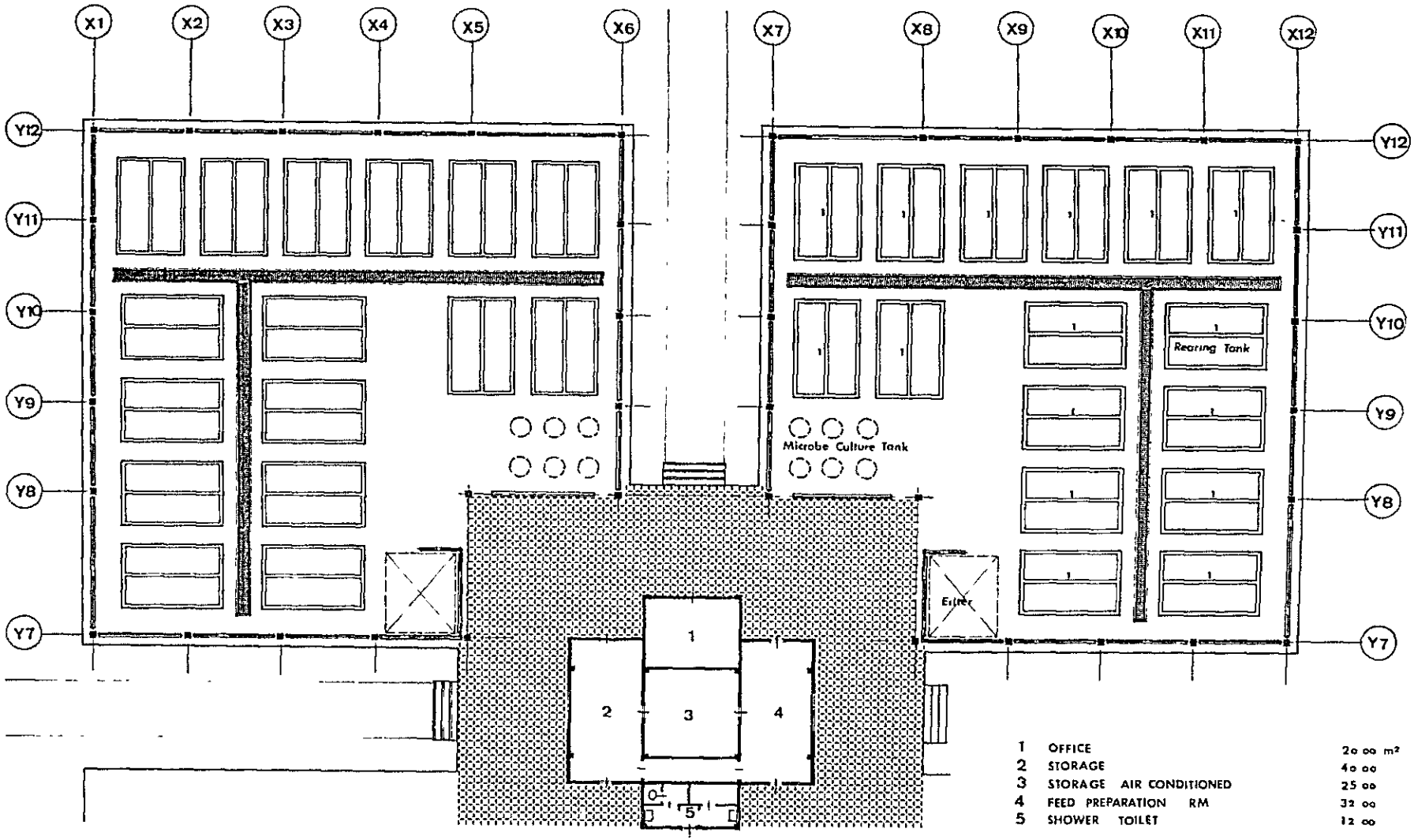
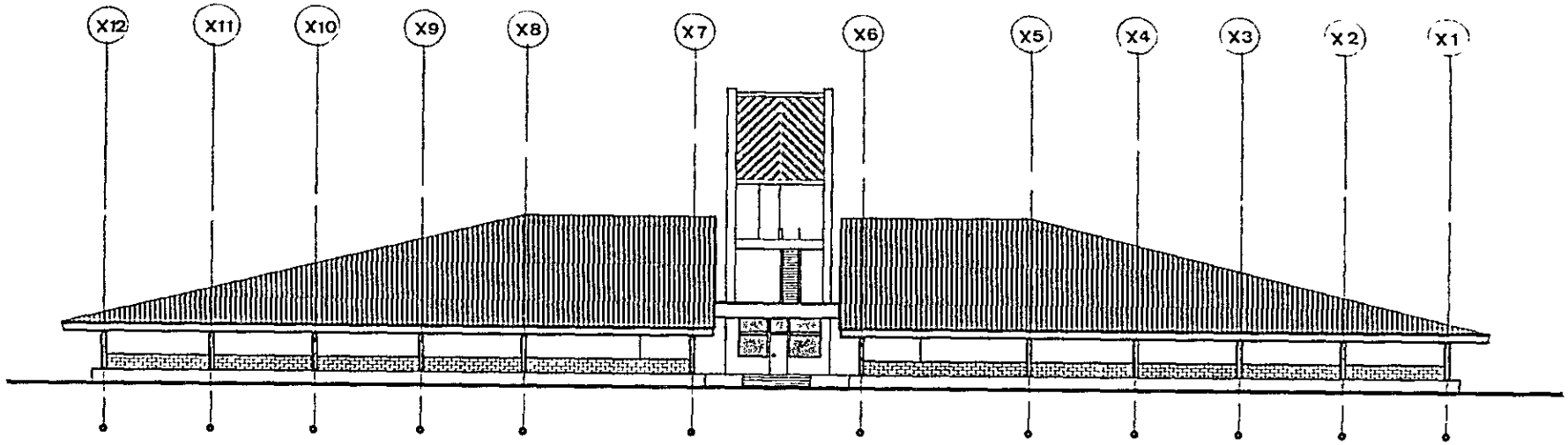
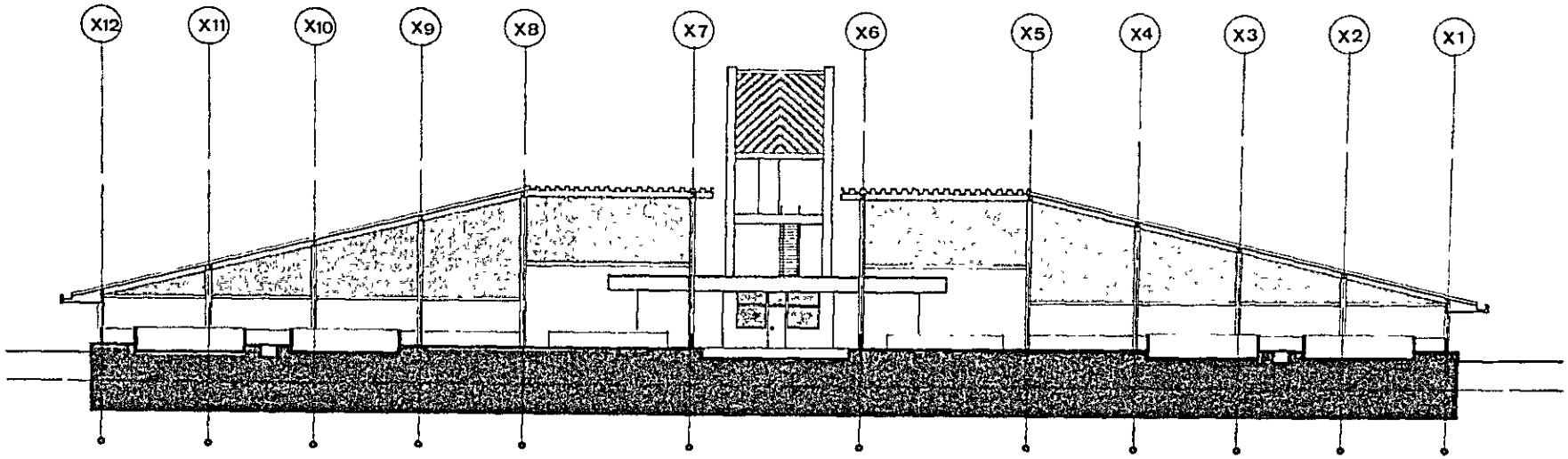


SEED PRODUCTION BLDG PART PLAN

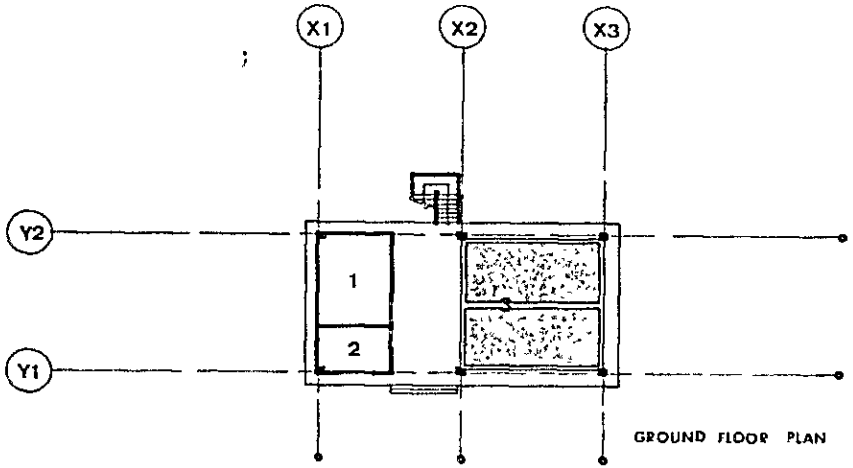


ELEVATION



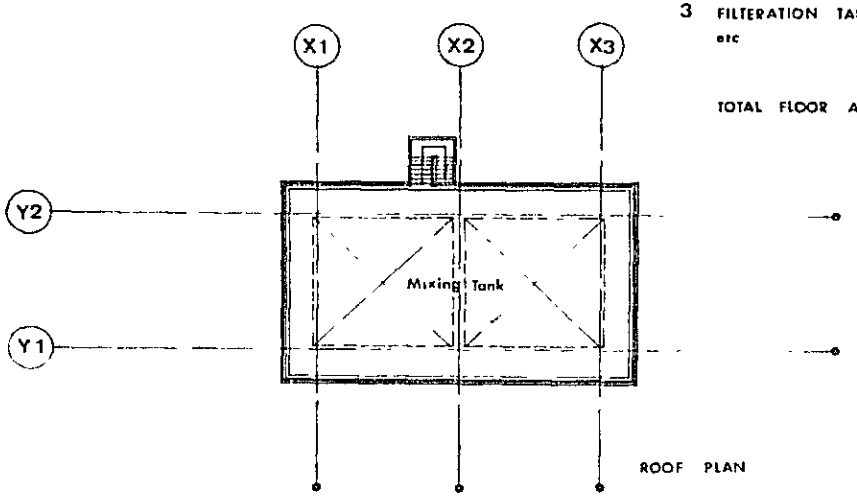
SECTION

SEED PRODUCTION BLDG ELEVATION & SECTION

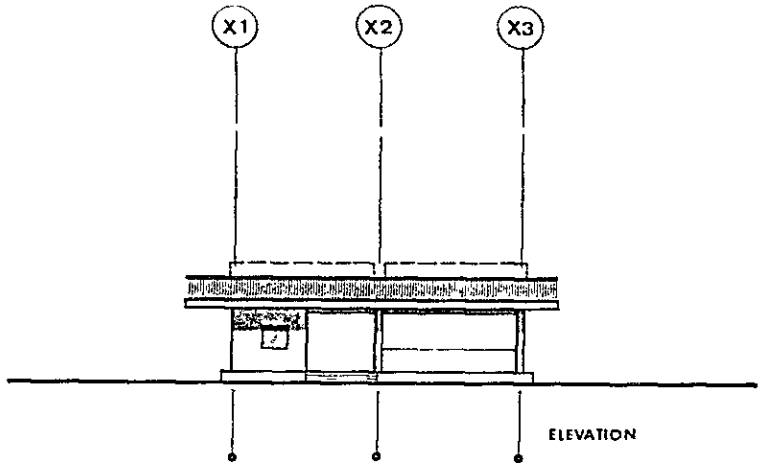


GROUND FLOOR PLAN

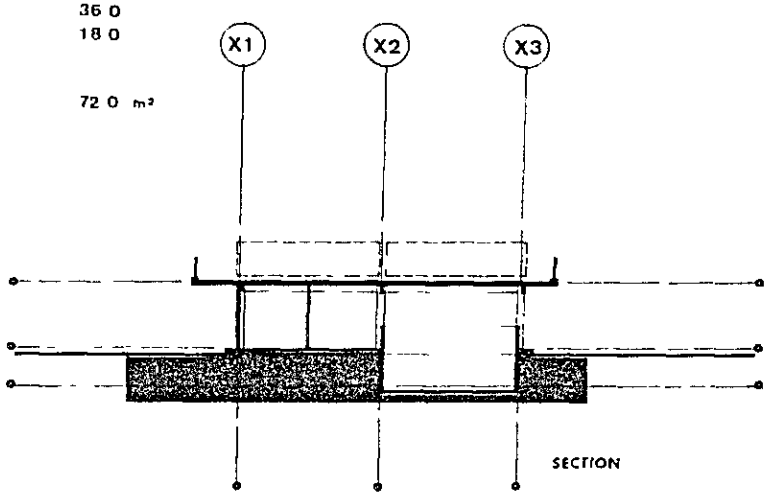
1	GENERATOR RM	12.0 m²
2	PUMP RM	6 0
3	FILTERATION TANK	36 0
	etc	18 0
	TOTAL FLOOR AREA	72 0 m²



ROOF PLAN

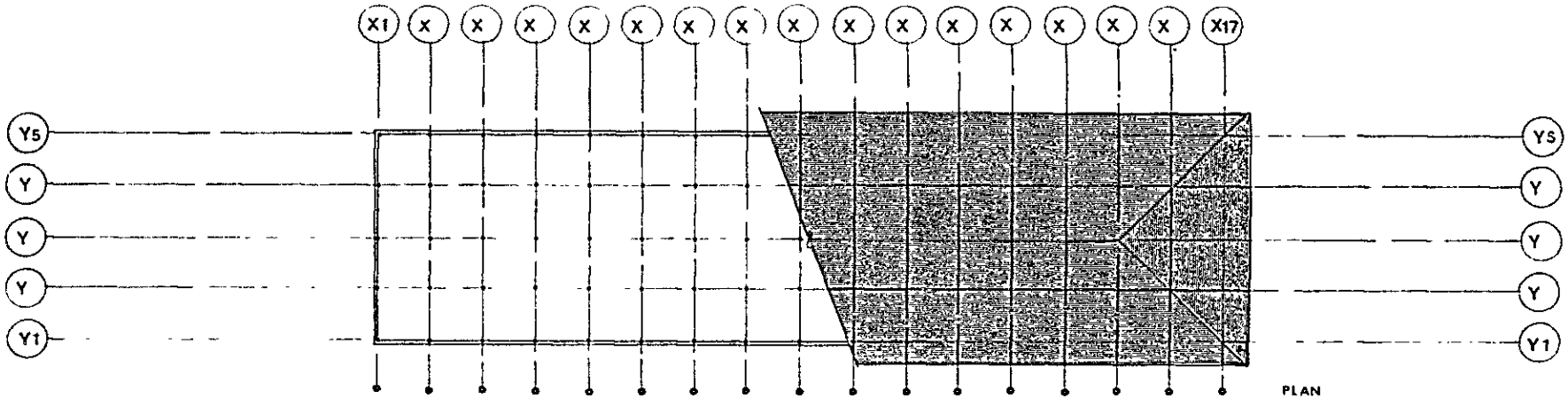


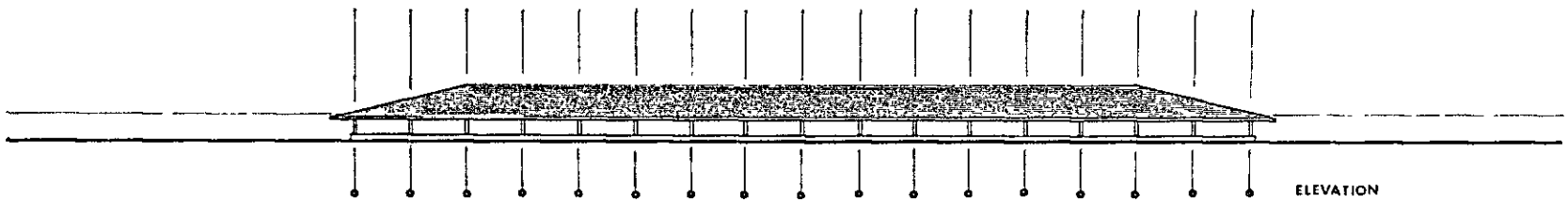
ELEVATION

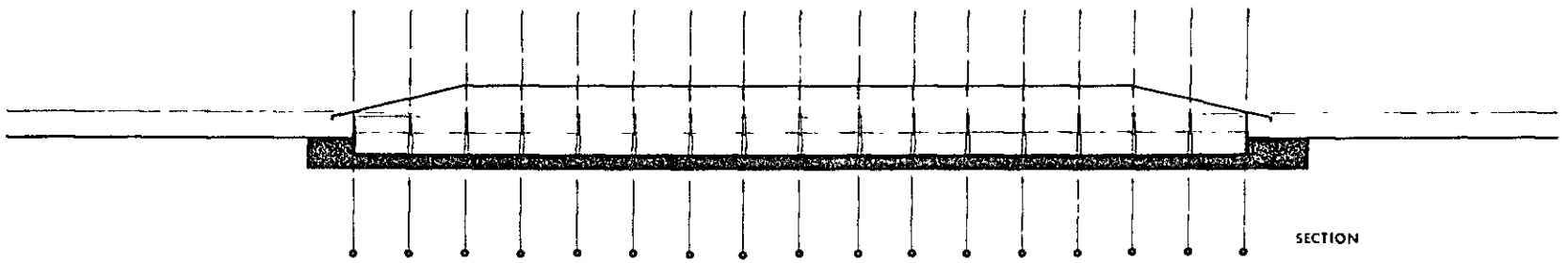


SECTION

MACHINE HOUSE **FLOOR PLAN , ELEVATION & SECTION**

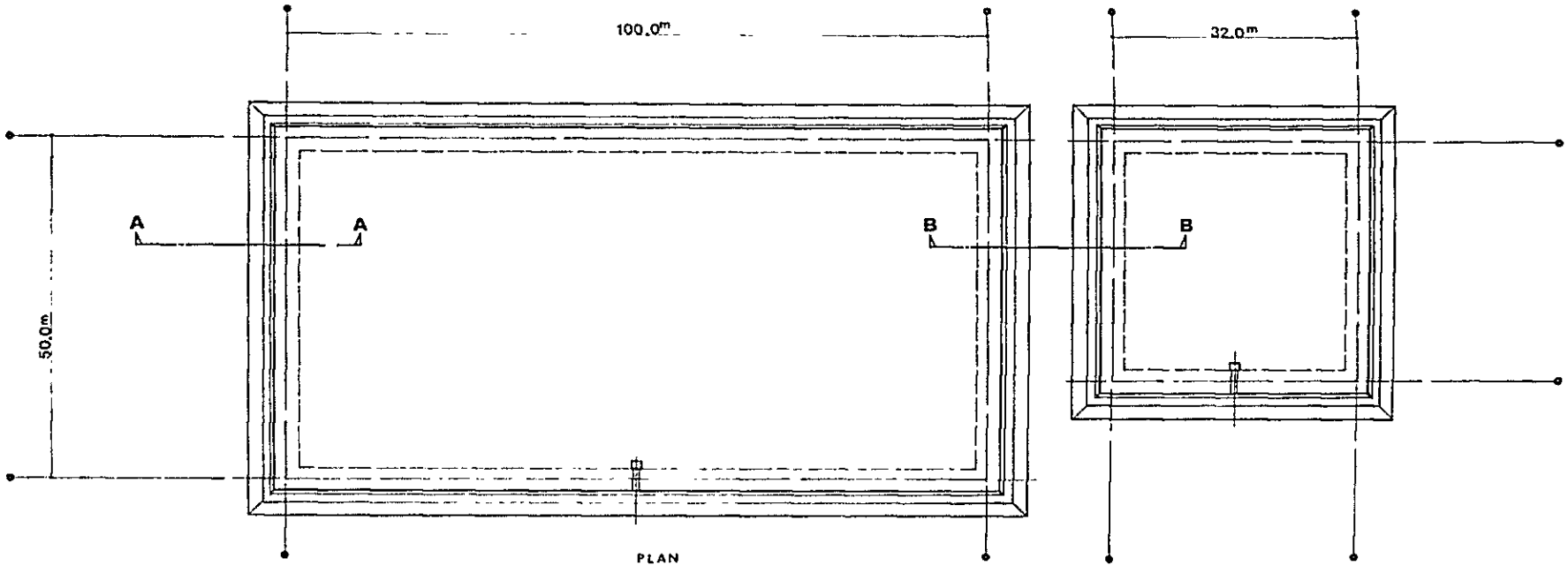


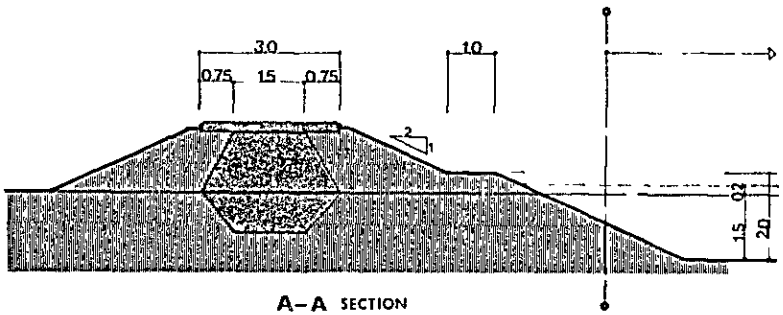


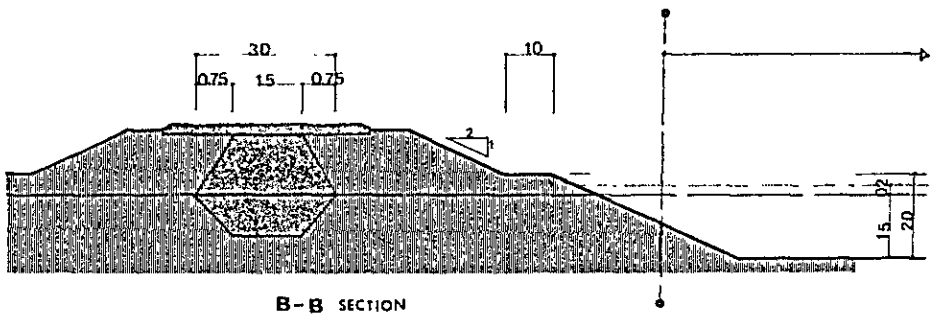


COVERED CONCRETE RESERVOIR PLAN , ELEVATION & SECTION

0 5 10 20m







BREEDER STOCK POND , BRACKISH & FRESHWATER RESERVOIR DETAIL

3-5 Project Scope and Executing Cost

(1) Project Scope

The subject Plan is to establish a Seed Production Center for freshwater prawn with 10 million seed output per year and to provide aqaculture equipment and materials by means of a grant-in-aid program of Japanese Government. The scope of the project will be as follows.

1. Site preparation for the seed production center.
2. Provision of electric distribution facilities to the site
3. Preparation of the exterior works
4. Construction of the seed production center
5. Provision of seed production research and aquaculture equipment and materials
6. Provision of other services required to implement or supervise the above.

(2) Responsibilities of the Burmese and Japanese Governments

1) The items to be carried out by the Burmese Government:

a) Removal of existing houses within the site and execution of site filling and leveling, and exterior works. (For filling details refer to Appendix (vi).

b) Provision of electricity to the facilities and installation of necessary equipment.

c) All costs relating to the customs clearance of construction materials and aquaculture equipment brought into Burma, payment of necessary duties and handling charges.

d) Exemption of taxes and levies to be imposed on Japanese nationals in Burma in connection with the supply of products and services.

e) Acquisition of permits, licences and other necessary documents required for the execution of the project and provision thereof to Japanese people concerned.

f) Proper management of operations and maintenance of the facilities as well as provision of a budget for furnitures and utensils for the facility.

2) The items to be born by Japanese Government

a) Provision of materials and services necessary for the construction of the facility.

b) Ocean shipment, inland transport, and insurance for the materials and equipment for the construction.

c) Consulting services related to detail design, tender evaluation and construction supervision.

(3) Estimated cost for the Burmese function

The following items will be the estimated cost for the functions to be shouldered by the Burmese side.

1) Filling and leveling of the site

$26{,}000\ m^3$ approx. x 2,000 yen / m^3 = 52,000,000 yen

(total volume) (incl. filling, transport and leveling)

2) Custom duties and other charges

200,000,000 yen x 50 % = 100,000,000 yen

(approx. CIF value) (Average duty)

3)	Furniture and utensile	1 lot	1,000,000 yen
4)	External construction work (gate, fence, etc)	1 lot	1,000,000 yen
	Total		154,000,000 yen

SECTION 4 PROJECT IMPLEMENTATION

4－1 Implementing Organization

As to be stipulated in the Exchange of Notes between our two countries, should this Plan be implemented, the PPFC, which is under the direct control of the Ministry of Livestock, Breeding and Fisheries, will be the organization with final responsibility for the entire project, from planning through implementation and operation.

The PPFC is headed by a chairman and is divided into 6 departments: Production, Finance, Planning and Budget, Pearl Culture, Marketing, and Administration and Provisioning.

Direct responsibility for planning, execution, and operation of this project will be exercised by the Aquaculture Section of the Production Department. However, during the construction phase, the Civil Engineering Section of the Planning and Budget Department will be responsible for checking and obtaining approvals of buildings and structures and other technical matters.

4－2 Construction Plan

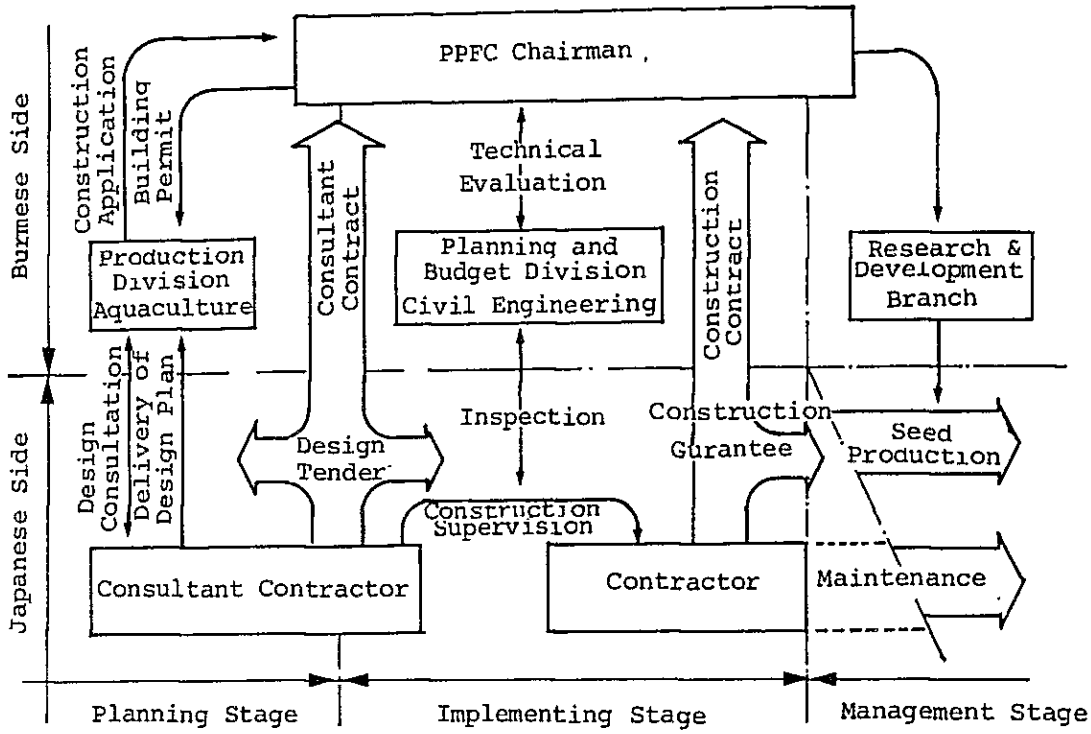
4－2－1 Methods

The methods that will be used for applications, permits, and tenders will be as shown below. Contracts for design and construction will be awarded by the PPFC to corporations of Japanese national.

Based on the detailed design prepared by the consultants, the Aquaculture Section will submit building permission, which will be approved following a technical evaluation by the Civil Engineering Section. Then, after establishing tender qualifications and making tenders, a construction contract will be signed.

The consultants will supervise the construction work from the outset and, upon completion, a completion check will be made in the presence

of the Civil Engineering Section, after which the facility will be turned over to the client. The relationships between the responsible Burmese organizations and the Japanese consultants and contractor are shown in the following chart.



4-2-2 Construction Plan

The construction program will involve buildings of 3,621 m^2 and the construction of reservoir and breeders stock ponds totaling 13,600 m^2.

(1) Building Construction:

It is anticipated that the sub-contractor for the construction project, who will supply both labor and local materials, will be the Construction Corporation. Judging by current conditions in Burma, the Construction Corporation is substantially the only contractor in the country available for this sort of work. The construction plan should be examined with this fact in mind.

With regard to the civil engineering part of the project, it will be necessary to give careful consideration to climatic

conditions in Burma. The peak of the construction work should take place during the dry season, with the rainy season period considered in effect as a period of preparation for the next dry season. The same consideration applies to the foundation work.

(2) Building Equipment

Building equipment is one of the most important part of this program. Particularly with reference to the water supply and drainage work, we estimate that, as compared with general construction projects, 3 - 5 times more piping will be required. Thus, considerable time must be taken in preparaing for shop drawings and processing materials.

A large quantity of supplies are expected to arrive on site at one time, so that a careful supervisory system will have to be worked out to allow for proper storage and control.

(3) Temporary Construction:

For temporary construction, the construction machinery belonging to the Construction Corporation will probably be used. However, since we do not expect that the necessary equipment will always be available, considerable effort must be given to obtaining such items in time.

With regard to items that are difficult to hire, it will be necessary to bring in the equipment from abroad, based on prior arrangements.

One of the special characteristics of the Burmese system is that, in many cases, ownership of any equipment brought into the country legally transfers to the government section that has contracted for the equipment. For this reason, if imports of construction machinery are too readily used, this can add greatly to project cost. Thus, equipment to be brought in for

this purpose, should be selected on the basis of a carefully designed temporary construction plan.

4-2-3 Supervisory Plan

In neither the civil engineering nor the building programs we feel that technical levels in Burma are particularly low in comparison with neighboring countries. Thus, the usual methods of supervision for overseas construction projects should be more than adequate. However, special care should be exercised for unfamiliar type of the construction work in Burma such as heavy steel framing. Above all supervisors must be deployed with a view toward assuring safety. As mentioned above, not only will the piping for this project be many times greater than that used in an ordinary building project but the construction will also involve materials brought in from Japan with which local workers may not be familar. For this reason, the key to smooth implementation of the construction program lies in the avoidance of confusion from these factors. At the same time, the smooth functioning of the water supply and drainage system will be an indispensable element in the operation of this type of facility. Thus, in order to assure good construction quality, it is necessary that construction supervision and technical guidance be provided by supervisors well versed in controlling the specifics of local operations.

4-3 Construction Phase

In this project, the construction of reservoirs and water intake facilities occupies a major part of the overall construction, including the Administration Lab Building and the Seed Production Building. For this reason, it is vital to pay special attention, in the progress plan, to climatic conditions.

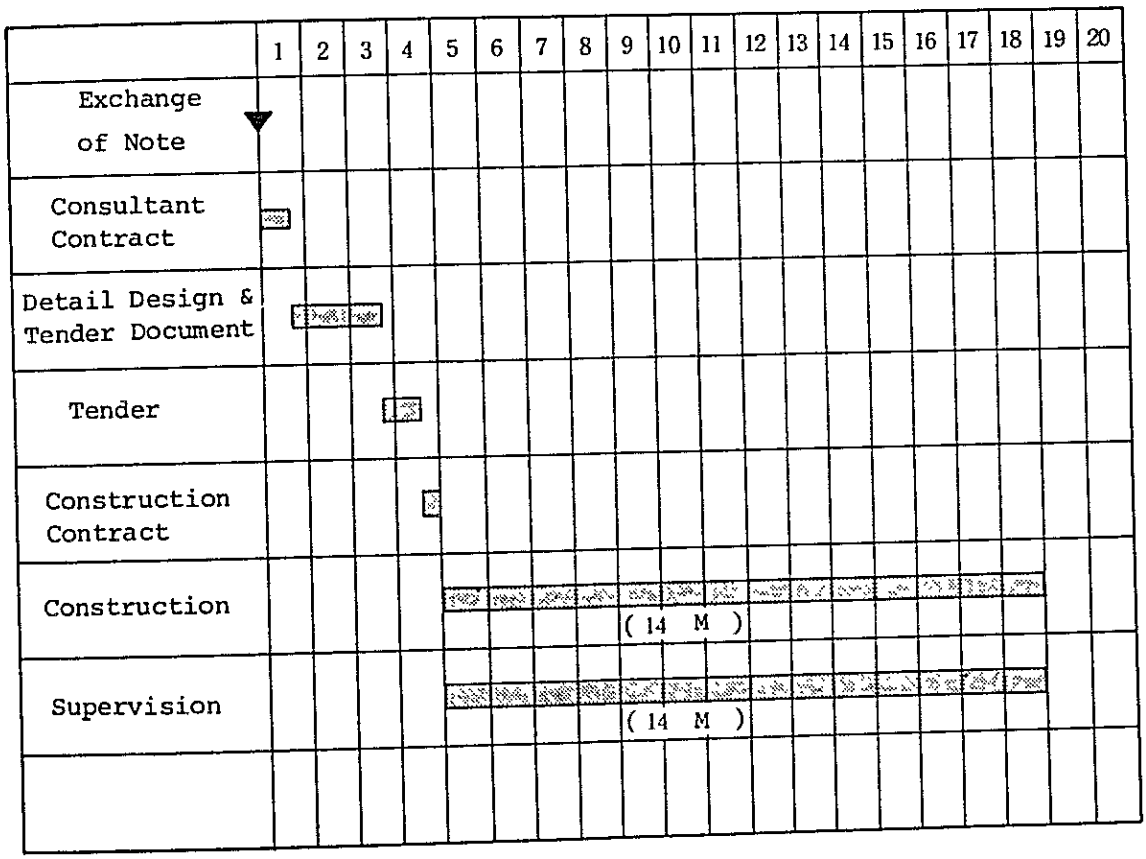
In the target area, the months from May to October usually correspond to the rainy season, during which period rainfall is considerable. The foundation work in the initial stages and the finishing work at the end are stages that are particularly susceptible to weather

conditions, and so it is highly desirable, from the standpoint of construction management, that the work be started and concluded during the dry season.

Considering the scale of the construction under this Plan, it would be difficult to complete the construction in just one dry season. We anticipate, therefore, that the construction will have to extend over 2 dry seasons, straddling one rainy season in between. It would be best, therefore, to plan on a 14-month construction period, starting as soon as the rainy season ends in November and finishing by January of the second year following the start of construction.

The following chart summarizes the construction schedule:

Project Progress Chart



4－4 Procurement of Materials

4－4－1 Materials to be Locally Procured

We anticipate that the Construction Corporation will be providing sand, gravel and other aggregate materials, the Ceramic Industries Corp. cement, brick, glass, and other ceramic materials, and the Timber Corporation, timber materials.

It is essential that orders for materials clearly specify specifications and quantities and allow ample time for delivery in accordance with the construction plan. There is a limit in Burma to the availability of core materials and secondary products so that, if construction is rushed and the plan is not carefully thought out, there could be considerable confusion in scheduling, with resulting delays and cost overruns. Thus, careful consideration must be given to the supply of materials from local sources.

4－4－2 Imported Materials

In this construction program, the bulk of the key materials will have to be sourced from Japan or third countries. Careful planning is required with regard to the methods of transporting these materials by sea and overland, and considerable lead time must be allowed.

(1) Ocean Shipment and Customs Clearance:

At present, 2 Japanese and 1 Burmese company provide scheduled shipping services from Japan to Burma, along with one company providing tramp service. As a total 1 - 2 shipping services can be expected every month.

The shipping time from Japan to Rangoon will depend on the number of stops en route; and can thus range from 15 - 50 days.

The organization responsible for port operations in Burma is the Burma Port Corporation. 15 - 20 days should be allowed for

unloading, customs clearance, and reshipment. Considerable advance liaison is required with the Burma Port Corp. with respect to the preparation of necessary documents and other customs procedures.

(2) Inland freight:

The agency in Burma that will provide inland transport services will be the Road Transport Corporation. Advance planning will be required to develop a transport plan specifying the deployment of truck trailers, items to be shipped, shape, weight, packaging, quantities, and shipping time.

The distance from Rangoon to the project site is about 7 km, about 30 minutes by motor vehicle. An adequate paved highway goes as far as the Thaketa Bridge, after which the road becomes asphalt or laterite surfaced, with an average width of 8 m. Road conditions present no problems except in the case of special oversized freight and items weighing over 20 tons.

4-4-3 Labor Supply

Local labor will be provided by the Construction Corporation. Based on our field survey, there appears to be an ample supply of labor at present in the Rangoon area, so that numbers pose no problem. However, in those parts of the construction work involving unfamiliar materials, or in the case of facilities requiring high construction accuracy, one cannot say that the quality of labor is entirely adequate.

Accordingly, in certain steel framing, piping, and electricl wiring, there is a need to establish, in close consultation with the contractor, a system whereby skilled technician can be brought in from Japan as necessary.

4-5 Operating Plan

4-5-1 Operating Program

The PPFC is the organization with operating responsibility for this facility.

The Aquaculture Section of the PPFC is responsible mainly for freshwater fish culture in ponds, which presently cover an area of 200 ha. With a loan from the Asian Development Bank, it has been putting a major effort into the expansion of culture farms and hatchery ponds as well as the propagation of cage culture. It has more recently entered the field of freshwater prawn cultivation which offers higher value-added products than other fish species and can utilize the technology and facilities of the existing fish farms.

The Research and Development Branch has, since 1979, when it completed a new facility at Thaketa, been devoting considerable energy to aquaculture research. Starting with giant freshwater prawn, for which, within a short period of time basic seed production technology was developed, this Branch has been spreading out into various areas, such as turtle, seaweed, earthworm and Artemia culture.

The PPFC Research and Development Branch presently employs 115 persons, of whom 13 are in administration, 46 are technical, and 56 general workers (including seasonal workers). 13 members of the staff are involved with the freshwater prawn program.

Priority in the supply of giant freshwater prawn seed, as produced at the subject seed production center, will be given to PPFC's own prawn culture farms at Hmawbi and Thanatpin. In addition, there are plans to supply seed to cooperatives and other ponds. On this basis, we must bear in mind that the facility will be more than just an internal arm of the PPFC; it will also possesses public service as a character. From this standpoint, in the operation of the facility,

attention should not be limited only to seed production technology but must be broadened to deal with technical development on a broad scale -- including intermediate nursery, aquaculture management, harvesting methods, and secondary processing methods at harvest site.

Fortunately, the project site for the center at Thaleta is located only about 1.5 km from the Research and Development Branch of PPFC and so can be operated in close association with this group.

The supervisory technicians needed to operate the center are to be dispatched from the PPFC R & D Branch. In addition, new skilled and unskilled works as well as office staff will have to be employed. Given the fact that the location is within the Rangoon metropolitan area, no problems are expected in recruiting staff.

The PPFC R & D Branch has, for the past 3 years, been involved in the development of seed production technology for giant freshwater prawn. During this period, it has gradually developed technicians well versed in seed production. In addition, starting this year, a new freshwater prawn cultivation training course has been established within the R & D Branch, using trained technicians as lectures. Thus, even assuming that no technical cooperation is received from abroad, the center should be able to function autonomously through the PPFC Aquaculture and R & D Sections.

4-5-2 Personnel Plan

The personnel required for this Plan may be divided into: 1) technicians directly concerned with seed production; 2) mechanic and electrician for facility maintenance; and 3) other office and administrative staff.

The production system at the center will utilize 128 rearing tanks, with the number of seed production technicians basically depending

on the number of working hours needed to supervise the tanks.

The supervisory operations for the tanks during the rearing period involve feeding, change of water, and cleaning. Assuming that these operations require 30 minutes per day per tank, the time requirement comes to 64 hours per day for the 128 tanks. At a net 6-hour working per day, some 11 technicians would be required. If we add to this rotation personnel, a senior technician and an assistant to supervise the overall operation, a total of about 17 technicians would be required.

For maintenance of the facility, daily checks and repairs can be handled by one electrician and one mechanic.

In addition to 2 general office workers, 4 persons whould be needed for transportation and security.

The above requirements may be summarized as follows:

Division	Type of Work	No. of Persons
Seed Production	Supervisory technicians (to serve also as Director and Assistant Director of the Center)	2
	Skilled workers	4
	Ordinary workers	11
Office and Administration	Office staff	2
	Maintenance technicians:	
	... electrician	1
	... mechanic	1
	Drivers	2
	Guards	2
Total		25

4-5-3 Maintenance and Repair Expense

The purpose of the management plan is to calculate the working capital requirements to maintain seed production activity at a level in accordance with the original goal of the subject center and permit the appropriation of a budget.

The capital required to operate the seed production center may be divided into --

1. Utilities (power and fuel)
2. Feed for seed production
3. Labor
4. Maintenance

We have estimated below the budgetary requirements for the designated categories, based on the seed production plan.

(1) Utilities:

1) Power:

Power cost is the biggest element in the utility budget. Annual power requirements for seed production and facility operations are as shown below:

Annual Power Requirement

Equipment	Capacity (Kw)	Demand Factor	Total Operating Hour	Operating Days per Year	Total (KWH)
Water Pump (Brackish water)	3.7	-	67.2 x 2	-	497.28
(Freshwater)	1.5	-	67.2 x 2		
(")	1.5	-	201.6 x 2		
(")	1.5	-	155.2 x 2		
(Mixed water)	1.5	-	155.2 x 2		
("	0.75	-	6	40	180
Air Blower	3.7 x 4	0.5	24	124	22,o22.4
Compressor for Well	0.75	0.5	3	260	292.5
Refrigerator	3.6	0.5	24	365	15,768
Cooler (for lab)	2.6	0.3	24	365	6,832.8
Cooler (for feed storage)	2.6	0.3	24	150	2,808
Fan	2	-	6 x 0.8	260	2,496
Feed Preparation Equipment	10	-	6 x 0.3	260	4,680
Lighting & Outlet	27	0.7	6 x 0.3	260	8,845.2
Total					66,159.78

From the above, the total power requirements come to 66,160 KwH per year. As of June, 1983, the rates of the Power Corporation were ¥5.1 /kwH for consumption of 48,000 kw/ month or less (i.e., commercial and industrial rate).

Thus, power costs per year come to:

66,160 kwh x 5.1 yen = 337,416 yen/year ≒ 337,500 yen

We estimate that there will, in practice, be occasional power stoppages from the regular power service and that, for considerable periods of time, the emergency generator will have to be used. But, we figure that the fuel cost of operating the generator would just about offset the servings on power charges during down periods. Thus, we have not figured generator usage in our calculations.

2) Fuel Costs

Electricity can be principally used to boil drinking water, so we do not contemplate using gas for this project. Thus, the fuel costs, as estimated here, are only for light grade oil for the pumps used with the water intake.

The amount of water intake required for the 2 cycles per year of seed production comes to 21,408 m^3 for breeding and a supplementary 20,000 m^3 to cover loss -- for a total of 41,408 m^3. From this, we may calculate, as follows, the hours of pump operation and the resulting fuel requirements:

Water intake	41,408 m^3 ≒ 41,500 m^3
Total pump capacity	120 m^3/hr.
Fuel consumption ratio	1.62 ltr/hr.
Start-up losses	anticipated at 20%
Fuel consumption	41,500 ÷ 120 x 1.62 x 1.2 ≒ 672 ltr/year

As of June, 1983, the unit cost of light oil in Burma was ¥20 per liter. On this basis, fuel costs work out to:

672 ltr. x 20 yen = 13,440 yen/year

Total utility costs then will come to ¥350,940.

(2) Feed Costs for Seed Production:

Annual feed requirements for the production of 10 million seed may be anticipated as follows:

1) Brine shrimp eggs --

This is an essential feed ingredient for the hatching to post-larva stage. In Burma, this can be obtained from U.S. and other sources. The current price of a 365 g can from the

U.S. is about ¥6,000.

Required volume 70 kg
Unit cost 16,070 yen/kg
70 kg x 16,070 yen = 1,124,900 yen

2) Formula feed --
Also used along with brine shrimp eggs during the hatching to post larva stage --

Required volume 750 kg
Unit cost 300 yen/kg
750 kg x 300 yen = 225,000 yen

3) Dried shrimp meal; dried fish meal --
Used from post-larva to seed size

Required volume 300 kg
Unit cost 1,320 yen
300 kg x 1,320 yen = 296,000 yen

Accordingly, total feed costs will come to ¥1,745,900/year.

(3) Labor Costs

Labor costs for seed production, management, and office staff may be estimated as follows:

Labor Costs (Kyat/month)

Division	Type of Work	No. of Persons	Wage	Total Cost
Seed Production	Supervisory engineer (to serve also as Director)	2	600	1,200
	Skilled workers	4	400	1,600
	Ordinary workers	11	250	2,750
Office and Administration	Office staff	2	350	700
	Maintenance technicians ... Electrician	1	750	750
	Maintenance technicians ... Mechanic	1	350	350
	Drivers	2	400	800
	Guards	2	300	600
Total		25	-	8,750/mon.

Total labor cost per year will be:

8,750 kyat x 12 months x ¥30 per kyat = ¥3,150,000/year

(4) Maintenance:

In order to efficiently utilize the planned center, a maintenance program must be prepared to provide for periodic checks on equipment and effective, timely repairs before any serious damage can develop. With particular regard to the water supply and drainage facilities, following the shipment of seed at the conclusion of one cycle and prior to the start of the next cycle, regular inspections should, in principle, be made to detect defects before they become serious and prevent accidents or breakdown during the seed production process.

The maintenance budget can be estimated as follows:

For facilities: Facility maintenance will include programmed maintenance at regular intervals and spot maintenance. Combining both types, we can set up an annual reserve of 0.5% of total construction cost = ¥2,665,000

For equipment: As in the case of the buildings, a maintenance reserve will be established at 1% of original equipment cost, or -- ¥250,000

Thus, the total maintenance budget will come to ¥2,915,000/year.

Consolidating the various cost components, we have the followings:

Category	Amount (¥)
(1) Utilities	¥350,940
(2) Feed for seed production	¥1,745,900
(3) Labor	¥3,150,000
(4) Maintenance	¥2,915,000
TOTAL	¥8,161,840

SECTION 5 PROJECT EVALUATION

The Seed Production Center at Thaketa, the main facility in this Plan will belong to the PPFC after its establishment and will be independently operated with the financial and personnel resources of this organization. However, the facility will not just supply seed for PPFC prawn culture farms; it will also sell seed to ponds owned by cooperatives and others. The ultimate objective of the project is to develop prawn culture in Burma and export high value-added products, thereby earning foreign exchange.

When this facility is completed, the PPFC will be able to offer ideal on-the-job training to graduates of its training course on prawn culture, which has begun this year. In addition, based on the guidance and training in freshwater prawn culture that these technicians can give to both cooperative and other culture farms, it will be possible to greatly improve the production structure, integrating it from seed production to distribution. The project can, accordingly, be expected to play a major role in the attainment of the ultimate objectives, as above noted.

In view of the above factors, there is probably ample justification, from a national economic perspective, for this facility to depend in part on financial support from the PPFC. But, if the facility can become financially independent, the project will become much more advantageous.

We shall first make an evaluation as to whether the cost level of the seed to be produced in the subject facility is justified in terms of the objective of developing the cultivation of giant freshwater prawn and then consider the project in terms of whether its operating and maintenance costs and technlogical requirements can be covered by the PPFC.

5-1 Seed Production Cost

The annual operating budget required to produce 10 million seed a year at the subject facility, as outlined in Section 4-5-3 , will be as follows:

Power and fuel	11,250 kyat
Feed (Brine shrimp eggs and other)	58,200 kyat
Payrool (25 employees)	105,000 kyat
Maintenance	92,500 kyat
Total	267,400 kyat

Depreciation on buildings and facilities should be calculated and added to the above operating costs.

Wooden and brick structures, the most common type of construction in Burma, are depreciated over a 20-year life. However, depreciation rates are not clear for steel frame construction, the type specified for this facility.

We have calculated the useful life of the various components in this facility on the bases of 'the Useful Life of Depreciable Assets' (Revised, March, 1981), as published by the Japanese Ministry of Finance.

The main structures in the facility may be broken down into four groups: buildings, concrete ponds and other concrete structures; earthen structures (such as the earthen ponds); and other materials and equipment. The useful life of each type of structure, based on the Japanese guidelines, is as follows:

Useful Life

Structure/Use	Particulars	Useful Life (years)
Steel frame construction with thickness of main frame exceeds 4 mm	For use in fish markets or for livestock use	35
Earthen structures	Water supply and reservoir	30
Concrete structures	- ditto -	40
Production facilities for edible marine products; fishing equipment; tractors and internal combustion engines for agriculture and forestry use		8

The depreciation cost per annum is thus calculated as follows.

Depriciation

Buildings	441,000 kyat
Concrete Structures	32,400
Earthen Structure	127,000
Equipment	87,600
Total	688,000 kyat

Incorporating the above depreciation costs, the total annual operating budget for the facility comes to 955,400 kyat. Based on a production of 10 million shrimp seed per year, an average cost of 9.55 pyas per seed is indicated.

5-2 Appropriateness of the Seed Production Cost

In order to make the facility financially independent, it must clearly be able to recover the production cost of about 9.55 pyas per seed. If seed price is set at seed production cost, we must examine whether or not, on the basis of this price, an economic surplus is assured from purchases of seed and the cultivation of

giant freshwater prawn under current market conditions in Burma. The results of this analysis are given in Appendix (xiii). Even in the case of a non-intensive cultivation, as used in small-scale family operations on ponds of only o.5 ha, the likelihood of earning some 1,500 kyat over a 10-month cultivation cycle has been fully validated. In this analysis there are some optimistic estimates in feed costs and growth rate. In the meantime, however, expected selling price of 10 kyat/kg is equivalent to the estimated prices at which freshwater prawn is presently being bought at sub collection station in PPFC's prawn collection operations in the Irawaddy Delta. In these operations, the prawn must be taken from the sub-station to the main station, where it is packed in ice for transport by vessel to Rangoon. Accordingly, a minimum of 48 hours is required to transport the prawn from the catch point to the processing plant.

Cultured prawn that can be deliverdd from a pond in the Rangoon area will be in an extremely advantageous position from the standpoint of transportation and preservation costs, so that it can be expected that much better prices will in practice be obtainable for the cultivated freshwater prawn.

In seed prices, obviously the cheaper the better. We cannot conclude here that a price of 9.55 pyas per piece is the most appropriate price, but it has been shown that it is possible for a non-intensive operation to be viable even at this price level. The seed to be produced under this Plan can not only be distributed to the PPFC culture farms but to other culture farms as well. In addition, by virture of experimentation and research using the aquaculture equipment to be provided under this Plan, we expect to see the development of a more effective technology for freshwater prawn cultivation. The project may therefore be deemed to be extremely useful from a national economic standpoint.

Under the planned seed production method, there are to be 2 production cycles a year of 5 million seed each. This can be increased to 2.5 - 3 cycles a year and, from this standpoint, an effort will be required to boost productivity and lower seed prices.

In the case of Kuruma prawn seed production, which is widely diffused throughout Japan, the average price per seed in 1983 at the 20th day after post-larva is 2.3 yen (about 7.7 pyas). Of course, in the case of the Japanese prawn seed, since this is intended for release into the natural environment, it is produced at very low cost. Nevertheless, even based on a comparison with Kuruma prawns, there certainly appears to be room for reducing the production cost of giant freshwater prawn seed in Burma.

The production of giant freshwater prawn seed is technically more difficult than that of carp-family fish, such as Labeo rohita and Cyprinus Carpio, as presently being carried out in Burma. One cannot expect for the time being that the prawn culture ponds will become self-sufficient in seed supply, as in the case of these freshwater fish species. The giant freshwater prawn, in particular, requires brackish water for its cultivation and so a certain level of facility scale and production technology becomes indispensable. The subject facility takes on major significance from this standpoint as well.

5-3 Appropriateness of Facility Operations

The subject facility will be operated by the PPFC. We now examine whether there are any problems in obtaining the requisite funding or personnel for this operation.

In order to carry out a production program of 10 million shrimp seed a year in this facility, it has been estimated that an annual budget of about 955,400 kyat will be required. These costs are to be recovered by distributing the seed at a price of 9.55 pyas per piece. Thus, the outlook is that the facility can become independently viable over the long term.

However, even if, production should fail for some reason to meet target, or should there develop a distortion in demand patterns, we cannot deny the possibility in such an eventuality of PPFC itself being called upon to provide temporary funding for the operation.

PPFC has a fishing fleet totaling 14,500 G/T as well as ice-making and refrigeration facilities. It also has a staff of some 2,000 employees to manage and operate these vessels and facilities, while its annual operating budget is estimated to run some 500 million kyat. Thus, based on the sheer size of its overall operations, we cannot anticipate any problems in the event of a call for emergency funding under the above circumstances.

As to the seed production technicians required for operation, senior staff of the PPFC Research and Development Branch, with extensive practical experience in the experimental production of giant freshwater prawn seed, are to be assigned as responsible supervisors to the operation, so that few problems are likely to be encountered. However, in the future, should the number of seed production centers or culture ponds increase, there is a danger that the present staff from the freshwater prawn program will no longer be able to service the expanded facilities.

The PPFC has established an advanced course in giant freshwater prawn cultivation with a view toward developing technical personnel trained in seed production and cultivation, based on the relatively high level of fish culture technology that has already been established.

Twenty persons have been selected from among qualified candidates -- all of whom are college graduates with at least two years practical experience in aquaculture. These students are receiving a concentrated 3-week training course at the Thaketa Research Station. The first such course was given in June, 1983.

In the future, when the seed production centers at Kyauktan and Thaketa are in operation, we anticipate a marked increase in opportunities for on-the-job training. This program should, therefore, be highly significant in a social sense in helping to raise the technical levels of freshwater prawn cultivation in Burma.

Based on the above, we conclude that there is every likelihood of obtaining the requisite funding and technical personnel to run the subject facility. We judge, therefore, that the facility can be operated in a suitable manner so as to realize the objectives of the Plan.

SECTION 6 CONCLUSION AND RECOMMENDATION

(1) Conclusions:

PPFC's program for freshwater prawn cultivation has been inaugurated with the construction of a seed production center at Kyauktan, with an annual production capacity of 2.5 million seed, and culture ponds of 20 ha each at Thantpin and Hmawbi. It is clear, however, that the supply of 2.5 million seed will not be able to satisfy the present demand for giant freshwater prawn seed in Burma.

Given this situation, we have prepared this Basic Design for a seed production center at Thaketa, with a planned production capacity of 10 million seed, in line with the PPFC Program.

As a result, it will be possible for seed to be supplied not only to the PPFC prawn culture ponds but also to existing fish ponds and ponds owned by various cooperatives. In addition, when the facility becomes operational, it will provide a place for giving on-the-job training to many technicians. And by utilizing the aquaculture equipment included in this Plan, the way should be opened to increase the efficiency of aquaculture production in future years. It has been demonstrated that the project has great significance from the standpoint of the national economy and that there is economic justification for implementing the subject Plan.

Since, in the production of giant freshwater prawn, both fresh and brackish water are required, the logistical conditions for the facility are quite circumscribed. At the proposed site for Thaketa seed production center under this Plan, primary reliance in water intake will be placed on the Pegu River, on which the site fronts. It is anticipated that, during the dry season (January - May), it will be possible at peak tides to obtain concentrated brackish water with a top salinity of 19 ppt.

By building reservoirs for fresh and brackish water, the facility has been designed to permit operation during periods when water cannot be taken from the river. In this way, there should be no technical problems in achieving an annual production of 10 million seed, divided into 2 production cycles of 5 million seed each, using existing levels of technloogy.

It is planned that the PPFC will operate the seed production center. The anticipated annual operating budget, including depreciation of the buildings and failities, has been estimated at 955,400 kyat (about ¥28,662,000). It has been made clear that, if the seed is distributed at a price of 10 pyas per piece, all operating costs, including those for administration and maintenance, can be recovered and the facility made independently viable.

As to the seed production technicians, who hold the key to facility operation, it is planned to assign to the center two senior technicians among the 13 persons attached to the PPFC Research and Development Branch who have been in charge of the giant freshwater prawn experimental research program. We do not, therefore, anticipate any personnel problems.

The seed that is to be produced will be distributed not only to PPFC culture farm but also to cooperative-owned ponds and, when production permits, to other culture ponds as well. PPFC plans to purchase the final product of these culture farms and process and export them.

In the PPFC collection system for freshwater prawn that are presently being carried out in the Irrawaddy Delta area, we estimated that purchases were being made at 16 kyat per piece. Even assuming that this will be the price at which the cultured prawn will be bought (and the price could well be higher), we can conclude that the culture farm operations will be viable at this price level. The findings also show that considerable economic benefits can be expected from the standpoint of transport and preservation costs in bringing the prawn to the Rangoon

processing plant. Based on these considerations, we have concluded that implementation of the Plan is certainly justified.

The share of giant freshwater prawn in Burma's fishing exports is quite high. In terms of promoting the development of exports using domestic resources, which is one of the objectives of the current Fourth Four-Year Plan, we believe that the PPFC Program to cultivate giant freshwater prawn will bring major benefits with a relatively small investment.

It is clear that the establishment of the seed production center will contribute to the development of freshwater prawn cultivation and technological progress in this industry field, thereby helping in a major way to realized the above goal. There is, accordingly, considerable significance in the Government of Japan extending cooperation in the form of a grant-in-aid for this project. We feel that it is highly desirable that the subject project be speedily implemented.

(2) Recommendations:

When the target production of 10 million seed under this Program has been attained, we recommend that efforts be made to raise productivity by the establishment a self-sufficiency in parent shrimp and a shortening of the breeding period.

At present, it is quite easy to buy egg-bearing shrimp at prices of 5 - 10 kyat per shrimp from fishermen. Thus, even if the Center does not always keep prawn, there are no particular problems with seed production. However, based on Burma's natural environment, parent prawn cannot be obtained during the December - February period, a fact that is an impediment to the year-round production of seed.

The subject Center will have two 1,000 m^2 ponds for rasing breeder prawn. With these ponds, it will be

possible to raise about 6,000 adult male and female prawn. thereby supply internally the requisite number of breeders at the required times, without having to rely on a natural catch.

It is not yet clear what the environmental determinants are that directly regulate the spawning of giant freshwater prawn. However, if research is continued on the spawning mechanism and a path is opened to the year-round production of seed, this will contribute greatly to an increase in production.

With regard to a shortening of the breeding period, under the present Plan, the time allotted for breeding from hatching to post-larva, based on existing production patterns in Burma, is about 50 days. Based on experiments that have been conducted in Japan, post-larva can be produced in an average of 25 - 35 days from hatching. Considering the ease in Burma of obtaining breeding water of suitable temperature, it can be assumed that feed is the major factor impacting on the length of the breeding period.

The PPFC has been using home-made formula feed in its experimental production program for giant freshwater prawn. If, in future years, nutritive values can be accurately measured and improved feeds can be developed, this should lead to a shortening of the breeding period.

In order to achieve the above technical breakthroughs, an expansion of the cadre of giant freshwater prawn specialists is clearly required. It is desirable that the PPFC make a concerted effort to develop such technicians through full utilization of the recently established training course in freshwater prawn cultivation.

In addition, we may note that Japan has achieved a certain degree of expertise and know-how in the areas of feed culture -- the main prop for the mass production of seed --, nutritional management, environment controls, breeding management, processing

and low-temperature distribution. It might be helpful, therefore, in the training and development of technical personnel, to have selected candidates receive training in Japan. In this connection, it would be most beneficial to consider taking of advantage of the various training programs that have been established by JICA.

On our judgment, the above recommendations, if implemented, should enable the scale of production at the subject facility to reach 15 million seed per annum, thereby permitting both a major expansion of seed supply and a lowering of seed cost.

APPENDIX

Appendix (1) Results of Discussions

The Results of Discussions on the Fresh Water Prawn Culture Project

Upon the recommendation by the Preliminary Study Team to the Government of Japan to carry out a basic design study before the rainy season in Burma, the Japan International Co-operation Agency (JICA) has sent a team headed by Mr. Tatsuhiko Iwasawa from May 9th to 26th, 1983.

The team has carried out a field survey and held a series of discussions and exchanged views with the People's Pearl and Fishery Corporation (PPFC) regarding the project.

As a result of the survey and discussions, both parties agreed to submit the findings of the Basic Design Study Team described in ATTACHMENT on the Fresh Water Prawn Culture Project to their respective Governments.

Signed on the 19th May 1983.

For and on behalf of JICA

Tatsuhiko Iwasawa
Japanese Team Leader

For and on behalf of PPFC

San Myint
Managing Director

Finding of the basic design study team sent by JICA

1. The objectives of the Project

According to the Fourth-Four Year Plan, the Project was planned to promote the export by the production of fresh water prawn by culture.

For the purpose, 4 hatchery stations and 6 culture farms will be constructed during the Fourth-Four Year Plan period, from 1982/83 to 1985/86.

2. The activities of the stations

The following activities will be carried out in each hatchery station,

(1) To produce 10 million fresh water prawn seeds,

(2) To carry out further research for improvement of fresh water prawn seeds productions, and in each culture farm,

(3) To produce 75 metric ton fresh water prawn annually.

3. The Location of the Stations

The hatchery stations will be located in

(1) Kyauktan township
(2) Thaketa township
(3) Thilawa township
(4) Amherst township

and the culture farms will be located in

(1) Thanatpin township
(2) Hmawbi township
(3) North Okkalapa township
(4) Insein township
(5) Waw township
(6) Mudon township

4. The Ministry of Livestock Breeding & Fisheries is responsible for the administration of the Project, and the People's Pearl and Fishery Corporation is the executing agency of the Project.

5. The team will convey to the Government of Japan the desire of the Government of the Socialist Republic of the Union of Burma that the former takes necessary measures to cooperate

Contd

in implementing the Project and provide the Government of the Socialist Republic of the Union of Burma with the items listed in ANNEX I within the scope of Japanese Economic Cooperation Programme in Grant Aid form.

6. The team explained the system of the Japanese Grant Aid and Burmese side understood it and they will take necessary measures listed in ANNEX II on condition that the Grant Aid Assistance would be extended.

ANNEX I

(1) to construct a hatchery station in Thaketa including the necessary equipment

(2) to provide the necessary machinery and equipment for the operation and maintenance of the Kyauktan hatchery station and the Thanatpin, Hmawbi culture farms constructed by Burmese side.

ANNEX II

Following arrangements are required to be taken by the Government of the Socialist Republic of the Union of Burma

1. To secure a lot of land for the construction of the station.

2. To clear, level and reclaim the site.

3. To construct the gate and fence in and around the site.

4. To provide facilities for distribution of electricity to the site.

5. To bear all expenses other than those to be borne by the Grant, necessary for the execution.

6. To ensure prompt unloading, tax payment, customs clearance at the port of Rangoon of the products purchased under the Grant.

7. To accord Japanese Nationals whose services may be required in connection with the supply of the products and the services under the verified contract such facilities as may be necessary for their entry into Burma and stay there in for the performance of their work.

8. To provide data and information necessary for the performance of the execution.

Appendix (ii) Team Members

Mr. Tatsuhiko IWASAWA	Team Leader	Assistant Director, Oceanic Fishery Dept. Fisheries Agency, Ministry of Agriculture, Forestry and Fisheries (MAFF)
Mr. Isamu SETOGUCHI	Aquaculture	Director, Ibusuki Freshwater Sub-station, Kagoshima Prefectural Fisheries Experiment Station
Mr. Hideki TOMOBE	Coordinator	Grant Aid Dept., Japan International Cooperation Agency (JICA)
Mr. Toshiya OGASAWARA	Fisheries Engineering	Fisheries Engineering Co., Ltd.
Mr. Naohiko NAKAJIMA	Distribution	- ditto -
Mr. Hiromu IKENOUE	Prawn Culture	- ditto -
Mr. Taizo KANEKO	Architect	- ditto -

Appendix (Ⅲ) Survey Itinerary

Day	Date	Itinerary	Discription
1	May 8 (Sun.)	Tokyo —TG741→ Bangkok	
2	May 9 (Mon.)	Bangkok ——→ Rangoon (RGN)	
3	May 10 (Tue.)	RGN Japanese Embassy Foreign Economic Relation Department (FERD)	Courtesy call on Japanese Embassy and Foreign Economic Relation Department (FERD) Discussion on the itinerary
4	May 11 (Wed.)	RGN PPFC Ahlone Office PPFC Thaketa Research and Development Branch	Discussion on the plan. Visit to Thaketa Research and Development Branch
5	May 12 (Thu.)	RGN ⟶ Hmawbi ⟶ RGN PPFC Thaketa Research and Development Branch PPFC Technical Dept.	Visit to Hmawbi Culture Farm site Visit to Thaketa Seed Production Center Technical discussion on culture farm construction
6	May 13 (Fri.)	RGN ⟶ Thanatpin ⟶ RGN	Visit to Thanatpin Culture Farm site
7	May 14 (Sat.)	RGN ⟶ Kyauktan ⟶ RGN	Visit to Kyauktan Seed Production Center site
8	May 15 (Sun.)	RGN	Discussion within the team

Day	Date	Itinerary	Description
9	May 16 (Mon.)	RGN PPFC Ahlone Office	Interim discussion with PPFC Discussion on economic analysis
10	May 17 (Tue.)	RGN Discussion Group Japanese Embassy, PPFC Ahlone Office Survey Group Seed Production Center site	Discussion on the Plan Survey of the site
11	May 18 (Wed.)	RGN Keighley Market Discussion Group PPFC Ahlone Office Survey Group Thaketa Seed Production Center site	Investigation of local fish distribution system Results of Discussion Survey of the site
12	May 19 (Thu.)	Discussion Group PPFC Ahlone Office Japanese Embassy RGN —TG305→ Bangkok Survey Group PPFC Technical Dept.	Signature of Results of Discussion Reporting of the outline of the Project Interim report of the site survey
13	May 20 (Fri.)	Discussion Group Bangkok —TG740→ Tokyo Survey Group RGN Construction Corporation (CC) PPFC Thaketa Research and Development Branch	Investigation of construction condition Discussion on the seed production center

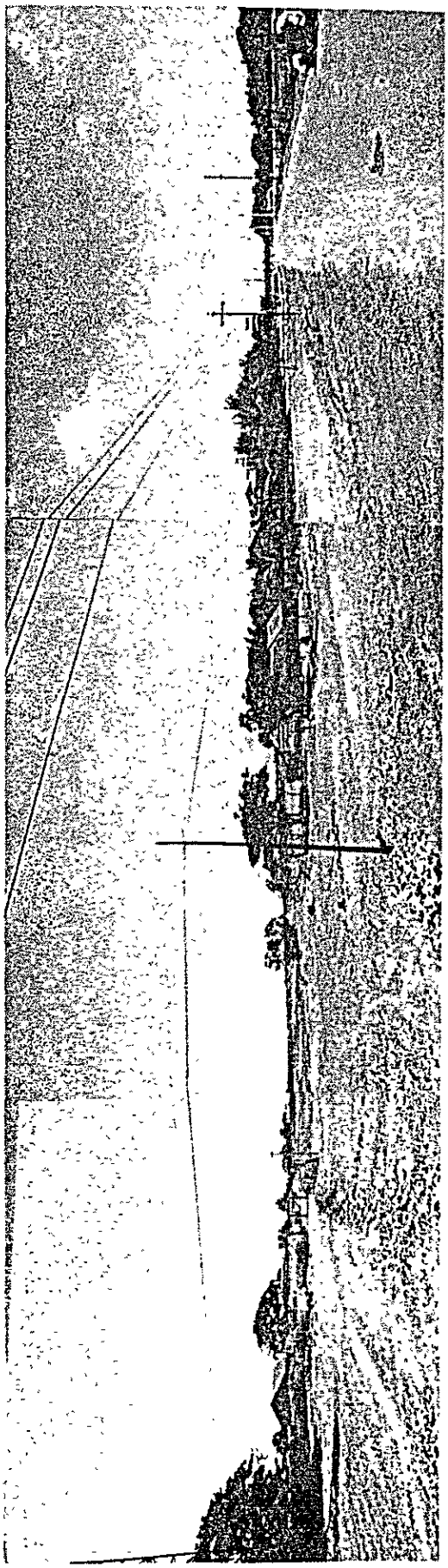
Day	Date	Itinerary	Description
14	May 21 (Sat.)	RGN Ahlone ⟶ Gyogung	Visit to Ahlone PPFC's cold storage site Visit to PPFC head-quarters site and Institute of Fisheries Technology
15	May 22 (Sun.)	RGN	Data and information collection
16	May 23 (Mon.)	RGN ⟶ Twente ⟶ RGN	Visit to Twente culture farm
17	May 24 (Tue.)	PPFC Thaketa Research and Development Branch Thaketa Seed Production Center site CC Electric & Power Corporation (EPC)	Discussion on the equipment Final confirmation of construction site Investigation of construction material cost Investigation of electricity condition
18	May 25 (Wed.)	Japanese Embassy PPFC Ahlone Office	Reporting of the result of the survey - ditto -
19	May 26 (Thu.)	RGN ⟶ (TG305) Bangkok	
20	May 27 (Fri.)	Bangkok ⟶ (TG740) Tokyo	

Appendix (IV) Burmese Discussants

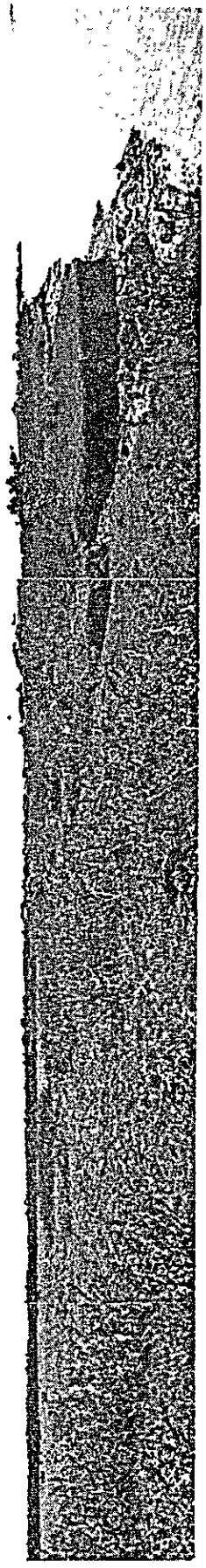
NAME	ORGANIZATION	TITLE
U THEIN MYINT	Foreign Economic Relation Department (FERD)	Director General
U MYINT HTOO	"	Assistant Director
U SAN MYINT	People's Pearl and Fishery Corporation (PPFC)	Managing Director
U TIN MAUNG MYINT	"	General Manager (Aquaculture)
U THAN HTAY	"	General Manager (Planning & Finance)
U MYINT SOE	"	General Manager (Marketing)
U AYE ZAW WIN	"	Deputy General Manager (Marketing Dept.)
U SEIN MAUNG	"	Staff Officer (Managing Director's Office)
DAW TIN TIN MYINT	"	Deputy Project Director (ADB Loans Project)
DAW TIN TIN HTAY	"	Manager (Planning & Budget)
U THEIN ZAN	"	Supervisor (Planning)
U MADAN CHAND	"	Manager (Engineering Dept.)
U BATHAN CHAIN	"	Assistant Engineer (Civil)
DR. NYAN TAW	"	Manager (Research & Development Branch)
U THET LWIN	"	(Research & Development Branch)
U MYINT SOE	"	(Research & Development Branch)

U KHIN MAUNG SOE	People's Pearl and Fishery Corporation (PPFC)	(Research & Development Branch)
U SOE TUN	"	(")
U KYAW SOE	"	(")
U WIN KYU	Construction Corporation	Staff Officer I (Q.S./ Research Section)
U E. DE SOUZA	"	Staff Officer II (Quantity Surveyor)
U SHWE WIN	"	Staff Officer II (Design) .
U NGWE TOON	"	Staff Officer II (Water Supply & Sanitation Dept.)
U KHIH	"	Staff Officer III (Quantity Survey)
U WIN KYI	"	Staff Officer III (Water Supply & Sanitation Dept.)
DAW SAN KYI	"	Staff Officer III (Electrical)
DAW SI THAN	"	Staff Officer III (Quantity Survey)
U C. K. TAIKWEL	Electric & Power Corp.	Deputy Chief Engineer
U HLAING MYINT	"	Assistant Executive Engineer

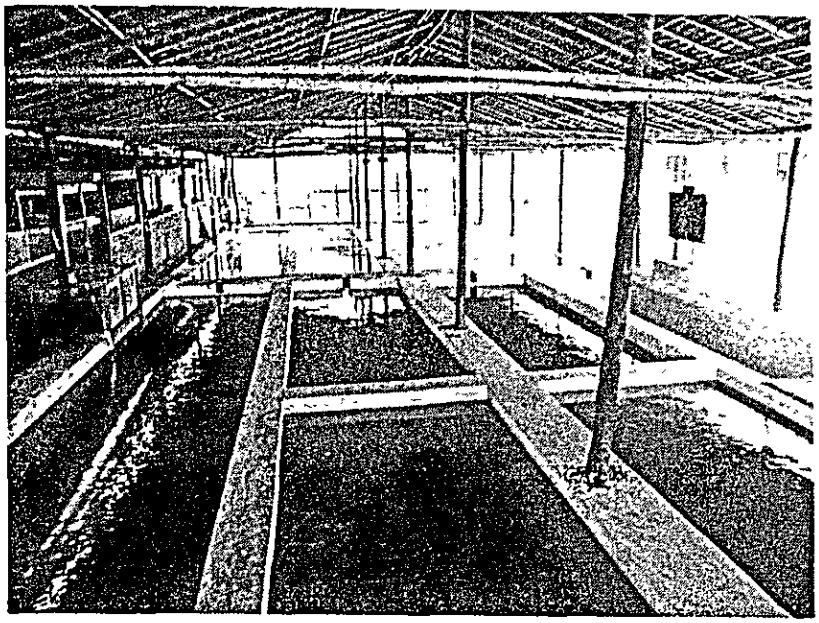
Appendix (V) Photographs



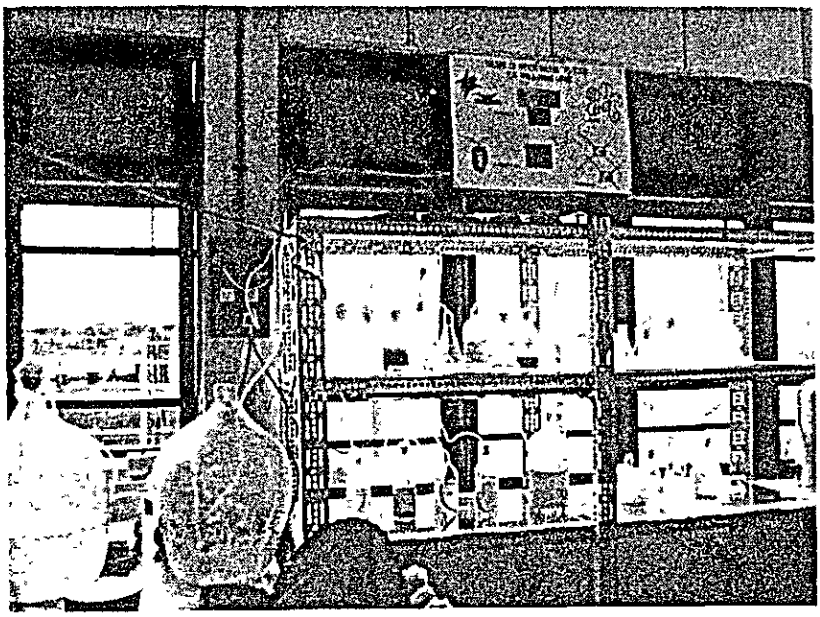
Site viewed from access road



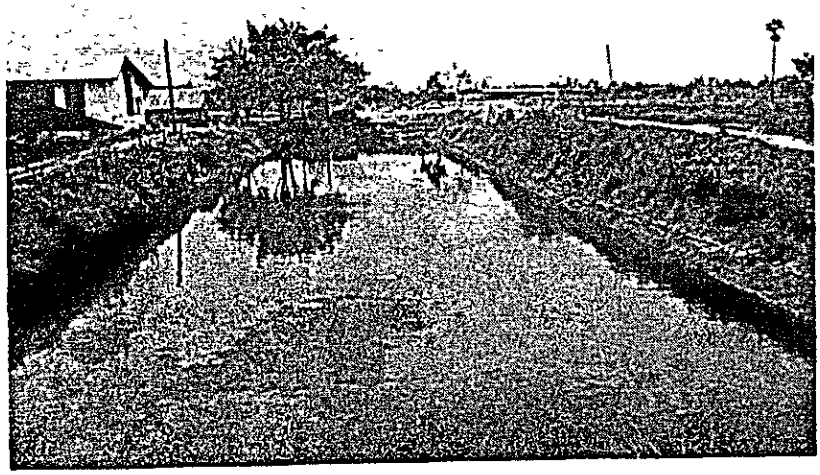
Site viewed from Pegu River



PPFC
Thaketa
Laboratory



ditto
Feed
Laboratory



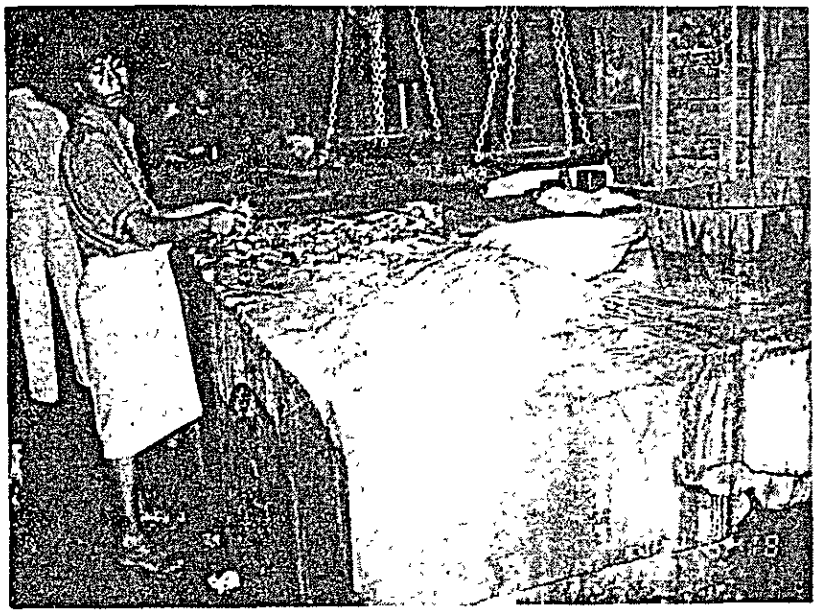
ditto
Reservoir

Hmawbi culture farm
Pond under construction

Tanatpin culture farm
Culture pond

Giant freshwater prawn captured from the above culture pond

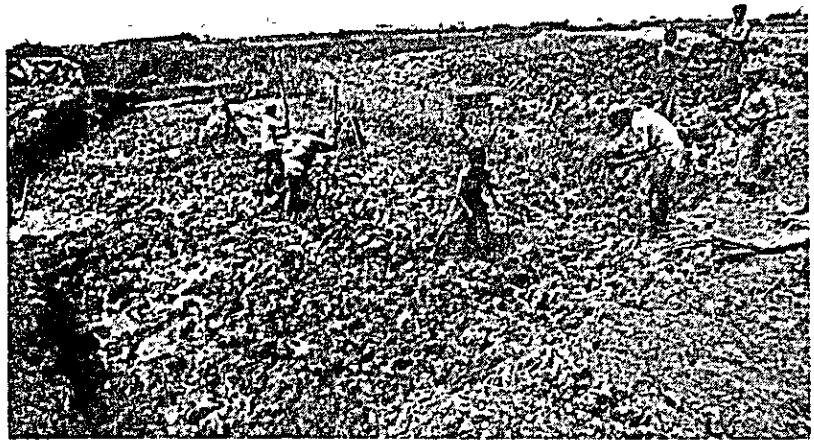
At
Keighley
market



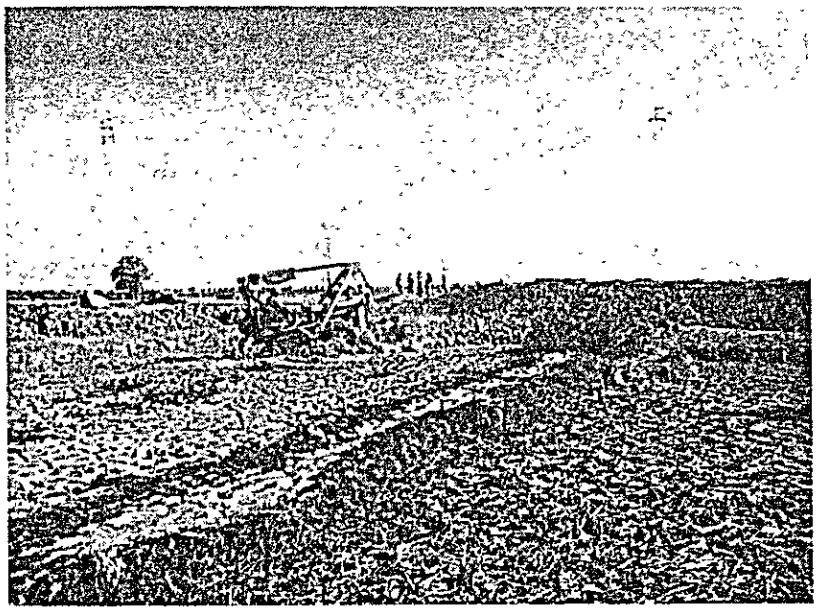
Freshwater prawn
at retail market

Twante Culture Farm
Harvesting and
weighing

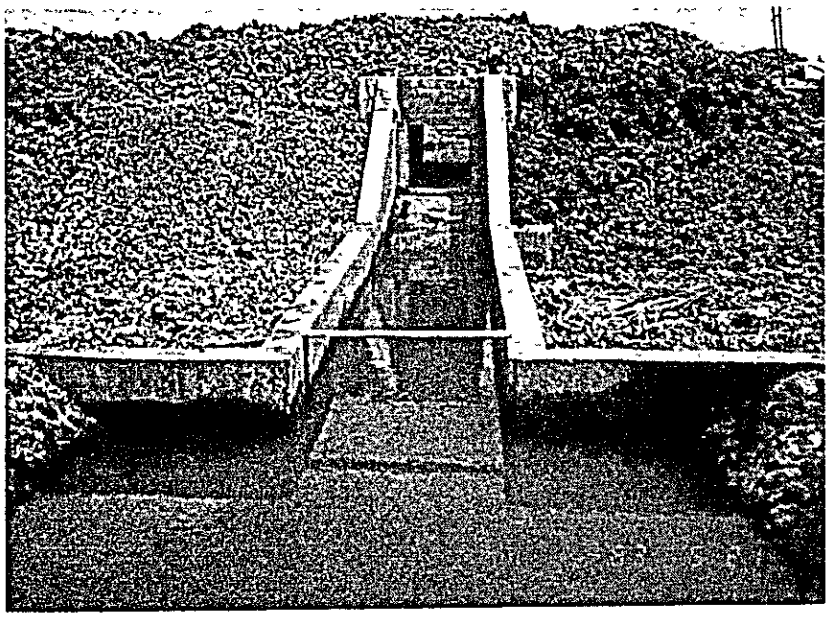
Other related construction work



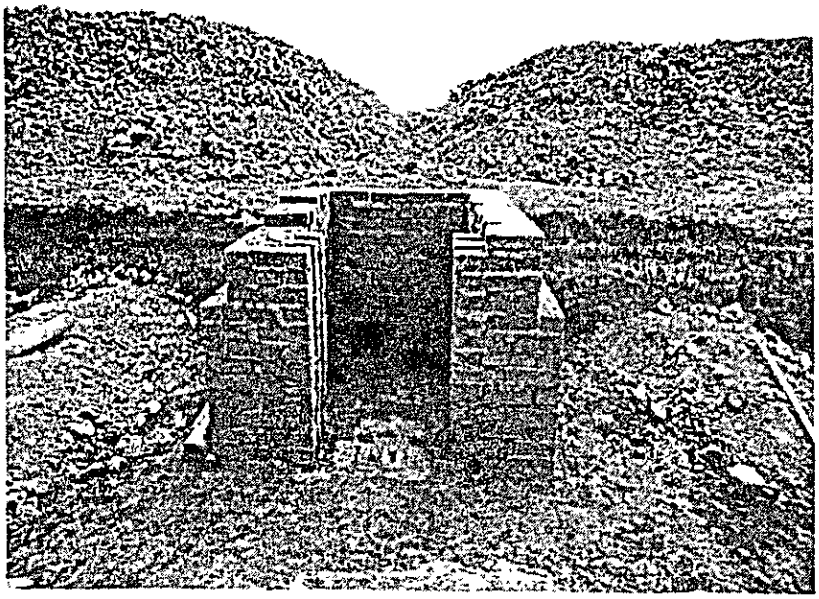
Excavation



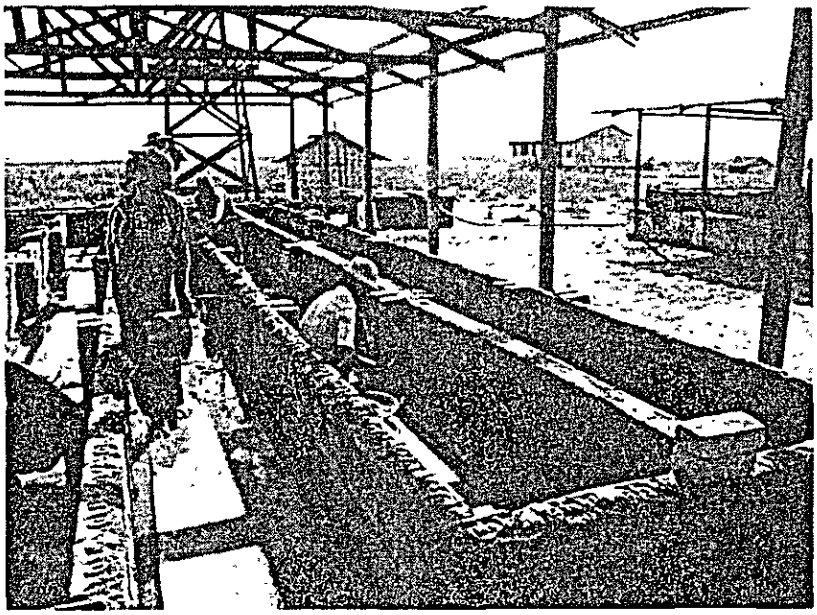
Pond construction



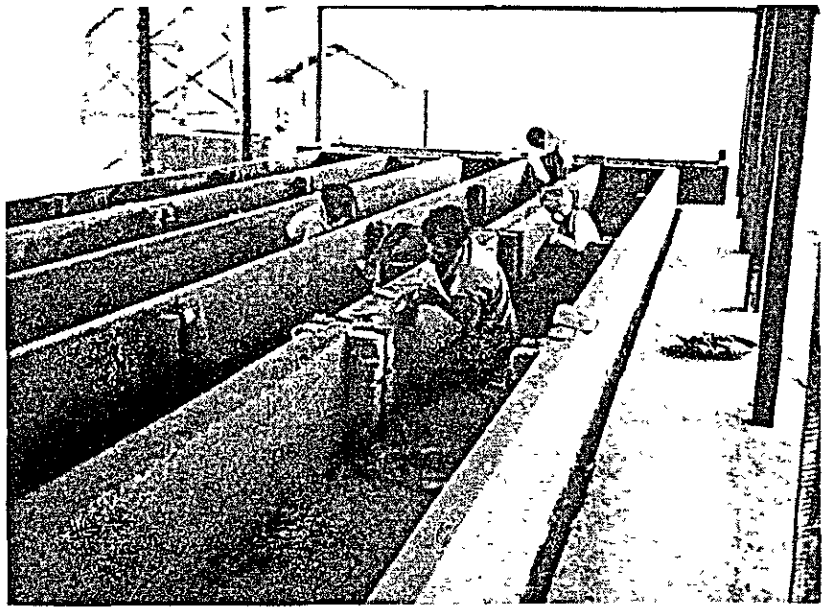
Inlet gate



Outlet gate

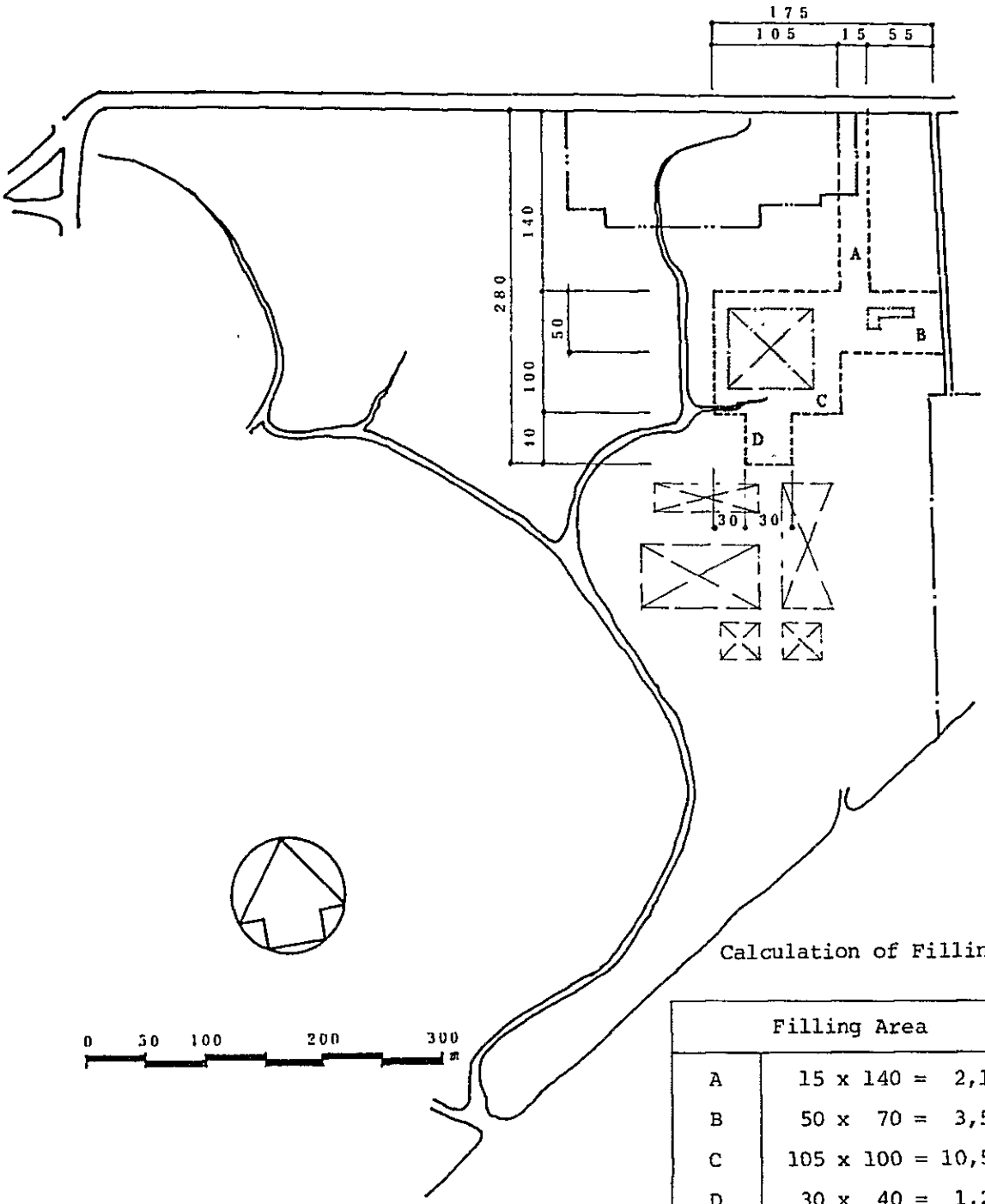


Rearing tank
(brick masonry)



ditto
(mortar finish)

Appendix (VI) Site Filling Plan

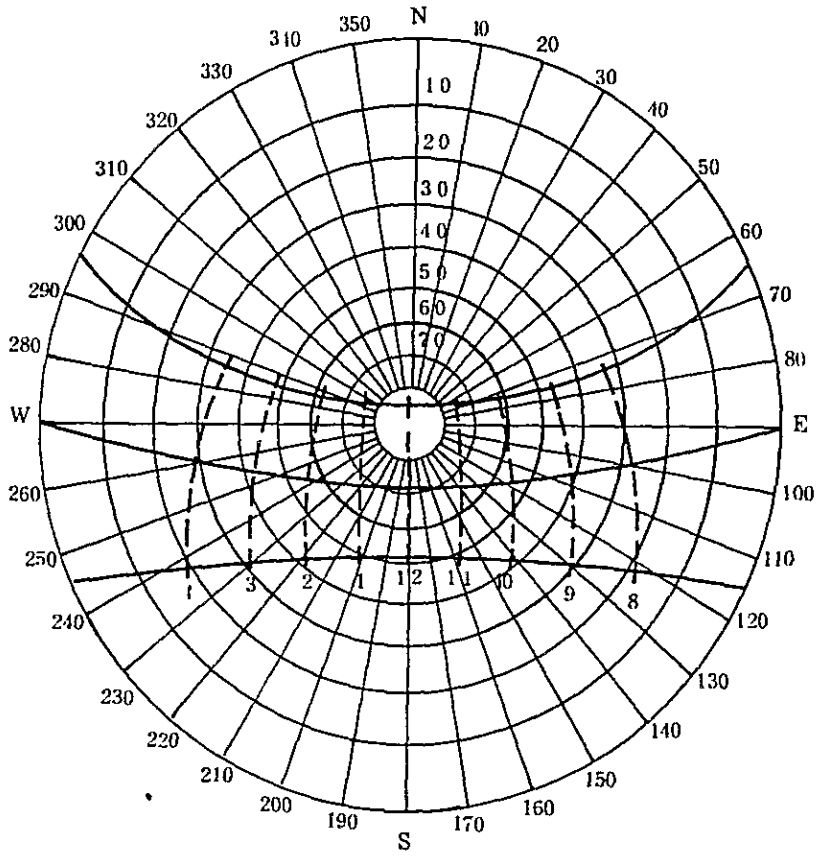


Calculation of Filling

Filling Area	
A	15 x 140 = 2,100
B	50 x 70 = 3,500
C	105 x 100 = 10,500
D	30 x 40 = 1,200
Total	17,300 m^2

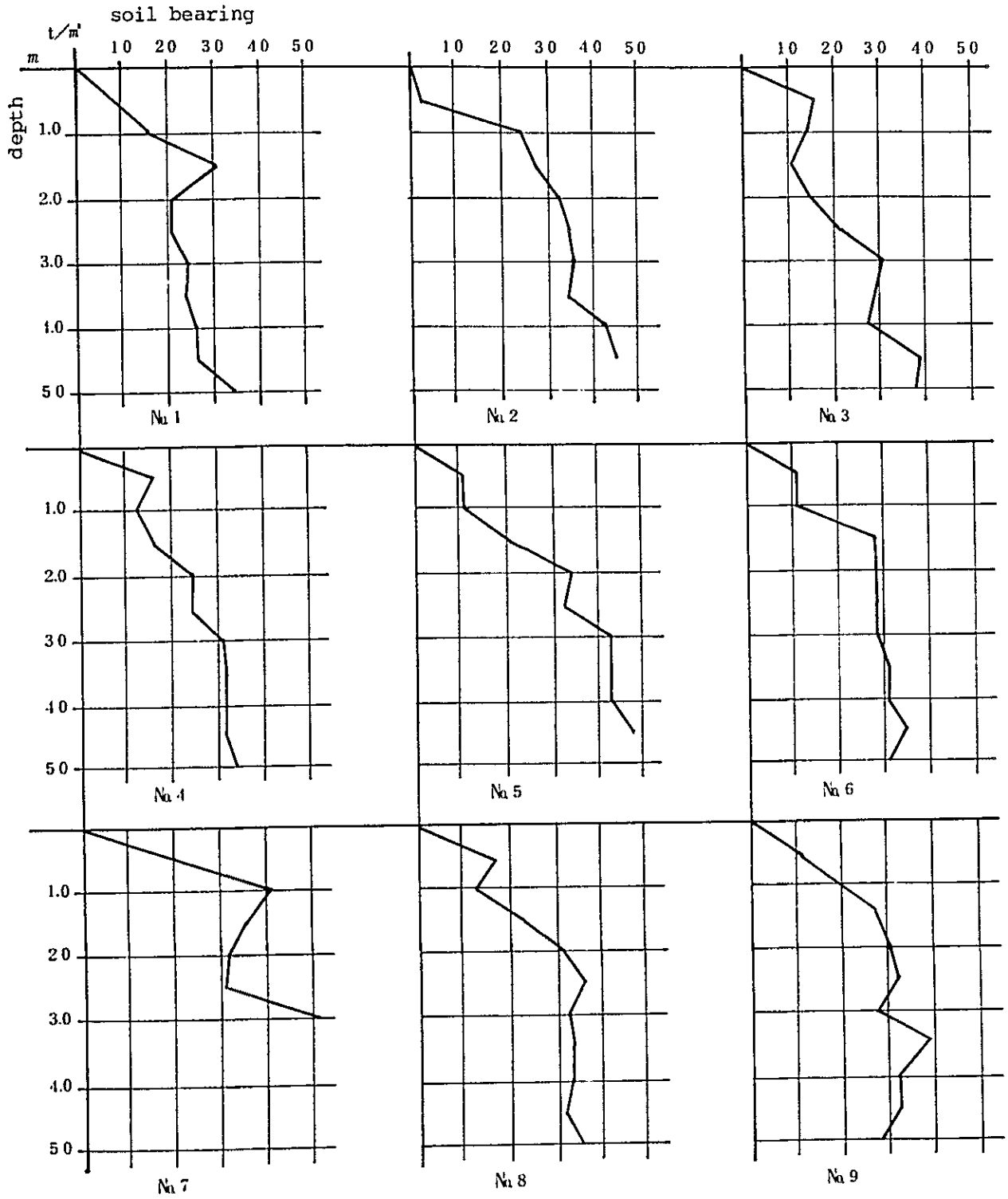
Filling volume	Filling height H = 1.5 m 17,300 x 1.5 = 25,950 m^3 (filling area) (filling height) (filling volume)

Appendix (VII) Solar Height Table



summer solstice			equinox			winter solstice		
time	azimuth	angle	time	azimuth	angle	time	azimuth	angle
12	0° 0′	82° 30′	12	180° 0′	74° 0′	12	180° 0′	50° 30′
11 1	59° 30′	74° 0′	11 1	135° 0′	68° 0′	10 2	142° 30′	40° 30′
10 2	69° 0′	61° 0′	10 2	115° 0′	56° 30′	8 4	122° 30′	19° 30′
8 4	72° 0′	33° 0′	8 4	99° 0′	29° 0′	6:32 5:28	114° 30′	0° 0′
5:28 6:32	65° 30′	0° 0′	6 6	90° 0′	0° 0′			

Appendix (VIII) Soil Bearing Test Results



Appendix (IX) Mean Monthly Evapotranspiration and Rainfall

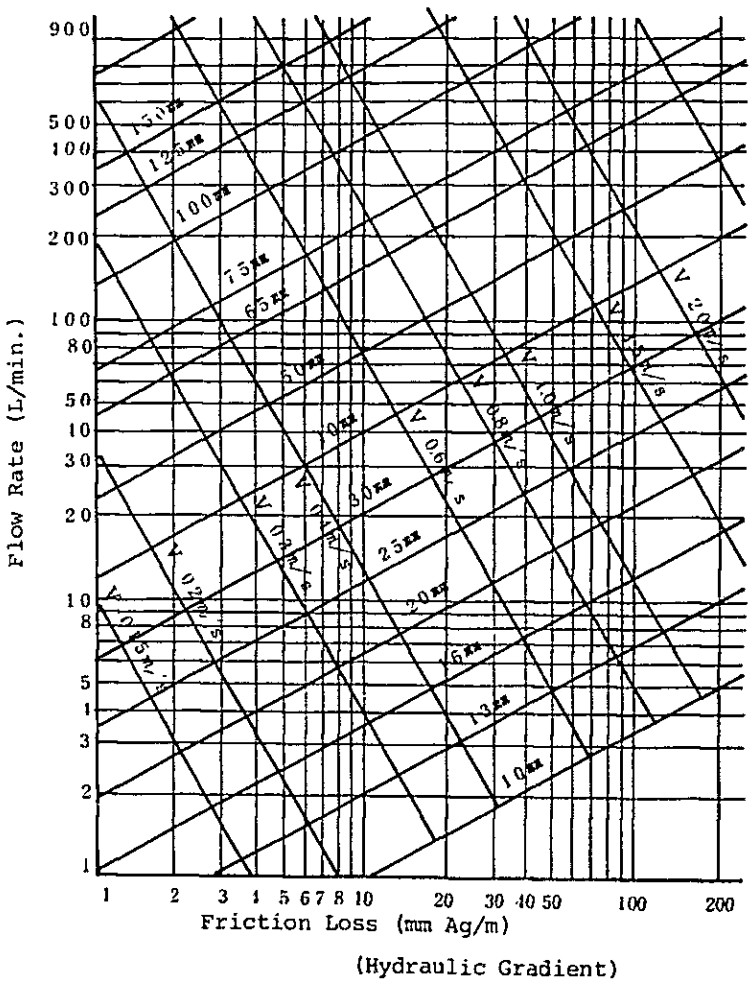
(mm) 1960 - 1980

月	1	2	3	4	5	6	7	8	9	10	11	12	Total
Evapotranspiration	176	205	270	291	225	139	140	134	131	147	166	170	2,194 M/M
Rainfall	6	2	7	21	300	506	525	596	395	200	34	9	2,601 M/M

Appendix (X) Well Water Quality Analysis

Item	Actual value		Standard value	
PH	7.1 (24.0 °C)		5.8~8.6	
Iron	1.68 mg/ℓ		0.3 mg/l. or less	
Chlorine ion	118 〃		200 mg/l. or less	
Calcium	251 〃			
Magnesium	159 〃			

Appendix (XI) Flow Rate Chart



Appendix (XII) Equipment and Materials List

1. Thaketa Seed Production Center

Item No.	Descriptions	Outline of Specifications	Q'ty
1-1.	Observation equipment		
1-1-1	Inductive salinometer	range: 0 - 50ppt precision: ±0.003ppt	1 unit
2	D.O. meter	range: 0 - 20 ppm portable and desk type	1 unit each
3	pH meter	minimum div.: 0.01 portable and desk type	1 unit each
4	Thermometer	minimum div.: 0.1°C standard with certificate	 20 pcs. 2 pcs.
5	Water sampler	KITAHARA type, 1,000 ml	1 unit
6	Binoculars		1 unit
1-2.	General laboratory equipment		
1-2-1	Microscope	trinocular type with photomicrographic camera, 40X - 400X	1 unit
2	Stereoscopic microscope	binocular type with illuminator, 10X - 100X	1 unit
3	Profile projector	10X - 100X	1 unit
4	Macro analytical balance	weighing range: 0 - 160g readability: 0.1mg	1 unit
5	Top-loading electronic balance	weighing range: 0 - 2,000 g readability: 10mg	1 unit
6	Open-beam balance	weighing range: 0 - 10kg readability: 1 g	1 unit
7	Distiller	5 ltrs/hr	1 unit
8	Centrifuge	15ml x 8pcs., 4,000rpm	1 unit
9	Dryer	max. temperature 200°C	1 unit
10	Freezer	approx. 400 ltrs.	1 unit
11	Refrigerator	approx. 200 ltrs.	1 unit
12	Blood corpuscles counting chamber		1 lot
13	Desiccator		1 pce.
14	Glass ware		1 lot

Item No.	Descriptions	Outline of Specifications	Q'ty
1-2-15	Reagent		1 lot
16	Aquarium	30 ltrs. and 500 ltrs.	1 lot
17	Air pump	free air capacity: 0.5 - 1.5 ltrs/min	5 units
18	Dissecting instruments	forceps, scissors, scalpels with spare blades	1 lot
1-3.	Operative equipment and material		
1-3-1	Meat agitating crusher	approx. 50 ltrs.	1 unit
2	Chopper	200 kg/hr with pelletizer	1 unit
3	Pulverizer	approx. 10 kg/hr	1 unit
4	Pellet dryer	approx. 600 ltrs. mechanical convection type	1 unit
5	Submersible pump	I.D. 2" 3/4"	3 units 5 units
6	Nylon netting	40,106,200 microns	1 lot
7	Airstone	approx. 3 O.D. x 5 L cm	500 pcs.
8	Vinyl hosepipe	5 I.D. x 7 O.D. mm 7 I.D. x 10 O.D. mm	500 m 500 m
9	Tube connectors	stainless steel made, various type	500 pcs.
10	Antibiotic	for aquaculture use	50 kg
11	Mixed feed	various type	2,000 kg
12	Fertilizer	various type	300 kg
13	Feed additive	vitamin, feed oil, etc.	1 lot
14	Brine shrimp		70 kg

2. Kyauktan Seed Production Center

Item No.	Descriptions	Outline of Specifications	Q'ty
2-1.	Obserbation equipment		
2-1-1	Salinity refractometer	range: 0 - 100ppt readability: 1ppt	10 units
2	D.O. meter	portable type range: 0 - 20 ppm	1 unit
3	pH meter	portable type minimum div.: 0.01	1 unit
4	Thermometer	minimum div.: 0.1°C standard with certificate	20 pcs. 2 pcs.
5	Binoculars		1 unit
2-2.	General labolatory equipment		
2-2-1	Microscope	trinocular type with photomicrographic camera, 40X - 400X	1 unit
2	Stereoscopic microscope	binocular type with illuminator, 10X - 40X	1 unit
3	Macro analytical balance	weighing range: 0 - 160g readability: 0.1mg	1 unit
4	Top-loading electronic balance	weighing range: 0 - 2,000g readability: 10mg	1 unit
5	Distiller	5 ltrs/hr	1 unit
6	Freezer	approx. 400 ltrs.	1 unit
7	Refrigerator	approx. 200 ltrs.	1 unit
8	Dryer	max. temperature 200°C	1 unit
9	Glass ware		1 lot
10	Reagent		1 lot
11	Aquarium	500 ltrs.	10 pcs.
12	Dissecting instruments	forceps, scissors, scalpels with spare blades	1 lot
13	Air conditioner	wall hanging type	2 units
2-3.	Operative equipment and material		
2-3-1	Pulverizer	approx. 10kg/hr	1 unit
2	Nylon netting	40,106,200 microns	1 lot
3	Air pump	free air capacity:1 cu.m/min	2 units
4	Submersible pump	O.D. 3/4"	2 units

Items No.	Descriptions	Outline of Specifications	Q'ty
2-3-5	Outbord engine	25 PS	1 unit
6	Generator	diesel engine, 15 KVA	1 unit

3. Hmawbi and Thanatpin

Item No.	Descriptions	Outline of Specifications	Q'ty
3-1.	Obserbation equipment		
3-1-1	Salinity refractometer	range: 0 - 100ppt readability: 1ppt	6 units
2	D.O. meter	portable type range: 0 - 20 ppm	2 units
3	pH meter	portable type minimum div.: 0.01	2 units
4	Thermometer	minimum div.: 0.1°C standard with certificate	 26 pcs. 4 pcs.
5	Secchi disc		4 sets
3-2	Operative equipment and material		
3-2-1	Meat aditating crusher	approx. 50 ltrs.	1 unit
2	Pelletizer	with dryer	1 unit
3	Pulverizer	approx. 10 kg/hr	1 unit
4	Vacuum packaging machine		1 unit
5	Harvesting net material	netting, rope, float, sinker	6 sets
6	Intake pump	I.D. 4" with diesel engine	20 units
7	Submersible pump	I.D. 2"	5 units
8	Fish ponds aerator	0.4 KW	30 units
9	Air pump	free air capacity: 1 cu.m/min	2 units
10	Small-type construction machinery	for excavation and ground clearing	2 units
11	Tractor	with trailer	2 units
12	Generator	diesel engine, 5 KVA	6 units

Appendix (XIII) Cost Estimation for Giant Freshwater Prawn

(1) Premise

Culture Pond area	0.5 ha (1.25 acre)
Culture period	Mid May - Mid. March, 300 days
Stock density	30,000/acre
Yield recovery	50 %
Mean weight	45 g/prawn
Culture method	Non-intensive culture method is taken. Rain water will be used during rainy season and during dry-season, culture is done with still water.
Management	Two family labors

(2) Initial Investment

Pond construction cost	Mean excavation depth 0.7 m. Watergate combined both inlet and outlet	
	Tamping only bank top and slope	
Soil excavation	3,500 m^3 x (K 25/100 cft) =	K 32,400
Tamping	3,500 m^3 x (K 10/100 cft) =	K 13,000
Water gate	1 lot	K 3,000
	Sub-total	48,400 Kyat

(3) Operation Expenses

1) Seed cost: 9.55 pyas x 37,500 seed = 3,582 Kyat

2) Feed cost: Prawn are fed 3% of body weight with formula of 3-parts rice bran and 1 part groundnut cake once every two days.

rice bran	1,425 kg x K 0.35 =	K 500
groundnut cake	475 kg x K 1.6 =	K 760
Sub-total	1,900 kg	1,260 Kyat

3) Depreciation

Life 30 year	Annual depreciation amount	1,613 Kyat

4) Pond maintenance cost

1% of construction cost	484 Kyat
Total	6,939 Kyat

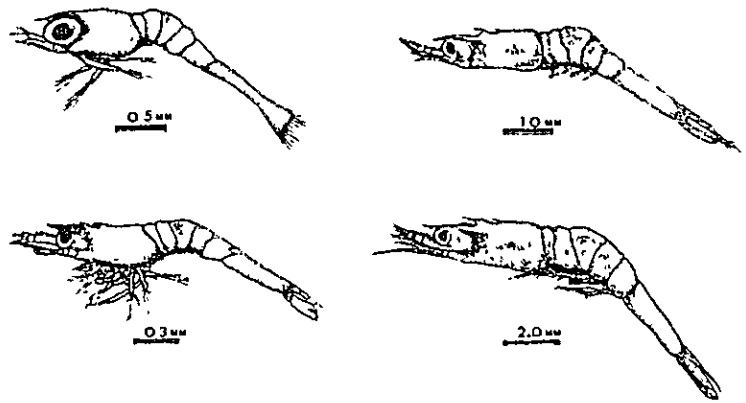
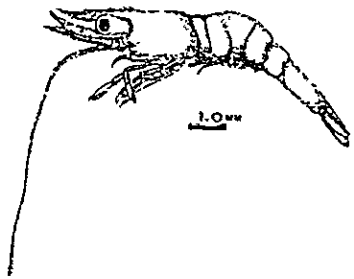
(4) Revenue

Pond-side price	K 10/kg
Harvest amount	37,500 tail x 50 % x 45 g = 844 kg
	844 kg x K 10 = 8,440 Kyat

(5) Crudr Income

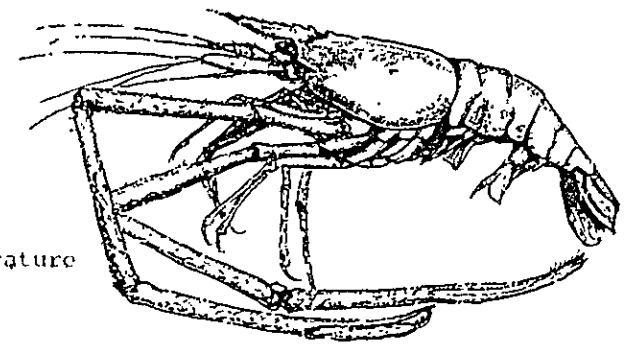
8,440 - 6,939 = 1,501 Kyat

APPendix (xiv) Life History of Giant Freshwater Prawn

GROWING STAGE	hatching	Zoea first stage - 11th staqe	post-larva *1
External Characters	Number of eggs: 30 - 50 thousand/tail Diameter of eggs: (eyed egg, major axis) 0.5 - 0.8 m/m Holded female abdomen	 Planktonic Life (Uno & Kwor, 1969)	 Bottom Dwelling Life
Time	after fertilization 3 hours: cleavage " 9 days: appearing eyespot " 20 days: hatching		30 - 40 days Fluctuations caused such factors as water temerature and feed.
Conditions of Habitat	brackish water water temperature 27 - 28°C		Brackish water → Fresh water

zoea	after hatching (day)	baby length (mm)
1st		1.92
2nd	2	1.99
3rd	4	2.14
4th	7	2.50
5th	10	2.84
6th	14	3.75
7th	17	4.06
8th	20	4.68
9th	24	6.07
10th	28	7.05
11th	31	7.73

Brackish water 10 - 13 ppt(S)

GROWING STAGE	Juvenile (seed)	Adult
External Characters	Body length: 1.5 - 2.0 cm Body weight: 0.05 - 0.1 g	Maximum size: 300 mm (more than 400 mm rarely found) Biological minimum size: 70 mm Feeding habit: Omnivore Optimum water temerature: 27 - 30°C Spawning season: Throughout year at high water temperature 
Time	After 20 days of metamorphosing into post-larva	Life span: 2 - 3 year
Conditions of Habitat	Fresh water	Fresh water, Brackish water