REPORT on the BASIC DESIGN SURVEY for the PRIMARY SCHOOL CONSTRUCTION PROJECT in THE KINGDOM OF TONGA

JUNE, 1980

JAPAN INTERNATIONAL COOPERATION AGENCY

PREFACE

In response to the request of the Government of the Kingdom of Tonga, the Japanese Government decided to conduct a survey on the Primary School Construction Project and entrusted the Japan International Cooperation Agency (J.I.C.A.) with the survey. The J.I.C.A. sent to the Kingdom of Tonga a survey team headed by Mr. Osamu Igami from April 5 to April 27, 1980.

The team had discussions with the officials concerned of the Government of the Kingdom of Tonga and conducted a field survey in the villages of Houma of Hihifo District and Kolonga of Hahake District, Tongatapu. After the team returned to Japan, further studies were made and the present report has been prepared.

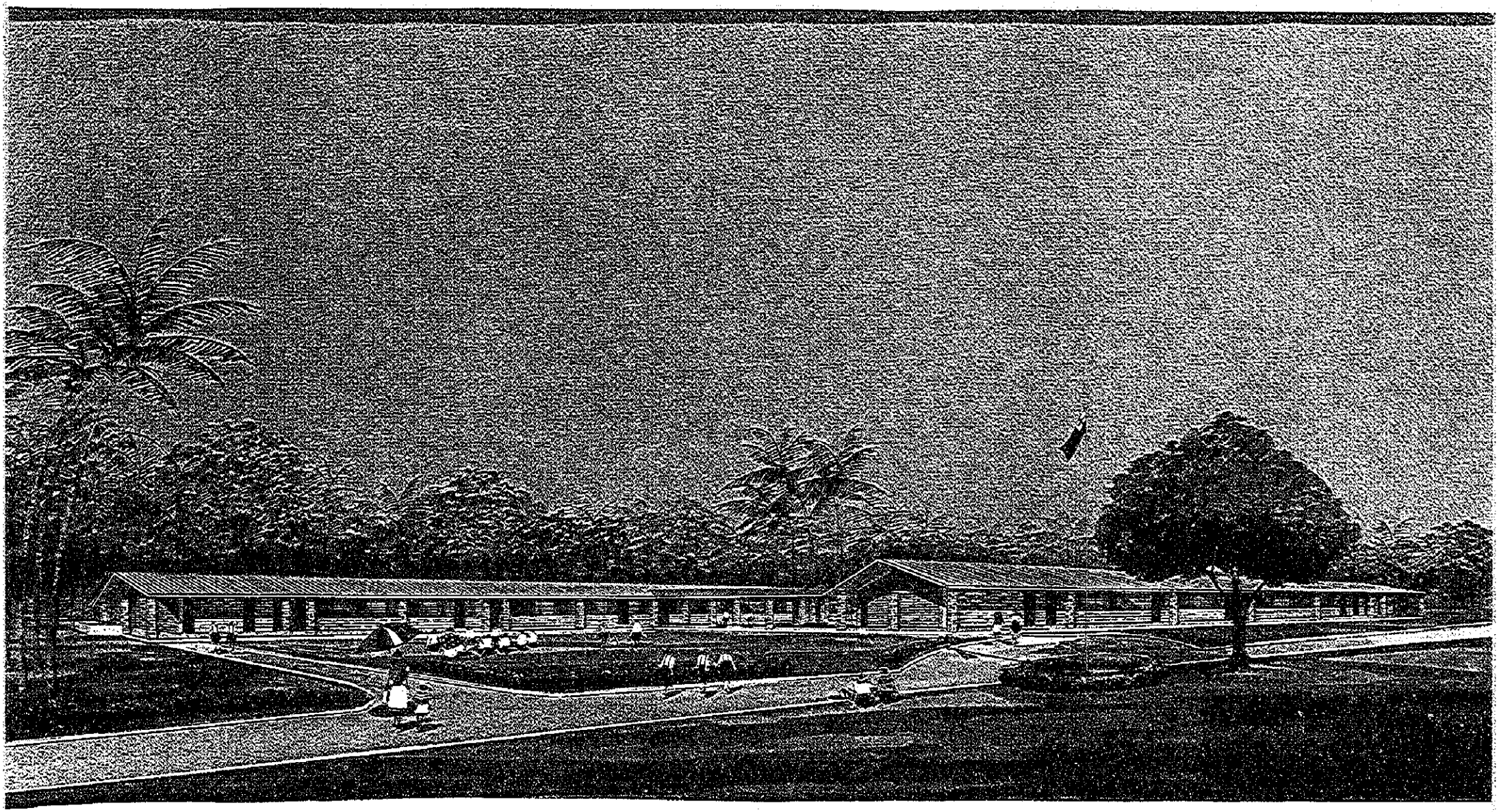
I hope that this report will serve for the development of the Project and contribute to the promotion of friendly relations between our two countries.

I wish to express my deep appreciation to the officials concerned of the Government of the Kingdom of Tonga for their close cooperation extended to the team.

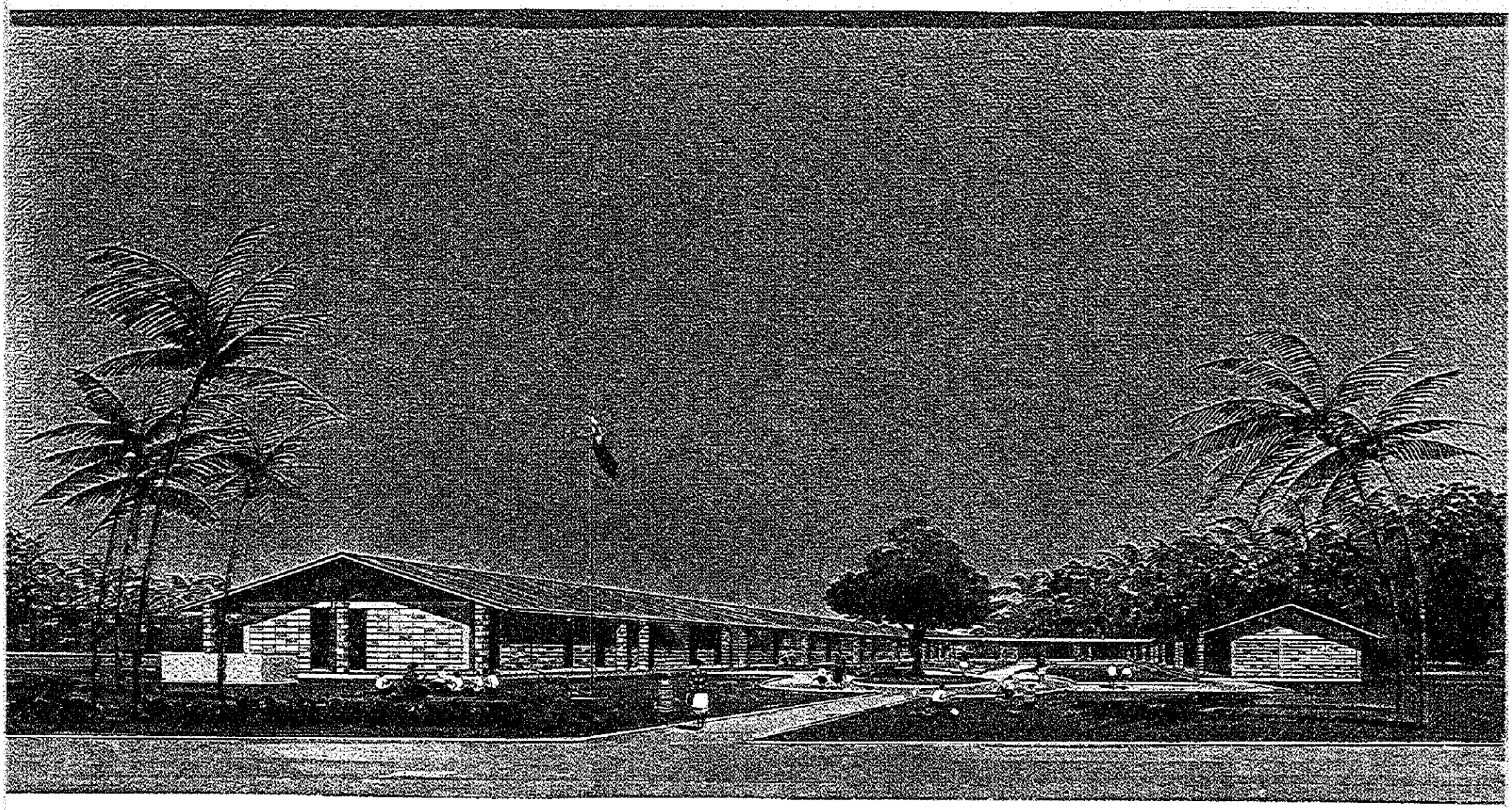
June, 1980

Keisuke Arita

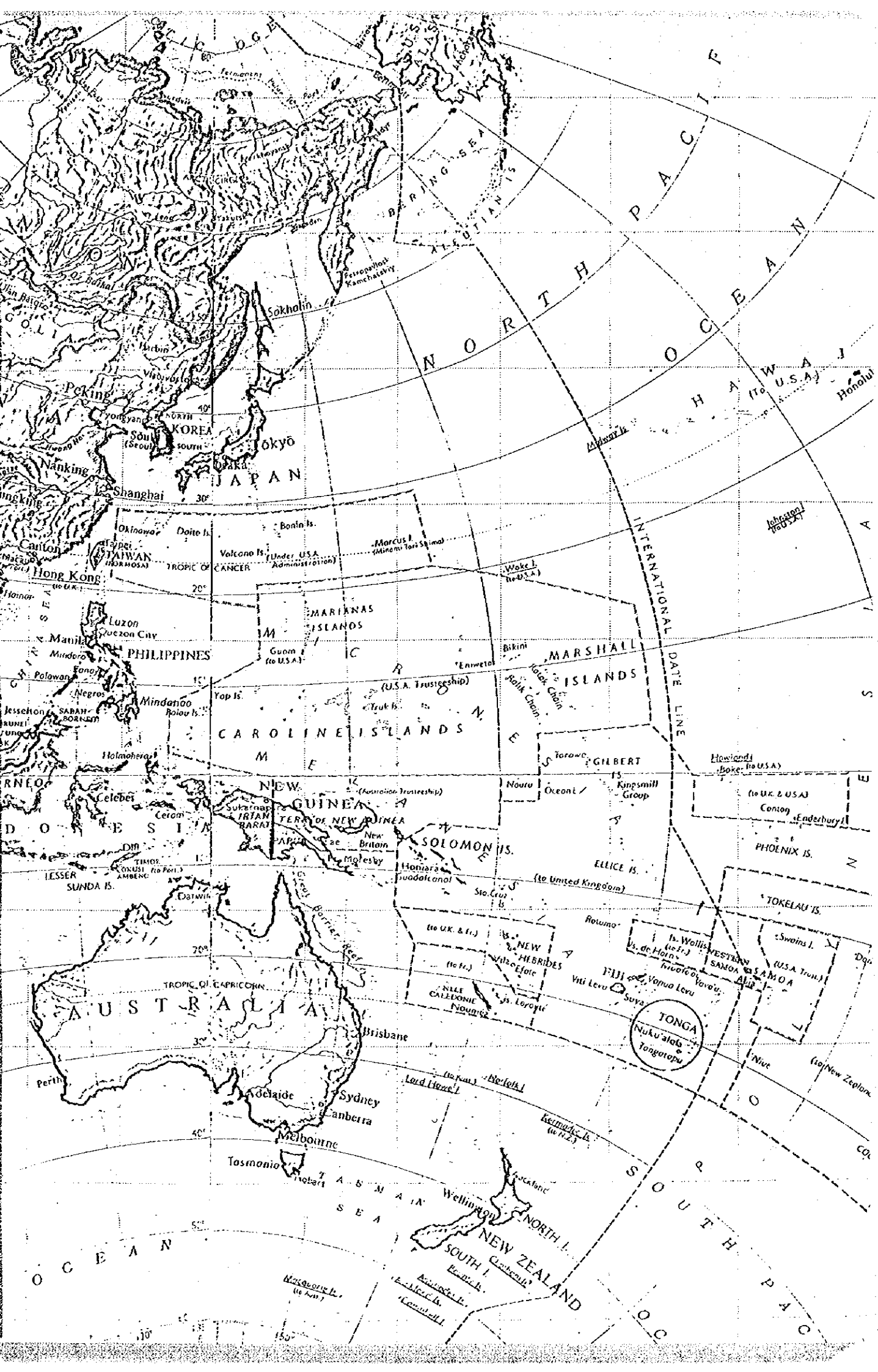
Keisuke Arita
President
Japan International Cooperation Agency



HOUMA PRIMARY SCHOOL



KOLONGA PRIMARY SCHOOL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SOUTH PACIFIC OCEAN
INDIAN OCEAN
TASMAN SEA
CORAL SEA
BERING SEA
ALEUTIAN IS.
HAWAII (to U.S.A.)
Honolulu
Midway Is.
Johnston I. (to U.S.A.)
INTERNATIONAL DATE LINE
Wake I. (to U.S.A.)
Howland I. (to U.S.A.)
Baker (to U.S.A.)
Canton (to U.K. & U.S.A.)
Enderbury I.
PHOENIX IS.
LINE IS.
GILBERT ISLANDS
MARSHALL ISLANDS
Bikini
Enewetak
Kwajalein Atoll
Ralik Chain
Ratak Chain
Nauru
Ocean I.
Kingsmill Group
MARIANAS ISLANDS
Guam (to U.S.A.)
Saipan
Yap Is.
Truk Is.
CAROLINE ISLANDS
(U.S.A. Trusteeship)
Palau Is.
Marcus I. (Minami-Tori-Shima)
Volcano Is. (Under U.S.A. Administration)
Bonin Is.
Ogasawara Gunto
Okinawa
Daito Is.
Kyushu
Honshu
Hokkaido
Sakhalin
Kamchatskiy Poluostrov
Petropavlovsk
Vladivostok
Harbin
Peking
Pyongyang
NORTH KOREA
Seoul
SOUTH KOREA
Tokyo
Osaka
JAPAN
Nanking
Shanghai
Taipei
TAIWAN (FORMOSA)
Canton
Hong Kong (to U.K.)
TROPIC OF CANCER
Luzon
Quezon City
Manila
PHILIPPINES
Mindoro
Palawan
Negros
Mindanao
Jesselton
SABAH
BORNEO
BRUNEI
Celebes
Ceram
Holmoheras
Sukarnapura
IRIAN BARAT
TERR. OF NEW GUINEA
NEW GUINEA
(Australian Trusteeship)
Dili
TIMOR
OKUSI (to Port.)
AMBENO
LESSER SUNDA IS.
Darwin
Great Barrier Reef
New Britain
Rabaul
Madang
Lae
Port Moresby
Honiara
Guadalcanal
SOLOMON IS.
Sta. Cruz Is.
ELLICE IS.
(to United Kingdom)
TOKELAU IS.
Rotuma
Swains I. (U.S.A. Trust.)
Is. Wallis (to Fr.)
Vs. de Horn
Futuna
Alofi
WESTERN SAMOA
SAMOA
Niue
(to New Zealand)
NEW HEBRIDES
Vila
Efate
(to U.K. & Fr.)
(to Fr.)
NELLE CALEDONIE
Nouméa
Is. Loyalty
FIJI
Viti Levu
Suva
Vanua Levu
Yasawa
TONGA
Nuku'alofa
Tongatapu
TROPIC OF CAPRICORN
AUSTRALIA
Brisbane
Perth
Adelaide
Sydney
Canberra
Melbourne
Tasmania
Hobart
Lord Howe I.
(to Aust.)
Norfolk I.
Kermadec Is. (to N.Z.)
Wellington
NEW ZEALAND
NORTH I.
SOUTH I.
Auckland
Campbell I.
Macquarie Is. (to Aust.)
Antipodes Is.
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Chatham Is.
Raoul I.
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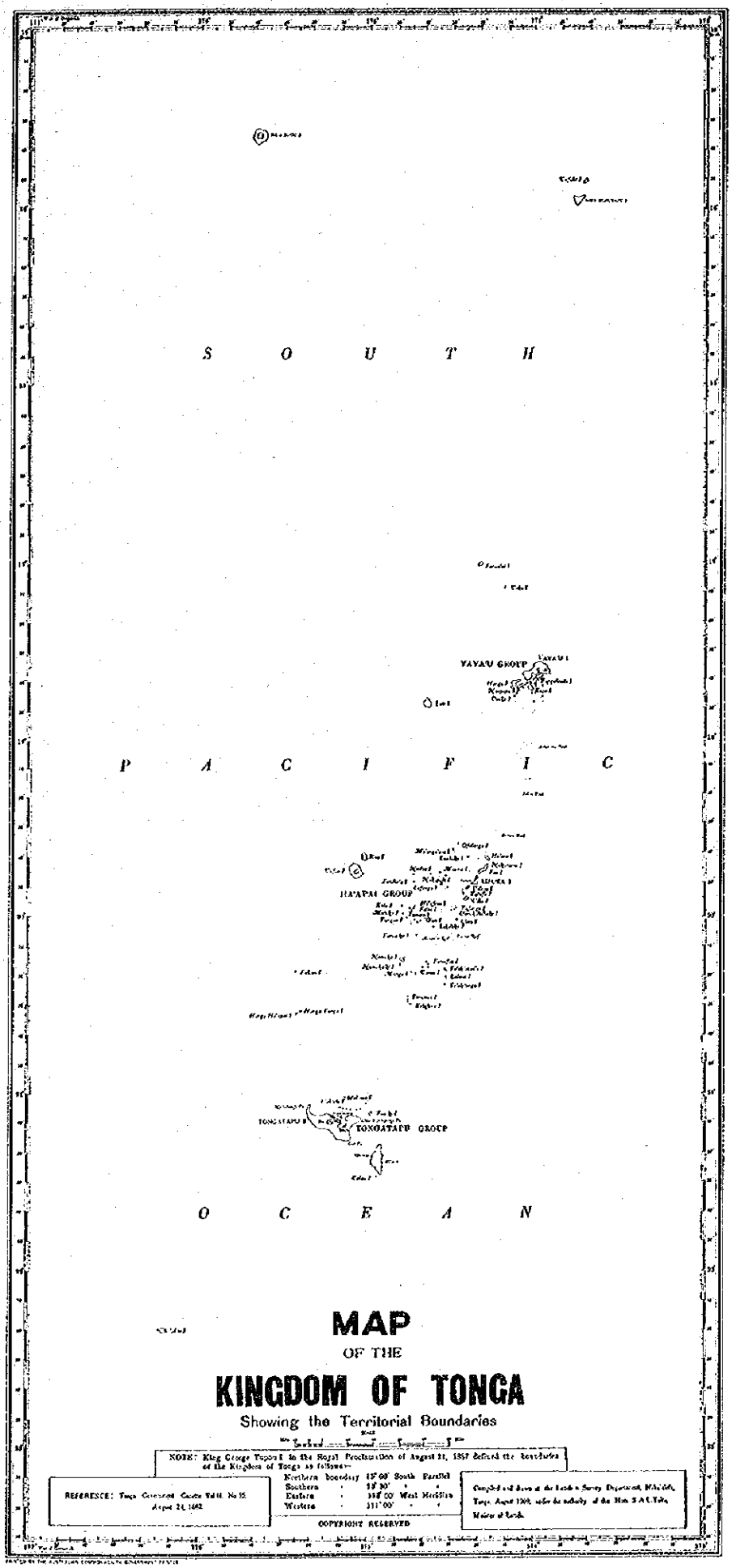


MAP

OF THE

KINGDOM OF TONGA

Showing the Territorial Boundaries

NOTE: King George Tupou I in the Royal Proclamation of August 21, 1887 defined the boundaries of the Kingdom of Tonga as follows:—

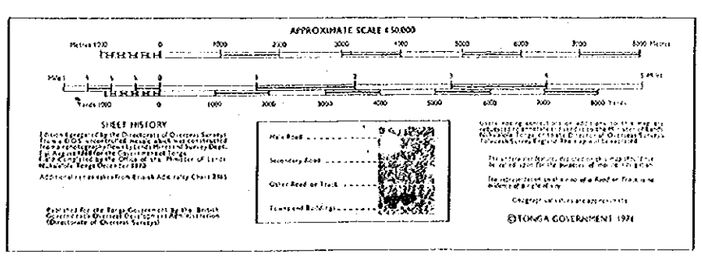
Northern boundary	15° 00'	South Parallel
Southern	23° 30'	"
Eastern	188° 00'	West Meridian
Western	173° 00'	"

REFERENCE: Tonga Government Gazette Vol. II. No 15. August 24, 1882

Compiled and drawn at the Lands & Survey Department, Nuku'alofa, Tonga, August 1969, under the authority of the Hon. S.A.L. Tei, Minister of Lands.

TONGATAPU ISLAND

KINGDOM OF TONGA



EGERIA CHANNEL

MARIA BAY

PIHA PASSAGE

NUKU'ALOFA

FANGA KAKAU LAGOON

FANGA UTA LAGOON

SOUTH PACIFIC OCEAN

Niu Arofo Point

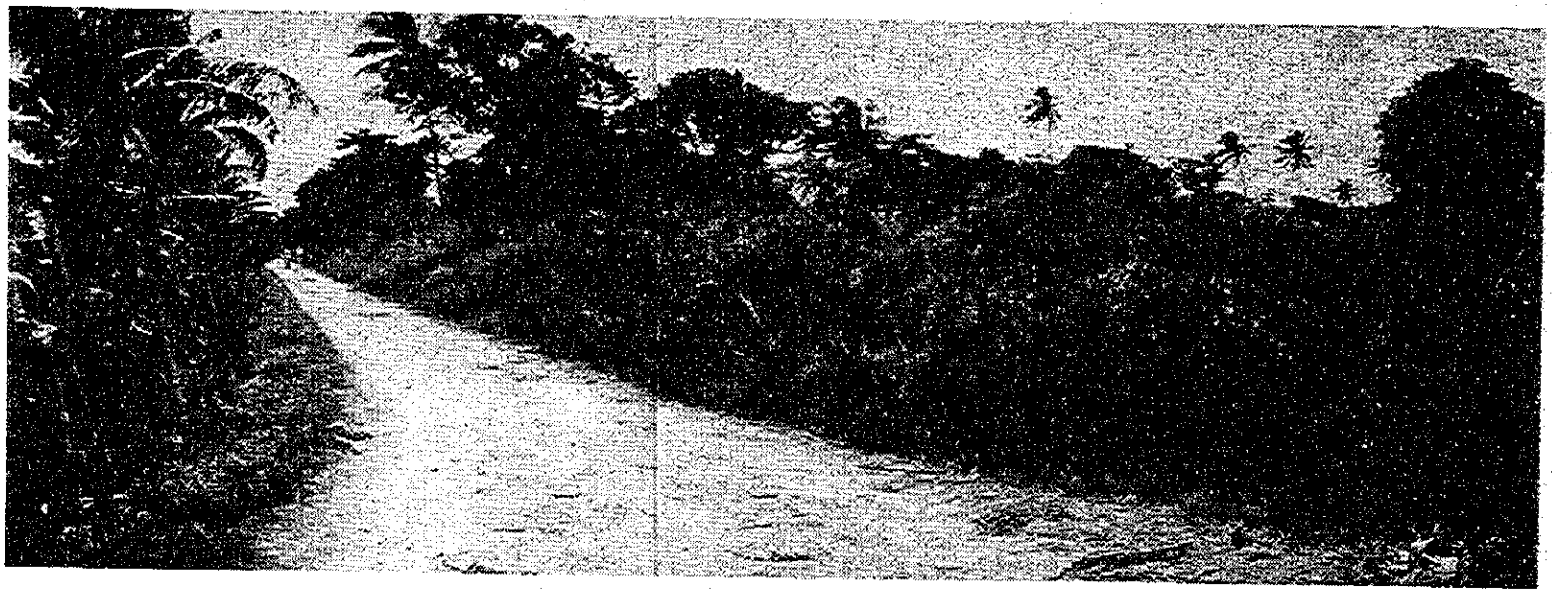
Muifanoa Point

Mui Hopohoponga Point

Houma Tafoa (Cook Point)

175°00 W

SITE OF HOUMA PRIMARY SCHOOL—VIEW FROM SOUTH



SITE OF KOLONGA PRIMARY SCHOOL—VIEW FROM SOUTHWEST

CONTENTS

CHAPTER 1

OUTLINE OF BASIC DESIGN SURVEY

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1-1 Details and Background of the Project

The Kingdom of Tonga has been a country devoted to the education for many years. Although its Fundamentals of Education Act providing compulsory education was enacted in 1876, it is said that most of the children of school age at that time were given primary education in some form or other. This is mainly due to educational contribution made by the foreign religious organizations who have been engaged in primary education for the children as part of their missionary tasks.

In recent years, however, it has become necessary for the primary education in the Kingdom of Tonga, having such a long and unique history, to develop or modify the primary schools in view of increasing the number of school children and the deterioration of the buildings and facilities. In addition, among these religious organizations running private primary schools independent of the Government, the Cathoric church and the Wesleyan church decided 7 years ago and 3 years ago respectively, to withdraw from school operations, along with other churches. At present, these schools are operated by the Government while using free school buildings and lands which are to be returned to their owner churches within a few years. Thus, the situation necessitates to build new primary school urgently. Until now, Catholic church and Wesleyan church have closed 15 and 12 primary schools respectively.

Under these circumstances, the Government of the Kingdom of Tonga planned in its Third Five Year Development Plan to build 246 classrooms in the years from 1975 to 1980. The Government, however, was able to complete only 57 classrooms, because of financial

difficulties. On the basis of the results of the Third Five Year Plan, the Government is formulating the Fourth Five Year Plan.

In view of this, the Government of the Kingdom of Tonga requested the Government of Japan to assist in the construction of primary schools in the Kingdom of Tonga through the provision of necessary funds on a basis of grant aid.

In line with the basic concept of "The Nation Building" presented by M. Ohira, the then Prime Minister of Japan who pointed out an important role played by "Men Building" in "The Nation Building" at the 5th Meeting of the United Nations Conference on Trade and Development held in Manila, and in compliance with the request of the Government of the Kingdom of Tonga asking for the provision of grant aid extended by the Japanese Government, the Japan International Cooperation Agency organized a basic design survey team to be sent to the Kingdom of Tonga in order to conduct field surveys concerning the construction of proposed primary schools. The team conducted a field survey for a period of 23 days from April 5 to April 27, 1980.

1-2 Organization of Survey Team

In response to the request of the Government of the Kingdom of Tonga, the Japan International Cooperation Agency (JICA) selected competent consultants and organized a basic design survey team in order to study the details of the request and to conduct field surveys including the investigations of the local conditions.

The team headed by Mr. Osamu Igami (Economic Cooperation Bureau, Ministry of Foreign Affairs) and composed of the following members was dispatched to the Kingdom of Tonga for a period of 23 days from April 5 to April 27, 1980.

Osamu Igami (Leader)	Economic Cooperation Bureau, Ministry of Foreign Affairs
Yoshio Yabe (Coordinator, Acting Leader)	Social Development Cooperation Department, Japan International Cooperation Agency
Takeo Saito (In charge of Planning)	Architect, Ishimoto Architectural & Engineering Firm, Inc.
Eiichi Yabumae (In charge of Architecture)	Architect, Ishimoto Architectural & Engineering Firm, Inc.
Yutaka Fukuda (In charge of structural Engineering)	Architect, Ishimoto Architectural & Engineering Firm, Inc.

1-3 Minutes of Discussion

The Japanese basic design survey team had a discussion with the officials concerned of the Government of the Kingdom of Tonga in connection with the primary school construction project. As a result of discussions, an aggreement was reached between the two governments. Mr. Osamu Igami, the Japanese Team Leader, and Mr. Sione Na'a Fiefia, Director of Education, Ministry of Education of the Government of the Kingdom of Tonga signed on the Agreed Minutes of Discussion on April 11, 1980, in Nuku'alofa.

Team Leader	Director of Education Ministry of Education
Mr. Osamu Igami	Mr. Sione Na'a Fiefia

CHAPTER 2

PRESENT SITUATION OF PRIMARY EDUCATION AND EXPANSION PLAN FOR EDUCATIONAL FACILITIES

CHAPTER 2 PRESENT SITUATION OF PRIMARY EDUCATION AND EXPANSION PLAN FOR EDUCATIONAL FACILITIES

The primary education in Tonga has been compulsory since 1876. The Fundamentals of Education Act effective in 1974 to implement the compulsory education stipulates that all children from 6 to 14 years of age, capable of attending school, shall finish a 6-year course of primary education. Accordingly, the primary schools in Tonga have 6 classes (class 1 to class 6) and those who have completed the course are allowed to go to post-primary education if they wish. Almost all primary schools in Tonga are operated by the Government and post-primary education is mainly run by the missionaries.

The primary school varies in its size depending on the number of children attending school. Each class has one or two classrooms, but many primary schools have three or four classrooms for the 6th-year pupils, since those failed in the entrance examination for post-primary education are allowed to remain in the same class as repeaters for another 2 years.

Teachers working in primary education are trained in a two year course provided by the Government Teachers' Training College. In addition, in-service trainings are conducted throughout the country. Guidance teachers are dispatched to the primary schools in remote areas to retrain the teachers. Moreover, some teachers are sent abroad to participate in a retraining course organized in foreign countries. They also undergo retraining courses given by volunteers dispatched from abroad. Therefore, many of the primary schools have an extra classroom provided for in-service training of teachers.

Total population of the Kingdom of Tonga is more than 100,000, of which a slightly over 40 percent is composed of juveniles under fifteen years of age. Thus, the primary education is a heavy burden to the Government of this

country, since the percentage of recruitment is almost equal to 100 percent. The fact that the population is heavily concentrated in Tongatapu, the main island, might be caused by the population inflow from the detached islands such as Vava'u and Ha'apai.

Since demands have been raised against the education authorities for evacuating the school buildings ever since the early part of 1970, and the buildings have been obsolete with the lapse of time, the construction of new schools and the modification of existing school buildings have become one of the urgent problems for the Government to deal with in the field of educational administration.

Table 2-1 shows the number of primary schools by school district and Table 2-2 covers the number of children and teachers by school district as of 1979.

To cope with this particular situation, the Government has included the construction and modification project of the primary school in its Fourth Development Plan effective in June, 1980 as shown in Table 2-3.

Table 2-1 Number of Primary Schools by School District (1979)

	School District	Schools
Government	Vahe Loto (Central Area of Tongatapu)	14
	Vahe Hahake (Eastern Area of Tongatapu)	18
	Vahe Hihifo (Western Area of Tongatapu)	13
	Vahe Ha'apai (Ha'apai Area)	19
	Vahe Vava'u (Vava'u Area)	29
	2 Niuas	4
	Total	97
Church	Missions	10
	S. D. A.	3
	Total	13
	Grand Total	110

Source: Ministry of Education

Table 2-2 Number of Children and Teachers by School District (1979)

	School District	Children		Total	Teachers		Total
		Male	Female		Male	Female	
Government	Vahe Loto	2,848	2,708	5,556	48	139	187
	Vahe Hahake	2,508	2,165	4,673	67	99	166
	Vahe Hihifo	1,274	1,124	2,398	36	49	85
	Vahe Ha'apai	1,063	969	2,032	41	38	79
	Vahe Vava'u	1,990	1,756	3,746	80	76	156
	Total	9,683	8,722	18,405	272	401	673
Church	Missions	550	575	1,125	24	27	51
	S. D. A.	103	111	214	3	8	11
	Total	653	686	1,339	27	35	62
	Grand Total	10,336	9,408	19,744	299	436	735

Source: Ministry of Education

Table 2-3 PRIMARY BUILDING PROJECT : DEVELOPMENT PLAN IV, JULY 1980 - JULY, 1985

Note : Teacher - Pupil Ratio, 1:30
Alloted Space per child : 3' X 3'
Area of the Classroom : 22' X 22'

Building Programme : In Order of Priority

Name of School	District	Roll 1979	Type of School	No. of Classrooms Required	Cost ($8,000 per CL)	Cost Furniture (Desk, Chairs, Cupboard)	Toilet Facilities	Total
1980-1981								
1. Houma	Nihifo (TT)	324	New	12+	96 000	2 749.80	12 000	110 749.80
2. Kolonga	Hahake (TT)	371	New	13+	104 000	2 978.95	12 000	118 978.95
3. Ha'atu'a	'Eua	266	Extension	3	24 000	687.45	-	24 687.45
4. Fatai	Nihifo (TT)	217	Extension	3	24 000	687.45	-	24 687.45
5. Ma'ufanga	Vaheloto (TT)	765	Extension	10	80 000	2 291.50	-	82 291.50
							SUB-TOTAL -	361 395.15
1981-1982								
1. Houma	Vava'u	103	New	3	24 000	687.45	6 000	30 687.45
2. Longoteme	Hahake (TT)	214	New	7	56 000	1 604.05	6 000	63 604.05
3. Ngele'ia	Vaheloto (TT)	586	Extension	6	48 000	1 374.90	6 000	55 374.90
4. Nuku'alofa	Vaheloto (TT)	840	Extension	10	80 000	2 291.50	-	82 291.50
5. 'Ohonua	'Eua	246	Extension	3	24 000	687.45	-	24 687.45
6. Folaha	Hahake (TT)	171	Extension	2	16 000	458.30	-	16 458.30
							SUB-TOTAL -	273 103.65
1982-1983								
1. Neiafu	Vava'u	725	New	16+	128 000	3 666.40	12 000	143 666.40
2. Veitongo	Hahake (TT)	220	New	7	56 000	1 604.05	12 000	69 604.05
3. Matamaka	Vava'u	49	Extension	2	16 000	458.30	-	16 458.30
4. Kapa	Vava'u	42	Extension	2	16 000	458.30	-	16 458.30
5. Tefisi	Vava'u	160	Extension	1	8 000	229.15	-	8 229.15
6. Houma	'Eua	63	Extension	1	8 000	229.15	-	8 229.15
7. Fasi	Vaheloto	417	Renovation	Conversion of Hall	36 000	2 062.35	-	38 062.35
							SUB-TOTAL -	300 707.70

Name of School	District	Roll 1979	Type of School	No. of Classrooms Required	Cost ($8,000 per CL)	Cost Furniture (Desk, Chairs, Cupboard)	Toilet Facilities	Total
1983-1984								
1. Holonga	Vava'u	128	New	4	32 000	916.60	6 000	38 916.60
2. Hihifo	Ha'apai	521	New	10	80 000	2 291.50	12 000	94 291.50
3. Vaipoa	Niuatoputapu	280	New	4	32 000	916.60	6 000	38 916.60
4. Havelu	Vaheloto (TT)	486	Extension	6	48 000	1 374.90	-	49 374.90
							SUB-TOTAL -	221 499.60
1984-1985								
1. Holonga	Hahake (TT)	141	New	4	32 000	916.60	6 000	38 916.60
2. Tongamama'o	Niuafo'ou	55	New	2	16 000	458.30	6 000	22 458.30
3. Sia'atoutai	Hihifo (TT)	75	New	2	16 000	458.30	6 000	22 458.30
							SUB-TOTAL -	83 833.20
							GRAND TOTAL -	1 240 539.30

CHAPTER 3

BASIC DESIGN

CHAPTER 3 BASIC DESIGN

3-1 History and Nature of the Sites

There are three school districts in Tongatapu Island; Central School District - Vahe Loto where Nuku'alofa, the country's capital is located, Western School District - Vahe Hihifo, and Eastern School District - Vahe Hahake.

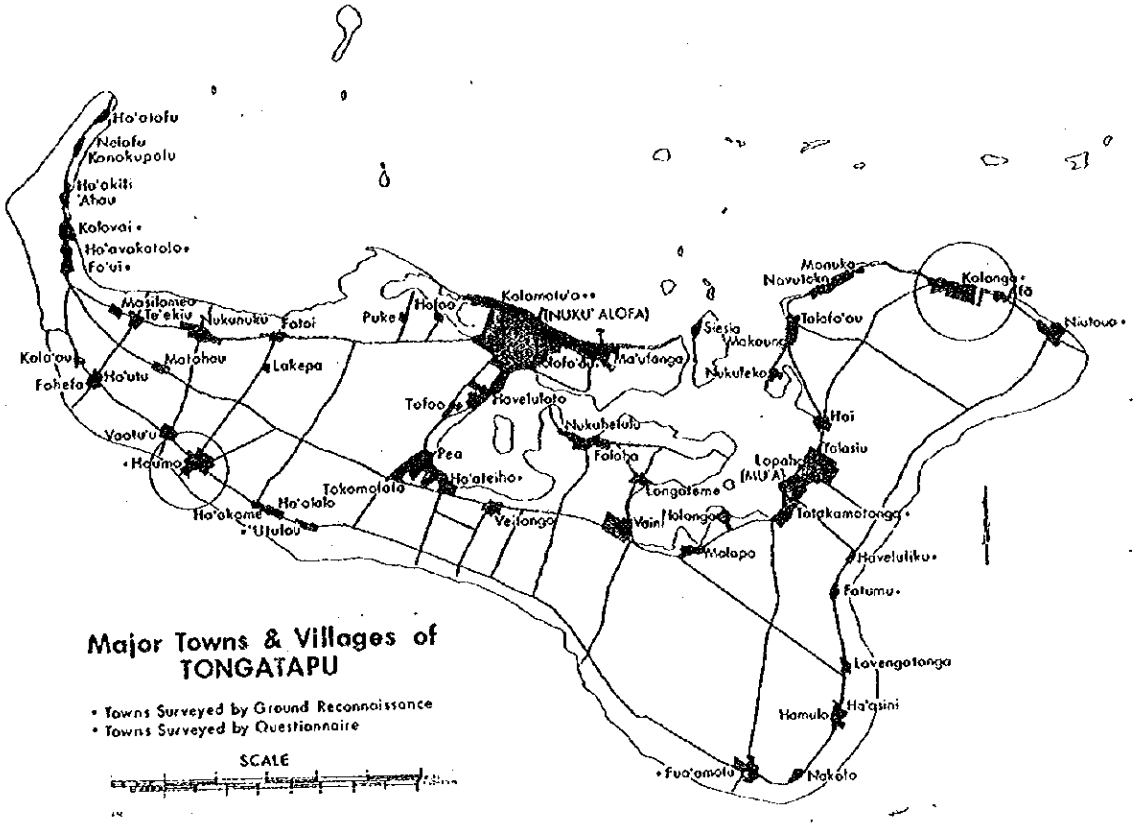
Houma village is located in Vahe Hihifo, and Kolonga village is seen in Vahe Hahake. Each village forms respectively an important administrative center of the island. Approximately 15 kilometers away from Nuku'alofa along a road running through the southern coast of the island, Houma village lies, close to the western tip of Tongatapu Island. The southern coast of the island is found about 700 meters southwest of the road, where 'Blow Holes', a well known spot of scenic beauty is located along a coastline featuring 10 meters cliff made of elevated coral reefs.

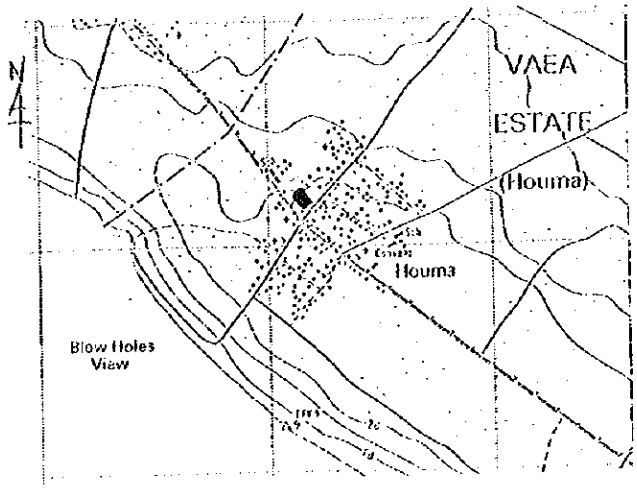
The existing Houma primary school is located to the east of Houma village and is using the buildings that Roman Catholic missionaries have built. The school, however, suffered from the lack of classrooms, being crowded with too many pupils when the children from the Weslayan school in Vaotu'u village to the west were transferred to the Houma primary school. Moreover, the school authorities are being asked by the missionaries to evacuate from the school buildings. Located in the central part of the village, the proposed school is nearer to vaotu'u village than that of the existing school, and is conveniently located to the children who are attending the school.

Kolonga village situated at a height of 5 meters above the seal level, is near the east end of Tongatapu

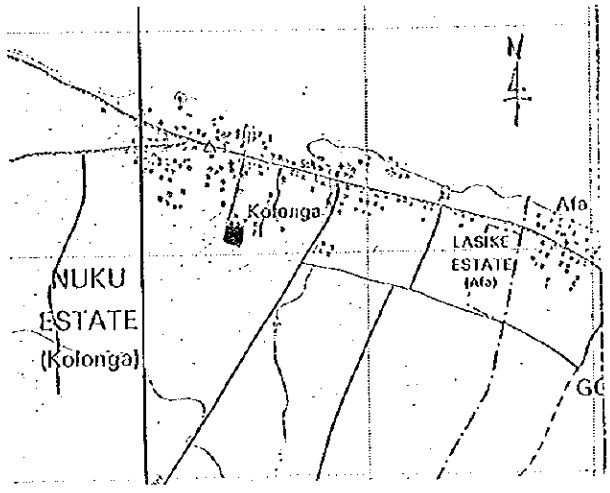
Island, 30 kilometers away from Nuku'alofa, facing road along the northern coast of the island. The northern coast boasting of shallow water in the beach is accessible at a distance of approximately 150 meters north of the road. Haketa, an ancient relics of the capital of Tuitatui Dynasty being flourished in the year, 1200 A.D. is located near Niutoua village to 2 km east of Kolonga village. The site is well known for its giantic structures called 'Ha'amonga Trilithone'.

The present Kolonga primary school is found near the eastern end of the village, close to seashore along the road. Children living in the three villages including Manuka, Kolonga, and Afa are attending the Kolonga primary school which features its Roman Catholic structures equipped with a Catholic hall. This hall, however, is provided for teaching junior class pupils under most unfavorable conditions. The proposed school is situated in the center of Kolonga village, about 300 meters south of the road.





Houma



Kolonga

3-2 Requirements

3-2-1 Climatic Features and Natural Conditions

(1) Earthquake:

Tonga Islands lies between large-scale Tonga Trench running on the east-side seabed and volcanic islands being scattered approximately in parallel with them on the west side.

Thus, Tonga Islands are characterized by typical topography representing the theory of plate tectonics which substantially demonstrates the cause of earthquakes. It seems that Tonga is an earthquake country just as Japan is. Apart from Japan, however, there have been few cases that an earthquake hits directly islands scattering in a small part of vast sea area, and causes damages to the buildings. Thus, this seldom leads to any serious question. Although this is a matter of probability, if an island is directly hit by an earthquake, it will suffer from heavy damages. When Tongatapu Island was hit by an earthquake in June, 1977, a considerably heavy damages were reported.

Accordingly, in Tonga, the same criteria as practised in Japan should be applied in designing aseismatic structures.

(2) Hurricane:

Tropical hurricanes generated in the northern sea area tend to proceed southwards. Its radius is smaller than that of cyclones approaching Japan, but its velocity seems to be the same. Just as in the case of earthquakes, there might be little chance for the hurricanes to approach, but once they should hit an island, there would be serious damages.

(3) Architectural style applicable to the sub-tropical climate:

Taking their economical advantage into account, the architectural styles especially effective to the local climatic conditions have taken root over all islands in the Southern Pacific. These styles have something in common with those prevalent in Japan in terms of the techniques in architecture, although they seem to be different from the modern Japanese construction methods.

(4) Salt damage:

Due to the exposure to oceanic weather, salt damage is liable to occur. In Tonga, water supply and drain pipes made of vinyl chloride are popular. Galvanized steel frames were used in a local factory constructed by New Zealand Aid.

(5) Insect damage on timber:

Timber is vulnerable to insect damage called 'borer'. Although they can be eliminated with an insectfuge in New Zealand, it is not preferable to use timber in the lower part of a building. According to a local engineer, the service life of a wooden building ranges from 10 to 15 years.

(6) Features and problems due to flat topography:

Tongatapu Island consisting of an elevated coral reef is featured by flat topography, there are neither drainage ditches nor rivers in the island. All rainfall infiltrates through the layers of volcanic-ash surface soil - equal to loam to be found in Japan, as well as coral reef. Therefore, whenever a heavy rain hits, some areas are always flooded, and their

exposed loam surfaces become muddy. A countermeasure is paving the ground surface with crushed coral reef.

Inevitably, sewage is being controlled through the application of infiltration method.

3-2-2 Primary School Buildings

In Tonga, Standard Designs have already been drawn up to efficiently construct the schools. There also are construction standards specifying sizes of the classrooms, storing spaces and others.

All building maintenance costs including those for water supply, electricity and maintenance of buildings, are borne by villagers. A strong demand calling for the reduction in these costs was made by the inhabitants. Since water supply is frequently shut off due to economical reasons and others, a combined utilization of water-supply and rainfall is desirable. Incidentally, most primary schools are equipped with flush toilets.

3-2-3 Construction Materials and Labour

Labour circumstances, skill of workers, locally available materials and construction equipment in Tonga are quite different from those in Japan. However, as for buildings such as those for a primary school, there can be no question at all, as long as most common construction methods in Tonga are to be applied.

When building materials are all brought from Japan, the transportation cost comes to a vast amount. If materials except for steel skeletons are locally procured, overall expenditures will be reduced to some extent. If they are bulky products such as furnitures, their costs would be considerably reduced.

3-2-4 Term of Construction Works

During the months from January to March, the country is in the wet season, and precipitation is greater than that in Japan throughout the year. Workermanship exceeding about one third of that of the Japanese workers can not be expected there, and this would makes it necessary to extend the term of construction works by more than twice that in Japan.

Since a new school year begins in January, it is hoped that the construction works will be completed by November in the preceding year.

3-3 Basic Principles

On the basis of the requirements mentioned in the preceding paragraph, the principles governing the guidelines for basic design will be as listed below.

(1) Taking note of the process of historical changes in the field of education, and also taking into consideration of the real situation in Tonga, the Tongan people's desire should be fully reflected on the proposed plans. Various efforts should be made to avoid possible confusions in the adoption of modern Japanese method into this country.

(2) In order to make maximum use of available lands for proposed buildings and considering an impact having on the surrounding areas, it is necessary to work out effective lay-out plan of the buildings and utilization of lands, especially lands with extra spacing for future extension. Local costs required to the consolidation of the site should be reduced to the minimum level.

(3) To use the most popular and suitable building styles and construction methods practised in the country under the natural and weather conditions, and to carefully work out locations of the buildings and determine appropriate styles by using basic theories for building design in sub-tropical areas.

(4) To conduct thorough functional analysis while designing classrooms and others based on the results of the survey, and to work out appropriate and efficient plans.

(5) To take local conditions into full consideration in connection with the evaluation of the maintenance costs for buildings.

(6) When there is a great need to construct school buildings, the emphasis should be given to quantity rather than quality. Although it seems difficult to complete the two school buildings based on the Minutes of Discussion within the budgetary limitation, efforts should be made to meet the Tongan people's desire, and by conducting thorough economic analysis, the construction plans should be worked out reflecting budget.

3-4 Selection of Building Style and Construction Methods

3-4-1 Building Style

A building style suited to the natural conditions should include ventilation and shading devices. Taking into account the economies of the building structure, the features of the building styles to be applied in Tonga are of deep eaves with their height held low, high ridges and windows fitted with glass louvers to secure adequate ventilation. Apart from the Japanese styles, the first priority should be given to the ventilation. Heat insulation device is not so developed due to economic reasons. As a result, the primary step to cope with the natural conditions is to locate school buildings against the wind direction, and attention should be paid to the formation of openings. High ridges is useful for dispersing radiant heat. Ceilings are effective to insulate heat, but the school buildings in Tonga are not usually provided with this fixture for economic reasons. Since Tonga enjoys sub-tropical climate, the atmospheric temperature falls during the winter season. All windows have to be shut down for the season. There was a case that the application of tropical building style resulted in many defective buildings in the early period of the days. From economical viewpoint the concrete flooring is recommendable. However, due attention must be paid to poor drainage capability of loam surface layer, as it has been mentioned, and caution should also be taken against upward moisture infiltration from the schoolyard around the buildings. It is also important to take measures against inundation when hurricanes are hitting.

3-4-2 Selection of Construction Methods

Main factors to be considered in selecting a construction method are complicated, however, they may be summarized as below:

1) Earthquake.

2) Salt damage.

3) Various local conditions affecting the construction works, such as:

   - available materials and their costs;
   - available manpower and its coasts;
   - technical level of workers and their efficiency;
   - construction equipment.

4) Costs of materials in Japan, cost of transportation.

5) Term of construction.

6) Measures taken for wet season in relation to the construction period.

7) Insect damage on timber.

8) Maintenance and management of building after its completion.

The first conclusion derived from the findings of the survey team is that the transportation costs accounts for a large portion of the construction cost, and because of this, a prefabrication method, for example, which needs to transport large bulk of materials is not feasible from economic standpoint.

In conclusion, it has been clear, as a result of cost analysis, that construction should be carried out by using materials obtained in Tonga as much as possible, in selecting a construction method.

The month, November, 1981, is the final completion date requested by the Government of the Kingdom of Tonga. Its construction may be delayed during rainy season. The labour quality is low in efficiancy. Therefore, it is necessary to choose appropriate construction method in order to finish the work by the completion date. This is the second factors to be studied in the selection of a construction method. In other words, it means that an adequate devise must be selected which enables us to execute works regardless of rainy weather.

In addition to the above mentioned factors, earthquake, insect and salt damage are to be considered. As a result, an adequate construction method adopted is as follows:

(1)	Footing:	Reinforced concrete footing placed on crushed coral stone rubble.
(2)	Floor:	Moisture-proof course on crushed coral stone rubble.
		Reinforced concrete placed on it, trowel finished.
(3)	Column:	Steel, sheathed with concrete, cast-finished.
(4)	Independent Column:	Reinforced concrete block construction, decorated laying.
(5)	Beam:	Steel, coated with zincchromate and then with marine paint.
(6)	Purlin	Wooden construction coated with oil paint.
(7)	Roof:	Galvanized sheet iron roofing.
(8)	Wall:	Reinforced concrete block construction, decorated laying.

(9)	Lying Beam (Bond Beam):	Reinforced concrete, cast-finished.
(10)	Upper Wall:	Wooden boarding.
(11)	Window:	Aluminium sash, glass louver window and, partly in-swinging glass window.
(12)	Door:	Plywood flush door finished with oil paint.

A special feature of this construction method is the utilization of steel frames to resist the transverse stress (caused by earthquakes and hurricanes), and to shorten the term of construction works. Block bearing wall along with wooden truss construction method of Tonga may present some problems, when the severe Japanese design standards which attach importance on the protective measures against transverse stress are applied. In view of the term of construction works, applicable method is to erect steel frames, and cover them with a roof in the first place so that block wall laying which requires many days to complete may be applicable regardless of the rain.

To eliminate rusting, lower portions of the steel frames are sheathed with concrete if it is economically practicable. Rust-proof agent should be applied to the upper portions.

As to the materials of a wall, it is most reasonable to use concrete blocks produced in Tonga in view of the circumstances mentioned above.

Use of timber is limited only to upper structures least threatened by insect damage.

As for roofing material, galvanized iron sheet can be used not only for economic reason, but also for

utilization of rainwater. Corrugated asbestos cement sheets may be used for roofing, but moss growing on them may cause problems.

Main openings of the windows should be of the glass louver type in local use. In addition, aluminium sashes should be used in view of salt damage, although they are somewhat expensive.

3-5 Conditions of Site

3-5-1 Site of Houma Primary School

The site is situated northwards from the center of the village. Groves are seen in the north and west, thick undergrowth makes it difficult for a man to walk through the site. Private houses are scattered in the grove to the east. The buildings of the middle school stand in the south direction across the playground and private houses. The space between the playground and private houses does not form a clear road.

The southern parts of the site are groves of coconut parms, mango trees, bread trees and others. The site is generally flat area with its southern part heightened slightly, forming a gentle slope to the northwards, so that a man walking feels that there is almost no slope.

The conditions of foundation at the test pitting point are such that humus soil of about 200 mm thick lies on a loam layer of 2,500 mm thick which in turn rides coral limestone. It is reported that coral reefs undulate by changing its depth from one place to another.

Site consolidation, provision of electric and water service lines to the site border are furnished at local expenses. Gardening and pavement of passage-ways with crushed coral stone are also completed at local expenses after the buildings are completed.

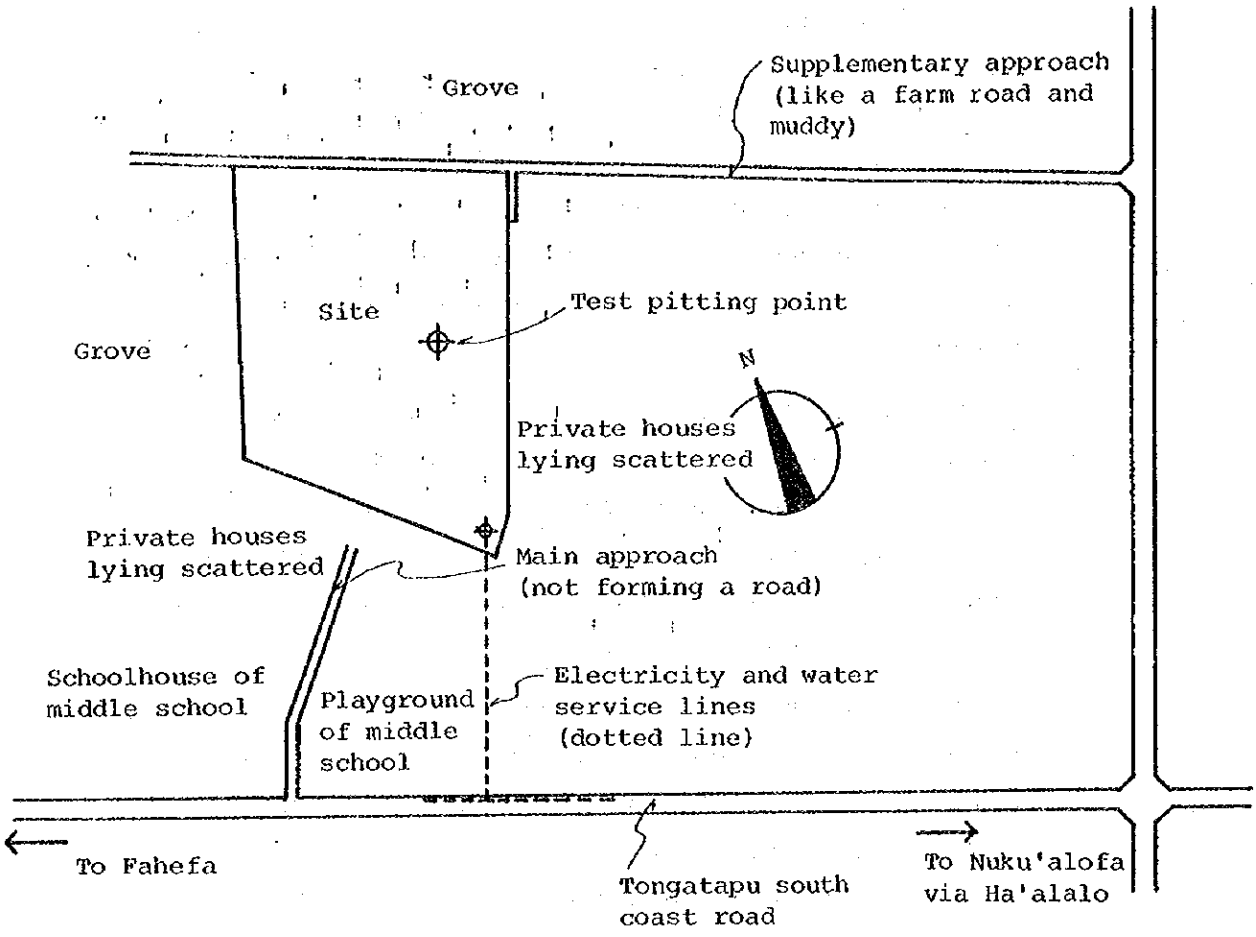
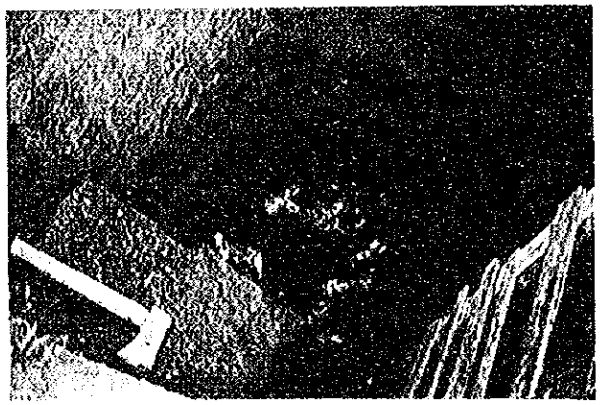


Fig. 3-1 Areas Around the Site at Houma



Test pitting

3-5-2 Site of Kolonga Primary School

The site is situated southwards from the center of the village. The northern and northeastern parts to the site are covered with turf-like grass with private houses lying sparsely. The remaining parts are groves which are difficult for a man to step in. A projected road is dividing the site into two portions. Although it is now a grove, but is expected to be cleared to make a road by the time the school will be constructed.

Groves covering the site make it difficult to step in, unless they are cleared. But the ground is approximately flat. There is a small swamp within the site which is not in the specified construction area. Although the existence of swamps in the site of building construction could not be confirmed, it should be done so immediately after the groves have been cleared.

The conditions of foundation at test pitting point are such that the surface is humus soil of 600 mm deep and loam layer of 1,100 mm deep lies beneath it to reach coral limestone, of which conditions are the same as those at Houma.

The same operations as those at Houma are conducted at local cost. The existing approach paved with coral stone presents no problem, but the newly constructed section of the projected road requires some measure for muddy road.

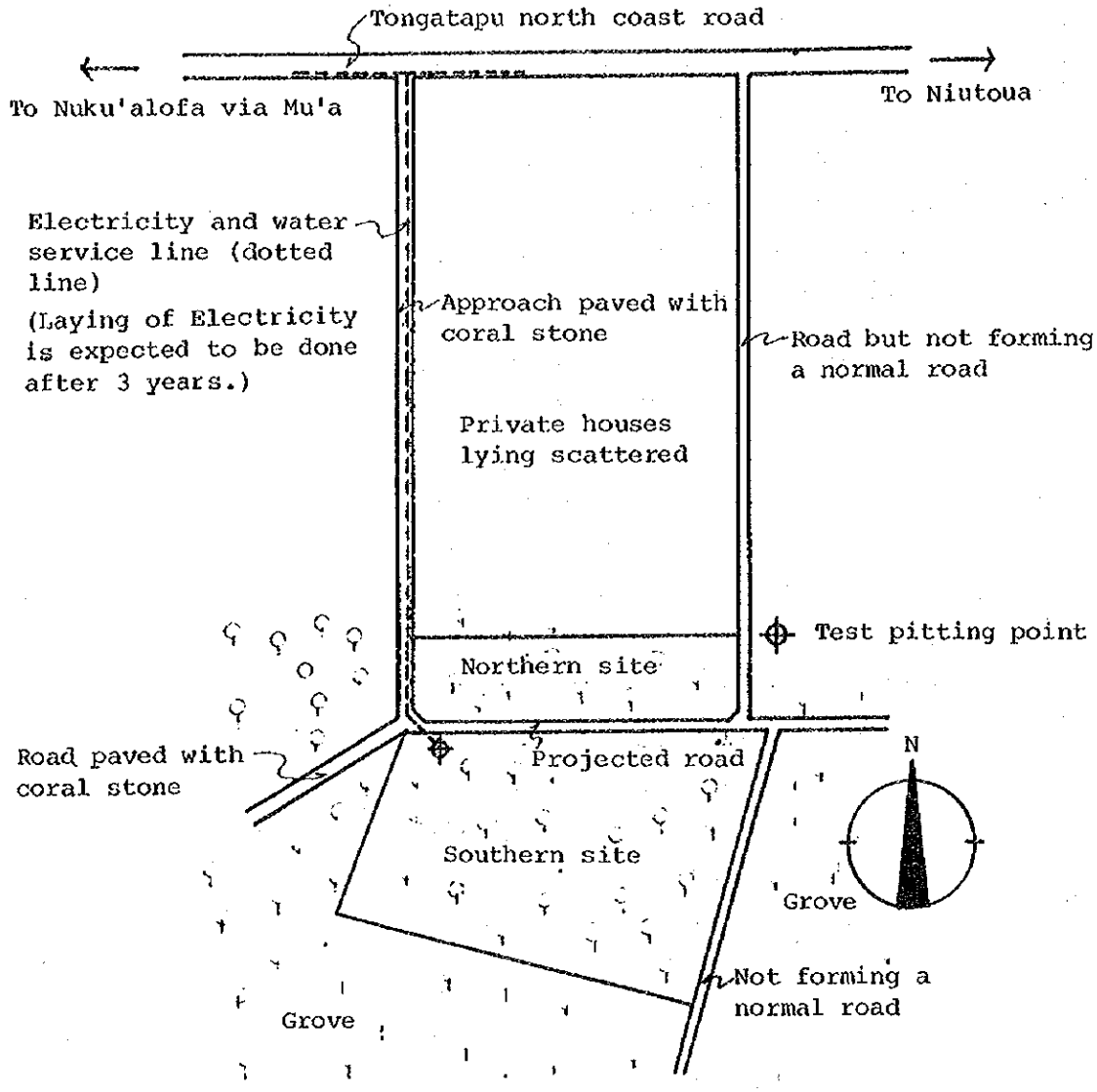
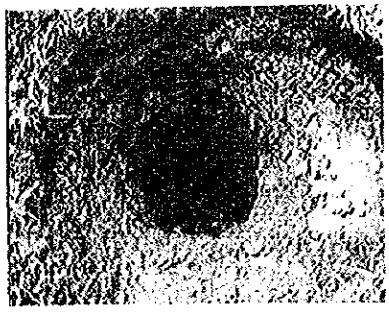


Fig. 3-2 Areas Around the Site at Kolonga



Test pitting

3-6 Outline of Basic Design

3-6-1 Site Planning

Along with buildings and playround, a training farm is required. The playground is not provided with children's game facilities such as those seen in Japan, and no standard is set for its size and shape. However, a spacious lawn is required to enable the children to enjoy folk dances all together.

The direction of the ridges of the buildings are arranged giving the first priority to wind directions. Wind blows from the east and the southeast most frequently at an annual frequency of 70 percent. Water closets are also positioned taking these wind directions into account. Separate buildings are provided for juniors (infants) and seniors to divide the living territories as it is the common practice in Japan. In Tonga, juniors are composed of the first- to the third-year class pupils and seniors the fourth- to the sixth-year pupils.

(1) Site Planning for Houma Primary School

An access is made from the south and the north directions by two approaches, and thus two gates are required, with the main gate provided on the south.

Training farm is placed on the north judging from the areal development around the site and the play ground is placed on the southeast taking account of that of the middle school bordering on in the south, so that a vast space can be secured at the same time. Buildings are placed in the southwest corner as far as practicable, leaving a space facing the main gate to lay out a front garden.

(2) Site Planning for the Kolonga Primary School

The site is divided by the projected road into two parts. At first, a desire was expressed to build the school in the north site. However, this involves difficulties that the site in question is too narrow to include a playground side by side, necessitating to place it in the south site across the road. In addition, as the land is long and narrow from east to west, it is necessary to build several houses with more connecting corridors, and thus the construction cost increases. On the other hand, a proposal was made to move the road section in question on the north of the site, but this idea presents a major problem in view of the priority. Moreover construction of roads to be connected to the said section has been well progressed. Thus, the use of the south site has been finalized, and the north site is used as a farm.

Buildings should be preferably located westwards in the site, closed to the paved approach. Also, it is required to pave part of the projected road at the local expenses.

In placing buildings, a space facing the main gate is reserved to lay out a front garden as in the case of Houma.

3-6-2 Architectural Planning

Necessary rooms and their functions are as follows:

Classcooms:

These are required to have a space of 7,200 mm x 9,600 mm. Apart from common practice in Japan, desks for each 3 pupils are laid out freely according to curricula. The number of pupils per classroom are 30, making up a smaller class compared with that in

Japan. The required space is relatively large against the number of pupils and this seems to prepare for the increase in the number of pupils in future. Teachers have not their own room, but use their respective classrooms. A large space is necessary for noticing in addition to a space for a blackboard. Teaching materials of teacher's own making are put up in a crowded fashion in each classroom. Since regular teaching materials are in common use, and not to be brought home by pupils, some shelves are necessary to keep them within the classrooms.

Classroom for In-service Training of Teachers:

One of the classrooms is used for in-service training of teachers. The same specifications should be applied to this classroom so that it may be used as an ordinary classroom in future after its initial purpose has been attained. It should be provided in the seniors' building and preferably at a quiet place as far as possible. A power source is necessary for projection purposes.

Assembly Hall:

Movable partition walls between 4 classroom will be removed to make a spacious hall. Opinions differed as to whether such hall should be included in the building for seniors or in that for juniors, but it is planned to use the latter's building for this purpose according to the usual practice in Tonga. The method adopted there to move a partition wall is to use a overhanging folding door of simple flush panel. It is not advisable to use a method largely different from those practised at the site in view of the amount of maintenance work. Power sources are necessary for projection purposes.

Principal's Office:

The required space is 3,600 mm x 3,600 mm in area. A single room for teachers' use and cupboard are requested to build. A general office is included in the Standard Design, although not included in the requirements. This office is next to the principal's office and is designed to hold meetings by teachers and interviews with pupils etc.

Store Rooms:

Store rooms of 2,400 mm x 2,400 mm in area are required for respective classrooms to keep teaching materials. In these store rooms cupboards are required to be provided.

Lavatory:

It is necessary to make separate entrances for male and female pupils as far as possible. In addition, a request was made to provide entrance equipped with doors to be locked. This seems to be the step to prohibit the use of lavatory while suspended water supply and to prevent supplied water from being used by outside people. Effective means for ventilation and lighting is to provide openings in the upper parts of walls and top light on the roof.

In addition, the provision of drink fountains, cleaners' closets and teachers' lavatory was requested by the Tonga side.

Request for the provision of gymnasium and music hall was not presented, but their aim would be satisfied, if teachers can hold these excercises in the classrooms.

As a pattern of planning, the territories are separated between the seniors and the juniors as described in the above paragraph and the open corridor

systems which enable natural ventilation is adopted in view of natural conditions and economy. The required shape of classrooms is of a type as allowing wind to blow smoothly through rooms from east to west. Lavatories should be provided separately for seniors and juniors, and are placed taking account of wind blow direction. It is desirable to position the principal's office in the center of the building to provide a grance over the whole school.

The most important point in sectional planning is how it can be adaptable to the natural conditions. On this point, description has been made in paragraph 3-4-1. A double ceiling is not appropriate and windows are of glass louver type. The height of the window sill should be low position for ventilation and natural lighting purposes.

From the standpoint of visual design, a building which will be matching well to a grove of coconut palm at the site is such that accentuated by holizontal lines, having a gable or hipped roof with deep eaves. An overall shady atmosphere of a building is one of the basic elements to be considered.

Exterior walls of concrete block match relatively well to the natural features and these blocks being locally produced can be used economically.

Independent columns of corridors are designed with special caution, as they accentuate the external appearance.

3-6-3 Structural Planning

In Tonga, neither regulations nor standards have been effective. Therefore, it will be reasonable to apply Japan's Building Standards Law and standards of

Architectural Institute of Japan, both of which are adaptable to the actual circumstances at the site.

(1) Framework Planning

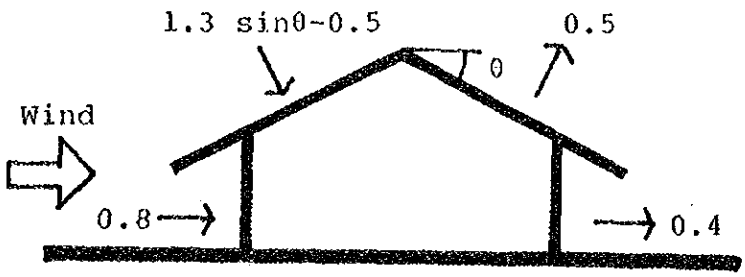
The features of this framework is that transverse stress in ridge direction is resisted by steel frames and that in span direction by reinforced concrete block walls, i.e., partition walls. As described in paragraph 3-4-2, - Construction Methods, aside from the requirement arising from the term and execution of construction works, using pure reinforced concrete block construction method does not conform to the Japanese standards, and the buildings to be completed by the method cannot be considered safe against earthquakes. A problem involved in this connection is the utilization of different kinds of structure with which movement varies depending on directions. A method adaptable to solve this problem is to sheathe steel columns with concrete and integrate them with concrete blocks through anchor reinforcing bars of the latter. This method also contributes to enhance the weather resistance of steel columns.

(2) Load

a) Wind pressure $q = 120 \text{ kg/m}^2$

(42.7 m/sec)

Wind pressure coefficient



b) Seismic force $k = 0.2$

c) Allowable bearing capacity of soil

$fe = 5.0\ t/m^2$ (long term)

3-6-4 Facilities Planning

The contents of facilities should be minimized considering the local circumstances that maintenance costs are borne by the villagers as well as possible discrepancies between the proposed and existing schools.

(1) Water supply:

The village is provided with waterworks facilities. A service pipe is expected to be laid up to the border of the site at local cost. However, this water supply is apt to be suspended due to various reasons, so that rainfall is utilized to supplement it. A water tank should be built to cope with actual water consumption and mean monthly precipitation during dry seasons. Another elevated tank should be provided so that appropriate water pressure can be obtained, and water will be drawn up with a hand-pump. Alternative measures which require no elevated tank and pump have been worked out, but they have proven to be unsuccessful because of various problems involved. The use of a hand pump will be most effective, although it is troublesome.

(2) Lavatory:

Lavatories are equipped with flushing equipment. For each one of the schools, the following toilet utencils will be provided after they are equally divided for both senior and junior school building.

Male Lavatory:

4 commodes

6 urinal stalls

4 wash basins

Female Lavatory:

8 commodes

6 wash basins

In addition to the above, two lavatories for teachers with commode and wash basins will be furnished. Ground sinks are provided in male lavatories for cleaning purpose.

The number of commode available seems to be rather few, but it is reasonable when the maintenance cost is taken into account.

(3) Drinking fountain and water for miscellaneous purposes

The drinking fountain and the ground sink for washing and cleaning purposes are provided at two points along the corridor near the water section.

(4) Since no drainage facilities are available at the site, infiltration is the only effective method. A septic tank of local standards will be furnished.

(5) Lighting and Receptacle:

One lighting fixture is installed in each room except store room. One receptacle is installed in the classroom for in-service training of teachers and principal's office, and two receptacles to juniors' classroom which will be used as a meeting hall. Available electric voltage is as high as 240 V. To prevent danger caused by high voltage, receptacles

should be installed not in classrooms but in store rooms.

3-6-5 Supply of Furniture

Basic equipment agreed upon in the Minutes of Discussion is as follows:

Desks and benches for pupils including spare parts.

Desks and benches in the classroom used for in-service training of teachers will be of a type to be adjusted for use by pupils.

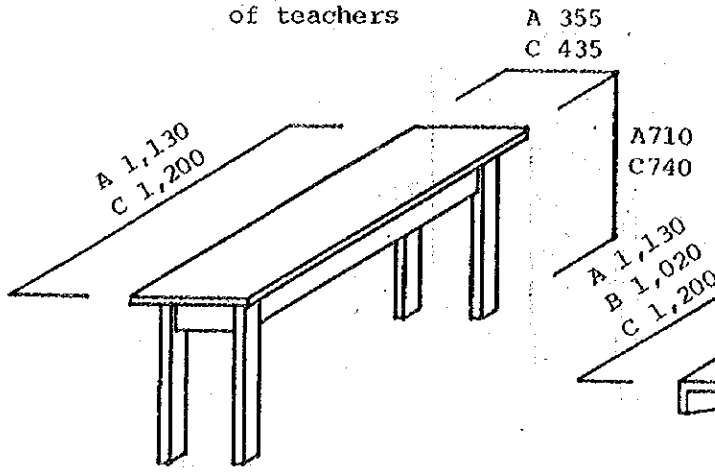
These desks and chairs/benches will be made of wood unless otherwise specified and be finished with clear lacquer.

Notice boards will be one of the fittings and included in the section of construction.

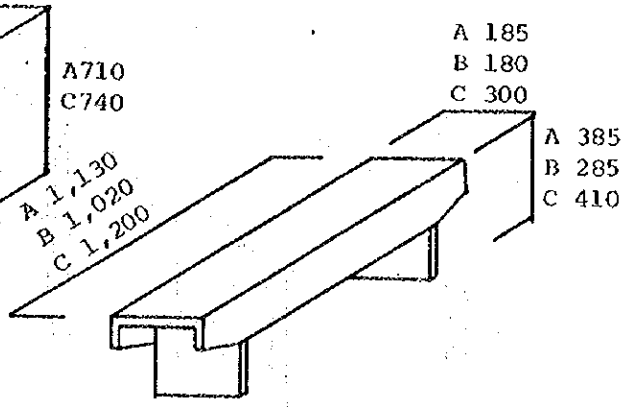
Table 3-1 Necessary Furnitures and Equipment

Name	Specification	No.		
		Houma	Kolonga	Total
Desk for seniors	For 3 pupils	69	78	147
Desk for juniors	"	46	58	104
Bench for seniors	"	69	78	147
Bench for juniors	"	46	58	104
Desk for in-service training of teachers	For 2 teachers	10	10	20
Bench for in-service training of teachers	"	10	10	20
Desk for teachers		11	13	23
Chair for teachers		11	13	23
Desk for principal		1	1	2
Chair for principal		1	1	2
Built-in blackboard	3,600W x 1,200H, wooden (except those mentioned below)	9	11	20
Movable blackboard	2,700W x 1,200H, wooden (that fitted to the movable partition wall between juniors' classrooms	2	2	4
Sideboard for classroom		11	13	24
Cupboard		12	14	26

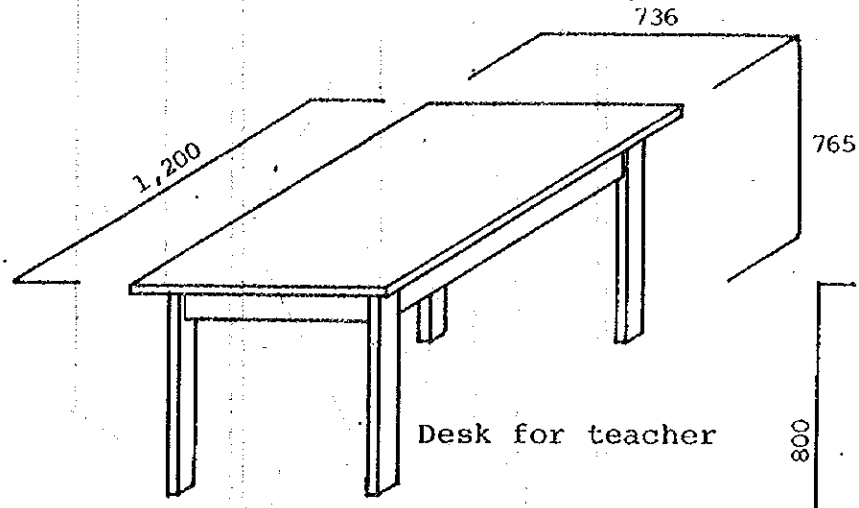
Note: A - for seniors
B - for juniors
C - for in-training
of teachers



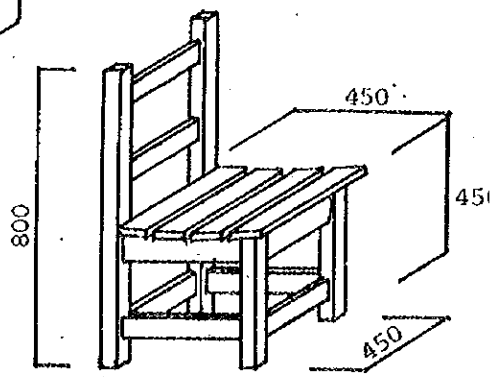
Desk for Pupil



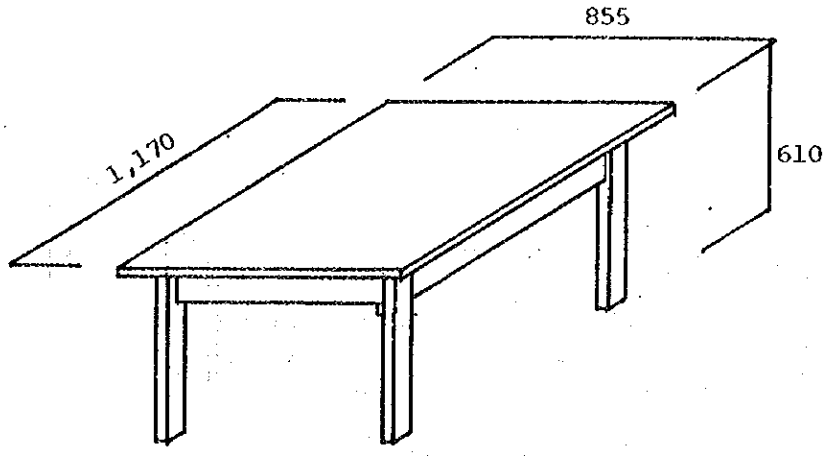
Bench for Pupil



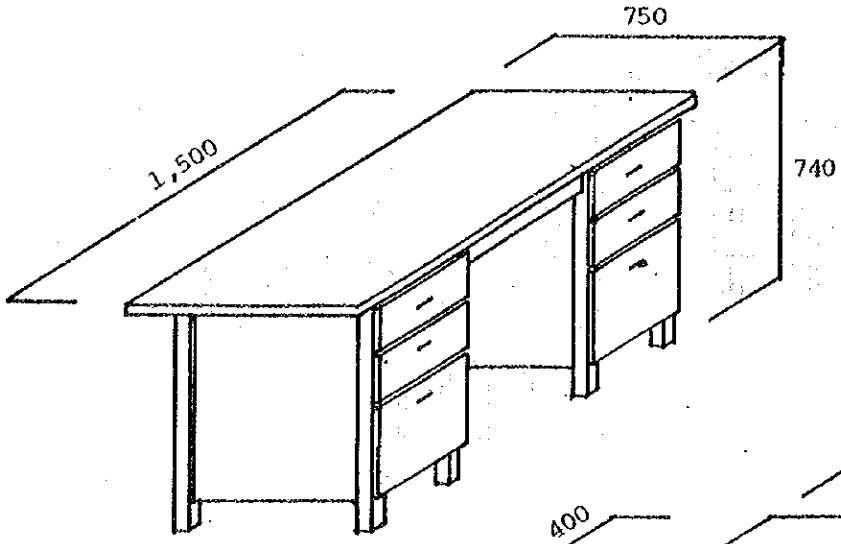
Desk for teacher



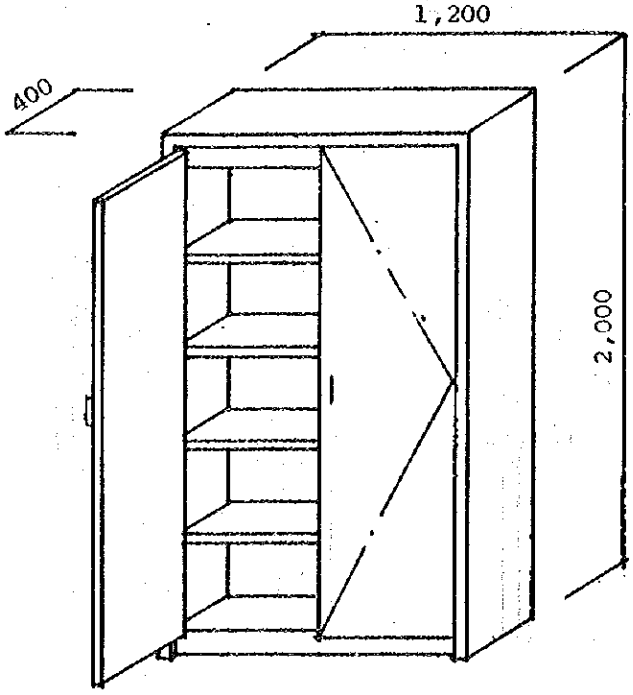
Chair for Principal
and Teacher



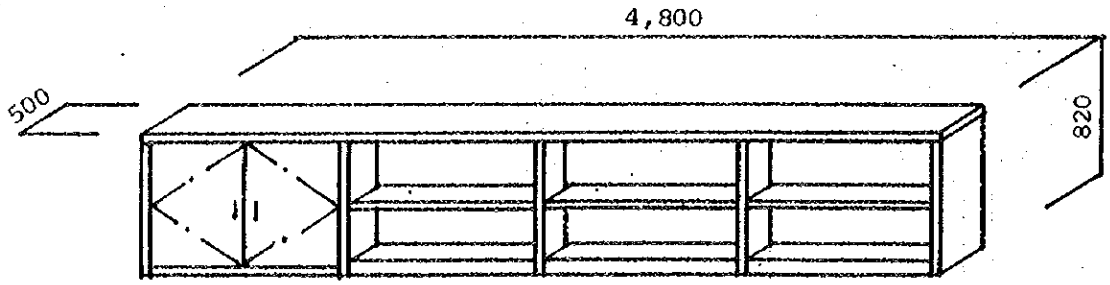
Desk for Pupil (The Junior)



Desk for Principal



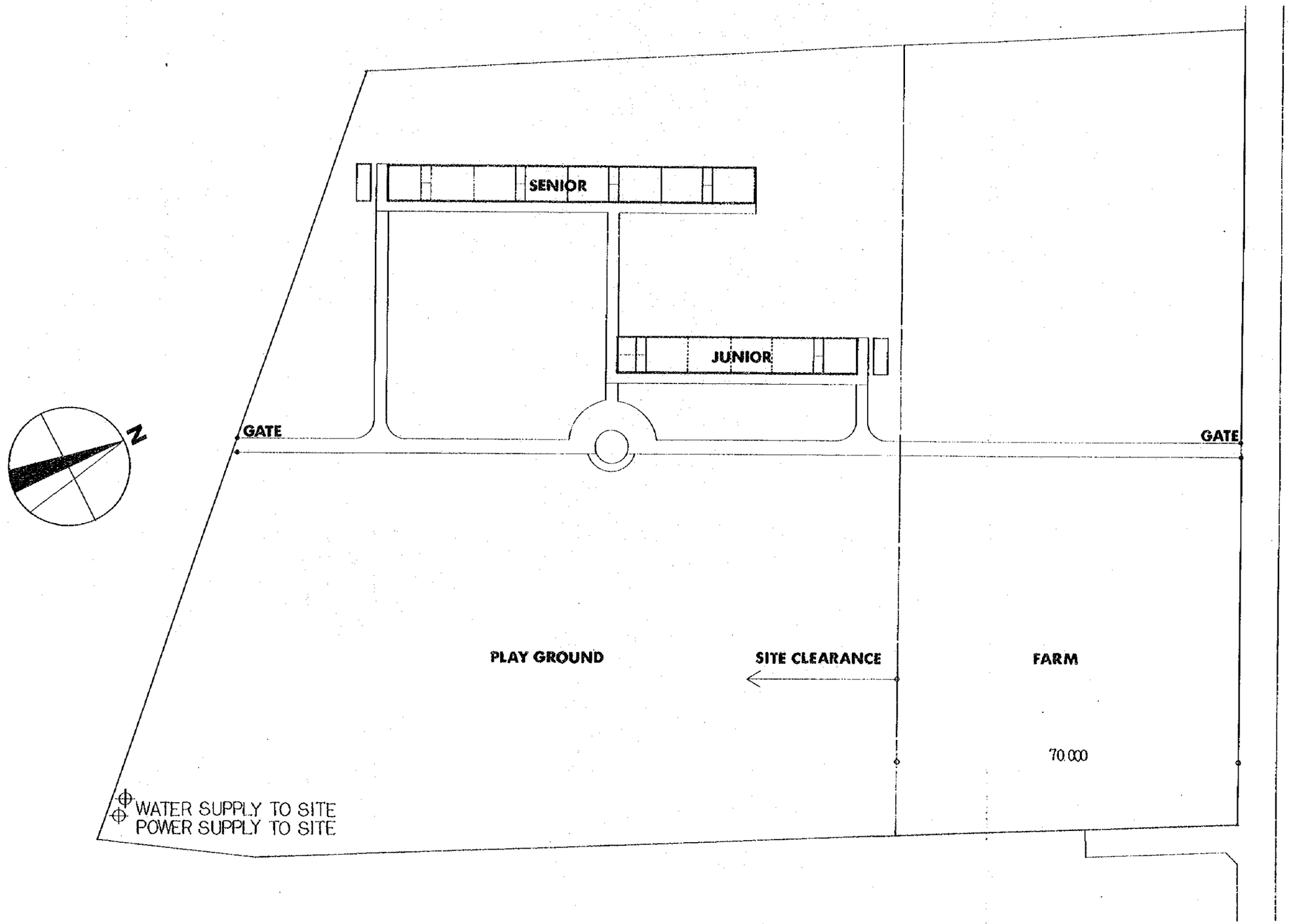
Cupboard



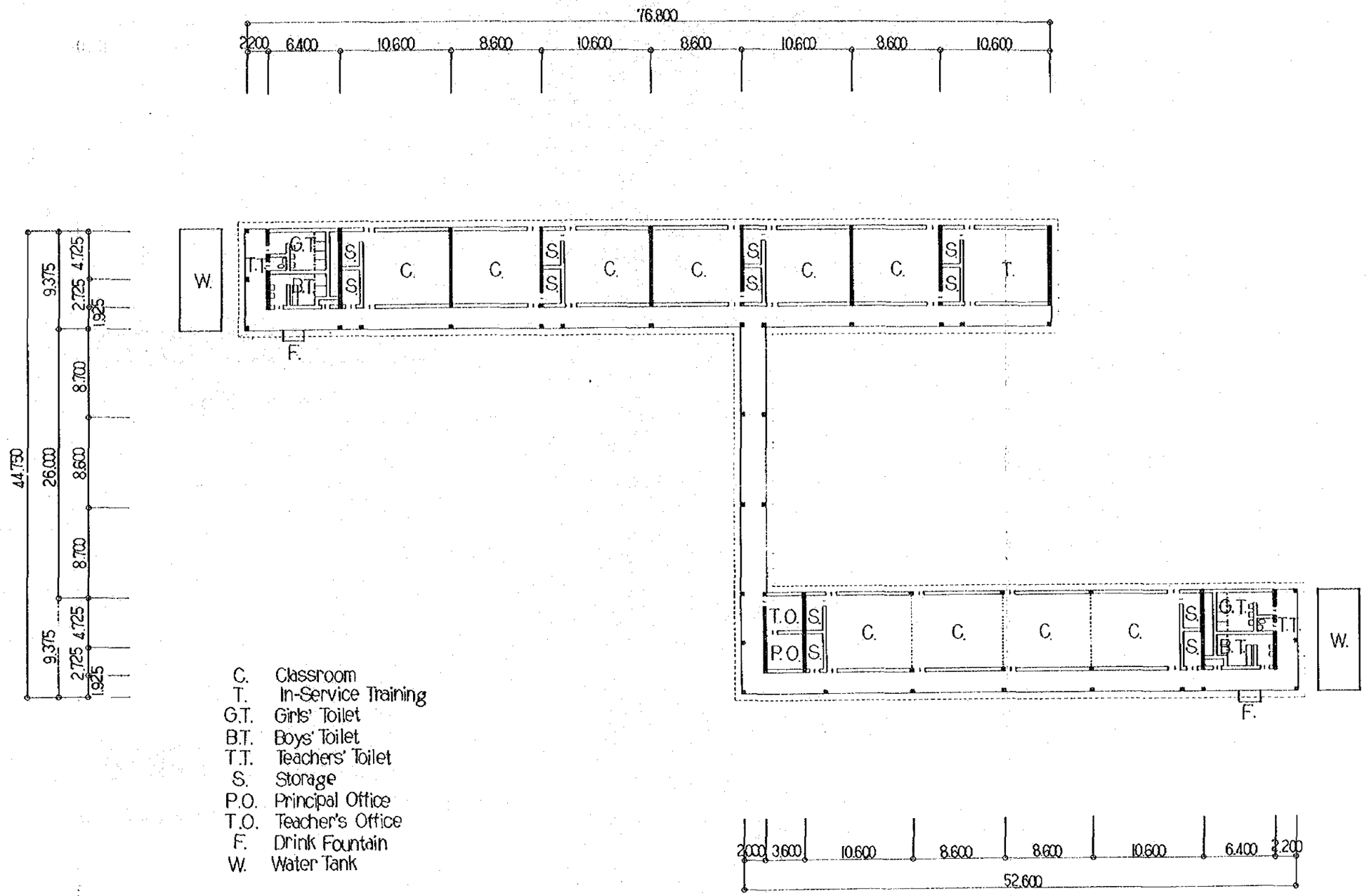
Sideboard for Classroom

3-7 Basic Design Drawings

1. HOUMA PRIMARY SCHOOL - Site Plan
2. " - Floor Plan
3. " - Elevation & Section
4. KOLONGA PRIMARY SCHOOL - Site Plan
5. " - Floor Plan
6. " - Elevation & Section



HOUMA PRIMARY SCHOOL-SITE PLAN s. 1:800



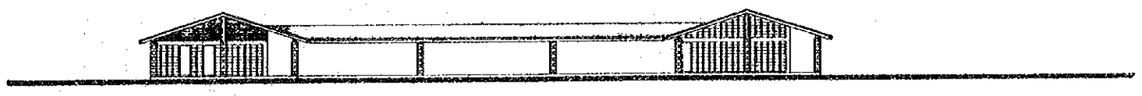
C. Classroom
T. In-Service Training
G.T. Girls' Toilet
B.T. Boys' Toilet
T.T. Teachers' Toilet
S. Storage
P.O. Principal Office
T.O. Teacher's Office
F. Drink Fountain
W. Water Tank

HOUMA PRIMARY SCHOOL - FLOOR PLAN s. 1:400

EAST ELEVATION

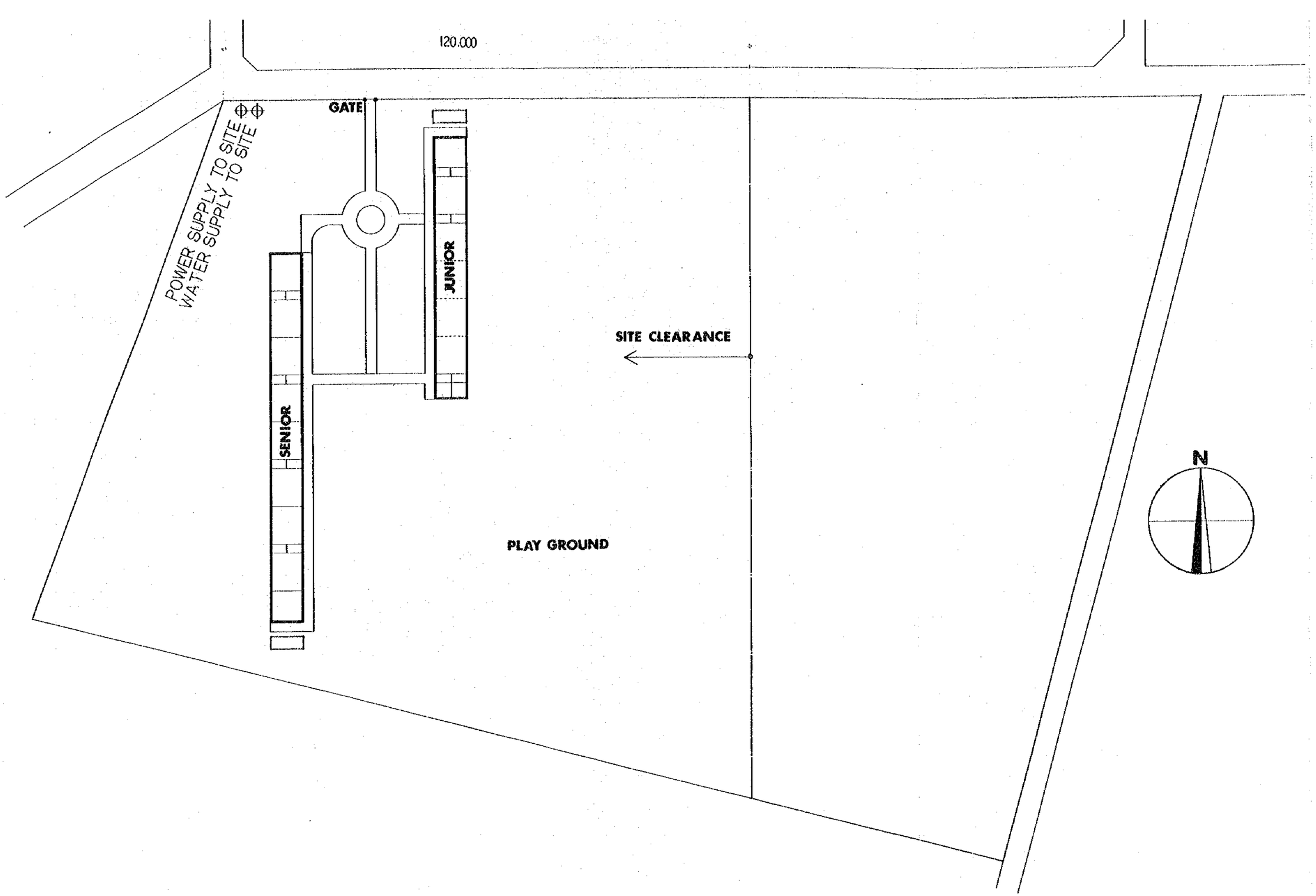
4.535
2,100
300 2,135

SECTION

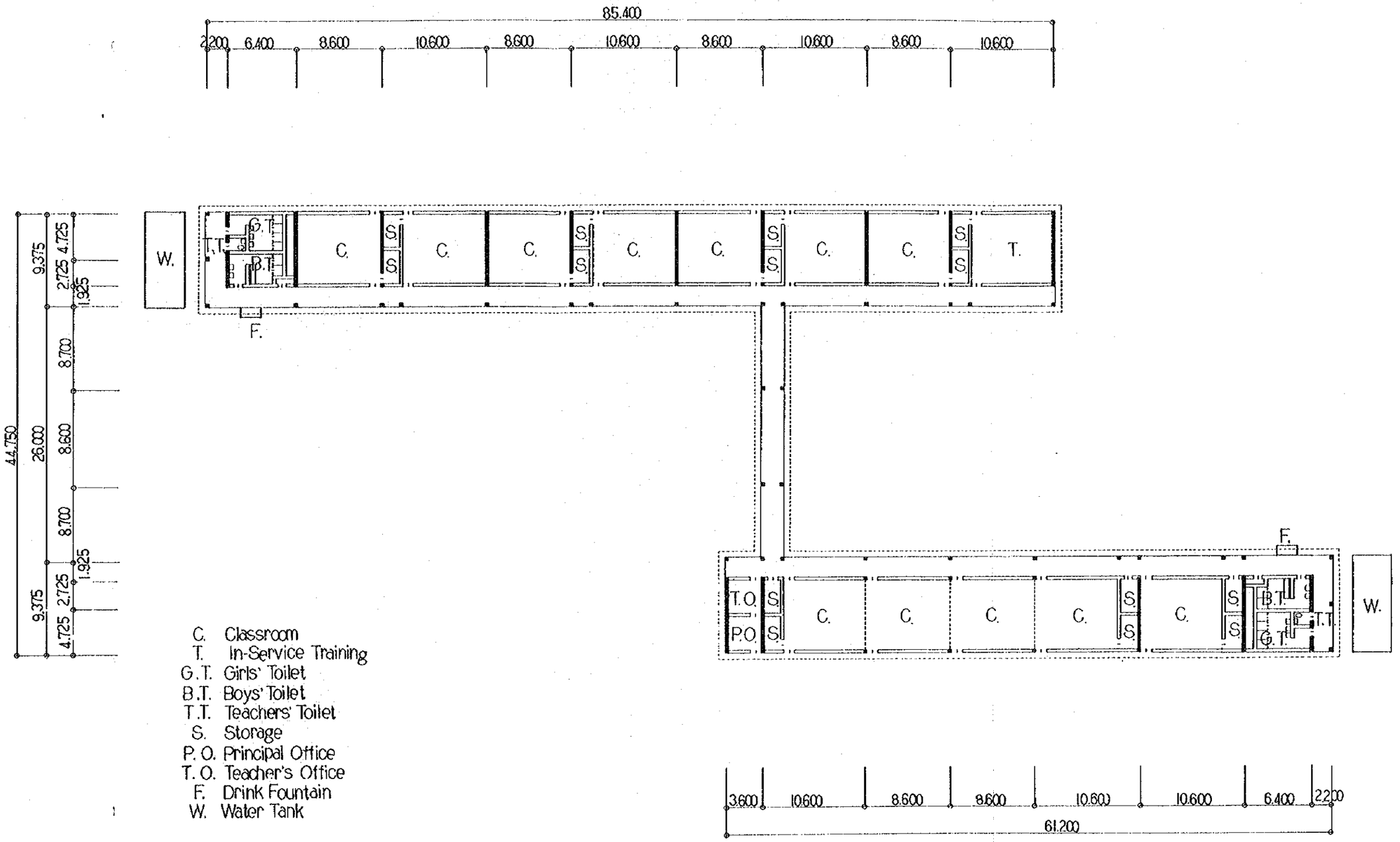


SOUTH ELEVATION

HOUMA PRIMARY SCHOOL-ELEVATION&SECTION s. 1:400



KOLONGA PRIMARY SCHOOL-SITE PLAN s. 1:800



C. Classroom
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T. O. Teacher's Office
F. Drink Fountain
W. Water Tank

KOLONGA PRIMARY SCHOOL-FLOOR PLAN s. 1:400

EAST ELEVATION

4.535
2.100
300 2.135

SECTION

SOUTH ELEVATION

KOLONGA PRIMARY SCHOOL-ELEVATION&SECTION s. 1:400

3-8 Construction Planning

3-8-1 Materials and Labour

(1) Quantity of Principal Materials

Table 3-2 Principal Materials

Name	Unit	Quantity		
		Houma	Kolonga	Total
Coral crushed stone for foundation works	m^3	234	264	498
Coarse aggregate, coral crushed stone	m^3	301	339	640
Sand	m^3	172	194	366
Cement	ton	87	97	184
Reinforcing steel	ton	15.3	17.3	32.6
Steel frame	ton	36.9	41.6	78.5
Concrete block (200 - 100 thick)	piece	11,300	12,600	23,900
Galvanized sheet iron (for roofing)	m^2	1,690	1,890	3,580
Hardboard, 1,000 x 2,000	sheet	246	287	533
Timber, structural	m3	6.5	7.3	13.8
Timber, for fixtures	m3	6.3	7.1	13.4
Paint, ready mixed oil paint	kg	590	660	1,250
Paint, marine paint	kg	740	840	1,580
Aluminium louver window (8 blades, 750W x 1,140H)	piece	209	243	452
Sheet glass for louver (750 x 165)	sheet	1,672	1,944	3,616
Aluminium in-swinging window (250W x 450H)	piece	9	11	20
Wooden flush door (900W x 2,000H)	piece	56	62	118
Wooden flush folding door (920W x 2,000H x 7 leaves)	piece	3	3	6
Vinyl film	m^2	940	1,080	2,020
Commode	piece	11	11	22
Wash basin	piece	9	9	18
Electric wire	m	480	380	860
Lightint fixture	piece	18	20	38

For furnitures, see Paragraph 3-6-5, Supply of Furniture.

(2) Supply of materials

Among building materials required for this project, locally available materials include only crushed coral stone being used for foundation works, aggregate to make concrete, concrete blocks and timber for temporary work. Other materials will have to be imported from abroad. To import these materials the following four methods will be made available.

1) A general contractor procures these materials in Japan for transportation.

2) A general contractor imports these materials directly from New Zealand or Fiji etc.

3) To entrust import business to the Ministry of Works and Commodities Board, government agencies for procuring these materials.

4) To entrust import business to a local subcontractor.

The most appropriate method of importing these materials should be determined taking into account the specifications, material costs, procurement expenses, time required for procurement and its relation to the term of construction.

The varieties of construction materials to be used have been limited by the course of choosing the aforementioned construction method. Therefore materials to be supplied in Japan were quite few things including steel frames and their paints. The former should be supplied in Japan in view of the term of construction, the latter also should be supplied in view of the specifications.

On the other hand, materials hard to procure in Japan due to the limitation of specifications include

electric fixtures, galvanized iron sheet and aluminium louver window sashes.

As for other materials the import business will be determined, taking into account of the requirement above mentioned along with accuracy of import procedures of an importer and convenience of transportation.

According to the findings of the survey team, the method 1) is most disadvantageous in terms of costs, and the methods 2), 3) and 4) involves indefinite factors, in terms of procurement periods.

(3) Method of transportation

At the end of every month, a regular ship leaves Japan for Suva, Fiji island. It takes fifteen days to reach there. Another transportation is available from Suva to Tongatapu. This takes fifteen to twenty days including a waiting time for trans-shipment of cargoes. Shipping contract covering the total course of transportation to Tongatapu, the destination can be signed in Japan.

Depending on the nature of cargoes, it is possible to make the liner proceed directly to Tongatapu.

In Tongatapu, although the pier is not equipped with unloading facilities, there is no problem for a large ship to cast anchor at the port. However, special device may be required for the transportation of steel frames so that they may not be entangled together but remain free from any damage in the course of transit.

(4) Provision of labour

There are two ways of securing local workers.

1) One is to get workers through local private construction firms. Among the three biggest firms, one of them is a firm being managed by the second generation of the Japanese.

2) Apart from Japan, the Ministry of Works, a governmental organization, retains its workers who participate in governmental construction projects under its direct control. It is possible to enter into contract with this organization to secure local workers.

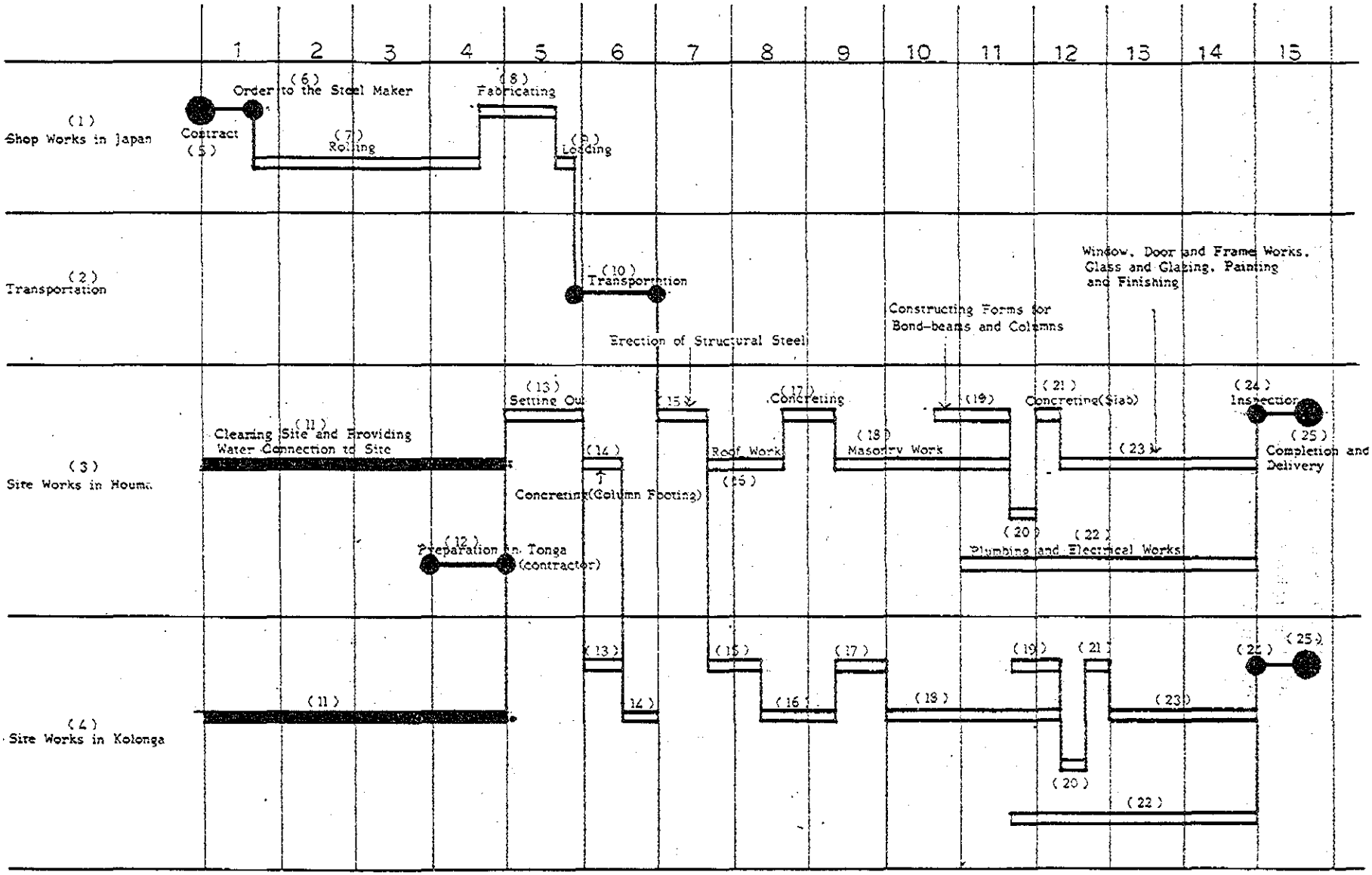
3-8-2 Problems Related to Execution and Its Flow Chart

Telephone service is not provided except in a certain area around Nuku'alofa. That a post-office box must be used for mailing purpose might be inconvenient. Taking into account the poorness of local communications and the works being started at two separate sites, it is necessary to establish a site office at Nuku'alofa. It takes forty to fifty minutes to reach the sites by car, and thus the provision of a light truck with 1 ∿ 2 tons loading capacity is effective for emergency transportation of small materials and workers. In addition, the use of wireless should be studied as the means of communication between the office and the sites.

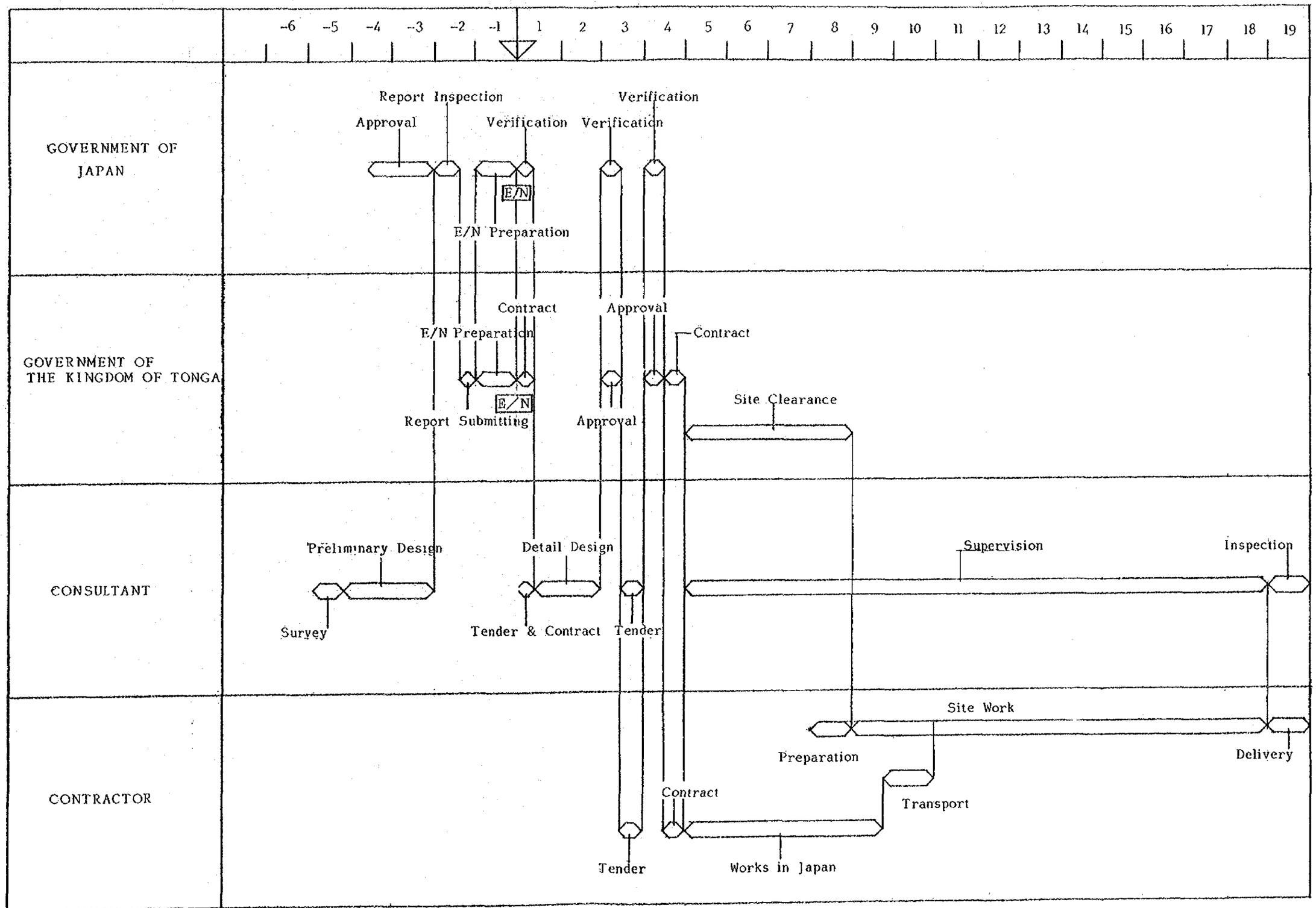
Proposed procedures for executing the works at the sites is mentioned in the flow chart. The major point of the chart is that steel frames are erected first and covered with roofs, and then blocks are laid to complete inside and outside walls, so that the term of works can be followed regardless of possible rainfall. Besides, concrete placing of earth floors should be accomplished after the block-laying will be completed so that their trowel-finished surface may not be contaminated during the construction works. A small time-lag found in the stages of execution between the two sites is intended to enable the field foreman to perform his duty efficiently and to conduct workers' field training more effectively.

Road sections not coral-paved in and around the sites always become muddy after rainfall, and this makes it necessary to provide temporary roads.

PROGRAMMES OF WORKS



PROGRAM OF THE PRIMARY SCHOOL CONSTRUCTION PROJECT OF THE KINGDOM OF TONGA



CHAPTER 4

NECESSITY OF/AND EVALUATION OF THE PROJECT

CHAPTER 4 NECESSITY OF/AND EVALUATION OF THE PROJECT

4-1 Necessity of the Project

Among the independent island countries in the Southern Pacific, the Kingdom of Tonga is a nation having realized the importance of education since religeous propagation were begun by missionary groups. The government has been laying emphasis on education, enjoying a high school attendance ratio of approximating 100 percent. Although family planning is put into practice in recent years, the natural increase in population is yet at a high level due to the religious reasons. They are living under the traditional large-scale family systems. The age groups form a pyramid pattern with a wide base consisting of the younger generation and children of school age accounting for about 30 percent of the total population.

In the mid-70's, the missionaries have withdrawn from the primary schools of which almost all had been managed by them. With the enactment of the Fundamentals of Education Act to make the primary education perfectly compulsory and the rapid increase in school children, the buildings of primary schools in Tonga have become deteriorated, and its classrooms were congested with pupils. This is particularly so in Tongatapu where a large number of population is concentrated.

The production copra is the country's major and sole industry, and is being exported abroad. Foreign currencies were mainly gained by both exports and workers' abroad. Except for articles produced domestically to achieve the goal of self-sufficiency, other commodities are dependent on imports from abroad. This trend applies not only to educational facilities, and equipment, but also teachers, an important human resources of the

country. In fact, many primary schools have been constructed and maintained through the assistance of foreign countries including New Zealand together with the cooperation extended by the neighbouring villagers.

Tonga is commencing the Fourth National Development Plan (1980 - 1985) starting July, 1980. Cooperation plan for constructing primary schools is intended to provide 12 new schools, extend 12 schools and renovate one school under specified construction standards. During the above five years, the country is expecting to provide 133 classrooms for which budgetary appropriation worth T$1,240,540 is allocated.

The Houma and Kolonga primary schools construction project for which financial cooperation of the Japanese Government was requested are given the first and the second priorities by the Government of the Kingdom of Tonga in the first year of the Fourth National Development Plan. The reconstruction of the two schools seems to be urgent tasks of the Government, considering their important location in Tongatapu Island and actual situation of the two schools.

In this two schools there are classrooms for in-service training of the teachers and instructors are planned to be invited from the peace corps of both the United States and Japan. If these facts are taken into consideration, it is clear that the construction of these schools to be accomplished by the financial assistance of the Japanese Government will cause a significant impact, both materially and spiritually, on the whole aspect of the primary education in Tonga. Thus, there is a great need for the implementation of the project.

4-2 Evaluation of the Project

On the basis of the findings of the Japanese basic design survey team dispatched, and the discussions held between the officials concerned of the Government of the Kingdom of Tonga and the members of the Japanese survey team, it was agreed that the construction of the two primary schools included in the implementation of the country's Fourth Development Plan will be top priority project for a grant assistance extended by the Japanese Government.

Although initial schools had been managed by the missionaries, the primary schools in this country maintains traditions which have long been fostered for more than 100 years. This may be due to the peculiar natural conditions including the climate. Moreover, a strong conciousness was felt among the villagers that the primary schools are being supported by villagers themselves. In fact, those providing precious water resources to the primary schools are villagers too. In addition, parents and teacher's association of the schools completed classrooms by their own labour, and it took one year to build them. Maintenance cost for the facilities are entirely borne by the villagers.

While discussions were held with the officials concerned of the education, a desire was expressed from Tonga side that any difference between the existing primary schools and proposed ones to be built by the Japanese Government should be minimized as far as possible.

Under these conditions, primary emphasis is being placed on the reduction of maintenance cost and administration expenses, and the building style and construction method can be decided by examining locally available materials and the technical ability of workers.

Buildings are one-storied with a sloping roof of deep eaves and have an open corridor on one side. Although this style which was introduced into Tonga from New Zealand or surrounding regions varies greatly from the traditional houses in the country, it has taken root under local climate without causing any trouble at all.

Basic design envisages that each building is placed with its axis in south-north direction to induce the east and southeast wind; that radiant heat caused by insolation on the roof is alleviated by deep garret space; that the location of a lavatory is determined according to a wind direction; and that the building for juniors is separated from that for seniors and the former is provided with movable partitions so as to make a large room. The utilization of rainfall and groundwater and the provision of flushing toilet are common practices in the country.

The use of steel as materials for framework is the only difference between the structural method proposed and conventional one. The reasons for this are (1) improved transverse resistance, and (2) reduced term of construction works.

Improved transverse resistance:

As stated in Chapter 3, Tonga is almost similar to Japan in its geography and forms an earthquake country, and is hit by tropical cyclones. As a result, construction standards specified by the Building Standards Law of Japan can be applied in order to make structure capable of resisting transverse stress.

Reduced terms of construction work:

Considerations are given to the relation of the time for starting construction with the arrival of the rainy

season, the completion date of buildings and the starting of new school-year so that steel frames can be fabricated in Japan, and transported there during the rainy season. Field works will be started at the end of the rainy season (March, 1981). After the erection of steel frames and completion of roofing, block laying for walls and others will be carried out as indoor operations, regardless of weather conditions in order to reduce the term of construction works.

Materials, except for steel frames and a small portion of them, are locally obtainable. Among them, however, only concrete blocks and aggregate are produced there. Major portion of these materials are imported from New Zealand and Fiji. Thus, material costs are not necessarily low. However, the use of steel for framework makes it possible to use locally produced concrete blocks in a great quantity and this may be advantageous to the country.

As for labour problem, skilled workers are small in the number, and their technical ability is not necessarily high, and their wages are low. Many workers have two jobs; they include carpenter and roofer. Although no large-scale construction work is planned in Tonga which will be simultaneously carried out along with the present works. Simultaneous execution of the construction works at the two different sites being separated by thirty kilometers give rise to some problems in securing workers. Since the works will be executed by usual methods, and materials are restricted to limited kinds, it is not hard to recruit workers. Efforts on the part of Tonga is requested to be made in exempting imported materials from customs duties, securing local construction materials and building workers.

It was feared that conflicts may arise between the assistance extended by Japan and that has been given by New Zealand. However, judging from the fact that the works carried out by the assistance of New Zealand have been suspended for financial reasons, it is hoped that there would be no problem involved in the construction of the two schools by the Japanese assistance.

Since the Kingdom of Tonga has been very eager for its educational development, and is yet in need of technical assistance from abroad for some years to come, Japan is needed to extend cooperation to alleviate the hard situations in primary education in which the country is involved. It is also necessary that Japan, as a developed nation of the world, should provide assistance in constructing the proposed primary schools by applying its advanced construction technology and earthquake engineering.

In this respect, we are convinced that friendly bilateral relations existing between the Kingdom of Tonga and Japan will be further promoted and strengthened.

APPENDICES

HOUMA PRIMARY SCHOOL

Location : Houma Village, Hihifo District, Tongatapu

Roll : February 1980 - 309.

Background

Many of the Church education systems have been phasing out their primary schools to concentrate their resources on Secondary education. The Catholic Church, for example, has completely phased out its primary schools in the last five years, which means that the government has to assume responsibility for a significant number of new schools within the last five years. It had meant the provision of new buildings and new teachers.

Houma Primary School was originally one of the Catholic Schools. To facilitate the transfer, the Catholic Church agreed to rent the school buildings to the government for about five years. In the meantime, the government was expected to construct a new School to which the pupils would be transferred. Because of financial constraints the government has been unable to comply with the agreement. The five years have ended and the Catholic Church is now urging the recovery of the use of the school buildings and grounds. It is now more urgent than ever for the government to construct a new school at Houma as soon as possible.

Building Needs

Estimates based on the rates of 30 pupils per classroom.

11 Classrooms
(10 general plus 1 for In-Service Training of Teachers)

Storage (one between every two-classrooms)

Principal's Office

Toilet Facilities

Each classroom approximately 7200 x 8600, each with small store-room approximately 2400 x 1800.

Principal's Office approximately 3600 x 3600.

Toilets: f - 5 wc 5 lb)
m - 5 wc 5 uv) - 5 lb

Drink fountains

Cleaners' Closets

KOLONGA PRIMARY SCHOOL

Location : Kolonga Village, Hahake District, Tongatapu

Roll : February 1980 - 357. No. of pupils

Background

Many of the Church education systems have been phasing out their primary schools to concentrate their resources on Secondary education. The Catholic Church, for example, has completely phased out its primary schools in the last five years, which means that the government has to assume responsibility for a significant number of new schools within the last five years. It had meant the provision of new buildings and new teachers.

Kolonga Primary School was originally one of the Catholic Schools. To facilitate the transfer, the Catholic Church agreed to rent the school buildings to the government for about five years. In the meantime, the government was expected to construct a new School to which the pupils would be transferred. Because of financial constraints the government has been unable to comply with the agreement. The five years have ended and the Catholic Church is now urging the recovery of the use of the school buildings and grounds. It is now more urgent than ever for the government to construct a new school at Kolonga as soon as possible.

Building Needs

Estimates based on the rates of 30 pupils per classroom.

13 Classrooms
(12 general plus 1 for In-Service Training of Teachers) ← Connect (ネスケ) (ガイドン)

Storage (one between every two-classrooms)

Principal's Office

Toilet Facilities

Each classroom approximately 7200 x 8600, each with small store-room approximately 2400 x 1800.

Principal's Office approximately 3600 x 3600.

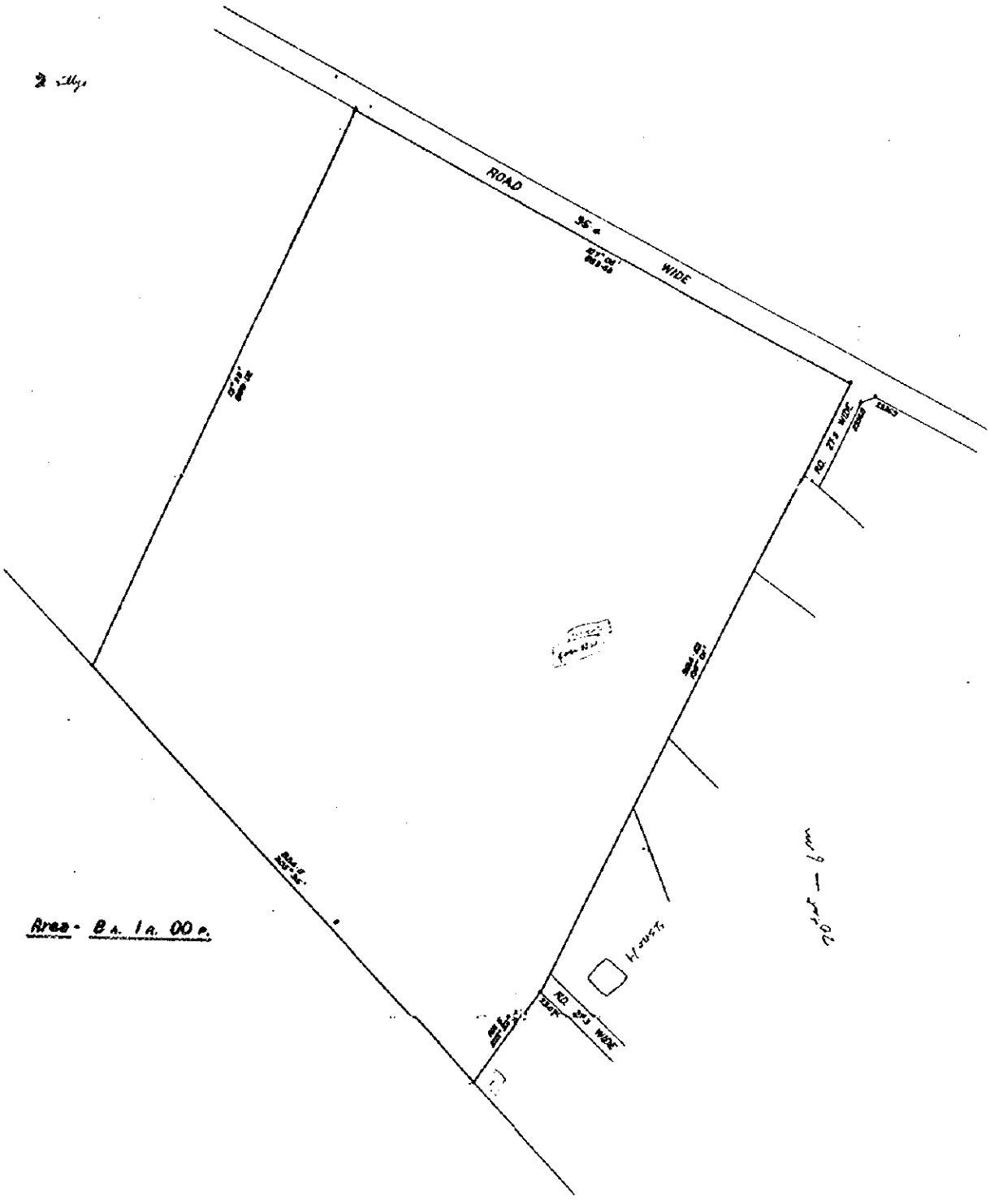
Toilets:
f - 5 wc 5 lb
m - 5 wc 5 uv - 5 lb

Drink fountains

Cleaners' Closets

GOVERNMENT PRIMARY SCHOOL (lease) AT HOUMA

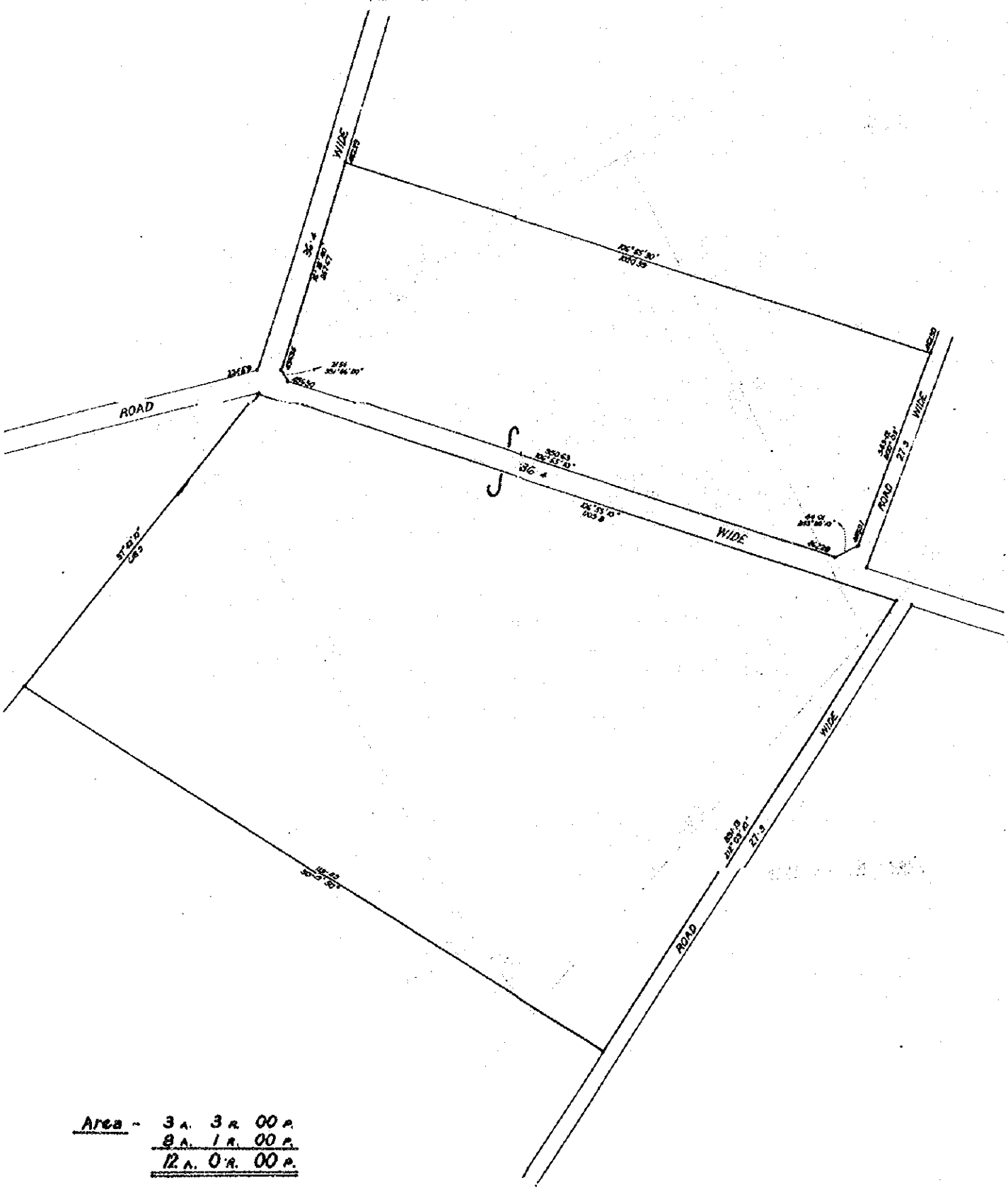
SCALE ONE CHAIN TO AN INCH
(All measurements in links)



Area - 8 a. 1 r. 00 p.

GOVERNMENT PRIMARY SCHOOL (lease) AT KOLONGA

SCALE : ONE CHAIN TO AN INCH
(All measurements in link)



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9 A. 1 R. 00 P.
12 A. 0 R. 00 P.

AGREED MINUTES OF DISCUSSION

In response to the request made by the Government of the Kingdom of Tonga for the Primary School Construction Project of the Kingdom of Tonga (hereinafter referred to as "the Project"), the Government of Japan has sent, through the Japan International Cooperation Agency (hereinafter referred to as "JICA"), a team headed by Mr OSAMU IGAMI, Ministry of Foreign Affairs to conduct a basic design survey for 23 days from April 5, 1980. The team had a series of discussions and exchange views with the Ministry of Education, Ministry of Foreign Affairs, Ministry of Works and the Central Planning Department of the Kingdom of Tonga.

As a result of the survey, both parties have agreed to recommend to their respective Governments to take necessary measures toward the realization of the Project.

11 APRIL 1980

...Osamu Igami...

OSAMU IGAMI
TEAM LEADER
THE JAPANESE SURVEY TEAM

MINISTRY OF EDUCATION

.....

SIONE NA'A FIEFIA
DIRECTOR OF EDUCATION
MINISTRY OF EDUCATION

MINUTES

1. The proposed sites of the Project will be in the village of Houma of Nihifo District and in the village of Kolonga of Nahake District in the Kingdom of Tonga (Hereinafter referred to as "the Project Sites").

2. The objectives of the Project is to provide necessary buildings, facilities and equipment for the primary schools at the Project Sites (Hereinafter referred to as "Primary Schools").

3. The Government of Japan will take necessary measures to cooperate in establishing Primary Schools and related facilities as listed in Annex I. The layout plans of Primary Schools are shown in Annex II.

4. The Government of the Kingdom of Tonga will take necessary measures:
   a) to provide data and information necessary for the construction including topographic survey and other geological survey reports
   b) to secure lands necessary for the construction
   c) to clear and level the Project Sites before the start of the construction
   d) to construct roads to the Project Sites before the start of the construction, and to provide other items listed in Annex III
   e) to ensure prompt unloading and customs clearance in the Kingdom of Tonga of imported materials and equipment for the construction and also to facilitate the internal transportation of them
   f) to exempt Japanese nationals concerned from customs duties, internal taxes and other fiscal levies which may be imposed in the Kingdom of Tonga on the occasion of the supply of goods and services for construction
   g) to provide and accord necessary permissions, licences and other authorization required for carrying out the Project

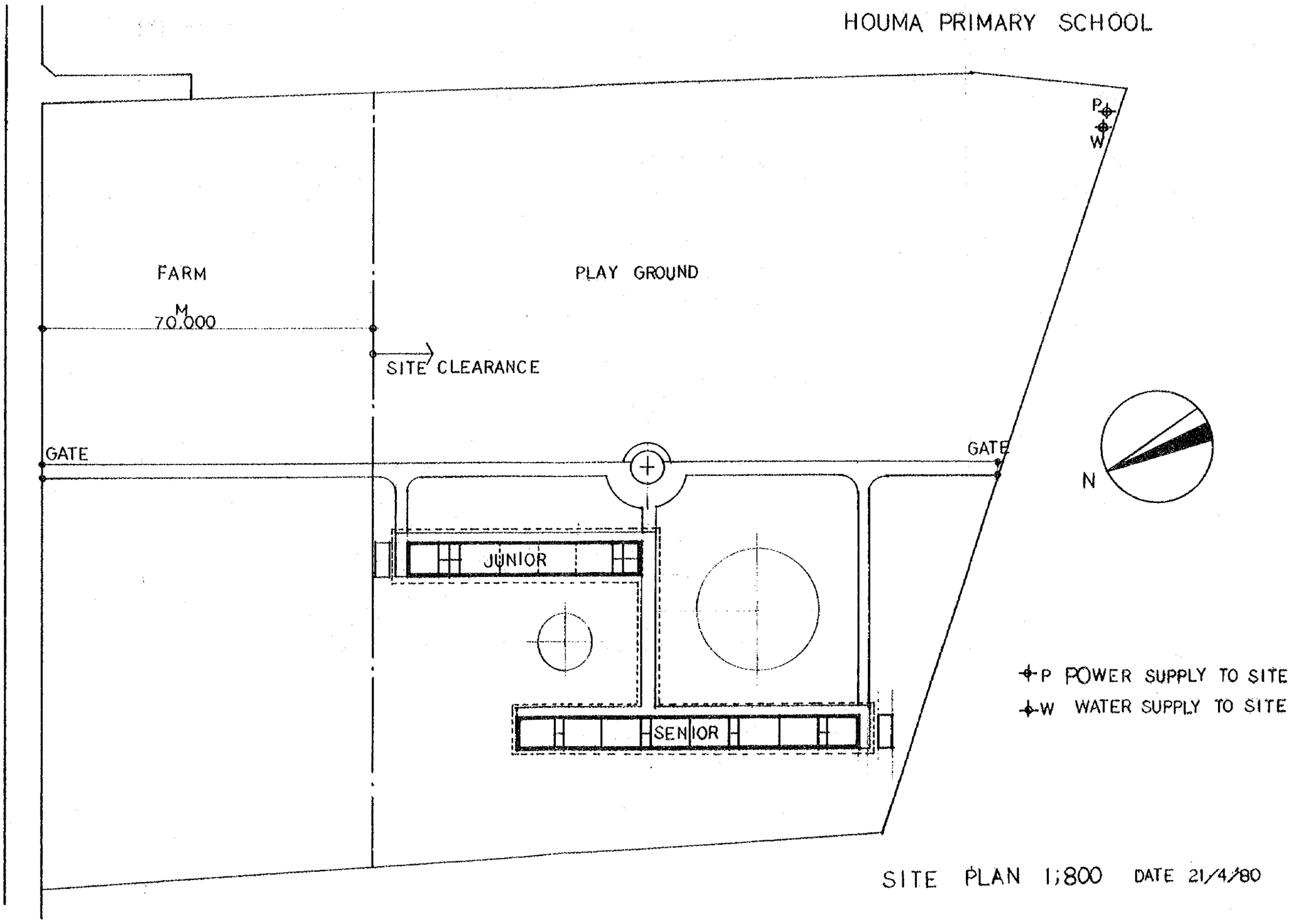
ANNEX I

1) Buildings

Houma Primary School
Kolonga Primary School

2) Basic Equipment such as desks and chairs to be used at Primary Schools

HOUMA PRIMARY SCHOOL

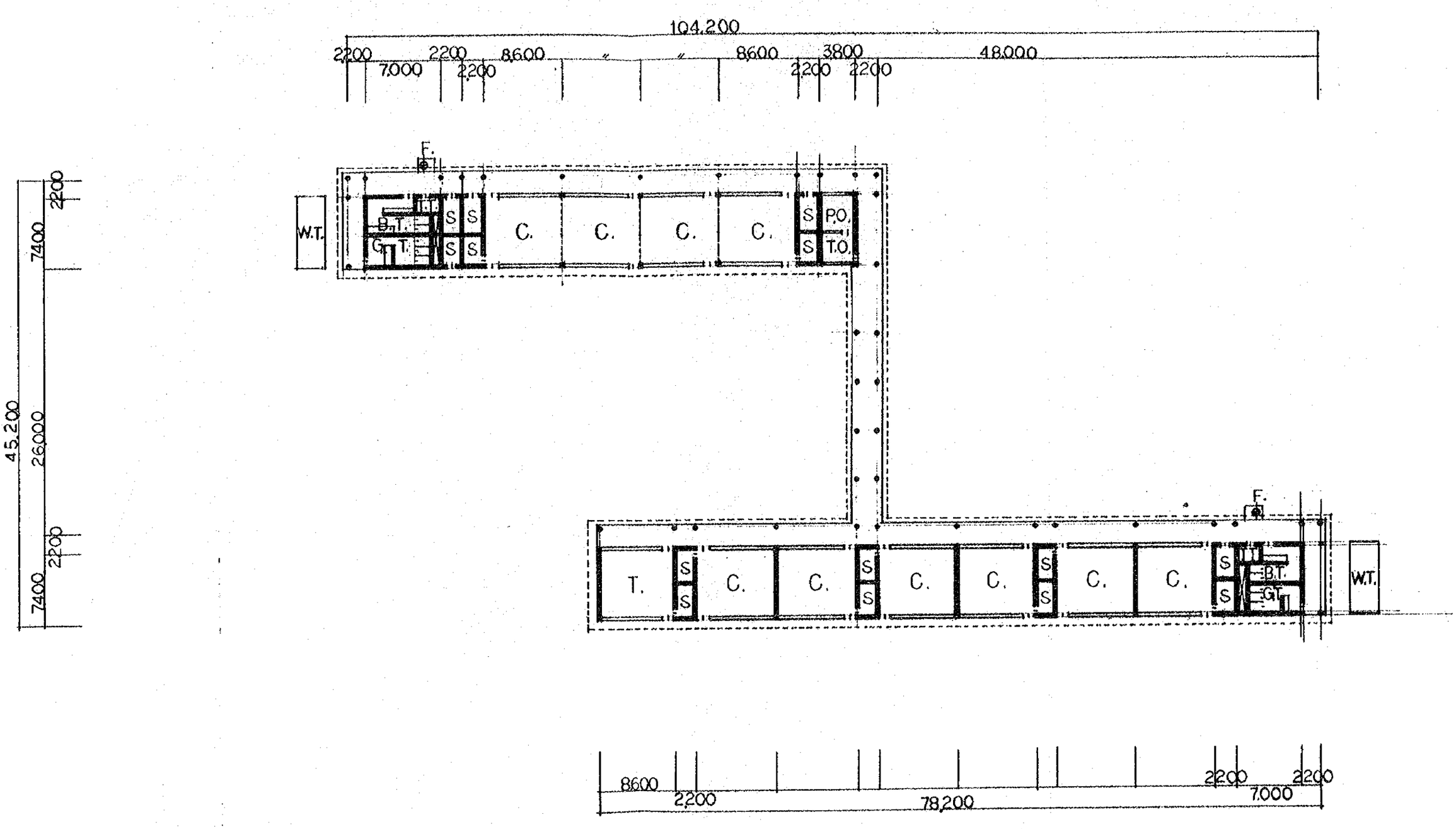


P POWER SUPPLY TO SITE

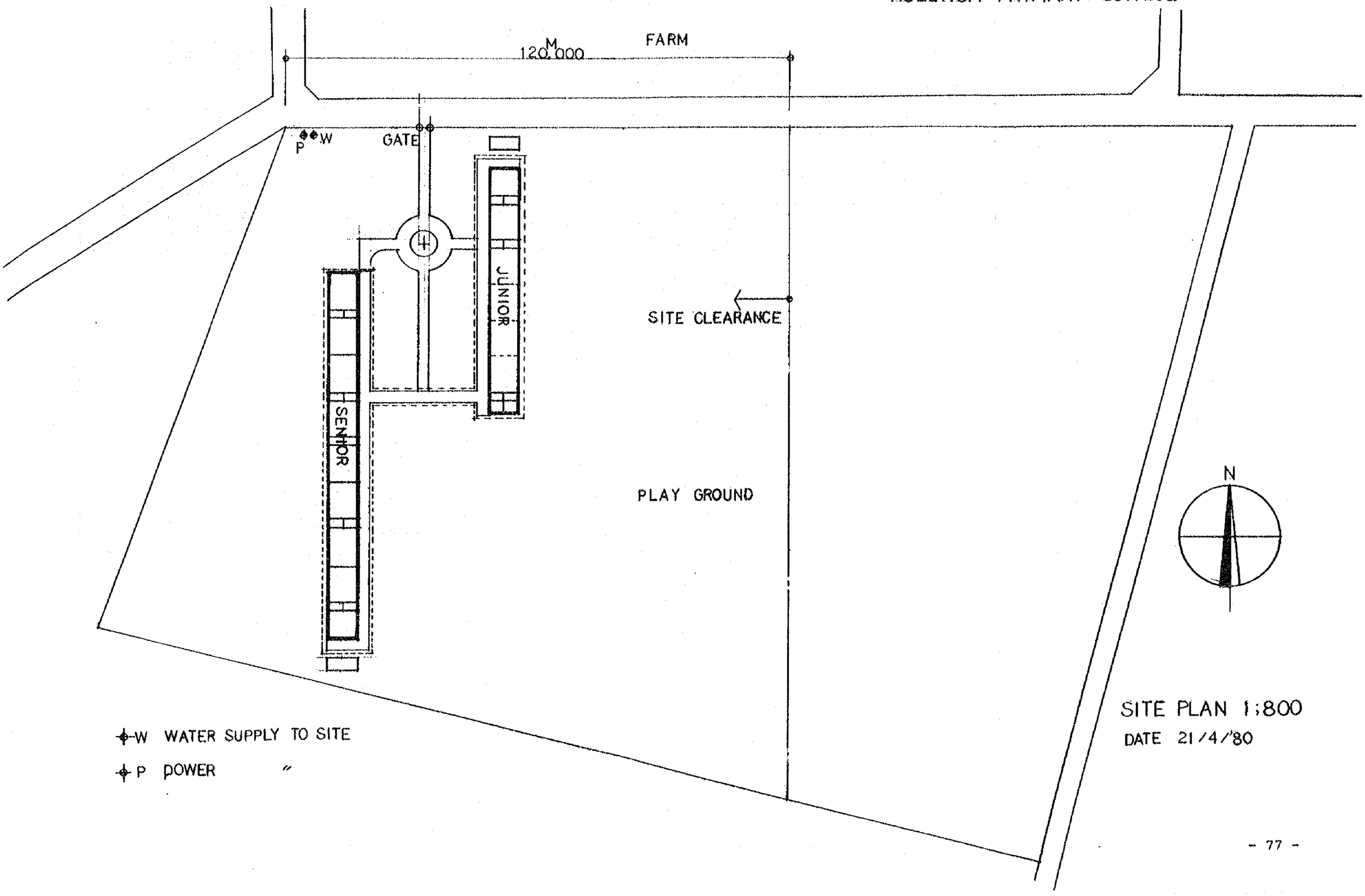
W WATER SUPPLY TO SITE

SITE PLAN 1:800 DATE 21/4/80

HOUMA PRIMARY SCHOOL



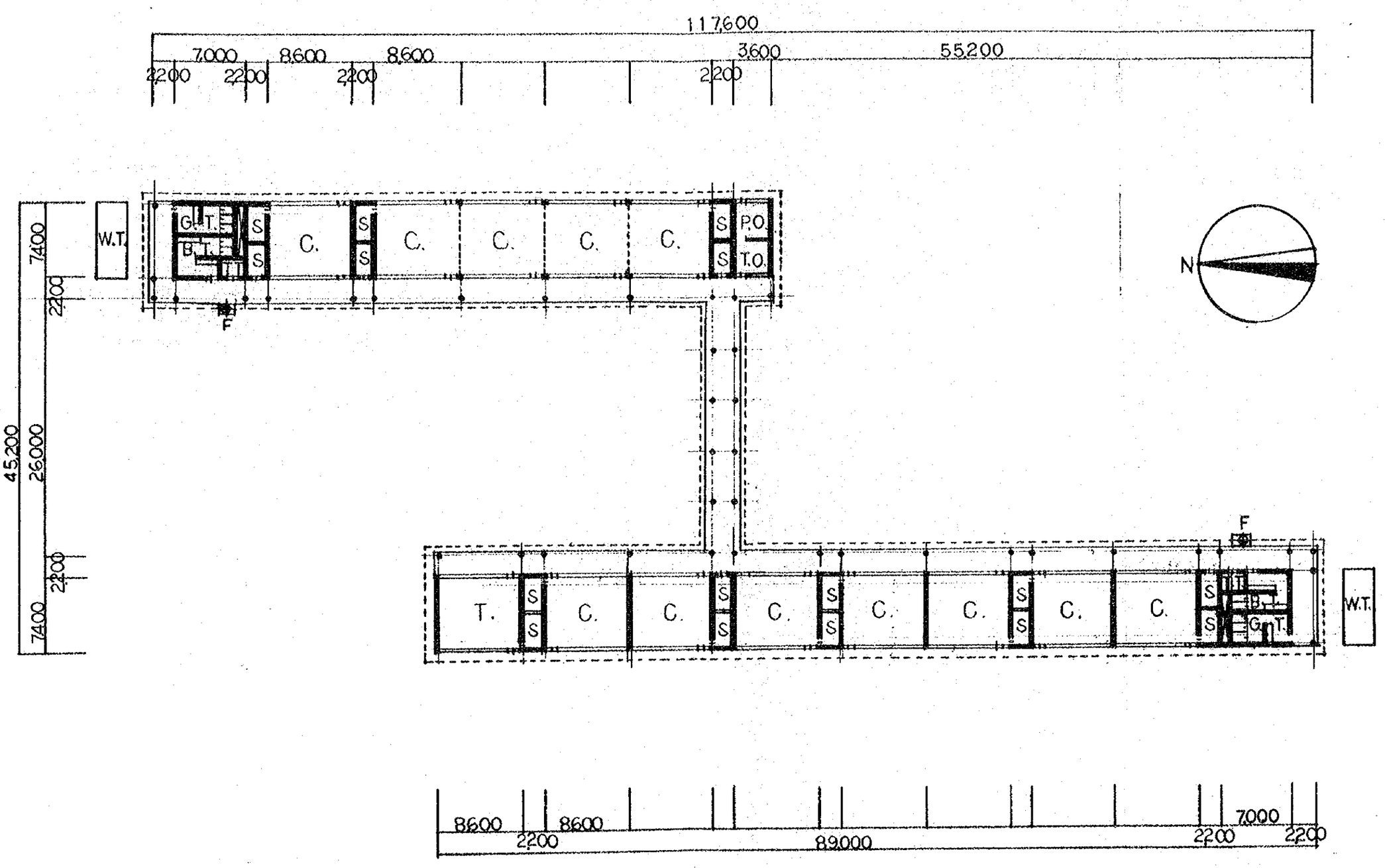
PLAN 1:400 · DATE 21/4/'80



SITE PLAN 1:800

DATE 21/4/'80

KOLONGA PRIMARY SCHOOL



PLAN 1;400 DATE 21/4/'80

ANNEX III

Items whose cost should be born by the Government of the Kingdom of Tonga.

Infra-Structure and others

(a) Water supply mains to the Project Sites
(b) Electrical power main line to the Project Sites, when completed the construction of electricity
(c) Outdoor Facilities & Landscaping
(d) Provision of space necessary for such construction as temporary office, working area, stock yards, etc.