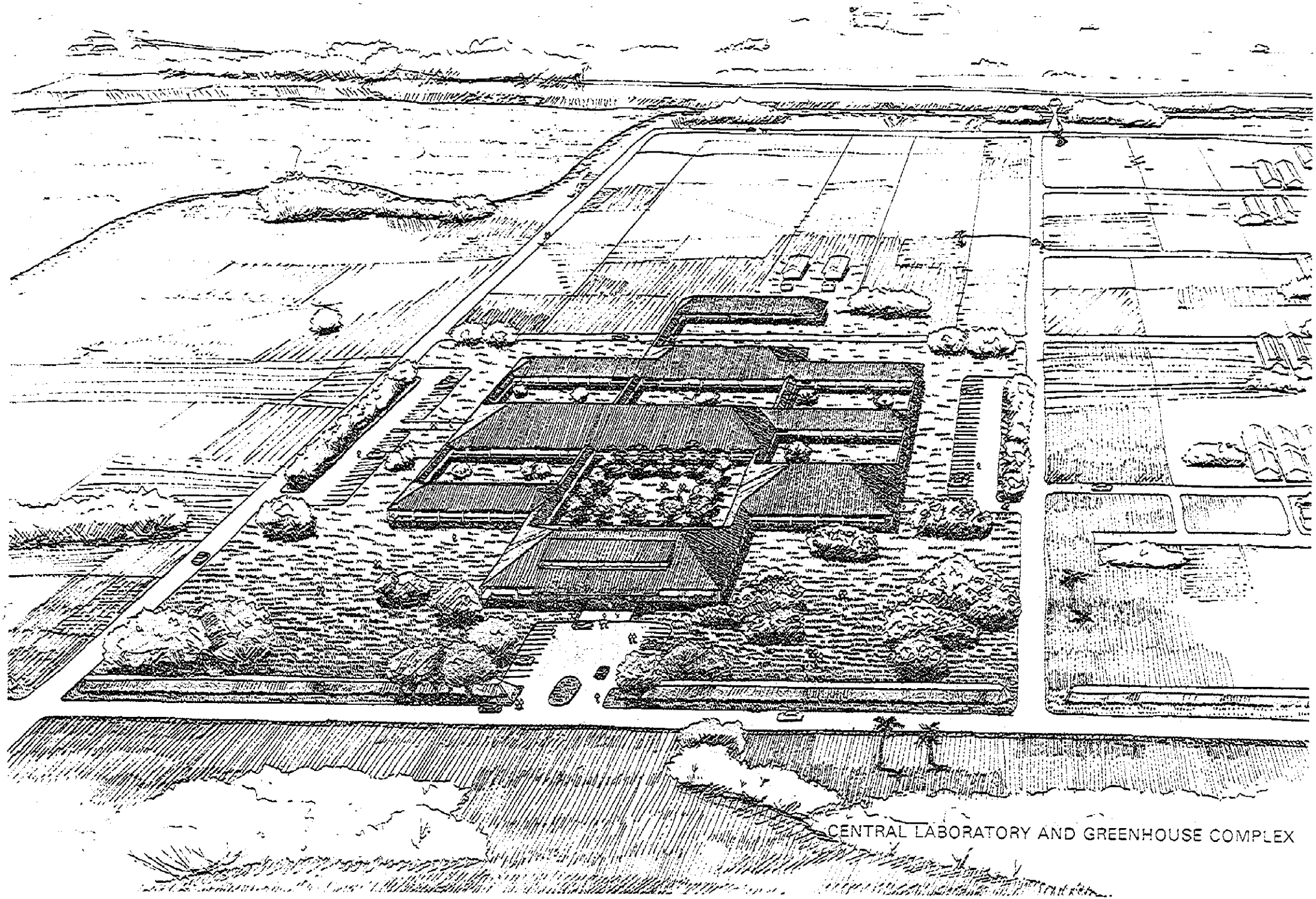
Preliminary Design for Central Laboratory & Greenhouse Complex of Kasetsart University Kamphaengsaen Campus in the Kingdom of Thailand

February 1978

JAPAN INTERNATIONAL COOPERATION AGENCY



CENTRAL LABORATORY AND GREENHOUSE COMPLEX

Preliminary Design for Central Laboratory & Greenhouse Complex of Kasetsart University Kamphaengsaen Campus in the Kingdom of Thailand

CONTENTS

APPENDIX

FOREWORD

This report contains survey results pertaining to the preliminary designs for the Kasetsart University Facilities Improvement: Research and Extension Service Facilities in Agriculture in the Kingdom of Thailand.

The Kasetsart University is a leading agricultural university in Thailand, having the highest academic standard. Its alumni have vast and far-reaching influence in all agriculture-related circles of Thailand.

However, with an increase in students in recent years and the growth of various requirements accompanying the development of the economy and the society of the country, the facilities of the Bankhen Campus of the University have now become too small and are virtually overflowing.

To cope with this situation, the University has acquired a 1,430ha site at Kamphaengsaen, 80km northwest of the Bankhen Campus and, with the assistance of the International Bank for Reconstruction and Development, the University has formulated a major facilities expansion plan. In connection with this plan, the Thai Government requested the Government of Japan for assistance in the construction in part of these facilities.

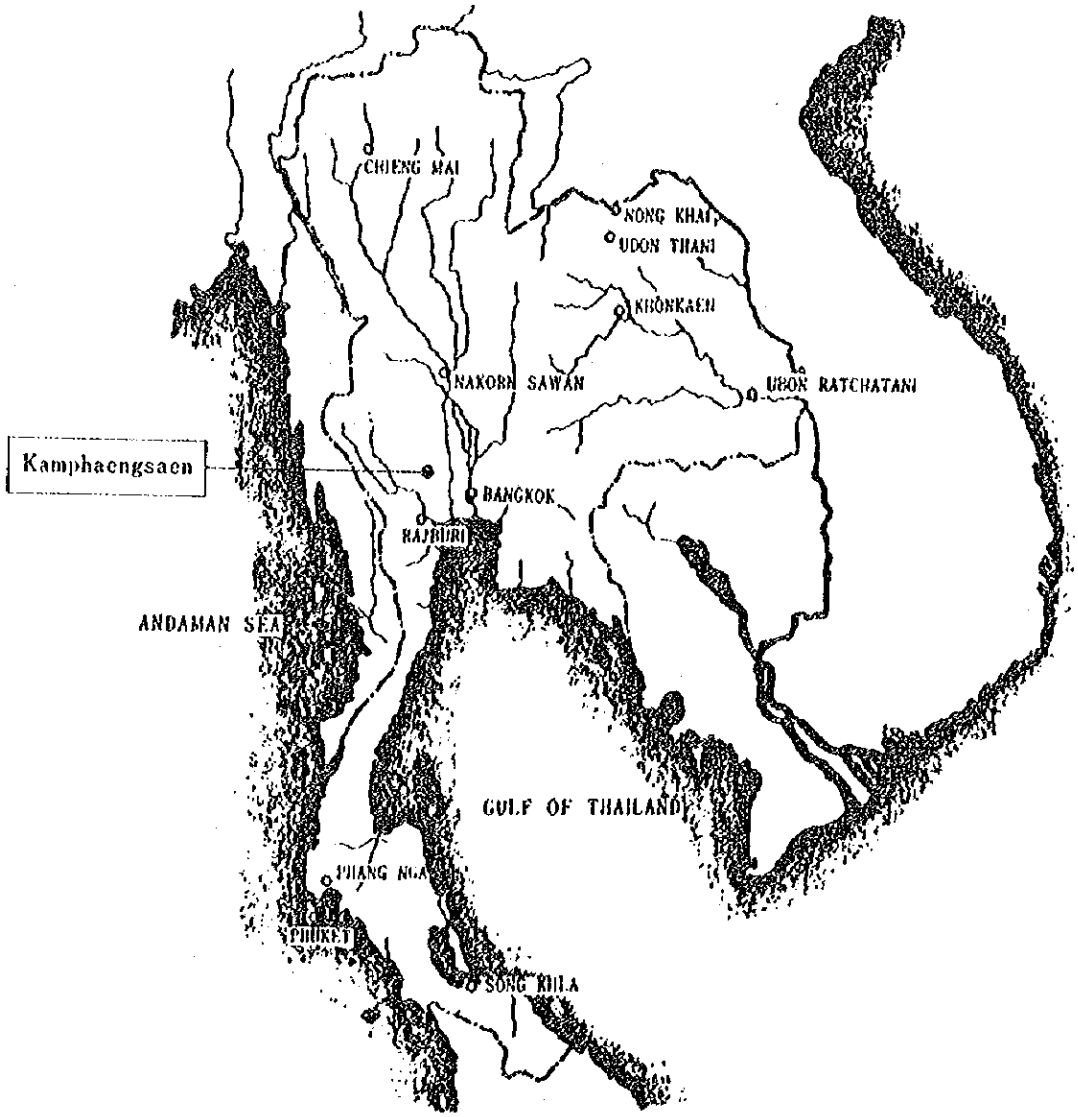
In response to this request, the Government of Japan has carried out a survey to determine whether this plan is suitable as a subject of its grant assistance fiscal 1978.

In order to conduct the survey, the Japan International Cooperation Agency first dispatched a Preliminary Survey Team to the Kingdom of Thailand In July, 1977 and then a Preliminary Design Survey Team including architectural design consultants in October, 1977.

In carrying out the survey the most generous cooperation was obtained not only from the pertinent officials at the Kasetsart University but also from all the officials in charge of the matter in the relevant government authorities, which facilitated smooth and effective implementation of the survey. As a result of such cooperation we have been able to put together this Kasetsart University Development Project Preliminary Design Survey Report, which I have much pleasure in forwarding to all those concerned. I wish to express my deep appreciation to all the people who have extended cooperation to our survey teams in preparing this report.

February, 1978

Shinsaku Hogen
President
JAPAN INTERNATIONAL COOPERATION AGENCY



MAP OF THAILAND

1. OUTLINE OF THE PROJECT

1.1 SUMMARY OF KASETSART UNIVERSITY

In Thai "Kasetart" means agricultural science. The Kasetsart University is the largest of the agricultural universities in Thailand, and it is also the only agricultural university that has a graduate school. It is situated at Bankhen approximately 15km north of Bangkok, and in the same campus Agricultural Bureau of the Ministry of Agriculture and Cooperatives also exists. The forerunner of the University was the Sericulture School. Subsequently it became the Agricultural College of the Ministry of Agriculture, and then it was amalgamated with the Royal Forestry College, until finally, in 1943, it became the Kasetsart University comprising four faculties.

Since then, its faculties have continued to expand, and today, the University has the faculties and other organizations given below.

1) Faculty of Agriculture
   Agronomy, Animal Science, Entomology, Agricultural Machinery, Food Sciences, Home Economics, Boriculture, Plant Pathology, and Soil and Fertilizer.

2) Faculty of Fisheries
   Fish Culture School, Marine Microboes, Marine Management, Marine Processing Engineering, and Oceanography.

3) Faculty of Forestry

4) Faculty of Veterinary Science

5) Faculty of Science

6) Faculty of Engineering

7) Faculty of Education

8) Faculty of Economics
Agricultural Economics and Agricultural Cooperative Union

9) Faculty of Social Science

10) Graduate School

11) Extnsion and Training Office

12) Institute of Food Research and Product Development

13) National Corn and Sorgham Research Center

In addition to the foregoing, it operates six agricultural experiment stations, two marine experiment stations, and five forestry experiment stations.

The staff members of the University keep very high standards and the number of them is 996, including professors, assistant professors, instructors, and others, and with around 80 holding Ph. D. degrees and around 400 holding masters' degrees. The number of students accounts 6,151, those in the graduate school are 1,126 for a total of 7,778, of which 30 percent are girls.

1.2 KASETSART UNIVERSITY DEVLOPMENT PROJECT

Functionally, in addition to its educational activities in the field of agricultural sciences, the Kasetsart University carries out research and extension training. However, insofar as the latter two activities are concerned, facilities are rather meager. In the University, there is the Office of Extension and Training which possesses faculty status for extension training but insofar as research is concerned, all that has been done is the establishing from a Research Council composed of representatives of each of the faculties, and the University does not possess an independent research facility. Its education-related facilities are also superannuated. As the Bankhen Campus itself is srrounded by a rapidly urbanizing area and from the standpoint of

agricultural education, its environment is deteriorating and its land area is also inadequate. Coexistence with the facilities belonging to the Department of Agriculture of the Ministry of Agriculture and Cooperatives, also constitutes certain inconveniency.

In the light of these circumstances, the Kasetsart University formulated a master plan for the development and strengthening program including rebuilding and strengthening the education-related facilities and establishing extension and training facilities, at newly acquired Kamphaengsaen Campus site. The preparation of the land of the new campus has already been completed. The campus site was surrounded already be long fences, and part of the construction work is now underway, those include roads, electric power facilities and buildings. The University has already embarked on extension and training activities at this new Campus.
According to the plan, construction of education-related facilities includes remodelling of buildings at the Bankhen campus and construction of buildings at the Kamphaengsaen campus, and the construction work began in 1972 with the completion target date of 1978, using a loan from the International Bank for Reconstruction and Development.

1.3 REQUEST FOR ASSISTANCE FROM KASETSART UNIVERSITY TO THE JAPANESE GOVERNMENT

The loan to be obtained from International Bank for Reconstruction and Development would be limited to education-related facilities and sufficient funds for research and extension and training are not likely expected. Accordingly, the Government of Japan had been requested informally to explore the possibility to extend grant to assist this project for the construction of these facilities, and this informal sounding out was followed by an official request for the assistance.

The original request for the assistance that was made by the Government of Thailand included following six facilities.

1) Central Laboratory and Greenhouse complex
2) Extension and Training Service Center
3) Soil and Fertilizer Research Center
4) Agricultural Machinery and Equipment Center
5) Fresh-water Fisheries Research Center
6) Agro-industry Technology Research Center

1.4 PROGRESS OF PRELIMINARY DESIGN

The first Preliminary Survey Team in July, 1977, concluded that the subject development project would contribute to the great extent to the growth and development of agricultural sciences in Thailand, that the contents of the project had been well prepared after thorough studies, and that it was a highly realistic and feasible project.

As a result of subsequent studies within the relevant departments of the Japanese Government, because of budgetary considerations, it was decided that the first item, i.e. Central Laboratory and Greenhouse Complex, would be taken up as the subject for the preliminary design survey under the possible grant assistance.

1.5 COMPOSITION OF CENTRAL LABORATORY AND GREENHOUSE COMPLEX

The Central Laboratory building project prepared by the Univeristy comprised a Central Administrative Office, a Soil and Fertilizer Testing and Applied Research Unit, a Postharvest Research Unit, a Plant Pest Clinic and

Quarantine Unit, a Seed Testing Unit, a Culture Collection Unit, an Environmental Science Unit, a Central Biochemistry Unit, a Radio Isotope Laboratory, a Type Specimen Unit, and a Small Animal Laboratory. This complex of laboratory would have supplementary facilities i.e., a Laboratory Maintenance Unit and a Controlled Condition Unit with a building housing a small environment adjusting test system, refrigerating equipment, etc. Alongside the Central Laboratory buildings there would be a greenhouse complex consisting of glasshouses, screen houses. According to the project plans, these buildings and facilities are to be built almost at the central part of the Kamphaengsaen Campus.

During the 1978 fiscal year, the University is to establish a new research center with faculty status and operate it in conjunction with the Department of Agriculture, the Ministry of Agriculture and Cooperatives. When this Central Laboratory building would be constructed, it would serve as the key facilities of the research center. It is considered that the research activities of the University in the fields of corn, sorghum, soil and fertilizer keep high at the present, but generally speaking, they are being handled as ancillary activities of education, and the contents of these activities do not go beyond tests for the purpose of practical usage. If and when it should come about that a central laboratory facility outfitted with the latest equipment and facilities should be built with Japanese assistance, and if and when research and cooperation should be carried out here, then the research standards of the University will improve tremendously, and these activities will then literally be in a position of mutual complementation with the tests and research being conducted by the Department of Agriculture, the Ministry of Agriculture and Cooperatives, and hopefully could develop to the stage where they would fulfill a role of supporting these governmental activities from even theoretical and academic aspects.

2. SURVEY FOR CONSTRUCTION

2.1 PURPOSE OF SURVEY

As stated earlier, the Government of Japan decided to carry out a preliminary survey on the matter concerning for grant-aid projects for the 1978 fiscal year. The Preliminary Survey Team visited the Kingdom of Thailand from the 17th to 31st of July, 1977, and carried out its survey.

As the result of the survey, it was confirmed that the Kasetsart University Development Project was of much significance and appropriate for consideration as a subject of Japan's cooperation activities, and accordingly, the dispatching of a Preliminary Design Survey Team was envisaged.

Then, it came about that an 11-member Kasetsart University Development Project Preliminary Design Survey Team headed, by Akira Arimatsu, Executive Director of the Japan International Cooperation Agency was dispatched from the 17th to the 26th of October, 1977.

The purpose of this survey team was to exchange views with relevant officials both of the Government of Thailand and the University in order to get basic idea, to make tentative estimations for the budget in connection with the construction of buildings with some equipment for the Kasetsart University and to make the on-the-spot survey on the new campus site for the construction.

2.2 MEMBER OF JAPANESE PRELIMINARY DESIGN SURVEY TEAM

Team Leader	Mr. Akira ARIMATSU Executive Director Japan International Cooperation Agency (JICA)
Educational Administration	Dr. Norio KONDO Tokyo University of Agriculture
Research and Experiment Administration	Dr. Yutaka WATANABE Head Second Laboratory of Social Chemistry National Institute of Agricultural Sciences
Cooperation Planning	Mr. Mahito Kojima Second Economic Cooperation Div. Ministry of Foreign Affairs
Coordination	Mr. Jiro HASHIGUCHI Special Assistant to the Director Agricultural & Forestry Planning & Survey Dept. JICA
Design Management Deputy Team Leader	Mr. Seiichi MATSUDA Director International Dept. Kume Architects-Engineers
Architectural Design	Mr. Osamu MATSUMURA Architect International Dept. Kume Architects-Engineers
Architectural Design	Mr. Akio KANNO Architect Architectural Design Dept. Kume Architects-Engineers
Structural Engineering	Mr. Shoichi FUKUDA Engineer Structural Engineering Dept. Kume Architects-Engineers
Mechanical Engineering	Mr. Makoto NAGATOMI Architect International Dept. Kume Architects-Engineers
Electrical Engineering	Mr. Katsuei OSAO Engineer Electrical Engineering Dept. Kume Architects-Engineers

2.3 THAI AUTHORITIES CONCERNED

Department of Technical and Economic Cooperation

[DTEC]

Mr. Xujati Pramoolpol
Director-General

Mr. Wanchai Sirirattna
Deputy Director-General

Mr. Thawal Polpuech
Colombo Plan Program Officer

Mr. Sutin Susila
Colombo Plan Program Officer

University Bureau

Professor Dr. Prasert Na Nagara
Under-Secretary of State

Kasetsart University

H. S. H. Prince M. C. Chakrabandhu
Chairman, Kasetsart University Council

Professor Rapee Sagarik
Rector

Professor Dr. Sutharm Areekul
Vice-Rector for Academic Affairs

Professor Dr. Phaitoon Ingkasuwan
Vice-Rector for Business Affairs

Professor Arb Nakajud
Vice-Rector for Development

Associate Professor Dr. Watna Stienswat
Vice-Rector [Kamphaengsaen Campus]

Associate Professor Sangtham Komkris
Assistant to Vice-Rector for Business Affairs

Assistant Professor Dr. Banjerd Boonsue
Dean, Faculty of Agriculture

Dr. Sam-arng Srinilta
Project Coordinator

Assistant Professor Dr. Thira Sutabutra
Deputy Project Coordinator

Mr. Kumropruk Suraswadi
Project Architect

Mrs. Yupayong Hemasilpin
Project Architect

Mrs. Ladasiri Limangkura
Assistant Professor

Mrs. Channuan Tansathit

Dr. Thira Chaichanawong
Professor

Bureau of the Budget

Two officers in charge of the matter

2.4 OFFICIALS OF JAPANESE GOVERNMENT AND JICA STATIONED IN THAILAND

Embassy of Japan in Thailand

Mr. T. Monoyama, Counselor

Mr. H. Imafuji, First Secretary

Japan International Cooperation Agency

Bangkok Office

Mr. Y. Kitano, Resident Representative of the office

Mr. K. Iwaguchi, staff member of the Office

3. OUTLINE OF THE DISCUSSIONS AND MINUTES

Progress of discussions

Prior to leaving for Thailand, in order to conduct the survey, the members of the survey team held preliminary discussions, and deliberated how the team should conduct the Preliminary Design Survey.

As a result, it was decided that in commencing the survey, first of all, the leader of the team would be better to convey the purpose and contents of the survey in a clear and positive manner, as a form of the introductory statement (see appendix 1).

After conducting frank and efficient survey activities including the useful exchange of views with the University, DTEC, and other relevant persons and on the spot survey in both Bankhen and Kamphaengsaen campus and other relevant places.

The survey team put together an outline of the results of the discussions in the form of Minutes (see appendix 2). The Minutes were signed by Professor Rapee, Rector of Kasetsart University, DTEC Director-General Mr. Xujati, and Team Leader, Mr. Arimatsu.

4. PLANNING FOR CONSTRUCTION

4.1 BASIC PLAN

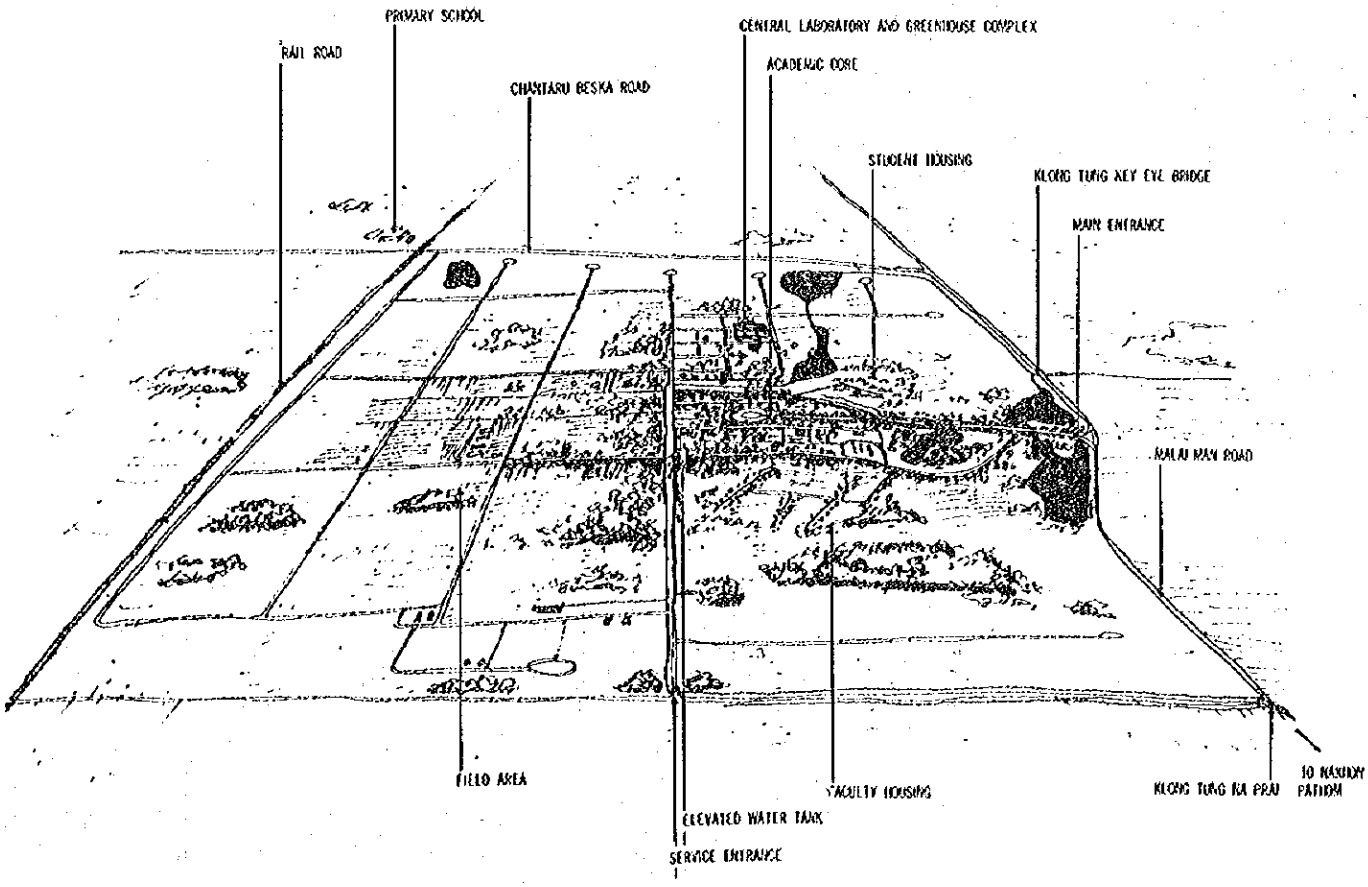
4.1.1 OUTLINE OF THE PLANNING

The preliminary design for the Central Laboratory and Greenhouse Complex was formulated after thorough study on the results obtained from the both Reports of Preliminary Survey in July and of Preliminary Design Survey in October and the basic plan and materials prepared by the Kasetsart University.

After the October Survey, Preliminary Design was formulated, though due respects were payed to the University's basic plan, reflecting also the letter with revised plan sent from Dr. Sam-arng Srinilta, Project Coordinator of the University to the team Leader and the advices by Professor Kondo of the Tokyo University of Agriculture and Dr. Watanabe of the Ministry of Agriculture and Forestry.

1) The plans were put together taking into consideration the natural conditions prevailing in Thailand and conducting studies on local construction conditions, to come up with plans matching the climatic conditions in Thailand insofar as the type and mode of construction of the structures, the indoor and outdoor environments, and service facilities were concerned.

2) In implementing the construction work of this project, there would be much fundamental work that must be handled by the Kasetsart University side, and detailed discussions were conducted on this point too.


PRIMARY SCHOOL
RAIL ROAD
CHAINTARU BESKA ROAD
CENTRAL LABORATORY AND GREENHOUSE COMPLEX
ACADEMIC CORE
STUDENT HOUSING
KLONG TUNG KEY EYE BRIDGE
MAIN ENTRANCE
KALAU MAN ROAD
FIELD AREA
ELEVATED WATER TANK
SERVICE ENTRANCE
FACULTY HOUSING
KLONG TUNG KA PRAO
TO RANGSIT PATHUM

4.1.2 PLANNING BASES

The planning of these facilities was carried out on the following bases.

1) The functions for the research facilities for which the request for assistance was made by the Kasetsart University will be clarified, and the building plans, structure plans, and service facilities plans will be prepared along the lines of the overall grade of the buildings of the Kamphaengsaen Campus.

2) The buildings shall conform to the Kasetsart University, and the planning shall be carried out in such a manner so that there will be no particular functionally related problems at the time of the completion of the first stage of the Kamphaengsaen Campus.

Planning of building stories

3) In the building stories planning, the plans will be prepared so that the structures will be single story structures taking into consideration the need for moving in or out of laboratory equipment, construction schedule, flow, etc., as has been requested by the Kasetsart University.

4) The plans were put together on the premise that of the construction materials available in Thailand, only those that can be used without any worries or concern in terms of both quality and quantity would be brought from Japan.

5) In every stage of the project, from planning to selection of materials, the natural conditions prevailing in Thailand such as the weather, climate and life; life style; and construction conditions prevailing in Thailand were taken into full consideration in the preparation of the plans for a form of construction, materials, and construction methods suitable for the region.

TABLE—I STAFFING PLAN FOR ADMINISTRATION AND OPERATION OF CENTRAL LABORATORY AND GREEN HOUSE COMPLEX (Not inoluding researchers)

Unit	Staff Name	Number of Staffs
1. Research and Development Institute	1 Deputy Director	1
	2 Secretary	1
	3 Administrative Assistant	2
	4 Clerk-typist	2
	5 Book Keeper	1
	6 Messenger	1
	7 Janitor	1
	8 Driver	1
2. Central Laboratory and Greenhouse Complex	1 Director	1
	2 Deputy Director	2
	3 Unit Head	9
	4 Assistant Unit Head	9
	5 Secretary	1
	6 Administrative assistant	12
	7 Clerk typist	12
	8 Telephone operator	1
	9 Book Keeper	2
	10 Procurement Officer	2
	11 Librarian	3
	12 Statistician	2
	13 Computing Technician	5
	14 Draftsman	2
	15 Photographer	2
	16 Electrician	2
	17 Electonician	2
	18 Plumber	2
	19 Machinist	2
	20 Glass blower	2
	21 Laboratory technician	40
	22 Laboratory helper	40
	23 Messenger	3
	24 Janitor	16
	25 Driver	3
	26 Night watchman	4
	27 Laborer	15

6) On the subject of harmonizing the new facilities with other facilities, it was decided that overall harmony of the campus would be achieved by existing Master Plan Design Guidelines prepared in October, 1973.

4.1.3 CONTENTS OF FACILITIES

Function of the Central Laboratory and Greenhouse Complex in the Kasetsart University is defined as a part of the research activities under the Research and Development Institute, as shown in following organization chart.

The Complex is positioned as part of the On-Campus Service Division in the Research and Development Institute.

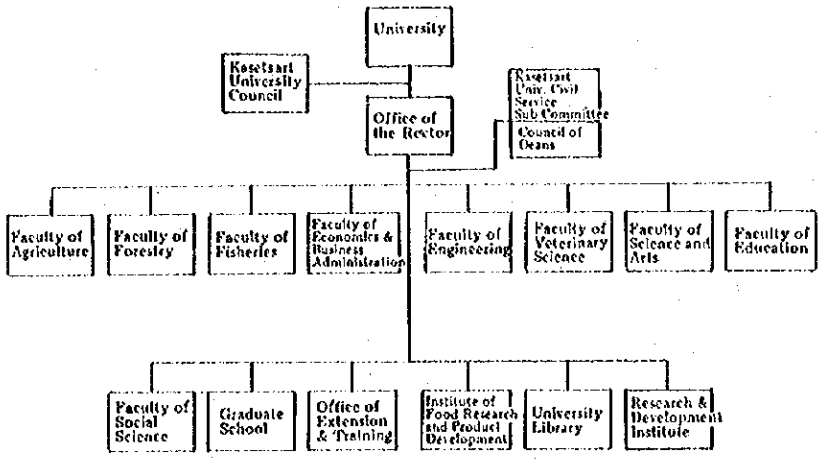
Staffing plan for the Complex is shown in Table I.

Table II shows the rooms required for the Complex.

TABLE – II ROOMS REQUIRED FOR THE COMPLEX

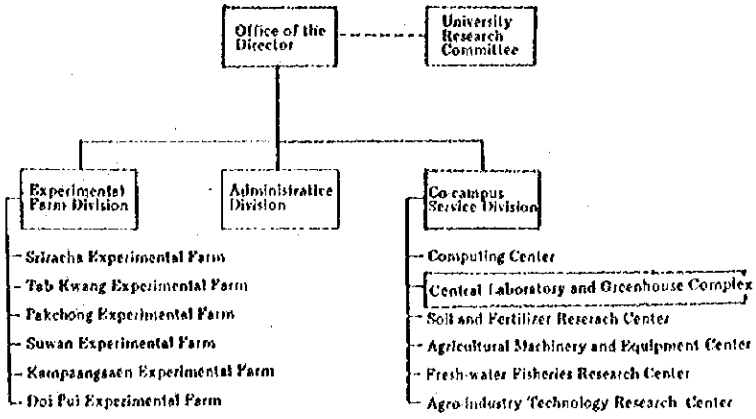
Unit	Room Name	
1. Central Administrative Office	1 Director's office	14 Conference room II
	2 Deputy directors' office I	15 Library
	3 Deputy director's office II	16 Document section
	4 Secretary	17 Librarian
	5 Printing room	18 Journal section
	6 Document storage	19 W.C.
	7 General office	20 Kasetsart University Research and Development Institute Office
	8 Telephone junction	
	9 W.C. and storage	
	10 Data processing and data bank	21 Deputy director's office
		22 Assist. deputy director's office
	11 Office	
	12 W.C. and janitor	23 Secretary
	13 Conference room I	24 Circulation
2. Central Biochemistry Unit	1 Central biochemistry lab.	11 Microscope lab.
	2 Chemical storage	12 Electron microscope
	3 General preparation	13 Power supply
	4 Office	14 Scanning electron microscope
	5 Photo taking room	
	6 Art studio	15 Microtome I & II
	7 Photo lab.	16 Central biochemistry lab.
	8 Photo processing	17 Glassware storage
	9 Storage	18 W.C. and janitor
	10 Dark room	19 Circulation
3. Culture Collection Unit	1 Office	7 Fungus lab.
	2 Data storage	8 Transfer room
	3 Mycoplasma lab.	9 Storage
	4 Bacteria and Virus lab.	10 Infectious lab.
	5 Cold room	11 Circulation
	6 Specialized equipment and culture collection	
4. Environmental Science Unit	1 Air pollution	4 Water pollution lab.
	2 Soil and agricultural commodity polluiton lab.	5 Storage
		6 Office
	3 Biological assay lab.	7 Circulation
5. Plant Pest Clinic and Quarantine Unit	1 Display	9 Nematode lab.
	2 Enquiry	10 Storage I
	3 Sample handling area	11 Storage II
	4 Office	12 Preparation room
	5 Entomology	13 Fumigation room
	6 Plant pathology lab.	14 Quarantine lab.
	7 Transfer room	15 Circulation
	8 Incubator area	

Unit	Room Name	
6. Post Harvest Research Unit	1 Enclose space for loading and unloading	6 Post harvest handling research & quality testing
	2 Storage	7 Cold rooms
	3 Post Havest pathology and entomolgy	8 Postharvest physiology lab.
	4 Enzyme lab.	9 Offices
	5 Pilot packing	10 W.C. and janitor
		11 Circulation
7. Soil and Fertilizer Testing and Applied Reserach Unit	1 Office	10 Balance
	2 Enquiry	11 Instrument room I
	3 Data processing	12 Instrument room II
	4 Sample storage	13 Fertilizer and soil fertility lab.
	5 Glassware and other supplies	14 Chemical storage
	6 Chemical analysis lab.	15 Sample handling and preparation
	7 Kjeldahl room	16 W.C. and janitor
	8 Data storage	17 Circulation
	9 Soil physical analysis lab.	
8. Seed Testing Laboratory	1 Purity lab.	7 Cold room
	2 Office	8 Transfer room
	3 Sample registration and analysis	9 Storage
	4 Balance	10 Biological testing lab.
	5 Sampling moisture testing lab.	11 Seed physiology lab.
	6 Germination testing lab.	12 Seed display
		13 Circulation
9. Greenhouse Assembly	1 Controlled condition unit	3 Glass house
	2 Head house	4 Screen house
10. Laboratory Maintenance and Material Mechanic Unit	1 Plumbing metal work and carpentry shop	8 Vacuum generator
	2 Glass blowing shop	9 Standby generator air compressor and compressor for airconditioner and cold chamber
	3 Main storage	10 W.C. and locker I
	4 Central supply	11 W.C. and locker II
	5 Electrical junction	12 Circulation
	6 Water distiller	
	7 Fuel gas generator	
11. General Corridor		



KASETSART UNIV. ORGANIZATION

Research and Development Institute Organization.



RESEARCH AND DEVELOPMENT INSTITUTE ORGANIZATION

4.1.4 FLOOR AREA OF FACILITIES

Table III shows the floor areas for each of the units of the Complex. The figures given under the column "Original" are the area figures prepared upon the request of the first survey team by the Kasetsart University, while the figures given under the "Revised" column are the area figures sent to the leader of the second survey team from the Kasetsart University after the return of the survey team to Japan.

It should be noted that these area figures were submitted as preconditions, and it is considered that there may be some minor changes when the plans would be actually implemented.

TABLE--III SUMMARY OF FLOOR AREA REQUIREMENT

* Including W.C. & Janitor

** Including controlled condition unit

	NET AREA (m²)		CIRCULATION AREA (m²)		TOTAL FLOOR AREA (m²)	
	ORIGINAL	REVISED	ORIGINAL	REVISED	ORIGINAL	REVISED
1. CENTRAL ADMINISTRATIVE OFFICE	1,591	1,564	64	1,412	1,658	2,976
2. CENTRAL BIOCHEMISTRY LAB.	810	808	24	152	834	960
3. CULTURE COLLECTION LAB.	396	392	120	120	516	512
4. ENVIRONMENTAL SCIENCE LAB.	384	381	120	120	504	501
5. PLANT PEST CLINIC AND QUARANTINE LAB.	392	392	144	120	536	512
6. POST HARVEST RESEARCH LAB.	681	844	288	152	972	996
7. SOIL & FERTILIZER TESTING AND APPLIED RESEARCH LAB.	856	856	120	200	976	1,056
8. SEED TECHNOLOGY LAB.	392	392	120	120	512	512
9. CONTROLLED CONDITION UNIT	—	350	—	—	—	350
10. LABORATORY MAINTENANCE UNIT	1,440 **	648	—	232	1,440 **	880
11. GENERAL CORRIDOR	—	—	—	480	—	480
GRAND TOTAL	6,948	6,630	1,000	3,108	7,948	9,738

4.1.5 FACILITIES LAYOUT

During the latest survey, as many discussions as time permits were held with the group of architects belonging to the Kasetsart University. The results of these discussions were put together with the studies conducted after the team's return to Japan. Taking into account the following points with the University's revised plans, a block plan was formulated.

1) The main access to the complex shall be made from the road on the north side of site for this project, and parking areas shall be provided on the east and west wings.

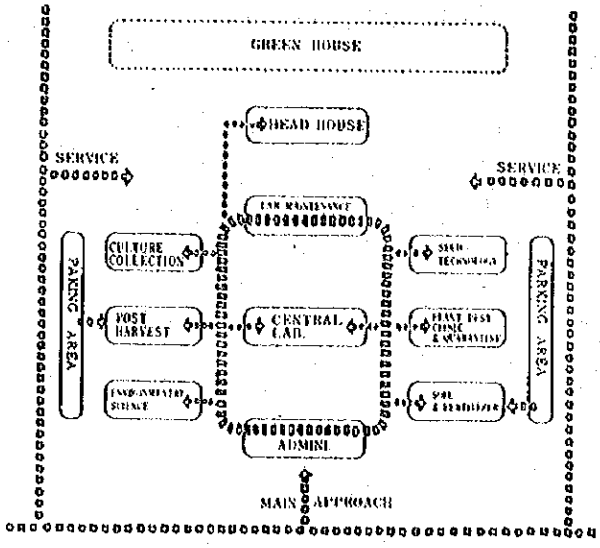
2) The service approach to the Soil and Fertilizer Testing and Applied Research Unit wing and the Postharvest Research Unit wing shall be made utilizing the parking area.

3) The plans and locations of the building shall be designed taking into consideration the prevailing natural winds for natural ventilation. In principle, the form of the buildings shall be rectangular in an east-west axis direction.

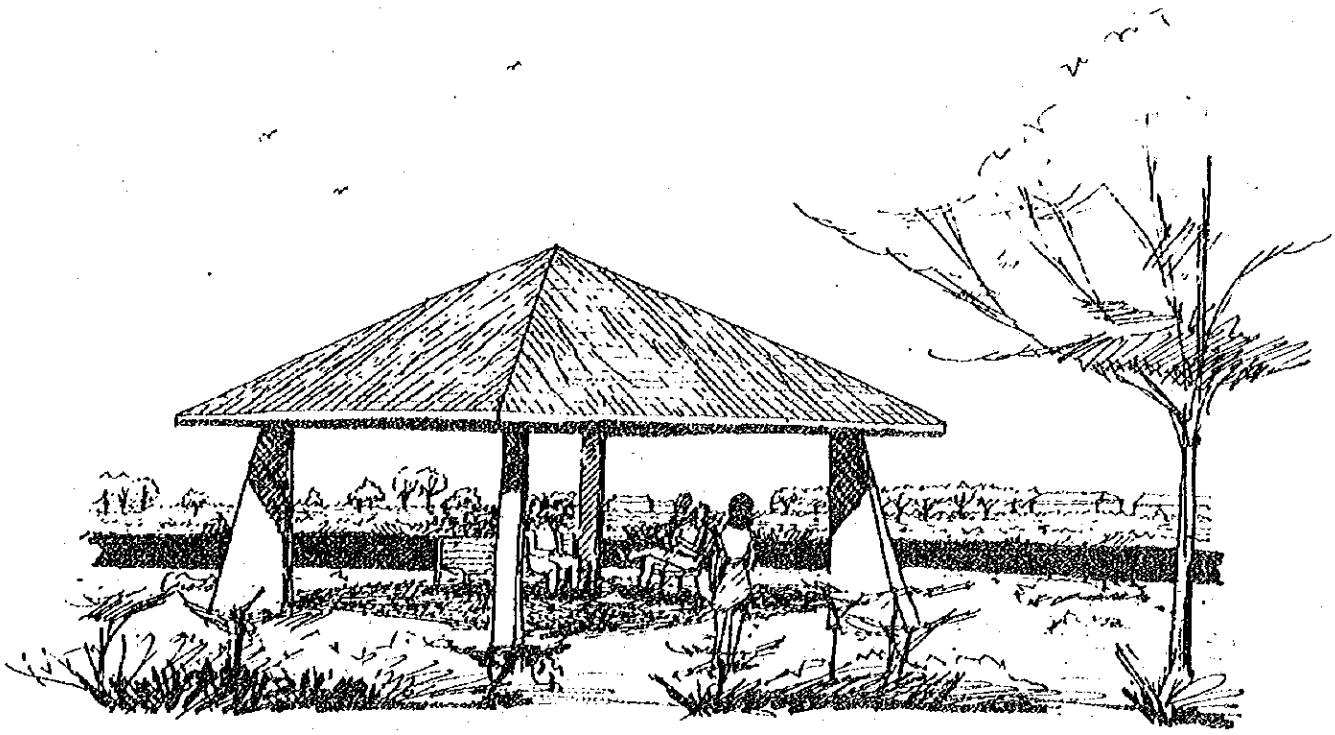
4) Each of the buildings for the different units shall be separated with ample space between, so as to assure abundant open spaces and drafts by wind to each building.

5) In locating each unit, the relationship between correlative functions and individual functions shall be taken into due consideration.

Based on the abovementioned concepts, zoning, flow lines and axial lines are as follows;



Approaching to the complex from the front road on the north, one enters the entrance hall of the central Administration office building. Approaches to each of the buildings on the east and west wings are made by two main circulation routes. Just before the greenhouses on the south side, the Laboratory Maintenance Unit building for this complex will be located, and here the circulation route forms a loop. The loop-form circulation route will be planned as the main flow line not only for the flow of staff but also for the various service facilities. In the center of the open space provided here will be located the Central Biochemistry Laboratory Unit building. The open space formed here for the detached wing serves to create an environment that is affluent in every respect, and will no doubt become a comfortable space for the staff who spend their days here.



4.1.6 BUILDING PLANS

In the case of building for Research the normal basic module will have a frontage of 3.5m or 3.0m. The former is most suited for a laboratory grid for teaching and training purposes, while the latter is effective for general laboratories to be used by smaller numbers of people other than teaching and training. Therefore, in this complex, the minimum unit is set at 3.5m x 7.0m, with highly functional research spaces being planned using basic modules of 7.0m x 7.0m.

The research buildings consists of six buildings of two types, a 14m type and a 21m type, made up of the basic modules, as follows.

1. Culture Collection Laboratory
2. Environmental Science Laboratory
3. Plant Pest Clinic and Quarantine Laboratory
4. Seed Technology Laboratory
5. Post Harvest Research Laboratory
6. Soil and Fertilizer Testing and Applied Research Laboratory

Each of the buildings are positioned on the outer side of the loop form general corridor, taking into consideration their functional and organic relationships. At the sections of the buildings that connect to the general corridor, common space such as offices and display rooms of each of the laboratory buildings will be situated, to facilitate administration. The connecting passages of each of the building open onto the parking areas to providing directly from the outside of any necessary services.

The following three facilities:

1. Central Administrative Office
2. Central Biochemistry Laboratory
3. Laboratory Maintenance Unit

which will be commonly used by each of the laboratories have been positioned on the inner side of the general corridor where they will be easily accessible, in order to endow them with function links as common facilities.

The indoor laboratories comprising the above nine buildings will be located with large spaces between each of them with a spacious inner court, which has been planned to provide sufficient environmental space for the research facilities.

The following outdoor laboratories will be located on the south side of the indoor laboratories, across from the service way.

1. Head house
2. Greenhouse

and they will be connected by means of covered passageways so as to protect any problems that might obstruct their usage during the rainy season or during the middy sun.

Standard height of the eaves will be 3.5m. The buildings will be low-rise buildings, which is the keynote of the overall plan for the campus, in order to achieve harmony with the other various facilities of the campus, and also to achieve human-oriented spaces.

4.1.7 ELEMENTS PLANNING

Insofar as the building elements are concerned, the basic items have already been submitted by means of the Master Plan Design Guidelines, and so the planning of the buildings has been carried out referring to these items and also taking into consideration the climate of the region (high temperature with high humidity in tropical region). That is to say, solar radiation, wind drafting, and precipitation affect structures in a big way, and so measures to cope with these natural phenomena are of much

import in creating a comfortable interior space environment.

Roofs

The roofs serve to protect people from the sun light and the rain, and insofar as the building planning is concerned, they are high susceptible to the effects of these phenomena.

In the case of Thailand, flat roofs which is constructed reinforced concrete structure as arewidrly seen in Japan are not very effective to strong solar radiation and precipitation in country like Thailand. The reason for this is that the water proofing materials (particularly asphalt water proofing) that must be used worsen quickly by ozone and so such roofs have low durability, and in order to prevent the transmission of the radiation heat into the room from concrete slabs, cutting off the heat by materials alone is not very effective. Accordingly, in Thailand, in the case of reinforced concrete structures, the popular method to cut off heat radiation is to frame a roof truss on the roof slab and shingle a roof covering material on the truss, to utilize air space beneath the truss as a heat insulating layer and cut off heat radiation into the room. Another method, one that was seen in the case of canteen building which was under construction at the Kamphaengsaen Campus, is not to introduce a roof slab style but form a reinforced concrete roof truss and cover it with asbestos cement sheet. Also, in the case of high, multi-stored building with large room capacities, the effects of radiation heat are not so bad because the heat is not readily transmitted to the lower parts of the rooms, while if sufficient ventilation of the vicinity near the roofs is carried out, the same results can be achieved even without the forming of a heat insulating layer. However, in the case of buildings such as those in this subject plan where the buildings are divided and partitioned into a large number of rooms and where the height of eaves are not so high, these effects cannot be achieved.

Exterior walls

The exterior walls are also susceptible to the effects of solar radiation. However, in such means as using materials of high overall heat transmission resistance plus the fitting of eaves and louvers [vertical louvers and horizontal louvers] are used, it is possible to avoid much solar radiation. Also, in Thailand, it is possible to obtain the draft by the seasonal south-north winds throughout the year. Therefore, from the standpoint of planning for natural ventilation, the buildings shall be built taking into consideration this wind direction and providing large openings in these direction for facilitation of wind pass through. For fittings at the openings wooden, steel, or aluminum, windows and doors are produced in Thailand. In particular sashes with movable louvers that are manufactured in Thailand are commonly used, and so by using products made of different materials, whether it is aluminum, glass, or asbestos, selectively, it will be possible to obtain a variety of functions: ventilation, light, or blinds, and so it is possible to select materials suitable for this region.

Floor levels

During the rainy season, there is a considerable amount of precipitation in Thailand. However, the drainage plans for the subject campus are extremely well thought out, and there is no risk of flooding as is seen in other regions. However, the floor levels should be set at a relatively high level just in case.

Materials plans

As a result of studies conducted on locally available construction materials, the following materials are being considered for use in the subject project.

[Roofs]

For the roof covering materials, corrugated asbestos cement sheets or roof tiles are suitable. Both are

being manufactured in large quantities in Thailand, and it is possible to obtain a stable supply of either, while there are many different types available also. It might be noted that the Master Plan Design Guidelines also proposes the use of such materials.

[Walls]
Reinforced concrete wall construction techniques in Thailand are, generally speaking, not very high, and materials that are stacked to form walls, such as Mhon bricks or hollow clay bricks are used. In the case of Mhon bricks, they can be used freely and the frames decided without any need to worry about joint plans. However, they have a heavy mass per area unit, and increases dead load of the building. However, in the case of hollow clay bricks or blocks, although there is a wide variety of types, while they feature good forms and high accuracy, joint plans have to be taken into consideration in determining the spans per modules of blocks beforehand. On the other hand though, because they have light mass per area unit, dead load can be reduced. Also, they feature high overall heat transmission resistance and provide extremely good heat insulating properties. In addition, decorative bricks or blocks are also in production.

In the case of plastered walls, a washed terrazzo finish for the exterior walls would be suitable; this type of finish is popular in Thailand. The local labourers are experienced in such work, and workmanship is satisfactory. In addition, its cost is also relatively low, therefore is used as a standard exterior wall finishing procedure.

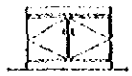
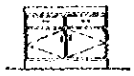
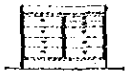
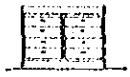
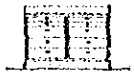
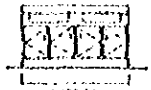
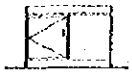
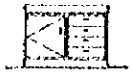
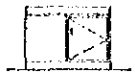
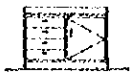
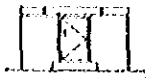
[Floors]
For the floors of the offices and laboratories of these buildings, bearing in mind the fact that they will need scrubbing with water, such materials as ceramic tiles, precast terrazzo, polished terrazzo, vinyl sheets, etc., are conceivable.

Section

Type A

Type E

Table's number and size were refered to referencial drawings submitted by Thai side.

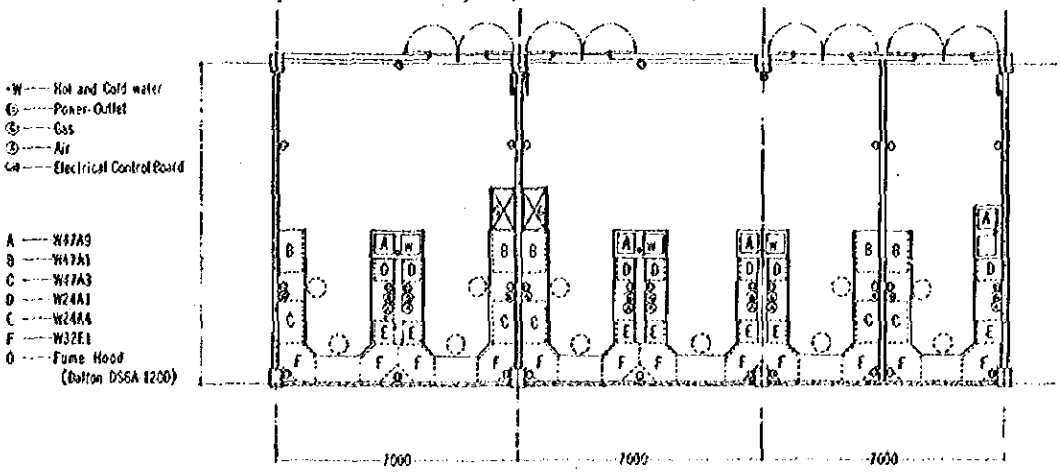
Size / Type	A1, E1	A2	A3	A4	A5	A9, E9
W47 w=1,194	 W47A1	 W47A2	 W47A3	 W47A4	 W47A5	 W47A9
	 W47A01			 W47A14		
	 W47A10			 W47A41		
W24 w=610	 W24A1			 W24A4		 W24A9
W18 w=457	 W18A1					
W32	 W32E1					 W32E9

TYPE OF LABORATORY TABLE

4.1.8 LABORATORY EQUIPMENT

During the visit by the survey team to Thailand, discussions were held with those concerned of the Kasetsart University on the assistance program-related equipment. The Japanese side had a preliminary plan to provide a part of the necessary equipment that would be permanently installed at the subject facility, with other equipment and fittings for the experiments to be provided under a separate technical cooperation program or to be borne by the Thai Government. Therefore, in the discussions with the other side conducted by this survey, no conclusions were reached on the details of quantities of experimental equipment necessary for each of the laboratories. However, equipment that could be necessarily provided within this subject grant assistance program are as follows.

A Example of Standard Layout plan for Laboratory tables and Fume Hoods



1.	Transmission electron microscope and accessories [costs to be included in the item of Equipment work]	1 unit
2.	Hume cupboard [costs to be included in the item of Equipment work]	
3.	Laboratory center tables and wall tables [costs to be included in the item of Architectural work]	
4.	Cold chamber [costs to be included in the item of Architectural work]	12 units
5.	Growth cabinets [costs to be included in the item of Equipment work]	3 units
6.	Blinds [costs to be included in the item of Equipment work]	
7.	Chilled water fountains [costs to be included in the item of Equipment work]	

Of the above, with regard to the Item 3. Laboratory center tables and wall tables, the Japanese proposal initially intended to prepare the layout plan only, and to provide the piping facilities that would be connected to the tables due to Thai researchers opinion that difference in specifications of Japanese made tables and it would be better to make them in Thailand where costs for materials and labour can be saved rather than to import the custom - built tables based on the Thai request from Japan. However, since unlike ordinary furniture, the table should be built and fixed during the course of the construction work and they would not be moved in the future, and because they are absolutely indispensable items from the standpoint of the research and experimental functions, strong requests were made of the Thai side that the tables should be provided by the Japanese side. Consequently it was decided that they would be built locally studying referential drawings of the tables desired by the Thai side within the scope of the work whose costs would be borne by the Japanese side.

4.1.9 STRUCTURAL PLANNING

1. Basic policy in structural planning

Thailand is out of any world's seismic zones and therefore has rarely experienced earthquake and so in designing buildings, there is no need to take seismic forces into consideration. As for wind pressure forces, the nation it not hit by typhoons like Japan. Records by the Kanchanaburi Meteorological Observation Station during the period from 1951 to 1965 show the average wind velocity was 1.5 - 2.1m/sec, and the maximum wind velocity was 28.3m/sec. Thus, since the horizontal forces such as seismic forces or wind pressure forces to act on buildings are extremely small, in the structural planning of single-storied or two-storied buildings, it is unnecessary to provide any special frames resisting against horizontal forces; frames composed with columns and beams are sufficiently capable of supporting a building.

As a result of standard penetration tests, the ground for the construction site consists of alternate layer of clay and sand, and the N value increases gradually along with the depth. However, there is no clearly defined supporting layer. Considering the scale of this complex building, pile foundations shall be employed for Indoor Laboratory buildings, and the sand layer at GL -12m is suitable to support them. For the lightweight building such as the greenhouses, a direct foundation shall be employed, which will be supported by the hard clay layer at GL - 1.5m. [Refer to the attached Boring Log for information on the ground configuration.]

In order to prevent irregular settlements of buildings or concrete shrinkage cracks, it would be desirable to employ expansion joints for buildings which lengths exceed 50m, and severing the buildings at the joints.

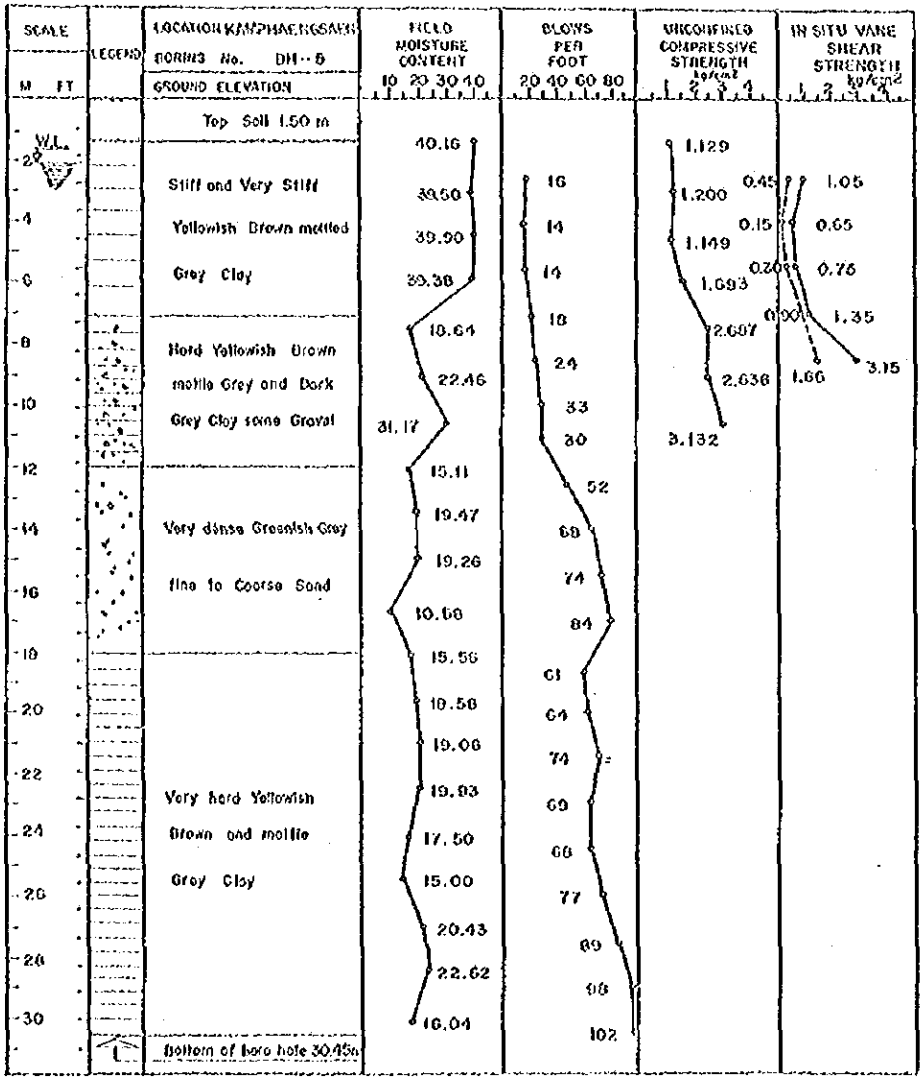
The frames which support the vertical loads principally, will appropriately have column span of 6 - 7m from the standpoint of safety and economony.

W.L. • -- 2.20 M below ground

---------- Undisturbed

- - - - - - - - - - Remolded

BORING LOG



2. Structural design policy

In carrying out the structural design of this complex building, it would be desirable to consider the following points.

1) The values of the external forces and the basic design loads applying on the buildings should be decided on taking into account such factors as conditions of local climatic, geographical, subsoil and the usages of buildings.

2) The allowable unit stresses for the structural materials should be determined with the values given in the Architectural Institute of Japan Standard, modified taking into consideration local construction standards and variations in quality. For example, whereas the allowable unit tension stress of SD35 reinforcing bars is 2.2t/cm^2 based on A.I.J. Standard, as a result of discussions with Thai staff, it was decided that the figure was lowered down to 2.0t/cm^2.

3) Stresses analysis and design of member sections of structural frames shall be based upon the calculation methods prescribed in the Architectural Institute of Japan Standards. The external forces and loads applying on the buildings are as follows.

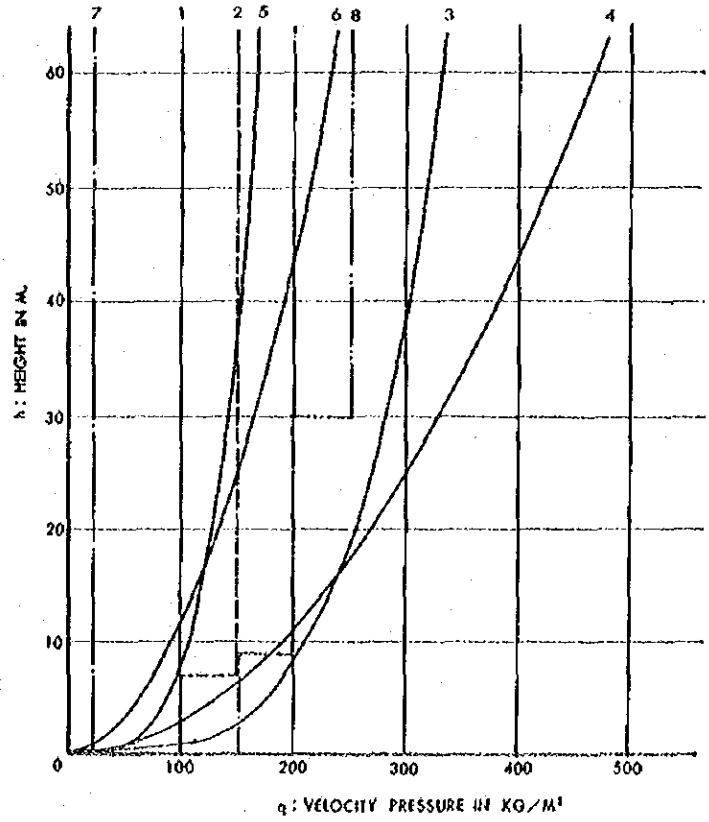
i) Dead load

The fixed weights of all structural compornents and finishing materials shall be calculated.

ii) Live load

In principle, the values of the Building Standards Law of Japan will be adopted, but for special rooms such as machinery rooms or storage rooms, the values which meet
calculated. The loads of the machines and equipments that will be installed in
will be taken into consideration. The live loads of the main rooms are as shown in the following chart.

1. SUBURBAN DISTRICTS IN THAILAND : q = 100 TO 50
   (THE CONTROL OF THE CONSTRUCTION OF BULDINGS ACT)
2. BANGKOK : q = 100 TO 150
   (BYE-LAWS OF THE BANGKOK MUNICIPALITY)
3. JAPAN : $q = 120 \sqrt[4]{h}$ FOR TALL BUILDING
4. JAPAN : $q = 60 \sqrt[4]{h}$ FOR LOW BUILDING
5. VIETNAM : $q = 60 \sqrt{h}$ FOR TALL BUILDING
6. VIETNAM : $q = 30 \sqrt{h}$ FOR LOW BUILDING
7. INDONESIA : q = 25
8. PHILPPINES : q = 150 TO 250



WIND PRESSURE

Room	For floor slab (kg/m^2)	For column, beam and foundation (kg/m^2)
Laboratories	300	180
Offices	300	180
Stockrooms for libraries	550	450
Corridors	360	330
Staircases	360	330

iii) Wind pressure forces

According to the records of the Kanchanaburi Meteorological Observation Station, the maximum wind velocity is about 28.3m/sec, and so wind pressure forces are relatively small. The floor number of projected buildings will be one or two, so in accordance with The Control of the Construction of Building Act, an allowance of $100kg/m^2$ of horizontal force would be sufficient. The values of wind pressure forces in the nations of Southeast Asia are shown in the following graph for reference.

iv) Seismic forces

There is no need to take seismic forces into consideration.

3. Structural materials and methods of construction

The structural materials to be used shall be selected and decided upon taking into consideration the scale of building, the types of structure, and usage of the buildings, the local supplying capabilities for the materials, qualities, methods of construction, and transportation conditions from other countries and prices thereof. In the case of the construction for this complex building, the building shall be of reinforced concrete frame, and it is considered that the following materials are suitable.

1) Concrete

All materials such as cement, fine aggregate, or coarse aggregate, can be obtained locally. A concrete batching plant will be provided at the site, in order to measure the weighting and mixing of concrete materials. Normal concrete will be used, and standard design compressive strength ., F28=210kg/cm^2 is considered appropriate. The construction site is located in the high temperature region, and so in order to prevent the formation of cracks in the cause of the drying and hardening of the concrete, the concrete will be mixed to a stiff consistency, with care to be taken in the curing such as frequent water sprinkling after pouring of the mixed concrete.

2) Reinforcing bars

The reinforcing bars can be obtained locally without any problems. However, 22mm diameter reinforcing bars are not being manufactured, while 12mm diameter bars are in widespread use rather than 13mm diameter bars, and so care should be taken to select the reinforcing bars at the designing stage.

3) Structural steel

Structural steel are suitable for the frames of light structures such as greenhouses. A construction method in which SS41 Japanese-manufactured steel frames are fabricated at the plant before shipment to erect the frame on the site through simple assembly alone, is desirable.

4) Piles

Because there is no supporting layer sufficiently, in addition to the supporting capacity of the tips of the piles, the circumferential friction force becomes an important factor in the overall pile bearing capacity. Since the precast concrete piles being manufactured locally have a large circumferential area, they are suitable for this thinking.

4.1.10 PLUMBING SYSTEM PLANS

A. Water supply system plan

The supplying of water to this complex building will be carried out by extending the main water line (4-inch) that is already installed on the west side of construction site. In order to maintain the required volume of water and stability of water supply pressure, the main distribution water piping within the site will be of the loop line system. The supplying water to each buildings can be classified broadly into three categories: miscellaneous water, drinking water, and pure water for experiments. Since water quality from the source mains has a high solidity, all supplying waters should be softened by water softening apparatus except the miscellaneous water, while the pure water for experimental use should be generated by pure water apparatus. The materials for the pipes shall be zinc plates steel pipes for the miscellaneous and drinking water. Vinyl chloride pipes will be used for the pure water. The valves, fittings, and water processing apparatus etc., while be imported.

B. Drainage system plan

The drainage system for this project can be classified broadly into four sub-systems: sanitary sewage, miscellaneous drainage, rainwater drainage, and experiment waste water drainage.

1) Sanitary sewage plan

The waste drainage from the lavatories of each buildings shall be led to a septic tank, and after going through a purifying process, shall then be discharged together with the miscellaneous drainage. Septic tanks shall be installed for each building, and the waste drainage lines shall be planned as short as possible. The materials shall be cast iron pipes for interior use and centrifugal concrete pipes for exterior, and locally manufactured products can be used for both types.

2) Miscellaneous drainage plan

The miscellaneous drainage from each of the buildings shall be piped into open ditch provided at perimeter of the building, and discharged into the drains. The materials for the drainage lines shall be zinc plated steel pipes for interior use and centrifugal concrete pipes for exterior. Locally manufactured products can be used for both types.

3) Rainwater drainage plan

Rainwater drainage from the roofs at each of the buildings and from within the site shall be planned in the same method as the miscellaneous drainage. Open ditches surrounding the site shall be used to cope with the large amounts of rainwater drainage that will occur during the rainy season.

4) Experiment waste water drainage plan

Waste water from each of the laboratories containing acid or alkaline substances shall first be led to a neutralizing tank and then discharged together with the miscellaneous drainage. Vinyl chloride pipes shall be used for the piping.

C. Sanitary fixture plan

Sanitary fixture shall be fitted at each lavatories of the buildings, in accordance with the building plannings. In accordance with the request of the Thai side, all fixtures installed shall be the western style. Also, emergency shower facilities shall be installed in the laboratories and corridors. All sanitary fixtures shall consist of locally manufactured equipment. However, all faucets shall be imported.

D. Sanitary sewage septic tank plan

Heretofore, sanitary sewage purifying system widely used in Thailand consisted of local type septic tanks. However, recently, they are now changing to use the ready-made fiberglass aeration type septic tanks so that for this project, aeration type septic tanks will be used.

E. Gas supply system plan

For this project, liquefied petroleum gas for experimental use will be supplied from gas concentrative apparatus installed at the Laboratory Maintenance Unit to each laboratories.

4.1.11 AIR-CONDITIONING AND VENTILATION SYSTEM PLAN

A. Air conditioning system plans

The air conditioning system in this project can be classified broadly into general air conditioning for people, and special air conditioning for the experiments.

1) General air conditioning system plan

In accordacne with the request of the Thai side, subjected floor area where it is necessary to plan the air conditioning is approximately 2000m^2. In accordance with the request of the Thai side, the design conditions shall be an outdoor's temperature of 34°C, an indoor's temperature of 26°C, and a humidity of 50 - 60 percent. The Thai side had been requesting an internal temperature of 72°F - 75°F (22.3°C ~ 23.9°C). However, this is not a suitable air conditioning temperature for people, and so generally accepted conditions will be planned. The heat source equipment will be installed in the Laboratory Maintenance Unit. The heat source shall be an air-cooled chilling unit as requested by the Thai side, and from this unit, chilled water will be supplied to the air conditioning units and fan coil units in each of the buildings, to carry out the air conditioning.

2) Special air conditioning system plan

Special air conditioning plans will be drawn up for the cold room, particular greenhouse, etc., in accordance with the temperature conditions necessary for the research and experiments. Since the temperature conditions and hours of usage will differ from the general air conditioning, individual air conditioning units will be installed for each of the facilities. The temperature conditions desired by the Thai side are as follows.

For Cold Room

Post Harvest Research Laboratory

Chamber 1	0 - 5°C, ±0.5°C
Chamber 2	5 - 10°C, ±0.5°C
Chamber 3	10 - 15°C, ±0.5°C
Chamber 4	15 - 20°C, ±0.5°C

Culture Collection Laboratory

Both chambers	0 - 5°C, ±0.5°C

Seed Technology Laboratory

0 - 5°C, ±0.5°C

Controlled Conditions Unit

Chamber 1	-10 - 0°C, ±0.5°C
Chambers 2, 3	0 - 10°C, ±0.5°C
Chambers 4, 5	10 - 20°C, ±0.5°C

For Glasshouse

External temperature minus 5°C

B. Ventilation system plan

In principle, ventilation for this buildings shall be utilized by natural wind draft. However, for the lavatories, hume cupboards of the laboratories, and conference rooms, etc., forced ventilation shall be carried out. The method of ventilation shall be a ceiling exhaust system, with the fans being fitted above the ceilings.

C. Emergency facilities plan and fire prevention plan for entire campus

Plans have been formulated for fire-fighting measures, emergency rescue activities, and clinical facilities. In the case of fires, initial fire-fighting activities shall be carried out by means of small fire extinguishers; and for subsequent fire-fighting activities to be conducted by fire trucks, although fire protecting service piping of the water mains direct coupled type are not necessary for this building, fire protecting service facility plan shall be conformed to the Bangkok's local codes.

4.1.12 ELECTRICAL SYSTEM PLANS

The electrical system plan for the Complex consist of the Main Electrical System and the General Electrical System.

A. Main Electrical System

1) Power station facilities

The electricity incoming led by a 22kV underground cable branching off from the existing power transmission line to the power station in the Laboratory Maintenance Unit, where it is stepped down to a low voltage of 3-phase 4-wire 380V/220V by transformers, to be supplied to each of the respective loads.

The equipment loads consist of the following.

o For Building	(1) Illumination, wall outlets
	(2) Air conditioning and ventilation facilities power
	(3) Water supply and drainage facilities power
o For Experimental equipment	(1) Single phase load for experimental equipment
	(2) 3-phase load for experimental equipment

The total capacity of the above facilities will be around 1,300kVA, and from the standpoint of ease in maintenance of the power station, prevention of any danger, aesthetic appearance, and P.E.A. regulations [transformers with capacities exceeding 300kVA shall be placed on the ground], an independent power station will be provided for this complex.

2) Power generator equipment

An in-house power generator system employing a stationary diesel engine will be installed for assuring power even during periods of failures of electricity, to maintain power stability for the research equipment.

The loads for the generator shall be as follows.

(1) Air conditioning power supply for growth cabinet

(2) Power supply for cold room

(3) Power supply for research equipment such as electron microscope

The fuel for the generator shall be light diesel oil, and a unit producing 3-phase 4-wire 380V/220V 50Hz with a capacity of around 150 - 200kVA shall be installed at the generator room in the Laboratory Maintenance Unit. Switching from one power source to the other shall be capable of being carried out automatically.

3) Power circuit system

a) Lighting power main lines

A low voltage switchboard shall be installed in the power station room, and supplied to each building through the connecting corridors. The main line systems shall consists of the following.

(1) General lighting; experimental main line
3-phase 4-wire 380V/220V

(2) Power main line for air conditioning, ventilating, water supply and drainage
3-phase 3-wire 380V

(3) Power main line for experimental equipment
3-phase 3-wire 380V

(4) Generator power main line for equipment such as electron microscope
3-phase 4-line 380V/220V

(5) Generator power main line for growth cabinet and cold room
3-phase 3-line 380V

In order to cope with voltage fluctuations [particularly voltage droppages], static type constant voltage regulators will be installed

for the research equipment that requires them, to stable the power. Also, in those places in the research equipment plans where a 110V power supply is necessary, individual transformers will be installed.

b) Telephone main lines

An MDF switchboard will be installed in the Central Administrative Office, and for the on-campus telephone trunk line, five line cables provided by the University will be led to the MDF switchboard by underground conduits. The telephone lines from the MDF switchboard to the IDF boards at each of the buildings will be connected through the connecting corridors.

4) Telephone switchboard facilities

Switchboard facilities will be installed in the Central Administrative Office for communications within the complex and with the other buildings on the campus, and swift and smooth communications shall be facilitated. Off-campus communications shall be carried out via the Central Administrative Office in the Academic Core by means of radio telephone.

a) Telephone switchboard specifications

i) Switchboard: Crossbar type automatic switchboard

ii) Repeater board: Cord-less table-top type

iii) Extension telephone instrument: Dial type

b) Trunk line and extension

There will be no trunk lines from the T.O.T.

From the switchboard in the campus Central Administrative Office, five connecting lines will be provided to the new switchboard of this complex and total of approximately 120 extension telephone units will be connected to those rooms necessary in each building.

B. General electrical system

1) Power facilities

Power source supplying work for the operation and control of the air conditioning, ventilation, and water supply and drainage equipment, and power supply work for the cold room, growth cabinet, and research equipment, shall be carried out. In the supplying of electric power to the research equipment, power distribution panels shall be installed near the place supervisable or the exits and entrance of each rooms, and the secondary wiring from the power distribution panels shall be lead by cables in exposed conduits tubes to the switchboard or control panel which directly controls.

All 3-phase electricity equipment shall be grounded. If the cables are to be left exposed, TW cables must be used.

2) Illumination equipment

Light sources for illumination shall consists in the main of daylight fluorescent lights, and the lighting fixtures shall be concealed in the ceilings or directly fitted. However, in the laboratories, in addition to the ceiling lighting, for laboratory tables, individual lighting shall be provided for sufficient intensity on the tables. The fluorescent light stabilizers shall be TIS standards products. ON-OFF switching for lighting circuits will be controlled in group.

The approximate intensities in the main rooms shall be planned as follows.

i) For offices, conference rooms, laboratories

300lx - 400lx

ii) For surfaces of laboratory tables

Approximately 2,000lx

3) Receptacles

Plug type receptacles shall be fitted in those places where required within the buildings, for the supplying of power. The conduits and wiring shall conform to TIS-IV and conduits tube. In those instances where 110V power is required for the research equipment, 110V receptacles shall be fitted. About two to three per every $40m^2$ shall be fitted in the offices and laboratories, while in the experiment rooms, receptacles compatible with the research equipment on the tables and one to three standard outlets shall be fitted. Receptacles for the generator circuit shall also be fitted in whatever rooms may need them.

4) Lighting outlet

The power distribution boards shall be of metallic, accessible for installed at places inspection and maintenance. The circuit breakers for wiring shall be used of no-fuse type and shall be 2-pole types. The lighting circuits and receptacles circuits shall be separated.

5) Telephone outlet

Conduit piping work for the connecting of telephones in each room from the IDF boards of each building shall be carried out. The installation of each individual telephone extension unit shall, in principle, be carried out in the form of wall mounts.

6) Public address facilities

An amplifier will be installed in the Central Administrative Office, to enable the broadcasting within the building of business messages, or the starting and closing of work for the day. Such broadcasts are to be possible independently for each building.

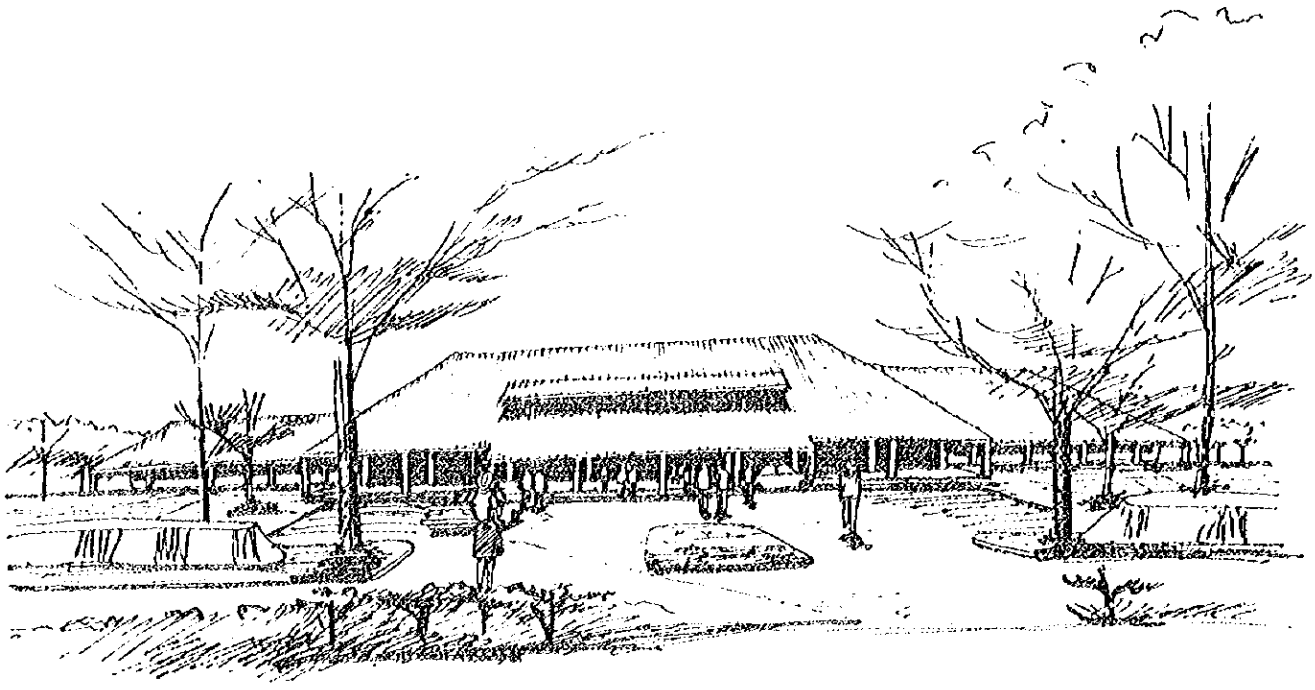
The conference room shall have individual amplifiers, for smooth management of conferences.

7) Fire alarm system

There will be a fire alarm system which will enable the sounding of a bell by manual operation in order to convey an alarm to the staff in the building as soon as possible to facilitate evacuation on occurrence of fire.

8) Lightning arrestor

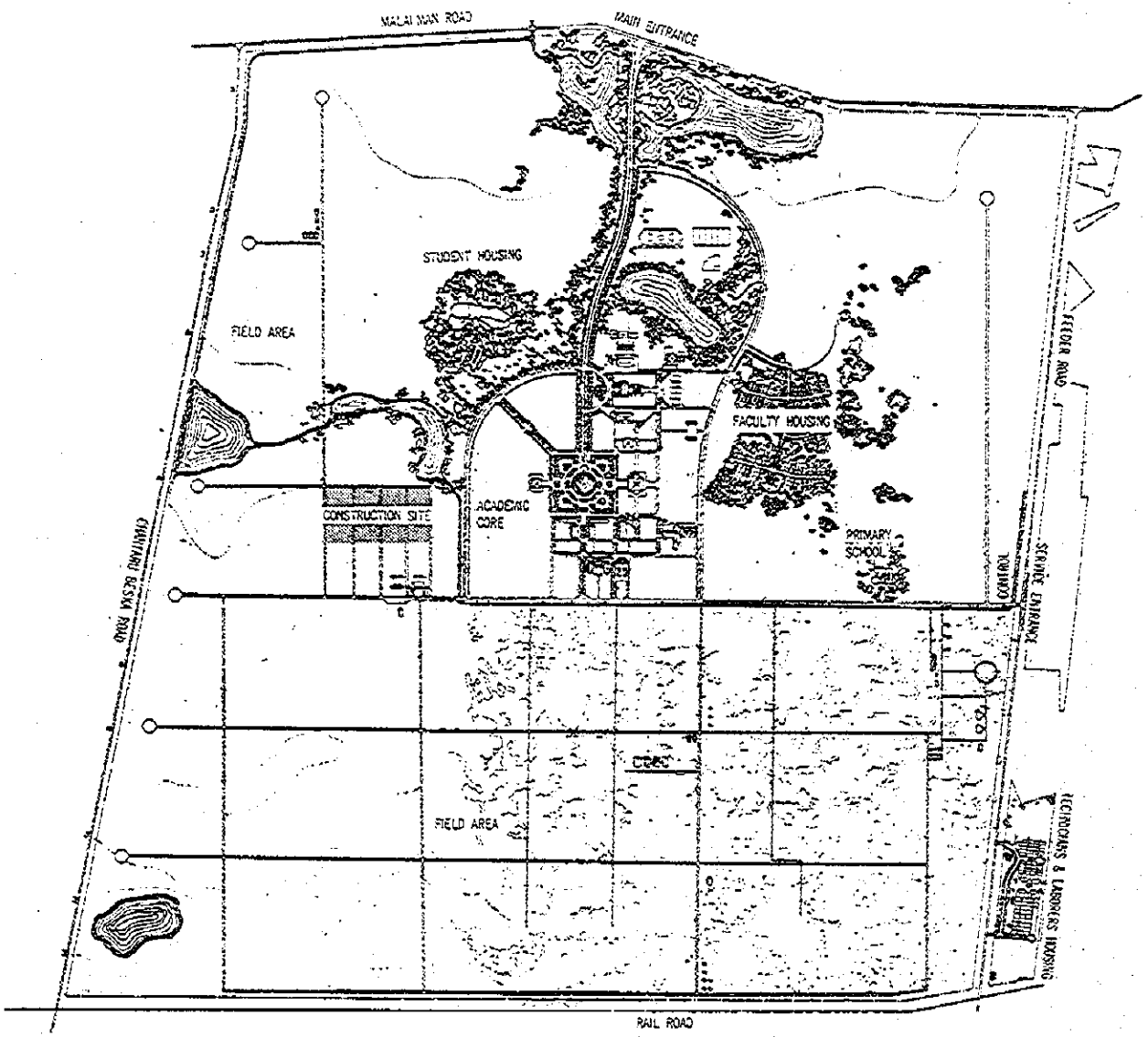
Lightning arrestor employing radio isotopes will be installed at the highest part of the building, to serve as accident prevention equipment in thunder-storms.



APPROACH TO ENTRANCE OF COMPLEX

LIST OF DRAWING

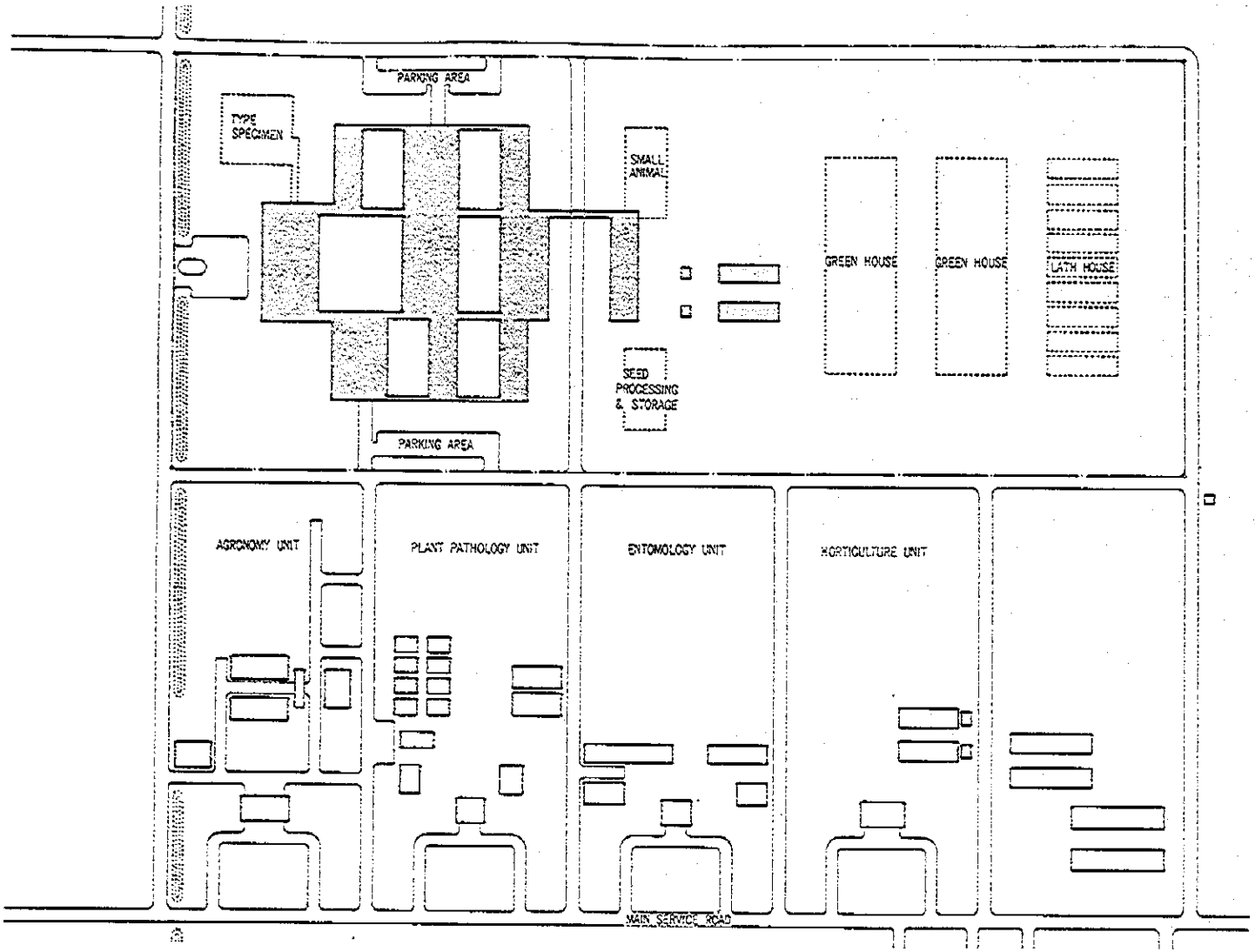
DRW. NO.	DRAWING TITLE
1	KAMPHAENGSAEN CAMPUS MASTER PLAN INITIAL PHASE
2	PLOT PLAN
3	BLOCK PLAN
4	1 ST & 2ND FLOOR PLAN-- 1
5	1 ST FLOOR PLAN-- 2
6	1 ST FLOOR PLAN-- 3
7	ELEVATION & SECTION-- 1
8	ELEVATION & SECTION-- 2
9	GLASSHOUSE & SCREENHOUSE
10	WATER SUPPLY SYSTEM PLAN
11	SEWAGE DRAINAGE & SEPTIC TANK LAYOUT PLAN
12	ELECTRIC POWER SUPPLY SYSTEM PLAN
13	TELEPHONE MAIN PLAN



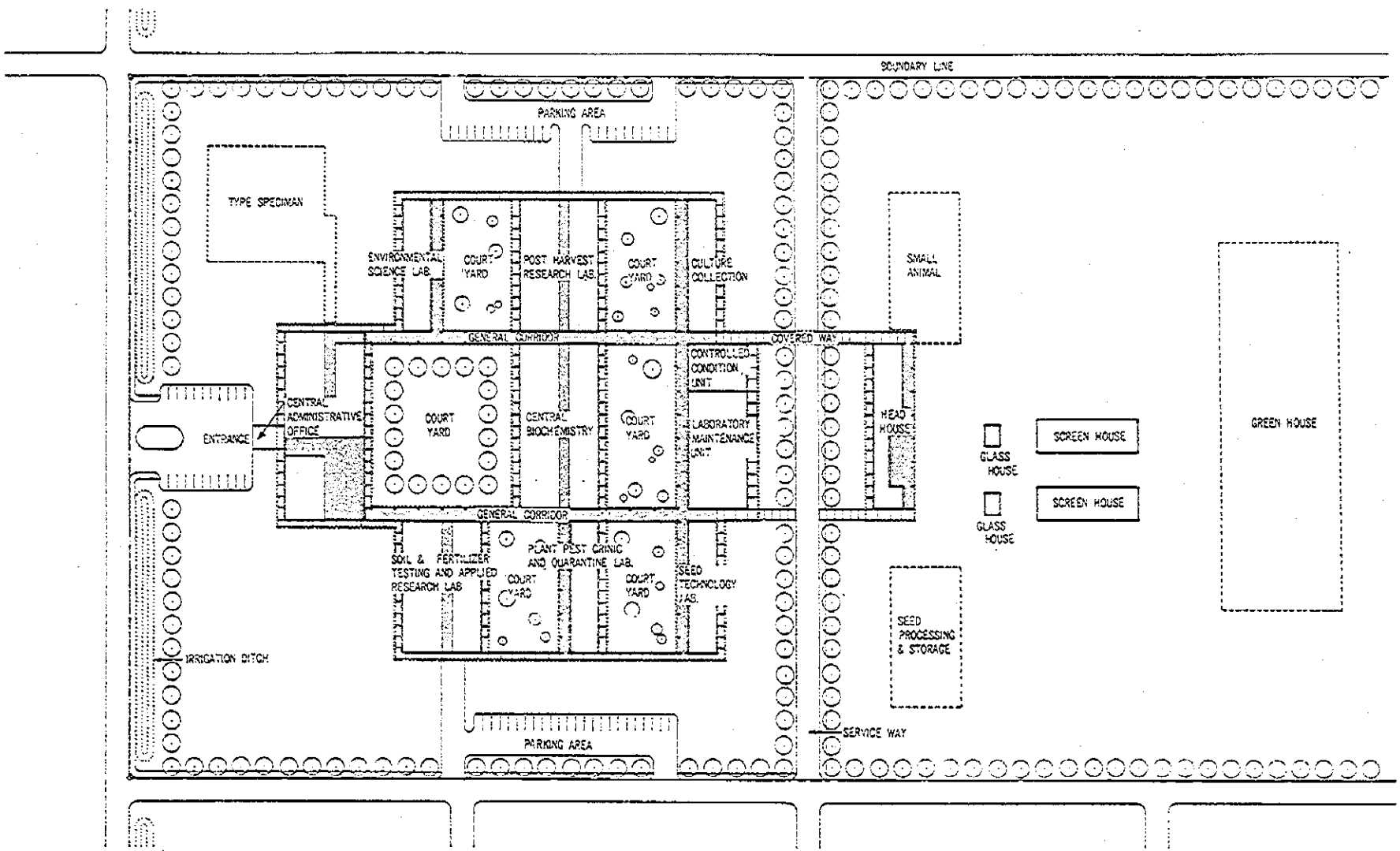
0 100 250 500M

KAMPHAENGSAEN CAMPUS MASTER PLAN INITIAL PHASE

01


PARKING AREA
TYPE SPECIMEN
SMALL ANIMAL
GREEN HOUSE
GREEN HOUSE
LATH HOUSE
SEED PROCESSING & STORAGE
PARKING AREA
AGRONOMY UNIT
PLANT PATHOLOGY UNIT
ENTOMOLOGY UNIT
HORTICULTURE UNIT
MAIN SERVICE ROAD
N
LEGEND
BUILDINGS TO BE PROVIDED BY JAPANESE SIDE
BUILDINGS TO BE PROVIDED BY THAI SIDE
EXISTING BUILDINGS
BOUNDART LINE
IRRIGATION DITCH
0 20 40 80M

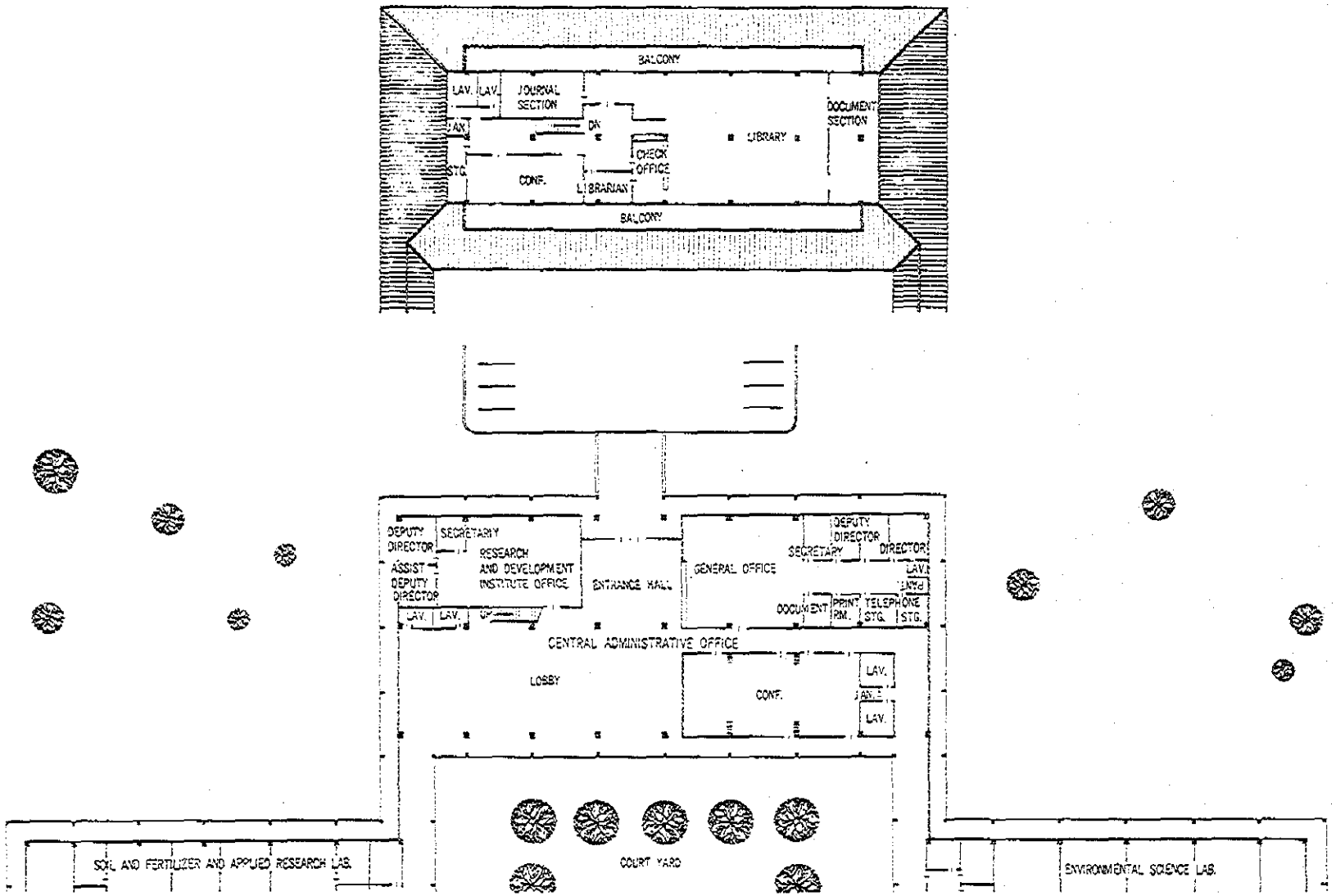
PLOT PLAN 02



0 10 20 40M

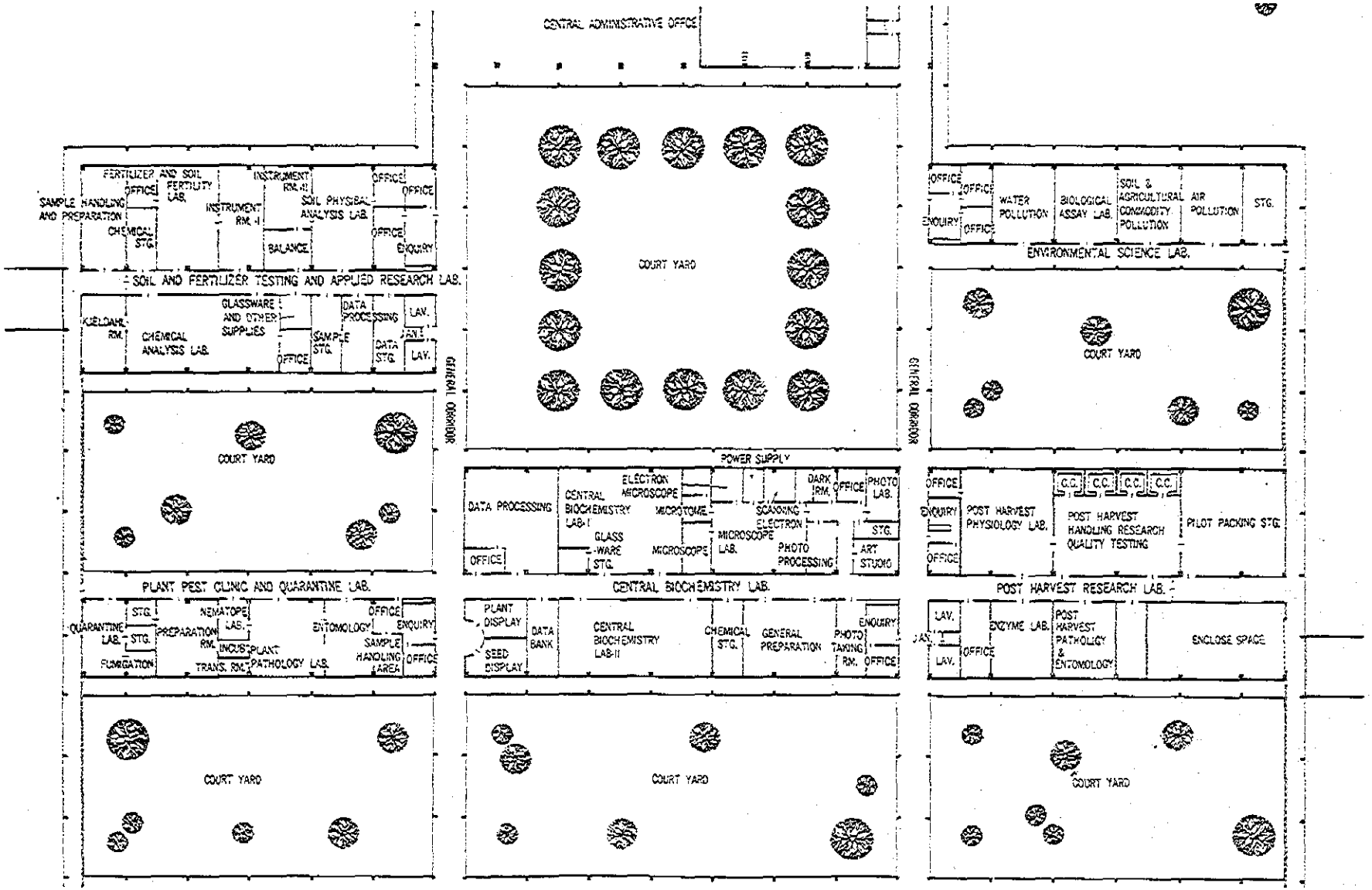
BLOCK PLAN

03



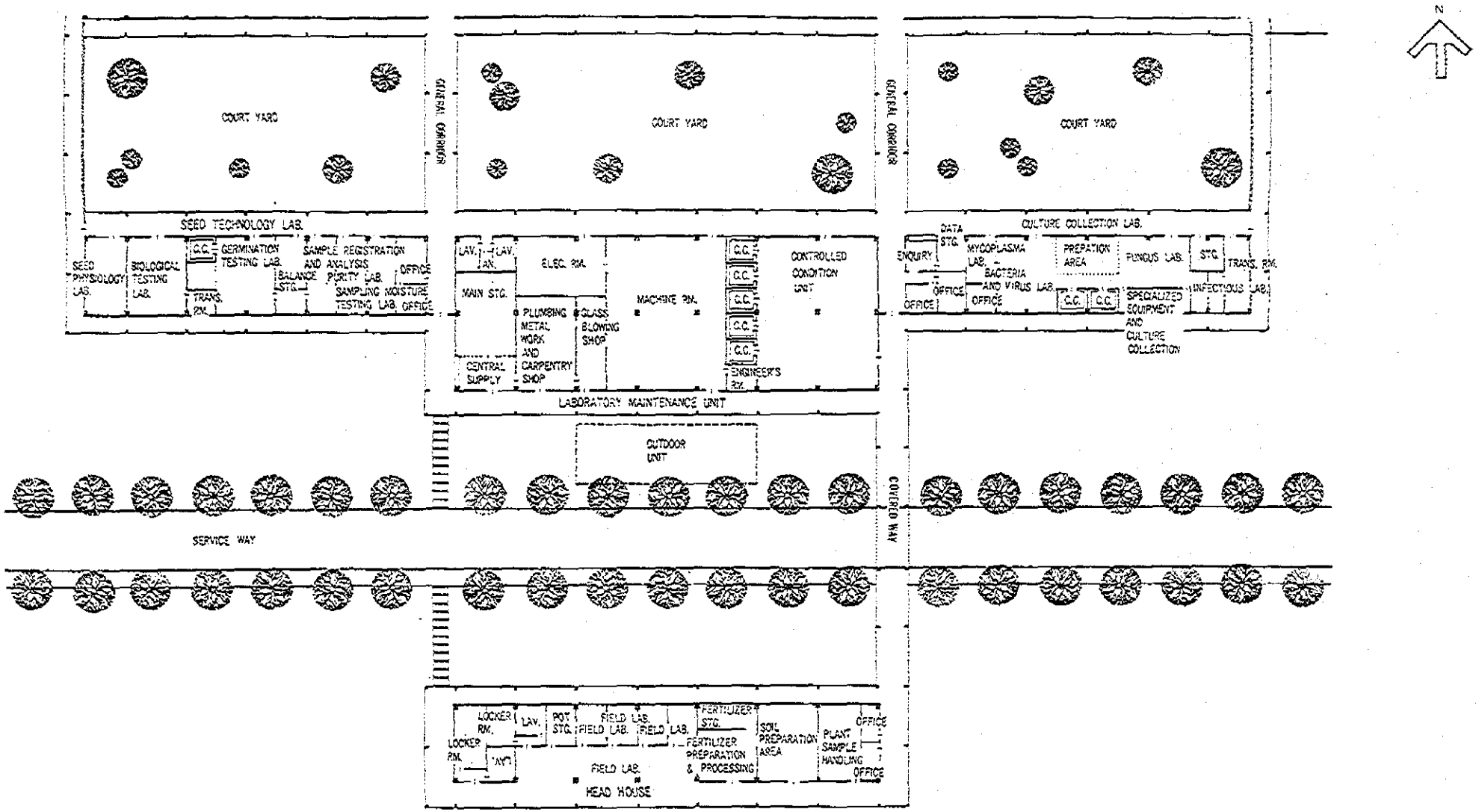
1ST & 2ND FLOOR PLAN—1

04



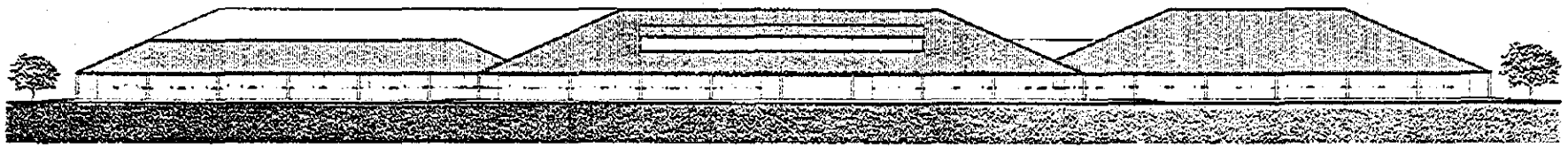
1ST FLOOR PLAN—2

05

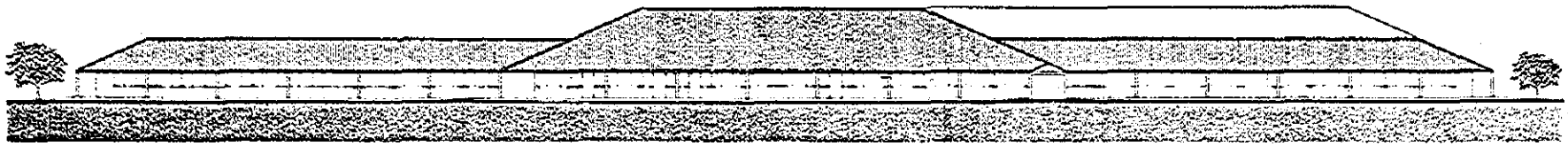


1ST FLOOR PLAN—3

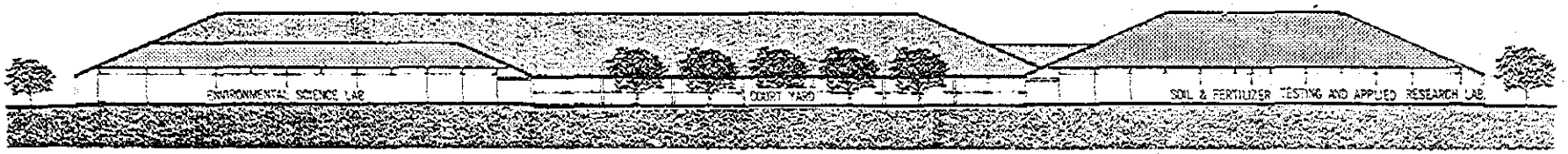
06



NORTH ELEVATION



SOUTH ELEVATION

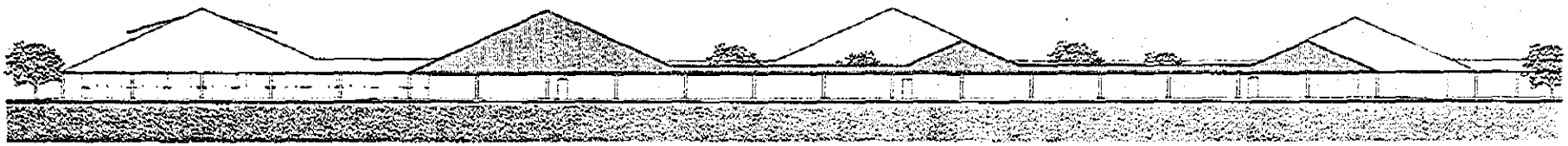


SECTION—1

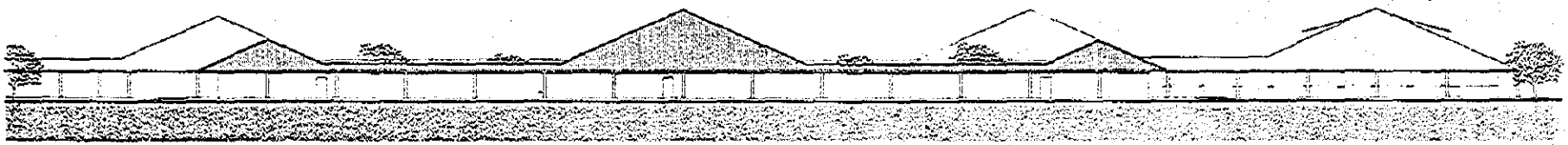
0 5 10 20M

ELEVATION & SECTION—1

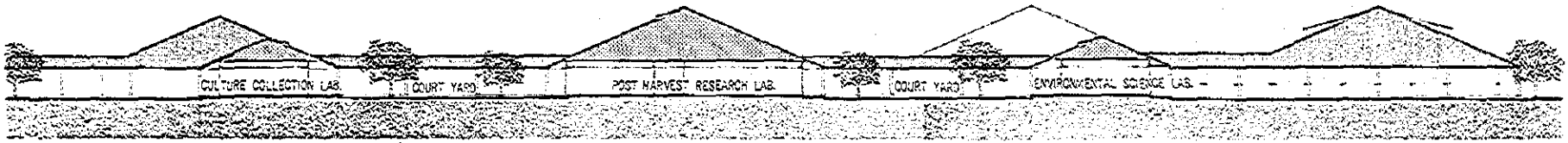
07



WEST ELEVATION



EAST ELEVATION

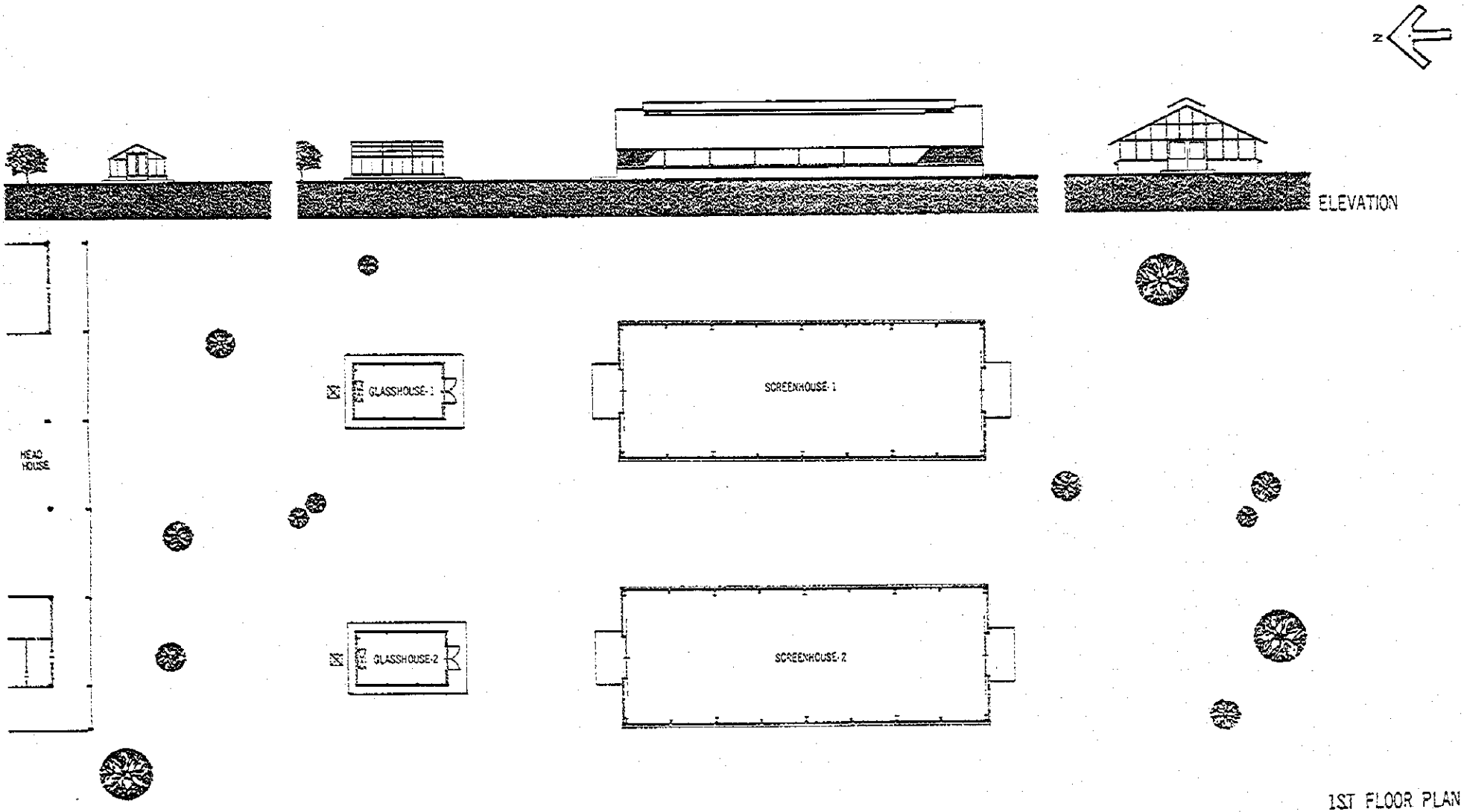


SECTION-2

0 5 10 20M

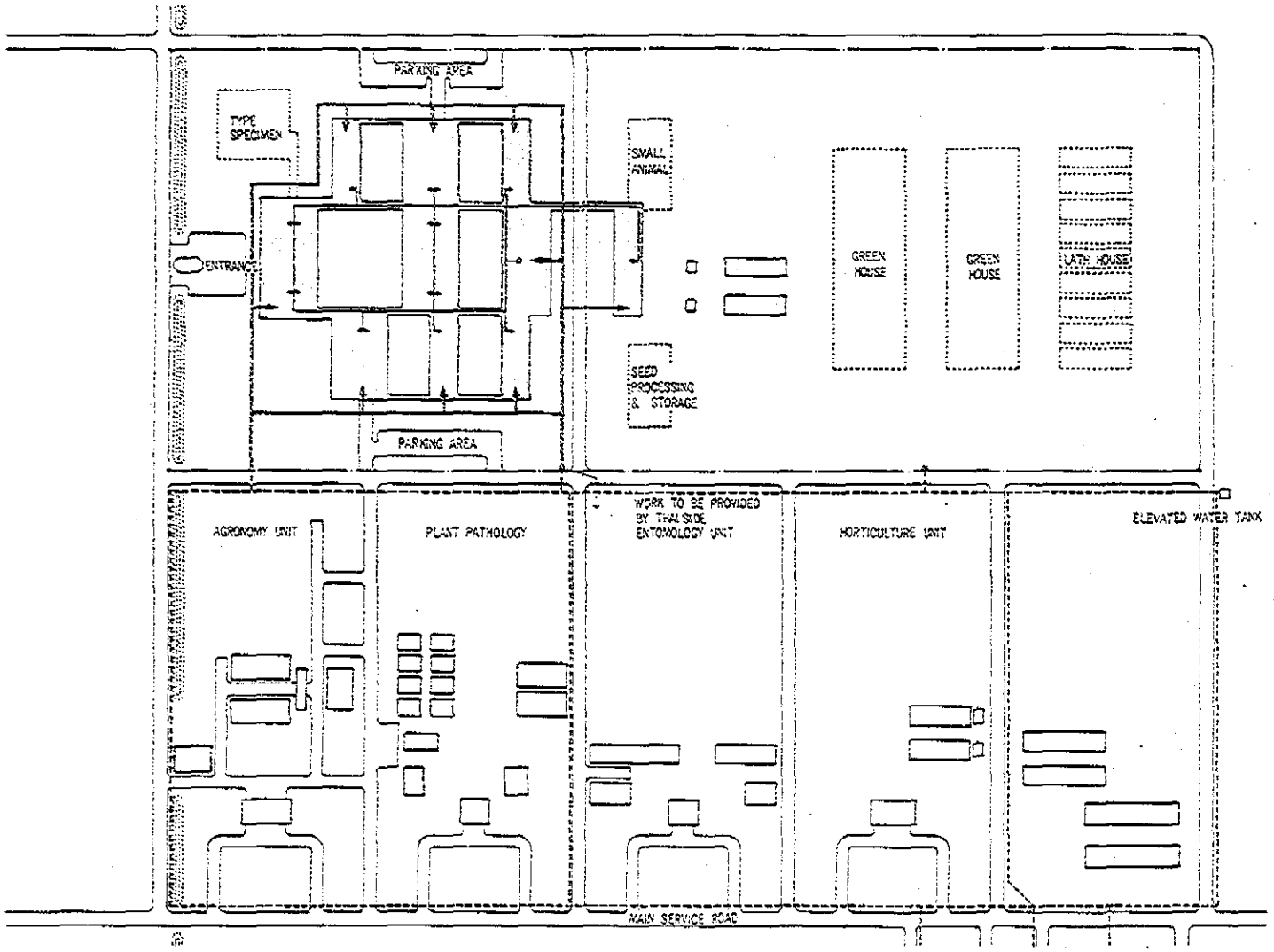
ELEVATION & SECTION—2

08



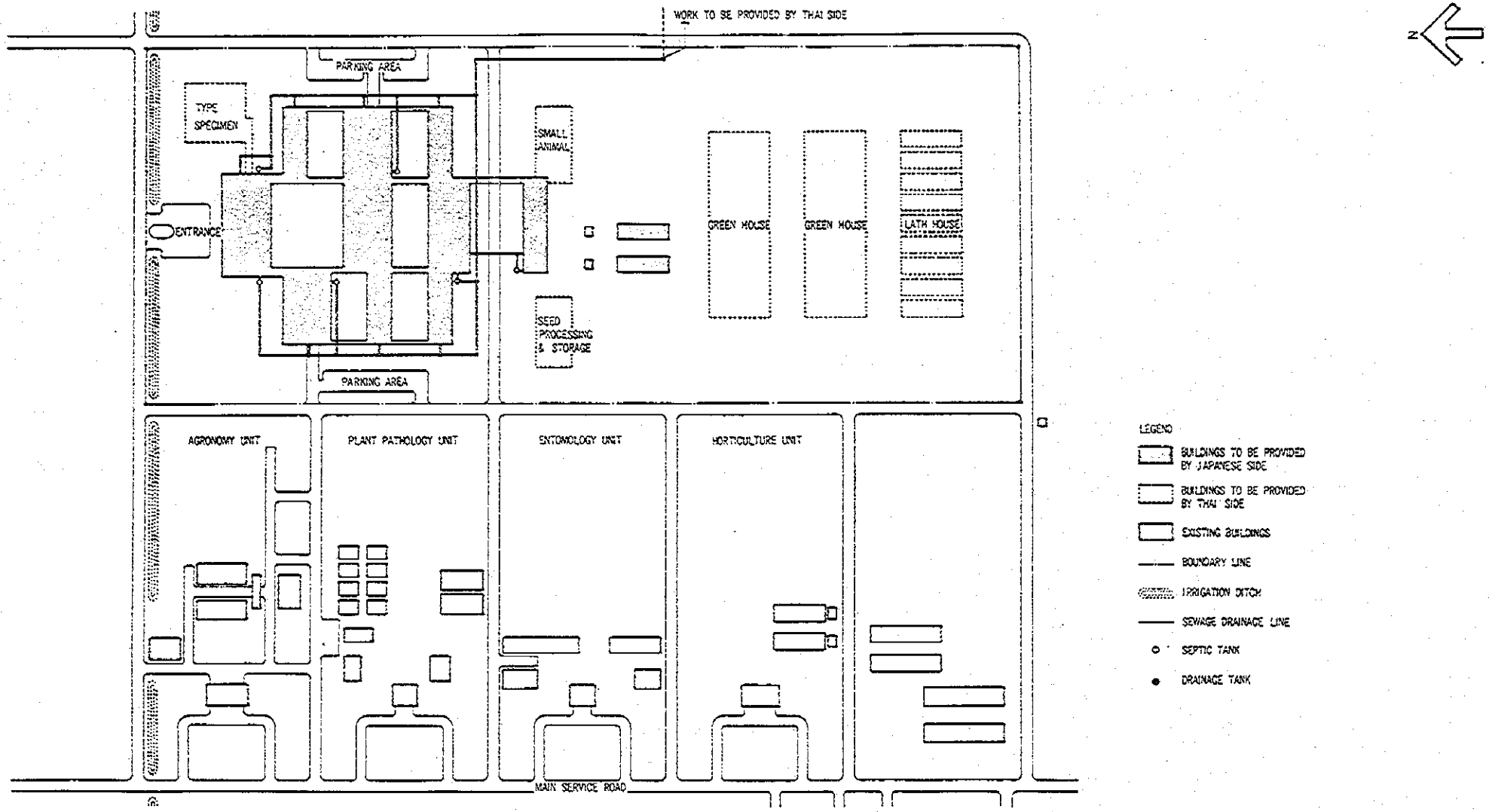
GLASSHOUSE & SCREENHOUSE

09



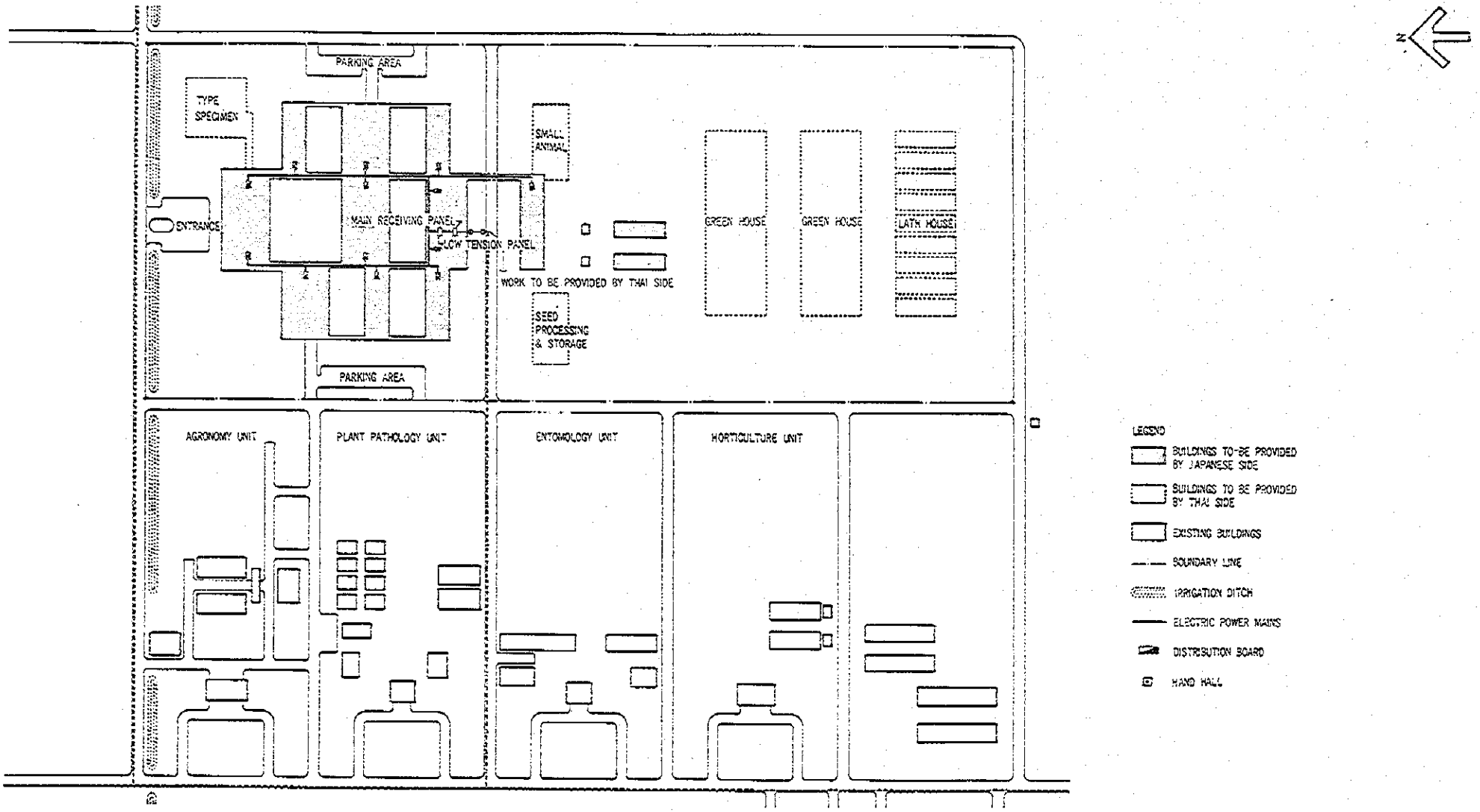
WATER SUPPLY SYSTEM PLAN

10



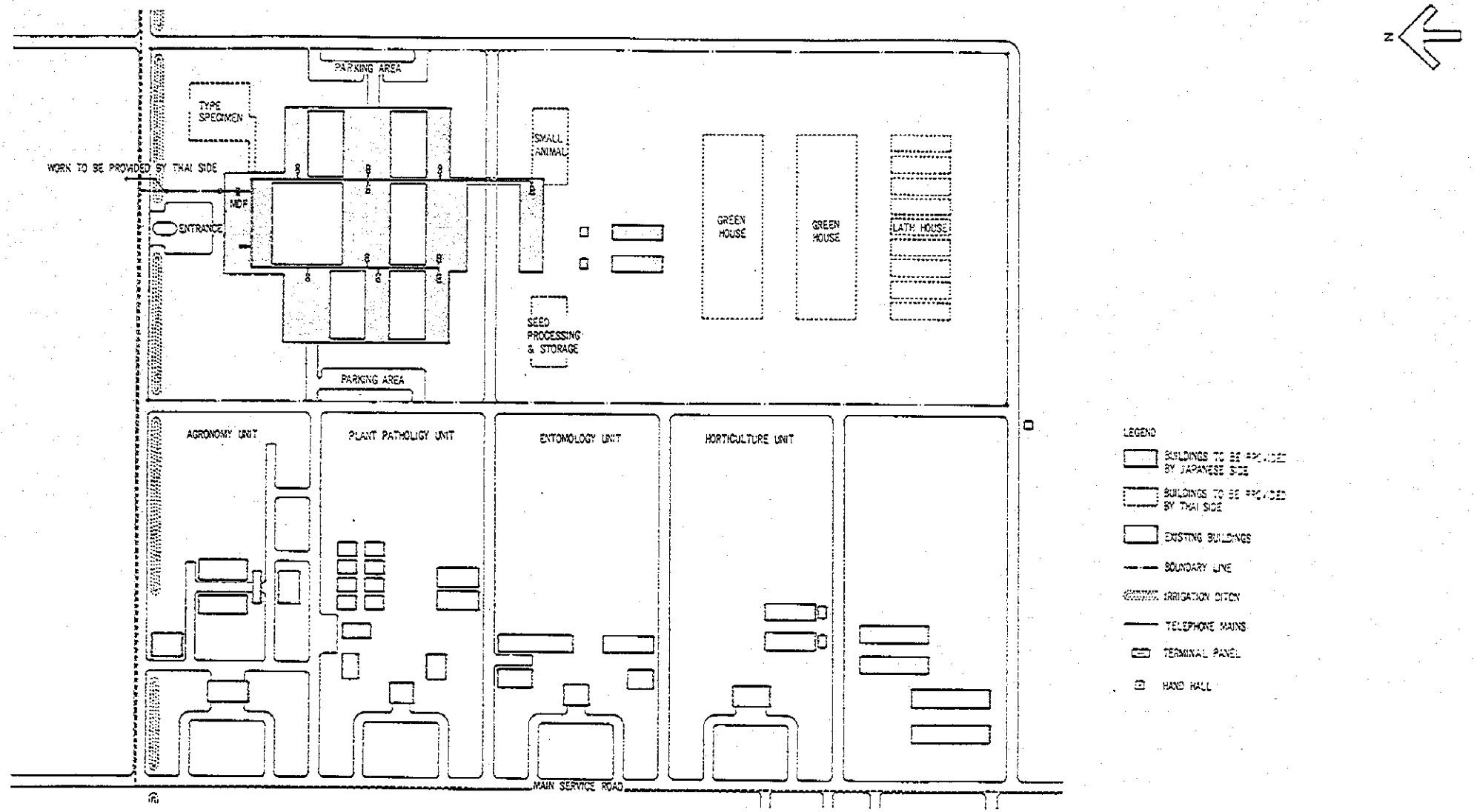
SEWAGE DRAINAGE & SEPTIC TANK LAYOUT PLAN

11



ELECTRIC POWER SUPPLY SYSTEM PLAN

12



TELEPHONE MAIN PLAN 13

FLOOR AREA TABULATION

UNIT NAME	FLOOR AREA (m^2)
1. CENTRAL ADMINISTRATIVE OFFICE	2, 145
2. CENTRAL BIOCHEMISTRY LAB.	955
3. CULTURE COLLECTION LAB.	480
4. ENVIRONMENTAL SCIENCE LAB.	480
5. PLANT PEST CLINIC AND QUARANTINE LAB.	510
6. POST HARVEST RESEARCH LAB.	960
7. SOIL AND FERTILIZER TESTING AND APPLIED RESEARCH LAB.	960
8. SEED TECHNOLOGY LAB.	510
9. CONTROLLED CONDITION UNIT	305
10. LABORATORY MAINTENANCE UNIT	870
11. HEAD HOUSE	670
12. GENERAL CORRIDOR AND COVERED WAY	930
13. GLASSHOUSE	60
14. SCREENHOUSE	600
TOTAL	10, 435

4.2 SCOPE OF WORK AND CONSTRUCTION SCHEDULE

During the stay of the survey team in Thailand, specific discussions on the scope of work of the Thai side and that of the Japanese side were held on a number of occasions with the architect group leading off with Dr. Sam-arng Srinilta, Project Coordinator.

4.2.1 SCOPE OF WORK AND WORK DEMARCATION

While the scope of work of the Thai side is already stated in the minutes, the demarcation of each work will be summarized below.

A. Fundamental work

1) Site preparation work

Thai side: prior to commencement of work, weeds, trees, and other obstructions will be eliminated.

2) Water supply

Thai side: Laying of water lines to three water connection points to be designated by the Japanese side will be carried out from the water tower that is scheduled to be constructed in the southwest sector of the site.

Japanese side: Will handle supplying of water from those three points to the complex building.

3) Electricity

Thai side: Will install aerial 22kVA wiring to a point to be designated by Japanese side.

Japanese side: Will carry out laying of lines from designated power pole to power station, of the buildings.

4) Telephones

Thai side: Will connect five campus telephone lines to telephone switchboard to be installed by Japanese side in Central Administrative Office.

Japanese side: Will provide 120 extension from MDF board onwards, via switchboard.

5) Drainage

Thai side: Will take care of drainage routes from terminal catch basin within the site to be installed by Japanese side.

Japanese side: Drainage routes within the site.

6) Road on outer circumference of site

Thai side: Thai side will carry out work of access road on outer circumference of site in good order.

7) Buildings

Thai side: All construction other than 12 items to be built by Japanese side as stated in minutes.

C. Exterior work

1) Paving

Thai side: Surface paving, paving bed and foundation work for parking areas and roads.

2) Planting

Thai side: Thai side will carry out work of planting of grass and other vegetation.

D. Furniture and miscellaneous

Thai side: Desks and chairs; filing cabinets; bookshelves; conference tables and chairs; lounge tables and sofas; lockers, etc.

Japanese side: To provide laboratory tables and necessary piping and wiring connections.

E. Transportation of materials

Thai side: Unloading of materials and equipments imported from Japan to Port of Bangkok; customs clearance; transportation of materials to construction site.

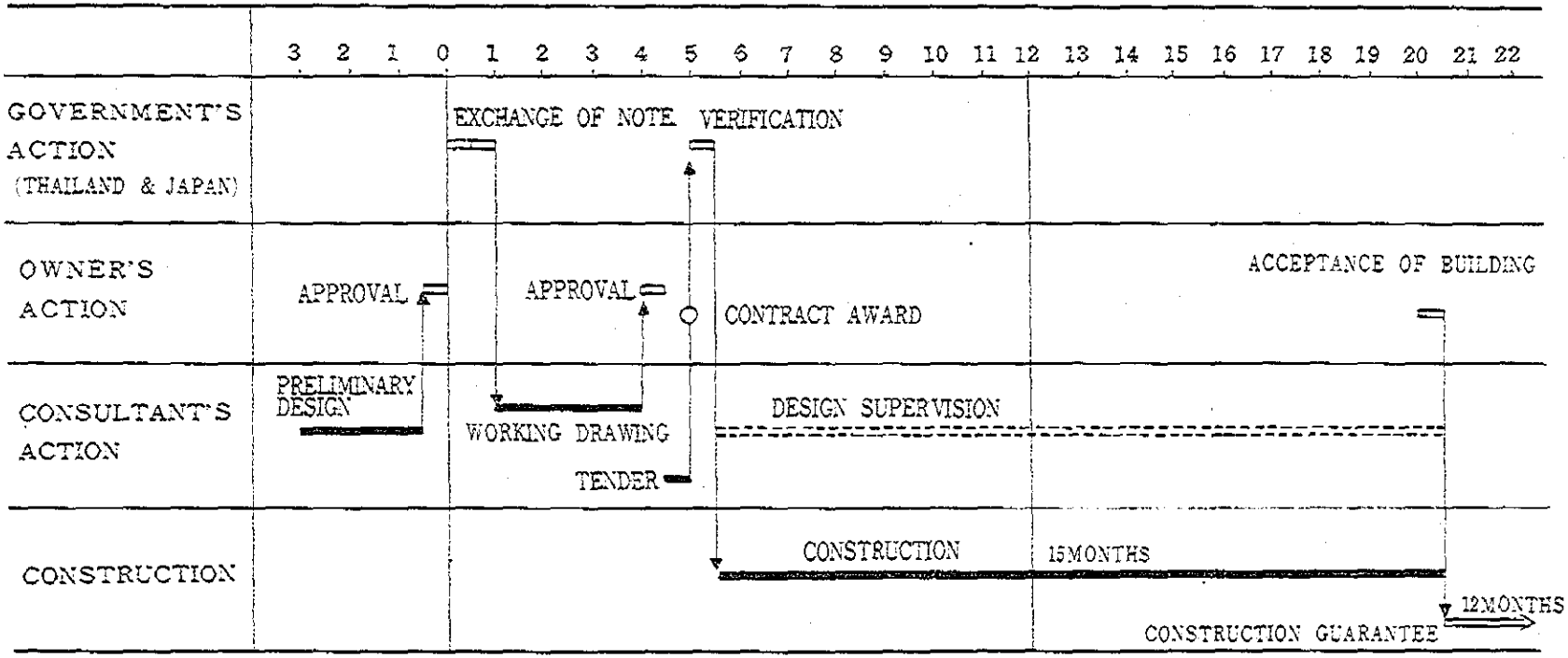
Japanese side: Packing of materials and equipment; to be exported from Japan; bearing of insurance charges; loading on to vessels at port of Japan, and marine transportation to Thailand.

4.2.2 CONSTRUCTION SCHEDULE

The work for preparation of execution drawings relating to this subject facilities construction under the grant program will commence following the conclusion of the exchange of official notes between the two governments. During this stage of the preparation of execution drawings, designs plans and specifications necessary for the work will be prepared and the documentation necessary for the work bid contracts will be made. Approval of the owner will be obtained on the contents of the execution drawings and documentation, after which contractors will be assembled and the work put out for tender. After concluding a contract between the successful tenderer and the owner, verification of the Government of Japan will be obtained and the work will then start. Judging from the scale, structure, and contents of equipment of the subject facilities, the period that will be required is approximately 15 months. The one-year period following the completion of the construction of the complex building and the delivery thereof to the owners will be the construction guaranty period.

Please refer to the subsequent pages for the construction schedule timetable.

TENTATIVE CONSTRUCTION SCHEDULE



4.3 ASSUMPTION ON THE ESTIMATION OF THE COST FOR CONSTRUCTION

The following assumptions were set for determination of the estimated construction cost.

1) Construction material
   In general, the materials produced in Thailand and Japan shall be used. The cost of the materials to be imported from Japan include packing cost, marine freight and insurance premium.
   Import duties to be levied on these materials and the inland transportation cost of imported materials and equipments are not included.

2) It is assumed that any constructors who may be engaged solely in the construction of the complex are exempted from all taxes, duties, due, etc. which may otherwise be imposed on the constructors.

APPENDIX

1. Introductory Statement on Preliminary Design Survey Team for Kasetsart Univ. Development Project in Thailand
2. MINUTES

APPENDIX – 1

Introductory Statement on the Perliminary
Design Survey Team for Kasetsart University
Development Project in Thailand

Gentlemen

I am pleased to say to be here again with a purpose to discuss further issues on Kasetsart University development project following my previous visit to Bangkok last July.

At the outset, with your permission, on behalf of the Survey Team, I should like to make a brief statement on what we have discussed among ourselves upon this subject before our departure from Tokyo in order to expedite our consultation here during our short stay.

1. First of all, may I explain the objective of this Survey Team. That is, based on the results obtained by last Survey, to confine to the extent of the intended financial cooperation by Japanese grants to contribute to the development of Kasetsart University, inter alia the contribution to some of the important buildings and supply of some equipment which have been proposed by the Government of Thailand to the Government of Japan under its fiscal 1978 budget. In addition to the above, we would like to formulate specifications for the implementation design which will be carried out in the next stage.
2. With regard to Japanese Government's budget for fiscal 1978, the budget draft which will be submitted to the Parliament for approval at the beginning of 1978 is now being prepared by the Ministry of Finance. Therefore, no difinite magnitude of grant aid for this project can be disclosed at this stage. But I personally believe that the amount to be allocated will not be at least less than the amount allocated to the Institute for Skill Development in the Northeastern region in Thailand which was incidentally 1 billion Japanese Yen.
3. We conceive, after careful examination on the data provided by the University at July Survey among the officials of the Japanese Government and designing engineers, that the Thai estimates on necessary expenses on this project seem by far the modest one, if Japanese constructing firm will actually enter into business of construction. Assuming ¥ 1 billion would be allocated to this project in the 1978 fiscal year, we should examine what items of the request would be covered by the budget and we reached a conclusion that the budget be too short to cover whole contents of the Thai Government's proposal, even if confined only to the Central Laboratory and Greenhouse complex.

4. When I think it over the effective use of various facilities after the completion and the necessary running expenses, I find it indispensable and reasonable that the selection of research subjects and scale down of initial plan of laboratory should be considered.
5. I expect under the current survey, as possible as specific, detailed investigation will be made with regard to the scale and the contents of the laboratory building, the equipment to be supplied and kind and the number and size of greenhouse. In this connection, I contemplate we should better refer to the priorities on each item and group which were contained in the materails furnished by the University during our mutual discussions last July, but of course I also welcome to discuss this matter more freely not necessarily be confined to the above.
6. Finally, I would like to refer to a technical cooperation project which will possibly be taken into account in this connection. Under this cooperation project some sorts of equipment would be provided by the Government of Japan. Budget for this scheme should be distinct from the grant assistance.

Thank you

Some Specific Comments

1. We are of the opinion that radio isotope facilities will be better not to include in the current project because huge amount of budget will be required to sophiscated apparatus, and at the same time there will be some technical problems on the operation.

2. It would be better to omit small animal laboratory the construction of which seems less important comparing with other research subjects in view of the limit of our budget.

3. To what extent the planned greenhouse complex should be developed under the climatic conditions of Tailand might be rather controversial. In particular controlled greenhouses will require tremendous operational cost. Because of this, the idea of putting small controlled apparatus indoor seems to be relevant.

4. It would be worthconsidering that multi-functional one unit building may be better than the original dispersal setting.

5. Although some scale down of the contents of laboratory in order to meet urgent requirements might be necessary, leaving of spare room in the building would be desirable, taking into account the future development of the research activities.

APPENDIX – 2

MINUTES OF THE DISCUSSIONS ON THE PRELIMINARY DESIGN SURVEY FOR THE KASETSART UNIVERSITY DEVELOPMENT PROJECT

At the request of the Government of the Kingdom of Thailand for the grant in order to contribute to the development of Kasetsart University (hereinafter referred to as "The University"), the Government of Japan through Japan International Cooperation Agency (hereinafter referred to as "JICA") had sent a preliminary survey team headed by Mr. Akira Arimatsu, Executive Director, JICA to conduct a preliminary survey on the Kasetsart University Development Project from 17th to 31st July, 1977.

Having considered the outcomes of the abovementioned survey, the Government of Japan decided to dispatch the Preliminary Design Survey Team (hereinafter called "the Survey Team") organized by JICA and headed by Mr. Arimatsu. The Survey Team visited Thailand for ten days from 17th October 1977 with the purpose of having more detailed discussion on the project so that JICA would be able to make preliminary design for the construction of the Central Laboratory and Greenhouse Complex of the University at Kamphaengsaen campus which constitutes one of the six project components proposed by the University.

The Survey Team held a series of active discussions and exchanged views with the Thai authorities concerned and both parties have agreed to recommend to their respective Governments to take further necessary steps on the contribution to the University's development project under the possible Japanese grant in fiscal year 1978 which begins in April.

Minutes of the discussions are attached herewith.

Bangkok, October 25, 1977.

Prof. Rapee Sagarik
Rector
Kasetsart University

Mr. Akira Arimatsu
Team Leader
Japanese Preliminary
Design Survey Team for
Kasetsart University
Development Project

Mr. Xujati Pramoolpol
Director-General
Department of Technical
and Economic Cooperation

MINUTES

1) The Survey Team could achieve its objectives with active cooperation of Thai authorities concerned, which include staff members of Kasetsart University, Bureau of the Budget, Department of Technical and Economic Cooperation and University Bureau.

2) The Survey Team firmly believed that the possible grant for construction of the Central Laboratory and Greenhouse Complex would contribute to strengthening research activities in the field of agriculture, thereby eventually contributing to economic development of Thailand.

3) The Thai side fully understood the Japanese budget system under which definite figures could not be released until Parliament would approve the fiscal year 1978 budget in spring of 1978. However, the Survey Team expressed its view that the amount of possible budgetary allocation would be at least not less than 1 billion Japanese Yen.

4) Because of the limitation of the budget, it would not be possible to cover all of the buildings and equipment which were included in the initial Thai requests under Japanese grant. Therefore, both parties made efforts to select some of the important and essential buildings in accordance with the priority given by the University.

The buildings which would likely be covered by the grant are shown in Annex I as agreed upon by both parties.

5) Both parties agreed on the demarcation of responsibilities in actual construction works which should be carried out by the respective Governments.

The fundamental works and auxilliary facilities indispensable for construction of the buildings should be provided by Thai side. The works under this category are shown in Annex II as agreed upon by both parties.

6) The Survey Team expressed its view that some equipment necessary for the Central Laboratory and Greenhouse Complex would be provided within the limit of budgetary allocation of the grant.

7) The Thai side stressed the urgent necessity of the technical cooperation which has already been requested by the Thai Government with respect to research activities of the University, and the Survey Team recognized the importance of this and expressed that the Team would recommend to the Government of Japan for its early realization.

8) The Thai side expressed warm welcome and extended active cooperation in all aspects of the survey activities during the entire period of stay. The Japanese side expressed its utmost gratitude to the Thai counterparts and recognized that the cooperation extended by them facilitated its survey activities greatly.

ANNEX I. Buildings of the Central Laboratory and Greenhouse Complex to be provided by the Government of Japan.

1) Central Administrative Office.
2) Central Biochemistry Laboratory.
3) Culture Collection Laboratory.
4) Environmental Science Laboratory.
5) Plant Pest Clinic and Quarantine Laboratory.
6) Post Harvest Research Laboratory.
7) Soil and Fertilizer Testing and Applied Research Laboratory.
8) Seed Technology Laboratory.
9) Controlled Condition Unit.
10) Laboratory Maintenance Unit.
11) Head House.
12) Two glasshouses and two screenhouses.

ANNEX II. Items the costs of which are to be born by the Government of Thailand.

1) Fundamental Works.

a) Site reclamation and clearance.

b) Water supply main pipe to construction site for Central Laboratory and Greenhouse Complex.

c) Electrical power main line to Transformer Substation at construction site.

d) Telephone main line to main distribution frame at Central Administrative Office.

e) External drainage line from construction site for Central Laboratory and Greenhouse Complex.

f) Access road to construction site.

2) External Work.

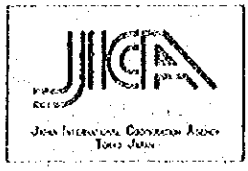
a) Road paving.

b) Lawn and Planting.

3) Furniture

Office desks and chairs, filing cabinets, library shelves, conference tables and chairs, lounge tables and sofas and lockers, etc.

4) Expenses necessary for unloading and customs clearance of imported equipment and other materials required for installation and use at this Complex at ports of disembarkation in Thailand and internal transportation thereof to construction site.


JICA
Japan International Cooperation Agency
Tokyo Japan