Basic Design Study Report
on
The Project for The Establishment
of
The Forest Research Institute
in
Papua New Guinea

November, 1 9 8 7

Japan International Cooperation Agency

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PREFACE

In response to the request of the Government of Papua New Guinea, the Government of Japan has decided to conduct a basic design study on the Project for Establishing Forest Research Institute and entrusted the study to the Japan International Cooperation Agency(JICA).

The JICA sent to Papua New Guinea a study team headed by Mr. Masao Tsujioka, Deputy Head, First Basic Design Study Division, Grant Aid Planning and Survey Department of JICA from July,18 to August,10 1987.

The team had discussions with the officials concerned of the Government of Papua New Guinea and conducted a field survey in the relevant areas such as Port Moresby, Lae, Bulolo and Madang. After the team returned to Japan, further studies were made, a draft report was prepared and a mission to explain it was dispatched to Papua New Guinea. As a result, the present report has been prepared.

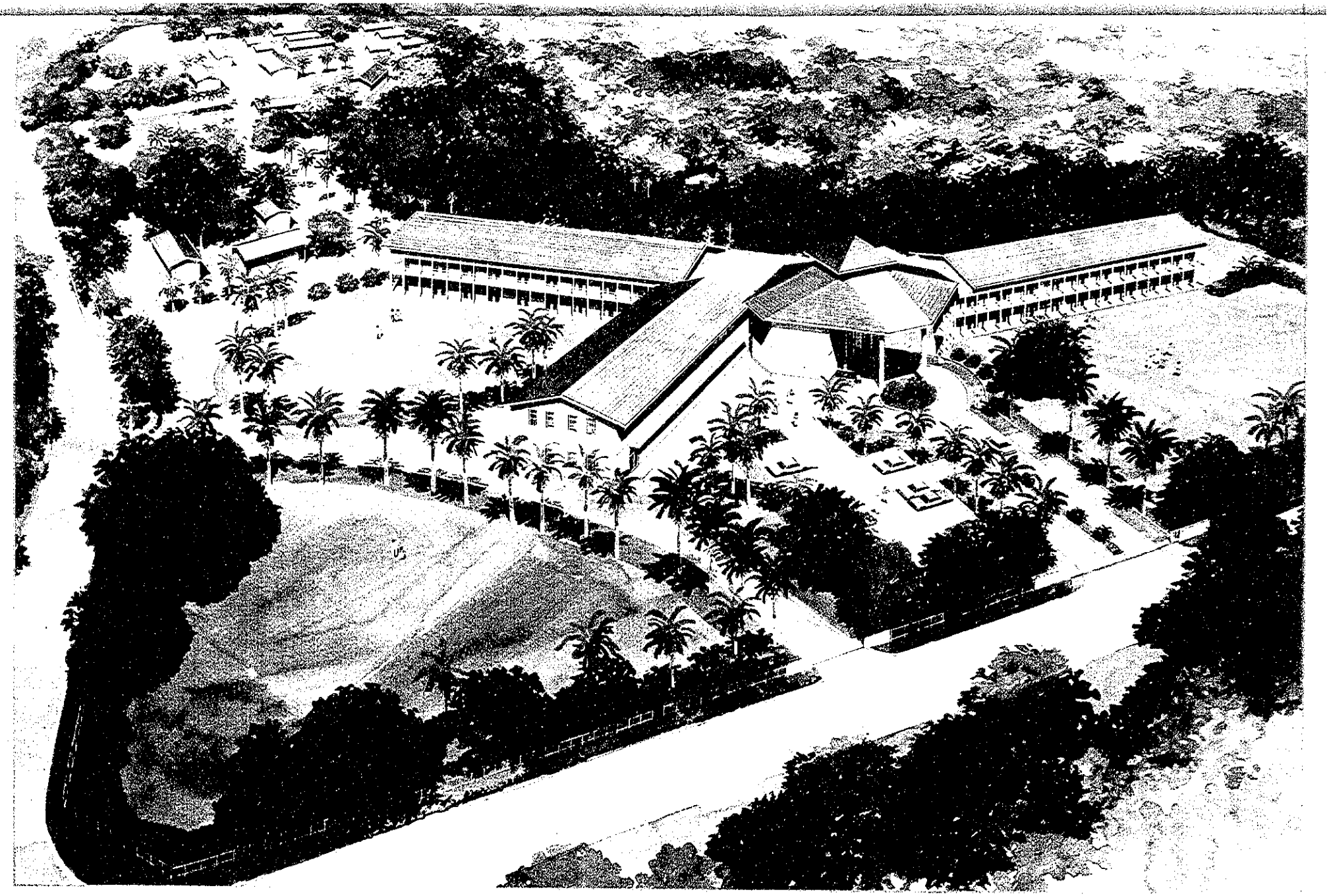
I hope that this report will serve for the development of the project and contribute to the promotion of friendly relations between the two countries.

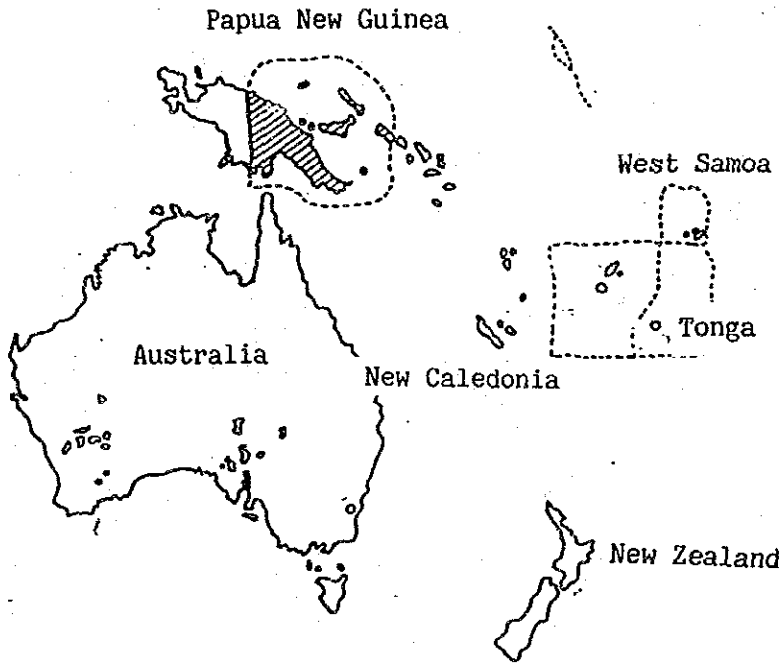
I wish to express my deep appreciation to the officials concerned of the Government of Papua New Guinea for their close cooperation extended to the team.

November, 1987

Keisuke Arita

Keisuke Arita
President
Japan International Cooperation Agency

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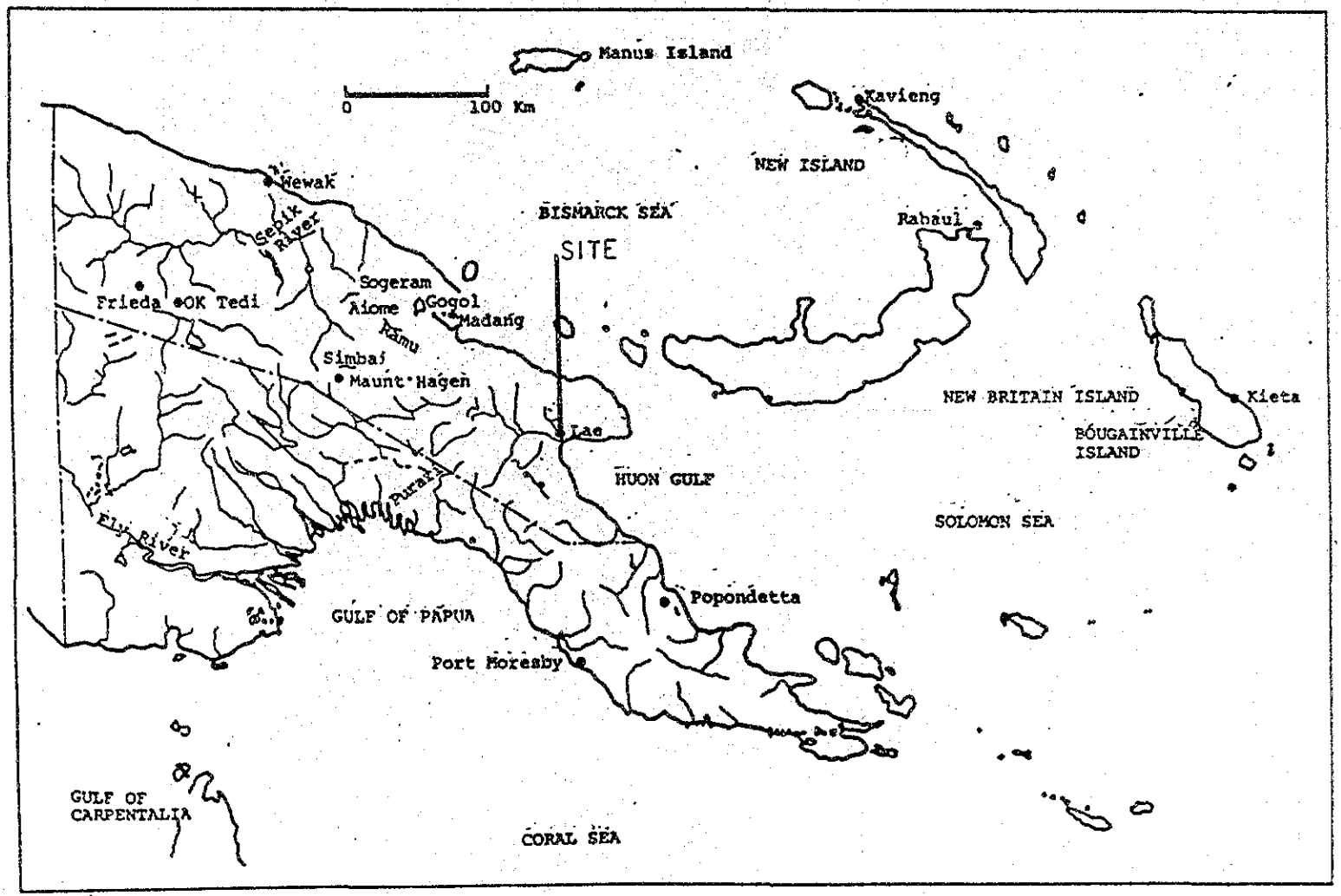
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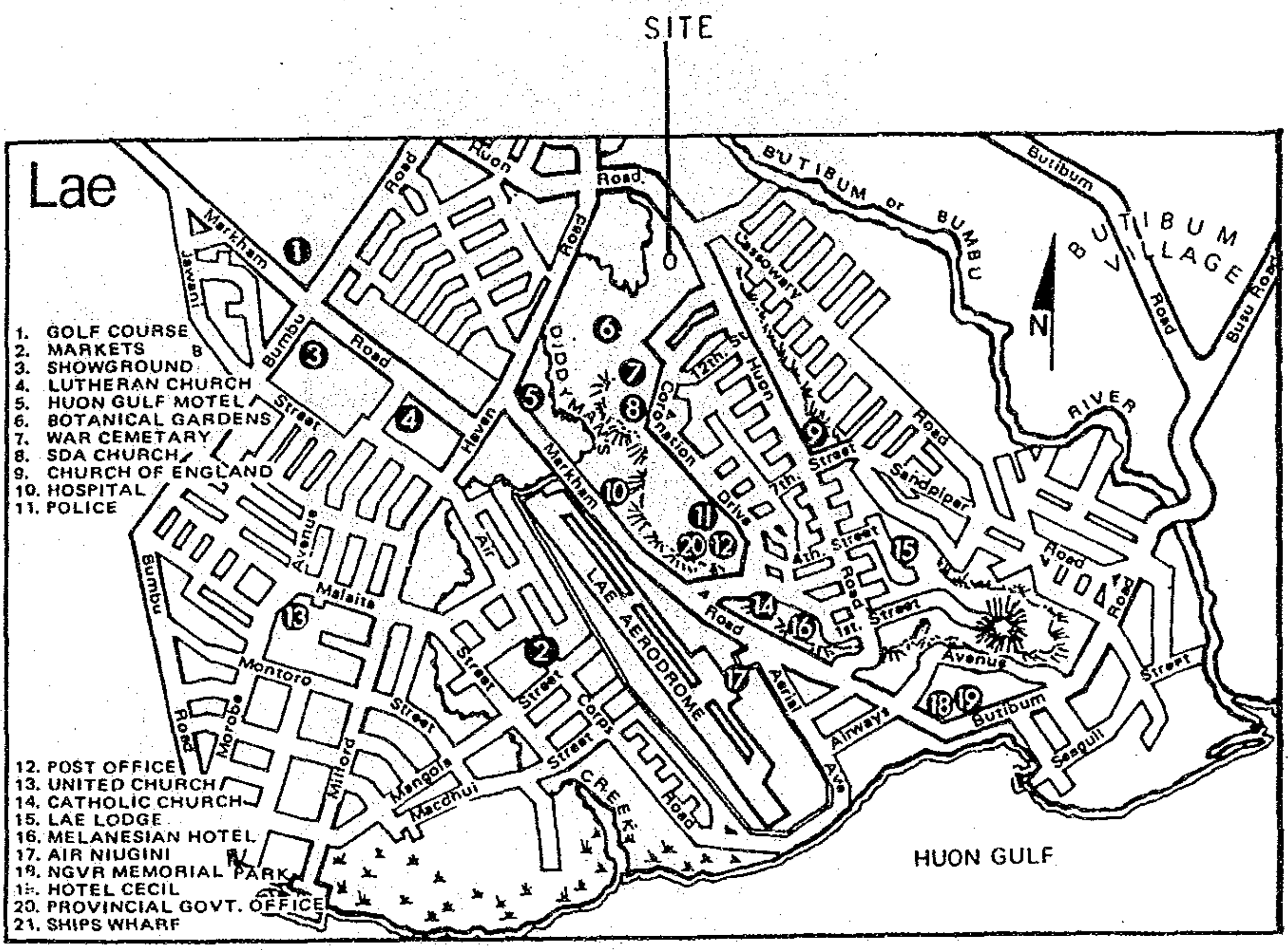
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3. SHOWGROUND
4. LUTHERAN CHURCH
5. HUON GULF MOTEL
6. BOTANICAL GARDENS
7. WAR CEMETARY
8. SDA CHURCH
9. CHURCH OF ENGLAND
10. HOSPITAL
11. POLICE
12. POST OFFICE
13. UNITED CHURCH
14. CATHOLIC CHURCH
15. LAE LODGE
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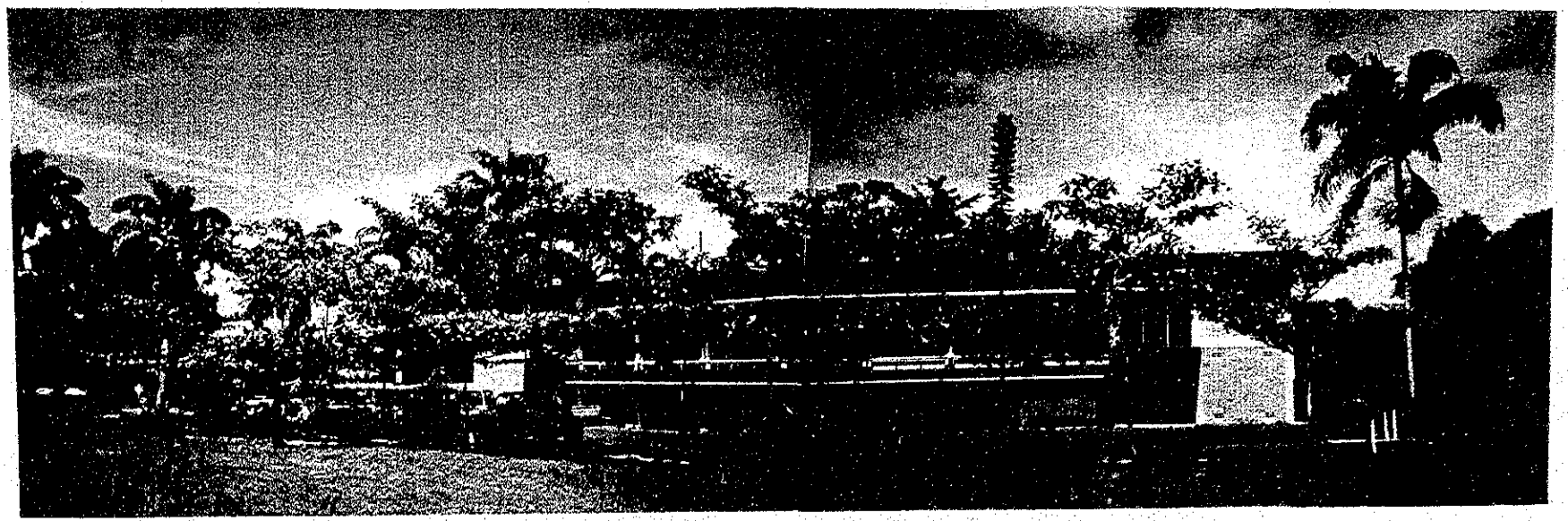

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SUMMARY

Papua New Guinea is a constitutional monarchy. They acquired their independence from Australia on September 16, 1975. It is located between the equator and 12° South Latitude and between 141° and 160° East Longitude, having a land area of approx. 46 million hectares with a population of 3.4 million as of 1985. Port Moresby, the capital, is the center of both political and economic affairs for the country.

The economic infrastructure of Papua New Guinea (hereinafter referred to as PNG) has yet to be fully developed. The estimated GDP for 1985 was approx. 2,280 million kinas (approx. US$2,246 million at a conversion rate of 1 kina = US$ 0.9852). Per capita GDP is approx. 670 US dollars. Major exports consist of copper, gold, coffee, cocoa, palm oil, timber, cobra, etc., of which copper, cobra, lobster and timber are exported to Japan.

The timber industry in PNG has a major role to play the country's economic activities; its expanded potential can create employment opportunities for the labor force that grows larger as the population increases, and can contribute to increases in government revenues including foreign exchange earnings through exports. PNG's forests are therefore considered highly significant economic resources as important as PNG's mineral and fisheries resources.

Principal goals and guidelines of PNG's policies regarding forestry resources are expressed in it's Constitution. It stipulates that all natural resources of the nation shall be conserved and utilized for the common benefit of all the people and replenished for future generations.

The government has exerted various efforts to develop a national economy and increased employment opportunities through a utilization of it's forestry resources. Since the 1980s, however, a prolonged worldwide economic recession, which brought about the fall in the export prices of PNG timber, has made it difficult for the forestry sector to make a come back.

Considering the difficulties in forestry administration, the PNG Government changed the status of the Forest Agency to the Department of Forests. In addition, the government has been shifting the focus of its forestry policies from low exporting to high value-added processing projects. Therefore, a forest management system which ensures forest reproduction is greatly required. Furthermore, the government is in need of personnel who have adequate knowledge and expertise in forest resources management. To meet this requirement the government has drawn up a plan to integrate and restructure its forestry research institutions.

The plan's aim is to enhance research efficiency by integrating the Forest Department's existing research branches, now operating in several diverse locations, into a new National Forest Research Institute. The government plans to construct the Institute within the present Botanical Garden Site located in Lae. To implement the Project for the Establishment of the Forest Research Institute, the Government of Papua New Guinea has requested grant aid to the Japanese Government.

In response to the request, the Japanese Government decided to dispatch a Preliminary Study Team and a Contact Mission for related technical cooperation. These teams were sent to PNG by the Japan International Cooperation Agency (JICA) in February and May 1987 respectively to discuss the objectives of the Project and proposed cooperation.

Upon confirmation of the request on the grant aid, JICA sent a Basic Design Study Team from July 18 to August 10, 1987. The team held discussions with PNG officials and conducted field surveys. The facilities and equipment which are most appropriate for the Project were thus decided.

The survey in PNG and its continued analysis work in Japan by the Basic Design Study Team confirmed that the Institute will produce immediate and long-term benefits for PNG. By integrating the present dispersed research branches, the new Institute can facilitate more efficient and comprehensive research activities. Therefore, enhancing the technological level of PNG's forestry research, collaboration among the various branches at the Institute will make it more efficient to conduct research that meets the socioeconomic needs of the country. The results of such research will certainly contribute to the promotion of forestry and forest product industries as well as to the development of PNG's national

economy. It is therefore concluded that the Project for the Establishment of the National Forest Research Institute is highly significant and that the Japanese grant aid for the Project is fully justifiable.

The following are the result of the Basic Design Study:

Construction Site:

Forest Research Institute...	within the compound of the National Botanical Garden in Lae
Accommodation.....	within the compound of the Timber Industries Training College in Lae (T.I.T.C)

Structure:

Forest Research Institute...	Reinforced concrete structure, two stories
Accommodation.....	wooden structure, one story

Floor Areas:

Floor Research Institute	4,160 m^2
Related Facilities.....	370 m^2
Accommodation.....	1,960 m^2
Total	6,490 m^2

1 Facilities

Building	Description		Area (sq.m)
Main Building	Administrative office, laboratory, exhibition hall, auditorium	1st fl.	
	Sample room, laboratory, library	2nd fl.	
	Subtotal	1 bldg.	4,160
Related facilities	Biological control facility (with a glass house)	1 bldg.	
	Insect house (net house)	1 bldg.	
	Experimental treatment plant	1 bldg.	
	Inflamable & Toxic chemicals	1 bldg.	
	Electric power generator	1 bldg.	
	Nursery house & store	2 bldgs.	
	Garage for vehicles	1 bldg.	
	Greenhouse (net house)	2 bldgs.	
	Subtotal	10 bldgs	370
Accommodation	Type A 3 LDK	2 houses	
	Type B 3 LDK 2 flats	bldg.x 6	
	Type C 1 LDK 5 flats	bldg.x 2	
	Subtotal	10 bldgs	1,960
		Total	6,490

2 Equipment

1	Office equipment	Word processor(Micro computer),copy machine,etc.	10 items
2	Meteorological equipment	Meteorologic observation box, thermometer, sunshine recoder, etc.	14 items
3	Laboratory equipment	Scanning electron microscope drying oven, incubator, etc.	51 items
4	Small laboratory items	Beaker, flask, plate,test,tube,etc.	130 items
5	Nursery equipment	Fencing tool kit, sprinkler, etc.	6 items
6	Training & Meeting equipment	Color VTR, projector, etc.	8 items
7	Vehicles & Transport	Land cruiser, tractor, etc.	9 items
8	Maintenance workshop & machine tools	Tool box, Electric Drills	5 items
		Total	233 units

The project cost to be borne by the PNG Government (covering site clearance, the supply of electricity, water and telephone lines to the site, furnishing and other infrastructural works not covered by grant aid) is estimated at 93,000 Kina.

The term of construction work required for the Project is 12 months. Facilities and equipment have been designed so as to allow easy and low-cost maintenance and operation.

The implementing agency of the Project is the Department of Forests, and the Research Division of the department will be in charge of the administration of the Institute after its opening.

In order to ensure successful Project implementation, close coordination between the Forest Research Institute and the Department of Forests, early recruitment and training of research staff as well as the necessary budgetary arrangements are considered to be vitaly important.

Also, it is to be desired that efforts should be made by both parties toward the realization of technical cooperation of the Japanese Government.

CONTENTS

CHAPTER 1 INTRODUCTION

CHAPTER 1 INTRODUCTION

Forestry resources in PNG, along with mineral and marine resources, are considered to constitute valuable economic resources that may ensure the welfare of the future as well as present generations. Forests cover 36 million hectares, or approx. 80% of the total land area, of which 15 million hectares are utilizable in terms of technology, access and economic profitability. The timber industry, taking advantage of these vast resources, has been contributing to some extent to foreign exchange earnings and to the provision of job opportunities for the ever-increasing labor force resulting from the steady population growth.

Despite the abundant resources, PNG's forestry sector, has not produced the expected results in economic development and job creation. This is apparent from the fact that forest products account for only 7.2% (as of 1985) of the total exports and that the number of factories and employees engaged in the timber and wood product industries are only 159 and 5,627 respectively. Furthermore, it has been reported that the country's emploitable forests will be exhausted in 50 to 70 years if they continue being felled at the present rate. This will bring about a critical situation in the country.

Faced with such a problem, PNG now desires to prevent forests from becoming exhausted and to promote forestry so that it can add momentum on other economic activities.

The staff capacity of the Department of Forests, an agency in charge of forestry work implementation however, totals only 176 (including 13 vacancies), which means that each staff member is supposed to take care of approx. 200,000 hectares of forest. This figure is extremely large compared with other countries. The personnel who serve in the forest research sector number 63, only 26 of which are research specialists. Moreover, most of the leading roles are filled by foreign experts.

At present research activities are conducted in three research center (silviculture, Botany and Forest Products) which are located in three distant places. Their facilities and equipment are far from sufficient to meet the requirements of proper administration and the society.

In view of the above circumstances, the PNG Government has formulated a plan for establishing a National Forest Institute by integrating the above-mentioned research centers which are now dispersed in the country. This plan aims at advancing forestry research through a unified, efficient study system; from a long-term point of view it aims at developing the forestry industry while simultaneously protecting forestry resources and social as well as natural environments. For implementation of the Project for Establishment of the National Forest Research Institute, the PNG Government has requested grant aid to the Japanese Government.

In response to the request, the Japanese Government decided to conduct a Basic Design Study for the Project. The Japan International Cooperation Agency (JICA) then sent to PNG a Preliminary Survey Team headed by Dr. Namio Ohyama, Director of the Silviculture Division, Kansai Branch, Forestry and Forest products Research Institute, Ministry of Agriculture, Forestry and Fisheries, from February 24 to March 9, 1987. Subsequently JICA sent a Contact Mission headed by Dr. Mitsuma Matsui, Adviser to Japan Forestry Technical Association, from May 31 to June 13, 1987 for the purpose of discussing technical cooperation in connection with the Project. These missions reviewed and discussed the viability of the grant aid and technical cooperation with concerned officials of the PNG Government. As a result, it was found that the PNG Government Strongly desired early implementation of the Project with Japan's grant aid and that the Basic Design Study should be carried out at the earliest possible time. Then the Basic Design Study Team headed by Mr. Masao Tsujioka, Deputy Head, First Basic Design Study Division, Grant Aid Planning and Survey Department of JICA was dispatched from July 18 to August 10, 1987.

Based on the findings of the previous surveys, the Study Team reviewed the viability of grant aid for the Project through the following studies:

① Analysis of the project's background and its appropriateness

② Present situation of forestry and forestry research in PNG.

③ Discussions on the contents and scale of the Project

④ Confirmation of the implementation and administrative systems and budgetary arrangements necessary for PNG to carry out its undertakings.

⑤ Selection and survey of proposed construction sites

⑥ Surveys of related facilities

⑦ Surveys of construction situation

This report compiles the results of the analysis work based on the above surveys. The Study Team members, their itinerary, a list of persons interviewed by the Team and a copy of the minutes of discussions are attached in the Appendices.

CHAPTER 2 PROJECT BACKGROUND

2-1 Current Status of Forestry

2-2 Outline of Forestry Research

2-3 Present Situation of Existing Facilities

2-4 Current Status of International Cooperation in Forestry

2-5 Background and Contents of Request

CHAPTER 2 PROJECT BACKGROUND

2-1 Current Status of Forestry

2-1-1 Forest Resources

There are 36 million hectares of forests and plains in PNG which corresponds to approximately 80% of its territory. The area that it is possible to develop at present amounts to 15 million hectares (32.6% of the land), the area that is difficult to develop 21 million hectares (45.6%), and the area without forests 10 million hectares (21.7%).

The forest resources of this country are almost evenly distributed, a condition which can benefit many scattered areas. The lowland rain forest below 1000 meters above sea level is especially rich in tree types and constitutes almost one half of the forests of this country, being a major forest property. If managed properly, these forest resources could greatly contribute to the economy of PNG as recyclable natural assets.

According to the data issued by the Department of Forests in March, 1986 (Forest Research in Papua New Guinea), areas such as forests can be classified by their ecotypes as shown in Table 2-1, and it can be seen that the area of lowland rain forests is approximately 19 million hectares, which is overwhelmingly large.

Table 2-1 Classification of PNG Areas by Ecotype

Ecotype	Area (million hectares)
Alpine	0.1
Montane	1.1
Lower montane forest	9.1
Lowland rain forest	19.1
Grassland	3.0
Regrowth and gardens	2.4
Savanna	2.6
Swamp woodland	1.3
Swamps	2.2
Mangroves	4.5
Total	45.4

Note: Since areas other than forests are included in the table, the total is greater than the area of forests and plains.

Further, according to the data published by FAO in 1985 (Forest Resources), the forest area and the living tree accumulation of PNG are as shown in Table 2-2.

Table 2-2 Forest Area (thousand hectares) and Living Tree Accumulation

(million m^3)

Item	Quantity	Remarks
Forest area	38,392	
Needle-leaf forests	652	Closed forests: 652
Broad-leaf forests	37,740	Closed forests: 33,795
		Spares groves: 3,945
Forest ratio	83.2%	
Forests in fallow	1,445	
Dense groves	85	
Living tree accumulation	4,441	
Needle-leaf trees	72	
Broad-leaf trees	4,369	

Since PNG is a tropical area, the area of broad-leaf forests is overwhelmingly large and the area of needle-leaf forests is fairly small. In terms of the accumulation, the total is approximately 4.4 billion cubic meters, only 1.6% of which is needle-leaf trees.

However, the forest area that it is presently possible to develop and which is capable of supplying commercially high-value logs for timbering, is limited. If the recent felling rate (900 thousand m^3, 30,000 hectares in 1979, increased to 1.8 million m^3, 61,000 hectares in 1986) continued, the forest resources which it is possible to utilize might be exhausted.

2-1-2 Forestry Policies

(1) Policies

The most abundant of PNG's natural resources is its extensive forests. Forestry policies related to this resource have been promoted in accordance with the above-mentioned principles. However, since over a period of several years changes have been seen in international market conditions and remarkable structural changes have started to occur in the timber export industry, the forestry policies were revised in June, 1979 to cope with the situation. The major point of this revision was that direction was given to the timber industry to contribute in more significant ways to the task of reaching national development objectives related to the generation of revenue, the people's ownership, local economic development, political stability, etc.

However, the world economy entered a depression the following year, 1980, when the prices of timer industry exports in PNG dropped and since that time the poor export situation has continued. Therefore, these revised forestry policies have been reviewed since 1984/85, and integrated forestry policies are scheduled to be issued at the beginning of 1988.

Among the policies, in addition to the forest products industry, guiding principles are also supposed to be presented for forest management aiming at continued production, for the roles of forests for local society development, forestry research, forestry education, etc.

The forestry policies, which have concentrated on an increase in log exports, are being reviewed, and studies are being conducted regarding the advisability of accepting processing projects which have high added value while providing a guideline for the introduction of foreign capital. In addition, PNG is trying to plan for an expansion of employment opportunities and the completion of infrastructual facilities.

In this way PNG has made various efforts in terms of formulating policies for utilizing its rich forest resources to contribute to progress of the people's economy and to increase employment opportunities. However, these efforts have not borne much fruit.

(2) Related Laws and Regulations

The laws and regulations related to forestry in PNG include the Forest Act, the Forest (Private Dealings) Act, etc., and according to these laws and regulations the Minister of Forests is responsible for the preservation and administration of forests.

Since forestry business is supposed to be executed jointly by local governments and the Ministry of Forests, the staff in charge of practical affairs is dispatched from the Ministry of Forests to the administration of a local government. However, allocation of forest development areas and issuance of forest lumbering permits are conducted by the central government.

The forests in PNG are owned not by the government but by the people. The forestry laws and regulations specify the following three methods for forest development. In the case of development of a large area, purchase of the lumbering rights (timber purchase) is applied for according to the Forest Act, and in the case of small-scale lumbering, the lumbering permit (timber authority) is applied for according to the Forest Regulation. When a timber owner wishes to transfer timber to someone, he can do so based on the Forest (Private Dealings) Act if he satisfies the conditions specified by the Minister of Forests.

(3) Administrative policies of the Department of Forests

① Protection and maintenance of forest resources

② Establishment of permanent forest estates

③ Afforestation of felled areas and reforestation of permanent forests by natural reproduction

④ Supervision of domestic timber industry

⑤ Research related to forest exploitation

⑥ Research and classification work in botany

⑦ Economic evaluation of forests, determination of priority species and formulation of deforestation programs.

⑧ Training of native people in silvicultural techniques for the purpose of effective administration of permanent forests.

As shown above, administrative policies related to forestry are well prepared. In line with the above policies, efforts have been made to expand forestry in the areas which may possibly be converted to Sarmland.

2-1-3 Current Status of Forestry

The timber industry of PNG provides employment opportunities for the growing labor force resulting from the increase in the population, contributes to acquisition of foreign currencies, and is an important revenue source for the government. Therefore, it is possible that it will be one of the economic mainstays of the country. Moreover, since the development of forests includes the servicing of various related facilities such as roads, it brings economic benefits not only to the people engaged in forestry and the forest products industry but also to people in other fields and has the effects of conveying education, culture, information, etc. to the hinterland.

The timber industry in PNG has developed remarkably over the last 30 years. That is, exports of forest products were 257 thousand Australian dollars in 1951 to 1952, which expanded to approximately 67.29 million kina in 1985. Further, the authority usage fees obtained from timber trades amounted to approximately 208 thousand kina in 1958 to 1959, which increased to approximately 6.4 million kina in 1984.

As for the domestic forest products industry in PNG, at present there are approximately 55 timber mills, one plywood factory, one single-board factory, and one chip factory. There are also 101 other factories engaged in wood processing (timbering, woodwork, furniture, etc.).

Those enterprises employ a total of approximately 5,627, paying approximately 14 million kina in wages annually and investing a total of approximately 33 million kina for land, buildings, and factory facilities.

The value of forest products exports in 1985 was, as shown in Table 2-3, approximately 67 million kina, which accounted for approximately 7.2% of PNG's total exports in that year. This figure is guite low compared with the export values of other industries; 490 million kina or 52.9%, for mineral products such as gold, silver and copper, and 314.1 million kina, or 33.9%, for agricultural products. (See Appendix-VI-1) The forest products, the majority of which are logs, are exported mainly to Japan, Korea, Taiwan, and Australia.

Table 2-3 Exports of Forest Products (1985)

Name	Quantity (thousand m^3)	Amount (thousand kina)	Ratio to total amount (%)
	1985 (1984)	1985 (1984)	1985 (1984)
Logs	1,158.3 (1,283.9)	58,379.8 (70,272.8)	86.8 (85.6)
Wood chips	81.8* (102.5)*	5,377.8 (6,137.8)	8.0 (7.5)
Timber	14.8 (17.8)	3,004.9 (3,322.1)	4.5 (4.1)
Playwood	1.2 (5.1)	524.6 (2,317.2)	0.7 (2.8)
Sample wood	- (-)	- (16.3)	- (-)
Chopsticks wood	- (-)	- (3.7)	- (-)
Total	1,174.3 (1,306.8)	67,287.1 (82,069.9)	100.0 (100.0)

Note: Kina 1=US$1.0229 or AUS$1.6488 (8.8.86)
* "000 Bone dry units, not cubic meters,
1 bdu = 1.546 m^3

2-2 Outline of Forestry Research

2-2-1 Current Status of Forestry Research

Despite the small population of PNG, it is rich in forest resources. The tree-type mix, which centers around tropical broad leaf trees, is a complicated one. It includes approximately 200 commercial woods and nearly 70 tree types which have recently come to be known in the international market. The well-known woods include the PNG rosewood, PNG walnut, PNG oak, taun, Kamarere, wau beech, calophyllum, etc., which are highly valued as materials for rotary single boards, single veneer, and high-grade woodwork products.

Although PNG had done little forestry research before the Second World War, attention has been given to such research since the end of the war. Major research fields have been as follows:

① Identification of tree types that are valuable from the commercial, medical, and industrial viewpoints

② Determination of the amount of each tree type to be used

③ Tree-type characteristics for processing, storage, and final application of timber

④ Afforestation by land usage plans such as natural regeneration, planting, and agroforestry

⑤ Environmental protection and improvement of industrial impact

2-2-2 Research Institutions of the Department of Forests

The ministry in charge of the Forest Research Institute Establishment Project under this grant aid cooperation is the Ministry of Forests. The organization of the Ministry of Forests is as shown below.

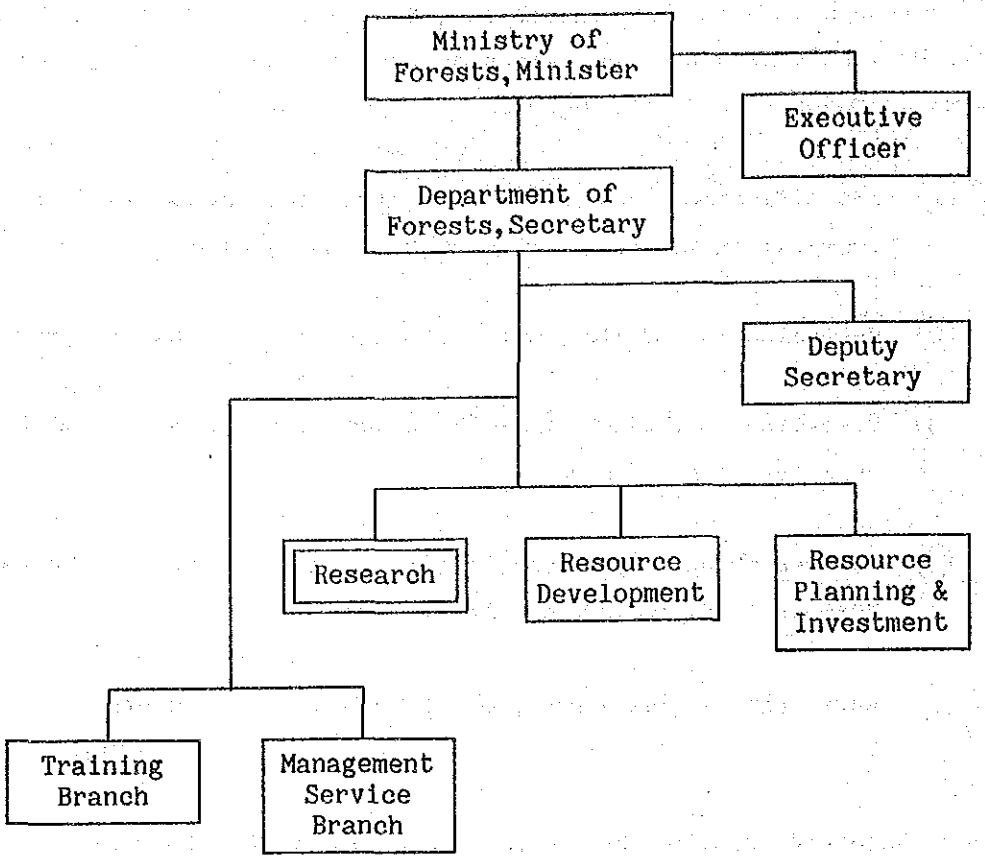


Figure 2-1 Organization of the Ministry of Forests

The status of the Forest Research Institutes the Department of Forests is not finalized yet. It is anticipated, however, that the outline of the configuration will be as follows.

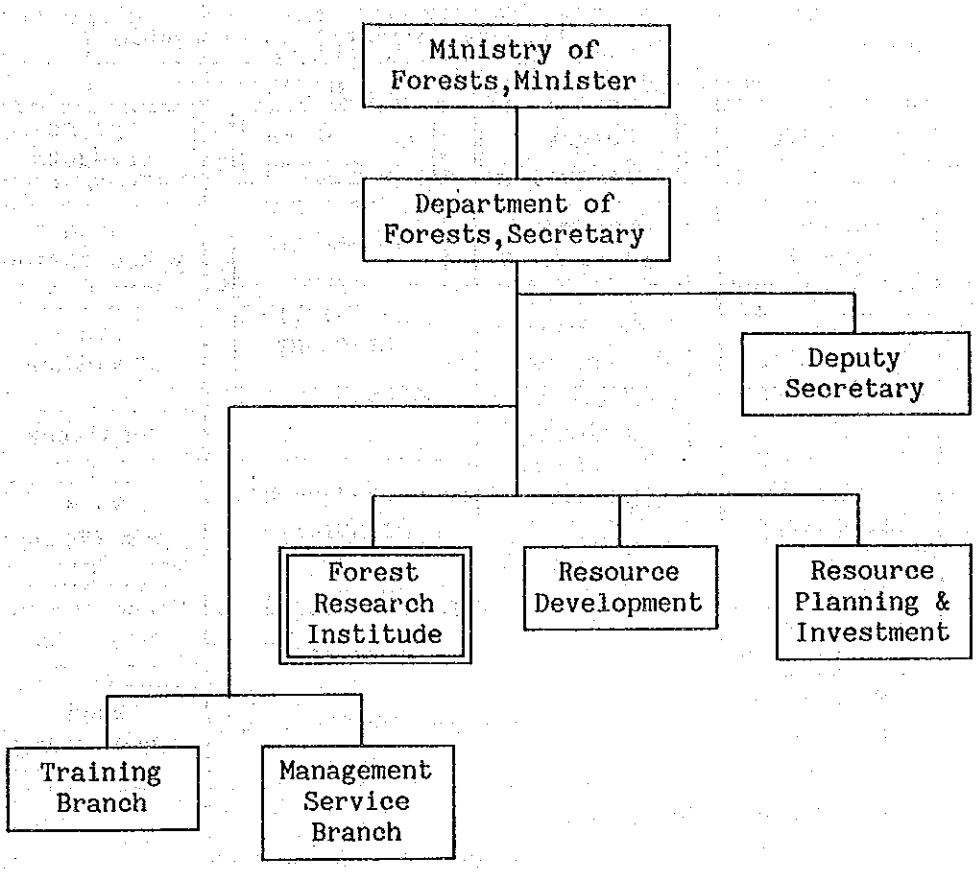


Figure 2-2 New Organization of the Ministry of Forests

Therefore, considering the survey results so far, this Basic Design Study Team has agreed to make the organization of the Forestry Research Institute consist of four divisions, as shown in the following chart, to establish a structure which can efficiently respond to administrative demands related to forestry and forest products, as a result of repeated consultations with the PNG side.

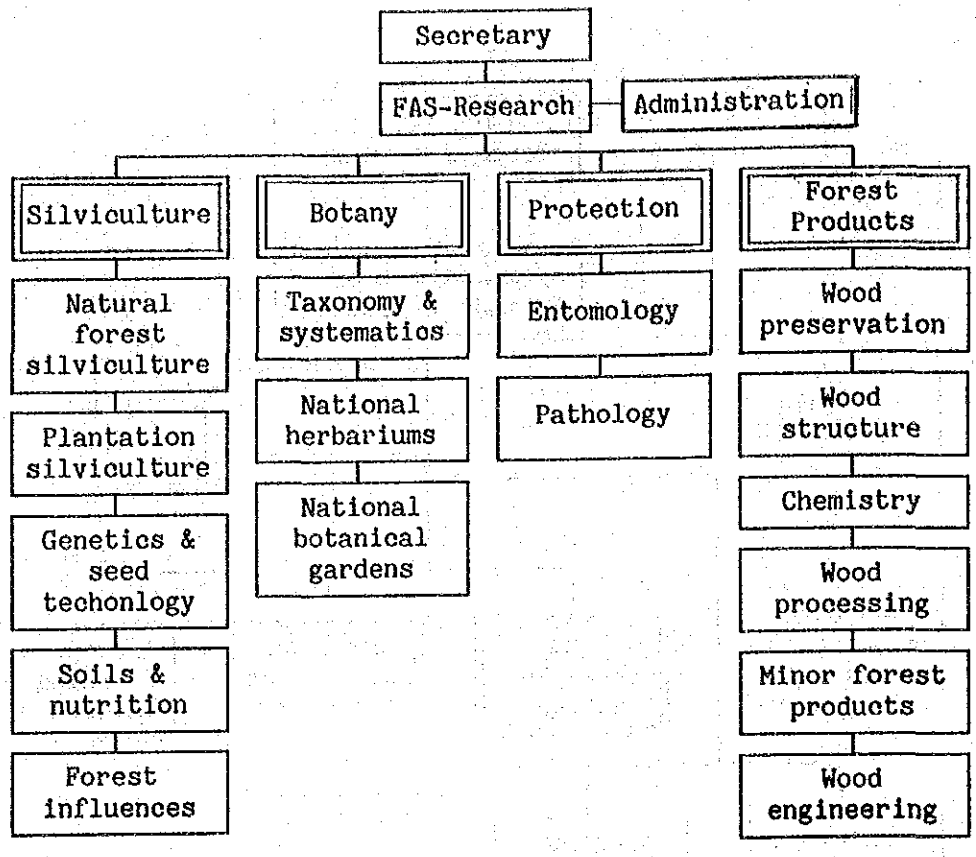


Figure 2-3 New organization of Forestry Research Institute

The organization has been changed so that the research part consists of four divisions; silviculture, botany, protection, and forest products.

5-YEAR RESEARCH DEVELOPMENT PLAN

Silviculture Division

Section	Objectives
Tree Improvement, Seed Technology and Plantation Silviculture	1. Production of quality seed of important reforestation / afforestation species in adequate amount for incountry use and export. 2. Improve quality of reforestation species through general research. 3. Research on various aspects of plantation silviculture. 4. Agroforestry demonstration trials.
Plantation Silviculture (Madang)	1. Research on different aspects of plantation silviculture. 2. Research on some aspects of natural forest silviculture. 3.Meteorological studies.
Natural Forest Silviculture	1. Develop T.S.I. and management systems for selectively logged forests.

Botany Division

Section	Objectives
Administer Support	1. Clerical Accounts, typing. 2. Artwork Illustrations 3. Photographic Illustrations plates 4. Collection and identification of flora 5. Filing, updating, loans 6. Specimen preparation 7. Fumigation

NCBG	1. Establish a Nation Garden for conservation and preservation of PNG Flora. 2. To manage the Garden as a recreation park. 3. Tourist attraction. 4. Establishment of a teaching garden by plant family for Biology Department. 5. Establish a nursery to supply plants for the university grounds, ornamental gardens and for staff garden. 6. Supply of plants for decoration on ceremonial occasions.
Herbarium	1. Study of flora of PNG. 2. Maintenance of Herbarium. 3. Other research projects. 4. Exchange of seeds, plant specimens and live plants with overseas herbarium. 5. Maintenance of the National Botanical Garden. 6. Distribution / sale of live plants to members of public. 7. Introduction of new plants in the Garden.

Protection Division

Section	Objectives
Forest Entomology	1. Survey and identification of insects on timber / forests species. 2. Develop economically viable control measures. 3. Test new chemicals as control agents. 4. Develop National Forest Insect Collection. 5. Publish reports and results.

Forest Pathology	1. Survey and identification of forest tree diseases. 2. Develop economically viable control measures and suggest suitable management practices to minimize the losses due to disease. 3. Publish results. 4. Research and technical advise on commercial cultivation of Shiitake Mushroom.

Forest Products Division

Section	Objectives
Wood Preservation	1. Prophylactic treatment of logs and sawntimber. 2. Alternative dip-diffusion formulation. 3. Performance of CCA pressure treated timbers in marine condition. 4. Remedial treatment of timber in service. 5. Effectiveness of plastic sheathing for the protection of marine piles. 6. Treatability studies of lesser-known species. 7. Natural durability trial of PNG timber against termites. 8. Factors affecting dip-diffusion treatment.
Chemistry	1. Qualitative and Qantitative Analysis of BFCA and CCA Pressure Treated Timber. 2. Chemical Properties of Lesserknown PNG timbers. 3. Distribution of CCA preservative in treated timber.
Wood Structure and Properties	1. Identification of PNG hardwoods. 2. Commercial promotion PNG Timbers..

Minor Forest Products	1. Utilization of mangrove timber. 2. Survey of rattan distribution, processing and protection in PNG. 3. Minor Forest Products Information Centre.
Wood Processing	1. The manufacture of wood chips and composite boards from PNG hardwood. 2. Wood seasoning practice in PNG. 3. Sawmilling practices in PNG.
Wood Engineering	1. Mechanical properties of lesser known species. 2. Protection by Design

2-2-3 Present Circumstances for Research Activities of the Ministry of Forests

There are three bodies under the organization of the Ministry of Forests of PNG; the Forest Management Research Institute, the Botany Institute, and the Forest Products Research Institute. The present circumstances of these institutes plans are as follows:

(1) Forest Management Research Institute

The headquarters is in Bulolo, with a branch located in Madang. It was founded in 1962 to prevent damaged by harmful insects at the inception of Araucaria silviculture in the Bulolo district which was a part of the plantation silviculture project. Since that time it has conducted research in general forestry such as silviculture of various valuable tree types, the collection of seeds, and protection. The following are its main fields:

① Plantation silviculture
② Seed technology
③ Natural forest silviculture
④ Entomology
⑤ Pathology

(2) Botany Institute

It was established in 1965 together with the botanical garden in Lae City on the premise of the garden. It conducts research on the flora of PNG and operates the national botanical gardens in Lae City and Port Moresby. The herbarium includes over 275,000 plants which are well-organized and well-preserved. They are drawing attention as affording valuable data for research on tropical forests.

(3) Forest Products Research Institute

This research institute was established in Port Moresby City in 1965 to plan for effective utilization of timbers in PNG. Research has centered around the anatomical characteristics and taxonomy of many useful tree types and unused tree types, storage technology for timbers to be used in severe environments, etc.

Listed below are its services.

① Supply information obtained from research and documents and information which promotes sales, and contribute to the export of PNG-produced timbers.

② Supply information for preventing biological deterioration of the timber industry.

③ Supply appropriate information on the usages of timbers to the nationals of PNG.

④ Conduct research to supply information on the characteristics of the timbers of unused tree types and of silvicultured tree types to the forest owners.

The following are its main fields:

① Wood preservation
② Chemistry
③ Wood structure
④ Minor forest products (such as mangrove and rattan)
⑤ Wood processing
⑥ Wood engineering

2-2-4 Research and Training Activities of related Institutions

The associated institutions are summarized below.

(1) Forest College

Located in Bulolo it focuses on training in general forestry. The curriculum includes mathematics, forestry, silviculture, forest survey, forest management, protection, fire, forest ecology, botany, engineering, geology, climatology, agroforestry, personnel-management, etc. The educational staff comprises ten members. It can accommodate 120 students, and diplomas are awarded to those who have completed the three-year educational curriculum.

(2) Timber Industries Training College

It was built in Lae City with assistance from New Zealand. The size of the educational staff is 12, and it can accommodate 70 students. The training courses of this college are divided into six fields; saw-setting, woodwork, lumbering, timber storage, small-sized lumber mill, and specials (including seasoning). The length of a course ranges from two weeks at the shortest to 40 weeks at the longest.

The college started to enroll students in 1978, and there are participants from private enterprises. Diplomas are awarded to those who have completed the curriculum.

(3) University of Technology

It is a national university located in Lae City and offers BSC, MSC, and Dr. courses. It has a forestry with from 8 to 15 graduates annually. There are three-year courses and four-year courses. Those who have completed the courses at the Forest College can graduate in three years.

(4) Ecology Institute

Located in Wau, it is an institution independent from the government where research is conducted on animals and insects mainly from the point of view of environmental preservation. There are approximately 40 staff members including 5 to 6 experts, 4 general affairs administrators, and workers.

2-3 Present Situation of Existing Facilities

(1) Facilities

Laboratories in the present branches are not sufficient to deal with research at the new Institute. It is necessary to provide laboratories that can cope with diversified contents and methods of research.

A soil physical laboratory and a forest influences laboratory will be newly provided in the Silviculture division and a wood processing laboratory and a wood engineering laboratory will be added in the Forest Products division.

In the Protection division, three laboratories are necessary to cover the three research subdivisions; mushroom, dicay and non decay.

In entomology research, a glass house and a shade house for virus study needs to be provided. This facility should be installed outside the Main Building since biotechnological study such as tissue culture will be required in the research of seed and genetics in the Silviculture division.

The chemistry laboratory in the Forest Products division will be extended to provide space for soil and fertilizer tests. Instead, a new independent soil physical laboratory will be provided.

For the study of wood engineering, a minicar pentry shop and a timber testing facilitate mutual exchange between researchers. A bathroom is also necessary to wash away dust after nursery or carpentry work.

(2) Laboratory Equipment

Laboratory equipment available at the existing institutes are far from adequate for fulfilling functions of a satisfactory laboratory. A diverse kind and considerable volume of equipment should be supplemented. Furthermore, equipment for new technology areas and the one for newly established laboratories should be provided in the Project.

However, since all equipment are not locally produced and are imported from Australia, they are not sufficiently supplemented, which is causing low efficiency in research work.

Collection of meteorological data is indispensable in the forestry research as an environmental factor.

The Institute should conduct meteorological surveys to provide data necessary for research.

2-4 Current Status of International Cooperation in Forestry

The following two cases are the main instances of technical cooperation related to forestry research involving foreign countries:

(1) Aid Cooperation of New Zealand

The technical cooperation of the New Zealand Government emphasizes training in forestry, agriculture (ranching), and small-sized energy development, and the total amount exceeds NZ$2.9 million in 1985. (See Appendix-VI-2)

The technical cooperation related to forestry plays the major role among these projects. The Timber Industries Training College (TITC) in Lae City was built with the 10-year (1976 to 1985) aid of New Zealand. It is under the jurisdiction of the Department of Forests, and it has contributed to the training of those who are engaged in the timber industry.

The recent cooperation plans focus on appropriate resource management, and four medium-sized silviculture projects are being implemented in various places. These silviculture projects started in 1985, and a total of 5 thousand hectares will be afforested in each of the self-governing bodies of Milne Bay, Madang, and New Ireland within the next five years.

Other cooperation plans include a forest fire prevention plan and building of a seed center in Bulolo and grants of materials and machinery, technical cooperation and training in fields such as forest planning and the charting of aerial photographs, etc.

Cooperation in the field of forestry has been rendered almost entirely, in the form of grant aid, and 3 million kina was granted in 1986. The amount is expected to increase to 5 million kina in three years. However, most of that will be spent on the previously mentioned silviculture project.

(2) UNDP Fund - Aid Cooperation by FAO

Under the UNDP fund, with FAO as the execution body and headquarters in Lae City, three experts in forest rearing, surveying, and felling are supposed to be dispatched.

The main purpose of this project is to conduct research on natural regeneration in sites where trees have been felled and on the damages caused to the remaining trees by transporting felled tress out. With these research results, improved technology related to forest rearing will be developed and applied to the vast sites where trees have been felled but where the technology of reforestation has not been applied.

Further, training of PNG engineers on forest rearing and felling and transport technology is also listed.

As funding for this, US$ 600 thousand is planned to be allocated in 1987 and 1988. Funding is limited to these two years for the time being, but there is a possibility of extension for 2 to 3 years. At the moment one advisor on felling and transport has been dispatched.

Since it seems that the fields and subjects which will be researched at the Forest Research Institute in the future will include ones related to the contents of the above-mentioned technical cooperation programs, it is necessary to communicate and make adjustments with the executive institutions performing these cooperation programs and to study management methods while maintaining a good relationship when promoting research at the institution.

(3) Activities of Foreign Researchers

Table 2-4 lists foreign scientists who are now playing leading roles in the respective research institutions of the Department of Forests.

Table 2-4

Name	Nationality	Current title	Research area
Dr. P. Srivastava	India	A/F Asst. Secretary	Silviculture
Dr. J. Croft	Australia	A/OIC Botany, Lae	Tropical forest botany
Dr H. Robert	Great Britain	OIC Research, Bulolo	Forest management, entomology
Dr. A. Amoako	Guinea	A/OIC, FPRC	Timber Preservation, timber evaluation

Note: OIC: Officer in Charge
FPRC: Forest Products Research Center
A: Acting

2-5 Background and Contents of Request

2-5-1 Background of Request

PNG's abundant forest resources are regarded as an important mainstay of economic growth for the country at present and in the future, and development of these forest resources is listed as one of the major policies of the country. However, since the level of forestry administration so far is lagging behind expectations and the structure for carrying out experiments and research is not complete, the level of individual experiments and research such as rearing of forests, preservation of the environment, and utilization of forest products is not high.

Especially, there is insufficient fundamental data related to resource procurement, little research on natural forests of useful tree types and poor implementation of forest plantings. Also, few comprehensive investigations and research projects have been conducted to relate continued production of timber with preservation of the environment and timber utilization.

Each research institute own, has conducted experiments and research on subjects necessary for PNG under the guidance of expects employed from foreign countries, and has made efforts to propagate the results.

However, since the research institutes are scattered, it is not a structure conducive to good communications among the divisions and to conducting organized experiments and research. Further, the facilities are not yet complete, and efficiency in experiments and research cannot be expected from the existing facilities. Moreover, there is a shortage of researchers and of leaders, and the situation makes it difficult to start experiments and research on new areas to respond to administrative requests.

The PNG Government has developed plans to integrate these three research institutions in Lae City, to alter the organization and improve the facilities, and to inaugurate a Forestry Research Institute to promote comprehensive experiments and research on forestry and forest products. Consequently it has requested grant aid cooperation for the Institute's construction.

2-5-2 Contents of Request

1. Confirmation Made by the Preliminary Study Team & the Contact Mission

   The outline of the Project confirmed by the Preliminary Study Team in February and by the Contact Mission for technical cooperation in June 1987 is as follows:

   (1) Objectives of the Project

   To integrate the three dispersed Forest Products, Forest Management and Botany branches into a Forest Research Institute so that a comprehensive and collaborative research system can be established.

(2) Proposed Project Site

The Institute will be constructed on the premises of the National Botanical Garden in Lae.

(3) Executing Agency

The Department of Forests is responsible for the implementation of the Project.

(4) Proposed Research Activities

The Institute will comprise the following four divisions:

① Silviculture
② Forest products
③ Protection
④ Botany

(5) Construction of the National Forest Research Institute

Facilities for the Institute

① Administrative office
② Laboratories
③ Library
④ Stores/workshop
⑤ Sample storage

Accommodations

① Staff houses to meet minimum requirements (for 4 Department Heads and their deputies)
② Guest houses for foreign scientists including Japanese experts
(Programs for accepting foreign scientists will be provided to the Study Team.)

Equipment

① Office equipment
② Meteorological equipment
③ Laboratory equipment
④ Nursery equipment
⑤ Training and Meeting equipment
⑥ Vehicles and Transport equipment
⑦ Maintenance Workshop and Machine Tools equipment

2. Confirmation Made by the Basic Design Study Team

The final contents of the project confirmed by the Basic Design Study Team in October 1987 are as follows:

① The objectives of the Project have been confirmed as agreed upon by the previous teams.

② The proposed construction site for the Institute remains unchanged. However, the construction site for accommodation facilities will be moved to the campus of TITC (the site of the old soccer field).

③ There has been no change regarding the implementing agency.

④ Facilities and equipment are the same, in principle, as those agreed upon by the previous teams.

⑤ It has been agreed that both sides will conduct further studies on the Availability of coordinated programs between the Institute and other related institutions in PNG.

CHAPTER 3 CONTENTS OF THE PROJECT

CHAPTER 3 CONTENTS OF THE PROJECT

3-1 Objectives of the Project

PNG desires to promote efficient utilization of its forest products and to advance its economic development while simultaneously planning for the healthy fostering and protection of its abundant forest resources. For this purpose PNG intends, through this project, to integrate the country's currently dispersed research institutions into the new Forest Research Institute in Lae and to establish a unified and efficient research system by improving and coordinating the various research divisions. This means that the Project will not only enhance forestry technology but enable research that immediately meets the socioeconomic needs of the country. The results of such research will certainly contribute to the development of forestry in PNG and the national economy.

3-2 Review of Requested Contents

3-2-1 Situation of the F.R.I

When the Institute is opened, various research centers now under the Forest Department's Research and Training Division will be integrated. The Institute will then serve as a unique institution that deals exclusively with research activities. Responsibilities for educational activities in forest technology or forest-research technology will be assumed by TITC, the Forestry College and the University of Technology which is under the jurisdiction of the Department of Education. The Forest Research Institute and these educational institutions are expected to work closely to fulfill their respective functions.

3-2-2 Plan for Utilizing Existing Facilities

With the implementation of the Project, the functions of the existing institutes will be transferred to the Institute except for some specific research or local work. Utilization of the existing facilities of these institutes is planned as follows:

(1) Facilities in Port Moresby

The facilities which are now serving as Forest Products and Silviculture branches will be used by the Headquarters of the Department of Forests after their transfer to the now Institute.

(2) Facilities in Lae

Staff and facilities which are now serving as the Botany and Natural Forest branches will be integrated in the Institute without changing locations. Herbarium will be extended.

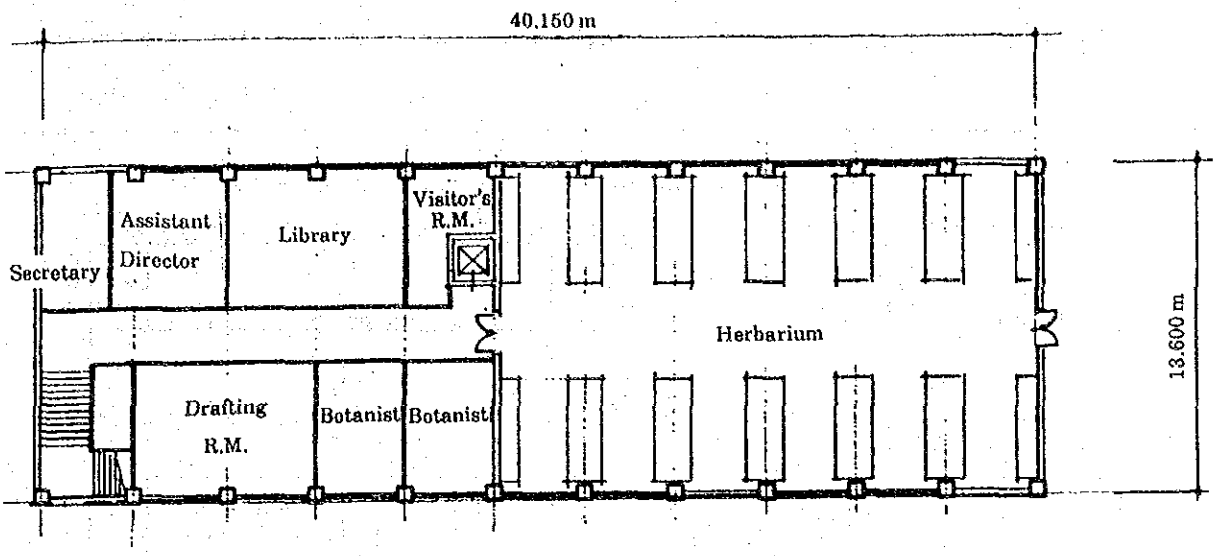
(3) Facilities in Bulolo

Except for a minimum necessary staff (3 or 4 persons) who take care of seed production and local afforestation work, all staffers of the Silviculture branch in Bulolo will be transferred to the Institutes. The existing facilities will be used by the Reforestation Project (a national project), Forestry College and the Department's Regional Forest section. The accommodation will be used by visiting researchers.

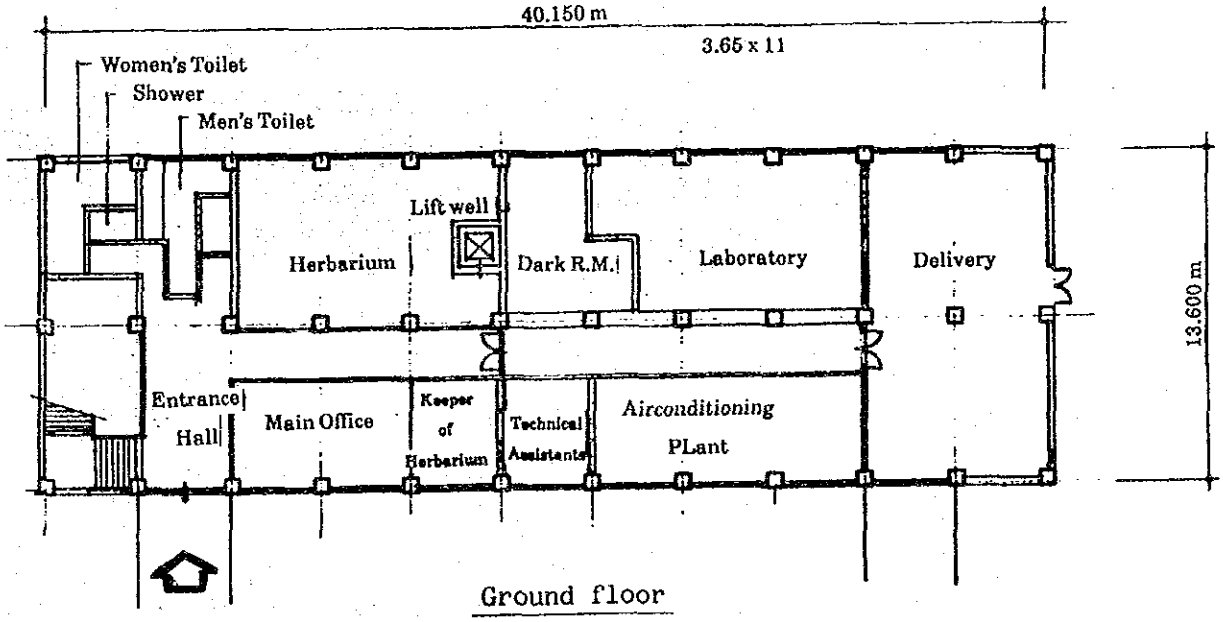
(4) Facilities in Madang

A minimum necessary staff (2 or 3 persons) will remain for a few years for the same reason as in the Bulolo branch. After that the facilities will be handed over to the Provincial Forest Division.

Floor plans of the Botany branch's existing facilities in Lae.



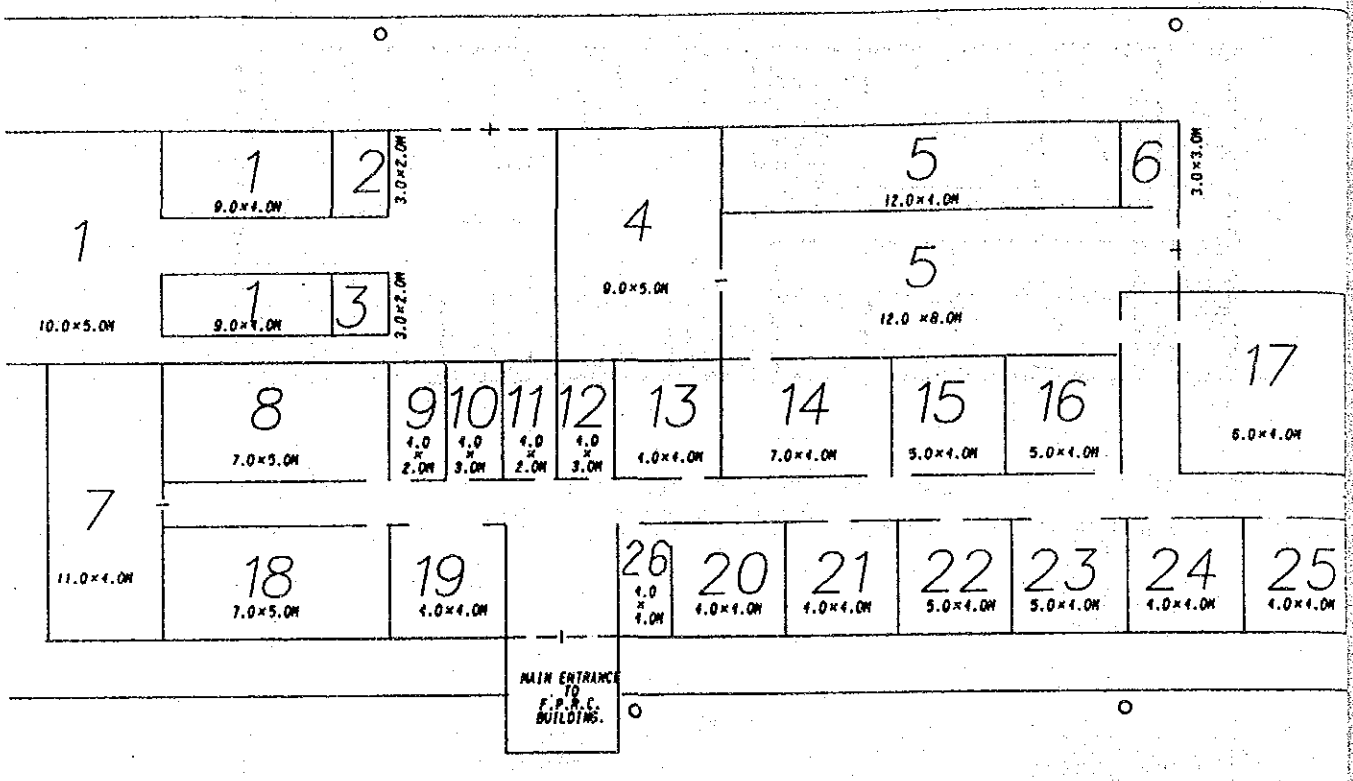
First floor



Ground floor

Figure 3-1

Figure 3-2 Existing Forest Products Research Center in Port Moresby



LEGEND

1. WOOD HANDSAMPLE STORE ROOM
2. TOOL ROOM
3. STATIONERY ROOM
4. AIR CONDITION CHAMBER
5. MAIN STORE ROOM
6. CHEMICAL STORAGE CHAMBER
7. LIBRARY
8. AGLUA/BORI OFFICE
9. MALE'S TOILET
10. COFFEE BOILER ROOM
11. FEMALE'S TOILET
12. DARK ROOM
13. MICROSCOPE ROOM
14. WOOD PRESERVATION LABORATORY
15. ANALYSIS LABORATORY
16. PREPARATORY ROOM
17. FUME CHAMBER ROOM
18. MAMUN.YALI.ROKOYA OFFICE
19. ADMIN OFFICE AND SWITCHBOARD
20. AMOAKO'S OFFICE
21. KONABE'S OFFICE
22. ARUCA/RAU OFFICE
23. PREPARATORY ROOM
24. PILOTTI/MAIRI OFFICE
25. MARINE LAB.ROOM
26. MEAURI'STYPING O

3-2-3 Existing Facilities and Equipment

1. Facilities

1) Laboratories

Laboratories in the present branches are not sufficient to deal with the scope of research at the new Institute. It is necessary to provide laboratories that can cope with diversified contents and methods of research.

In the Protection Division, three laboratories are necessary to cover the three research subdivisions; mushrooms, decay and nondecay.

In entomology research, a glass house and a shade house for virus study needs to be provided. This facility should be installed outside the Main Building since biotechnological research such as on tissue cultures will be required in the study of seed and genetics in the Silviculture Division.

A soil physical properties laboratory and a forest influences laboratory will be newly provided in the Silviculture Division and a wood processing laboratory and a wood engineering laboratory will be added in the Forest Products Division.

The chemistry laboratory in the Forest Products Division will be extended to provide space for soil and fertilizer tests. In addition, a new independent soil physical properties laboratory will be provided.

For the study of wood engineering, a small carpentry shop and a timber testing room and indispensable. The lumbermill necessary for wood processing research, on the other hand, should be substituted for by utilizing the existing facilities of TITC in Lae.

2) Herbarium

PNG's national herbarium possesses plant samples which are highly regarded internationally. A new herbarium should be provided in the Project to contain timber samples of the said herbarium and those possessed by the present Forest Products Division. A facility to contain the national insect collection should also be provided.

3) Insectarium

An insectarium should be provided independently along with the glass house and shade house mentioned above. This is to prevent unfavorable effects on the insects due to the fumigation conducted twice a year in the herbarium.

4) Nursery and related facilities

Breeding of parasitic plants is indispensable for the study of silviculture, seeds, insects and bacterium. There is a nursery for silvicultural operations which may be used for the study of tropical lowland plants at the Institute. However, the nursery will not be immediately transferred to the Institute because it has to be used for forestry operations. Also it is located 30 minutes by car from the proposed site of the Institute. In view of these conditions it is judged appropriate to install a nursery with an attached house and storage by dismantling old disused buildings and filling the lot.

5) Green house (Plant Generation Facility)

Glass houses are commonly used in Japan to grow potted saplings for laboratory use. However they are inappropriate for the present Project because the temperature would grow too high in the glass houses. Therefore installation of two plant generation houses with wire netting is judged to be appropriate.

6) Inflammable and toxic chemical storage

To store explosive or inflammable chemicals, an independent installation with necessary structure should be constructed for the sake of safety.

7) Library

A library with a capacity of 20,000 books should be provided.

8) Meeting rooms

Various meetings, symposiums and lectures will be held at the Institute, inviting researchers from other institutions in PNG or abroad. They are an important part of research activities. Meeting rooms with a seating capacity of 24 and 50 are considered to be appropriate in view of the scale of the Institute.

9) Common facilities

A chemical balance room, a darkroom, a draft chamber, a drawing room, a microscope will be provided for the common use of the divisions and laboratories. Apart from these, storage to accommodate field survey equipment, laboratory expendable supplies, camping equipment and seed for laboratory use should be provided. Chemicals other than inflammable and toxic ones will be stocked in storerooms, of which one will be provided for each division. As for the computer room, installation of a large-size computer would require special air conditioning and additional maintenance costs. Installation of terminal units which can be connected to TITC's computer might be appropriate, though provision of such terminal units have been excluded from the present grant aid project.

10) Offices

Administrative offices of the Institute should be arranged like other government offices in PNG; a Director's office, Assistant Director's office, Branch Head's office, Section Head's office, Scientific Officer's room and a Main Administrative office will be provided. Rooms for officers above the rank of Branch Head will have an attached secretary's room.

Existing offices are available for the Branch Head, Section head and Scientific Officers in the Botany Branch. No new construction is necessary for these offices. To supply offices for foreign researchers including those from Japan, a few rooms equivalent to the Section Head's office and Scientific Officers room should be provided.

The entrance hall should be spacious because it will also serve as a display room and contribute to the diffusion of information. a canteen-cum-tea lounge should be provided so as to serve as a place to receive guests and to facilitate mutual exchange between researchers. A bathroom is also necessary to wash away dust after nursery or carpentry work.

2. Equipments

1) Meteorological Equipment

Collection of meteorological data is indispensable as an environmental factor in the forestry research. However, no such data are available in the existing branches. The Institute should conduct meteorological surveys to provide the data necessary for research. The selection of meteorological equipment should include items equipped with various sensors for the sake of economical operations. To minimize data failure due to breakdowns, replacement sensors should be provided.

2) Laboratory equipment

Laboratory equipment available at the existing institutes are far from adequate for satisfactorily fulfilling the functions of a laboratory. A diverse kind and considerable volume of additional equipment should be supplied. Furthermore, equipment for new technology areas and for the newly established laboratories should be provided in the Project. Equipment owned by the existing institutes is listed in Appendix-VI-3. All items are Australian made.

Operation and maintenance of the equipment have been taken care of by researchers or their assistants. There is no problem regarding their expertise in this regard. As long as they are equipped with operation manuals, they will find no difficulty in handling the equipment to be provided in the Project.

The existing institutes are provided with the necessary glassware items for laboratory use. However, since they are not locally produced and are imported from Australia, they are not in sufficient supply, which is causing low efficiency in research work. A small number of glassware items of various types should be supplied in the Project.

3) Audio-visual equipment

The Institute should be equipped with audio-visual equipment for facilitating various kinds of meetings and lectures, such equipment is not available in the existing institutes.

It is considered necessary to provide those items included in the list of training and meeting equipment.

4) Vehicles

The vehicles are necessary for conducting field surveys and transporting people and equipment to and from various sites such as experimental forests, nurseries nd facilities a Bulolo.

5) Tools

A set or two of tools for repairing laboratory equipment and vehicles should be furnished at the Institute.

6) Office equipment

Office equipment such as copying machines, word processor (micro computer), planimeter, cabinets, etc. were requested by PNG for the administration of the Institute. A minimum necessary supply of such equipment should be included in the Project.

3-2-4 The Construction of the Accommodations

(1) Background of Construction of the Accommodations

① Current Status of Budget Measures of PNG

The amount of the annual budget for the Research of the Department of Forests for 1987 is only approximately 730 thousand kina, 53% (390 thousand kina = 62,800 thousand yen) of which is the personnel cost of the staff in the Research and Training (At this moment there are 63 in three divisions.), and there is no budget allocated for establishment of the Forest Research Institute.

Although some increase in the maintenance and administration expenses is expected after the establishment of the Institute, a substantial increase is not expected. Instead, a decrease from the integration of the scattered research divisions is anticipated. Considerable items for deduction are transportation fee, accomodation fee, correspondance fee, fuel fee, various purchasing expenses (parcially be covered by this aid), and rental fee. And total deductable amount will come to 130 to 140 thousand KINA (20,000 to 22,000 thousand Japanese Yen). This amount is pertinent amount with 40% of yearly budget of the Research Division.

② Current Status of Accommodation Acquisition (See Appendix-VI-4)

According to the above table, 17 of the total of 63 employees have official residences in Lae, which makes for a shortage of 48 units, and the shortage for the 46 researchers is 34 units.

③ Records of Accommodation Aid from Foreign Countries other than Japan

It is noted that the aid from New Zealand to PNG includes staff houses.

④ PNG's Self-help Efforts for Construction of Accommodations (See Appendix-VI-5)

PNG has expressed its intention to make efforts to include in the budget accommodations for staff members without official residences.

⑤ Acceptance of Foreign Researchers

An upgrading of the level of research is aimed at by inviting researchers from third world nations who need similar research and from advanced countries already promoting such research. (See Appendix-VI-6)

⑥ Dispatch of Japanese Experts

Japanese experts will be invited to assist in upgrading research technology. (See Appendix-VI-7, Appendix-VI-8))

(2) Number of Accommodations Constructed and Dwelling Unit Types

As a result of analyses in Japan and of discussions with each Ministry after returning to Japan based on the previously-mentioned background, and in consideration of the economic condition of PNG, the special circumstances of the Project, and the fact that accommodations were included in a cooperation program by a country other than Japan, it has been agreed to construct accommodations for 24 dwelling units as shown below.

Table 3-3 Number of Accommodations to be Constructed

	3 LDK (lux.)	3 LDK (ord.)	1 LDK	Unit type
I [Accommodations for staff]				
A. Director	1			House
B. General manager		4		2-unit bldg. x 2
C. Assistant general manager		4		2-unit bldg. x 2
II [Accommodations for Guest Researchers]				
A. Project Leader	1			House
B. Long-term Researcher		4		2-unit bldg. x 2
C. Short-term Researcher			10	5-unit bldg. x 2
Total	2	12	10	10 buildings
Total number of dwelling units		24		

3-3 Outline of Project

3-3-1 Implementing Agency, Implementing System and Personnel Plan

1. Implementing Agency

The Department of Forests is in charge of formulation and implementation of the Project. After completion of the Institute, its operation will be under the control of the Research of the Department.

Not only is the Department of Forests responsible for project implementation, but it is also responsible, as a representative of the PNG side, for negotiations, procedures and coordination with other agencies.

The Project will be implemented under the direction of the Secretary of the Forest Department. However, actual formalities related to the conclusion of contracts are taken care of by the Department of Finance.

2. Administrative System

The operation and administrative system for the Institute will be as shown in Figure 2-3. The total staff will number 63, and be broken down as follows:

Division	Number of Staff
Silviculture	20
Botany	21
Protection	6
Forest Products	16
Total	63

Of the staff listed above, 23 people are research specialists with university degress, 6 of which are foreign researchers.

3. Personnel Plan

If the Institute is to be administered with the present number of staff, they should be allocated as shown below.

Division/Sections / Staff	Director's Office	General Affairs/Secretarial Section	Silviculture	Botany	Protection	Forest Products	Total
Director	1						1
Asstt. Director	1						1
Branch Head			1	1	1	1	4
General Affairs Manager		1					1
Section Chief			1	1	1	1	4
Section head			5	3	2	6	16
Researcher			4	2	2	5	13
Librarian		1					1
Maintenance Staff		2					2
General Affairs Staff		8					8
Typist		1		1		1	3
Secretary	1		1		1		3
Chauffeur		1					1
General Laborer		5					5
Total	3	19	12	8	7	14	63

Note : Regarding officers (secretary) serving concurrently are included in either side of the section.

3-3-2 Outline of Facilities and Equipment

The following facilities and equipment are necessary to achieve the objectives of the Project.

1. Facilities

In view of the interrelationship between the various functions to be carried out in the Institute, facilities should be divided into three parts; namely, an Administration and Research Building (Main Building), Related facilities and Accommodations. Each will have the following rooms and facilities.

(1) Administration and Research Building (Main Building)

Reinforced concrete structure, two-storied.

① Laboratories and researchers' offices:	Laboratories and researchers'offices for the three research divisions other than Botany
② Data and information supplies:	Library, specimen and sample storage areas
③ Lecture and meeting rooms:	Lecture rooms, small and medium-sized meeting rooms
④ Display facilities:	Display room space for exhibits
⑤ Administration:	Offices, director's office, general manager's office
⑥ Experts' offices:	Japanese expert's office, Visiting researchers' offices

(2) Related Facilities (outdoor installations)

① Experimental treatment plant
② Glass house and shade house
③ Generator house
④ Insectarium
⑤ Inflammable and toxic chemicals
⑥ nursery facility, workshop
⑦ Garage

(3) Accommodations (Wooden, one-storied, high-floored)

①	For staff:	3 LDK	House and apartment
		1 LDK	Apartment
②	For guests:	3 LDK	House and apartment
		1 LDK	Apartment

2. Equipment

① Laboratory Equipment

Equipment to be used in biological tests such as germination in an artificial environment and chemical tests such as soil analyses. Such tests are aimed at developing silviculture that best fits the soil.

② Nursery Equipment

Nursery cultivators, pot producing device and other equipment necessary for pot nursing.

③ Silviculture Equipment

Tractors, chain saws and other equipment for mechanized silviculture.

④ Meteorological Equipment

Barometers, thermometers, hygrometers, anemometers, rain gauges and other equipment to be used for collecting meteorological data necessary for silviculture.

⑤ Audio-visual Equipment

Acoustic equipment, OHP, Video monitoring equipment, Projector, etc. will be installed in the lecture room so as to facilitate lectures.

⑥ Training and Meeting Equipment

Printing machine, Word processor, Walkie-talki, Planimeter, etc. to be used in preparation of teaching materials.

⑦ Vehicles

Truck, Land Cruiser to carry equipment for field surveys.

3-3-3 Outline of Project Sites

1. Proposed Construction Sites

The proposed sites are the current National Botanical Garden in Lae for the site of this research institute and the sports field on the premises of TITC for the accommodation site.

The proposed site for this research institute is located in the center of Lae and has an area of approximately 38 hectares, which is sufficient for this purpose. The shape is good, and there is little space that is not usable. The land is owned by the nation, and there are no obstacles to development. Although there is an elevation difference of approximately 10 meters at the border between the section where the existing facility (the research institute used by the Botany) is located and the other section, it will not interfere with the Project. There is no inclination in either of these two sections. In fact, the section with the existing facility is completely flat and has no obstacles. There are no conditions detrimental to the proposed facilities such as poor ventilation, noise, and air pollution. There are no problems with the ground conditions for construction such as nature of the soil, underground water level, drainage, and land endurance. The same is true for the accommodations site.

2. Infrastructure Situation

(1) Electricity

① There is an overhead electric power line of 11,000 volts, three-phase, four-wire, and 50 hertz on the road in front of the proposed site for the Forest Research Institute.

② Since the proposed accommodations site is on the premises of the already-functioning TITC, it is possible to distribute electricity from the lead-in pole on the premises.

Since Lae has a power stoppage of approximately 15 minutes once or twice a month, measures to deal with this power stoppage will be necessary. (Details described later)

(2) Water Supply

① There is a water main laid along the road in front of the proposed site for this research institute.

② Water for the proposed site for the accommodations will be branched from the water main on the school premises.

(3) Drainage

① A main sewer pipe is planned to be laid along the side road of the proposed site for this research institute in June 1988.

② Since there is no main sewer pipe at the proposed site for the accommodations, sewage there will be treated by vapor osmosis.

(4) Gas Supply

There is no city gas of either site. LPG will be used.

3-4 Technical Cooperation

The PNG Government has requested project-type technical cooperation of the Japanese Government with respect to the Project. The Minutes of Discussions of the Contact Mission and the PNG Government dated June 11, 1987 indicate the following:

(1) Objectives of technical cooperation

To assist in enhancing research activities through provision of advice and guidance

(2) Dispatch of Research Specialists

JICA-assigned official research specialists (2 persons) will be stationed in PNG for a period necessary to ensure smooth implementation of the Project.

According to its report, as a result of discussions held on the specific contents conforming to the Forest Research Institute plans of the PNG side and on the areas in which Japan can render technical cooperation, at this stage the following fields are listed as subjects of the technical cooperation:

① Silviculture

Natural forest silviculture
Plantation silviculture
Seed technology
Soils and nutrition
Watershed management

② Botany

Application of computerized filing system to taxonomy of tropical species

③ Protection

Heart-rot-research and biological control

④ Forest Products

Physical and mechanical properties
Seasoning and sawing

CHAPTER 4 BASIC DESIGN

CHAPTER 4 BASIC DESIGN

4-1 Basic policy on design

The policies for implementing the projects of facility construction and equipment installation are explained in the following:

(1) Soft aspects of the laboratory's activities.

① Have complete functions adequate to meet any needs in the research activities.

② Each facility must be located properly so that the management of the research activities may be performed in an effective and systematic manner.

③ Each facility and its own room shall be allocated properly so that it may meet the future increase in the number of employees.

④ The laboratory must have a dignity as well as facilities and other equipments which are suitable to a national research institution.

⑤ The maintenance and management of each facility can be done easily and at a lower cost.

⑥ The maintenance works of the facility can be performed even by staff without special technical qualifications.

(2) Hard aspects of the laboratory

① The construction of the facilities of the laboratory must be able to meet the local climate and requirements.

② More emphasis must be put on the operability of the facility.

③ It must be planned so that the facility may be built at a reduced initial cost and operated economically. At the same time, it must be a facility with a low running cost from a comprehensive point of view.

④ On determining the construction method to be employed for each construction item. A heavy emphasis shall be put on safety and ease of maintenance with a higher priority for methods commonly used locally.

⑥ Complete measures against rain, termites, flying insects etc. and for sunshine and security shall be prepared based on information on the current situation of the country. Most importance shall be placed on the security measures.

⑥ An architectural style which can contribute to amenity of living shall be adopted by introducing positively any local architectural factors which can produce an advantage in terms of usability and function.

⑦ Local products shall be given the highest priority in selecting building materials and equipment to be used for this project. On the other hand, there must be checked for precision, weatherability, availability, quality, etc. Use of Japanese products may be considered in suitable cases.

⑧ Materials and equipment imported into the PNG country may also be considered as a supply source for this project with the same treatment as for local products, in addition to the above-mentioned genuine local products and Japanese products. This comes from the situation that the supply of building materials and equipment in the PNG market, largely depending on imports from Australia.

4-2 Basic Guideline for Design

4-2-1 Guideline for Scale Setting

For calculating the total area of the facilities, the rooms and additional facilities, the following provisions shall be observed:

1) The total area should be calculated referring to The National Forestry Institure

   (Tsukuba) and the similar institutions including foreign ones.

2) For determinating the area of each room and the outside facilities the aforementioned references and the following guidelines shall be observed:

   a. Collection of The Construction Projects

   b. KENTIKUGAKUTAIKEI in Japan

   c. Requests of PNG about the area

   d. Other references

3) For calculating the area size of those facilities that can not be determined based on the number of room occupants - e.g., it is important to consider the sizes of equipments to be allocated to such rooms.

4) The area size of those facilities, that can be easily determined based by computing the number of room occupants shall be calculated as such.

5) For calculating the spaces of the boarding facilities shall be based on the Types of Residential Standard of Department of Works of PNG.The number of the bed rooms may vary in accordance to specific needs.

6) Facilities such as toilet, locker room, shower and bath room, must be allocated in accordance to the ratio of the occupants. However, local social customs must be considered.

4-2-2 Guideline for the scale calculation

The following 4 steps were considered in order to determine the floor area of the Institute:

1) The pattern of the distribution of the laboratory of this institution was established after studies of the distribution of the laboratory equipments and the relations between laboratories and researchers' rooms were conducted.

2) 20 laboratories size and setting (their width X length and spaces between tables) from 6 countries were compared for determing a laboratories standard size.

3) The number and the size of the laboratories were determined, after placing in standard laboratory machines and equipments required by the type of studies which might be conducted in each laboratory.

4) The final standard size and the number of the laboratories were established according to the aforementioned process. In addition to those laboratories the primary area (i.e. laboratory area), and the size of the secondary area (i.e. area reserved for general use and rest rooms) was determined by a certain ratio in relation to size of the primary area. The total of those areas is the total area of the institute.

4-2-3 Discussion on the scales of various items and of the whole project

1. Laboratory

Equipment setting at 20 model laboratories from 6 countries - West Germany, United States, Switzerland, Japan, Soviet Union and East Germany - , were studied to classify the types of equipment settings and the relations between researcher's room and laboratory (See Appendix-VI-9). Studies have shown that in the daily works conducted in this institute, priority is given to the researches conducted by one person, and the group works complementary to former. Bearing this factor in mind, the following patterns were selected:

① Distribution of laboratories: Single Type

② Distribution of laboratory equipments: Island and Peninsular Type (mainly two-sides tables are provided.)

③ Setting of Laboratory-researcher's room distribution: Independent Type

④ Positioning of laboratory and researcher's room: Facing one to another across the corridor

For calculating the area of a standard laboratory, analytical studies of the Single Type model (See Appendix-VI-10) were conducted to determine the optimum size of a laboratory.

① Area of a Standard Type Laboratory: 42.0 m2

② Width and length: 6.0 m x 7.0 m

Necessary scale each laboratory which is calculated with arranging its facilities and equipment on the basis of above the standard scale are shown as follows;

① SILVICULTURE

MAPPING & SURVEY LAB.	63 m^2	Refer to Layout Plan 1
SILVICULTURE/ TREE PHYSIOLOGY/MICRO-PROPAGATION	63 m^2	Refer to Layout Plan 2
SEED LAB.	63 m^2	Refer to Layout Plan 3
SOIL & PHYSICAL LAB./FOREST INFLUENCES LAB.	63 m^2	

② PROTECTION

FUNGI HERBARIUM	42 m^2	
AUTOCLAVE R.M.	21 m^2	
MUSHROOM LAB.	63 m^2	Refer to Layout Plan 4
NON-DECAY LAB.	45 m^2	
DECAY LAB.	42 m^2	
PLANTATION/NATURAL FOREST ENTOMOLOGY LAB.	42 m^2	Refer to Layout Plan 5
FOREST PRODUCTS ENTOMOLOGY LAB.	42 m^2	
INCUBATER R.M.	21 m^2	
INCECTICIDAL LAB.	42 m^2	
NATIONAL INSECT COLLECTION	60 m^2	

③ FOREST PRODUCTS

WOOD PRESERVATION I	63 m^2	Refer to Layout Plan 6
Do. II	63 m^2	
WOOD PROCESSING LAB.	63 m^2	
WOOD ENGINEERING LAB.	63 m^2	
MINICARPENTRY SHOP WOOD STRAGE/PREPARATION R.M.	84 m^2	
SEED STORE	15 m^2	
OPTICALS R.M.	15 m^2	
CAMPING EQUIPMENT R.M.	20 m^2	
EXPERIMENTAL TOOLS WASHING R.M.	21 m^2	
CHEMISTRY LAB.	84 m^2	Refer to Layout Plan 7

MINOR FOREST PRODUCTS R.M.		63 m²	

④ BOTANY

PLANT SAMPLE STORAGE		194 m²	Refer to Layout Plan 8

2. Scale of each room other than laboratory

Scale of each room other than laboratory are shown as follows;

① OFFICE SPACE

DIRECTOR'S OFFICE & ATTACHED SECRETARY'S R.M.	1	30 m²	
MAIN ADMINISTRATIVE OFFICE	1	161 m²	Refer to Layout Plan 9
BRANCH HEAD'S OFFICE & SECRETARY'S R.M.	3	30 m²	Refer to Layout Plan 10
SECTION HEAD'S OFFICE	13	15 m²	Refer to Layout Plan 11
SCIENTIFIC OFFICER'S R.M.	12	15 m²	
JAPANESE EXPERT SCIENTIFIC OFFICER'S R.M.	4	15 m²	
FOREIGNER EXPERT OFFICER'S R.M.	2	15 m²	Refer to Layout Plan 12
LIBRARY	1	109 m²	

② COMMON SPACE

LECTURE R.M.	1	200 m²	Refer to Layout Plan 13
MEETING R.M. 2	2	125 m²	Refer to Layout Plan 14
CANTEEN	1	66 m²	
ELECTRONIC MICROSCOPE R.M.	1	37 m²	Refer to Layout Plan 15
CHEMICAL BALANCE R.M.	1	15 m²	

③ OUTDOOR INSTALLATION

GENERATOR HOUSE	1	36 m^2
GLASS HOUSE & SHADEHOUSE	1	72 m^2
INFLAMABLE & TOXIC CHEMICALS	1	65 m^2
EXPERIMENTAL TREATMENT PLANT	1	36 m^2

④ ACCOMMODATION

A-TYPE	2	186 m2
B-TYPE	12	1116 m2
C-TYPE	10	657 m2

3. Total areas of space

Folloings are the final calculation of areas of experimental rooms and its related rooms (called Primary area), and other rooms (called Secondary area). (See Appendix-VI-11)

① Primary area;

such as nomal experimental room, special experimental room, specially air conditioned room, large spanned experimental room are used for research and experiment directly.

Total areas of Primary area in this building are 1,700 sqm.

② Secondary area;

such as researcher's office, service space, staff facilities, traffic space (collidor, stairs) and store space.

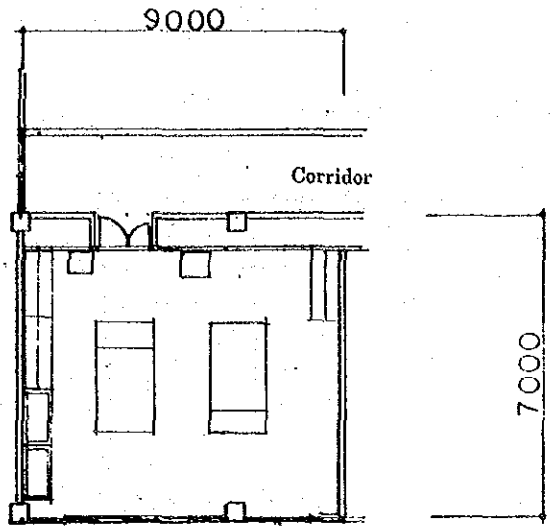
Total areas of Secondary area in this building are 2,460 sqm.

The ratio between ① & ② become 41:59 and it seems to be appropreate ratio in view of the sample calculation in England which is common usable calculation system in the world. (See Appendix-VI-12)

Silviculture

Layout Plan 1

Mapping & Survey Lab. (63 m2)

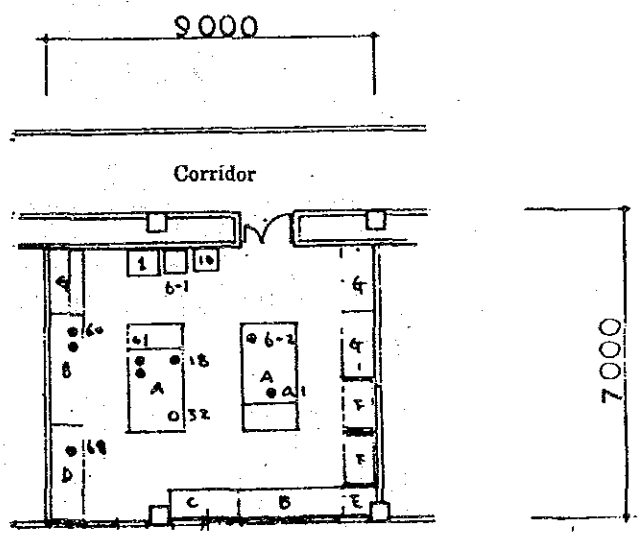


Silviculture

Layout Plan 2

Tissue Culture (Micro Propagation) (63 m2)

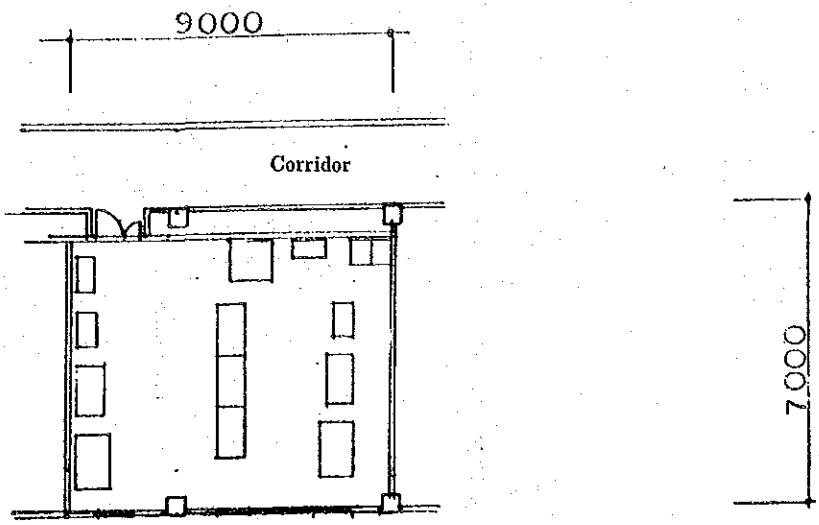
Silviculture / Tree Physiology



Silviculture

Layout Plan 3

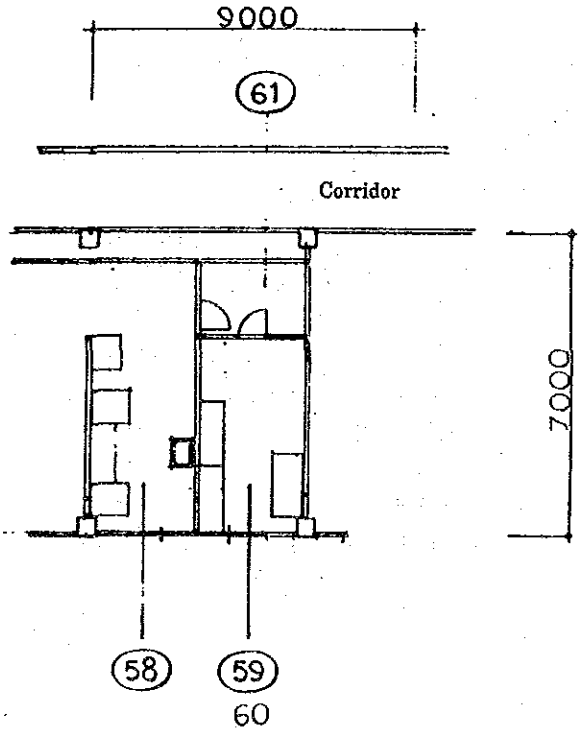
Seed Laboratory (63 m2)



Protection

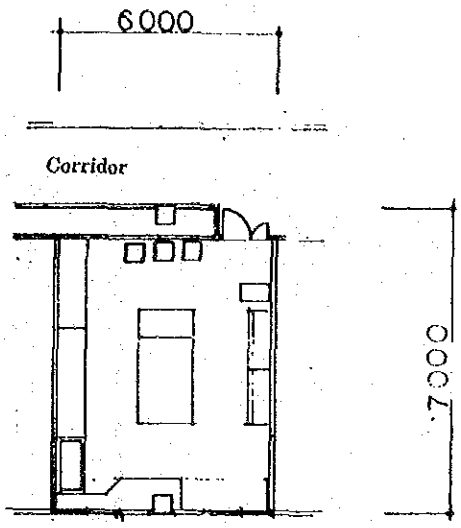
Layout Plan 4

Mushroom (Pathology) Lab. (63 m2)



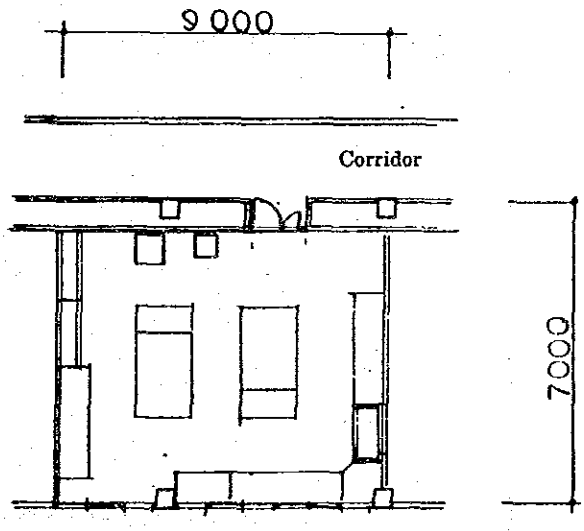
Protection — Layout Plan 5

Plantation / Natural Forest Entomology Lab. (42 m2)



Forest Products — Layout Plan 6

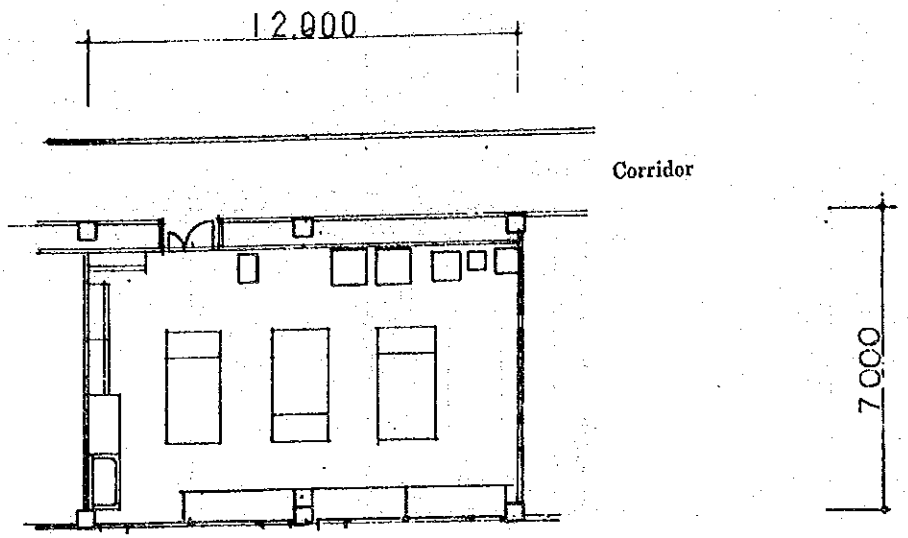
Wood Preservation II Marine (63 m2)



Forest Products

Layout Plan 7

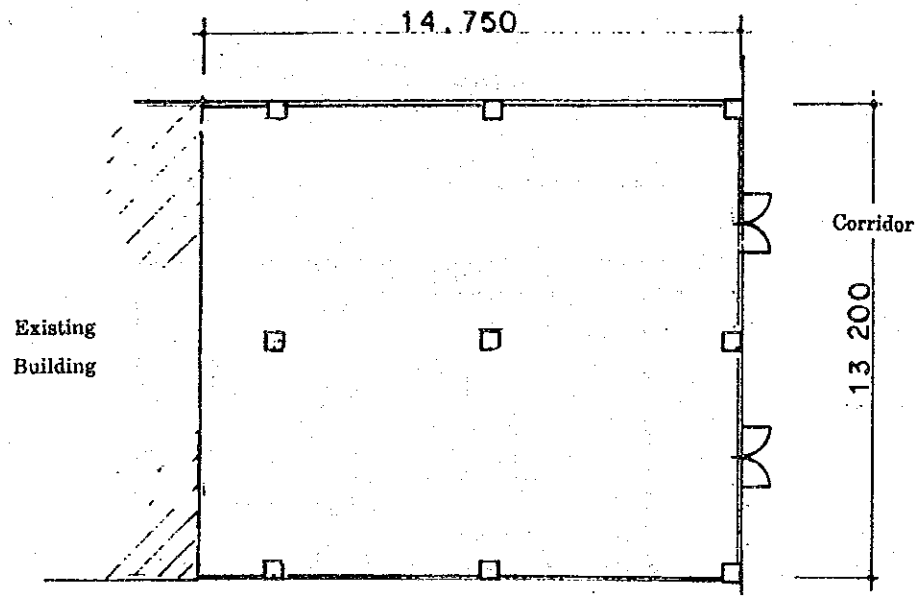
Chemistry Lab. (139 m2)



Botany

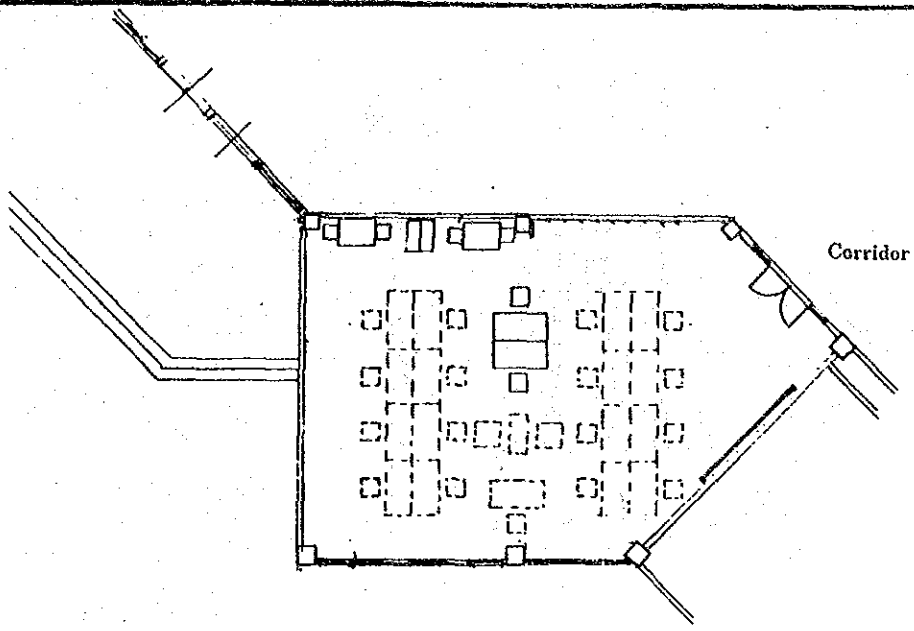
Layout Plan 8

Herbarium (194 m2)



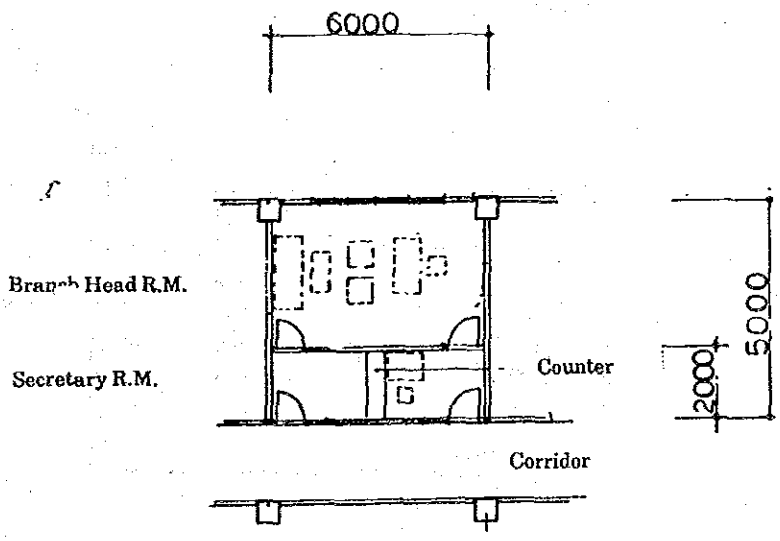
Administration — Layout Plan 9

Main Administrative Office R.M. (124 m2)



Administration — Layout Plan 10

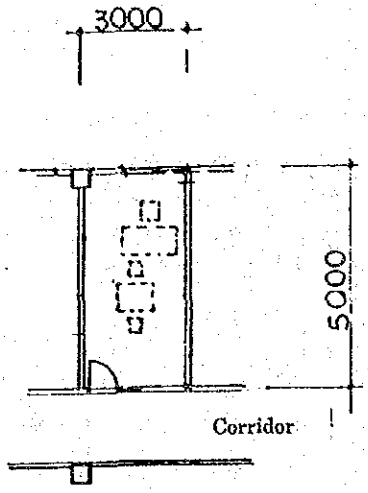
Branch Head with Secretary R.M. (30 m2) x 3 rooms



Administration

Layout PLan 11

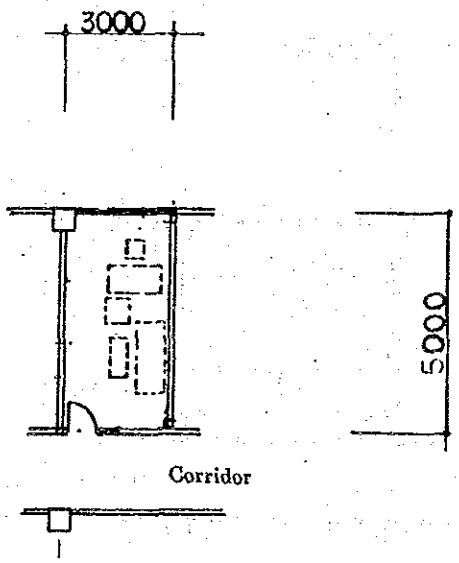
Section Head R.M. (15 m2) x 13 rooms



Administration

Layout PLan 12

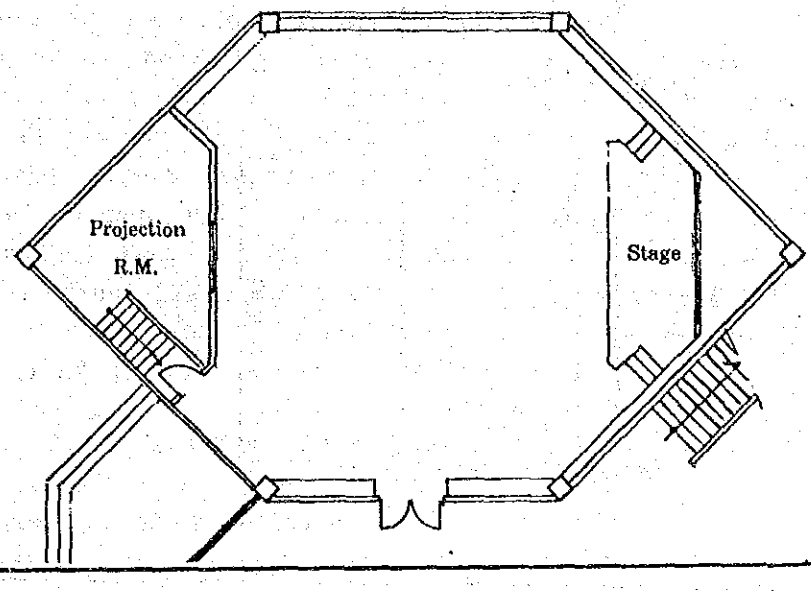
Foreigner Scientific Officers R.M. (15 m2) x 2 rooms



Common Space

Layout Plan 13

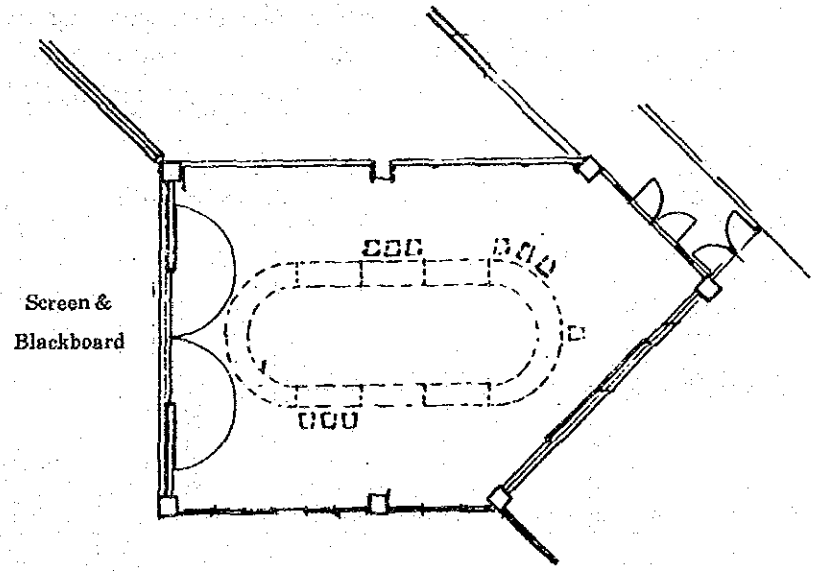
Auditorium / Lecture R.M. (200 m2)



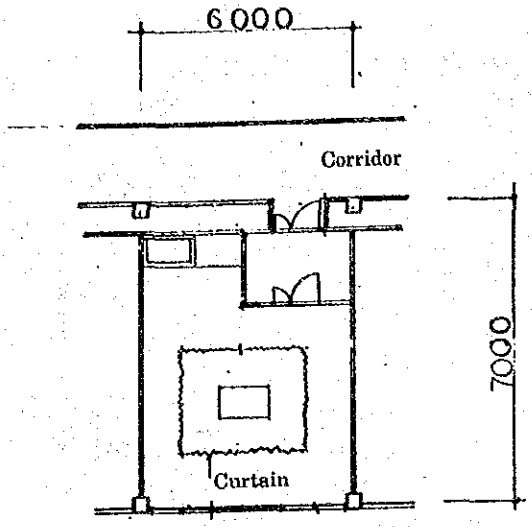
Common Space

Layout Plan 14

Bigger Meeting R.M. (124 m2)



Electric Microscope R.M. (46 m2)



4-3 Standard Plan

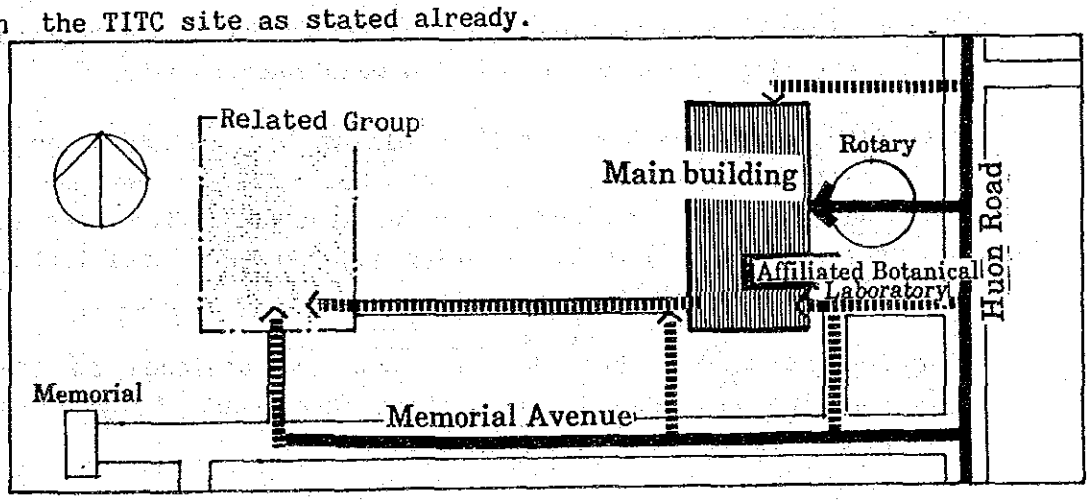
4-3-1 Construction site layout plan

The construction site is located in the central area of Lae City. Huon Road and Memorial Avenue run on the east side and south side respectively of the site. These two streets will be the ones facing the front side of the building. Currently, there is the laboratory affiliated to the Botanical Garden on the southeastern side of the site, while there are the offices of the Botanical Gardens and the outdoors facilities including the nursery fields on the west side of the lot. Installation of the electric power supply lines to the main building will be made by making branches from the existing lines coming into the laboratory and Botanical Gardens' offices. Water is supplied from the pipe coming from Memorial Avenue, which is already installed. A sewage system will be installed along Memorial Avenue by 1988.

It is 2.7 kilo meters from the accommodation blocks in the TITC lot which are located to the north of the main building of the laboratory complex from the main building of the laboratory complex from the main building. A car is used as the usual means of transportation.

Considering the above situations, it would be reasonable to outlay the main building on the southeast side of the lot near the laboratory affiliated to the Botanical Gardens and other building units on the west side of the site in the proximity of the Botanical Gardens' office.

The main entrance of the main building is installed on the east side facing Huon Road. A u-turn area and parking spaces are installed in the area between the main entrance and main building. The main building will face to the u-turn area. The residential blocks will be built separately in the TITC site as stated already.



Drawing No. 4-1

The layout of the facilities involved in this project shall be determined so that the function of the Forest Laboratory may be integrated into the total botanical gardens facility system.