

BASIC DESIGN REPORT
ON
FISHERY DEVELOPMENT PROJECT
IN
MAURITIUS

DECEMBER 1980

JAPAN INTERNATIONAL COOPERATION AGENCY

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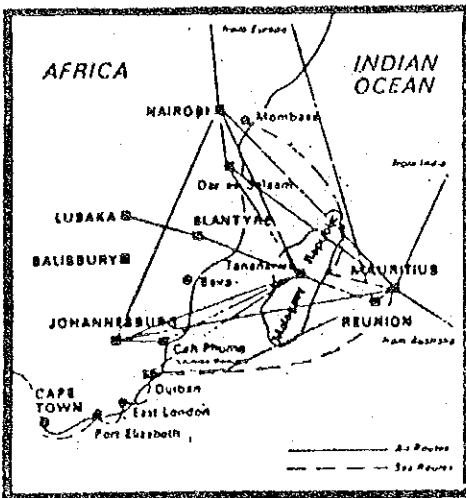
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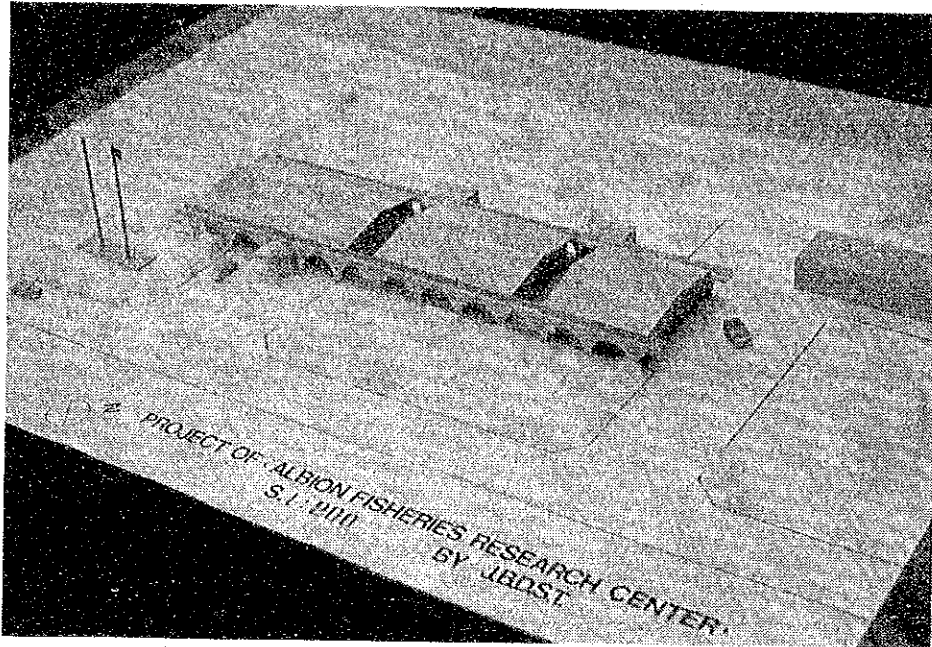
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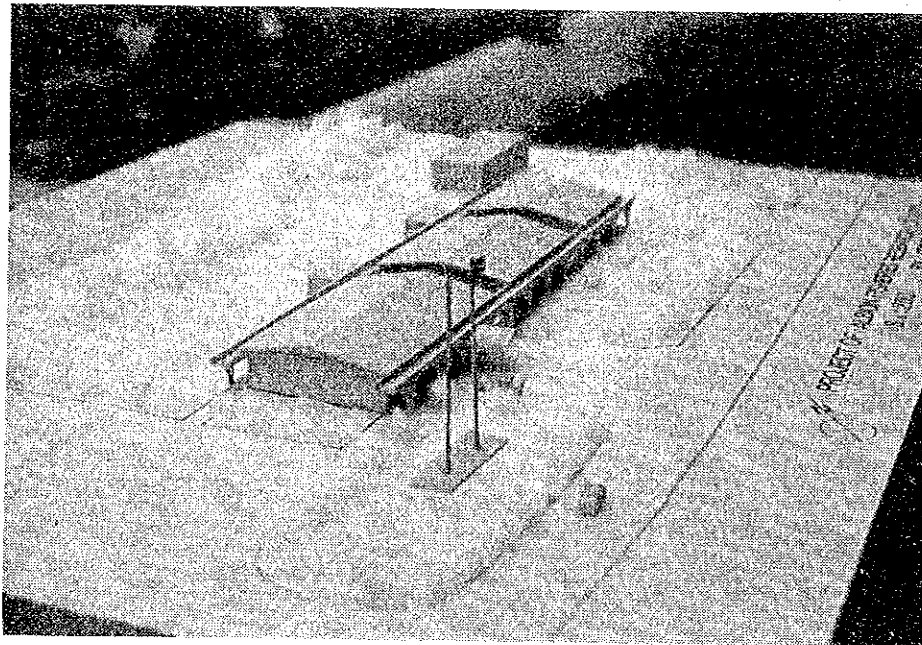
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MAURITIUS





BIRD'S EYE VIEW FROM THE NORTHEAST



BIRD'S EYE VIEW FROM THE SOUTH

ABBREVIATIONS

the Research Center	the Albion Fishery Research Center
M. FCCD	Ministry of Fisheries and Co-operatives and Co-operative Development
JICA	Japan International Cooperation Agency
the Survey Team	the Japanese Basic Design Survey Team of Fishery Promotion in Mauritius

PREFACE

It is with great pleasure that I present this report entitled Basic Design Report on Fishery Development Project in Mauritius to the Government of Mauritius.

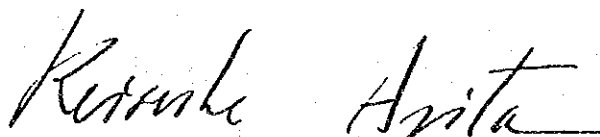
This Report embodies the result of a basic design survey which was carried out from October 16th to November 8th, 1980 by the Japanese Survey Team commissioned by the Japan International Cooperation Agency following the request of the Government of Mauritius.

The survey team had a series of discussions with the officials concerned of the Government of Mauritius and conducted an extensive field survey and data analyses.

I sincerely hope that this report will be useful as a basic reference for development of the project.

I wish to express my deep appreciation to the officials concerned of the Government of Mauritius.

December, 1980

A handwritten signature in black ink, reading "Keisuke Arita". The signature is written in a cursive style with a long horizontal stroke at the end.

Keisuke Arita
President

Japan International Cooperation Agency

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ABBREVIATIONS

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SUMMARY

In promoting the diversification of industries, Mauritius emphasizes the importance of promoting the fisheries industry in the Two-Year Plan for Economic and Social Development (1980 - 1982) from the viewpoint of stable supply of animal proteins to the people.

Of the fisheries industries of this country, the lagoon fisheries accounts for about 60 percent of the total fish catch, and constitutes a major fisheries industry of this country, in which over 90 percent of all fishermen are engaged. Despite this important position, the lagoon fisheries are not expected to register a production increase, and the fishermen engaged in this line are placed in an extremely petty position due to the special marketing system.

Under these circumstances, the Government of Mauritius requested the Government of Japan for assistance in the fishery promotion project, and the Government of Japan despatched the Survey Team in response to this request.

Through prior discussions with parties concerned, the Survey Team reached a conclusion that, of the diverse requests by the Government of Mauritius, the aid to the establishment of a fisheries research center would be the most adequate and effective assistance to be granted by Japan to Mauritius. The Survey Team obtained agreement of the Mauritius Government in this respect through the survey activities and discussions with the personnel concerned of the Government, and prepared the basic designs for the Research Center.

The Research Center will conduct test & research and survey mainly regarding aquaculture such as seed production of fish and rearing of fish fries, will give instruction and dissemination of the techniques obtained through these activities and will conduct chemical research with respect to the ciguatera poison typically observed in the fishes in tropical areas as well as quality control of fish.

The site of the Research Center is located in Albion at a distance of about 20km from Port Louis. Being almost entirely flat, this site is surrounded by sea and river, and offers a quiet environment suitable for the Research Center. It is possible to obtain fresh water and sea water of high quality essential to the research. The ground is confirmed to have sufficient bearing capacity for the construction.

The basic design policies for the buildings and equipment are enumerated as follows:

1. The Research Center is to be the central institution for the overall fisheries center to be installed over the entire site with impressive visual effect.
2. The Research Center is to conduct test and research for seed production and rearing of fish, survey and research for analysis of the ecosystem, and instruction and dissemination of the obtained results.
3. The materials and construction method of the locality should be employed to minimize the construction cost and period.
4. The Research Center should reflect the customs and mode of living of the local people.
5. It should be provided with equipment which have sufficient functions at a reduced building construction cost.
6. Ease of maintenance control and cost reduction should be taken into consideration.
7. Weather conditions of the locality should be taken into account.

The buildings and equipment have been designed as follows, on the basis of the above policies:

The facilities will comprise the main building of 1150m², hatchery block of 150m² and outdoor rearing area of 200m². The main building will consist of the Administration Block including the office, conference room and dining room, the Research Block including the study room and laboratories and the Working Block including the technician's room, nurserymen's mess, workshop and machine room.

These blocks are separated from each other by inner courts and, at the same time, connected by open corridors.

Concept of connection and separation constitutes a main system and philosophy of the design. This is designed with sufficient consideration given to the function of the Research Center, weather conditions, social customs and many other factors.

Concrete and concrete blocks will be mainly used for the major structure of the facilities. This is because the island of Mauritius formed by volcanic activities abounds in gravel and sand for concrete and the facilities are required to withstand cyclones since the country is located in the course of cyclones.

The Research Center will conduct test & research for seed production and rearing of fish, survey to analyse the ecosystem mainly in lagoons, and instruction of dissemination of aquaculture technique. These activities require equipment for aquaculture, marine biology and chemical analysis, and should be selected over an extensive range.

A total of 13 months and half are estimated for the construction including the designing for execution, tender-related works and construction, after signing the Exchange of Notes.

It should be noted that shortage of construction materials, cost increase or delay of the construction period might be caused by cyclones. This possibility should be taken into account in executing the project.

M. FCCD will serve as a direct changing organization on the part of Mauritius. The Survey Team have obtained a definite promise that leveling of the project site and construction of water and power supply equipment will be completed before the start of this project.

The expected effects of this aid will be

1. stable supply of animal proteins,
2. stability and improvement of fishermen's livelihood engaged in fisheries and increase of employment for these people,
3. promotion of fisheries structure improvement from "catching fisheries" to "sea farming fisheries" through introduction of the resource culture technique,
4. the Research Center developing into a central organization for fisheries research in neighboring countries as well as in Mauritius,
5. training of personnel through instruction and dissemination of research.

Major factors for promotion of the fisheries industry of Mauritius are adequate control of the fisheries resources, stable fish catch in the vast 200-sea mile waters, and transfer from catching fisheries to sea farming fisheries. This is based on the adequate control of the fisheries research by making effective use of the test and research results. It is therefore concluded that the effect of the grant aid in this project will be extremely large.

CHAPTER 1
BACKGROUND

1-1 PREAMBLE

Mauritius was developed on the basis of a monoculture structure mainly producing sugar. However, with the independence in 1968, the country has been tackling the problem to diversify the industries, placing major emphasis on their modernization and development and reinforcement of other industries. The country is currently proceeding with the Two-Year Plan for Economic and Social Development.

Emphasizing the importance of modernizing the fisheries industry to achieve a stable supply of foods and animal proteins, the Mauritius Government submitted eleven fishery-related requests to Japanese Government. In response to these requests, parties concerned in Japan discussed with each other regarding the purpose, effects, etc. of cooperation through the grant aid, and reached the conclusion that, of these requests, the establishment of a fisheries research center would be most appropriate to such cooperation.

Thus, it was determined to despatch the Survey Team to investigate the basic design of the building facilities and equipment required by the Research Center.

1-2 OBJECTS OF SURVEY

The objects of the Survey are to obtain the condition of the fisheries research, to determine the building facilities and equipment required for such research, and for this purpose, to exchange views and opinions with the personnel concerned in Mauritius, to investigate the project site and circumstances for construction and to collect data for preparing the basic design.

The Survey Team was despatched from October 16, to November 8, 1980 in order to obtain the circumstances of the fisheries industry including the position of the fisheries industry in the total Mauritius industries, structure of fisheries, processing of marine products, aquaculture marketing, etc., to investigate the necessity of establishing the Research Center as the grant aid, and to conduct basic design for construction of the Research Center.

The Survey Team exchanged views with the M.FCCD and other Government personnel concerned for the purpose of the survey, and made the survey for the basic design of the Research Center.

This survey has revealed that the project site fills land conditions required for the fisheries research in promoting the fisheries industry of the country and there is no serious problem in the construction of the facilities.

1-3 MEMBERS OF JAPANESE BASIC DESIGN SURVEY TEAM

- Dr. Takeshi Hara ----- Team Leader
Chief of Pathogen Laboratory
National Research Institute of
Aquaculture Fishery Agency
Ministry of Agriculture, Forestry
and Fisheries
- Mr. Masahito Oyama ----- Team Coordinator
Social Development Cooperation
Department
Japan International Cooperation
Agency
- Mr. Shigehiko Sugi ----- Chief Architect
President
Shigehiko Sugi & Architects Inc.
- Mr. Joji Ogawa ----- Fishery Facility Expert
Marine Biologist
Shigehiko Sugi & Architects Inc.
- Mr. Yoshiyuki Ando ----- Building Expert
Architect
Shigehiko Sugi & Architects Inc.

This survey was participated in by Shigehiko Sugi & Architects Inc.

1-4 MAURITIUS AUTHORITIES CONCERNED

Ministry of Fisheries and Co-operatives and Co-operative Development	Hon Iswardeo Seetaram	Minister
	Mr. Pyneesamy Padayachy	Permanent Secretary
	Mr. Balakistnen Veerasamy	
	Mr. John David Ardill	
	Mr. Suresh Chandre Seeballuck	
	Dr. S.P. Ayyar	
	Mr. Muhammad Ismet Jehangeer	
	Mr. Dhaneswar Goorah	
	Mr. Vishwamitra Chineah	
	Mr. Benjamin Moutou	
Prime Minister's Office	Mr. Jugdish Rugoobur	
Ministry of Information and Broadcasting	Mr. Khodadeen Sumodhee	
	Mr. Noormanode Goolamamode	
Ministry of Finance	Sir Veerasamy Ringadoo	Minister
	Mr. Virjanan Mulloo	
Tender Board	Mr. Mohammad Haniff Ramdin	Chairman
Ministry of Agriculture & Natural Resources & the Environment	Sir. Satcam Boolell	

Ministry of Health	Mr. Luckrazsingh Hurpaul	
Ministry of Works	Hon. Emmanuel Bussier	Minister
	Mr. D. Ramyeed	Permanent Secretary
	Mr. Liwanpo	Principal Architect
	Mr. Rambhojun H.	
Ministry of Local Government		
Fire Services	Mr. Rajcoomar Ramgreed	
Ministry of External Affairs, Tourism & Emigration	Sir. Harold E. Walter	Minister
	Mr. Mohunlall Goburdhun	
Ministry of Communications	Mr. Silvio Desvaux	
Meteorological Services		
Telecommunications	Mr. Baboo Chandraduth Rye Rughoo	
Ministry of Economic Planning and Development	Hon. R. Ghurburrun	Minister
	Mr. Guy Wong So	
	Mr. Ayub Hussein Nukhuda	
	Mr. Louis France Harace Empeigne	
	Mr. Koosram Beerachee	
Ministry of Power, Fuel and Energy	Mr. Ah-sue	
	Mr. Koonkamking	

CHAPTER 2
RESEARCH CENTER AS GRANT AID PROJECT

2-1 EXCHANGE OF MINUTES

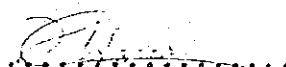
The following Minutes were exchanged between Mr. P. Padayachy Permanent Secretary, M. FCCD and Dr. T. Hara Team Leader of the Japanese Survey Team, 23rd October 1980 at the office of M. FCCD.

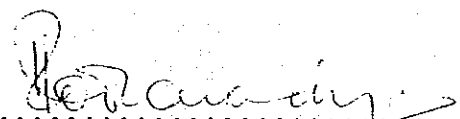
MINUTES OF DISCUSSION

In response to the request made by the Government of Mauritius for the Fishery Promotion Project in Mauritius (hereinafter referred to as "the Project"), the Government of Japan has sent, through the Japan International Co-operation Agency (hereinafter referred to as "JICA"), a team headed by Dr. TAKESHI HARA to conduct a basic design survey for 24 days from October 16th. The team had a series of discussions and exchanged views with the authorities concerned.

Both parties have agreed to recommend to their respective Governments to examine the results of the survey attached herewith towards the realization of the Project.

23rd OCTOBER 1980


.....
Dr. TAKESHI HARA
TEAM LEADER
THE JAPANESE SURVEY TEAM


.....
Mr. PYNEESAMY PADAYACHY
PERMANENT SECRETARY
MINISTRY OF FISHERIES AND
CO OPERATIVES & CO OPERATIVE
DEVELOPMENT

MINUTES

1. The proposed site of the Project will be Albion in the Black River District of Mauritius (hereinafter referred to as "the Project Site").
2. The object of the Project is to provide necessary buildings, incidental facilities and equipment for the Albion Fisheries Research Centre at the Project Site (hereinafter referred to as "the Centre").
3. The Japanese Survey Team will convey to the Government of Japan the desire of the Government of Mauritius that the former takes necessary measures to co-operate in implementating the Project and provides the buildings and other items listed in Annex I within the scope of Japanese economic co-operation in grant form.
4. The Government of Mauritius will take necessary measures, in the event that the grant assistance by the Government of Japan is extended to the Project -
 - (a) to provide data and information necessary for the design and the construction of the Centre,
 - (b) to secure lands necessary for the construction of the Centre,
 - (c) to clear and level the Project Site before the start of the construction,
 - (d) to provide the other items listed in Annex II;
 - (e) to ensure prompt unloading and customs clearance in Mauritius of imported materials and equipment for the construction, and to facilitate their internal transport,
 - (f) to exempt the Japanese nationals concerned from ^ccustoms duties, internal taxes and other fiscal levies imposed in Mauritius for the supply of goods and services for construction ,
 - (g) to provide and accord necessary permissions, licen^cses and other authorisation deemed advisable for carrying out the Project.

ANNEX I

Items requested by Government of Mauritius the cost of which will be borne by the Government of Japan -

- 1) Buildings
 - (a) Fisheries Laboratory
 - (b) Chemical Laboratory
 - (c) Optical Laboratory
 - (d) Observation Room for Ecology
 - (e) Offices
 - (f) Others

- 2) Equipment to be supplied for the study of -
 - (a) Aquaculture
 - (b) Marine Biology
 - (c) Chemical Analysis

ANNEX II

Items the cost of which will be borne by the Government of Mauritius -

- (1) Water supply mains to the Project Site,
- (2) External drainage and sewage line to the Project Site,
- (3) Electrical power main line to the Project Site,
- (4) Telephone lines and equipment,
- (5) Exterior facilities like access roads, fencing, parking and landscaping,
- (6) Provision of space necessary for such constructions as temporary offices, working area, stock yards, and others,
- (7) Items (1) and (3) shall be completed prior to the start of site works.

2-2 FISHERIES RESEARCH IN MAURITIUS

Mauritius is advancing from the monocultural structure centering on sugar to diversification of industries. Under this circumstance, the promotion of the livestock industry and fisheries industry is essential to assure a stable supply of food, especially animal proteins to the people.

The land of Mauritius is extremely limited and is developed mostly as sugar cane fields. Therefore, extensive land for livestock industry cannot be expected.

Mauritius is an oceanic country located on the Indian Ocean and is surrounded by a huge extent of fishery grounds having been developed and continuing to be developed in the future. Development of the marine resources in these fishery grounds is of extreme importance from the viewpoint of attaining a stable supply of animal proteins, and should be advanced on a scientific basis.

However, much production increase is not expected from the lagoon fisheries conducted in the coastal sea, especially in lagoons; therefore, introduction of aquaculture is taken into consideration. Furthermore, use of irrigation water ponds for inland fisheries is planned for the inland fisheries.

A series of these fishery promotion measures should be pushed forward in a scientific concept and method, and basic survey, test and research are essential for this purpose. The instruction and dissemination of the information and techniques obtained through these activities are also of the extreme importance.

2-3 FUNCTION OF RESEARCH CENTER

The production by lagoon fisheries accounts for about sixty percent of the total fisheries production, and makes up a major fisheries industry engaged in by over 90 percent of the total fishermen. In this sense, the improvement of lagoon fisheries is extremely important for the promotion of the fisheries industry in Mauritius. However, since lagoon fisheries is conducted in the limited sea area of lagoons, it is feared that the increase of fish catch is greater than that of fish resources, resulting from overfishing. To solve this problem, possibility for positive utilization of the lagoons, especially, for aquaculture in the Barachois is considered.

This requires test & research and survey regarding the selection of species, acquisition of seeds and development of the aquaculture, and the immediate requirements will be the establishment of the seed production and rearing technique for oysters, musells, crabs and mullets, etc. which are currently considered to be covered by aquaculture.

The culture of feed organisms for fish fries and improvement of the artificial feed quality will be the immediate subject for study regarding the macrobrachium, for which a seed production test has been carried out with success.

To promote inland water fisheries, the major problem will be concerned with the establishment of the polyculture technique and application of the technique in the irrigation pond measuring as much as 1,200 ha.

From the standpoint of utilizing marine products as foods, it is essential to study the quality control method for maintaining freshness of the products and handling, and to conduct tests and researches with respect to the ciguatera poison.

Through these activities, the Research Center will serve as a central test and research organization in the field of fisheries research in Mauritius.

CHAPTER 3

ESTABLISHMENT PLAN

Establishment Plan of the Research Center has been worked out through the survey by the Survey Team and discussions between the authorities concerned of Mauritius and the Survey Team. The Research Center will conduct test & research and survey regarding fisheries, as well as give instruction and dissemination of the techniques acquired, thereby making fundamental contribution to the promotion of the fisheries industry in Mauritius.

3-1 BASIC POLICIES

Architecture is a combined product of function, economy and formative arts. To materialize this concept, the following basic policies for fundamental design are established:

- (i) Since the Research Center is to become a central organization for overall fisheries in Mauritius, it should be designed to have excellent visual effect.

The project site is located in an extensive area surrounded by preserved nature. Since the Research Center is to become a central organization for overall fisheries, it is to be designed and built to present a high-quality impression with harmonious blending with the surrounding nature. Use and dissemination of Japanese techniques and equipment are anticipated as a result.

- (ii) The materials and construction processes of the locality are to be considered for designing whenever possible, so that the construction cost and period will be reduced.

Since Mauritius Island is formed by volcanic activities, aggregates are easily obtainable, and the concrete and concrete blocks are typical construction materials of this country. With consideration given to this fact, reinforced concrete is to be used for the structure while concrete blocks are to be used for walls.

- (iii) Designing is to be based on local habits and customs.

Study rooms will be built for each scientific officer, and two water closets will be set up according to the local custom.

- (iv) Through accurate understanding and analysis of the functions of the Research Center, as many equipment as possible are to be installed for the required purposes, minimizing the building construction cost.

The Research Center has the functions of test and research regarding seed fish production and rearing and survey for analysis of the ecosystem mainly in lagoons, and the functions of instruction and dissemination of the results obtained through these activities. It is staffed by six scientific officers, and is to be composed of the Administration Block, Research Block, Working Block,

Hatchery Block and Outdoor Rearing Area. The respective spans will be determined according to the economic consideration of the structures, subjects of research and number of the personnel to be accommodated.

- (v) Means should be provided to facilitate maintenance control and to minimize the maintenance cost.

Equipment piping should be provided at exposed positions in principle for easy maintenance control and reduced maintenance cost. Top lights should be provided in the laboratories, and the need for artificial light should be eliminated in the daytime. Rise of the room temperature should be prevented by effective ventilation through prevention of direct exposure to sunlight through open corridors and by effective heat insulation through an air layer on the ceiling, thereby eliminating the need for artificial room cooling as a rule.

- (vi) Sufficient consideration must be given to the climatic conditions of the locality.

The open corridors are required to serve the purpose of protecting the rooms against the cyclones and intense sunshine.

3-2 BASIC DESIGN

3-2-1 Site

The proposed site is located along the Albion beach, 20 km south-west from the capital city, Port Louis of the Mauritius Island. Part of 18 ha. land area in the site belongs to M. FCCD and Ministry of Agriculture & Natural Resources & the Environment, and the rest have been acquired from Medine Sugar Estates Co., Ltd.

(1) Circumstances and Geography

The north-western part of the site is located near the sea which spreads to a lagoon. In the north-east, a bathing resort is dotted with residential houses. River Cabots runs along the other two sides. The elevation of the site is about 2 - 3 m above the Highest Water Level.

In accordance with the proposal of the National Physical Development Plan, this zone falls within the agricultural zone. The beach-area located in the north-eastern and south-western areas of the site is the nature reserve zone. But, this status has not yet been approved.

(2) Geology

According to the boring logs in the site, the upper layer with a depth of 7.0 m is made up of coral sand. Below this layer the subsurface consists of boulders and clinkery layer. Soil bearing investigations were carried out at a depth of 1 m from the existing ground level in 3 different points within the site area. As per the investigation results, the soil at that depth has a bearing capacity of 25 t/m².

(3) Infrastructure

Fresh water supply source is located at a distance of about 1 km from the site. Sewage is required to penetrate into underground after treatment through a septic tank. Electricity can be available from a place about 1 km away. As wire telephone is not available, wireless telecommunication system is required. Gas can be supplied using gas cylinders.

(4) Natural Environment

Subtropical weather prevails in Mauritius. Cyclone occurs from November to May. The zone is almost free from earthquake.

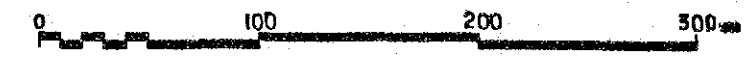
(5) Transportation

A main road is running from Port Louis for a distance of about 10 km towards south-west. From this point a byroad is stretching for about another 10 km to Albion. Starting from the early morning till evening bus service is available at the Albion bus stop. The site is in the opposite side of River Cabots. Road communication is available either through the existing bridge or through another bridge which will be repaired.

(6) Adequacy of the Project Site

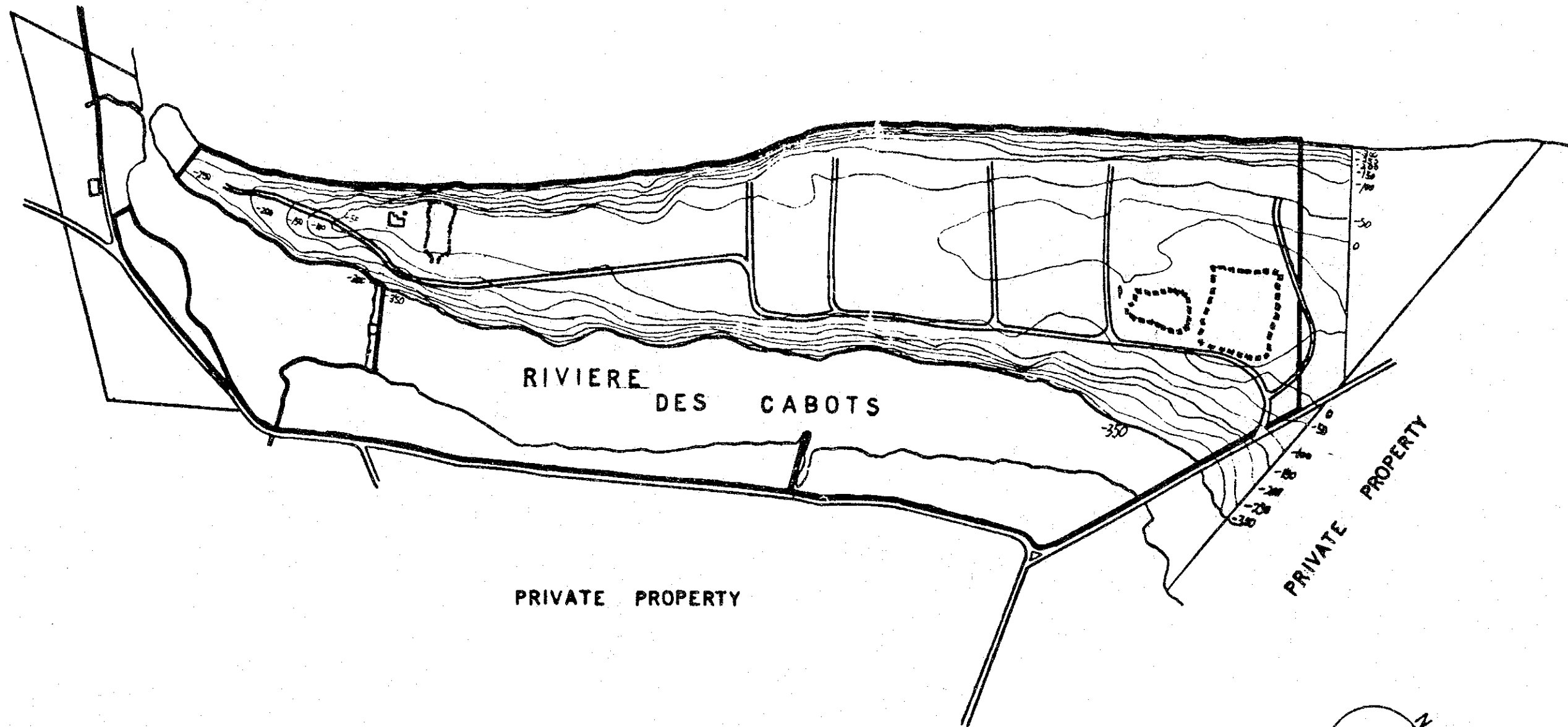
As the site is located near the country's administrative center Port Louis, exchange of informations is easy. Also, the quiet surrounding of the site is suitable to continue uninterrupted research activities. In addition to these, both fresh water and sea water supplies are possible and the site can be reached by boats. The soil condition can be considered to permit easy construction. The site belongs to the Government and is easy to level because of the almost flat shape. Furthermore, as the site is large enough for the possible future extension plans related to the fisheries, long term prospect could be required to consider in planning.

• SITE PLAN •



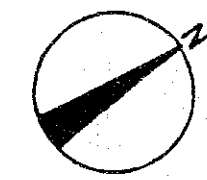
□ SITE 17.8ha

SEA



PRIVATE PROPERTY

PRIVATE PROPERTY



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3-2-2 Building Plan

(1) Outline and System

The Research Center is composed of two buildings, main building and hatchery building. The main building consists of administration, research and working blocks. These three blocks are connected by the open corridors and at the same time separated by the inner courts. The concept of connection and separation is the principal system and underlying philosophy of the design.

The architectural functions of the open corridors are as follows:

Protection from the direct sunlight and control of sunlight.

Protection from cyclone.

Main walkway.

Principal line for various facilities.

Infrastructure for the possible future extension.

Natural lighting from south and north in the inner courts.

Contrasting view due to sunlight and sunshade.

Total gross area of the buildings is 1,300 m². Besides, outdoor rearing area is 200 m². The buildings are one-storied and made of reinforced concrete and concrete blocks although part of them is made of steel. Following are the respective areas of the different buildings.

Administration Block	510 m ²
Research Block	360 m ²
Working Block	280 m ²
Hatchery Block	150 m ²
Total	1,300 m ²
Outdoor Rearing Area	200 m ²

Building equipments to be used are water supply, sanitary, electricity, air-conditioning, ventilation, gas and fire extinction.

(2) Block Planning

The site extends 1,200 meters from north-east to south-west along its longitudinal direction and is sandwiched between the sea and river. Following reasons can be mentioned in selecting the project site of the Research Center in the south-western part of the site.

As the south-western part is surrounded by the sea and river, this part is separated from the surroundings.

As the south-west part is near to the ship entrance way built by dynamiting the lagoon, passage of boats is convenient.

The form of the main building is straight and simple for the following reasons:

To assure a good view of the sea from various places within the facilities

To assure natural ventilation

To assure a much natural lighting

To blend well with surrounding huge nature

(3) Material Planning

As a principle, materials for construction shall be supplied from either Mauritius or Japan. Furniture, insulating materials, water tanks, etc. which have high quality and involve much transportation costs can better be supplied from the local markets. As materials of structure, reinforced concrete as well as concrete block shall be used. This is because aggregates in concrete are most representative raw materials of construction in Mauritius, and this promotes the local industry and expands the employment opportunity for the local people. Also the reason for constructing buildings with reinforced concrete is due to the anticipation that they will prevent the structures from being damaged by the strong cyclone wind or salty wind from the sea.

(4) Architectural Planning

1) Rooms to be constructed

a) Administration Block

The following rooms will be provided:

- Administration Room
- Study Room
- Conference Room
- Data Room
- Ecological Observation Room
- Night-duty Room
- Garage

b) Research Block

The following rooms will be provided:

- Study Room
- Biological Laboratory
- Chemical Laboratory
- Optical Laboratory
- Dark Room

c) Working Block

The following rooms will be provided:

- Technicians' Room
- Nurserymen's Mess
- Feed Preparation Room
- Workshop
- Machine Room

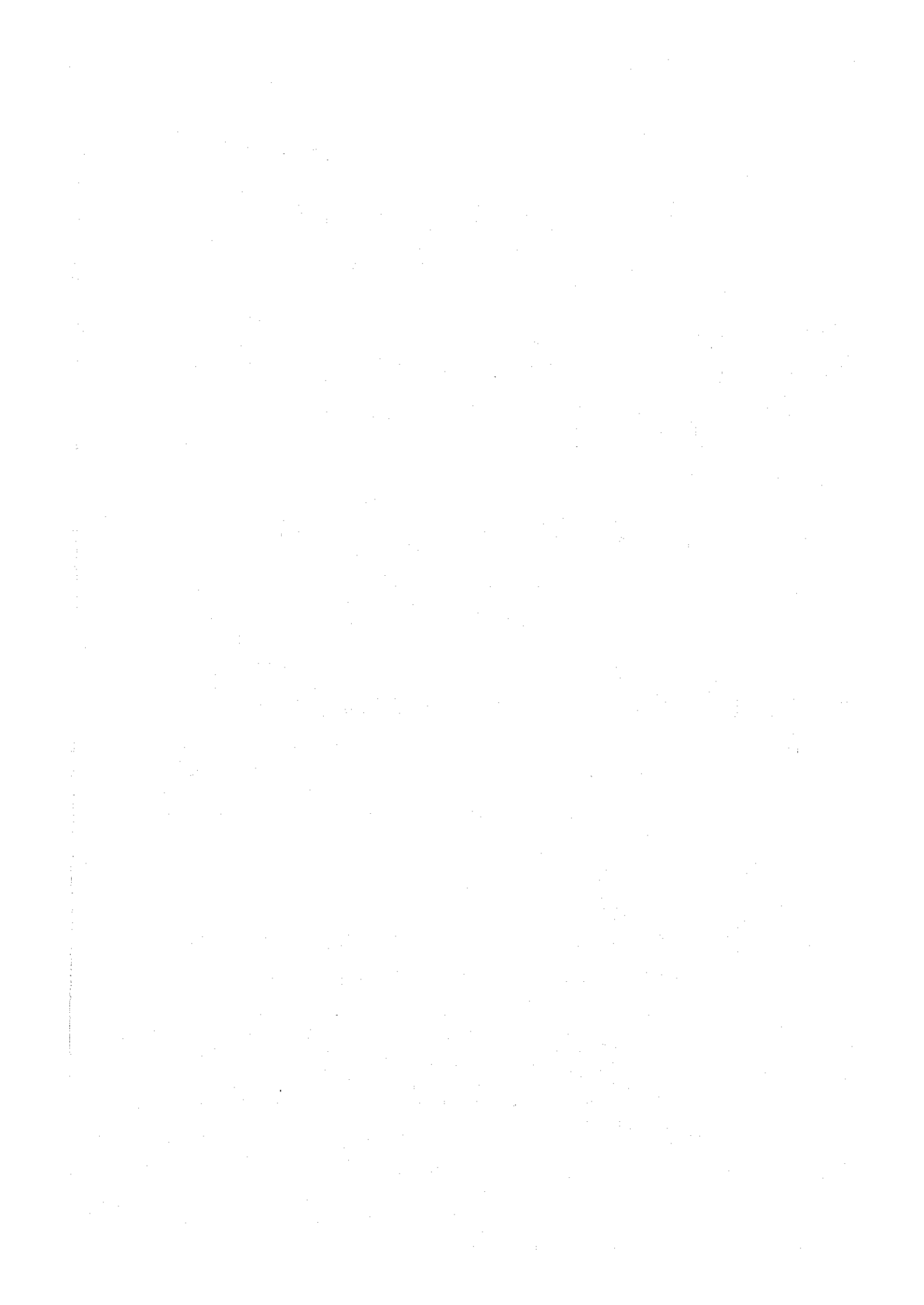
d) Hatchery Block

The following rooms will be provided:

- Hatchery
- Storage

2) Span and Floor Height

Considering the arrangement of the laboratory equipment and economy of the structure, the span is decided to be 9.0 m x 6.4 m. Considering the ceiling clearance required for the well distributed natural light of the laboratory and air layer required to control the room temperature, the floor height will be 3.7 m.



3) Building Components

The building components shall be designed mainly considering protection from strong wind and direct exposure to sunshine.

a) Roof

To protect the building from direct sunlight and heavy rainfall, waterproofing sheet is applied. Heat insulating material is placed between the sheet and slab to stop the rise of temperature of concrete roof slab due to the solar heat.

b) Open Corridor

Open corridor will take the role of controlling the direct sunlight, alleviate the strong wind and become a space for equipment pipings.

c) Exterior Walls

To withstand the climate, the exterior wall shall be made of concrete and concrete block with spray finish.

d) Windows

To withstand the strong wind pressure and stop the salty wind from entering aluminum sash shall be used.

e) Ceiling

The ceiling will reserve air layer space between concrete slab for insulation of heat.

f) Partitions

Considering the waterproofing and sound insulation, concrete or concrete blocks shall be used.

g) Floors

Waterproof mortar finish is applicable to the wet floors. For the remaining areas, vinyl asbestos tile will be used mainly.

(5) Finish Planning

	FLOOR	WALL		CEILING	
ENTRANCE HALL	TERRAZZO TILE	STL TRWLD MORTAR	E.P.	ROCK WOOL BOARD	
ECOLOGICAL OBSERVA- TION R.M.	"	"	"	"	
CONFERENCE R.M.	VINYL ASBES- TOS TILE	"	"	"	
ADMINISTRATION R.M.	"	"	"	"	
DINING R.M.	"	"	"	"	
STUDY R.M.	"	"	"	"	
BIOLOGICAL LABORA- TORY (D)	"	"	"	"	
BIOLOGICAL LABORA- TORY (W)	STL TRWLD MORTAR	"	V.P.	ASBESTOS BOARD	V.P.
CHEMICAL LABORATORY	VINYL ASBES- TOS TILE	"	E.P.	ROCKWOOL BOARD	E.P.
OPTICAL LABORATORY	VINYL ASBES- TOS TILE	"	"	ROCKWOOL BOARD	
DARK R.M.	STL TRWLD MORTAL	"	V.P.	ASBESTOS BOARD	V.P.
STORAGE	"	"		CONCRETE FINISHING	"
TECHNICIANS' R.M.	VINYL ASBES- TOS TILE	"	E.P.	ROCKWOOL BOARD	
FEED PREPARATION R.M.	STL. TRWLD MORTAR	"	V.P.	CONCRETE FINISHING	V.P.
NURSERYMEN'S MESS	VINYL ASBES- TOS TILE	"	E.P.	PLYWOOD	E.P.
MACHINE R.M.	STL. TRWLD MORTAR	"		CONCRETE FINISHING	
TOOL R.M. CUM ME- CHANICAL WORKSHOP	"	"	E.P.	"	E.P.
TOILET	MOSAIC TILE	"	V.P.	PLYWOOD	E.P.
OPEN CORRIDOR	PAVING CONCRETE BLOCK	ACRYLIC SPRAY		ACRYLIC SPRAY	

(6) Structural Planning

The main structure is a reinforced concrete structure with the columns, beams and footing beams being fixed.

1) Foundation

In 3 different points within the site penetrations up to 1.0 m depth were made. The result shows the presence of coral sand in the subsoil. Cone penetrometer results give a load bearing capacity of soil of 25.0 t/m².

From these results, the design bearing capacity of soil for permanent loading condition is assumed to be 12.5 t/m². For temporary loading the bearing capacity is assumed to be 25.0 t/m². Considering these factors, independent footing directly supported by soil shall be the best method. Footing beam shall be constructed so that the bending moment of the column is not directly supported by the footing itself.

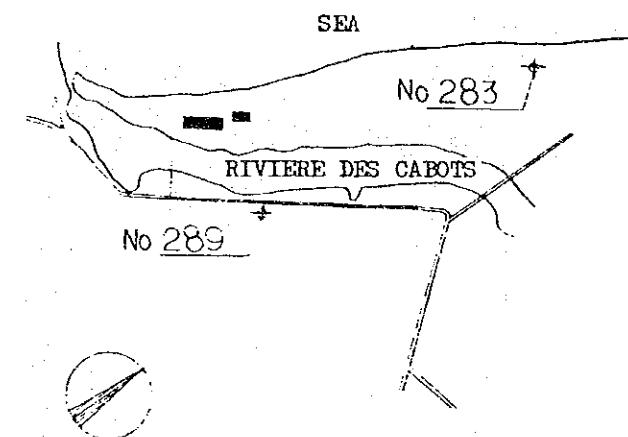
DIAMOND DRILLHOLE RECORD

Central Water Authority

m	Hole No.	Description
0	289	Sand corals and loam Flow. Bl. gy. med. gr. with consp. large fclsp. xtals 9-11 ves. last foot
10		Short flow Coral and sand Flow. Bl. gy. med. gr. 25-27, 29-30 ves. broken Flow. Bl. gy. fine gr. 30-31, 37-38 ves. broken Short thin flows Bl. gy. fine gr. weathered to purple
20		V. ves. and clinkery throughout Flow. Bl. gy. med. gr. slightly weathered to greyish white 67-70, v. ves. 70-80 rather fresh-broken
30		Flow as above. 88-90, 92-95, 98-100 weathered ves. with traces of white clay in ves. Flow. Bl. gy. med. gr. with consp. fclsp.
40		111-112 weathered ves. 113-114 clinkers with clay Flow. bl. gy. med. gr. with small consp. fclsp. xtals 115-117 red tuff. 117-122 slightly weathered and ves. rest fresh Red tuff Thin flows.
50		Bl. gy. med. gr. with large consp. fclsp. 144-146, 150 ¹ -151, 152-153 weathered & tuffaceous 147-150, 151-152, 156-165 Flow greenish Bl. gy. med. gr. 165-167 ves. ves.
60		Flow. Bl. gy. med. gr. slightly weathered Flow as above. 184-186, 188-194, 199-202 weathered ves.
70		Flow as above. weathered tuffaceous and ves. 205-223 v. poor recovery
80		
90		
100		Weathered tuffaceous lava Tuff (weathered lava 7)
110		Flow-early lava. Bl. gr. fine gr. chloritised with few ves. filled with Kaelin soolites Flow as above. weathered-fissured with deposits of Kaeline in fissures Coral with a few small lava boulders
120		
130		Weathered early lavas (marine influence). The lava has become yellowish grey with ves. filled with yellowish brown mineral deposits Old volcanic series. Bl. gy. fine gr. chloritised.

283

m	Hole No.	Description
0	283	Sand and coral Flow. Bl. gy. med. gr. 23-31 soil and boulders-rest fresh but broken
10		Flow as above. 37-43 v. ves. and broken 45-48 clinkery with some corals? Flow as above. -ves. broken throughout
20		Flow as above. Fresh fissured at a few places with greenish grey deposits in fissures. Flow. Bl. gy. med. to fine gr. with small ves. filled with zeolites but deposits of manganese in larger ves. 75-87 ves. clinkery Short lava blocks with ves. filled with zeolites. 100-102, 105-106 v. ves.
30		Flow partly altered with consp. fclsp. 110-112, 115-117, fissured and partly altered to red. 117-120 weathered to light grey.
40		
50		Flow. Bl. gy. med. gr. 120-143 clinkery-rest fresh with few large ves.



2) Policy of Main Frame Analysis

Main frame consists of column, beam and footing beam. Design works are done using elastic design method. In the analysis of stresses, safety factors shall be checked for two different loading conditions. One is when vertical load (Permanent load) is applied and the other one is when vertical load and horizontal load acts simultaneously (Temporary load). In accordance with the analysis method, stress and deformation of each member are determined by the deformation method.

3) Load

(Vertical load)

Dead load	Reinforced concreted	2.4 t/m ³
	Concrete block	100 - 250 kg/m ²
Live load	Roof	50 kg/m ²
	Floor	300 kg/m ²

(Horizontal force)

As per seismic distribution map, this zone almost free of earthquake. Also, in accordance with the data available from the past weather report concerning the maximum wind velocity due to cyclone, wind pressure can be calculated by using the following formulas.

$$p = c \cdot q \text{ (kg/m}^2\text{)}$$

$$q = 1/2 \rho \cdot v^2 \text{ (kg/m}^2\text{)}$$

where

p = wind pressure

q = wind velocity

$$\rho = 1/8 \text{ (kg} \cdot \text{sec}^2/\text{m}^4\text{)} \quad v_0 = \text{maximum wind velocity}$$

$$v = v_0 \sqrt[4]{h/15} \text{ (m/sec)} = 80 \text{ (m/sec)}$$

$$p = 103c \sqrt{h} \quad c \text{ (Wind Pressure factor)}$$

$$c = 0.9$$

$$c = 0.3$$



4) Materials and Allowable Stress.

Cement Portland Cement

Coarse aggregate Crushed Stone

Fine aggregate Coral Sand

Concrete

Specified concrete strength at 28 days, $F_c = 210 \text{ (kg/cm}^2\text{)}$

Shear strength $F_s = 7.0 \text{ (kg/cm}^2\text{)}$
 (10.5 kg/cm^2)

Compressive strength $F_c = 70 \text{ (kg/cm}^2\text{)}$
 (140 kg/cm^2)

Steel Bar (SD30)

Yield stress 3,000 (kg/cm²)

Allowable tensile stress 2,000 (kg/cm²)

Allowable compressive stress 2,000 (kg/cm²)

(3,000 kg/cm²)

Steel (SS41)

Yield stress 2,400 (kg/cm²)

Allowable tensile stress 1,600 (kg/cm²)

Allowable compressive stress 1,600 (kg/cm²)

(2,400 kg/cm²)

Note: Strengths written within the parenthesis shall be applicable in case of temporary loading.

5) Design of References

The design method and diagrams of the Architectural Institute of Japan can be used with consideration given to local conditions.

(7) Machinery Equipment Planning

1) Water supply equipment

a) Amount of Water Supply requirement

Well water for living purposes 5 tons/day

Sea water for research purposes 200 tons/day

Well water for research purposes 70 tons/day

Well water for living purposes:

The above figure is calculated assuming that one person consumes 150 litres of water per day, and 30 persons are stationed.

Sea water for research purposes:

The standard for conversion rate varies according to the kind of fish and density of fish. All water in the tanks for fish culture by running water system is assumed to be changed in four hours. The total amount of the tanks in the Research Center is approximately 100 tons, of which 35 tons is considered to be used for fish culture by running water system.

Well water for research purposes:

This is used to dilute sea water, and the required amount will be one third of that of the sea water. This water is also used to clean the research equipment.

b) Water supply system

(Fresh water)

Fresh water shall be supplied from the Government well to the setting sand and water storage tank by using pumps. And from there, by using the pressure method water will be distributed to each of the necessary places. For distribution of water from the water storage tank 4 number of pumps will be used with reciprocal operation.

(Sea water)

Pond will be dug near the sea-shore. Sea-water will be sent to the setting sand and water storage tank by using pumps. Afterwards this water will be distributed by the same method as fresh water.

2) Drainage equipment

a) Sewage

Sewage from toilets will be purified in the septic tank and discharged through the permeation tank. Other sewage will be discharge through the permeation tank.

b) Rain water and tank water of fish culture discharge.

They will be discharged directly outside the project site.

3) Septic tank facility

Decomposition process will be used for the septic tank.

4) Sanitary equipment

A system suitable for the local living condition shall be utilized.

5) Gas equipment

Using gas cylinder liquified gas shall be utilized.

6) Ventilation equipment

Natural ventilation will be used. But, mechanical ventilation system shall be provided to the dark room without direct connection with the open air.

7) Cooling equipment

In general cooling equipment will not be used. Cooling system will be used only in the optical laboratory for dehumidification.

8) Air distribution equipment

To supply air into the water tank central system and unit system will be used. Capacity of central system is 100 m³ per hour.

(8) Electrical Equipment Planning

1) Electric service

Considering the load using factor, it is assumed that the desired electric power is about 40 KVA.

2) Private power plant

Just to cover the above estimated electric power a private power plant will be planned. The generator will be specifically diesel operated air-cooled low-pressure power system. With a supplementary generator, power will be produced reciprocally.

3) Distribution equipment

Planning of the power distribution within the buildings will be as follows.

Main electric power line	3-phase 4-line	400/230V	50 Hz	
Circuit for electric power	3-phase 3-line	400V		"
Circuit for illumination	Single-line 2-line	230V		"

Power controlling board and light distribution board will be utilized. Each of the boards will be controlled and supervised.

4) Lighting Fixtures

Illumination devices will be mostly fluorescent and degree of illumination will be as follows.

Office room, laboratory, etc.	100 x
Storage, corridor, toilet, etc.	50 x

5) Telephone conduit equipment

For the communication with outside, wireless system will be used. Interphone system with loud speaker will be used within the building.

6) The outdoor lights will be installed at the project site and will be automatically operated by timers.

(9) Garden Planning

As the environment of the site is good enough, the basic policy of this planning will be the preservation of nature. This object will be reached by minimum grading and keeping the existing trees in the present condition.

Infrastructure such as the road, etc. will be built in coordination with the natural shape.

(10) Tabulation of Floor Area

ADMINISTRATION BLOCK	510 m ²
Administration Room	18 m ²
Study Room (C.O)	24 m ²
Study Room (D.S.O)	18 m ²
Entrance-hall	35 m ²
Conference Room	92 m ²
Data Room	23 m ²
Ecological-Observation	25 m ²
Night-duty Room	10 x 2 m ²
Dining Room	23 m ²
Garage	46 m ²
Others	186 m ²
RESEARCH BLOCK	360 m ²
Study Room (S.O)	12 x 6 m ²
Biological Laboratory	92 m ²
Chemical Laboratory	46 m ²
Optical Laboratory	23 m ²
Dark Room	6 m ²
Storage	12 m ²
	6 m ²
Others	103 m ²

WORKING BLOCK 280 m²

Technician's Room 46 m²

Nurserymen's Mess 23 m²

Feed Preparation Room 23 m²

Tool Room Cum

Mechanical Workshop 23 m²

Machine Room (Pump) 12 m²

23 m²

Storage 6 x 2 m²

23 m²

Others 95 m²

HATCHERY BLOCK 150 m²

Hatchery 125 m²

Storage 25 m²

3-2-3 Research Equipment Plan

The selection will be made of those equipment meeting the purposes specified below and according to the Minutes.

- | | | |
|-----|----------------------------------|---|
| (1) | Test & Research | Research, Test Equipment, etc. |
| (2) | Survey | Boat with Outboard Motor,
Jeep, etc. |
| (3) | Instruction and
Dissemination | Diesel Panel Van, etc. |

3-2-4 Drawings and List

(1) List of Main Equipment

1) Equipment for Tests & Research

Equipment	Q'ty
Physical and Chemical Equipment	
Direct Reading Balance	1
Direct Reading Balance, Pan Type	2
Spectrophotometer	1
Flame Spectrophotometer	1
Ethedstem Type Thermometer	15
PH Meter	1
Water Checker	1
Refractometer	3
Submarine Illuminometer	1
Biological Microscope	1
Dissection Microscope	2
U.V. Sterilizer	3
Autoclaves	1
Centrifuge	1
Water Baths	1
Constant Temp. Oven	1
Muffle Furnace	1
Drying Sterilizer	1
Paraffin Melting Apparatus	1
Water Distiller	1
Cutting Mill	1
Vacuum Pump	1
Shaker	1
Automatic Weighing Balance	1
Refrigerator	3
Freezer	3
Draft Chamber	1
Central Table	3
Storage Cabinet	4

Compressor	1
Microtome	1
Small Water Tank	50
Rotary Evaporator	1
Water Bath (for Rotary Evaporator)	1
Submersible Pump	4
Paraffin Spreading Apparatus	1
Thin-layer Chromatograph	1
Safety Box	1
Support Jack	1
Arm Jack	1
Small Blower	10
Photo Dryer	1
Enlarger	1
Lens	1
Easel Mask	1
Dark Room Lamp	1
Projector	1

Glass made Experimental Equipment (Beaker, Flask, Pipet, etc.)

Auxiliary Experimental Equipment (Micrometer, Slide Glass, etc.)

Essential Equipment for Experiment (Alcohol Lamp, Gas Burner, etc.)

2) Equipment for Survey

Jeep	1
FRP Boat with Outboard Motor	1
Diving Gear	2

3) Equipment for Instruction and Dissemination

Diesel Panel Van	1
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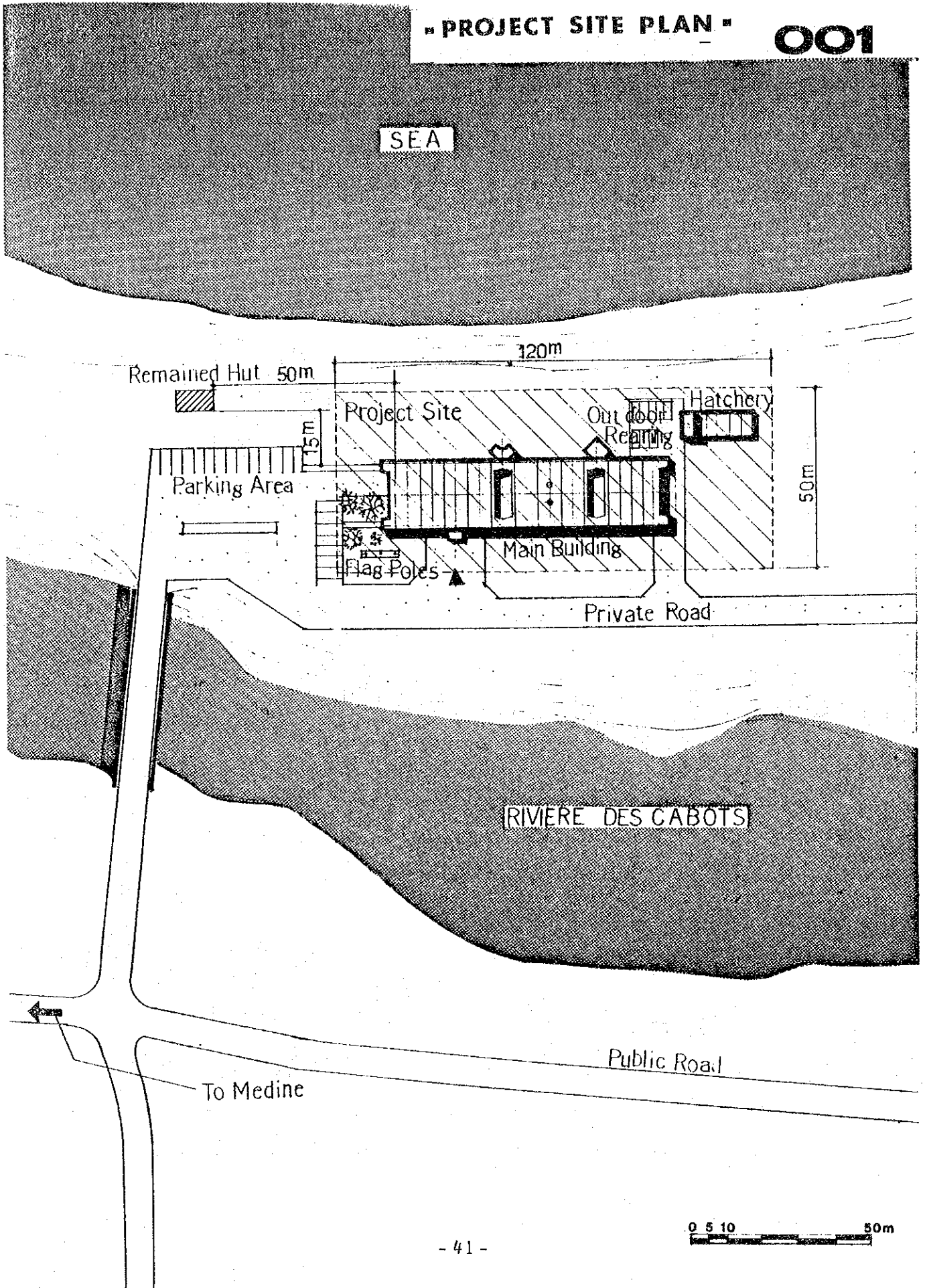
(2) Drawings of Basic Design

LIST OF DRAWINGS

- 001 PROJECT SITE PLAN
- 002 MAIN BUILDING GROUND FLOOR & ROOF PLAN
- 003 MAIN BUILDING SECTION & ELEVATION
- 004 HATCHERY GROUND FLOOR PLAN, SECTION & ELEVATION
- 005 WATER SUPPLY SYSTEM
- 006 DRAINAGE SYSTEM
- 007 AIR SUPPLY SYSTEM
ELECTRICAL EQUIPMENT
- 008 LAYOUT OF EQUIPMENT I
- 009 LAYOUT OF EQUIPMENT II
- 010 LAYOUT OF EQUIPMENT III

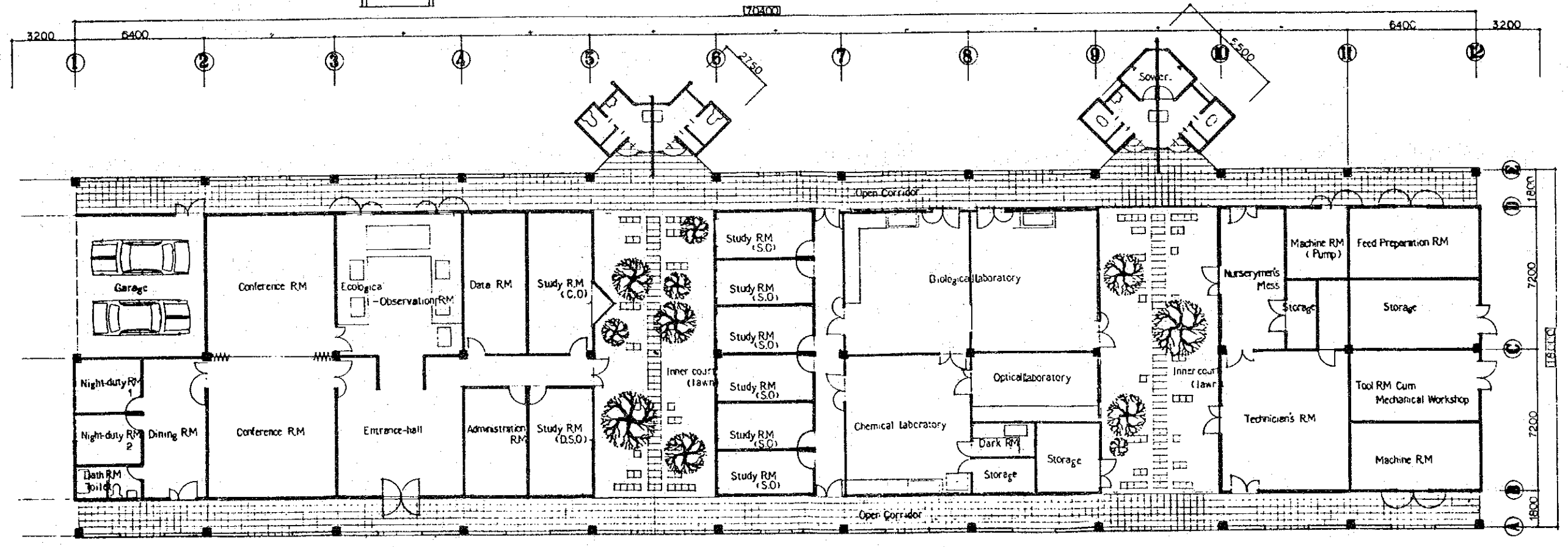
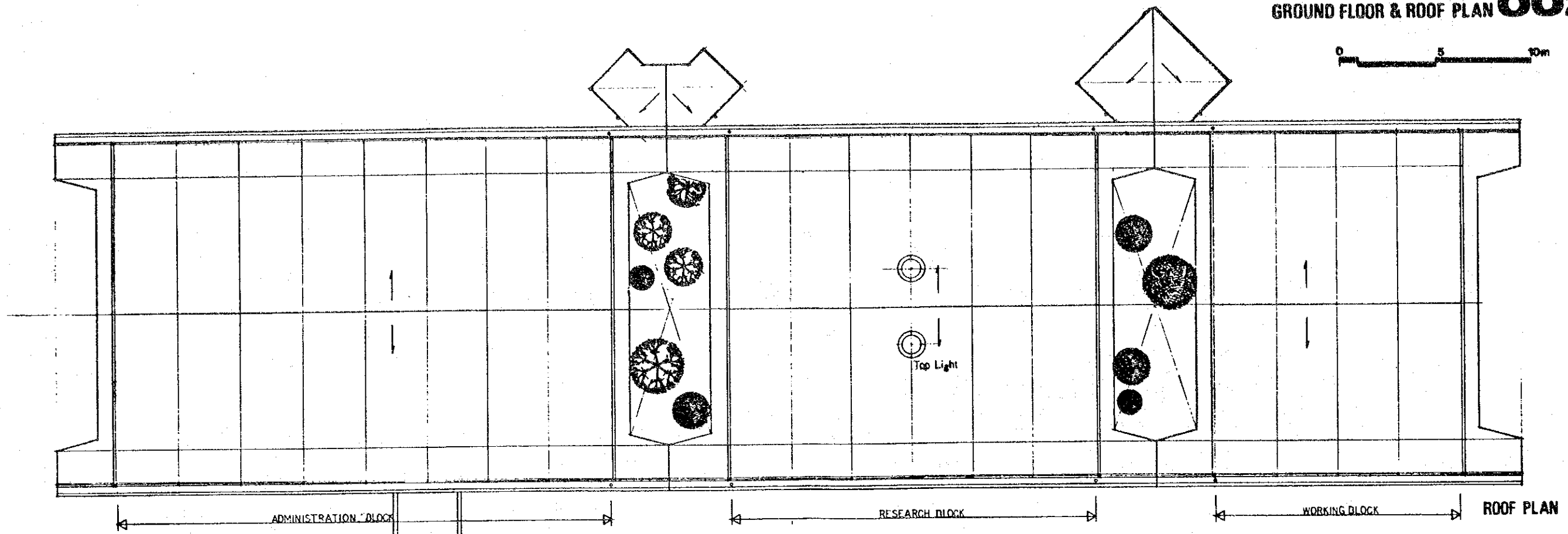
PROJECT SITE PLAN

001



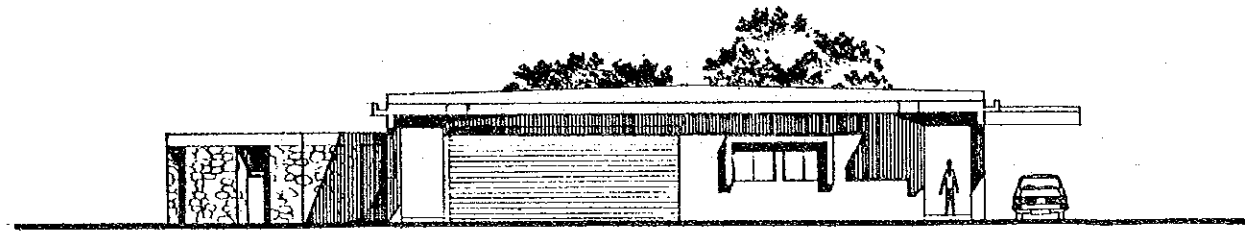
MAIN BUILDING
GROUND FLOOR & ROOF PLAN **002**

0 5 10m

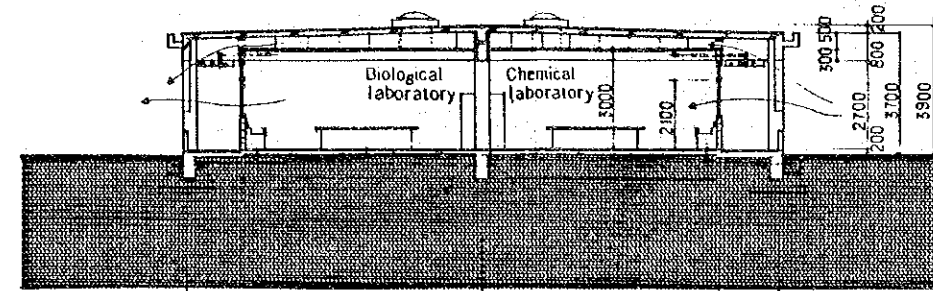


GROUND FLOOR PLAN

■ MAIN BUILDING ■
SECTION & ELEVATION 003

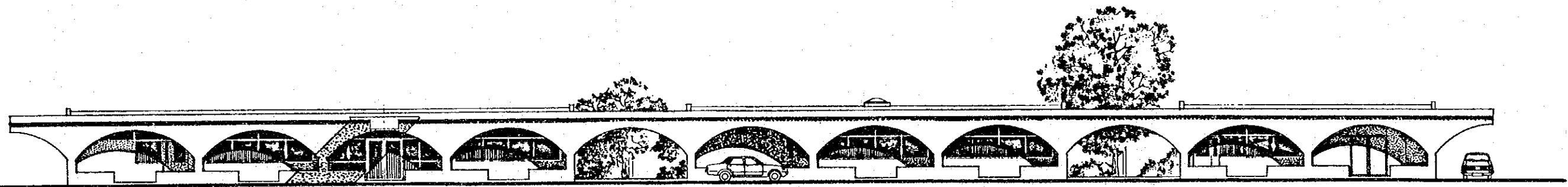


Ⓔ Ⓕ Ⓖ Ⓗ Ⓘ ELEVATION



Ⓔ Ⓕ Ⓖ Ⓗ Ⓘ SECTION

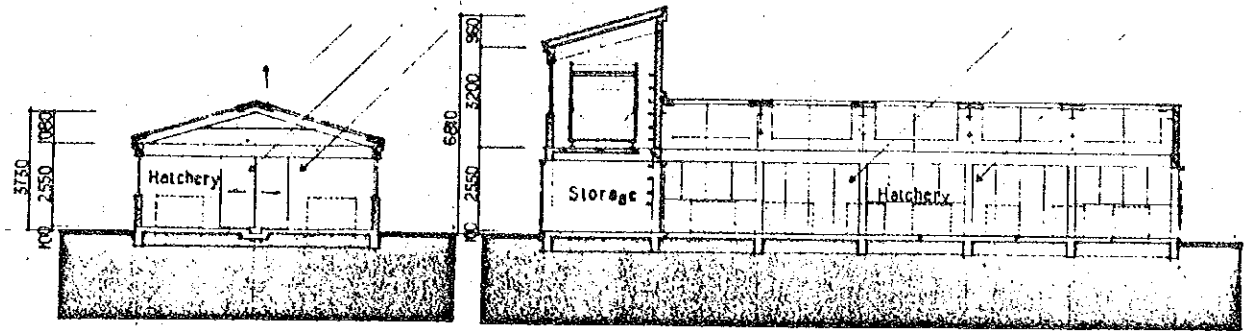
1800	7200	7200	1800
9000		9000	
18000			



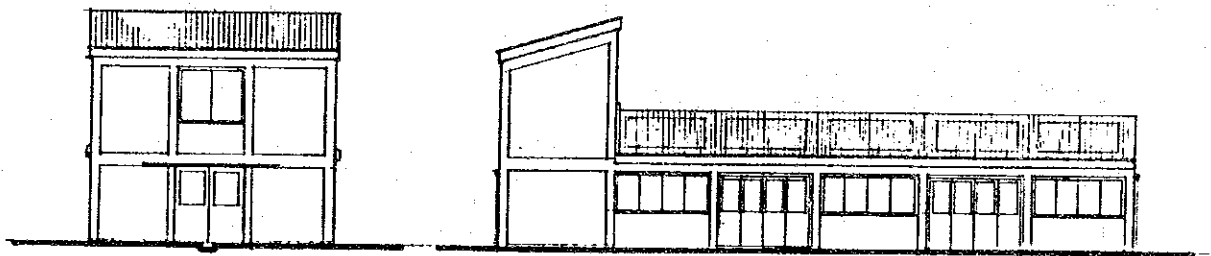
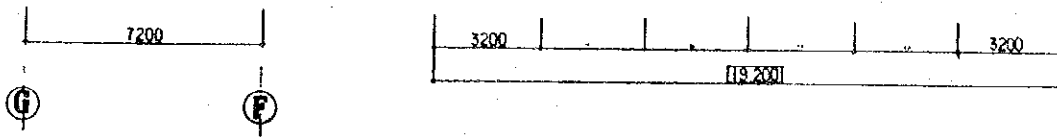
① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ELEVATION

HATCHERY

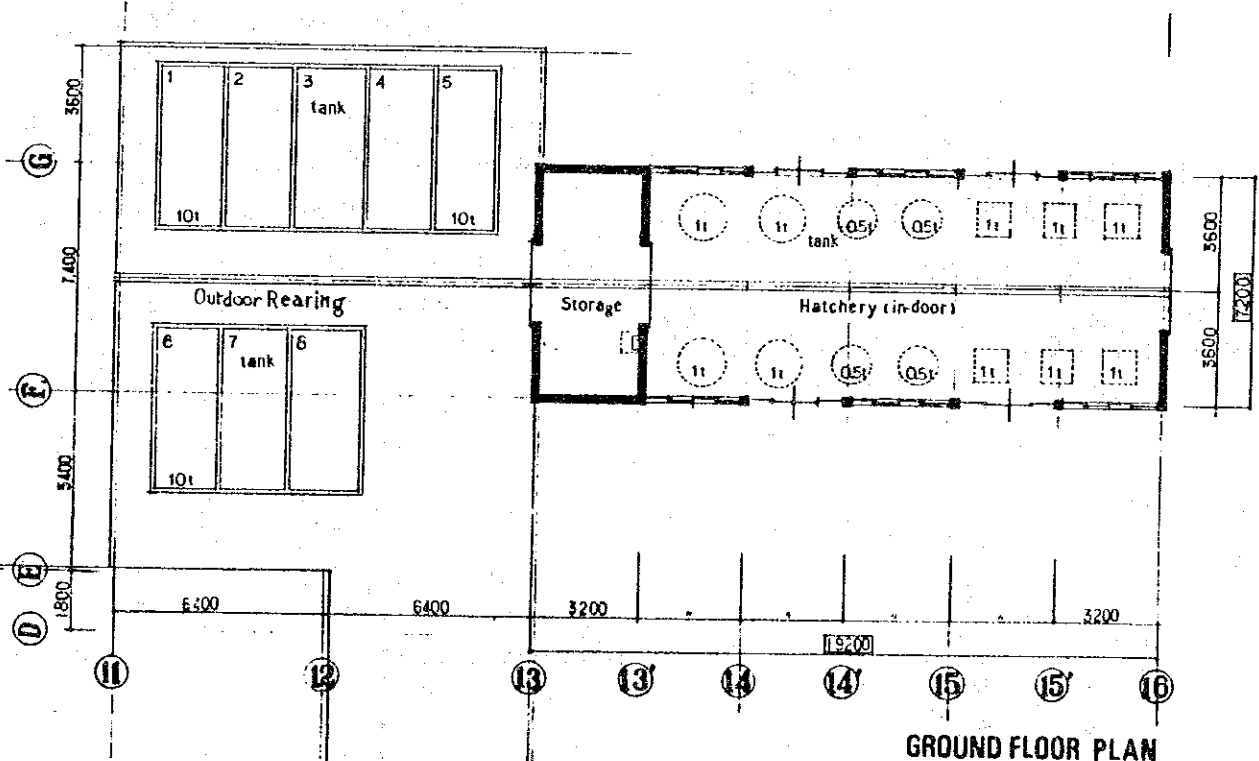
GROUND FLOOR PLAN, SECTION & ELEVATION 004



SECTION

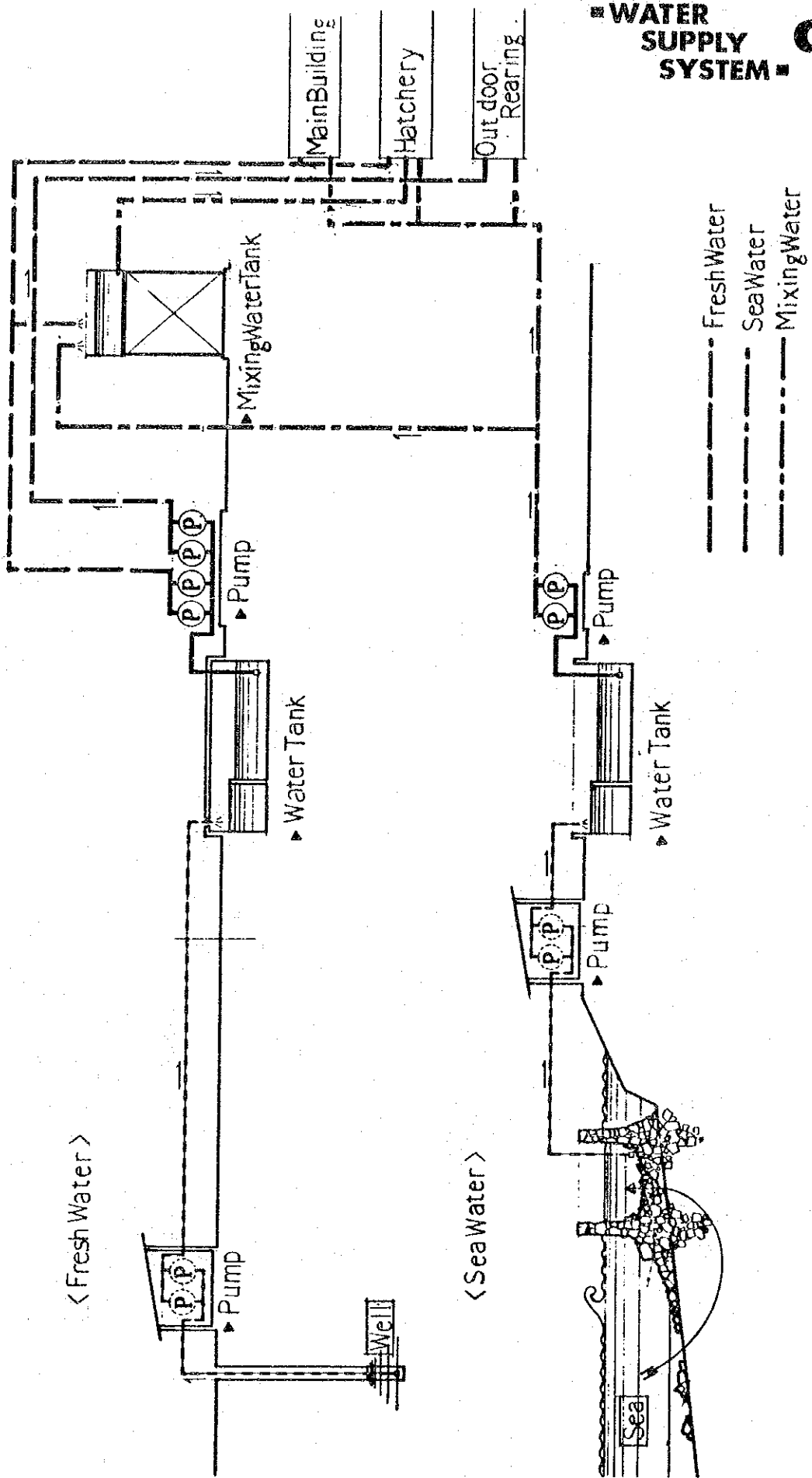


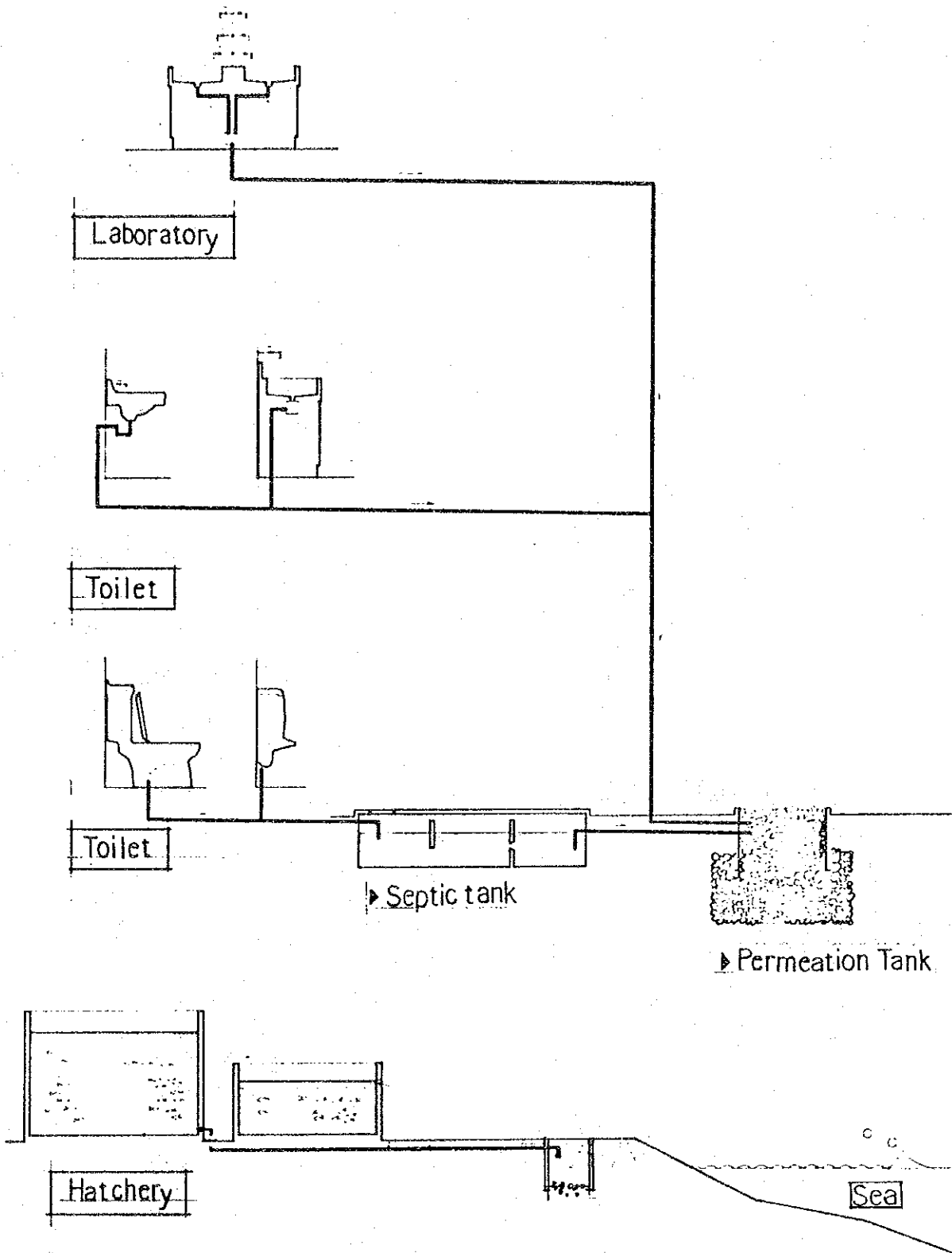
ELEVATION



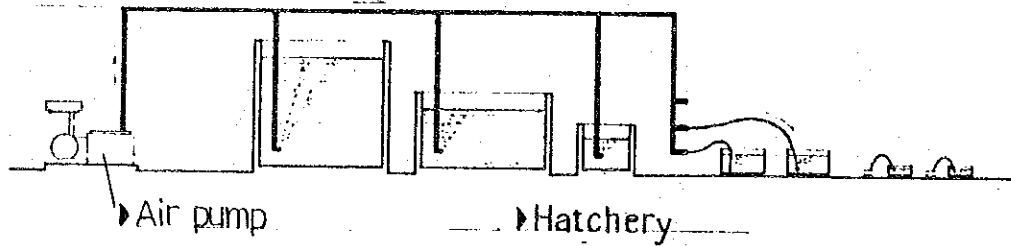
GROUND FLOOR PLAN

■ WATER SUPPLY SYSTEM ■ **005**

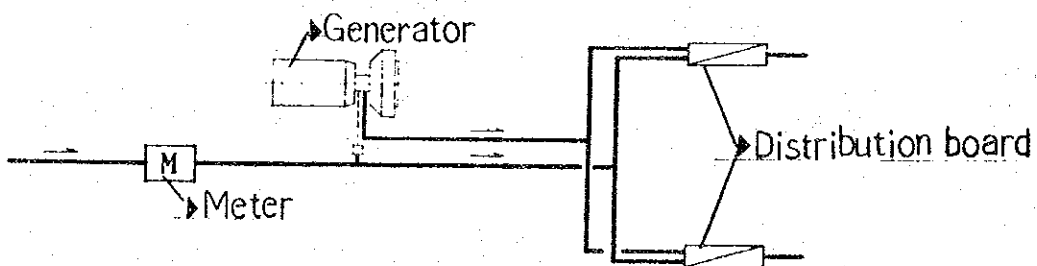




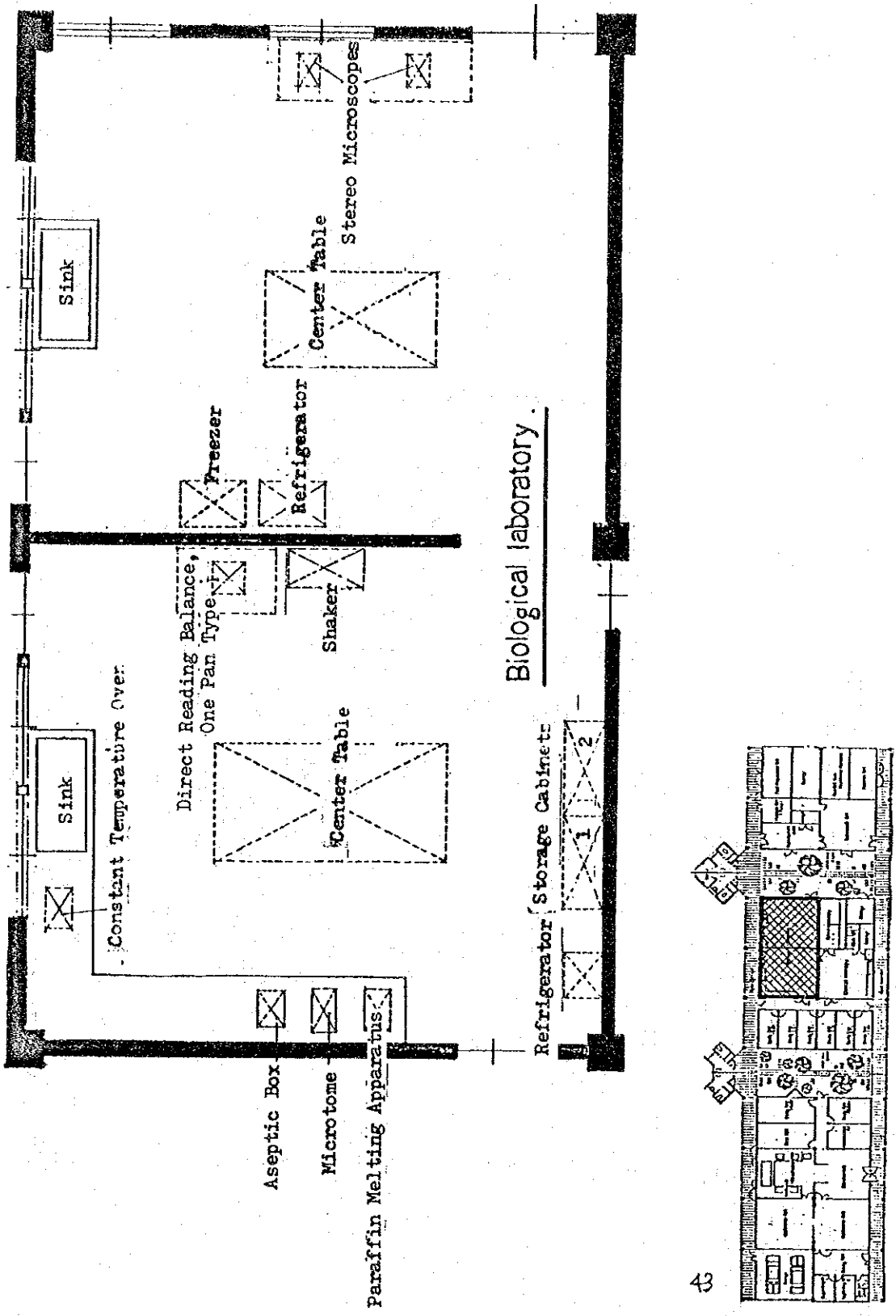
AIR SUPPLY SYSTEM



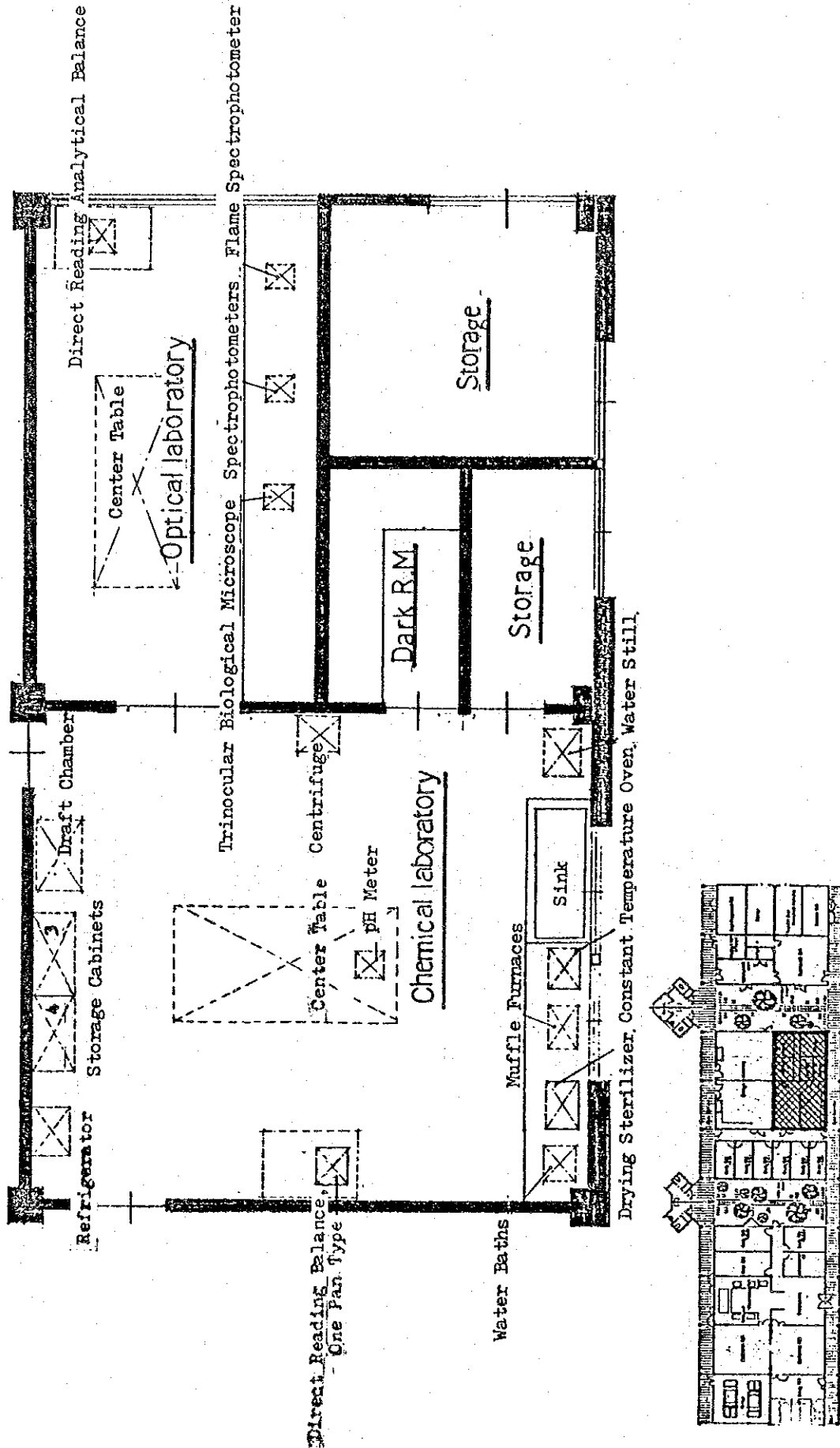
ELECTRICAL EQUIPMENT



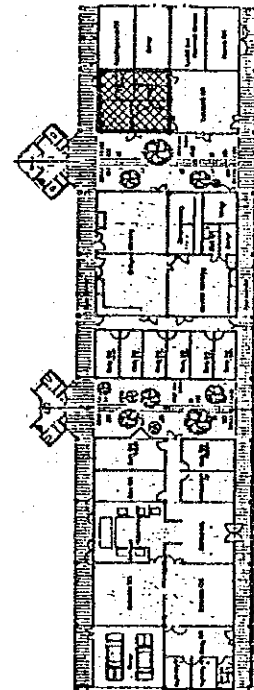
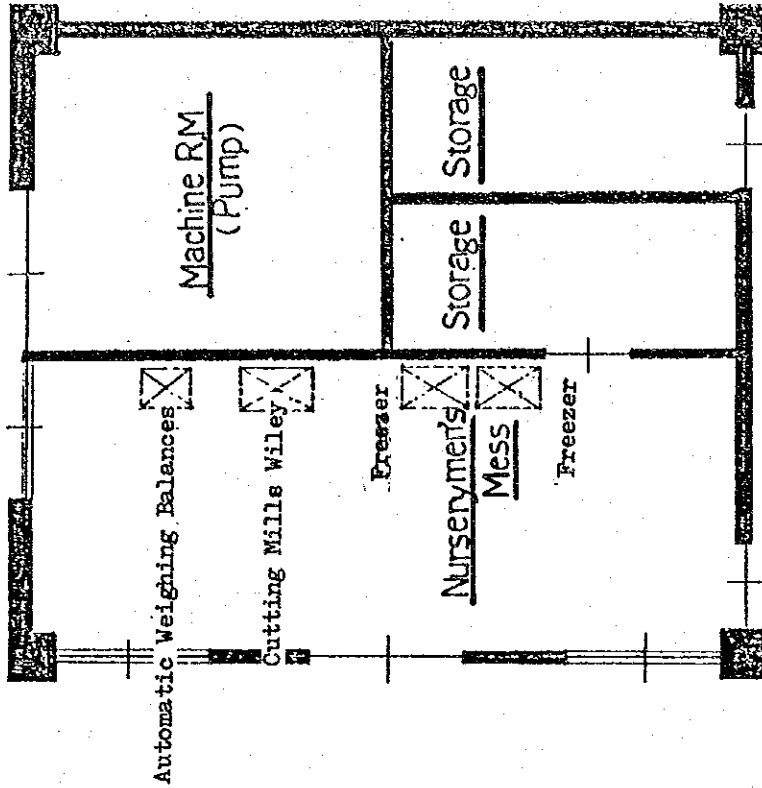
LAYOUT OF EQUIPMENT I 008



LAYOUT OF EQUIPMENT II 009



LAYOUT OF EQUIPMENT III O10



3-3 CONSTRUCTION PLAN

Through discussions between the Mauritius authorities concerned and the Survey Team, governmental organizations to take charge of this project, were arranged.

3-3-1 Organization

Enumerated below are the governmental organizations which will take charge of the respective assignments over this project.

	Governmental organization in charge	Name of representative
Main charge	Ministry of Fisheries and Co-operatives and Co-operative Development	Minister Hon Iswardeo Seetaram
Exchange of Notes	Ministry of External Affairs, Tourism & Emigration	Minister Sir Harold E. Walter
Banking arrangements	Ministry of Finance	Minister Sir Veerasamy Ringadoo

Consultant agreement and construction contract

	Ministry of Fisheries and Co-operatives and Co-operative Development	Minister Hon Iswardeo Seetaram
OR	Ministry of Works	Minister Hon Emmanuell Bussier
Tendering	Tender Board Ministry of Finance	Chairman Mr. Mohammad Haniff Ramdin
Building clearance	Ministry of Works	Minister Hon Emmanuell Bussier

3-3-2 Scope of Work

Regarding the scope of work on the part of Mauritius and Japan in the performance of this project, the Survey Team had discussions with the Mauritius authorities with the Minutes taken into account, over each of following items.

(M stands for Mauritius and J for Japan)

(1) Site Preparation

M Removal of obstruction, levelling and cleaning the project site before the commencement of the construction

(2) Water Supply Facilities

(Fresh water)

M Water supply facilities between the government-owned well and the service water tank in the project site

J Water supply facilities between the service water tank and the installations thereafter erected for this project

(Sea water)

M Pond to be dug near the shore for sea water intake, and the water supply facilities between the pond and the service water tank

J Water supply facilities between the service water tank and the installations thereafter erected for this project

(3) Electric Power Facilities

M Electric power intake up to the project site with 4 wires, 400/230V, and the connection to the electric terminal

J Electric facilities after the electric terminal

(4) Telephone Facilities

M Wireless telephone facilities

J In-facility telephone sets to be connected to the wireless telephone system

(5) Exterior Works

M Access roads, bridge to the project site, fencing, parking and landscaping

J Roads in the project site

(6) Transportation

J Marine transportation of the materials and equipment to be imported from Japan to Mauritius

M Inland transportation in Mauritius from the port to the site

Various procedures, permits, tax exemption, and cooperations by customs house, and others necessary for the above

(7) Others

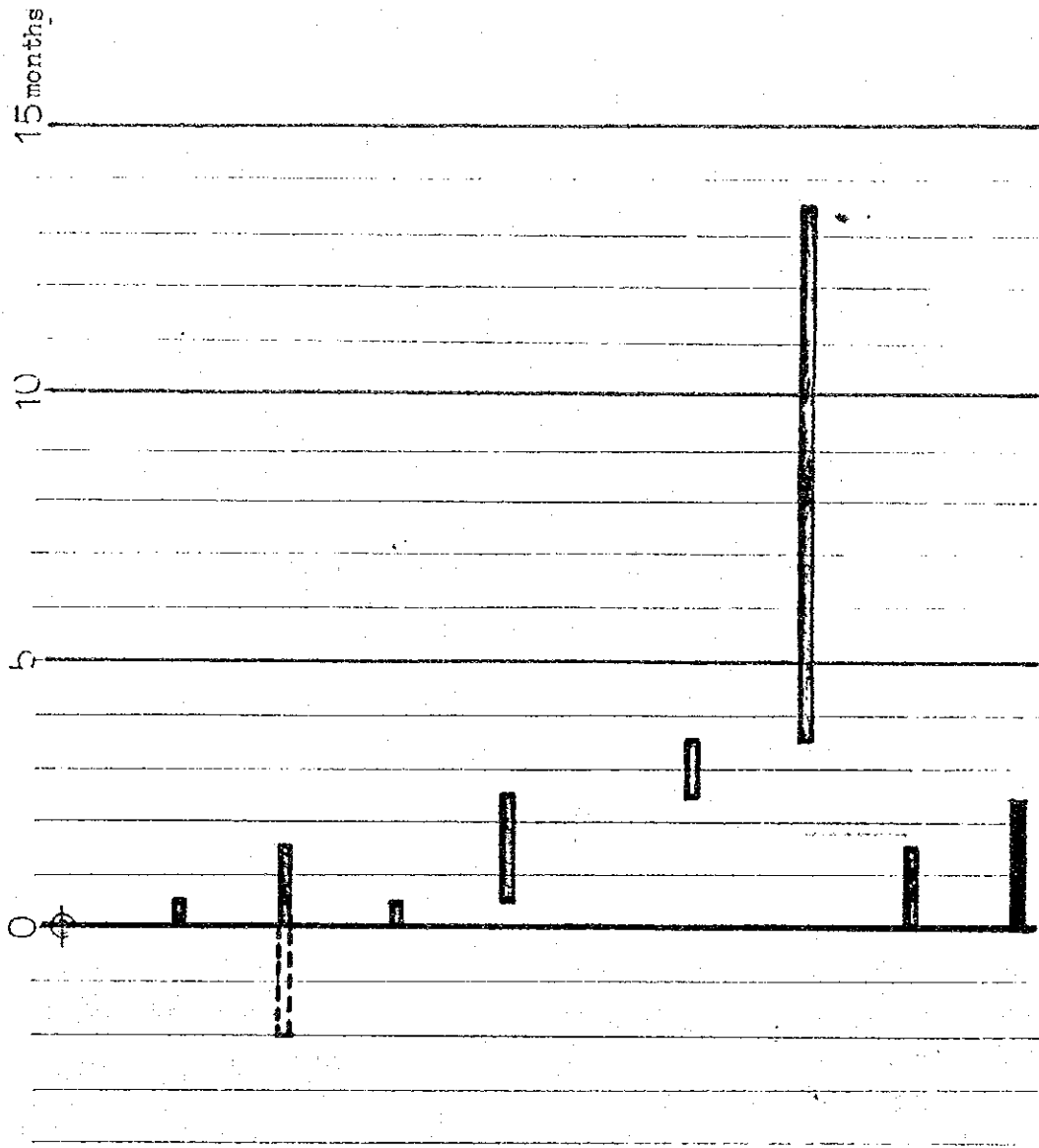
M Assurance of proper maintenance of the subject facilities and equipment for their normal performance

Maintenance of security for the Japanese personnel staying to execute the construction work for this project, and the conveniences necessary for entry into and leave from this country

3-3-3 Schedule

After the agreement is reached with the Exchange of Notes between the Mauritius and Japanese Governments, this project will be put into effect and will be followed by the consultant contract, working design, invitation of tenders for the subject project, and construction contract. When all enumerated above is duly executed, the project will get started practically. The construction work period is estimated to be approximately 10 months, and the guarantee period is one year after the acceptance.

SCHEDULE



- Exchange of Notes
- Consultant Agreement
- Design of Building & Equipment
- Banking Arrangement
- Tendering
- Construction Work
- Preparation
- Work
- Levelling of The Ground (by Mauritius)
- Electric Service Water Supply (by Mauritius)

CHAPTER 4
RECOMMENDATIONS AND CONCLUSION

4-1 JUSTIFICATION OF PROJECT

The Survey Team has reached the conclusion that the establishment of the Research Center is sufficiently justified, based on the fundamental understanding that reinforcement of basic research activities will be essential to the promotion of the fisheries industry of Mauritius. The reasons for this justification are enumerated below:

- (i) Of animal proteins consumed in Mauritius, fish protein ranks extremely high. However, half of the consumption depends on imports.

Approximately sixty percent of the fish catch depends on lagoon fisheries, in which more than ninety percent of the total fishermen of this country are engaged. They are petty fishermen, whose livelihood is economically unstable. The Two-Year Plan for Economic and Social Development emphasizes the importance of the fisheries industry. Under these circumstances, it is of the utmost necessity to enrich the basic research for fish culture, ecology, etc.

- (ii) The Research Division of M. FCCD has six scientific officers. It is located at four different places, the facilities are insufficient and obsolete, and are provided only with poor research equipment. This seems to be causing trouble to research activities. Establishment of the Research Center is expected to integrate and enrich the research activities.

- (iii) Through discussions between the Mauritius authorities concerned and the Survey Team, it has been determined that M. FCCD will serve as an organ in direct charge for this project. This ministry will make adjustments with other related organizations, and leveling of the construction site and supply of power and water will be completed before the start of the construction work.

- (iv) The site has an area of 18 ha., and it is possible to work out a plan to make this site into a Fisheries Research Area in future. The project site is separated from surrounding lands by sea and river, and is favoured with an environment suited to research activities. Access to the project site is also convenient.

- (v) Carefully planned buildings of the Research Center will be blended harmoniously with beautiful nature, rendering an impressive visual effect.

As described above, this project will be justified in the sense of promoting the fisheries industry of Mauritius and cultivating friendship between Mauritius and Japan.

4-2 EFFECT OF PROJECT AND NECESSITY OF GRANT AID

Among the diversified requests made by Mauritius to Japan, the grant aid to the Research Center is necessary for the following reasons:

- (i) The country of Mauritius was visited by cyclones in 1979, dealing heavy blows to the sugar canes as basic industry of this country, housing, roads and other public facilities, and recovery from this damage requires huge amounts of capital investment. So the country cannot afford to build a large-scale research center.
- (ii) As prerequisite for the grant aid from Japan, this aid is incompatible with capital introduction from other countries, and can be granted only to non-commercial purposes. Furthermore, the grant aid should preferably be extended to a monument-like project of permanent nature which will lay the foundation for the country's future, rather than to a project which will have only immediate effect like consumable goods.

The purpose of the Research Center is to conduct test & research and survey as well as instruction and dissemination of techniques. Therefore, the research activities will be based on a long-term perspective and will train expert personnel of this country.

The following summaries the effects of the Research Center:

Stable supply of animal proteins

Stability and improvement of the lagoon fishermen's livelihood and increase of opportunities for their employment

Promotion of structure improvement in the fisheries industry from "catching fisheries" to "sea farming fisheries" through introduction of positive research culture techniques

The Research Center to be developed as a central organization for fisheries research in neighboring countries as well as in Mauritius

Training of personnel through instruction and dissemination of research results

Dissemination of Japanese equipment and construction techniques

4-3 NECESSITY OF TECHNICAL COOPERATION

The existing research facilities and equipment in Mauritius are rather poor. After establishment of the Research Center, it will be essential to despatch fishery-related researchers to other countries in order to operate the well-equipped facilities effectively, to make full use of the equipment, to enhance the average level of research techniques, and to cultivate expert personnel. It will also be highly significant that Mauritian researchers will be assigned to research organizations of other countries for long-term training to acquire advanced techniques.

JICA