DETAILED DESIGN REPORT
ON
THE IMPROVEMENT
OF
RICE CULTIVATION TECHNOLOGY PROJECT
IN
FIJI

OCTOBER 1985

JAPAN INTERNATIONAL COOPERATION AGENCY

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PREFACE

Recently, the demand of rice-supply in Fiji has been increased up to 40,000 tons per year.

Half of them are imported and an annual expenditure of more than 6 million US dollars has been spent for the importation.

Natural and climatic conditions in this country, however, have been reported suitable for rice cultivation.

Furthermore, agricultural development for sufficiency in rice has been considered as a national program of this country.

From this background, the Government of Fiji has inquired Japan for a technical cooperation for studies and experiments for improvement of rice-cultivation technology in this country.

The R/D of this Project was signed and the five-year Project aiming to improve cultivation techniques and contribute to augmenting rice-production executed on the 18th April 1985.

Concerning the implementation of the project, the preparation of Test Farm was needed and the Survey Team headed by Mr. Kikuoka (Senior Engineer, Disaster Prevention Division, Agricultural Structure Improvement Bureau, the Ministry of Agriculture, Forestry and Fisheries) was dispatched to investigate the conditions of the Koronivia Research Station and worked on the Detailed Design of Model Infrastructure Improvement of the Test-Farm in the Station in Fiji during July 19th – September 1st, 1985.

This report deals with the results from the above field-survey and various related preparation-studies performed in Japan.

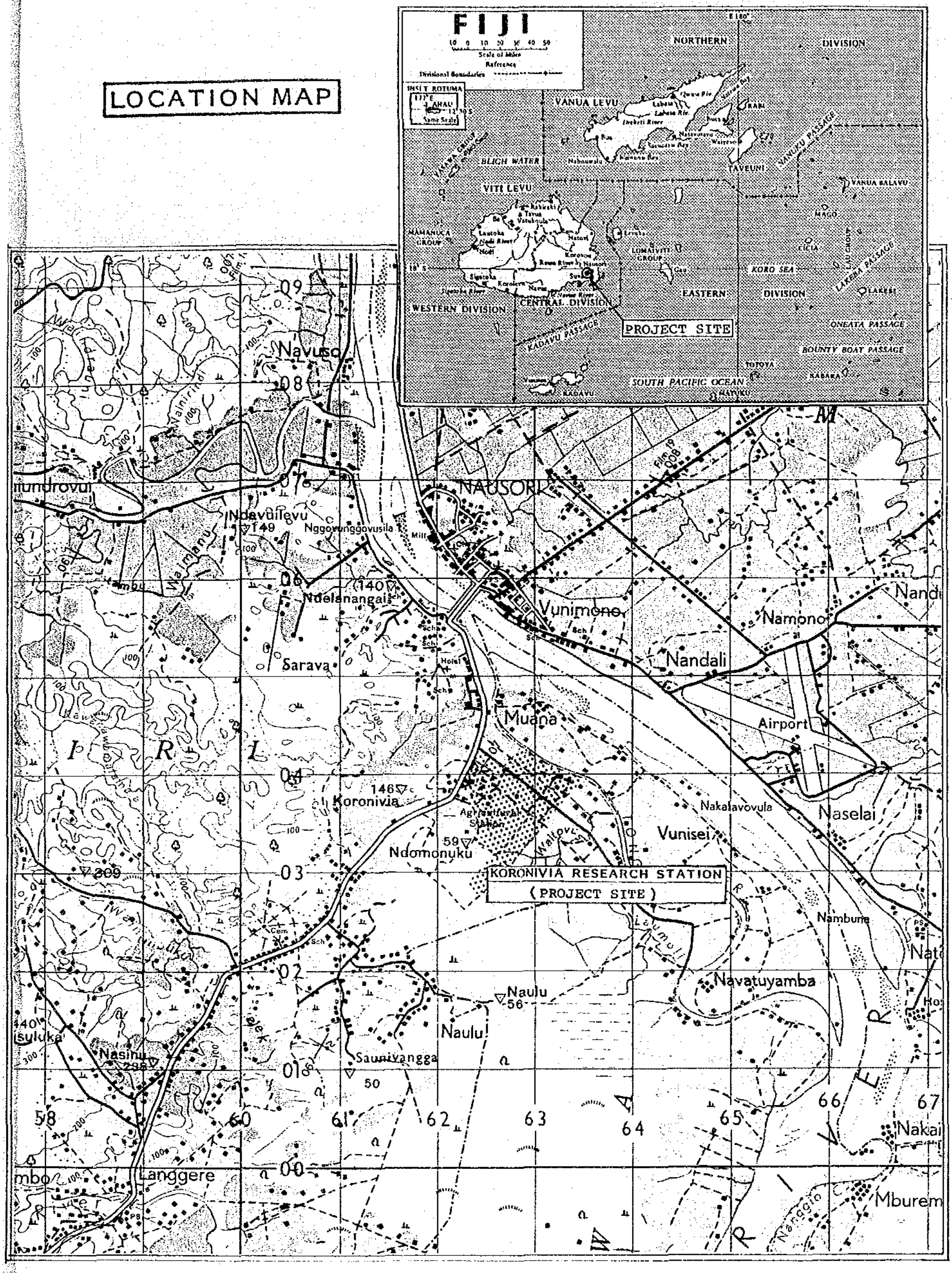
We would be very gratified if this report would be utilized to the improvement work of the above Test-Farm.

Finally, I would like to express my deep appreciation to Authorities concerned in the Fiji Government, all members of the Survey-Team and persons concerned with this report.

October, 1985

Takashi TAUCHI
Director, Agricultural Development
Cooperation Dept,
Japan International Cooperation Agency

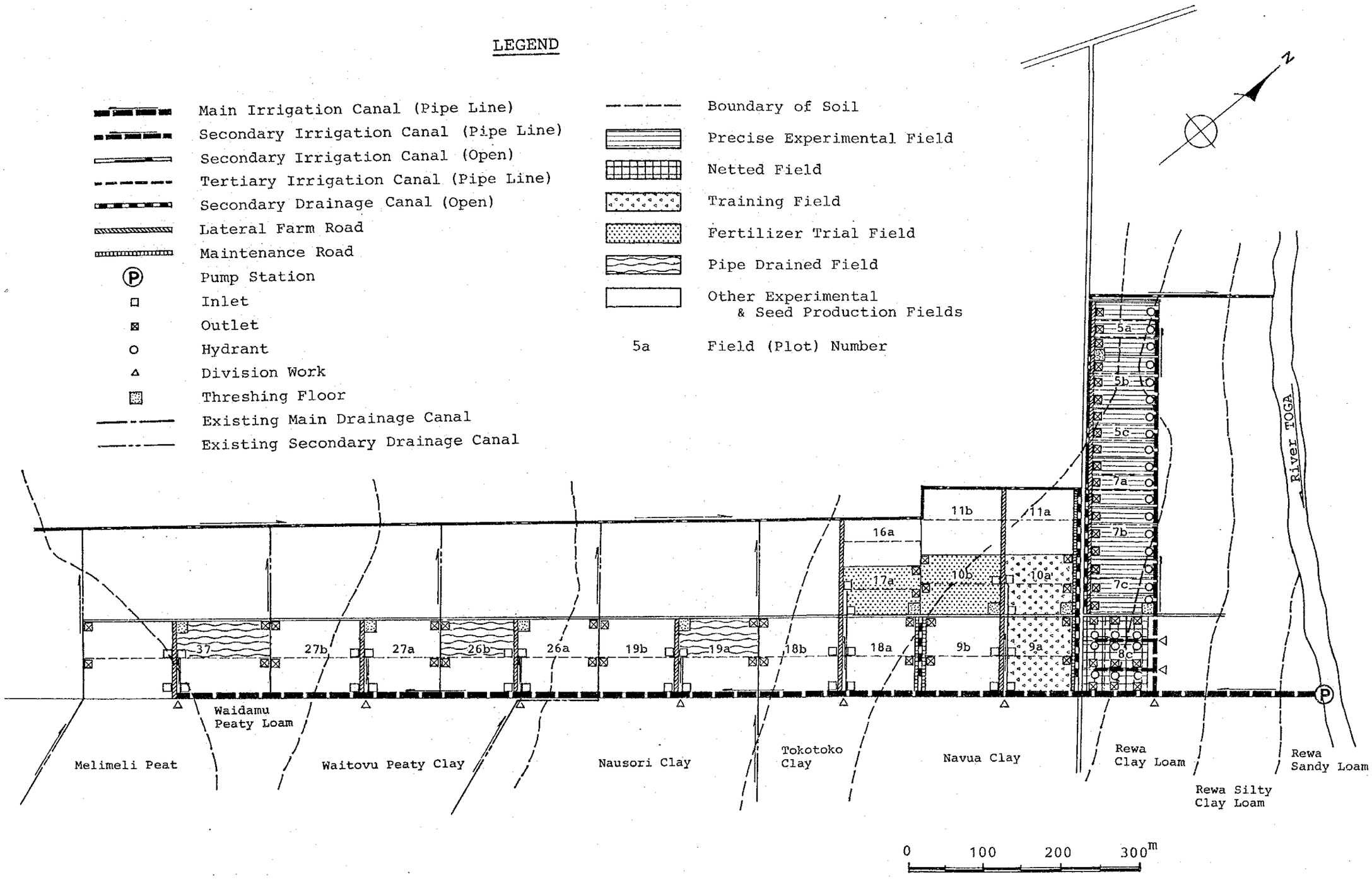
LOCATION MAP



GENERAL PLAN

LEGEND

- Main Irrigation Canal (Pipe Line)
- Secondary Irrigation Canal (Pipe Line)
- Secondary Irrigation Canal (Open)
- Tertiary Irrigation Canal (Pipe Line)
- Secondary Drainage Canal (Open)
- Lateral Farm Road
- Maintenance Road
- Ⓟ Pump Station
- □ Inlet
- ⊠ Outlet
- ○ Hydrant
- △ Division Work
- ▨ Threshing Floor
- Existing Main Drainage Canal
- Existing Secondary Drainage Canal
- Boundary of Soil
- Precise Experimental Field
- Netted Field
- Training Field
- Fertilizer Trial Field
- Pipe Drained Field
- Other Experimental & Seed Production Fields
- 5a Field (Plot) Number



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1. BACKGROUND OF THE PROJECT

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1-1 General Tendency of Rice Production

(1) The rice started to produce immediately after turning the century has become to take an important position as staple foods for domestic use in parallel with root crops. Nevertheless, the production can not catch up with the consumption, and about a half of the total domestic consumption has been forced to be imported.

(2) The total planted area of rice has continuously proceeded with an area of nearly 10,000 ha, most of the area has been dominantly fed by rain and the per ha yield has stagnated at a low level of two tonnes in terms of paddy. On the contrary, the number of population accompanying with the more preference for rice has been steadily increasing.

(3) To meet the increasing demand for foods and to save the foreign currency, the Government of Fiji has been paying a great deal of efforts for improving its traditional rain-fed cultivation of rice, developing the irrigable paddy fields enabling to grow double crops and trying the expansion of rice fields on a vast area of poorly drained land.

(4) The irrigated rice field initiated in the end of 1960's has been gradually but steadily expanding throughout the country under the new Irrigation Act, and a portion of the planted area has been already surpassed over 10% of the total. In the same manner, a vast of poorly drained area has been improving so as to stabilize and extend rice cultivation through the Drainage Board established under the Drainage Act. In the down stream areas of the Rewa and Navua rivers where one of the main rice growing areas is forming, the first comprehensive regional development project in Fiji, the Agricultural Development Project (DP), has been commenced in 1985 based on a scientific land evaluation procedure, the land use capability classification, and the technical and financial supports by both banks of the World and Asian Development. The DP 9 to be started 1986 will accord a high priority to the rice development.

1-2 Present Problems of Rice Production to be Confronted and Solved.

(1) There exist many constraints to overcome for accerelating a tempo of the rice development: flood, drought, windstorm, temporary coldness, weeds, insects, diseases and problem soils in the

natural environment and land ownership, land tenure system, farmer's eagerness, technological level, financial provisions and the like in the socio-economic circumstances.

(2) To break through these obstacles, as partly stated above, the Government has been paying its efforts for: renovating rice production technology to overcome the natural restrictions, controling and eliminating natural calamities to reduce damages from them, improving rice fields by irrigation aggressively to grow double crops, educating farmers to upgrade their abilities and providing loans and subsidies for farmers to motivate their actions.

(3) Two governmental divisions are directly responsible for the rice development. One is the Drainage and Irrigation Division and another is the Research Division. The former is in charge of the land improvement and also the extension of the related new technologies to farmers. The latter is in charge of the creation of the new knowledges and technologies of rice cultivation. Namely the former is responsible to realize a modern rice cultivation on the fields through improving farm land for rice and applying new production technologies of it and the latter,

as a commissariat, is responsible to develop new technologies at laboratories and to convey them to the former ensurely through the deviced media.

(4) Of course, the linkage between both divisions has become closer and more effective than before. In parallel with this, however, it has become the technological development of rice is still under-developed. Some rice fields developed with great efforts has been still remained as it was, new cultivars can not cover all of soils in number, the yield amount resulted from the new varieties is not neccessarily higher than expected and a number of agronomical technical fields is waited for development. The technical cooperation by the Government of Japan concentrated on the research and extension is expected to make it more functional and efficient.

1-3 Present Situations of Rice Research Facilities

(1) The rice research activities started 1951, which was immediately after establishing the Koronivia Research Station (KRS) and have brought about the appropriate achievements so far. Most of the activities is centralized to the station in Koronivia and some of them is scattered over some other stations and experimental plots on the farmer's fields in accordance with their different soil conditions.

(2) Formerly the research efforts were separately conducted by different scientific sections, and this situation is also true to the rice research. To utilize the limitted research resources at maximum and to realize the purposive and timely studies, the well organized research action has been carried out under the long-term research programme since 1984.

(3) The rice research programme is composed of nine major projects including plant breeding, plant protection, fertilization, soil improvement, cropping system, mechanization and synthesized rice technology etc.. More than 20 percent of the scientific manpower and the total budget in KRS is allotted to the rice research group in 1985, though the seat of the staff is not yet fulfiled. Besides that, the technical cooperation of the rice research and development between Japan and Fiji has simultaneously started. Now it is looking forward to conducting the more efficient research activities of rice than before.

(4) Although the experimental rice fields in KRS is equipped with a modern irrigation system installed in 1965 and other infrastructures such as farm roads, fences, drains and so on, the space is restricted to the narrow area along the bank of the Toga river. Accordingly the present experimental fields can not only afford

the increasing research projects in quantity, but also the results of the experiment can not cover most of the rice growing areas in quality.

(5) Fortunately, however, the Koronivia Research Station is located in the center place of the major rice growing area and includes the different types of soil, which represent major types of rice growing region, and in which some types of soil are remining in natural state. There is a need to enlarge the experiment fields so as to meet the present and future demands for the rice research and, at the same time, to renovate it so as to conduct the experimental treatments more efficiently, and also to secure the conveyance of the newly developed technologies to the extension and farmers sectors.

2. PHYSICAL CONDITION OF THE EXPERIMENTAL RICE FIEIDS OF KRS

2. PHYSICAL CONDITIONS OF THE EXPERIMENTAL RICE FIELDS OF KRS

2-1 Topography

The experimental rice fields are in the flat area formed as the Rewa alluvial plain. Topography is flat or gently sloping from the Toga river bank to the inner area. The survey group with the help of senior surveyor and other staff of D and I Division, has intensively made the topo-survey of an area of 20 ha including the proposed experimental fields. Elevation of the area surveyed is between 2.5 and 6.0 m.

2-2 Soils

In the past two soil surveys were conducted on the KRS, in 1965 and 1981. According to the findings of the survey, there are nine different soil series starting from the river bank, are Rewa sandy loam, Rewa silty clay loam, Rewa clay loam, Navua clay, Tokotoko clay, Nausori clay, Waitovu peaty loam, Waidamu peaty loam and Melimeli peat. Amongst the soil types, there are great differences in their characteristics such as texture, moisture, plasticity, underground water table, pH value and others.

On three soil series namely Rewa sandy loam, Rewa silty clay and Rewa clay loam, experiments are conducted on upland crops including dryland rice. These soils are found along the river levee. The

two soil series, Navua clay and Tokotoko clay are used for experimental and seed production purposes under irrigated conditions. The remaining four soil series are left idle or has some pasture. The peaty soil areas are covered with paragrass, sedges, mimosa, yellow primrose and jungle rice. (See attached Fig.1)

2-3 Climate

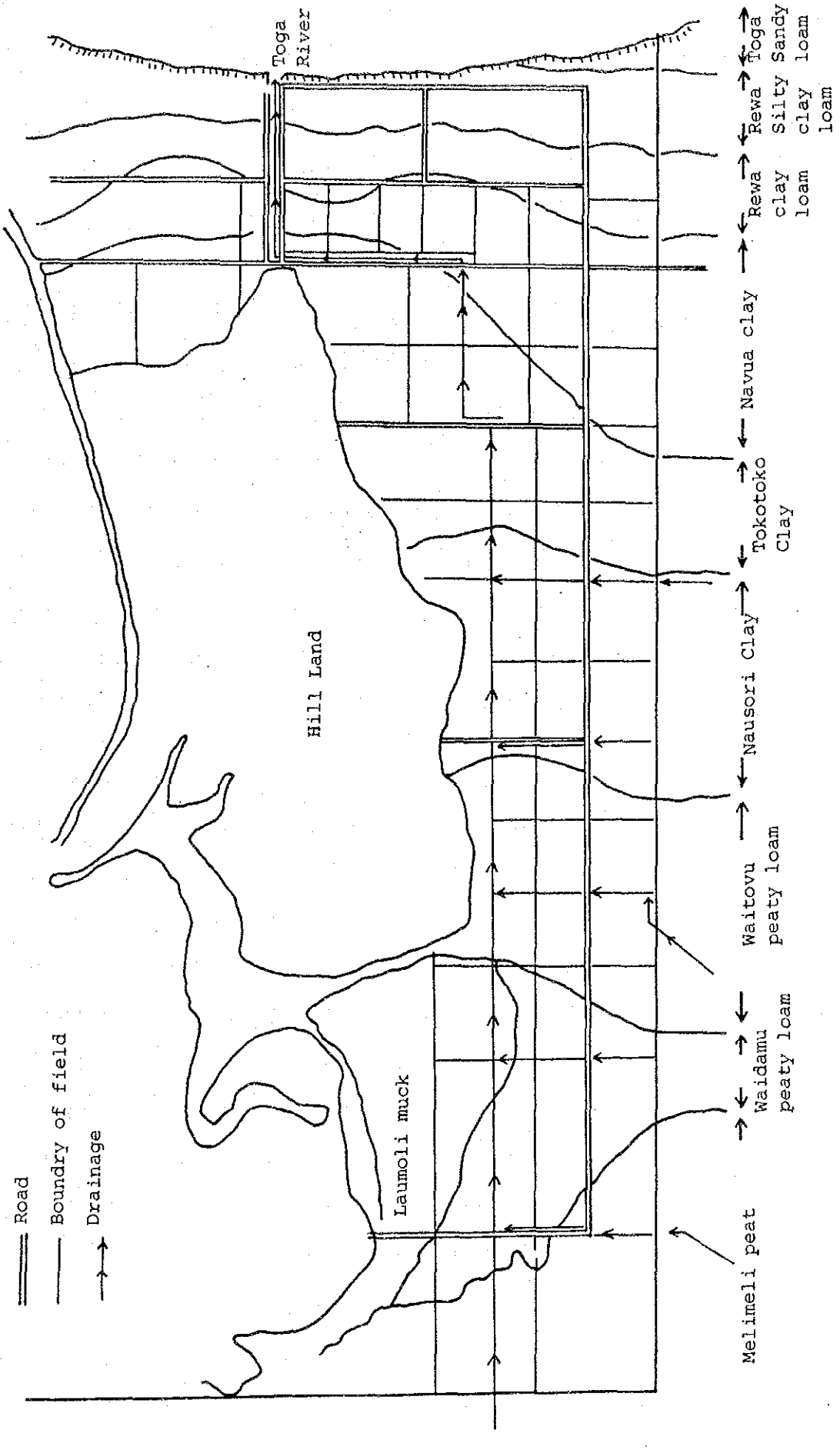
According to the weather records of KRS, the average monthly maximum temperature goes upto about 30°C in summer months, November to April and down to 25 - 27°C in winter, June to September. The minimum falls down below 20°C in winter and the lowest sometimes drops below 14°C which tends to cause cold damage in growing rice.

Annual rainfall is around 3,000 mm and it is normally heavy in summer and light in winter. The heaviest rainfall recorded was 4,155 mm per year in 1980. In April 1973, 1,054 mm per month rainfall was obtained. In October 1980, 368 mm rainfall per day was recorded. This kind of diversity and irregularity of rainfall causes damages due to flooding and drought effect. The planting and harvesting dates are also affected.

Besides these, there are cyclone attacks with plenty of rain and strong wind in summer, November to March. During the season, rainy days with a precipitation

Fig.1 Soil Distribution Map of Low Land Area,

Koronivia Research Station



of more than 5 mm for 10 to 17 days, outdoor works can be restricted.

2-4 Drainage

The drainage feature of the proposed area has improved considerably. The soil survey report of 1965 mentioned that most of peaty and peat soil areas were inundated even in dry seasons because of the high underground water table. The recent soil survey report has shown that the water table has gone down upto 60 - 100 cm in dry season. This is largely due to newly constructed drains by D & I Division and maintained by Nausori Drainage Board. The main drain passes through the KRS fields. It is essential to make flood gate to protect backflow from Toga river.

2-5 Irrigation Water

The Toga river which is a subsidiary of the Rewa river is the only source to irrigate the experimental farm. The high tide rises at most upto 1.6 m high or so, and it does not affect the quality of water at the pumping site. The water analysis at the pumping site in 1964 when the first pump was installed, indicated the following results:

	pH	SS ppm	P ppm	Cl ppm
Max.	7.70	105	0.1	9.0
Min.	6.05	84	0.1	0.0

The results showed that water was suitable for irrigation.

2-6 Infrastructure

One public unpaved road runs through the fields. There are two roads by which fields can be visited from the office sites. One road runs parallel to the public road. There are no lateral roads connecting different fields.

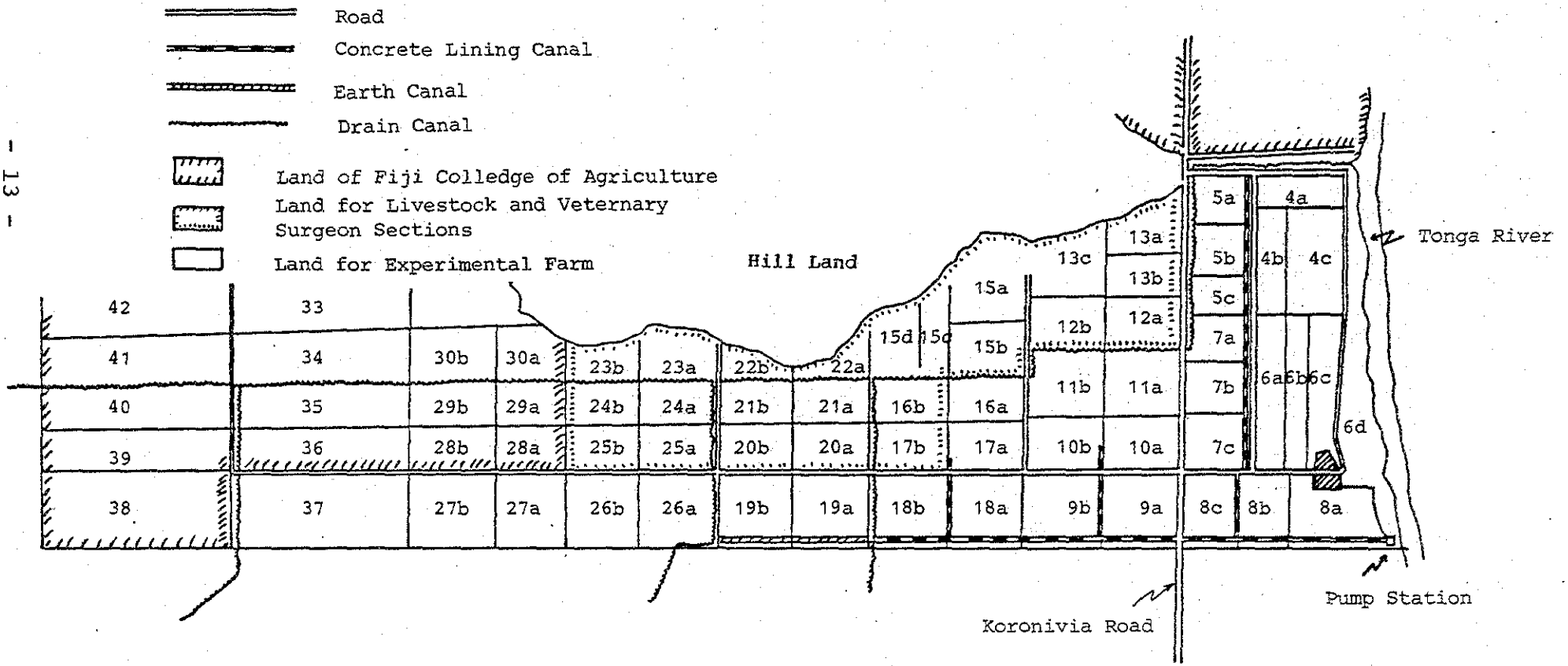
The main irrigation canal is 1,100 m long out of which 700 m is lined with concrete and 400 m is earth canal. Three lateral canals lined with concrete still operating with poor performance and several other earth canals have deteriorated. The main and lateral drains are not lined and left unweeded.

The experimental fields are surrounded by barbed wire fence to protect cattle and outsiders coming into the area.

The field numbers, 5a, 5b, 5c, 7a, 7b and 7c are used for the breeding and weed control experiments. Each of these 6 fields are further sub-divided into three sub-fields for better management practices. The

field 8c is covered with wire net (protect from bird damage) for cold tolerance study and to raise seedlings. The field 17a and 10b are sub-divided into smaller plots to conduct long term fertilizer trial. Fields 10a, 9a, 9b, 15a and 18a are used for seed production at present. Amongst the remaining proposed fields 18b, 19a, 19b, 26a and 26b are bunded. Fields 27a, 27b and relatively large field 37 are left in natural state (see attached Fig.2)

Fig.2 Present Land Use Map



3. DESIGN PRINCIPLES OF THE EXPERIMENTAL FARM

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3-1 General

(1) The detailed design of the experimental farm shall be worked out on the basis of the mutually agreed guide line, July 31st, 1985.

(2) In addition to this, the physical conditions stated previously, the managerial requirements for experiment and the available funds shall be taken into consideration.

3-2 Land Use

(1) Presently 8.7 ha of paddy field and 1.6 ha of upland field are used for the experimental and seed production purposes. The paddy field will be expanded to 14.5 ha as shown below.

Usage	Present ha.	Planned ha.
Experimental:	(5.1)	(8.1)
Breeding	3.5	4.1
Weed Control	1.0	1.0
Agronomic trial	0.6	3.0
Seed production	(3.6)	(4.6)
Training	-	1.8
Total	8.7	14.5

(2) Considering the on-going rice development programme, the new fields will cover peat and peat soil areas which are representative of development area.

The land use plan of the experimental rice field is indicated as follows:

(a) Amongst the existing experimental fields, seven fields located on eastern side along the public road shall be used as before (5a, 5b, 5c, 7a, 7b, 7c and 8c).

(b) Two fields 10a and 9a currently allocated to produce foundation seeds will be converted to training use for the convenience of visitors because of location.

(c) The field numbers 10b and 17a will be also used as before, though there is a need of some modification.

(d) Amongst the new fields, the field 19a of Nausori clay, 26b of Waitovu peaty loam and half of 37 of Waidamu peaty loam will be equipped with underground drains.

(e) The remainder will be designed suitable for either experiment or seed production purpose.

(f) Upland rice field is excluded in this plan.

(g) The land use map is attached for reference (see Fig.2).

3-3 Irrigation

(1) For the purpose of experiment, the irrigation system will be greatly improved to bring about efficiency, preciseness and overall effective use of water than ever before.

(2) Accordingly all of irrigation facilities including pump, main canal, lateral canal and inlet will be renovated for above purposes.

3-4 Drainage

(1) Although the main drainage system in general is complete, minor improvement is needed to facilitate surface drainage at the experimental fields.

(2) In addition, underground drainage system shall be designed on the representative types of soil to make it more effective.

3-5 Others

(1) To make operational works on the field efficient, lateral road shall be provided to give access for tractor to each field.

(2) To ease post-harvest operation and to avoid mixing of seed, several threshing floors shall be prepared at the appropriate.

(3) To keep a close contact between the field trials and the laboratory works and between the respective researchers and extension workers, field laboratory shall be built. The site will be selected nearby the main building of KRS by taking its future use into consideration.

4. DETAILED DESIGN OF THE EXPERIMENTAL FARM

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4-1 Determination of Location and Size of the Experimental Rice Farm.

Considering the expansion of the research needs for rice cultivation in the future, 20 ha of research fields included the existing area are required to be consolidated. The location of the fields shall be selected so as to include such types of soil as represented the on-going Agricultural Development Project Area as shown Fig. 1. Fortunately, the candidate area is already equipped with farm roads and drainage system and is located on the same direction of the main irrigation canal.

This selection was derived from the mutual discussion between both sides of Fiji Govt. and JICA Team.

4-2 Land Consolidation Works

(1) Land reclamation works

The land reclamation work of the existing grass land of the approx. 9 ha (Plot No. 18b ∿ 37) will be carried out. This is one part of 20 ha of the project area. The land reclamation work consists of grass cutting, burning, surface soil removing, land grading, subsoil compaction and backfilling. Furthermore, the drainage condition in the peat soil area (Plot No.37) is

so poor that the swanp type bulldozer should be applied.

(2) Drainage improvement work

Due to the low level of Plot No.18b, one half of this plot located along side the main canal cannot be utilized for cultivation. For improvement of this area, the 20 cm of soil dressing will be carried out.

(3) Underground drainage work

In order to drain the excess water from field quickly and to reduce the ground water level effectively, the underground drainage work should be applied to 3 selected soils among 6 types of soil of the area. The drain pipe will be installed on each half area along the roads of 3 typical soil plots. The comparative study about "with drain pipe" and "without drain pipe" will be carried out to examine their effectiveness.

Nausori clay .....Plot No.19a

Waitovu peaty clay....Plot No.26b

Waidamu peaty loam....Plot No.37

The structure of drain pipe is shown in Drawing 2. The perforated polyvinyl pipe will be applied. The ditch will be excavated by trencher and backfilled with previous materials, such as sand, fine aggregate and chaff. According to the

coefficient of soil conductivity, the diameter and spacing of drain pipe will be determined at 50 mm and 15 m respectively. And the relief well will be installed at the outlet point of drain pipe in order to control the drainage water effectively.

4-3 Irrigation Plan

(1) Irrigation water

For the experiment purpose, irrigation water is neccessary to be supplied adequately at any time needed for experimental operation, besides supplementing it for growing crops during dry season. Accordingly, irrigation water requirement for the experiment field should be usually estimated with a sufficient allowance. The existing irrigation facilities including pumps are so designed as to meet the above mentioned demand and to enable covering more area than as it is. For designing irrigation system, the present designed water requirement will be assumed and an effective water distribution system will be worked out. The irrigation canal system is shown in Drawing 3.

(2) Design of main irrigation canal

(a) Study of canal type

The existing concrete-lined main canal

causes the serious seepage problem because of its deterioration. If this situation were resolved, a shortage of water head on each plot would be caused by the expansion of the research field. To solve the present and possible problem mentioned above simultaniously, the existing main canal is better to be substituted by the pipeline. As a result, the efficient water and land uses and the easier operation and maintenance can be assured.

(b) Study of pipe material and its diameter

The pipe diameter is determined based on the standard velocity as shown below.

Diameter (mm)	Designed Velocity (m/sec)	(Max.V)
200 - 400	0.9 - 1.6	(5.0)
75 - 150	0.7 - 1.0	(5.0)

The results of hydraulic calculation are summarized as below.

Section	Designed Capacity m^3/sec	Diameter mm	Velocity m/sec	Distance m
Pump - C-1	0.120	ø300	1.698	183.10
C-1 - C-2	0.098-0.081	ø250	1,996-1.650	202.85
C-2 - C-3	0.062	ø200	1.974	206.40
C-3 - C-4.	0.049-0.038	ø200	1.560-1.210	202.30
C-4 - C-5	0.030	ø200	0.955	211.35
C-5 - C-6.	0.020	ø150	1.154	196.70
C-6 - C-7	0.010	ø125	0.814	230.60
				(1,433.30m)

According to the calculation, the pipe diameter of ϕ125mm (V=0.98 m^3/sec) is sufficient size to the Section C-6 - C-7. However, considering the possibility of extension of main canal in future, the pipe diameter of ϕ150mm is adopted.

Regarding pipe materials, either polyvinyle chloride, concrete or asbestos cement will be considered to apply. The reason for these comes from their smaller internal and external pressure. However, since the project requires to complete in a short construction period and the area to install them includes peat and peaty soils, the polyvinyle chloride pipe (PVC) which is handy and flexible will be adopted. On the other hand, the steel pipe will be adopted for valve works and road crossing works due to specialities of these structures.

(c) Design of related structures

The diversion, road crossing, canal crossing, air valve and blow off works are to be considered as the related structures for the main and secondary canals. The structure of these works are described below.

(i) Diversion work

The water diversion structure from the main pipe line to the secondary pipe line No.1 is designed by using two sluice valves which are installed at the down portion of each pipe line after diversion point. On the other hand, the water diversion structure from the main pipe line to the secondary canals (No.2 - No.7) is designed by using the gate valve which discharges the water directly to the open canal.

(ii) Road crossing work

Road crossing structures are constructed at the crossing point of the main canal and the Koronivia road. (RD 269.3m from beginning point). and at the crossing point of No.1 secondary canal and the main road. (RD 93.2m from diversion point). The structure is designed as steel pipe with concrete linning.

(iii) Canal crossing work

Canal crossing structures are constructed at the crossing point of the man canal and No.3 secondary

drainage canal (KEI-1 RD)(RD 689.3m from beginning point) and at the crossing point of the main canal and No.4 secondary drainage canal (KEI-2, (RD 900.0m from beginning point). The structure is designed as aqueduct type.

(iv) Air valve work

Air valves are installed at the upper portion of road and canal crossing point. The type of air valve is designed as single type. The relationship of diameter between air valve and main pipeline are shown as follows.

Diameter of main pipe (mm)	Diameter of air valve (mm)
ϕ350 - ϕ250	ϕ50
ϕ200 - ϕ125	ϕ25

(v) Blow off work

Blow off valves are installed at the upper portion of drainage canal crossing point which are connecting with blow off pipe for discharge water to the drainage canal. The diameter of blow off pipe is desinged at 50 mm

(3) Design of secondary irrigation canal.

As for the secondary irrigation canal No.1, among all secondary irrigation canals, the existing deteriorated canal of concrete-lined will be replaced by pipeline system for irrigation into the precise experiment fields. The gate valve will be applied for the purpose of diversion water to the field.

As for secondary irrigation canals No.2 and No.3, the existing concrete lined canals will remain as mush, though there is some need to repair by mortar. And the extension portion will be constructed as an open type canal lined with cost-in-place concrete.

Four(4) new secondary canals (No.4, 5, 6 and 7) will be constructed as an open type canal lined with cast-in-place concrete.

The main feature of secondary canals are shown as follows.

No.	Type	Length
SHI-1	pipe line	484 m (ø150)
2	open canal	124
3	"	116
4	"	44
5	"	39
6	"	44
7	"	44

(4) Design of tertiary canal

Two(2) new tertiary canals in pipe lines branched off the secondary canal No.1 will irrigate the netted area of Plot No.8c. The diameter of these pipe lines are designed at 75 mm. In order to irrigate the existing area of subdivided 9 units, nine hydrants with stop valve type will be installed at each inlet of these nine farming units.

Regarding drainage, existing drainage outlets and drainage canals will be fully utilized.

4-4 Pump Plan

(1) Design of pump

At present, there are two pumps, one is out of order and another is working but in deteriorated state. In this project, the former pump will be replaced by a new one. This has nearly the same capacity as the existing one. Due to the extension of the main pipe line, the water head will be increased. Therefore, in the design of pump facilities, the pump outlet will be directly connected to the main pipe line in order to keep a sufficient water head.
And the existing pump still functioning will serve as a standby in emergency.

The specifications of the new pump shall be same as those of the existing as shown below:

Type of pump	Incline type
Diameter of pump	ϕ250mm(10")
Discharge	$Q=7.2m^3/min=0.12m^3/sec$
Total Head	H=17.5m(7.0m for the old)
Power of motor	P=37KW(15KW for the old)

(2) Design of pump house

The existing deteriorated pump house will be replaced by a new wooden house with a size of 4.2 x 2.8 and a height of 3.0m.

4-5 Drainage Plan

The project area is situated within the area of the Koronivia-East Drainage Improvement Project, Nausori Drainage Board. Under this project, the main and secondary drainage canals are under costruction. However, two secondary drainage canals (No.1 and No.2), in this drainage plan, are excluded from the areal drainage scheme stated above and they should be treated in this plan.

The No.1-A secondary canal along the northern side of the Koronivia Road for Plot No.7a, 7b and 7c and the No.1-B canal along the opposit side of the road for Plot No.9a, 10a and 11a will be newly constructed. Both canals will be designed to connect to the main drainage canal.

In addition, the secondary canal No.2 will be widened to secure sufficient canal cross section. The canal depth is designed at more than 1 m to meet the ground water level of the related fields.

The design capacity of each canal is determined as follows. In this calculation, the unit area drainage discharge of 0.012 m^3/sec/ha is adopted.

Secondary 1-A Q=0.054 m^3/sec(A=4.54 ha)

" 1-B Q=0.031 m^3/sec(A=2.55 ha)

" 2 Q=0.023 m^3/sec(A=1.93 ha)

Considering the natural gradient of ground surface, hydraulic gradient is designed 1/400. Hence, the drainage canal sections are computed as follows:

- Type: Trapezoidal earth canal
- Roughness Coefficient: 0.03 for Manning formula
- Bottom width: 0.30m
- Canal Height: 1.00m
- Inside slope 1:1.0

4-6 Road Plan

The Roads to be newly constructed can be classified into two categories according to their functions, namely (a) Secondary farm roads constructed along the lateral irrigation canals, and (b) maintenance roads constructed along the drainage canals.

However, the strip burying pipe line such as main pipe line and No.1 secondary irrigation canal shall be used as the maintenance roads for managing and watching on foot, because there are many valve structures are attached to the pipe line. A new farm road will also be constructed along the secondary drainage canals No.1-A and No.1-B for the tractor use. Because the road constructed along the No.1 secondary irrigation canal (pipe line) will be converted to the maintenance road.

Secondary farm roads will be paved with gravel or macadam. the typical section of the roads are shown in Drawing 10, and the main features of these roads are shown in the following page.

	Effective width (m)	Shoulder (m)	Total width (m)	Height of road surface (m)
Secondary Farm road	3.0	0.5	4.0	0.3 over
Maintenance road	1.0	-	1.0	0.3 over

The total length of farm and maintenance roads is listed below:

Type	No. of Road		Length m
Secondary road	SFR-1	L=	400.80
"	2		249.00
"	3		248.20
"	4		196.30
"	5		90.10
"	6		80.00
"	7		88.60
"	8		92.30
Total			1,445.30
Maintenance road	MR-1	L=	1,433.30
"	2		495.00
"	3		257.00
Total			2,185.30

4-7 Relative Facilities Plan

(1) Field laboratory

In order to improve a flow of experimental activities, the field laboratory is proposed to be established. A space of 150 m^2 is considered to fit for accomodating and arranging the various equipments to be introduced.

The prefabricated house will be used for laboratory shed, supplied by the JICA. It will be placed at the building site to avoid floods and other possible troubles (Ref. to Drawing No.11.)

(2) Threshing floor

Nine concrete paved threshing floors in total, an area of 9 square meters for each will be provided on the right place of the field for threshing works at site.

5. CONSTRUCTION PLAN

5. CONSTRUCTION PLAN

5-1 Construction Schedule

The time span required for the construction works would be about 6 months. In the first half, the land consolidation work will be conducted and, in the latter half, the pipe line and other related structures works will be done.

The construction schedule is shown in the Fig.3.

5-2 Construction Plan

Construction plans for the experimental farm, including the land consolidation and other related structures works are summarized as follows:

(1) Temporary Works

Temporary works, such as establishment of site office, conformation of road for construction use, setting of center line of roads and canals, and preparation for construction materials shed will be carried out.

(2) Land Consolidation works

(a) Land Reclamation work (A=8.5 ha)

As for fields from plot No.18b to plot No.37 to be reclaimed for the additional experimental farm, the grass cutting, burning, surface soil removing, land grading and backfilling will be carried out.

For grass cutting and clearing, the tractor with mover will be used, and for earth works after burning, the bulldozer (11 ton class) will be used. The work quantities and construction equipments required for this item are estimated as follows:

Earth work volume V=8,500 m^3

Construction equipment

Tractor with mower	1 unit	
Bulldozer (11 ton)	2 units	
Bulldozer (swanp type)	1 unit	- For peat soil area

(b) Drainage improvement work (A=0.47 ha)

As for the field Plot No.18a to be improved in drainage, the 20 cm of soil dressing will be carried out in order to gain the same level as the adjacent land. The estimated earth volume for the area of 0.47 ha is 940 m^3. The bulldozer will be applied for hauling and compaction.

(c) Drain pipe work

The construction equipment, either trancher or backhoe can be used for pipe placing.

Total Length L=945 m(315m x 3 places)

Excavation V=142 m^3

Pipe placing will be carried out after completing the surface soil removing in the land reclamation work.

(3) Irrigation canal works

(a) Main irrigation canal work

The existing concrete lined canal of 600m long will be demolished to substitute for pipe line. Of which, a distance of 80m along the Plot No.8c, the netted field, will be carried out by man-power because the construction equipment can not apply for the site. The work quantities for this item are estimated below.

Total Length	L_1	=1,353m (by machinery)
	L_2	= 80m (by man-power)
Earth work volume	V_1	=1,768.2m^3
	V_2	= 135.2m^3

The backhoe will be used for demolition of existing concrete lined canal and for excavation of canal.

(b) Secondary irrigation canal work

As for the secondary irrigation canal No.1, the existing concrete lined canal will be demolished for placing of pipe line similar to the case of main canal. Both existing concrete lined canals, No.2 and 3, shall be used as they are and they will be extended. The remaining planned canals, No.4, 5, 6 and 7 will be constructed as an open type canal lined with cast-in-place concrete.

The work quantities for this item are estimated below.

Total length

Pipe line: L=484m

Open canal: L=173m(inprovement)

L=244m(new construction)

(c) Tertiary canal work

The tertiary canal in pipe line branched off the secondary canal No.1 will irrigate the Plot No.8c. The man-power work can not help to be applied for construction of this pipe line.

The work quantities for this item are estimated below.

Total length (pipe line) L=144m(by man-power)

(4) Pump station works

(a) Pump installation work

Regarding replacement of pump, the works for demolition of old pump and installation of pump will be carried out after completion of fundation work of pump house. The main feature of pump are shown as follows.

Pump diameter: ϕ250mm

Length of Suction pipe: L=14m

(b) Pumping house construction work

The pump house will be renewed by a new wooden house. The size of new pump house are shown as follows;

Area of pump house: $A=4.2m \times 2.8m=11.8m^2$

Height of pump house: $H=3.0m$

(5) Drainage Canal Works

The work quantities for the drainage canal work including new construction of secondary canal (SDC) No.1-A and 1-B, and enlargement of canal cross-section of SDC2-2 are estimated as follows:

Length: L=498 (new construction)

L=117m (improvement)

Earth work volume: $V=1,340m^3$ (new construction)

$V=150m^3$ (improvement)

The backhoe will be used for excavation and finishing of side slope of the drainage canals.

(6) Road Works

(a) Secondary Farm Roads

The farm roads along the secondary canals will be roughly finished for the temporary use of construction and then they will be completed after finalizing the connected construction works. For the course base work, residual earth remained by the land reclamation works will be appropriated

or the other suitable material to the course base will be applied. The bulldozer will be applied for hauling and compaction use. The work quantities for this item are estimated as follows:

Total length: L=1,440m

Earth work volume: V=1,860m^2

(b) Maintenance roads

The maintenance road construction along the secondary drainage canals, having a width of 1.0m, will be carried out in parallel with the canal excavation work. The work quantities are shown below:

Total length L=340.0m

Earth work volume: V=240m^3

The soil material for course base will be obtained from excavation of drainage canal. However, when this material is not suitable, other material shall be procured.

(7) Relative facilities works

(a) Field laboratory work

The prefabricated house for field laboratory will be put together after completing of foundation work. At the same time, electrical and other works for laboratory equipments and watering

facilities will be carried out. However, the water and electric supply system up to the laboratory house will be provided by the Fiji side. The size of prefabricated house is shown below:

Area: 7.2m x 21.6m (1 Floor)

Height: 2.4m

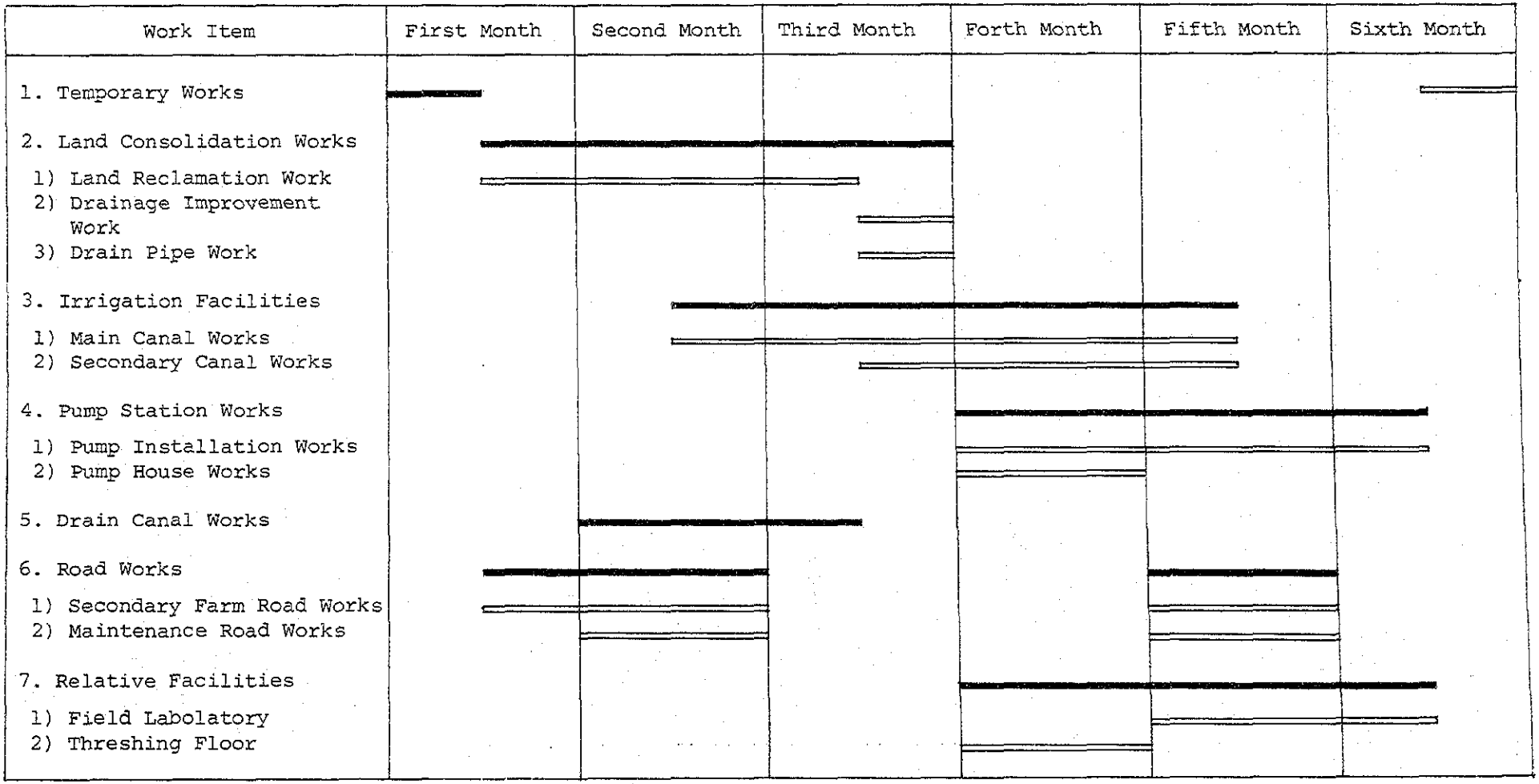
(b) Threshing floor work

The threshing floor work will be carried out after completing of land reclamation and irrigation and drainage canal works.

Area: A=3m x 3m

Number of Unit: 9 units

Fig.3 Construction Schedule



6. CONSTRUCTION COST

6. CONSTRUCTION COST

6-1 Procurement of Construction Materials and Equipments

The procurement of materials and equipments needed for the land consolidation work is based on the following plan:

(1) Materials and equipments procured locally

Construction materials such as sand gravel, steel, cement and ready mixed concrete will be procured in Fiji. So are all of necessary construction machineries available in Fiji.

(2) Materials to be supplied by the JICA

The materials to be supplied by the JICA are listed as follows:

(a) Pipes (PVC)

(b) Pump

(c) Drain pipes

(d) Field Laboratory house

6-2 Cost Estimate

(1) Construction Cost

The construction cost for the experimental farm is estimated at ¥ 2.80 million as indicated below:

Work items	Cost (F$)
Land Consolidation	33,499.40
Irrigation facilities	43,891.91
Drainage facilities	5,709.76
Roads Construction	4,076.95
Relative facilities	6,676.98
Sub-total	93,855.00
Overhead Cost	14,078.25
Total	107,933.25
Contingency	10,793.32
Other Expense Construction	8,548.43
Grand Total	F$127,275.00 (¥28,000,000)

The total cost including the materials to be supplied by the JICA are summarized in Table 1.

Table 1 Construction Cost

(Unit : F$,J¥)

Work Items	Q'ty	Construction cost	Cost for Material Supplied	Remarks
1. Land Consolidation Works		F$	J¥	
1-1 Land Reclamation Work	8.3ha	29,514.40	-	
1-2 Drainage Improvement Work	0.47ha	1,663.20	-	
1-3 Drain Pipe Work	988m	2,321.80	347,000	
Sub-total		33,499.40	347,000	
2. Irrigation Facilities				
2-1 Pump Facilities	1 L.S.	1,450.00	6,728,000	
2-2 Main Pipe Line	1.43km	21,595.87	7,799,000	
2-3 Secondary Pipe Line	0.49km	3,762.04	1,347,000	
2-4 Secondary Canal	0.47km	15,211.18	-	
2-5 Tertiary Pipe Line	0.14km	803.08	185,000	
2-6 Hydrant	27places	1,069.74	368,000	
Sub-total		43,891.91	16,427,000	
3. Drainage Facilities				
3-1 Secondary Canal	0.61km	2,414.48	-	New construction
3-2 Relative Facilities	1 L.S.	3,295.28	-	Improvement
Sub-total		5,709.76	-	
4. Roads Construction				
4-1 Secondary Farm Road	1.19km	3,598.79	-	
4-2 Maintenance Road	2.33km	478.16	-	
Sub-total		4,076.95	-	
5. Relative Facilities				
5-1 Field Laboratory	158m^2	5,346.87	5,026,000	7.2m x 21.6m, 1F
5-2 Threshing Floor	9 places	1,330.11	-	
5-3 Relative Equipments	1 L.S.	-	-	
Sub-total		6,676.98	5,026,000	
6. Total (1 ~ 4)		93,855.00	21,800,000	
7. Overhead Cost		14,078.25	-	(6) x 15%
8. Construction Cost (6+7)		107,933.25	-	
9. Contingency		10,793.32	-	(8) x 10%
10. Total (8+9)		118,726.57	-	
11. Other Expense		8,548.43	-	(8+9) x 7%
12. Grand Total (10+11)		127,275.00	21,800,000	

(=J¥28,000,000)

ATTACHMENTS

ATTACHMENT 1	Contract for Construction of Experimental Rice Fields and its Related Facilities for Koronivia Research Station
ATTACHMENT 2	Specification

1．工事費請負契約書（案）

CONTRACT

FOR

CONSTRUCTION OF

EXPERIMENTAL RICE FIELDS AND ITS RELATED FACILITIES

FOR

THE KORENIVIA RESEARCH STATION

CONTRACT

For Construction of Experimental Rice Fields

and its Related Facilities for the

Korenivia Research Station.

This Contract is made and entered into this ____ day of

_____ at the JICA Suva Office between

Japanese International Cooperation Agency, Swva Office

by _____ Title _____

as its authorized representative of the Suva Office, hereinafter called "the JICA" of the one part, and _____ whose office is situated at _____

_____ Represented by

_____ Nationality ____ Title _____

hereinafter called "the Contractor" of the other part.

Both parties mutually agree under the terms of this Contract as follows:-

Article - 1 (a) (Description of Work)

Contractor shall carry out the construction of experimental rice fields and its related facilities for the Korenivia Research station.

Article - 1 (b)

The following documents shall be deemed to form. be read and constructed as port of this agreement viz:-

i) Bill of quantities (itemized statement)

ii) The attached construction drawings

iii) The attached specification

Article - 2 (Contract Sum of Construction)

The contract sum of construction shall be F$ _____.( ) and be based on the bill of quantities attached here.

Article - 3 (Time Limit on Construction and its Prolongation)

The Contractor shall start work within ten (10) days of signing by both parties of this agreement, and complete work by the ____th of ___, 1986.

Article - 4 (Delays)

In a case where it is clear that the Contractor is failing to fulfil his obligations within the period referred to in the preceeding Article. The Contractor shall inform the JICA of this as soon as possible and if the JICA agrees that the delay is due to such causes as natural calamity or others for which the Contractor is not liable, a reasonable extension of time shall be approved. In this case, the sum referred to in Article 15 shall not be collected.

Article - 5 (Process of carrying out of Work)

The Contractor shall carry out the work in accordance with the drawings and specification referred to in Article 1(b). And in cases where it is necessary for carrying out such work as is not mentioned therein for the purpose of promoting the present construction or for reasons of established practices, the Contractor shall caryy out the said work under the direction of the JICA. In cases where the Contractor finds any doubt in the plans of construction, the Contractor shall ask the JICA for the necessary directions before commencing work

on that part for which there exists some doubt. The JICA must provide such information and details within seven (7) days of the written request from the Contractor.

Article - 6

The Contractor shall follow the direction of the JICA or the Engineer to be appointed by the JICA. As to materials for the construction, the Contractor shall use only those inspected and approved by the JICA or the Engineer appointed by the JICA. In cases where any defective work has been done as a result of such use of materials which have not been inspected by the Engineer. The Contractor shall be liable to change the materials or repair the work at his own responsibility. The construction shall be carried out in accordance with the proper technique and durability shall be the principal aim as regards to the construction.

Article - 7

As to the workman to be hired by the Contractor for the work, the Contractor shall assume the responsibility as entrepreneur or employer, as provided for by Laws and Regulations.

Article - 8 (Transfer of Right and Obligation)

The Contractor shall not assign or sublet to a third party the whole or part of the construction except in cases where the Contractor has obtained written approval from the JICA.

Article - 9 (Damages)

In cases where any damage is caused to the JICA or a third party, materials or buildings, through carelessness on the part of the Contractor during the course of work or transportation of materials, the Contractor shall be liable to repair or compensate such damage at his own expense by the date appointed by the JICA or the third party.

Article - 10

In case where the Contractor fails to repair or compensate such damages referred to in the proceeding Article by the fixed date, the JICA may pay for such repair on behalf of the Contractor and collect compensation from the Contractor by deducting the amount from the sum of construction to be paid to the Contractor under the provisions of Article 20, and in cases where the damages exceed the sum of construction, the JICA may collect the deficit.

Article - 11(a) (Change of Construction Drawing and Submission of Necessary Documents)

In cases where the JICA feels it necessary to discontinue work owing to unavoidable circumstances or to alter the plan of construction, the JICA may request the Contractor to calculate, on the basis of the unit prices as detailed in the priced bill of quantities referred to in Article - 2, as increase or decrease in the sum of construction resulting from the suspension or alteration of the work and the Contractor shall comply with the request. When the JICA orders such a suspension or alteration, depending on the statement of the above mentioned calculation, the Contractor shall submit a written consent by the date appointed the JICA.

Article - 11(b)

Where additional work cannot be properly measured and valued on the basis of the unit price in the bill of quantities referred to in Article - 2, the Contractor shall be allowed daywork rates in accordance with a written consent by the JICA.

Article - 12 (Price Adjustment)

(a) In the case of the costs of materials rising sharply as a result of the fluctuation in the market prices due to an unexpected change in the economic conditions, a reasonable adjustment of the above mentioned sum or the contents of the work, will be made according to a mutual agreement between the JICA and the Contractor.

(b) In a case where the Contractor incurs loss or suffers loss unreasonably in some item of Bill of quantities due to the JICA's failure to provide the information and details referred to in Article - 5 of the particular item or work, then reasonable adjustment of the above mentioned losses shall be considered by the JICA on the detailed claim submitted by the Contractor.

Article - 13 (Right to Rescind Contract and Penalty)

In cases where the Contractor fails to fulfil his obligations under this contract, the JICA may rescind the whole or part of the Contract. In such a case, the JICA may collect from the Contractor a sum as a penalty of 10 percent (10%) of the amount which is equivalent to the rescinded. In cases where the damages caused on the JICA, on account of the non-fulfilment of contract by the Contractor, exceed the sum referred to in the

preceeding paragraph, the JICA may further demand the Contractor to pay the excess.

Article - 14

In cases other than provided for in the preceeding Article where the Contractor fails to fulfil his obligations, or in cases where the fulfilment of obligation by the Contractor is regarded to be difficult, the JICA may have a third party fulfil, at the cost of the Contractor, the whole or part of the obligations of the Contractor. Even if liability of the Contractor exceeds the contract sum referred to in Article - 2 in consequence of this, the Contractor may not raise any objection to it.

Article - 15

In cases other than provided for in Article 13, where the Contractor fails to complete the construction at his own responsibility, within the period referred to in Article - 3, the Contractor shall be liable, a period fixed by the JICA, to pay the JICA, per week of delay, a sum equivalent to 0.2 percent (0.2%) of the contract sum referred to in Article - 2.

Article - 16 (Damages caused by Natural Calamity etc.)

In cases where serious damages occur to the completed part of the work, or the materials, tools etc., already carried into the field of construction, the Contractor shall promptly inform the JICA of the circumstances. If such damages are caused by a natural calamity, an earthquake, a flood, a civil war, a war, an epidemic, or a general/trade strike, rioting or other unavoidable reasons, for the occurance of which no responsibility

can be attributed to either the JICA or the Contractor and it is admitted that the Contractor has paid the care of good administration to avoid the occurance of such damages, the JICA shall be liable for the amount of the damages which shall be fixed through negotiations between the JICA and the Contractor.

Article - 17(a) (Inspection)

The work at any stage shall be subject to inspection to be conducted by the JICA or an inspector appointed by the JICA, in the presence of the Contractor and necessary labour and articles required for such an inspection shall be provided by the Contractor.

Article - 17(b)

In cases where the work fails to pass the inspection referred to in the proceeding paragraph, the Contractor shall carry out necessary repair at his own cost, under the direction of the JICA.

Article - 18 (Date of completion of construction and obligation thereafter)

The date of completion of construction shall be regarded as that on which the final work, including removal of temporary constructions and cleaning, has passed the inspection referred to in Article - 17 and on that date the object of the total construction shall be delivered to the JICA by the Contractor. For a period of three (3) months thereafter, any defect in the construction, the cause of which is judged in the opinion of the JICA to be attributable to faulty or inadequate technique or materials employed by the Contractor, shall be immediately repaired or improved at the cost of the Contractor.

Article - 19(a)(Payment & currency)

The JICA shall pay to the Contractor in Taka currency as follows:-

Payment for the part of the work already completed shall be allowed by the JICA three times during the course of construction at the request of the Contractor, provided that it has passed the inspection referred to in Article - 17.

However, the amount of the payment shall be limited to ninety per cent (90%) of the work already completed. The final payment will be carried out within one month after the JICA receives the bill which will be submitted by the Contractor on or after the date of completion of construction referred to in the preceeding Article.

Article - 19(b)

Ten per cent (10%) of the contract price shall be paid as advance payment for mobilization with order to commence, upon production of a refund bond or Bank Guarantee for the same amount as the said advance payment.

Article - 19(c)

This advance payment shall be adjusted from subsequent monthly bills by such sum as the proportionate to the monthly progress stated in the said bills.

Article - 19(d)

The refund bond or bank guarantee as provided in paragraph (b) here or shall be returned to the Contractor by the JICA upon the delivery of the works.

Article - 20 (Interest for the delay of payment)

In cases of the payment referred to in the preceeding Article being delayed owing to a cause or causes

attributable to the JICA, the Contractor may request the JICA to pay, per week of delay, a sum equivalent to 1.0 per cent (1.0%) of the bill sum on arrears of payment.

Article - 21(a)(Settlement of dispute)

If there arises any dispute with regard to this Agreement or the construction Drawings or Specification referred to in Article - 1(b) it will be settled by a mutual consultation between the JICA and the Contractor.

Article 21(b)

Should it not be possible to reach a mutual agreement between the JICA and the Contractor on such dispute, then it shall be referred to an Arbitrator or Arbitrators acceptable to both the JICA and the Contractor and the decision of this Arbitrator or/of Arbitrators shall be binding on both the JICA and the Contractor.

The Conclusion of the Agreement:

Two copies of the Agreement shall be prepared with the signature of both parties affixed to each of the copies, one copy to be held by each party.

Date :

.....JICA

Mr._____, Resident Representative
JICA, Suva Office

.....Contractor

.....Witness

.....Witness

2．工事仕様書（案）

Specification

Specification

Section 1. General

1. General

1-1. Application

1) This specification is applicable to "Construction of Experimental Rice Fields and its Related Facilities for ths Korenivia Research Station in Fiji".

2) Quantity of main work

(i)	Land Consolidation Works	11 ha
(ii)	Irrigation Facilities	
	Pumping station	1 No.
	Main pipeline	1,450 m
	Secondary pipeline	490 m
	Open canel	730 m
	Tertiary pipeline	160 m
	Hydrant	33 Places
(iii)	Drainage Facilities	
	Secondary drainage Canel (new construction)	410 m
	Secondary drainage Canel (inprovement)	90 m
(iv)	Rood works	
	Farm road	1,090 m
	Maintenance road	2,000 m
(v)	Relative Facilities	
	Field Laboratory	158 m^2
	Threshing Floor work	9 Places

3) Specifications entered in the drawing shall be treated in reference to this specification.

1-2. Engineer

"Engineer" means the engineer who was appointed to supervise the works by the JICA.

1-3. Site Representative

Site representative shall be well qualified in supervision or have enough experience of supervision. The Contractor shall submit career history of a site representative to the Engineer for his approval.

1-4. Work Schedule

The Constractor shall submit his work schedule before the commencement of the works at the job site. If the Contractor intends to change the work schedule, the approval from the Engineer shall be obtained prior to the modification of schedule.

Also the Contractor shall submit the machineries scheme including the numbers, and kind of machineries and using period of them.

1-5. Field Test and Inspection

The field tests in accordance with the specifications and the demands from the Engineer shall be the responsibility for the Contractor. The charges for such fields test shall be included in the total amount of the construction cost, and the Contractor is not entitled to claim any amount of the field test charges.

1-6. Temporary Office and Residence

In case the Contractor intends to build the temporary office, residence and so forth, the Contractor shall submit the plan to the Engineer for approval at least 10 (ten) days in advance of the commencement of such works.

The Contractor is required to always keep the buildings and facilities in good condition and to make proper drainage and sanitary system. Should the Contractor build them outside of the job site, the Contractor shall arrange with the owner of such land and at its own expense.

1-7. Record on Construction

The Contractor shall submit the record on whole progress of Construction every week to the Engineer.

1-8. Clearance of the Work Site

Upon completion of the works, the Contractor shall clear the site within period of construction.

Section 2. Earth Works

2-1. Scope

The work under this section shall consist of all classes of grading leveling, ditching, earthmoving, all other excuvation, backfill, banking, surfacing and ony other such construction work.

2-2. Clearing and Stripping

(1) Clearing

All areas to be cleared will be as designated on the Drawings and/or as directed by the Engineer. This work shall basically consist of clearing all vegetation, roots, brush, rubbish and other objectionable matter from the specified area to the satisfaction of the Engineer.

(2) Stripping

All the surfaces which are to be stripped will be as shown on the Drawings and/or as directed by the Engineer. This work shall basically consist of removing boulders, underground roots and other undesirable items to a depth as shown on the Drawings or as otherwise stipulated by the Engineer.

Materials obtained from stripping work shall be deposited in places approved by the Engineer. Stockpiled material shall be smoothed to a measurable outline and shall not be higher than that specified by the Engineer.

2-3. Excavation

(1) Excavation of all canals, ditches, pipelines and structure shall be in accordance with cross-section, line and grades shown in the drawings. Excavation operations shall be such that all suitable materials for embankment shall be separated from objectionable materials which are to be wasted.

(2) If the spontaneous landside of the slope occurs or is expected to occur, the Contractor shall inform the Engineer without any delay and shall ask him how to deal with landslide.

(3) The excavation of the slope shall be finished with tools to have the gradient indicated in the drawings or by the Engineer.

(4) If the slope and the foundation of the canals, ditches, or the foundation of pipelines, structures, ponds and the inlet suction tank of the pump are over excavated, the Contractor shall backfill with gravel or other material approved by the Engineer at the contractor's expense and the backfilled materials shall be compacted sufficiently.

2-4. Backfill and Fill

Backfill and fill shall be placed to the lines and dimensions as shown on the Drawings.

The materials to be used for backfill and fill shall be all classes of disposed or excavated materials available in-situ. The quality of such materials shall be approved by the Engineer and shall be free from any organic matter or other objectionable material such as large clods or stones, boulders, etc.

The material shall be handled and placed in such manner as to achieve favorable compaction and density. The method of placing, moisture controlling and compacting backfill and fill shall be subject to approval by the Engineer.

2-5. Embankment

Embankments shall be placed and trimmed to the lines and dimensions as shown on the Drawings. The materials to be

used for embankment shall be all classes of disposed or excavated materials available in-situ. The quality of such materials shall be approved by the Engineer and shall be free from any organic matter or other objectionable material such as large clods or stones, boulders, etc. The material shall be placed in successive horizontal layers of loose material not more than 200mm in depth. Each layer shall be spread uniformly on a soil surface that has been moistened or aerated as necessary and scarified or otherwise broken up in such a manner that the fill will bond with the surface on which it is placed. The material shall be handled and placed in such manner as to achieve favorable compaction and density. The method of placing, moisture controlling, compacting and trimming of the embankment shall be subject to approval by the Engineer. The surface of the embankment shall be left 150mm above final grade to allow for settlement. After an adequate period approved by the Engineer, the Contractor shall return and fill in low spots, or scrape off high spots.

2-6. Disposal of Excavated Material

Excavated materials may be used for backfilling and/or embarking unless otherwise specified or directed by the Engineer. Excavated material in excess of requirements, shall be disposed of in the disposal area appointed by the Engineer. Waste material shall be piled by taking sufficient measures to avoid injury or damage to adjacent area and properties.

Section 3. Concrete Works

3-1 General

All concrete works shall be performed as established on the Drawing or directed by the Engineer. Unless specifically provided in this specification, the concrete shall be produced, transported, placed, cured, finished and tested in accordance with the ASTM and JIS provisions or equivalent standard approved by the Engineer.

3-2 Materials

(1) Cement

(i) Cement used in Concrete mixture shall be normal portland cement, properties of which shall be in accordance with ASTM-C150 and JIS-R5210 or equivalent standard approved by the Engineer.

(ii) Cement shall be reliable brand, good quality and absolutely dry.

(iii) The Contractor shall construct a water-proof cement storage shed at the job site, floor of which shall be higher than the ground surface at least 30 (thirty) cm.

(iv) The Contractor shall not keep cement at the job site more than 1 (one) month, and the storage period is counted from the date when the cement is transported from the manufacturing factory to the job site.

(v) During the course of construction, the Contractor shall not use cement for the works properties of which are changed, especially consolidated.

(2) Fine aggregate

(i) Fine aggregate shall be river sand that is clean and rigid without organic matter and other substance.

Fine aggregate shall have the properties as shown in following table.

Sieve No.	Percent Retained by Weight
4	0 - 5
16	25 - 40
100	93 - 97

The fineness modulus shall be in the range from 2.30 to 3.00.

(ii) The Contractor shall keep fine aggregate at clean and good drainage place, which shall be protect against the mixture with harmful substance such as clay, soil and so on.

(3) Coarse aggregate

(i) The Contractor shall use crushed stone as coarse aggregate which is rigid and endurable substance without organic and harmful materials.

(ii) Coarse aggregate shall have the grading as shown in the following table.

Sieve Size	Percent Retained by Weight
1"	0
3/4"	0 - 10
3/8"	45 - 80

(iii) Coarse aggregate shall be stored in such manner as to avoid inclusion of foreign materials. All coarse aggregate shall be maintained in saturated moisture content and surface dry conditions.

(4) Water

(i) Water used in Concrete shall be clean free from oils, acid, alkali or other matters detrimental to the quality or durability of the concrete.

(ii) Water shall be stored in tanks and not to be exposed to the direct rays of the sun.

3-3 Mixing Design of Concrete

Concrete shall have the proportion as follows:

Class	Compressive Strength 28 days	Mixing portion Cement:Fine A: Coarse A	Slump
Reinforce concrete	f'_c=210 kg/cm^2	1:2:3 (by volumn)	8 - 12 cm
Plain concrete	f'_c=160 kg/cm^2	1:3:6 (by volumn)	8 - 12 cm
Lean concrete	-	1:4:6 (by volumn)	

Fine A : fine aggregate

Coarse A: coarse aggregate

Other proportions for mixed design may be indicated by the Engineer at the job site, if it is necessary.

3-4 Slump Test

The Contractor shall make slump test in each batch in accordance with JIS 1101. In case the Contractor intends to place concrete, the Contractor shall not pour the concrete without prior inspection for the value of slump test by the Engineer.

After the completion of the concrete Works, the Contractor shall submit the data of slump test to the Engineer.

3-5 Mixing the Concrete

The Contractor shall use a power-driven concrete mixer and quantities of cement, aggregate and water in concrete mixture shall be measured correctly in each time. The driving time for mixing concrete shall be more than 2 (two) minutes and less than 5 (five) minutes in order to make concrete with constant consistency and good quality. Take out from the concrete mixer, concrete shall be placed in the form within 30 (thirty) minutes. The concrete mixer shall be checked and cleaned every day and the Contractor shall remove concrete debris attached the concrete mixer.

3-6 Concrete Form Work

(1) Concrete form shall be rigid and strong enough to support the weight of concrete without deformation, and the Contractor shall make concrete form tightly in order to prevent water seepage from unsolid concrete.

(2) The Contractor may use wood form, plywood form and steel form, in any case surface of form shall be smooth and have no damage.

(3) In case the Contractor set up concrete form, the iron embedded within concrete to hold the form shall be cut at concrete surface.

(4) Before placing concrete, concrete form shall be inspected by the Engineer for correctness of size, good preparation and so on.

(5) Before placing concrete, the Contractor shall paint oil on inner side of concrete form for good separation between concrete and concrete form after solidness of concrete.

3-7 Placing Concrete

(1) Before placing concrete, the Contractor shall check and clean the floor and the surface of concrete form.

(2) After a batch of concrete is placed, the surface height of concrete in concrete form shall have same height in a block, and the height of placed concrete layer shall be less than 40 (forty) cm. in each placing.

(3) The Contractor shall place concrete continuously into a lock of structure such as wall, slab and so on.

(4) In case the new concrete is placed on solid concrete, the Contractor shall take out laitance, loose aggregate, low quality concrete on the surface of solid concrete.

3-8 Compaction of Concrete

After placing concrete, the Contractor shall compact concrete by using immerstion type vibrator. Should the Contractor intends to use another type of vibrator, the Contractor shall obtain the prior permission of the Engineer.

3-9 Curing

The Contractor shall cure concrete completely with water. If the Contractor intends to use curing chemical, the Contractor shall obtain the prior permission of the Engineer.

3-10 Reinforcing Bars

(i) Reinforcing bars which are used in reinforced concrete works shall be round bar or deformed bar in accordance with ASTM designation A-7-55 and A-141-55 or JIS G 3112, when the Contractor uses round bars, hook shall be provided as directed by the Engineer.

(ii) The equipment and tool which are to be used to cut, bend and manufacture shall be approved by the Engineer, Hot manufacturing of the reinforcing bar is not permitted.

(iii) Before the bar is erected, the surface of the bars and the surface of any metal supports shall be clean and free from all the dirt and deteriorates which in the opinion of the Engineer is objectionable.

(iv) The minimum coverage for all main reinforcing bars shall be 5 cm.

(v) Cutting and bending of reinforcing bars may be done in a slop or at the job site. All bending works shall be in accordance with the standard approved practice of the industry or by other approved machine methods. Radial for bend and hooks will be as per the detailed approved drawings.

(vi) Laps at joints of reinforcing bar shall have a length at least thirty times of the diameter of bar and shall be bound by steel wire.

Section 4. Land Consolidation Works

4-1 Scope

The work under this Section shall consist of clearing and stripping and grading works, all in accordance with the Drawing and these specifications or as directed by the Engineer.

4-2 Work Preparation

Prior to the work, the planned area shall be isolated from outside drainage to prevent the water coming in. During the work, surface water in the planned area shall be removed as much as practicable.

4-3 Clearing and stripping Work

(1) The Contractor shall conform the boundary of work area in attendance of the Engineer before the commencement of work and shall place boundary posts, if necessary.

(2) Clearing and work shall conform to the requirements specified under Section 2.

4-4 Earthmoving and Filling

(1) Primary earthmoving and filling shall be made within the planned area as a rule.

(2) Earthmoving and filling work shall conform to the requirements specified under Section 2.

(3) Slope surface shall be finished evenly with the grade given in the Drawings. Final grading shall be carried out using a bulloadozer.

(4) In case of over-excavation, the Contractor shall dispose according to the instruction of the Engineer. Its cost shall be borne by the Contractor.

Section 5. Drain Pipe Works

5-1 Scope

The scope under this Section shall consist of furnishing of all labor, materials, equipment and supplies needed for the installation of drain pipe in accordance with the Drawings and these Specifications or as directed by the Engineer.

All pipe, fittings and appurtenamces shall be supplied by the JICA.

5-2 Installation

(1) Excavation of trench

Trench shall be excavated by backhce to the depth shown on the Drawings. The width at the bottom of the trench shall not be less than 50 cm.

The depth of the trench of the drain pipeline shall be such as to have a backfill height, measured above the top of the pipes, of not less than 60 cm.

(2) Backfilling of Trench

Backfilling of trench and other earthwork relating to the trenches shall be executed as specified in Section 2.

(3) Pipe joints

Pipe joints shall conform to the requirements specified in Section 7.

(4) Pipe Cutting

Pipe cutting shall conform to the requirements specified in Section 7.

Section 6. Pumping Stations Construction Works

6-1 Scope

The scope under this Section shall consist of furnishing of all labor, materials equipment and supplies needed for the installation of pump and related equipment and constructing of pumping house in accordance with the Drawing and these Specification or as directed by the Engineer.

The pump and related facilities shall be supplied by the JICA.

The power transmission line to the pumping station shall be furnished by the Fiji Government.

6-2 Earthwork and Structure Excavation

Earthwork shall conform to the requirements specified in Section 3.

6-3 Concrete Work

Concrete work shall conform to the requirements specified in Section 3.

6-4 Reinforcing Steel Bars

All reinforcing steel bars shall conform to the requirements specified in Section 3.

6-5 Brick Masonry

(1) The work under this clause consists of all brick masonry work shown in the Drawings.

(2) Local products can be used and it shall be the first class.

(3) All bricks shall be laid after applying mortor.

6-6 Carpentry

(1) The work under this paragraph consists of all carpentry work shown in the Drawings.

(2) Local timber can be used, and it should be the first class.

(3) All frameworks shall be jointed by optimum jointing method.

6-7 Roofing

Local materials can be used and the construction method shall conform to Fiji specifications.

6-8 Installation of Pump and Related Facilities

The installation of pump and related facilities shall be made strictly in accordance with the manufacturer's technical instruction.

Section 7. Irrigation Pipeline Works

7-1 Scope

This Section deals with matters of irrigation pipeline. The pipeline is composed of the main and distributary pipeline. All pipe, fittings and appurtenances shall be supplied by the JICA.

The Contractor shall furnish all labor, materials, equipment and supplies needed for the construction of these pipelines above mentioned and perform installation and testing of them at the site in accordance with Specifications and Drawings.

8-2 Installation

(1) Excavation of trench

The section of excavation for laying pipes are shown on the Drawings. The excavation of trenches shall be made

in accordance with specification described in Section 2. Additional costs for the excavation exceed the limits and backfill to such sections other than by direction of the Engineer shall be borne by the Contractor.

(2) Pipe bedding

The Contractor shall make pipe beds for pipelines as shown on the Drawings.

The bedding material shall be carefully placed on the bottom of the prepared trench, hand tapped and shaped to fit the lower portion of the pipe conduit barrel. Care shall be taken to ensure that the pipe will be uniformly supported on the bedding material.

(3) Pipe joints

Joints for pipe shall be taper sized solvent welding method, and shall construct the jointing in accordance with the manufacture's technical instruction. In making connections, clean dirt, moisture and oil from pipe and fittings. Particular care shall be taken not to overstress threaded connections at joint.

(4) Pipe cutting

When cuts are necessary, they shall be perpendicular to the axis of the pipe and smooth. Cut shall be made with tools in conformity with the pipe manufacture's recommendations.

(5) Appurtenant equipment

Such as sluice valves and air valves shall be carried out in accordance with the manufacture's instruction.

(6) Protection device

Such as concrete thrust block or locking device shall be done in accordance with the Drawings.

Section 8. Secondary Irrigation canel works

8-1 Scope

The scope under this Section shall consist of excavation embankment and concrete lining for the irrigation canels, all in accordance with the Drawings and these Specifications or as directed by the Engineer.

8-2 Earth Work

Earth work for irrigation canels shall be in accordance with Section 2.

8-3 Concrete Work

Where shown on the Drawings or as directed by the Engineer, the Contractor shall construct a lining for the irrigation canals. Concrete lining shall be constructed in accordance with the applicable provision as Section 3 and the relevant Drawings.

Section 9. Secondary Drainage Canal Works

9-1 Scope

The scope under this Section shall consist of excavation of Canals and construction of the pipe culvert for drainage canel in accordance with the Drawings and Specifications or as directed by the Engineer.

9-2 Earth work

Earth work for drainage canals shall be in accordance with Section 2.

After banking operations are terminated the slope of banking shall be formed by means of slope tamping.

9-3 Pipe Culvert

Pipe culvert shall be made with locally manufactured concrete pipes. Pipe bedding shall comply with the applicable provisions of Section 7-2. Concrete works shall comply with the descriptions of Section 3.

Section 10. Road Works

10-1 Scope

The scope under this Section shall cover the construction of roads consisting of Farm road andMaintenance road. The work shall include grubbing clearing embankment and excavation, all in accordance with the Drawings and these specification, or as directed by the Engineer.

10-2 Earthwork

The earthwork needed for construction of the roads shall be conducted according to the applicable provisions of Section 2.

10-3 Earth Materials

The road base shall be formed with those earth materials as surplus in excavation of ditch, when those materials are appropriate or equivalent in quality to those found in borrow pits.

10-4 Compaction

The base of the embankment shall be compacted with roller and thickness of one compaction shall be about 30 cm in spread. During compaction, water shall be sprinkled for keeping optimum moisture content of the materials.

Section 11. Relative Facilities

11-1 Scope

The scope under this Section shall cover the installation of prefabricated house for field laboratory and construction of threshing floor for drying paddy in accordance with the Drawings and Specifications. The prefabricated house shall be supplied by the JICA.

11-2 Earth work

The earth work needed for construction of the foundation of those facilities above mentioned shall be conducted according to the applicable provisions of Section 2.

11-3 Concrete Work

The concrete work needed for construction of the foundation of those facilities above mentioned shall be conducted according to the applicable provisions of Secion 3.

11-4 Installation

The installation of prefabricated house for field laboratory shall be made strictly in accordance with the manufacturer's technical instruction or directed by the Engineer.

DRAWINGS

LIST OF DRAWINGS

Dwg.1	General Plan
Dwg.2	Pipe Drain Plan
Dwg.3	Irrigation Network Plan
Dwg.4	Main Canal Longitudinal Plan
Dwg.5	Secondary Canal No.1 Longitudinal Plan
Dwg.6	Irrigation Pipe Facilities
Dwg.7	Road Crossing Works Plan
Dwg.8	Canal Crossing Works Plan
Dwg.9	Pump Station Plan
Dwg.10	Typical Section of Road, Drain Canal and Others
Dwg.11	Field Laboratory Plan

THE GOVERNMENT OF FIJI

THE IMPROVEMENT OF RICE CULTIVATION TECHNOLOGY PROJECT

TITLE OF DRAWING

GENERAL PLAN

JAPAN INTERNATIONAL COOPERATION AGENCY
TOKYO JAPAN

DWG. NO. 1

GENELAL PLAN

S=1:2000

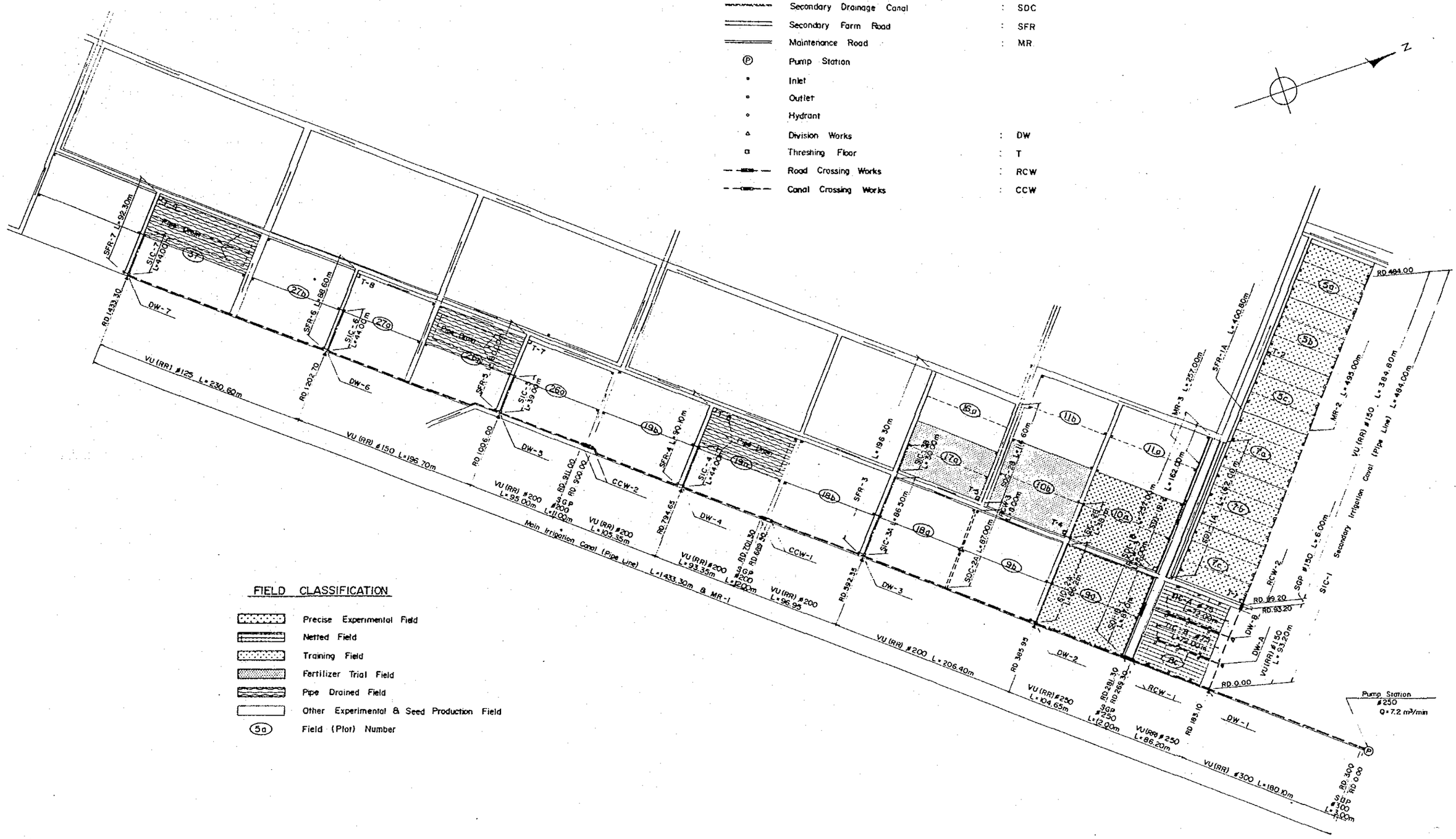
LEGEND

		(Abbr.)
———	Main Irrigation Canal (Pipe Line)	
———	Secondary Irrigation Canal (Pipe Line)	: SIC
———	Secondary Irrigation Canal (Open)	: 〃
———	Tertiary Irrigation Canal (Pipe Line)	: TIC
———	Secondary Drainage Canal	: SDC
═══	Secondary Farm Road	: SFR
═══	Maintenance Road	: MR
Ⓟ	Pump Station	
•	Inlet	
◦	Outlet	
◦	Hydrant	
△	Division Works	: DW
□	Threshing Floor	: T
———	Road Crossing Works	: RCW
———	Canal Crossing Works	: CCW

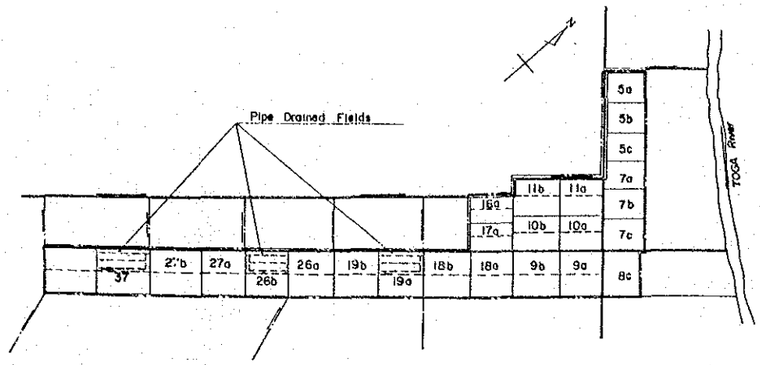
N

FIELD CLASSIFICATION

- Precise Experimental Field
- Netted Field
- Training Field
- Fertilizer Trial Field
- Pipe Drained Field
- Other Experimental & Seed Production Field
- (5a) Field (Plot) Number



LOCATION OF THE PIPE DRAINED FIELD



PIPE DRAIN PLAN (Field No.19-a)

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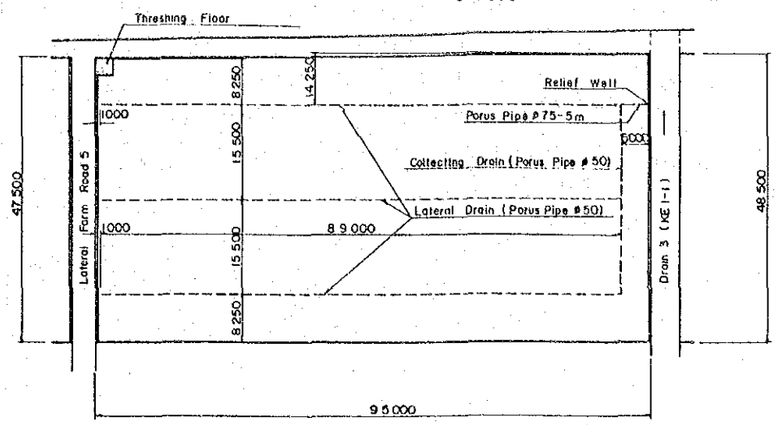

LONG SECTION

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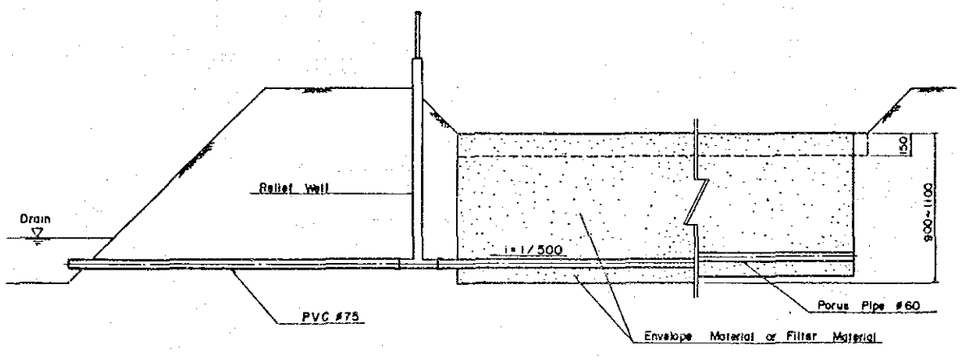

PIPE DRAIN PLAN (Field No.26-b)

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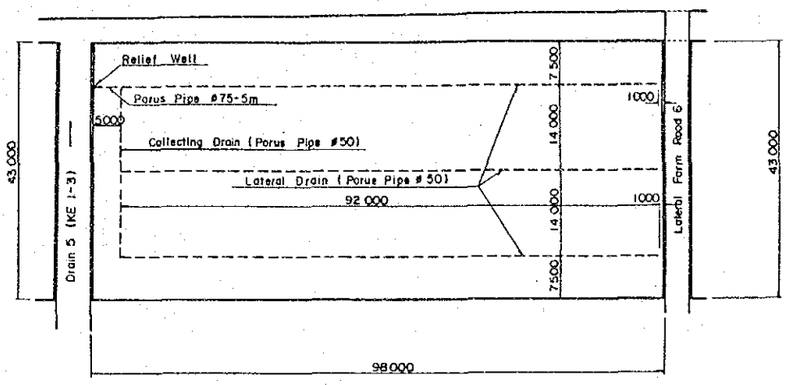

CROSS SECTION

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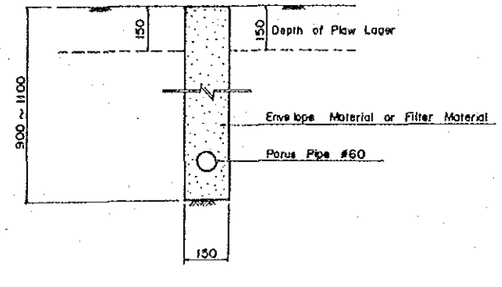

PIPE DRAIN PLAN (Field No.32)

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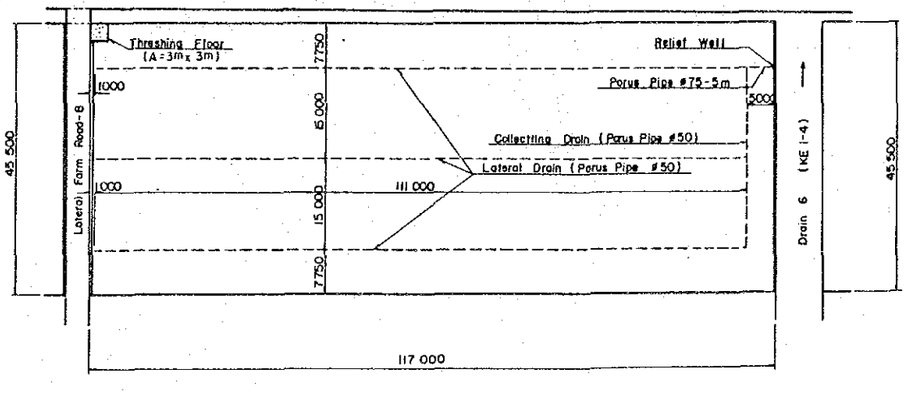


THE GOVERNMENT OF FIJI

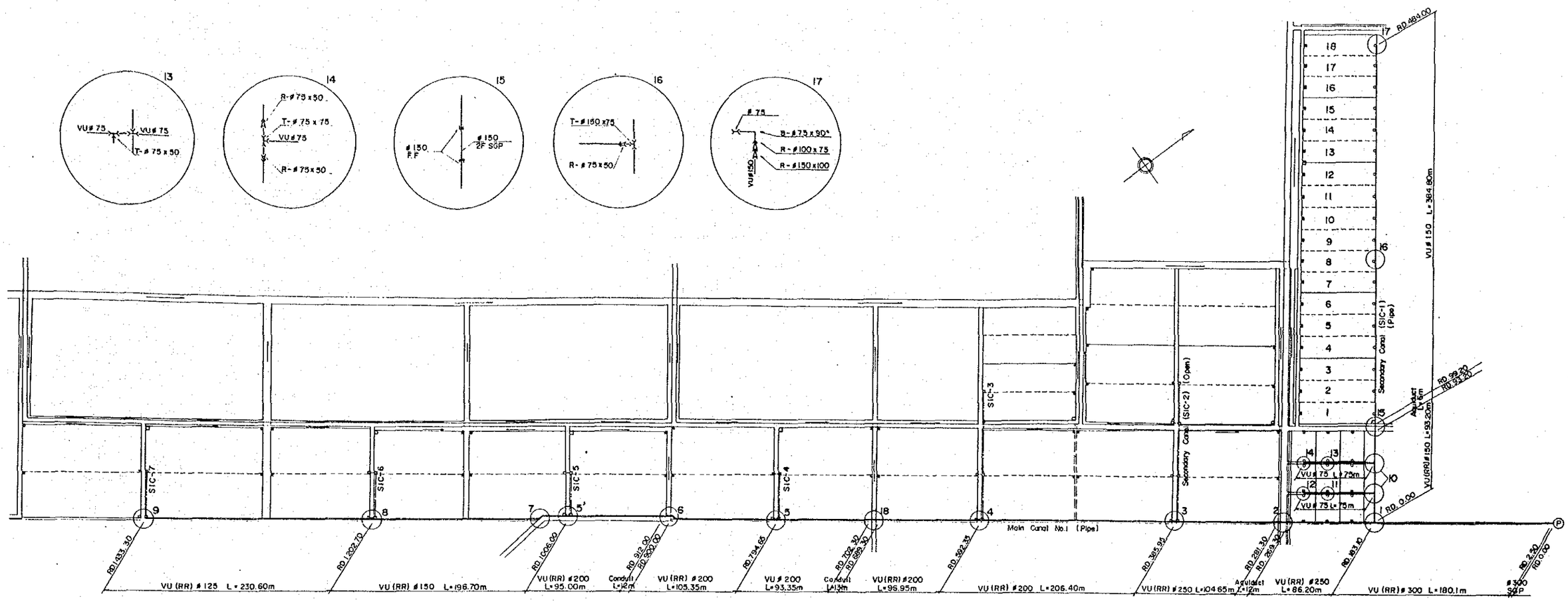
THE IMPROVEMENT OF RICE CULTIVATION TECHNOLOGY PROJECT

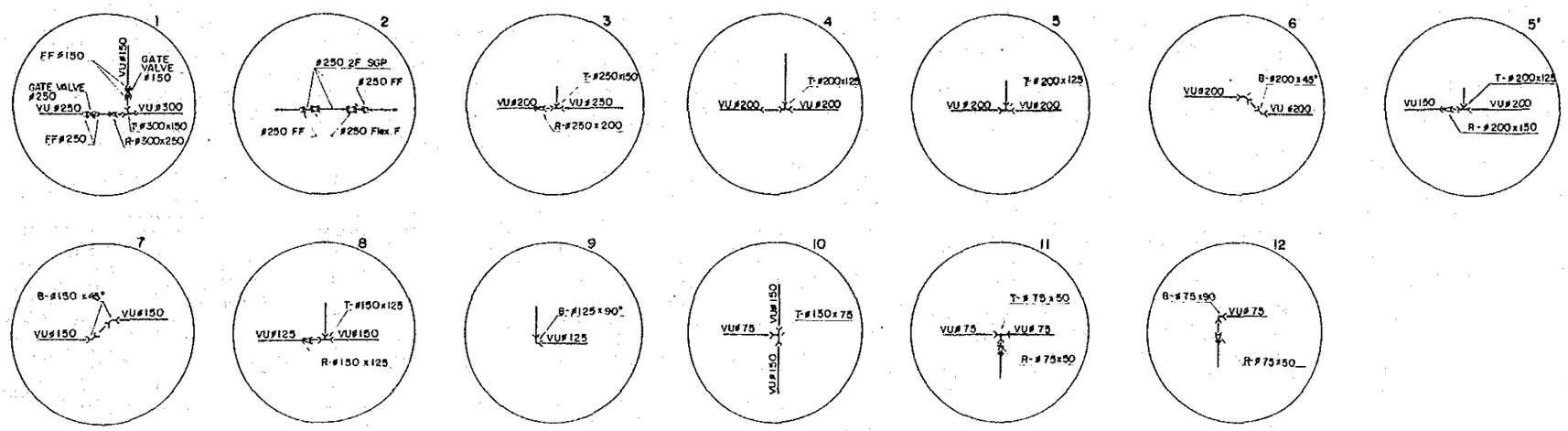
TITLE OF DRAWING

PIPE DRAIN PLAN

JAPAN INTERNATIONAL COOPERATION AGENCY
TOKYO JAPAN

DWG. NO 2





THE GOVERNMENT OF FIJI

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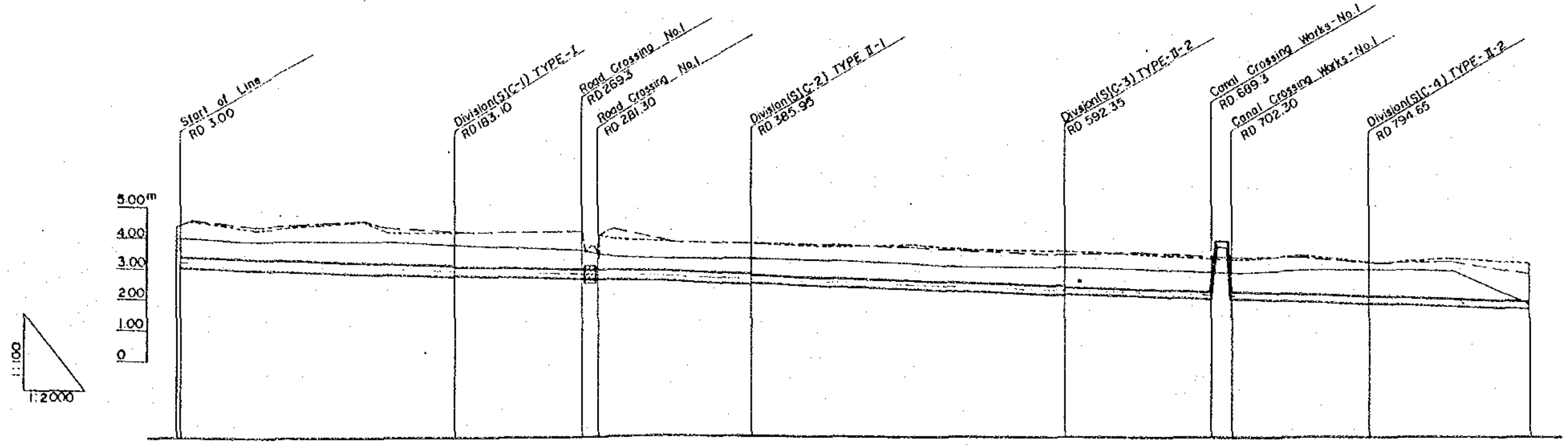
TITLE OF DRAWING

IRRIGATION NETWORK PLAN

JAPAN INTERNATIONAL COOPERATION AGENCY
TOKYO JAPAN

DWG. NO. 3



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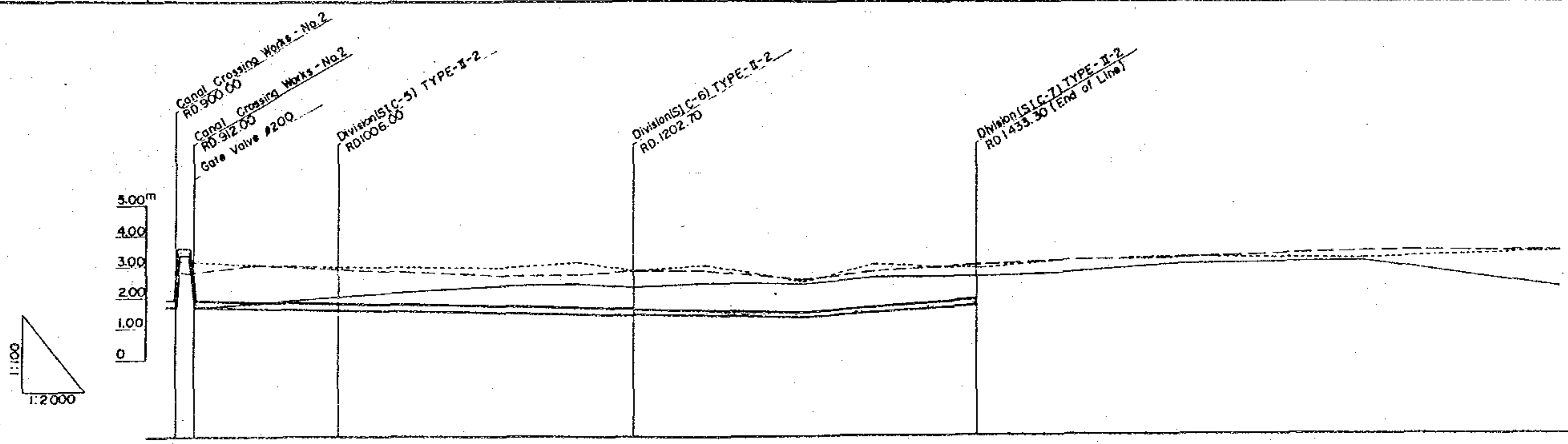
RUNNING DISTANCE																						
ORIGINAL	LEFT HAND SURFACE	4.38	4.36	4.38	4.33	4.18	4.12		4.24	3.78	3.76	3.74	3.60	3.55	3.48	3.51		3.36	3.40	3.19	3.26	
	BED OF CANAL	3.86	3.84	3.87	3.86	3.72	3.35		3.31	3.26	3.27	3.24	3.15	3.04	3.02	2.97		2.86	2.99	3.00	2.96	
	RIGHT HAND SURFACE	4.32	4.26	4.36	4.20	4.19	4.10		3.90	3.77	3.73	3.67	2.78	3.60	3.58	3.43		3.28	3.44	3.19	3.33	
	R.L 5m L.H.S	4.64	3.33	4.61	4.45	3.87	3.74		3.32	3.42	3.46	3.34	3.23	3.26	3.10	3.13		2.78	2.86	2.82	2.78	
	R.L 10m R.H.S	4.18	3.98	4.61	4.37	3.72	3.90		4.03	3.38	3.33	3.48	3.25	3.10	3.10	3.10		3.06	3.12	2.94	2.86	
PLAN	PIPE LEVEL	3.200 / 3.188	3.102	2.996	2.974	2.898 / 2.890	2.735	2.730	2.719	2.653	2.561 / 2.556	2.484	2.408	2.334	2.260 / 2.259	2.187	2.118	2.029 / 2.030	2.031	1.964 / 1.956	1.885	1.810

PIPE SLOPE: I = 0.001665; I = 0.00146

PIPE LENGTH OTHERS: VU (RR) ϕ300 L=180.60m | VU (RR) ϕ250 L=86.2m | SGP ϕ250 L=12.00m | VU (RR) ϕ250 L=104.65m | VU (RR) ϕ200 L=206.40m | VU (RR) ϕ200 L=96.95m | ϕ200 L=13.00m | VU (RR) ϕ200 L=197.70m



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RUNNING DISTANCE																	
ORIGINAL	LEFT HAND SURFACE	2.78	3.07	2.30		2.69	2.73	2.36	2.66	2.65	2.53	2.63	3.03	3.18	3.10	3.47	3.46
	BED OF CANAL	1.88	1.85	2.03		2.36	2.43		2.31	2.43	2.41	2.63	2.68	2.74	3.01	3.11	2.29
	RIGHT HAND SURFACE	3.16	3.03	2.99		2.96	3.11		2.86	3.01	2.30	3.06	2.93	3.17	3.28	3.23	3.47
	R.L 5m L.H.S	2.44	2.67	2.66	2.66	2.53	2.71		2.87	2.83	2.76	2.82	3.07	3.18	3.33	3.46	3.39
	R.L 10m R.H.S	2.90	2.82	2.83	2.80	2.82	2.78		2.73	2.61	2.74	3.06	3.03	3.11	3.23	3.36	3.60
PLAN	PIPE LEVEL	1.810 / 3.465 / 1.798	1.759	1.707 / 1.703	1.653	1.600	1.551	1.534	1.516	1.467	1.403 / 1.400	1.571	1.793				

PIPE SLOPE: I = 0.00097I; I = 0.00333

PIPE LENGTH OTHERS: SGP ϕ200 L=12.00m | VU(RR) ϕ200 L=94.00m | VU(RR) ϕ150 L=196.70m | VU (RR) ϕ125 L=230.60m

THE GOVERNMENT OF FIJI

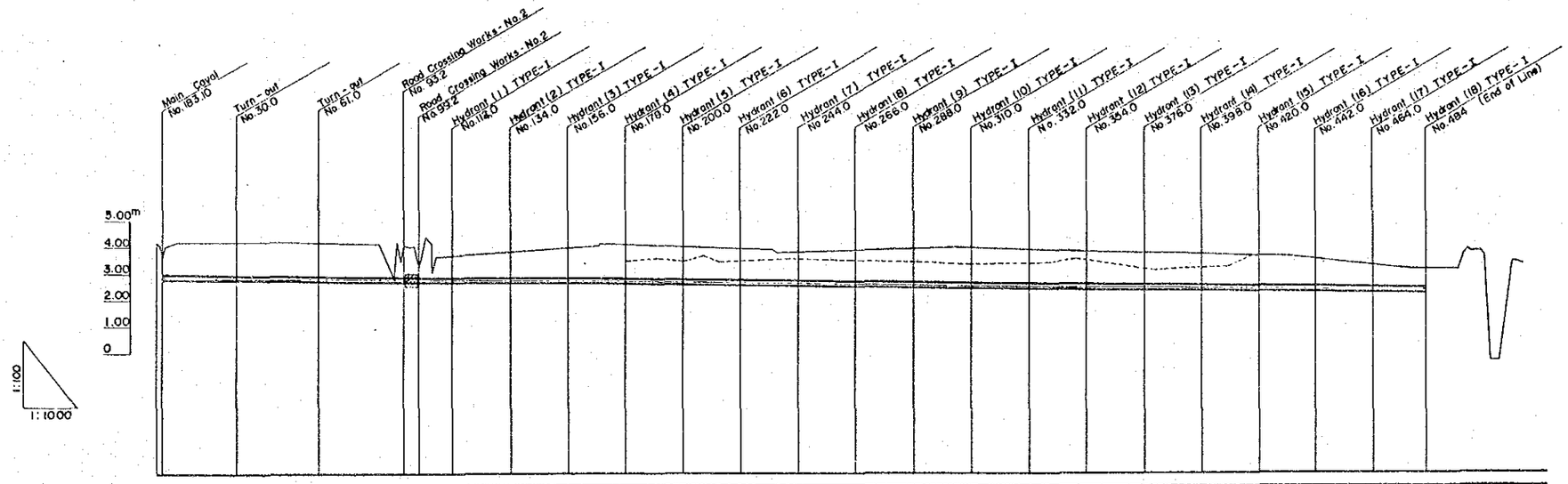
THE IMPROVEMENT OF RICE CULTIVATION TECHNOLOGY PROJECT

TITLE OF DRAWING

MAIN CANAL LONGITUDINAL PLAN

JAPAN INTERNATIONAL COOPERATION AGENCY
TOKYO JAPAN

DWG. NO. 4



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ORIGINAL	TOP OF PEG	4.068 3.988 4.041 3.856 3.874 3.803 3.82
	TOP OF BANK	4.15 4.26 4.16 3.68 4.01 3.96 4.01 3.91 3.84 3.78 3.75
	LEFT HAND SURFACE	3.44 3.33 3.42 3.38 3.43 3.57 3.48 3.48 3.38 3.41 3.80 3.14 3.28 3.85 3.10 3.21
	RIGHT HAND SURFACE	
PLAN	PIPE LEVEL	2.839 2.845 2.808 2.797 2.790 2.783 2.715 2.712 2.702 2.688 2.678 2.668 2.662 2.639 2.635 2.633 2.583 2.578 2.567 2.560 2.555 2.521 2.508 2.496 2.476 2.448 2.435 2.417 2.416 2.369 2.367 2.360
	PIPE SLOPE	I=0.00112
	PIPE LENGTH OTHERS	VU (RR) ϕ150 L=91.20m; SGPI ϕ150 L=6.00m; VU (RR) ϕ150 L=384.80m

THE GOVERNMENT OF FIJI

THE IMPROVEMENT OF RICE CULTIVATION TECHNOLOGY PROJECT

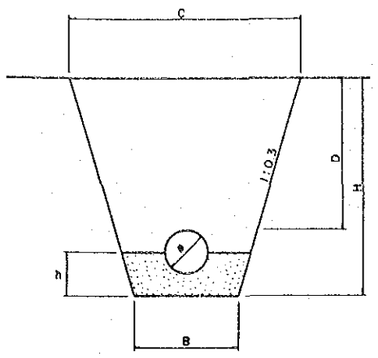
TITLE OF DRAWING

SECONDERY CANAL NO.1
LONGITUDINAL PLAN

JAPAN INTERNATIONAL COOPERATION AGENCY
TOKYO JAPAN

DWG NO. 5

TYPICAL SECTION OF PIPE LINE

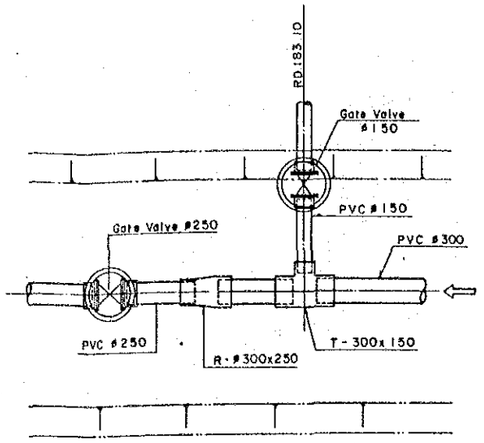


DIMENSION TABLE

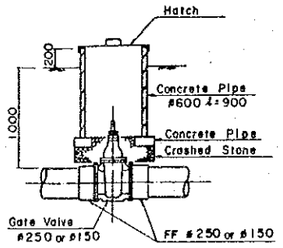
(Unit : mm)

ø	D	B	H	h	C
PVC 100	800	500	1064	207	1048
150	1000	500	1315	233	1315
200	1000	500	1366	258	1366
250	1000	600	1417	284	1417
300	1000	800	1468	309	1468
350	1000	850	1520	335	1520
75	800	500	1004	89	1102
125	1000	500	1255	215	1253

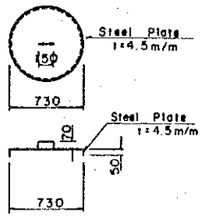
DIVISION WORKS TYPE-I



VALVE BOX



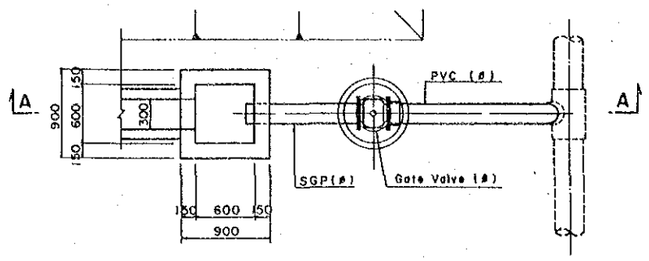
HATCH



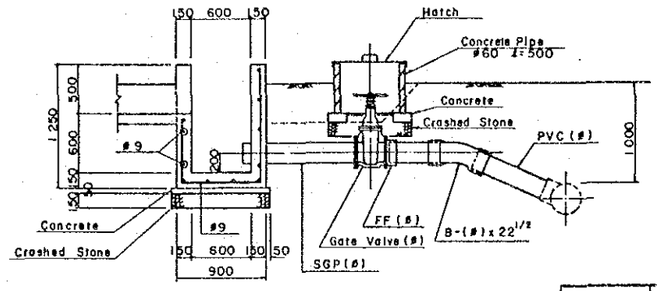
DIVISION WORKS TYPE-II

S=1:30

PLAN



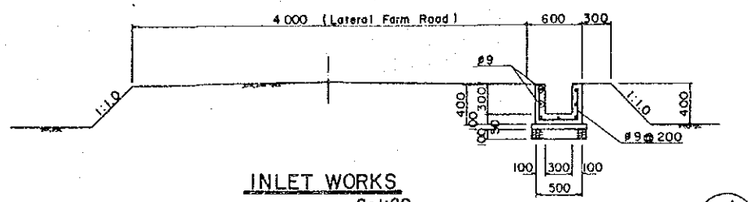
SECTION A-A



TYPE II-1	(ø)=150
TYPE II-2	(ø)=125

TYPCAL SECTION OF OPEN CANAL

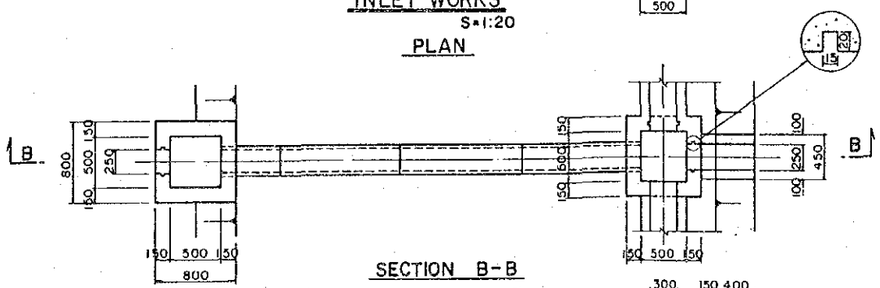
S = 1:30



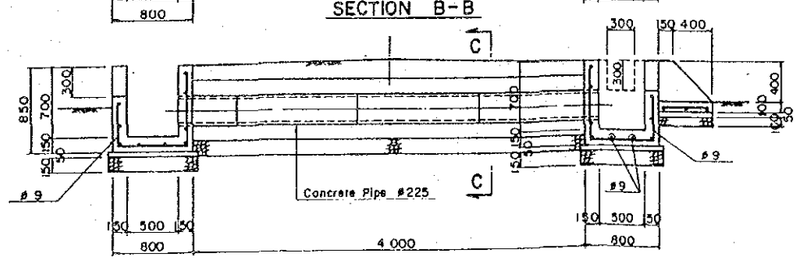
INLET WORKS

S=1:20

PLAN



SECTION B-B



HYDRANT WORKS

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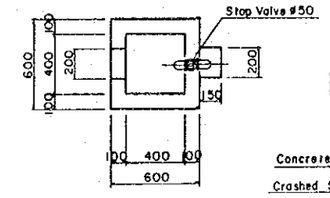
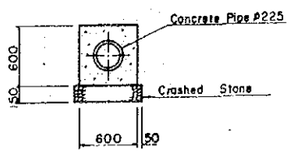
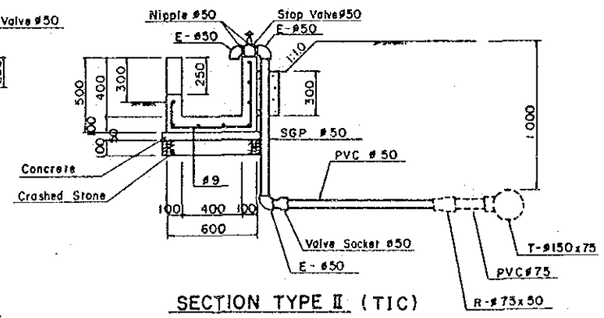
PLAN



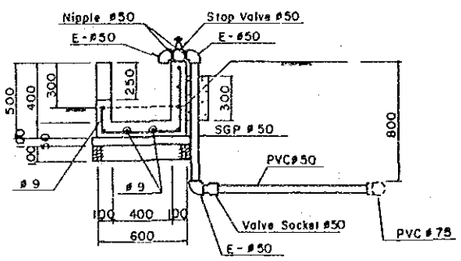
SECTION C-C



SECTION TYPE-I (SIC-1)



SECTION TYPE II (TIC)



THE GOVERNMENT OF FIJI

THE IMPROVEMENT OF RICE CULTIVATION TECHNOLOGY PROJECT

TITLE OF DRAWING

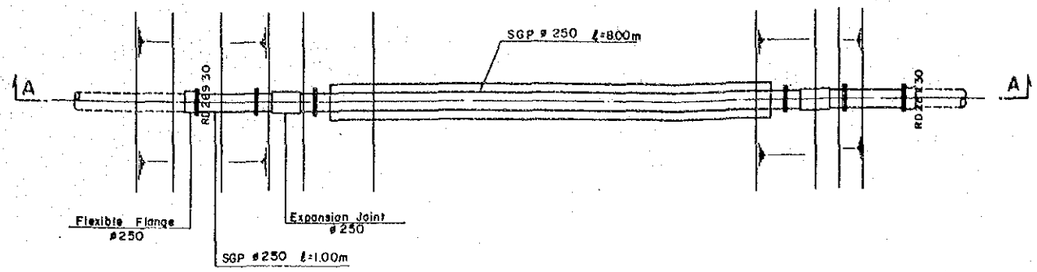
IRRGATION PIPE FACILITIES

JAPAN INTERNATIONAL COOPERATION AGENCY
TOKYO JAPAN

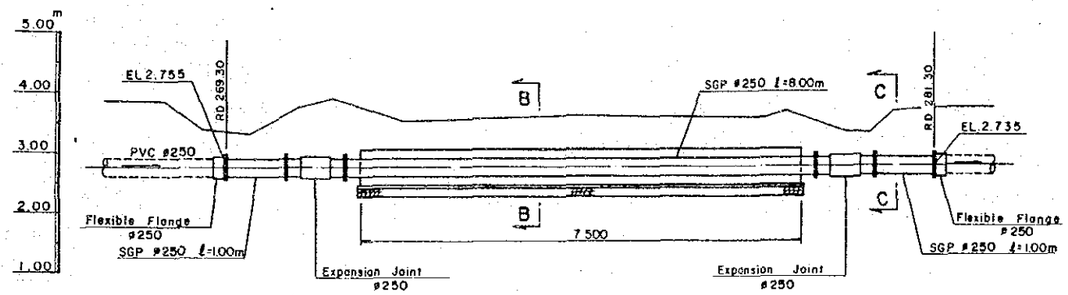
DWG.NO. 6

ROAD CROSSING WORKS NO.1

PLAN



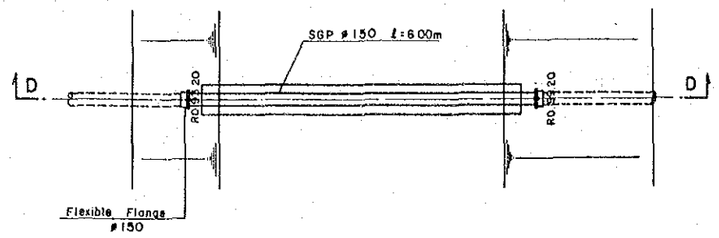
SECTION A-A



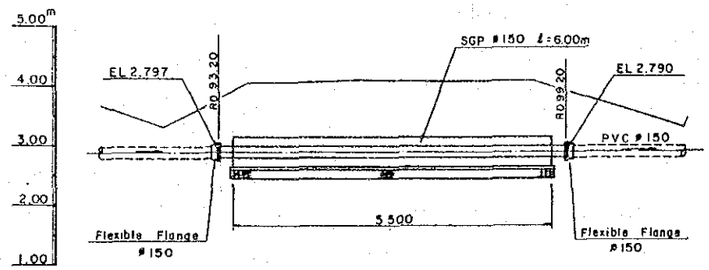
ROAD CROSSING WORKS NO.2

S=1:50

PLAN



SECTION D-D



SECTION B-B

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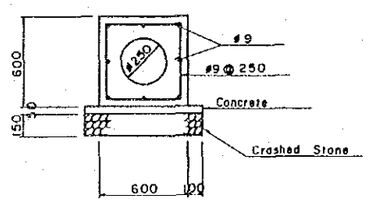
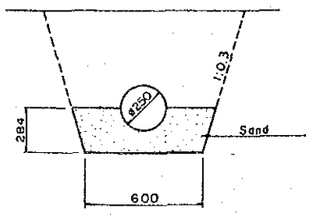


SECTION C-C

S=1:20



SECTION E-E

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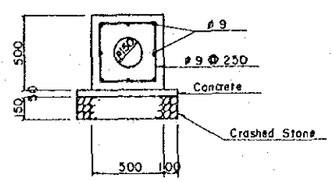


THE GOVERNMENT OF FIJI

THE IMPROVEMENT OF RICE CULTIVATION TECHNOLOGY PROJECT

TITLE OF DRAWING

ROAD CROSSING WORKS PLAN

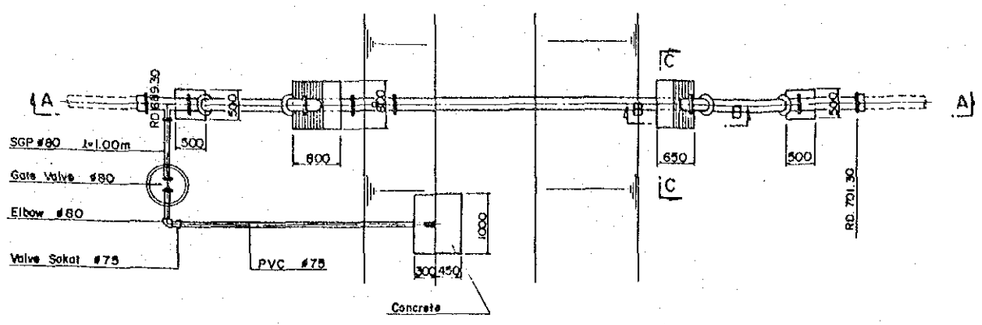
JAPAN INTERNATIONAL COOPERATION AGENCY
TOKYO JAPAN

DWG. NO. 7

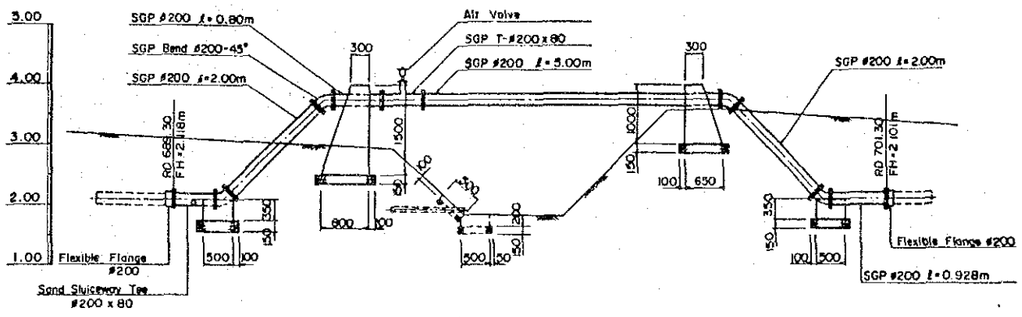
CANAL CROSSING WORKS NO.1

S=1:5

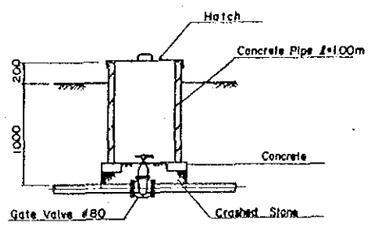
PLAN



SECTION A-A

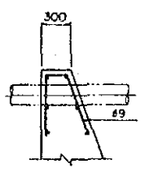


VALVE BOX



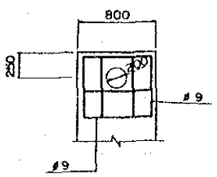
SECTION B-B

S=1:30



SECTION C-C

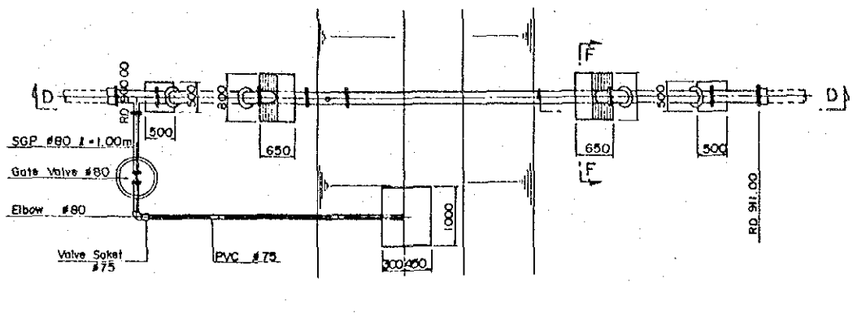
S=1:30



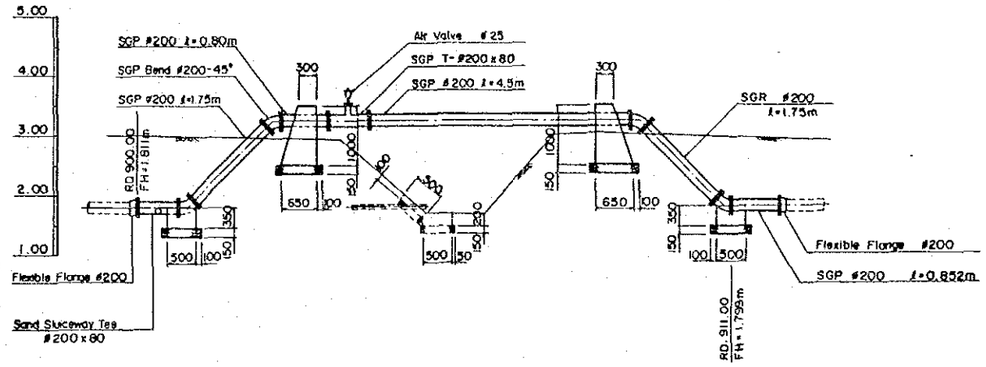
CANAL CROSSING WORKS NO.2

S=1:50

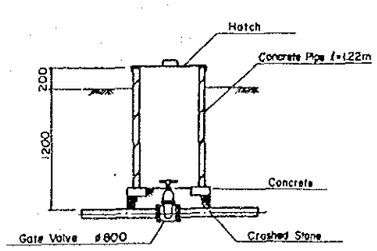
PLAN



SECTION D-D

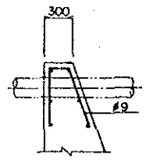


VALVE BOX



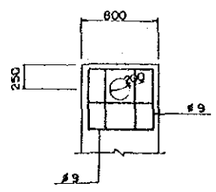
SECTION E-E

S=1:30



SECTION F-F

S=1:30



THE GOVERNMENT OF FIJI

THE IMPROVEMENT OF RICE CULTIVATION THCHNOLOGY PROJECT

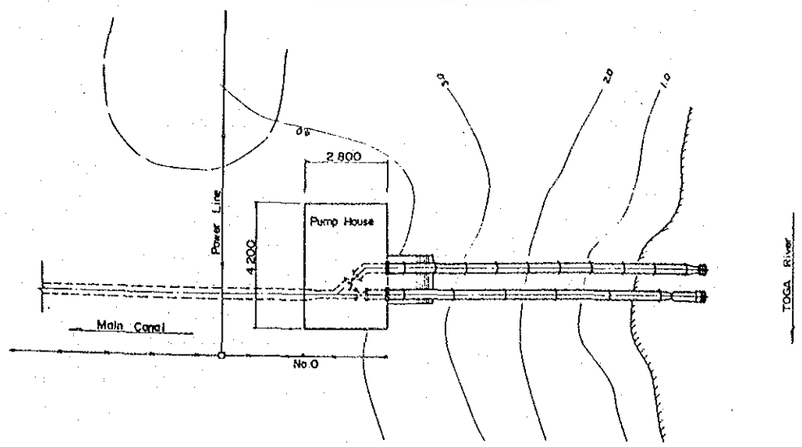
TITLE OF DRAWING

CANAL CROSSING WORKS PLAN

JAPAN INTERNATIONAL COOPERATION AGENCY
TOKYO JAPAN

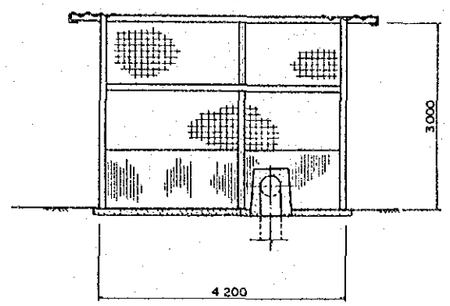
DWG. NO. 8

PUMP STATION PLAN

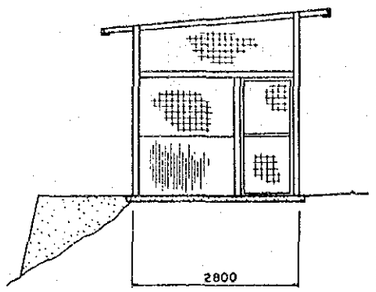


PUMP HOUSING PLAN

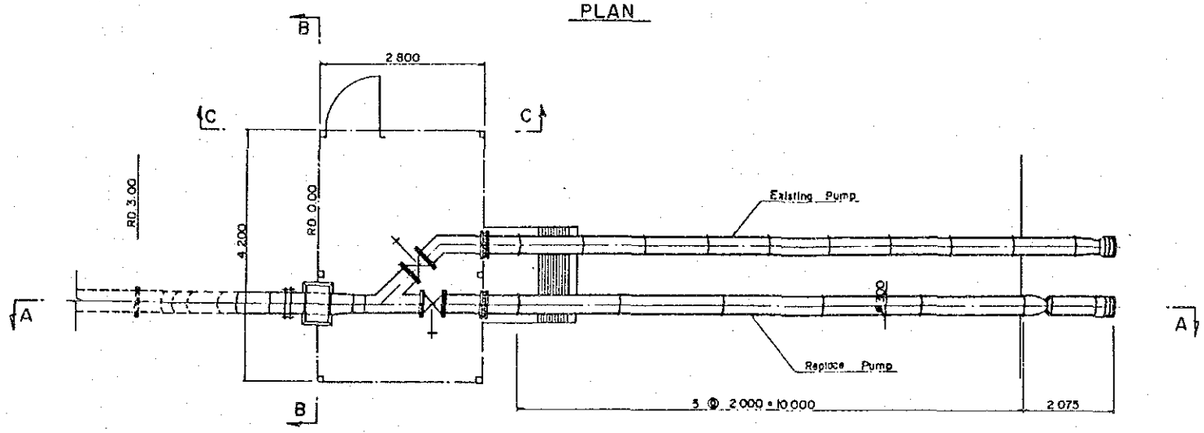
B-B SECTION



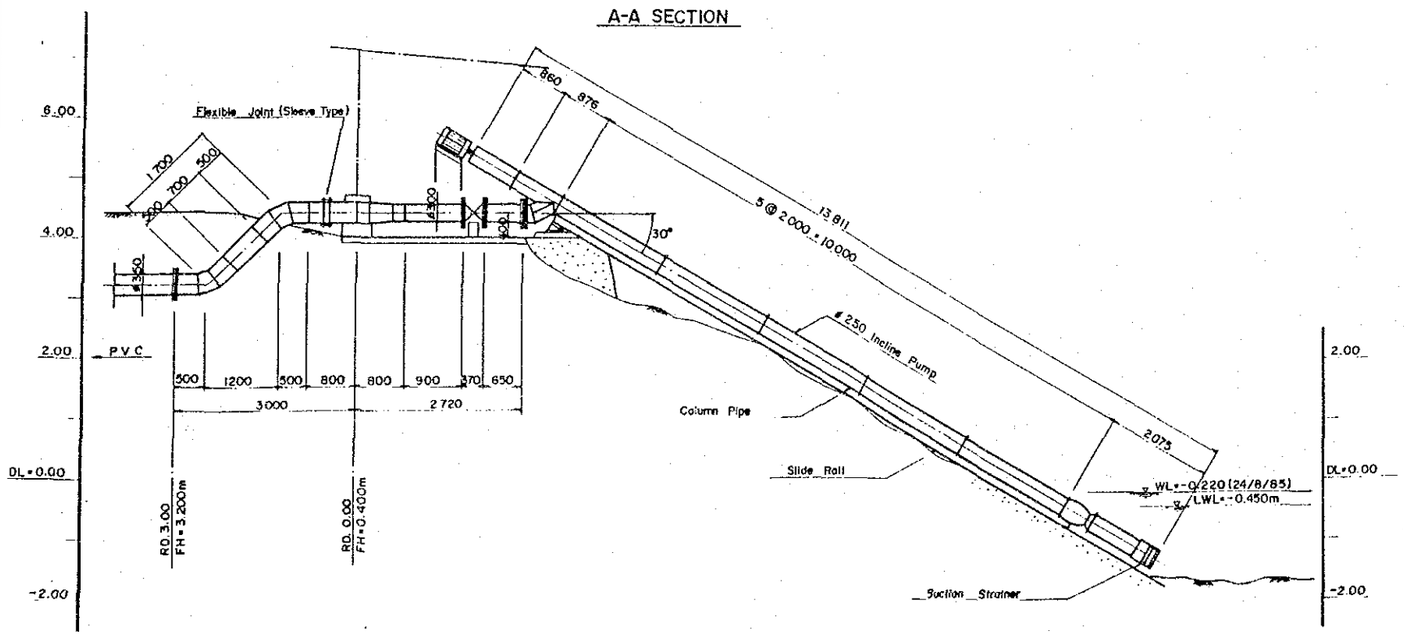
C-C SECTION



PLAN



A-A SECTION



THE GOVERNMENT OF FIJI

THE IMPROVEMENT OF RICE CULTIVATION TECHNOLOGY PROJECT

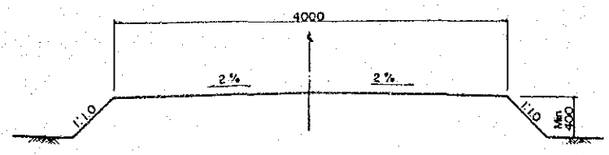
TITLE OF DRAWING

PUMP STATION PLAN

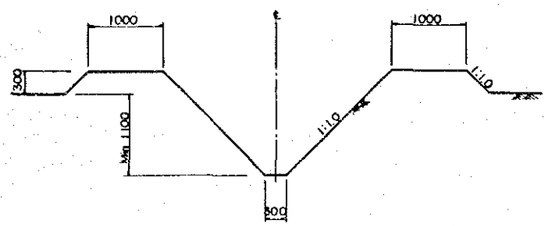
JAPAN INTERNATIONAL COOPERATION AGENCY
TOKYO JAPAN

DWG. NO
9

LATERAL FARM ROAD
S=1:30

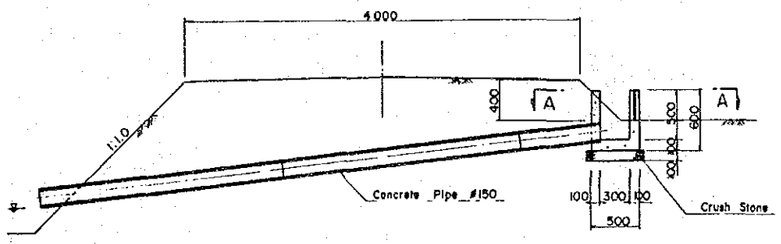


DRAIN CANAL
S=1:40

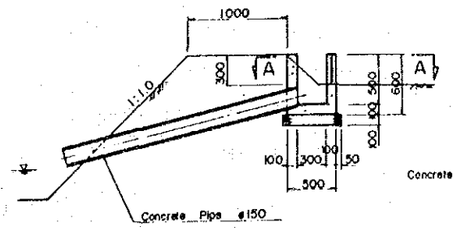


OUTLET WORKS
S=1:30

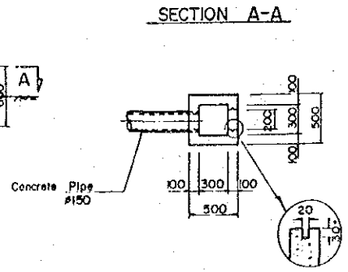
CROSS SECTION (TYPE-I)



CROSS SECTION (TYPE - II)

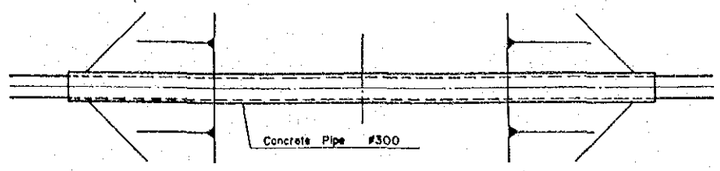


SECTION A-A

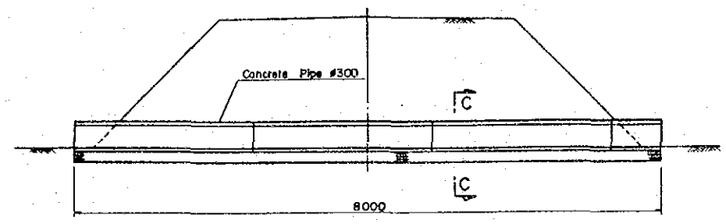


ROAD CROSSING FOR DRAIN
S=1:40

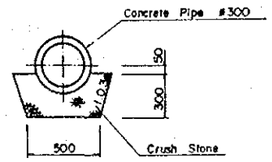
PLAN



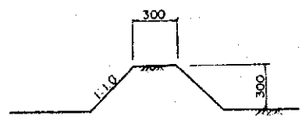
SECTION B-B



SECTION C-C



LEVEE
S=1:20



THE GOVERNMENT OF FIJI

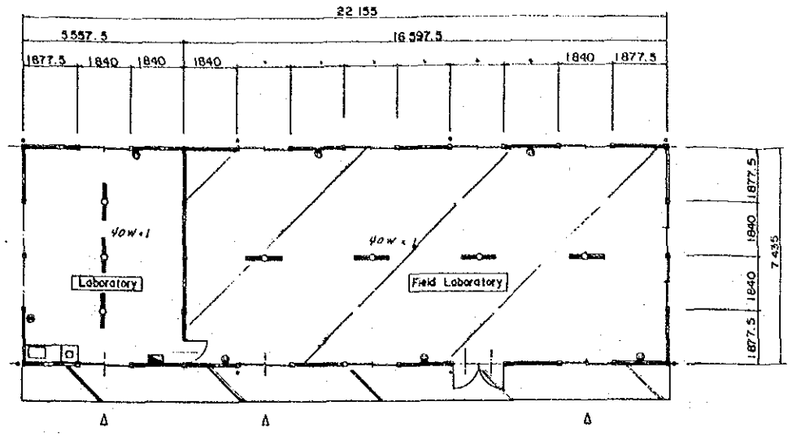
THE IMPROVEMENT OF RICE CULTIVATION TECHNOLOGY PROJECT

TITLE OF DRAWING

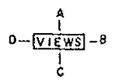
TYPICAL SECTIONS OF ROAD, DRAINAGE CANAL AND OTHERS

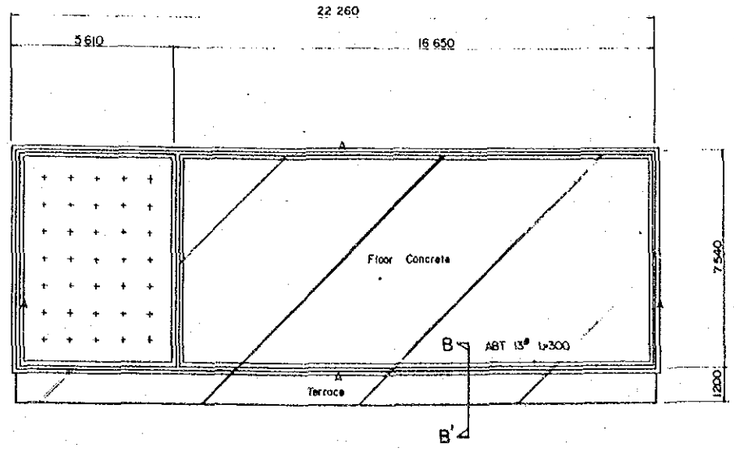
JAPAN INTERNATIONAL COOPERATION AGENCY
TOKYO JAPAN

DWG. NO. 10

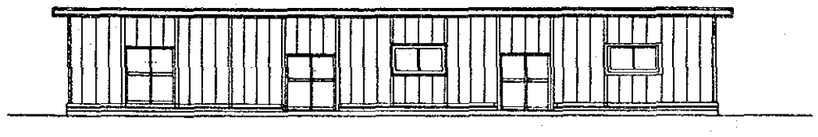


PLANE
S=1:100

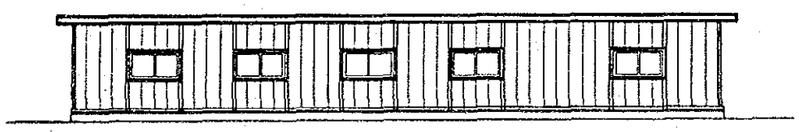




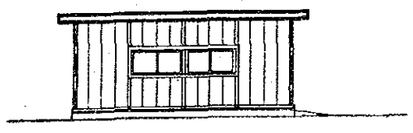
FOUNDATION PLAN
S=1:100



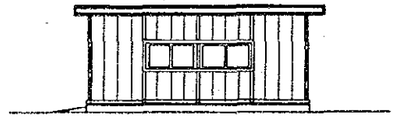
FRONT VIEW C
S=1:100



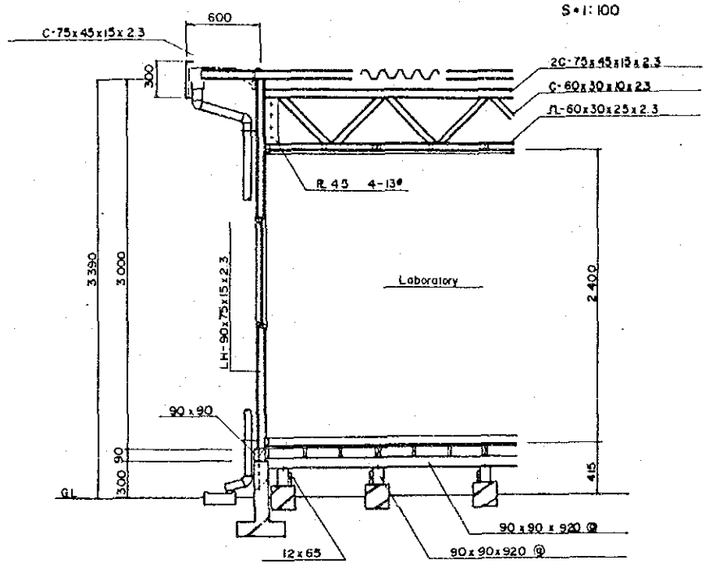
FRONT VIEW A
S=1:100



SIDE VIEW D
S=1:100

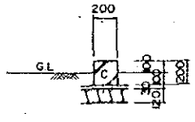


SIDE VIEW B
S=1:100

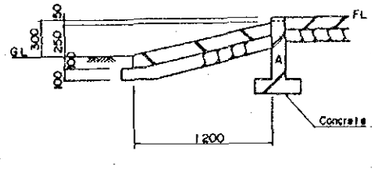


SECTION

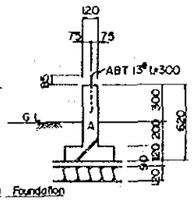
Specification	
Structurer	Lightweight Iron Structure
Foundation	Concrete
Outside Wall	Magnesium Carbonate Board
Roof	Roof Deck 0.5mm
Doors & Windows	Aluminum Sash Glass Thickness 3mm (Trans Parency)
Floor	Floor Concrete Flooring (Laboratory)
Wall Supporter	30 x 60 OP
Inside Wall	Print Prywood T=4mm
Ceiling Support	30 x 39 OP
Ceiling	Coloured Prywood T=3mm
Etc.	Roof Gutter – Coloured Galvanized Iron Plate Vertical Gutter – P.V.C Pipe



DETAILED C



DETAILED B-B'



DETAILED A

THE GOVERNMENT OF FIJI

THE IMPROVEMENT OF RICE CULTIVATION TECHNOLOGY PROJECT

TITLE OF DRAWING

FIELD LABORATORY PLAN

JAPAN INTERNATIONAL COOPERATION AGENCY
TOKYO JAPAN

DWG. NO 11

JICA