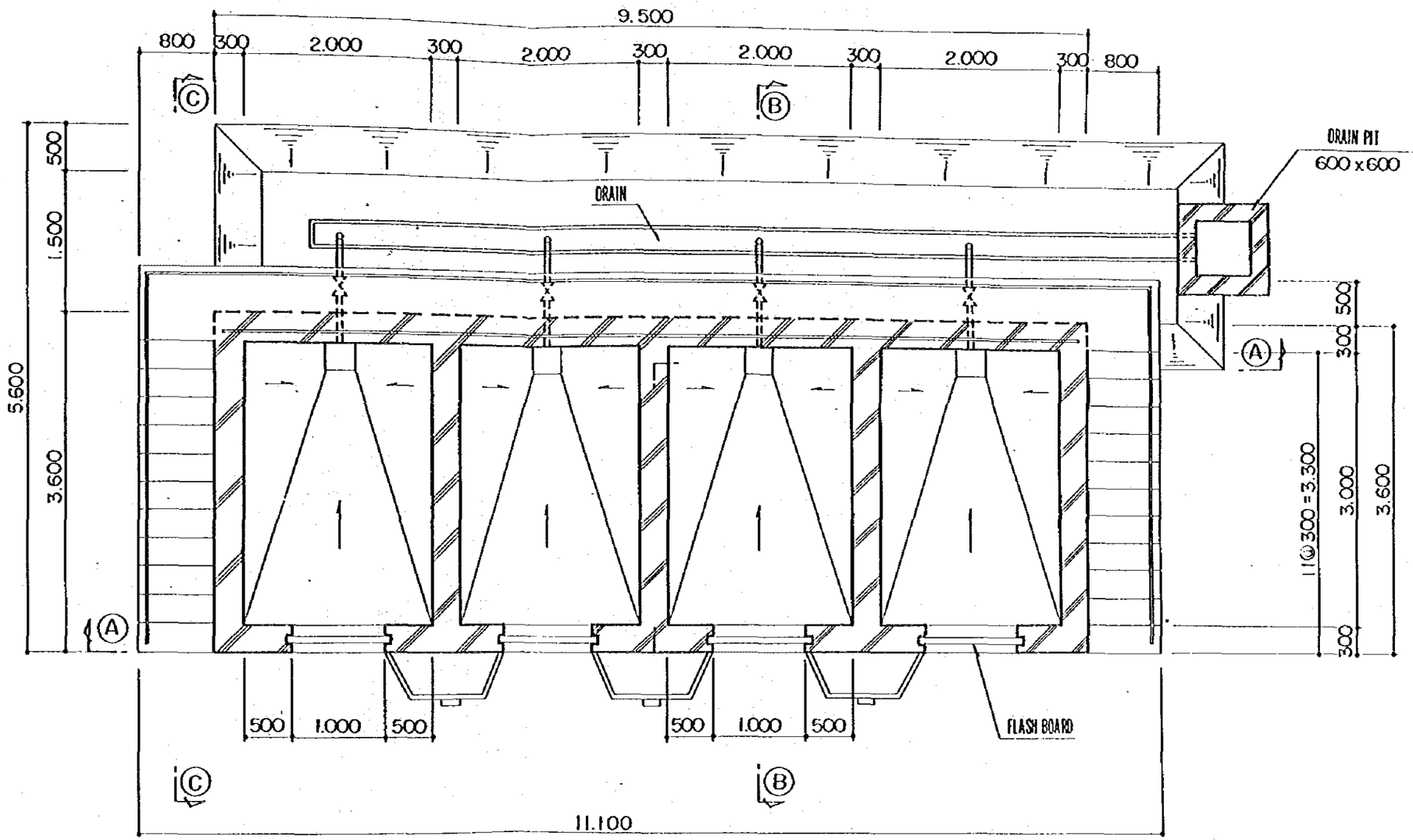
LEAKAGE SURVEY TRAINING YARD LAYOUT PLAN



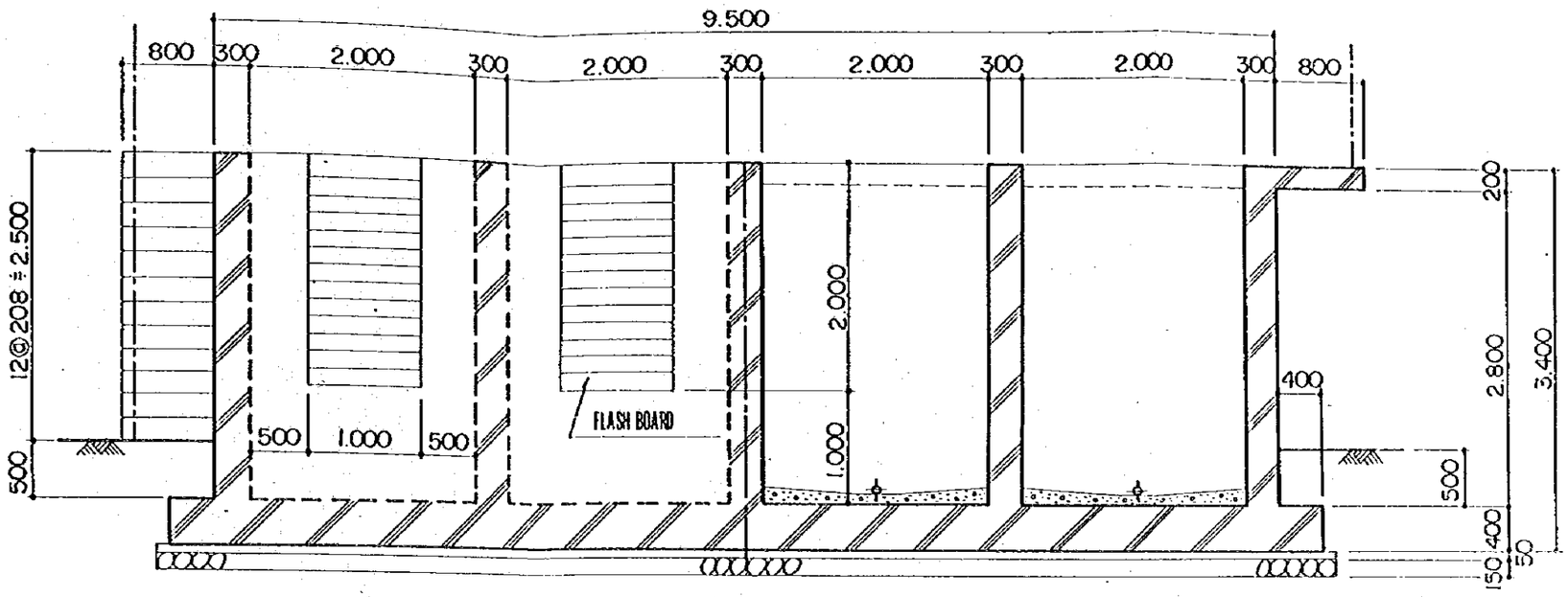




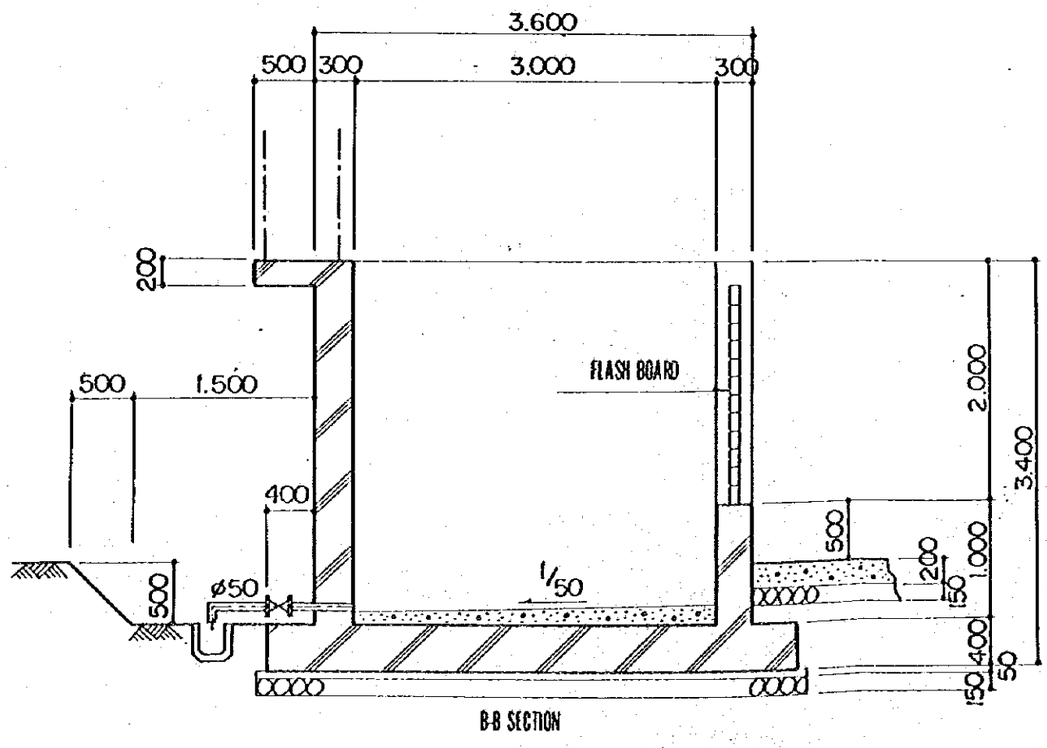
PIPE LAYING TRAINING YARD PLAN & SECTION S, 1:50



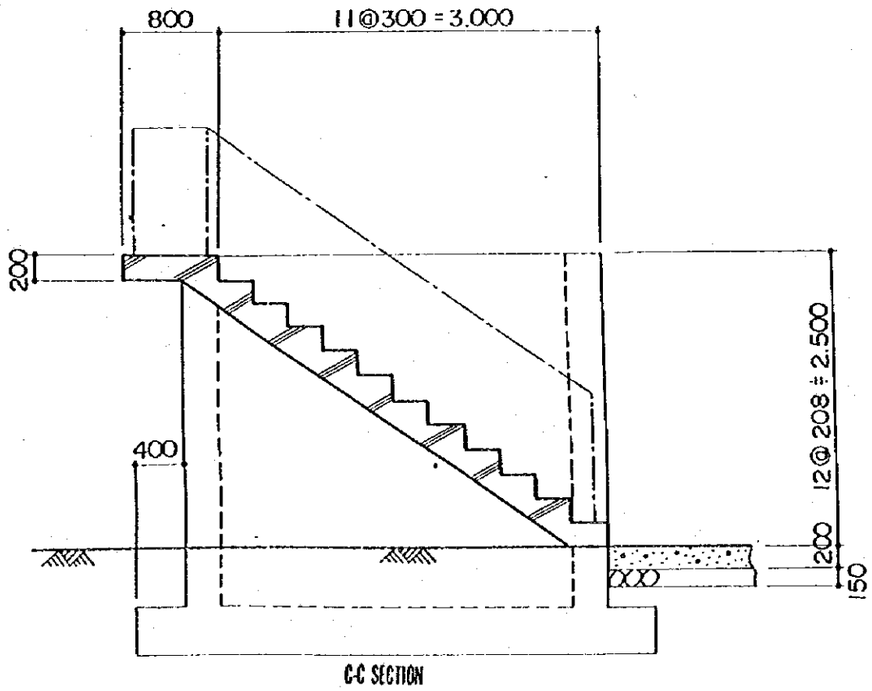
SANITARY LANDFILL EXPERIMENT PLANT PLAN S, 1:50



A-A SECTION



B-B SECTION



C-C SECTION

SANITARY LANDFILL EXPERIMENT PLANT SECTIONS S, 1:50