3.6　建設工事工程

計画地域近傍での雨量観測はマヒヤンガナ（1974年以降）ギランドルコッテ(1981 年以降）のものが収集された。

この月雨量を表-3.6.1に示す。

日雨量は1982年～84年の 3年間のものが入手できたためこれにもとづき稼動日数を検討した。 3年間平均稼動日数を表-3.6.2に示す。表-3.6.1に明からなとおり、1980年及び1984年は極端な旱ばつ年と多雨年に当たっている。従って、表-3.6.2に示す稼動日数は、1984年を含む 3年平均値であることから、安全側の資料となる。しかし、土工事、コンクリート工事、屋根工事等については、 9月中に作業を完了することが強く望まれる。平均年では10月以降マハ期の始めは多雨であり作業能率は著しく落ちる。

以上にもとづき工事計画を図-3.6.1のとおり作成した。準備期間を含む工時期間は建築工事に約 6カ月、圃場工事に約 4ケ月を予定する。なお、プラントの据付工事期間は建築工事完了後開始し、試験運転並びに通常の運転管理訓練を含めて 2ケ月程度が必要となろう。

表-3.6.1 月別降雨量

in MM

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JULY	AUG	SEPT	OCT	NOV	DEC	TOTAL
1974	2.3	155.7	54.6	288.0	92.7	29.2	15.5	101.6	228.9	35.3	109.0	552.2	1665.0
1975	242.3	130.3	205.0	92.5	114.0	0	132.6	24.9	64.3	44.7	249.7	403.1	1703.6
1976	712.0	98.0	51.1	126.2	11.9	0	62.7	87.1	2.5	45.0	301.8	852.2	2350.5
1977	131.8	122.2	143.5	134.4	72.9	3.8	46.5	9.7	246.1	334.5	505.2	530.1	2280.7
1978	144.0	194.8	96.0	142.2	87.4	0	30.7	0	46.2	362.2	280.9	604.3	1988.7
1979	205.7	81.8	120.4	112.5	51.8	5.1	72.1	80.5	154.4	354.6	498.3	376.4	2113.6
1980	99.1	0.5	106.9	110.5	23.1	0	0	1.8	11.4	128.5	409.4	110.5	1001.7
1981	93.0	163.0	74.0	71.0	62.0	0	166.0	38.0	108.0	234.4	157.1	397.3	1563.8
1982	17.3	0	125.5	56.9	110.2	1.9	18.7	64.8	70.5	330.4	514.8	580.6	1891.6
1983	111.0	0	0	17.5	89.5	11.7	85.7	51.0	35.5	367.1	119.9	828.8	1717.7
1984	688.5	769.0	339.5	107.5	20.2	0	246.2	36.5	298.1	116.8	325.8	365.7	3313.8
Average	222.5	155.9	119.7	114.5	66.9	4.7	79.7	45.1	115.1	214.0	315.6	509.2	1962.8

表-3.6.2　　稼動日数

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1 9 8 2	31	28	25	27	20	30	30	27	23	11	9	9
1 9 8 3	26	28	31	29	28	28	30	30	26	18	25	5
1 9 8 4	4	8	22	27	30	30	23	29	20	26	15	25
Average	20	21	26	28	26	29	28	29	23	18	16	13
	WET SEASON		DRY SEASON							WET		

Daily rainfall(mm)　0　10　20　30　40 or more

Non Operative days　0　1　2　3　4

図-3.6.1　工事工程

工種		数量	工程（月） 1	2	3	4	5	6	7	備考
	準備									仮設工事を含む
プラント建屋建築工事	基礎工事									
	躯体工事									
	組積工事									
	屋根工事									
	建具工事									
	内部仕上工事									
	外部仕上工事									
	雑工事									
	電気工事									
	給排水工事									
	外構工事									
	手直し工事									
圃場施設整備土木工事	見学道	2,680 m								
	圃場内配水路	3,710 m								
	水口改良工	23ヶ所								
	排水路	1,200 m								
	暗渠	8ヶ所								
	刃形堰	1ヶ所								
	畦畔築立	600 m								
	フェンス工	2,750 m								

3.7　施工業者

1)　工事の特徴

本計画の施設整備工事は実験・展示圃場の(23ha)の整備に関る土木工事と収穫後処理施設のためのプラント建屋(584㎡) に関る建築工事に大別され、工事の特徴は次の通りである。

a)　圃場施設整備工事は、何れの工種も現地業者が充分な経験を有する工種であり、用排水路建設に関する水位確保に留意するならば技術的に大きな問題は生じない。しかし、現在既に日本政府による無償資金により、道路、水路、横断構造物等が完備していることから、建設工事中にこれら既存施設にできるだけ損傷を加えないような配慮が要求される。更に、10月以降極端に降雨量が増加することから、主な土工事及びコンクリート工事は完了しておく努力が必要となる。

b)　プラント建屋の軒高は約9mと高く、屋根は鋼材トラス構造となることなどから、これらに経験を有する、ある程度水準の高い現地業者であることが望ましい。この工事も、基礎、コンクリート、屋根工事等を 9月中には完了させる予定で工程を組むことになる。なお、電動シャッターは、日本から購送する予定である。

2)　施工業者の選定

上述のとおり、土木工事と建築工事は建設内容が全く異なり、施工場所も約500m程度離れている。しかし、計画地域が僻地であることから、労働力、資機材の調達、搬入、施工管理の便等を考慮すると土木及び建築工事を一括して行える単一の業者に請け負わせることが有利であると判断する。

スリランカの建設業者は、A(大企業) からC(小企業又は政府直営工事専門業社) までの 3者にランク付けされており、 Aランクの請け負い金額は cランクの

それの15～17%割り高である。しかし、本件の場合は、クレーン、ブルドーザー、ローラー、溶接機械等が必要となることから、A 又は Bランクの建設業者の中で小まわりのきく業者を選定することが望ましい。但し、大規模開発担当の以下に示す 3者の半国営企業は除くことになる。

State Development Construction Corporation

River Valleys Development Board

State Engineering Corporation

建設業者の選定に当たっては、スリランカ国の従来の慣習に沿って実施することが望ましい。これについてはMEA 側からの強い要望があり、MEA において、公平を期すためのプレ・クオリフィケーションを必ず実施し、その中から数者をMEA で選定し、JICAコロンボ事務所へ推薦される予定である。

社会主義体制であることからの機会均等への慎重な対応と、工事進渉中の諸問題に対するMEA 側からの支援を期待することを勘案した結果、上記方針により円滑な業者選定が可能となると判断した。

3) 契約及び支払い方法

a) 契約

上に述べたMEA 側推薦による数社に対し、入札図書を配布し、相見積りを徴収して随意契約を採用する方式が有利と考える。

b) 支払いについて

マハベリ開発の工事契約における標準的な支払い方法は以下のとおりである。

(1) 契約時の前払金は10%・但し、計画地区が僻地に位置することから、運用上はモビライゼーションを含み20%としている。しかし、MEA からは、銀行保証をとりつけた上で、30%の前払いを行うことが円滑な作業進渉を期待する上で

望まれるとのアドバイスがあった。但し、この前途金は中間及び最終払いから控除される。

(2) 中間払いは、1回とする。これは請負い業者の提出する出来高報告書の数量を確認した上で支払われる。瑕疵担保はこの中には含まれない。

(3) 最終払い時には、数量増減、主要資機材の市場価格変動を契約時と比較し、クレーム処理として、一括支払うことになる。

3.8　契約書

1)　契約書（案）

別添のとおり

2)　仕様書（案）

別添のとおり

CONTRACT

The Representative of Japan International Cooperation Agency, Colombo Office, the Democratic Socialist Republic of Sri Lanka which is located at .....
..... Mr. .....
or his successor (hereinafter referred to as the Employer) as the firstparty, and
.....
which is located at .....
(hereinafter referred to as Castractor) on the second party, hereby conclude a contract of the Construction work of the experimental field and plant building for the Integrated Agricultural Development Demonstration Project, Mahaweli Area on the following terms.

ARTICLE 1 (a) DESCRIPTION OF WORK

The Contractor shall carry out the construction work of the experimental field and plant buildings for the Integrated Agricultural Development Demonstration Project in Unit 1 area, Block 302, System "C", Mahaweli Ganga Project.

ARTICLE 1 (b)

The following documents shall be deemed to form, be read, and constructed as part of this Agreement viz:

- The attached Detailed Drawings
- The attached Specifications

ARTICLE 2 CONTRACT SUM OF CONSTRUCTION

The contract sum of construction shall be .....
.....(.....).

ARTICLE 3 TIME LIMIT OF SUBMISSION OF PRICED BILL OF QUANTITIES

The Contractor shall submit a copy of the Priced Bill of Quantities to the Employer within seven (7) days after signing by both parties of this Agreement. The Contractor reserves the right to remeasure the work and check the Bill of Quantities, both for quantity and description.

ARTICLE 4 TIME LIMIT ON CONSTRUCTION AND ITS PROLONGATION

The Contractor shall commence the work within ten (10) days after signing by both parties of this Agreement, and complete the work by ....., 1985.

ARTICLE 5 DELAYS

In a case where it is clear that the Contractor is failing to fulfill his obligations within the period referred to in the preceding Article, the Contractor shall inform the Employer of this by a letter as soon as possible, and if the Employer 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 will be approved. In this case, the sum referred to in Article 16 will not be collected.

ARTICLE 6 PROCESS OF CARRYING OUT OF WORK

The Contractor shall carry out the work in accordance with the Drawings and Specifications referred to in Ariticle 1 (b). In cases where it is necessary for the Contractor to carry 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 carry out the said work under the direction of the Employer or his authorized representative. In cases where the Contractor finds any doubt in the plans of construction, the Contractor shall ask the Employer for the necessary directions before commencing the work on that part for which there exists some doubt.

The Employer shall provide such information and details within seven (7) days of the written request from the Contractor.

ARTICLE 7

The Contractor shall follow the direction of the Employer or his designated supervisor. As to materials for the construction, the Contractor shall use only those inspected and approved by the Employer or the supervisor appointed by the Employer. In cases where any defective work has been done as a result of such use of materials which have not been inspected by the supervisor, or of disobedience to the direction of the supervisor, the Contractor shall be liable to charge 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 8 WORKMEN

As to the workmen 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 in Sri Lanka.

ARTICLE 9 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 Employer.

ARTICLE 10 DAMAGES

In cases where any damage is caused to the Employer or a third party, materials or construction, 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 damages at his own expense by the date appointed by the Employer or the third party.

ARTICLE 11

In cases where the Contractor fails to repair or compensate such damages referred to in the preceding Article by the fixed date, the Employer 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 by the Employer under the provisions of Article 21, and in cases where the damages exceed the sum of construction, the Employer may collect the deficit from the Contractor.

ARTICLE 12 (a) CHANGE OF CONSTRUCTION DRAWINGS AND SUBMISSION OF NECESSARY DOCUMENTS

In cases where the Employer feels it necessary to discontinue the work owing to unavoidable circumstances, or to alter the plan of construction, the Employer 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 3, so as to increase or decrease the sum of construction resulting from the suspension or alteration of the work, and the Contractor shall comply with the request. When the Employer 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 by the Employer.

ARTICLE 12 (b)

Where work cannot be properly measured and valued on the basis of the unit price in the Bill of Quantities referred to in Article 3, the Contractor will be allowed to calculate on the basis of the daywork rates which shall be approved by the Employer before their application.

ARTICLE 13 (a) PRICE ADJUSTMENT

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 contract sum or the unit prices in the Bill of Quantities will be made through negotiations between the Employer and the Contractor.

ARTICLE 13 (b)

In case where a loss such as may render it unreasonable for the contract sum referred to in Article 2, is inflicted upon the Contractor by virtue of the Employer's failure to provide the information and details referred to in Article 6 or to obtain the necessary approvals under the local byelaws, then a reasonable adjustment of the above mentioned sum will be made on the basis of the detailed claim submitted by the Contractor.

ARTICLE 14 RIGHT TO RESCIND CONTRACT AND PENALTY

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

ARTICLE 15

In cases other than provided for in Article 14 where the Contractor fails to fulfil his obligations, or in cases where the fulfilment of obligations by the Contractor is regarded to be difficult, the Employer may ask a third party to 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 shall not raise any objection to it.

ARTICLE 16

In cases other than provided for in Article 14 where the Contractor fails to complete the construction at his own responsibility within the period referred to in Article 4, the Contractor shall be liable, within a period fixed by the Employer, to pay the Employer per week of delay a sum equivalent to 0.1 percent (0.1%) of the contract sum referred to in Article 2.

ARTICLE 17 DAMAGE 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 Employer 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, riot or other unavoidable reasons, for the occurrence of which no responsibility can be attributed to either the Employer or the Contractor, and it is admitted that the Contractor has played the role of good administrator to avoid the occurrence of such damages, the Employer shall be liable for the amount of the damages which shall be fixed through negotiations between the Employer and the Contractor.

ARTICLE 18 (a) INSPECTION

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

ARTICLE 18 (b)

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

ARTICLE 19 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 facilities and cleaning, has passed the inspection referred to in Article 18, and on that date the object of the construction shall be delivered to the Employer by the Contractor. For a period of one year thereafter, any defect in the construction, the cause of which is judged in the opinion of the Employer to be attributable to faulty or inadequate techniques or materials employed by the Contractor, shall be immediately repaired or improved by the Contractor at the cost of the Contractor.

ARTICLE 20 PAYMENT

Payment for the part of the work already completed shall be allowed for twice excluding advance payment during the course of construction at the request of the Contractor provided that it has passed the inspection referred to in Article 18, based on the unit prices in the Bill of Quantities.

However, the amount of the payment shall be limited to ninety percent (90%) of the work already completed. The final payment will be made within one (1) month after the Employer receives the bill which will be issued by the Contractor on or after the date of completion of construction referred to in Article 19.

ARTICLE 21 (a) SETTLEMENT OF DISPUTE

If there arises any dispute with regard to this Agreement or the Detailed Drawings or Specifications referred to in Article 1 (b), it shall be settled by a mutual consultation between the Employer and the Contractor.

ARTICLE 21 (b)

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

CONCLUSION OF THE AGREEMENT

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

Date .....

Employer
Signed .....

Contractor
Signed .....

WITNESS
Signed .....

TERMS AND CONDITIONS OF THE CONTRACT

1. Objectives

The Japan International Cooperation Agency (JICA) intends to construct an 'Experimental and Demonstration Farm and Plant Building for Paddy Processing Plant in Unit 1, Block 302, System "C"' in the Democratic Socialist Republic of Sri Lanka.

2. Work Schedule

The Contractor shall submit to the Employer for his approval the detailed work schedule for performing the construction works specified in Article 1 (b) of the Contract and attached "Description of the Works" within ten (10) days after signing by both parties of the Agreement.

3. Operation of Work

To supervise the construction works, the Contractor is required to retain a full-time engineer fully responsible for the works at the construction office. If the engineer does not stay at the office without appropiate reason, the Employer reserves the right to stop the works or part of the works instantly and the Contractor is required to be responsible for any damage from this neglect.

4, Progress Report

Progress reports shall be submitted to the Employer by the Contractor every month. If there is any delay of work from the agreed schedule, the Contractor shall submit the modified work schedule to the Employer to justify for such a delay so as to achieve the originally set target.

5. Acceptance of Completed Work

Upon receipt of the written request from the Contractor, the Employer will check the work actually benformed in the field. If everything is satisfactorily completed, the Employer will accept that part of work within seven (7) days after the receipt of the

request. If there are any inconsistencies and shortcomings in the work presented by the Contractor, the Employer will reserve the right not to accept the work. During the improvement of the work, it will be regarded that the work has not been accepted. After completion of the improvement work, the Contractor shall request the Employer to inspect the same. If the improvement work is satisfactorily completed, the Employer will accept the work within seven (7) days after the receipt of the request.

However, the acceptance does not necessarily mean the discontinuation of the responsibility of the Contractor for possible damages to that part of the work. The complete acceptance takes place only when all the works have been completed and accepted.

6. Increase or Decrease of Unit Price

In the event of remarkable fluctuation in the costs of labor, materials, equipment, etc., the adjustment of unit prices may be made based on the escalation factors through negotiations between the Employer and the Contractor. However, no adjustment will be made in case of the delay of construction works due to the fault of the Contractor.

7. General Text

The construction works shall proceed in accordance with the Drawings and Specifications in every respect. If the same is found lacking in detail the Contractor may refer to the quidelines prepared by the Mahaweli Engineering & Construction Agency. However, before proceeding the Contractor is held responsible to confirm his planned approach with the Employer's site supervisor.

In case, however, the Employer adds to or revises the original Drawings and/or Specifications in order to attain further engineering perfection, the Contractor is required to proceed with the construction in accordance with the added or revised drawings and/or specifications in every way without any objections.

8. Alignment, Leveling and Site-Plan Setting

The Employer is to inform the Contractor of the bench mark which gives the base elevation to be used for the construction. The succeeding steps shall be the duty of the Contractor. The Contractor shall set and determine the alignment and elevations in accordance with the Drawings in the construction area and obtain inspection by the Employer prior to the commencement of the construction. The Contractor is required to preserve all the pegs that indicate the alignment and elevations in a good condition throughout the construction period. In cases where the Employer requests, the Contractor shall conduct checking survey and submit the results to the Employer as soon as possible.

SPECIFICATIONS

1. GENERAL

1.1 In principle, building methods and materials shall conform to MECA specifications as compiled in 'Technical Specificatons, Volume III' published by Sri Lanka. However, as the same are prepared as a general guideline, the following specifications shall supersede said publications when a conflict arises between the two.

2. SURVEY & LAYOUT WORK

2.1 Data and information developed by the Contractor as Survey Work shall be reviewed with the Engineer as and when requested.

2.2 The Contractor shall protect existing or established reference points or markers as necessary.

2.3 No Work under the Contract shall be permitted to proceed until respective Survey and Layout Work has been provided and verified as correct.

2.4 Survey Work shall be under direct control and continuous supervision of a Civil Engineer or Licensed Surveyor, retained and paid by the Contractor as part of Work under this Contract.

3. CLEARING AND GRUBBING

3.1 Clearing and grubbing shall consist of clearing ground surfaces within designated areas of all trees, stumps, fallen timber, logs, snags, brush, undergrowth, hedges, heavy growth of grass or weeds, debris, rubbish of any nature, natural obstructions or such materials which, in opinion of the Engineer, are unsuitable for the proposed project site including the grubbing of stumps, roots, and the disposal from the project area of all spoil materials resulting from clearing and grubbing by burning or otherwise.

3.2 All spoil materials removed by clearing and grubbing shall be disposed by burning or by removal to approved disposal areas.

Piles for burning shall be placed either in cleared areas near the center or in adjacent open spaces where no damage to trees, other vegetation, or other property will occur. The Contractor shall be responsible for controlling fires in compliance with any and all local laws and regulations relative to building fires at site. Ashes resulting from burning shall be removed and disposed as directed by the Engineer.

3.3 Ground surface shall be graded after removal of all spoil materials to the appropriate elevation as directed by the Engineer.

4. EARTHWORK

4.1 Excavation

4.1.1 The excavation covers all kinds of soil including clay, sand, pebble, gravel and cobble stone, and does not include soft or hard rock excavation. If a rock layer is encountered, additional cost for that excavation will be paid by mutual Agreement between the Employer and the Contractor.

4.1.2 The excavation for the construction of boxes, pipelines and other structures shall be done in an adequate and proper manner in consideration of the construction method of the structures.

4.2 Backfilling

The excavated materials shall be used for backfilling after removing unsuitable materials. The backfilled materials, shall be well tamped, moistened and compacted in each horizontal layer not exceeding 20cm in thickness.

4.3 Embankment

4.3.1 The Contractor shall place and compact the materials for embankment true to the lines, grades and dimensions shown on the Drawings or as directed by the Engineer.

4.3.2 Embankment materials shall be reasonable well-graded and suitable ones acceptable to the Engineer. The embanked materials shall be well tamped, moistened and compacted in each horizontal layer not exceeding 20cm in thickness.

4.3.3 The compaction of road materials shall be executed by a bulldozer of not smaller than 15t class or other heavy equipment approved by the Engineer for 5 times in each layer. However, the compaction of the final layer shall be performed by a tireroller or equivalent approved by the Engineer.

4.3.4 The Contractor shall clear up roots, stumps and any other unnecessary materials along the alignment of the road before embankment operation.

4.3.5 Embankment materials shall be obtained from a proper and suitable borrow pit or pits outside the site at the responsibility of the Contractor. If the Contractor wants to use the materials inside the site for embankment, prior approval of the Engineer shall be received.

4.4 Grading & Compacting

The Contractor shall perform the grading work in an adequate and proper manner for the road without filling, where its alignment, section or profile is not suitably fitted to the requirements of the Drawings or as directed by the Engineer, and shall perform the compacting work by a motor grader or other equipment approved by the Engineer for 5 times in each section.

4.5 Gravel and Cobblestone

4.5.1 Gravel and cobblestone shall be placed as shown on the Drawings or as directed by the Engineer.

4.5.2 The materials for gravel and cobblestone shall be either natural or crushed, round or semi-round pieces of rock with suitable diameter.

4.5.3 Gravel and cobblestone shall be neatly placed, trimmed and compacted true to the line, elevations and dimensions after compaction of the base surface.

4.6 Removal of Surplus Soil

Surplus soil shall be removed to a suitable place inside the site as a rule. However, if it is impossible to find a suitable place inside the site, the Contractor shall find a suitable place outside the site upon obtaining the approval of the Engineer.

5. CONCRETE WORKS

5.1 Plain Concrete

5.1.1 The plain concrete of $1m^3$ shall have the following compositions by volume:

Cement - 1 (Min. 225kg)
Sand - 3 (Approx. $0.54m^3$)
Gravel - 6 (Approx. $0.81m^3$)

5.1.2 Cement and gravel shall be well washed and graded, hard and free from dust, mud and organic matter.

5.1.4 Sand shall have a fineness modulus of not less than 2.5. Size of gravel shall be smaller than 40mm in diameter.

5.2 Reinforced Concrete

5.2.1 The reinforced concrete of $1m^3$ shall have the following composition by volume:

Cement - 1 (Min. 350kg)
Sand - 2 (Approx. 0.50m3)
Gravel - 4 (Approx. 0.75m3)

5.2.2 Cement shall be brand new, good quality and absolutely dry.

5.2.3 Sand and gravel shall be well washed and graded, hard and free from dust, mud and organic matter.

5.2.4 Sand shall have a fineness modulus of not less than 2.5. Size of gravel shall be smaller than 25mm in diameter.

5.3 Mixing

5.3.1 Cement, sand and gravel shall be mixed with a mechanical mixer as a rule. When a mechanical mixer is used, each batch shall be continuously revolved for not less than 90 seconds after all materials including water are added in the mixer.

5.3.2 New materials shall not be added before all the concrete in the mixer has been removed.

5.3.3 The quantity of water to be added shall be such as to obtain proper workability and consistency.

5.3.4 Water to be used in concrete mixing shall be fitfor drinking.

5.4 Placing

5.4.1 No concrete shall be placed until all form work, treatment of surface, reinforcement and other embedded parts have been inspected and approved by the Engineer.

5.4.2 All surfaces upon or against which concrete is to be placed shall be thoroughly cleaned and well moistened before concrete is placed except for where there is danger of freezing.

5.4.3 Laitance on the surface of the concrete at any and all horizontal joints shall be throughly removed by suitable

means to the satisfaction of the Engineer, before placing succeeding concrete.

5.4.4 Before concrete is placed, the surfaces of concrete so prepared and approved in accordance with the provisions shall be covered with mortar with a composition of cement 1 to sand 2.

5.4.5 Placing of concrete, once started, shall be carried out continuously in order to prevent the development of cold joints.

5.4.6 In placing concrete in columns and walls, suitable tools acceptable to the Engineer shall be used in order to avoid segregation of the materials.

5.4.7 Concrete, soon after being placed, shall be sufficiently compacted by tamping and vibrating with suitable tools.

5.5 Curing

5.5.1 After concrete has been placed, it shall be protected and cured strictly in accordance with the method approved by the Engineer.

5.5.2 The Contractor shall cover the surface of concrete with mats, burlaps or wet sand and maintain watering operation for at least 7 days.

5.6 Formwork

5.6.1 Wooden forms shall comply with the positions, shapes and dimensions of the structure shown on the Drawings, and shall be rigid and strong enough to support the weight of concrete without deformation or deflection.

5.6.2 Froms shall be tight enough to prevent the seepage of water and mortar, and designed to permit ready removal.

5.6.3 The form surfaces coming into contact with concrete shall be thoroughly cleaned and oiled before placing concrete. Oil to

be applied shall be mineral oil or an other kind which will not stain the concrete surface.

5.6.4 Chamfers shall always be employed at corners of forms so as to produce beveled edges on all permanently exposed concrete surfaces.

5.6.5 Forms may be reused upon approval of the Engineer provided that they are in good and proper condition and thoroughly clean.

5.6.6 Forms shall not be removed until the concrete obtains enough strength against imposed loads and other incidental loads occuring during construction.

6. REINFORCEMENT

6.1 Mild steel bars shall be processed strictly in accordance with the shapes and dimensions shown on the Drawings or as directed by the Engineer, without effecting any damage to the quality of materials.

6.2 Diameters of bends and hooks are as follows:

Bend: 5 times bar's diameter or more
Hook: 4 times bar's diameter or more

6.3 Steel bars shall be well cleaned, arranged in the right places and put together very rigidly so that no movement takes place during concrete placing.

6.4 Intersecting points and splices of steel bars shall be fixed with suitable clips or wire of 0.7mm or more in diameter.

6.5 Steel bars shall be accurately placed in the position shown on the Drawings, and spaced with mortar blocks, metal spacers or other spacers suitable for supporting loads imposed in order to maintain the positions, alignment and coverage throughout the form erection, reinforcement work and concrete placing operation.

6.6 Overlap lengths for splices shall have, as a rule, 45 times and 35 times bar's diameters for tension and compression sides, respectively. Both ends of the bar shall have proper hooks.

6.7 Splices at places where bigh stress is to be applied shall be avoided.

6.8 Standard coverage shall be 40mm, unless otherwise directed by the Engineer.

7. MORTAR PLASTERING WORKS

7.1 Mortar for plastering shall have the following composition by volume:

Cement - 1
Sand - 3

7.2 Quality of sand shall be the same as that used for concrete. However, it shall be used after sieving with 1.2mm sieve.

7.3 Before plastering, the surface of concrete or brick to be plastered with mortar shall be thoroughly cleaned and moistened.

7.4 The first coating of minimum. 3cm thick shall be made carefully by using a trowel. No remarkable void shall be left.

7.5 After scratching the surface of the first coat, the second or finishing coating of minimum. 1cm thick shall be made carefully especially of the chamfer and corner so that no spot remains. After plastering, final finish treatment shall be effected with brush or a trowel.

7.6 Spraying of water on the surface of mortar shall be continued for at least 4 days after completion of plastering.

7.7 Floor plastering shall be performed as soon as possible after concrete is placed.

8. STONE MASONRY WORKS

8.1 Ashlar stone to be used in the works shall be obtained from an approved quarry, and shall be free from holes or defects, and shall not be thin or slender. The size shall not be smaller than 25cm.

8.2 Before any masonry work is started, a sample wall section shall be laid for the approval of the Engineer.

8.3 Mortar paste shall be placed between ashlar blocks with suitable thickness in accordance with the Sri Lankan standard or as directed by the Engineer.

9. CONCRETE PIPE WORKS

9.1 Precast concrete pipes shall be placed at road crossing locations true to the lines, grades and dimensions shown on the Drawings or as directed by the Engineer.

9.2 Excavated soil shall be set aside in order not to hinder traffic and topsoil shall be preserved seperately from subsoil so as to be used as topsoil over backfill earth.

9.3 The trench dimensions shall be suitable or adequate for normal operation of precast concrete pipe placing.

9.4 The bottom of the trench shall be leveled except for the pipe joints portions. In the case of rocky or stoney ground, at least 10cm excess-excavation is required and shall be backfilled with sand or sandy soil.

9.5 In backfilling, due care shall be taken to avoid direct touching of pipes with stones, and backfill materials shall be thoroughly tamped at every 20cm layer.

9.6 Before lowering the pipe into the trench, inside and ends of the pipe shall be made free from sand, mud, pebbles and other obstacles, and thoroughly cleaned.

9.7 The pipes shall be carefully laid with no cracks, breaks or any other damages.

9.8 Pipe joints shall be wrapped with mortar 20cm in width and 10cm in thickness.

9.9 Surplus soil after backfilling shall be removed to a suitable site as per normal procedures of Sri Lanka.

10. BRICK MASONRY WORKS

10.1 Brick to be used shall be of good quality having no irregularity in shape, cracks or flaws.

10.2 Bricks shall be cleaned first and laid rightly and evenly along the batter board.

10.3 No vertical joints placed in a straight line shall be allowed.

10.4 Mortar paste shall be placed between bricks with suitable thickness in accordance with the Sri Lankan standard or as directed by the Engineer.

11. PAINTING WORKS

11.1 Paint shall for all steel structures such as steel pipes, door and windows and also be applied for surfaces of wall and lumber.

11.2 Steel surfaces shall be thoroughly cleaned and painted with one coat of rust-preventing paint before it is delivered from the workshop or factory. However, portions where it is impossible to paint after assembling shall be coated twice with rust-preventing paint at the factory before delivery.

11.3 The portion to be buried in concrete will not be required to be painted.

11.4 Painting shall be done with a brush uniformly and properly so that such defects as nonuniformity and bubbles will not occur.

12. CARPENTRY WORKS

12.1 Lumber shall be clear surfaced on all four sided and shall be worked in the such patterns as are indicated or specified.

12.2 Nails and accessories shall be steel and galvanized and the size and type shall be as indicated in the Drawings or as directed by the Engineer.

13. TILE WORKS

13.1 Tile to be used shall be of good guality having no irregularity in shape, nor cracks or flaws.

13.2 Tile shall be cleaned first and laid rightly as shown in the Drawings or as directed by the Engineer.

13.3 Tile shall be fixed firmly in accordance with Sri Lankan standards or as directed by the Engineer.

DESCRIPTION OF THE WORKS

The works proposed to be undertaken under this Contract for the construction of the Experimental and Demonstration Farm, and Plant Building in Unit 1, Block 302, System "C", Mahaweli Area, shall include furnishing of all labor, materials, plant and equipment necessary for construction and supplying completely the items given below.

OUTLINE OF THE WORK

Work Item	Quantity	Description
1. Plant Building	584m^2	
Loading area	(92m^2)	Floor: reinforced concrete
Office	(24m^2)	Columns: " "
Seed grading, milling, etc.	(324m^2)	Beams: " "
Parboiling plant	(72m^2)	Walls: brickmasonry
Husk boiler	(72m^2)	Roof: angle truss
2. Experimental and Demonstration Farm Facilities	23ha	
Inspection paths	2,660m	W: 4m, unpaved
On-farm ditches	3,710m	bottom width: 0.3m, H: 0.3m earthen ditch
Improvement of inlets	23	0.15m dia. RC pipe & diversion box
Field drains	1,195m	botton width: 0.3m, H: 0.3m; earthen ditch
Road crossing culverts	8	0.45m dia. RC pipe; L: 4.9m
Sharp crested weir	1	W: 1.8m
Fence	2,750m	H: 1.5m barb wire
Bund construction	600m	Corrugated PVC sheet reinforced with wire mesh

BILL OF QUANTITIES

ARICHITECTUAL WORK

No.	Description	Unit	Qty.	Unit Rate	Amount	Remarks
A.	**Plant Building Works**					
1	Land Levelling Work	m^3	300			
2	Common Excavation Work	m^3	243.4			
3	Compacted Gravel	m^3	68.3			
4	Concrete Work (1:3:6)	m^3	30.5			
5	Concrete Work (1:2:4)	m^3	286.2			
6	Form Work	m^3	286.2			
7	Reinforcement Work	t	54.3			
8	Steel Trass Work	t	44.3			
9	Welding	m	132.6			
10	Brick Masonry Work	M^3	118.5			
11	Door and Window Work	-	LS			
12	Metal Work	-	LS			
13	Corrugated Asbestos Sheet Roofing Work	m^2	865.4			
14	Waterproof Work	m^2	20.0			
15	Plastering Work	m^2	505.3			
16	Painting Work	m^2	2,563.1			
17	Gutter Work	-	LS			
18	Miscellaneous Work	-	LS			
19	Drainage Work, etc.	-	LS			
20	Electric Work	-	LS			
21	Plumbing Work	-	LS			

BILL OF QUANTITIES

CIVIL WORK

No.	Description	Unit	Qty.	Unit Rate	Amount	Remarks
A.	**Construction Work of Inspection Path (2,620m)**					
1	Stripping Work of Top Soil	m^3	1,200			
2	Common Excavation Work (haul: 1,200m)	m^3	4,932			
3	Placing & Compaction Work Including Watering (roller)	m^3	4,932			
B.	**Construction Work of On-Farm Ditch**					
1	Common Excavation Work (haul: 1,200m)	m^3	835			
2	Placing & Compaction Work Including Watering (manual)	m^3	835			
C.	**Improvement Work of Farm Inlet (23 sets)**					
1	Common Excavation Work	m^3	67.2			
2	Backfilling Work	m^3	57.5			
3	Compacted Gravel Work	m^3	3.5			
4	Concrete Work (1:3:6)	m^3	2.3			
5	Concrete Work (1:2:4)	m^3	4.7			
6	Form Work	m^3	7.0			
7	Reinforcement Work (ø6mm)	kg	122.6			
8	Furnishing Pipe (ø150mm)	m	112.7			

No.	Description	Unit	Qty.	Unit Rate	Amount	Remarks
D.	**Construction Work of Culvert for Irrigation (2 sets)**					
1	Common Excavation Work	m^3	11.7			
2	Backfilling Work	m^3	10.0			
3	Compacted Gravel Work	m^3	0.6			
4	Concrete Work (1:3:6)	m^3	0.4			
5	Concrete Work (1:2:4)	m^3	0.8			
6	Form Work	m^3	1.2			
7	Reinforcement Work (ø6mm)	kg	21.3			
8	Furnishing RC Pipe (ø150mm)	m	19.6			
E.	**Construction Work of Drainage Canal**					
1	Common Excavation Work	m^3	630.0			
2	Embankment Work (manual)	m^3	270.0			
F.	**Construction Work of Culvert for Drainage (8 sets)**					
1	Common Excavation Work	m^3	54.4			
2	Backfilling Work	m^3	48.0			
3	Compacted Gravel Work	m^3	1.3			
4	Concrete Work (1:3:6)	m^3	5.0			
5	Concrete Work (1:2:4)	m^3	22.2			
6	Form Work	m^3	27.3			

No.	Description	Unit	Qty.	Unit Rate	Amount	Remarks
7	Reinforcement Work (ø12mm)	kg	266.7			
8	Furnishing RC Pipe (ø450mm)	m	39.2			
G.	**Construction Work of Sharp-Crested Weir (1 set)**					
1	Common Excavation Work	m^3	19.0			
2	Backfilling Work	m^3	10.0			
3	Compacted Gravel Work	m^3	1.49			
4	Concrete Work (1:3:6)	m^3	1.8			
5	Concrete Work (1:2:4)	m^3	7.3			
6	Form Work	m^3	9.1			
7	Reinforcement Work (ø12mm)	kg	390.24			
8	Steel Work (L: 50x50x5x1,800)	kg	8			
9	Gitmodjomh Water Level Gage	no	1			
H.	**Construction Work of Corrugated Sheet Bund**					
1	Common Excavation Work	m^3	420.0			
2	Backfilling Work	m^3	420.0			
3	Furnishing Reinforced PVC Sheet	no.	400			

No.	Description	Unit	Qty.	Unit Rate	Amount	Remarks
I.	**Construction Work for Fence (2,750m)**					
1	Common Excavation & Spoil to Waste or Fill Material	m^3	687.5			
2	Backfilling Work	m^3	613.3			
3	Compacted Gravel Work	m^3	28.9			
4	Concrete Work (1:3:6)	m^3	41.3			
5	Concrete Work (1:2:4)	m^3	33.0			
6	Form Work	m^3	74.3			
7	Reinforcement Work (ø9mm)	kg	7,205			
8	Furnishing of Barbed Wire	m	1,828.8			
9	Furnishing of Wooden Gate	set	6			

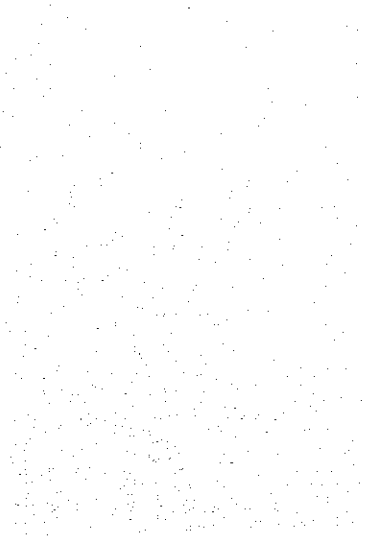
付　録

Ⅰ．帰国報告書

Ⅱ．現地調査報告書

Ⅲ．修正電気系統設計助言

Ⅳ．追加設計助言



Ⅰ．帰国報告書

国際協力事業団

農業開発協力部

帰国報告書

スリランカ・マハベリ集約農業開発計画

実施設計調査

昭和６０年3月１５日

中央開発株式会社

目　　次

1. はじめに

1.1 調査の目的、内容

別途契約書参照

1.2 現地調査日程

国内事前準備の後、昭和60年 2月 5日より、同年 3月11日までの35日間、スリランカに滞在し、実施設計調査を行った。この間、 2月 5日から 2月10日まではRDミッションと同行した。現場調査は 2月 8日から 2月26日までの間、システムC地域を中心として実施し、この後、帰国する 3月10日までの間、(3月10日はバンコク泊) は、コロンボを中心として資料収集、意見交換、現地調査報告書の作成、提出、説明を行った。詳細は、現地調査報告書に記載してある。

1.3 現地調査報告書

現地調査報告書は概要、設計助言、概略設計の 3章からなっており、報告書の提出先は、次頁表の通り。

1.4 今後の予定

現地で収集した情報に基づき、国内解析、設計、入札書類等を作成し、草案を4月上旬に貴事業団に提出、最終報告書を 4月下旬に提出する。

Field Report　提出先

No.	氏　　名	役　　職
01	Mr. P.H.K. Dayaratne	Project Coordinator, MEA
02	Mr. K.H.S. Gunatillaka	Director General, MASL
03	Mr.J.Bandaragoda	Executive Director, MEA
04	Lt.Col. P.V. Pathirana	Resident Project Manager, MEA
05	Mr. L. Godamune	Secretary General, MASL
06	Mr. G.W.Liyanage	Senior Agronomist, MEA
07	Mr. A. Wickremaratne	Chief Irrigatrion Engineer, MEA
08	Mr. M. R. Iddawala	Mechanical Engineer, MEA
09	Mr. J.Boralessa	Farm Manager, Seed Farm, MEA
10	小林　二等書記官	日本大使館
11	池田所長	JICA　コロンボ事務所
12 ～ 14		CKC
15	Mr. T. P. Ranasinghe	General Manager, MECA

以上15部　コロンボ製本

他　4部　国内製本、JICA提出

2. 設計助言

設計助言については、貴事業団との契約にのっとり、以下の各項目に関し実施した。

(1) センター全体計画

用途地区の指定、測量杭保存、道路、造園、敷地造成、フェンス工

(2) 建物、住居

事務所拡張（駐車場改造、実験棟、展示棟）

日本人専門家宿舎（サイト新築、ギランデルコッテ改修）

(3) 設備

電力、水道、電話、無線

以上の設計助言内容は、すべて現地調査報告書に盛り込み、速やかに工事を着手するよう強く勧告した。

MEA からは、日本人宿舎については既に入札中であったが、DDミッション到着に伴い一次作業を中断していたものであり、今回の明確な勧告に基づき作業を再開するとの旨返事があった。電力、電話、無線についても関係部局へのアクションを開始している。今後はこれから着手する水道、事務所拡張、敷地造成と併せて、進捗状況のチェック、促進が必要となる。

3. 概略設計

概略設計は、貴事業団との契約にのっとり、以下の項目について実施した。これから国内作業において実施設計、積算、入札図書としてまとめられる。

(1) ポストハーベストプラント

カウンターパート等と共にこれまでの資料をレビューし、作付体系を決

定した。これに基づき、種子プラントの容量を決定し、併せてパーボイル、精米プラントについても展示等の役割を勘案し決定した。また、乾燥場の必要面積についても解析を行い、これらについて概略のプラントレイアウトを検討した。

(2) プラント建屋

前述プラントの検討結果に基づき、建屋の概略レイアウトを検討した。併せてワークショップ、トラクターシェッド、農作業棟もレイアウトを行ったが、これらについては、充分現地仕様で建設し得る。但し、プラント建屋のシャッターは、日本からの購送機材に含まれてため、A4フォームの資機材リストに加えてある。

(3) 実験、展示圃場

展示圃場の大部分は既に第 1作目が始められており、4 月に刈り入れの予定である。当初若干みとめらた圃場内の小石は、 1作目の耕作時に取り除いた残りであり、以後はそれ程問題視されていなかった。表土が薄い圃場が若干認められるが、マハベリの平均的な現状とてらし、特別な改良工事の必要性は乏しいと判断された。

踏査並びに測量に基づき、次の各項目について建設されることになる。

見学道、圃場配水路、フェンス工、排水路、水口改良等。

4. その他

4.1 スリランカ予算

種子センターに係る本件のスリランカ側1985年予算については、長期ミッシ

ョンとの打ち合わせ結果を略満足させる内容で措置されていたが、宿舎関係を主として不足することが予想されることが指摘される。これに対し、MEA としては、予算の流用が運用上かなり弾力性があること、更に本件は最優先事業のマハベリ関係であることの 2点から、できる限り今回の設計助言に基づき（ワークショップ、トラクターシェッド、農作業棟も加え）実行したいとのことであった。

4.2 提言

.設計助言については、急を要しており、現地で作業を完了しなければならなかった。このため、貴事業団からの御指示に加え，必要と判断した点についてもかなり精力的に作業を行って、設計助言に盛り込んだことから、MEA 等関係者から、「これから何を行うかに関して具体的に明確になった。」との高い評価を受けることができた。しかし、日本人専門家宿舎等については、これから再度入札をし直し、建設にかかることから完了までに最低 4ヶ月はかかること、ギランデルコッテの宿舎についてはRPM が一次使用することも考えられること等から、7 月 1日を目標に今後とも注意深い作業進捗のチェックが必要である。貴事業団コロンボ所長を通して、毎月 1～2 回の作業進捗状況の確認、促進方、御尽力が望まれる。

この他、事務所、電力、水道等も緊急であり、早期着手、完了を強く希望する次第です。

Ⅱ．現地調査報告書

DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA

MINISTRY OF MAHAWELI DEVELOPMENT

MAHAWELI AUTHORITY OF SRI LANKA

MAHAWELI ECONOMIC AGENCY

FIELD REPORT

ON

DETAIL DESIGN STUDY

OF

INTEGRATED AGRICULTURAL DEVELOPMENT DEMONSTRATION PROJECT

IN

MAHAWELI AREA

MARCH 1985

JAPAN INTERNATIONAL CO-OPERATION AGENCY

PREFACE

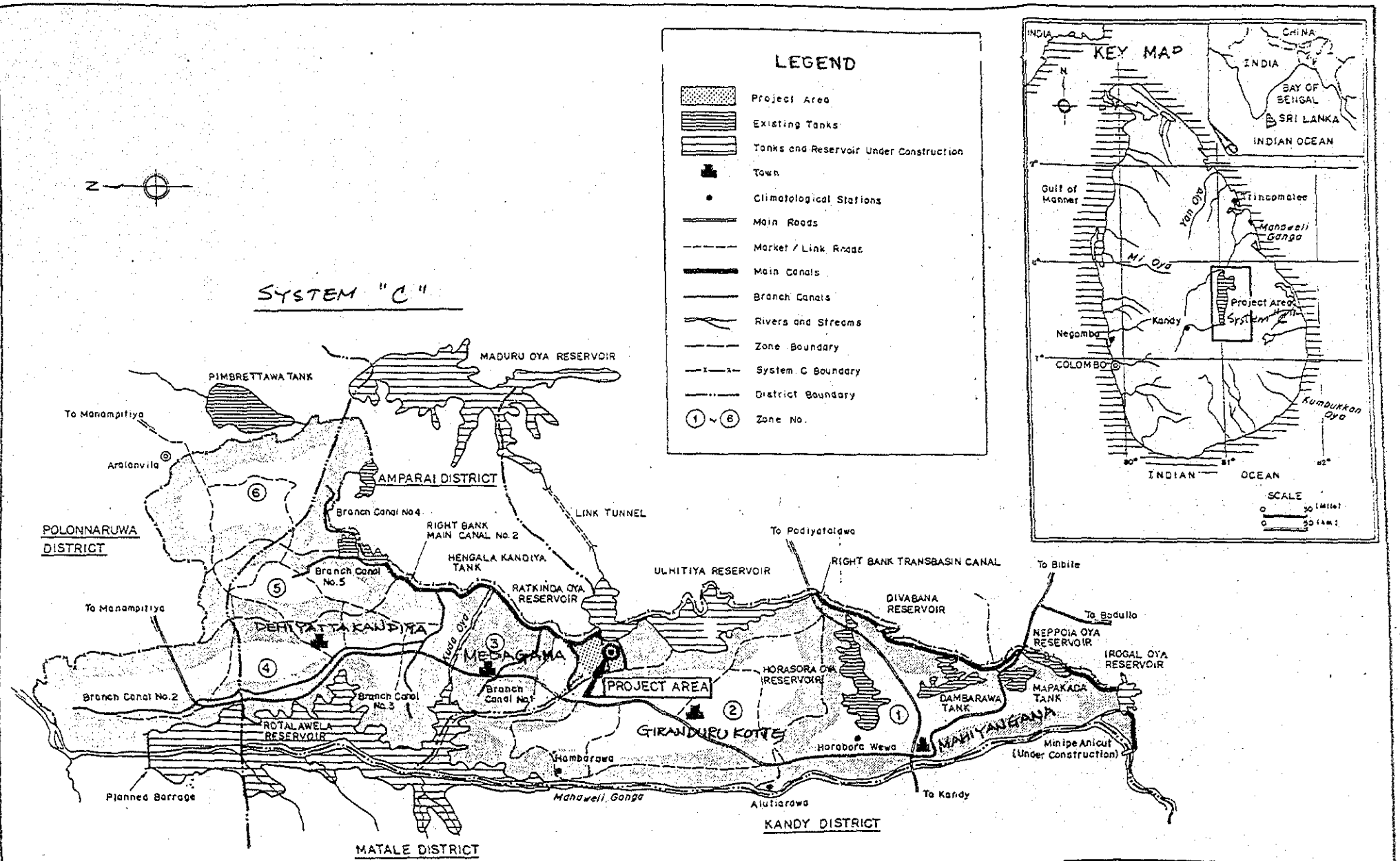
In response to the request made by the Government of the Democratic Socialist Republic of Sri Lanka, the Japan International Cooperation Agency (hereinafter referred to as JICA) as the Executing Agency for Technical Cooperation Programs of the Government of Japan has sent a Japanese expert team (hereinafter referred to as the Team) to Sri Lanka,to conduct a detail design study (hereinafter referred to as the Study) on the Integrated Agricultural Development Demonstration Project in Mahaweli Area (hereinafter referred to as the Project).

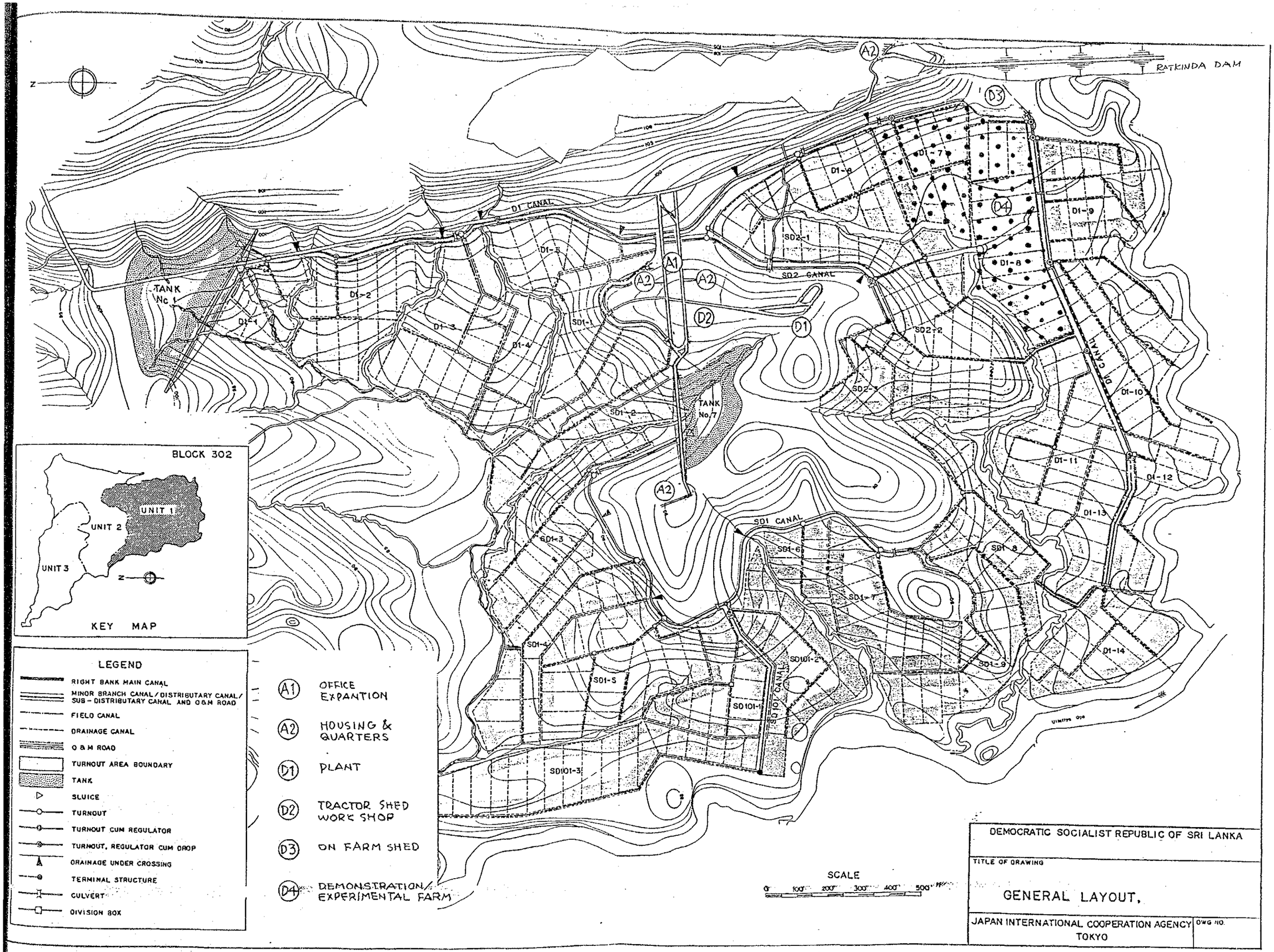
The Team arrived at Sri Lanka on 5th February 1985, together with the Implementation Survey Team headed by Mr. T. Tauchi who left Sri Lanka on 13th February after signing of the Record of Discussion (hereinafter referred to as R/D).

The Team visited the relevant sites of the Project from 8th to 26th February 1985 to undertake the Study and to hold necessary discussions with concerned personnel in the sites.

This Field Report has been prepared in line with the said R/D signed on 11 February 1985, and its contents include the "Design Advice" on the facilities to be promptly constructed by the Government of Sri Lanka and "Preliminary Design" of the remaining facilities which will be finalized in the home office as the detail design.

Finally the Team expresses the hearty appreciation to the concerned officials and engineers who extended their close cooperation to the Team.


LEGEND
Project Area
Existing Tanks
Tanks and Reservoir Under Construction
Town
Climatological Stations
Main Roads
Market / Link Roads
Main Canals
Branch Canals
Rivers and Streams
Zone Boundary
System C Boundary
District Boundary
① ~ ⑥ Zone No.
KEY MAP
INDIA
CHINA
BAY OF BENGAL
SRI LANKA
INDIAN OCEAN
Gulf of Manner
Trincomalee
Yan Oya
Mahaweli Ganga
Mi Oya
Project Area System C
Kandy
Negombo
COLOMBO
Kumbukkan Oya
SCALE
SYSTEM "C"
MADURU OYA RESERVOIR
PIMBRETTAWA TANK
To Manampitiya
Aralanvila
AMPARAI DISTRICT
POLONNARUWA DISTRICT
Branch Canal No.4
RIGHT BANK MAIN CANAL No.2
LINK TUNNEL
HENGALA KANDIYA TANK
Branch Canal No.5
RATKINDA OYA RESERVOIR
To Manampitiya
DEHIYATTAKANDIYA
Kuda Oya
MEDAGAMA
Branch Canal No.2
Branch Canal No.3
Branch Canal No.1
PROJECT AREA
ROTALAWELA RESERVOIR
GIRANDURU KOTTE
Hambarawa
Planned Barrage
Mahaweli Ganga
MATALE DISTRICT
To Podiyatalawa
ULHITIYA RESERVOIR
RIGHT BANK TRANSBASIN CANAL
DIVABANA RESERVOIR
HORASORA OYA RESERVOIR
DAMBARAWA TANK
Horabora Wewa
MAHIYANGANA
To Bibile
To Badulla
NEPPOIA OYA RESERVOIR
IROGAL OYA RESERVOIR
MAPAKADA TANK
Minipe Anicut (Under Construction)
Aluthgrawa
To Kandy
KANDY DISTRICT
SCALE
DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA
INTEGRATED AGRICULTURAL DEVELOPMENT
DEMONSTRATION PROJECT IN MAHAWELI
GENERAL LOCATION MAP


RATKINDA DAM
TANK No.1
TANK No.7
D1 CANAL
SD1 CANAL
SD2 CANAL
SD101 CANAL
D1-1
D1-2
D1-3
D1-4
D1-5
D1-6
D1-7
D1-8
D1-9
D1-10
D1-11
D1-12
D1-13
D1-14
SD1-1
SD1-2
SD1-3
SD1-4
SD1-5
SD1-6
SD1-7
SD1-8
SD1-9
SD2-1
SD2-2
SD2-3
SD101-1
SD101-2
SD101-3
A1
A2
D1
D2
D3
D4
BLOCK 302
UNIT 1
UNIT 2
UNIT 3
KEY MAP
LEGEND
RIGHT BANK MAIN CANAL
MINOR BRANCH CANAL / DISTRIBUTARY CANAL / SUB - DISTRIBUTARY CANAL AND O & M ROAD
FIELD CANAL
DRAINAGE CANAL
O & M ROAD
TURNOUT AREA BOUNDARY
TANK
SLUICE
TURNOUT
TURNOUT CUM REGULATOR
TURNOUT, REGULATOR CUM DROP
DRAINAGE UNDER CROSSING
TERMINAL STRUCTURE
CULVERT
DIVISION BOX
A1 OFFICE EXPANTION
A2 HOUSING & QUARTERS
D1 PLANT
D2 TRACTOR SHED WORK SHOP
D3 ON FARM SHED
D4 DEMONSTRATION / EXPERIMENTAL FARM
SCALE
0 100 200 300 400 500 m
DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA
TITLE OF DRAWING
GENERAL LAYOUT,
JAPAN INTERNATIONAL COOPERATION AGENCY
TOKYO
DWG NO.

CONTENTS

I GENERAL DESCRIPTION

1.1 Scope of the Study

The scope of the study includes principally the following:

(1) Collection of necessary information and data;

(2) Site Survey of the project site selected in the Unit 1, Block 302, System 'C'.

(3) Advice the MEA on designing the necessary facilities for the Project listed in Table -1.

(4) Detail Design of the facilities listed in Table -1.

(5) Selection of the machinery and Equipment for the rice processing facilities.

(6) Detail design of experimental and demonstration farm.

(7) Preparation of Field Report.

(8) Preparation of Draft and Final Report after detail design in home office.

(9) Preparation of Tender Document

The facilities to be adviced, designed or selected are tabulated in Table - 1.

Table - 1.

STUDY ITEMS AND SCOPE

Study Items	Study Scope
A. Building for Common Facilities	
1. Tractor Shed	Design
2. Workshop	-do-
3. Buildings for Seed cleaning and parboiling plants	-do-
4. Office expansion	Design Advice
B. Common Utilities	
1. Water supply for:	
- plant facilities	Design
- office & quarters	Design advice
2. Power supply	-do-
3. Telephone facility	-do-
C. Project Facilities	
1. Residence for experts	
- existing house	Design advice
- new house	-do-
2. On-farm shed	Design
3. Mill building	-do-
D. Plant Facilities	
1. Layout for seed cleaning and parboiling plants	Design
2. Layout for milling units	-do-
3. Machinery and equipment for:	
- seed cleaning	Selection
- parboiling	-do-
- rice milling	-do-
E. Experimental Farm	
1. On-farm access for observation	Design
2. On-farm ditch	-do-
3. Improvement of on-farm turnout	-do-
4. Fencing work for farm	-do-
5. Experimental and demonstration farm	Adjustment
6. Review of drainage canal	Review & check
7. Concrete paddy dike for water management test lot	Design

1.2 Major Activities and Progress

The major activities of the Team is presented in Table - 2.

The Team has collected the data and information and completed the layout of all necessary facilities in Colombo after site investigation. After submission of this Field Report the Team will depart Colombo on 10 March for Japan to prepare the detail design and other necessary document in their home office and will complete the work by the end of April 1985.

Table - 2

MAJOR ACTIVITIES

Date	Work Item
Feb. 5	Arrived at Colombo
6-7	Courtesy call and data collection
8	(Colombo to System 'C') [1/]
9-11	Reconnaissance and data collection
12-15	Inspection of existing rice processing facilities in Anuradhapura.
16	Meeting with RPM and Project Coordinator (Mr. Sakamoto left for Colombo)
17	Data analysis and site reconnaissance
18-23	Plant: Inspection of the existing burner and facilities for rice processing in Anuradhapura Architect: Survey and Basic planning Irrigation: Survey and data collection
24	Data collection, analysis and planning
25	Supplementary investigation and progress reporting to RPM.
26	(Site to Colombo)
27-28	Meeting and data collection at JICA, MEA and MEC
Mar. 1-2	Data collection and layout
3-6	Preparation of Field Report
7	Meeting with MEA, etc.
8	Meeting at JICA office
9	Supplemental work
10	Depart Colombo for Japan

1/ Mr. Sakamoto, Team Leader, joined the R/D Mission. He departed Colombo on Feb. 19 for Japan after meeting with MEA on Feb. 18, '85.

CHAPTER II DESIGN ADVICE

2.1 General

A design advice to the entire site plan of rice processing center, office expansion, houses for Japanese expert, electricity, water supply and communication facilities have been prepared based on the field investigation, survey and discussion with the concerned officials of Sri Lanka.

The accelerated action made by the Government of Sri Lanka in order to initiate the necessary construction is strongly recommended in accordance with the following design advice.

2.2 Site Plan of Rice Processing Center

2.2.1 Zoning

Considering the operation of Rice Processing Center and characteristics of each facilities the zoning has been studied as illustrated in Fig. 2-1.

The forthcoming facilities in and around the center is strongly recommended to be constructed in line with the said zoning.

2.2.2 Survey Stakes

The wooden survey stakes which are indicated in the Fig. 2-1 and 2-3 with the mark of "+" were established in this study by the Team and Mr. Sangarandeniya, MEA surveyor, system 'C'. These stakes shall be reserved as it is for the future construction work.

2.2.3 Road

The proposed road has been planned with maximum employment of existing road in due

consideration of future traffic. All proposed road shall be paved with gravel in the earliest stage of construction, however, the main road starting from main gate and ending at plant site shall be repaved by bitumen surfacing providing the pedestrian roads in both side of the said road immediately after the commp-letion of all the plant in order to meet with the future traffic.

2.2.4 Landscaping

All the large and medium trees shall be reserved as it is. The turfing and tree planting shall gradually be arranged along both sides of road and around the buildings and houses.

2.2.5 Levelling for Plant Site

The selected area for the paddy processing and milling plant has very gentle undulation. Therefore, the MEA is expected to carry out the stripping and levelling works in prior to the construction of the building for the above mentioned plant.

2.2.6 Fencing Work

The special consideration for the fencing work shall be paid to the meteorological station, power substation, water source and other necessary area in addition to the outer fencing work for the entire Unit 1 area.

2.3 Building and Housing

2.3.1 Office Expansion

The proposed office expansion is planned as follows: (Fig. 2-2)

a) Renovation of existing parking space to the office specifically as conference room (office I);

b) Remodeling of existing large room for Japanese experts and counterparts (office II);

c) The office III will be the office of Japanese Team Leader;

d) Construction of laboratory, store and additional toilet;

e) Construction of display shed.

The first priority shall be placed to the above a). to d). to meet with the arrival of Japanese expert. Accordingly the construction of display shed has second priority.

2.3.2 Houses for Farm Manager and Japanese Experts

(1) New House

A three modified grade IV houses and one modified grade III twin house is planned to be located at Ratkinda lakeside in the vicinity of the north end of Ratkinda Dam (Fig.2-3). The details of the houses are illustrated in Fig. 2-4 for Grade IV and Fig. 2-5 for twin house.

The specific advices are listed as follows;

(2) Existing House in Giranduru Kotte

One existing house in Giranduru Kotte will be provided to one of the Japanese experts after its redecoration The Team recommends that Mr. Bond's house is the most appropriate to the above mentioned house with the same utilities requested to the aforementioned (1) new house.

HOUSING FOR FARM MANAGER & JAPANESE EXPERTS

Housing areas shall have a harmonious appearance and be in keeping with the Ratkinda environment.

Trees

In areas where construction is to take place only under brushing and removal of small trees.

Rocks

Be available for landscape

Specifications

Specifications are the same as Grade III and Grade IV

Notes

Column for corridor/200D wood painted with varnish, external walls/pointed joint painted white, roof/half round tiles.

Utilities	Hall	Living	Bed R.M I	Bed R.MII	Bath R.M	Etc R.M
Insect screen			All rooms			
Wood Screen (with net)	X					
Fan(ceiling)	X	X	X	X		
Bath tub					X	
Hot water supply (E)					X	
Receptacle (wall mounted)	2	3	3	3	1	

Rain water tank will be provided in accordance with the request made by the Japanese experts.

2.4 Electricity, water supply and communication facilities

2.4.1 Electricity

The peak demand of electricity for the project and required substation capacity have been estimated at 230 KW and 400 KVA respectively.

A sufficiently capacitated 33 KV power transmission line and old substation site are available in the project site (fig.2-6(A)). This substation provided with 250 KVA capacity was established for the construction of Ratkinda dam, however, the electric equipment except pole, wire and foundation had been removed after the completion of the construction work of dam. Although, CEB Mahiyangana suggested the Team to utilize the existing facilities, new construction or sufficient rehabilitation will be necessary to the proposed 400 KVA substation for the project.

After stepped down the voltage from 33 KV to 440 volt at the proposed substation, the distribution line (440 volt, 3 phase, 50 Hz) will be constructed in the earliest time of 1985 for the entire project area which approximate alighnment is illustrated in Fig.2-6 (A) to (C). Hence, the peak power demand of the plant facility was estimated at 130 KW.

2.4.2 Water Supply

The maximum daily water supply has been estimated at 80 cu.m based on the daily demand for the rice processing plant and the domestic demand which are analysed on the basis of 20 cu.m for the plant and 50 gallons/head/day for the domestic use respectively.

The existing ground water sources are available at the existing office, Toda's temporary shed and the shallow well along a creek flowing about 400 meter north of the project area. However, the Team judged that the ground water sources in and around the site are relatively poor in both quantity and quality to meet with the project requirement based on the water quality test and the information collected at Water Resources Board.

According to the investigation, the surface water in the existing tanks is broadly utilized in System 'C' area. Therefore, the water from Ratkinda Reservoir can be proposed for the water supply source for the project with simple purification in the concrete tank and necessary disinfection such as chlorination.

The Team's recommendation for the water supply system are presented in Fig. 2-6 (A) to (C).

The water purification tank composed of gravel, fiber, little charcoal or equivallent, etc shall be constructed together with water tank. A sample design for large scale facility is available in MECA for the Area Center of System 'B'.

The proposed pump of the water source for the project can be specified approximately as follows:

- Self priming pump (75 mm dia.)
- Design discharge : 3 litters per second at 7 meters for static suction head and 30 meters for total head.

The layout for the water supply system is illustrated in Fig. 2-6 (A) to (C).

2.4.3 Telephone and Radio

1) Telephone

At least one telephone line or preferably two lines are recommended to be installed at office and Farm Manager/Japanese expert quarters.

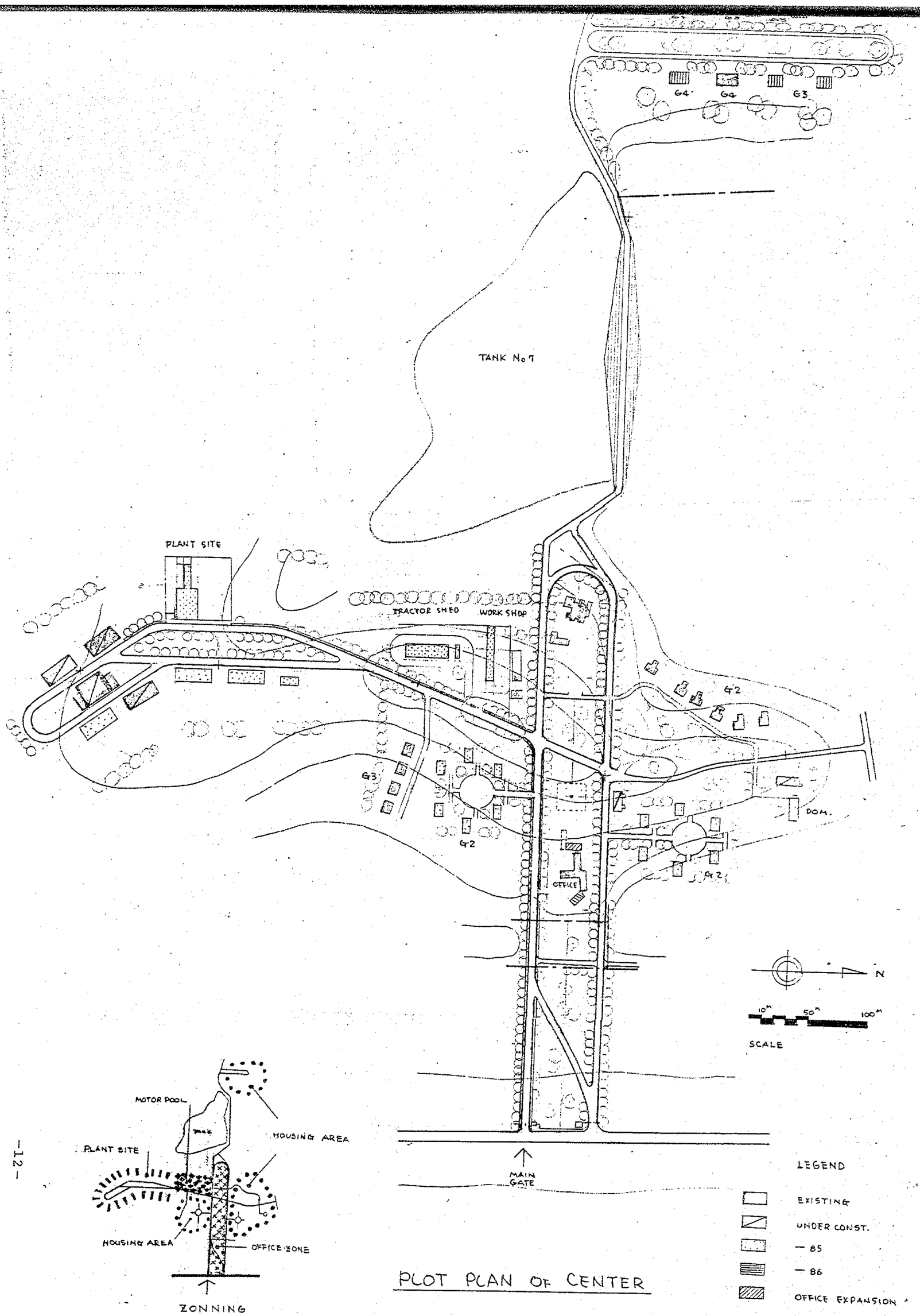
The proposed minimum slave stations of telephone linkage are as follows:

office	:	4 linkage telephones one for Japanese Team Leader one for Japanese expert's room.
Quarters	:	5 linkage telephones one for Japanese twin house one of each for two Japanese Gr.IV houses.

In addition to the above, one telephone facility is required to the Japanese expert's house in Giranduru Kotte.

2) Radio

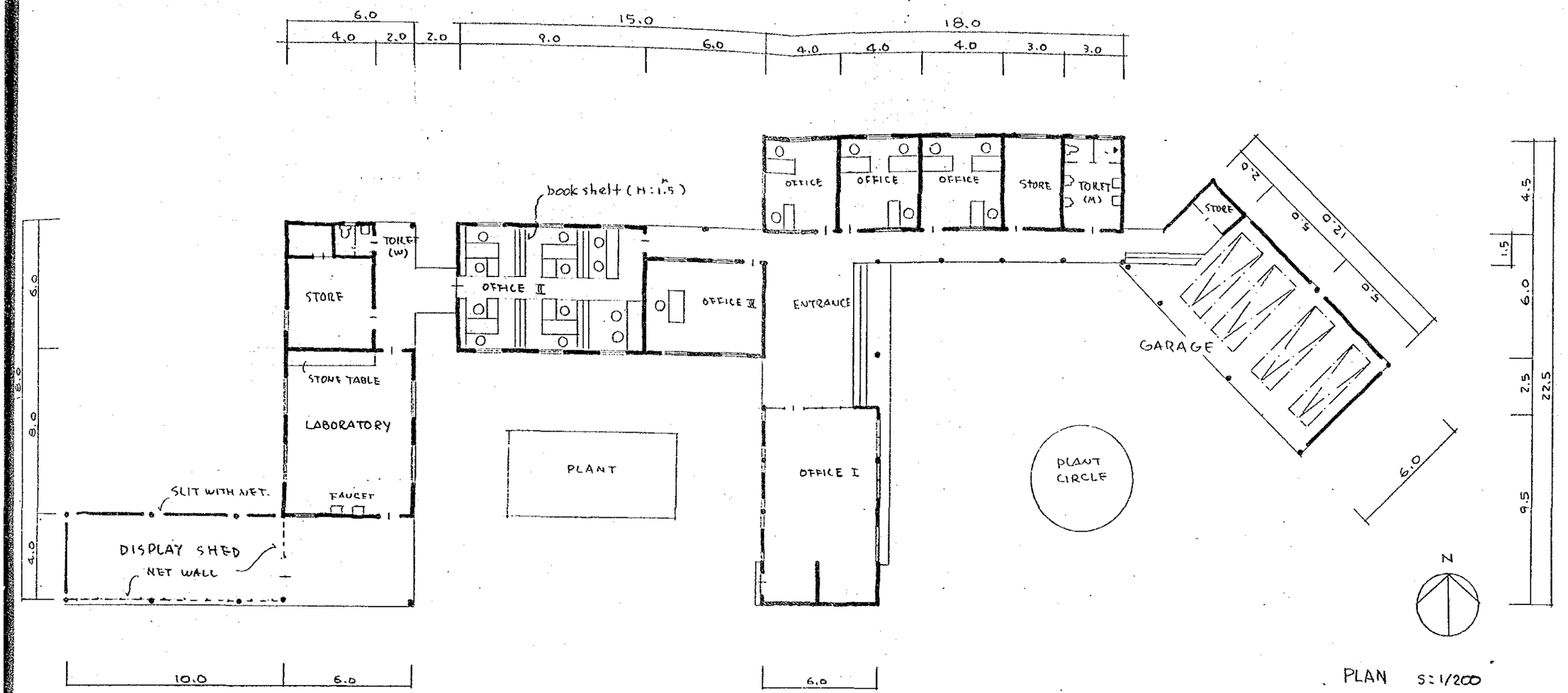
The MECA's radio system communicable to Colombo are established at 18 stations in System 'C' and its nearest station is located at the Ulhitiya Circuit Bungalow. On the other hand, MEA has 29 sets of VHF radio system communicable within the System 'C' area. One of the above system has already installed at existing office in the Project area. The Team recommends that one additional radio set will be installed at proposed Farm Manager's house in the Japanese Expert's Quarters.



PLOT PLAN OF CENTER

FIG. 2-1

FIG. 2-2

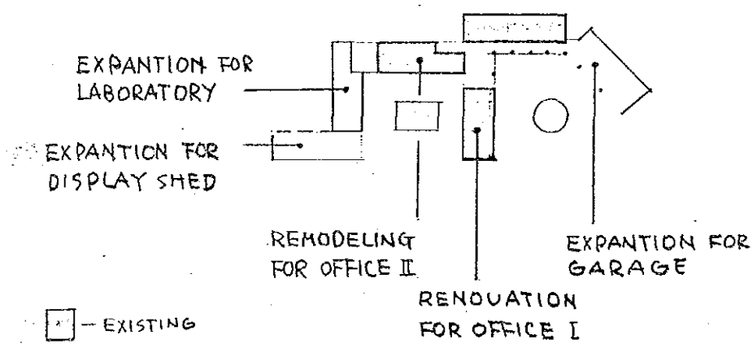


PLAN S:1/200

UTILITIES	40W FL	CL	SWITCH	RECEPTACLE (WALL MOUNTED)	INSECT SCREEN
OFFICE I	+3×2		+2	6	○
OFFICE II	—		+2	+2	—
III	—		—	—	—
LABORATORY	9×2		2	6	○
STORE	2×2		1	2	○
TOILET(W)	—	1	1	1	○
DISPLAY SHED	4×2		2	3	—
GARAGE	5×2		2	1	—

FL: FLUORESENT TUBE LIGHT
CL: INCANDESCENT LAMP

NOTE : SPEC.& DITAILS ARE THE SAME AS EXISTING.



OFFICE PLAN

Fig. 2-3

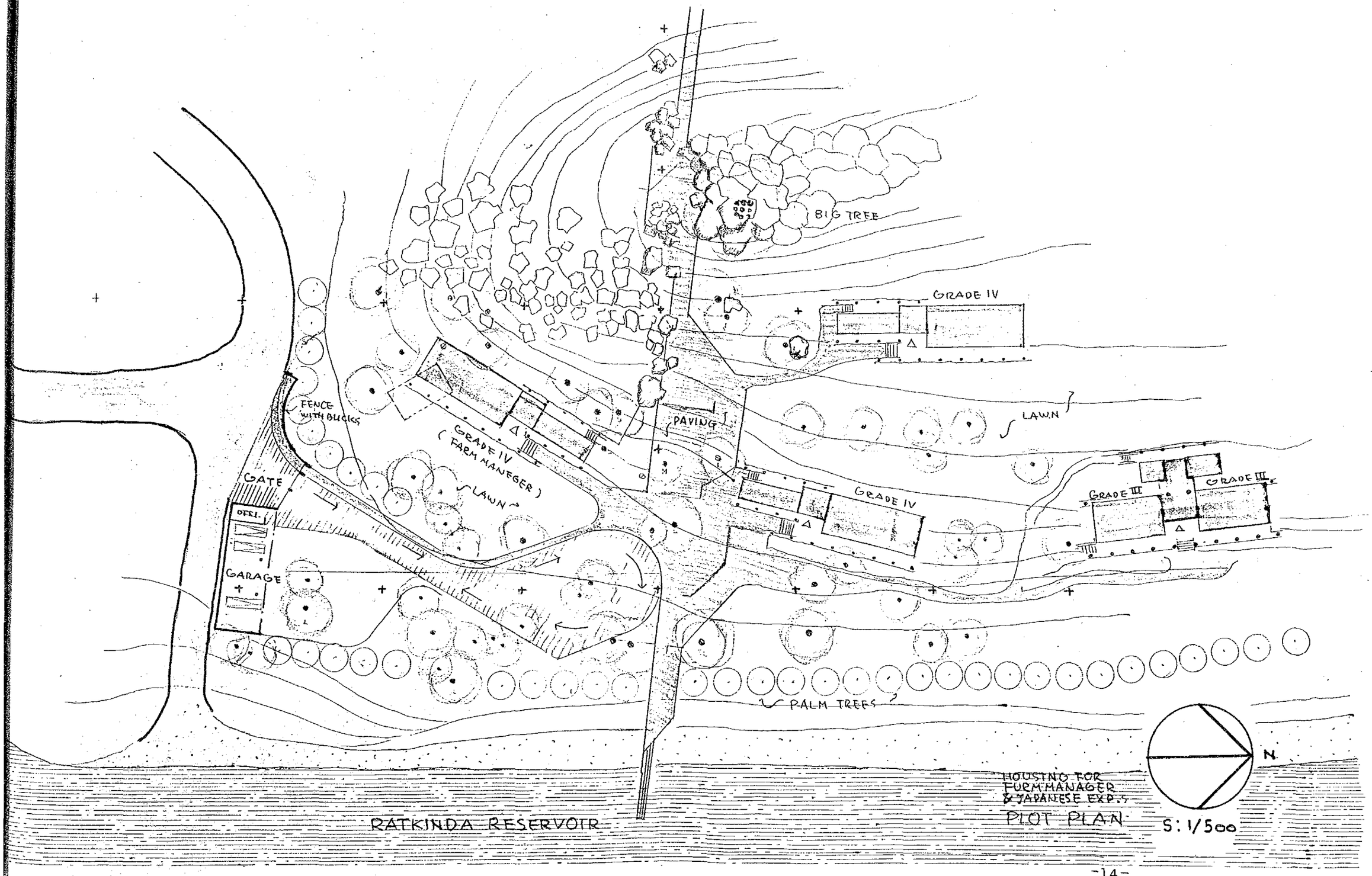
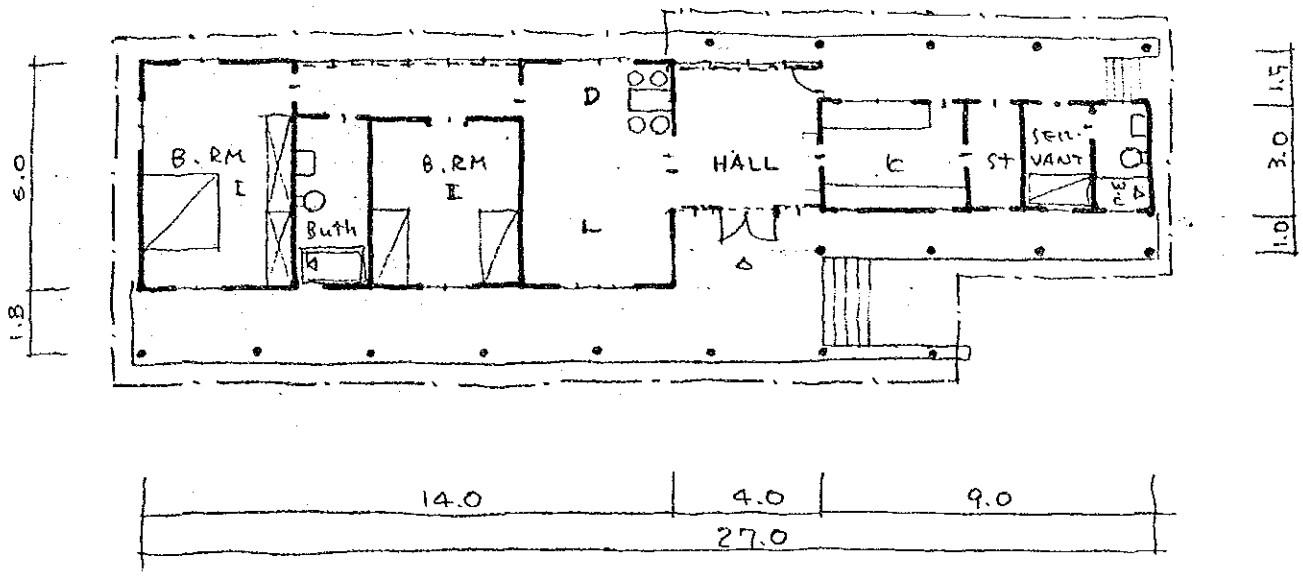
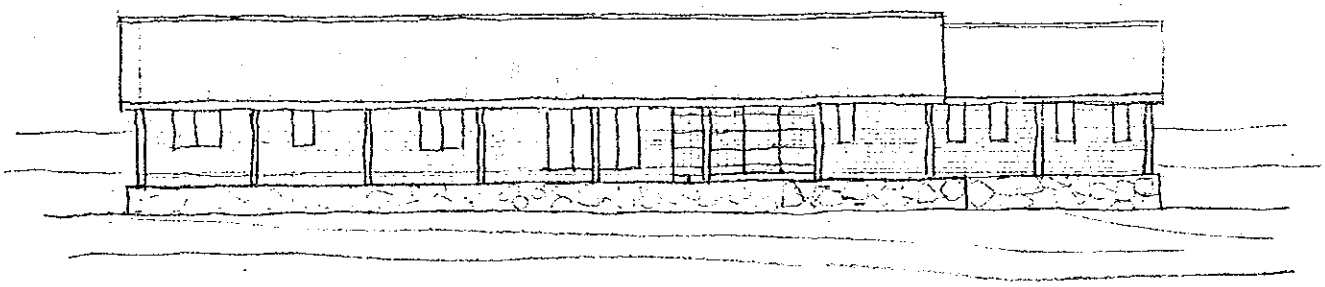

BIG TREE
GRADE IV
FENCE WITH BUSHES
GRADE IV (FARM MANAGER)
PAVING
LAWN
GATE
OFFICE
GARAGE
GRADE IV
GRADE III
GRADE III
LAWN
PALM TREES
N.
RATKINDA RESERVOIR
HOUSING FOR FURM MANAGER & JAPANESE EXP.'s
PLOT PLAN S: 1/500

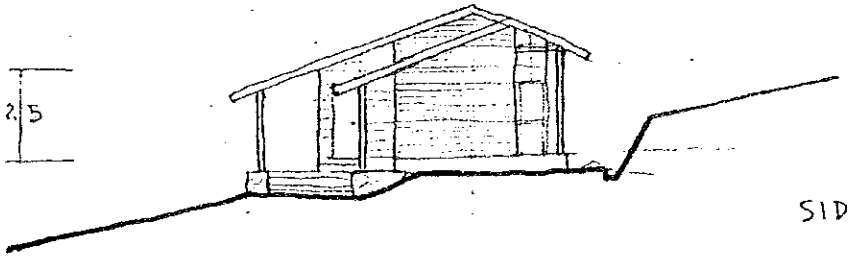
FIG. 2-4



PLAN
S: 1/200



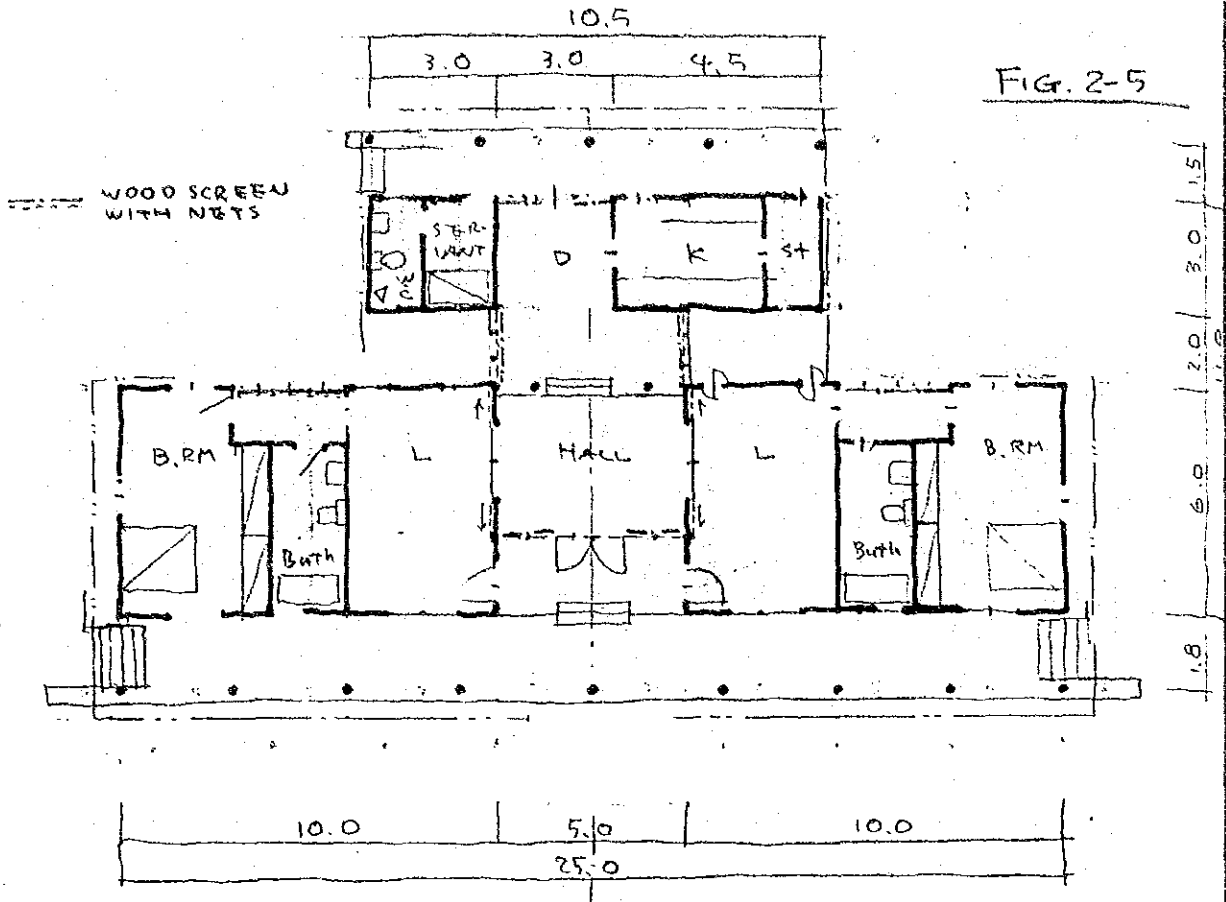
FRONT ELEV.
S: 1/200



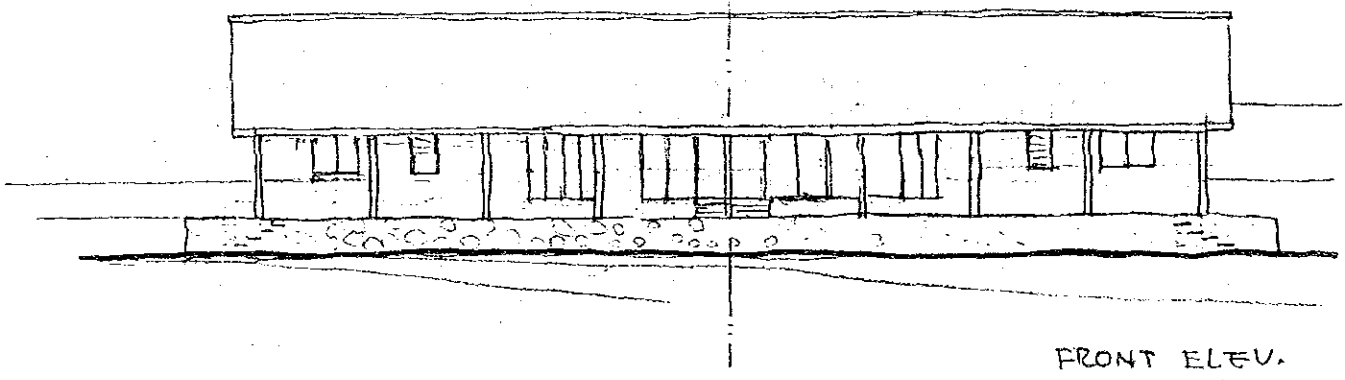
SIDE ELEV.
S: 1/200

GRADE IV

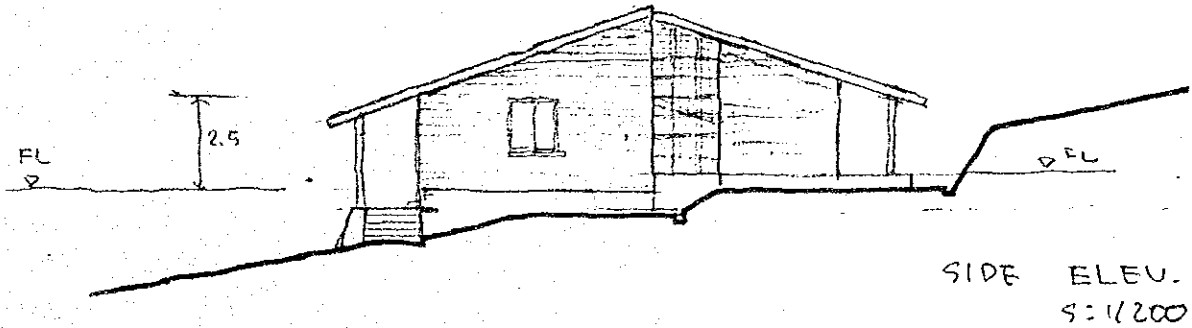
FIG. 2-5



PLAN.
S : 1/200

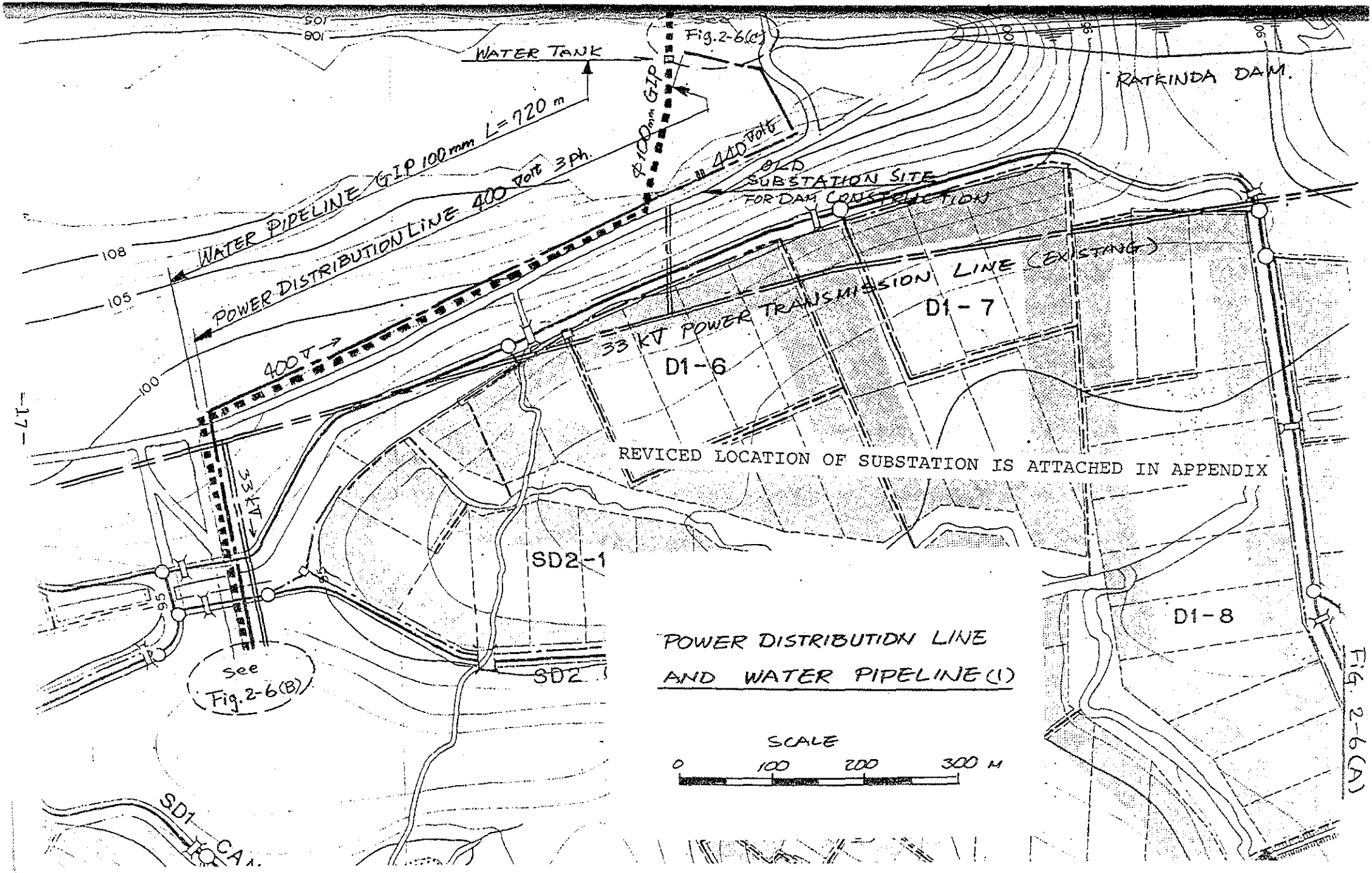


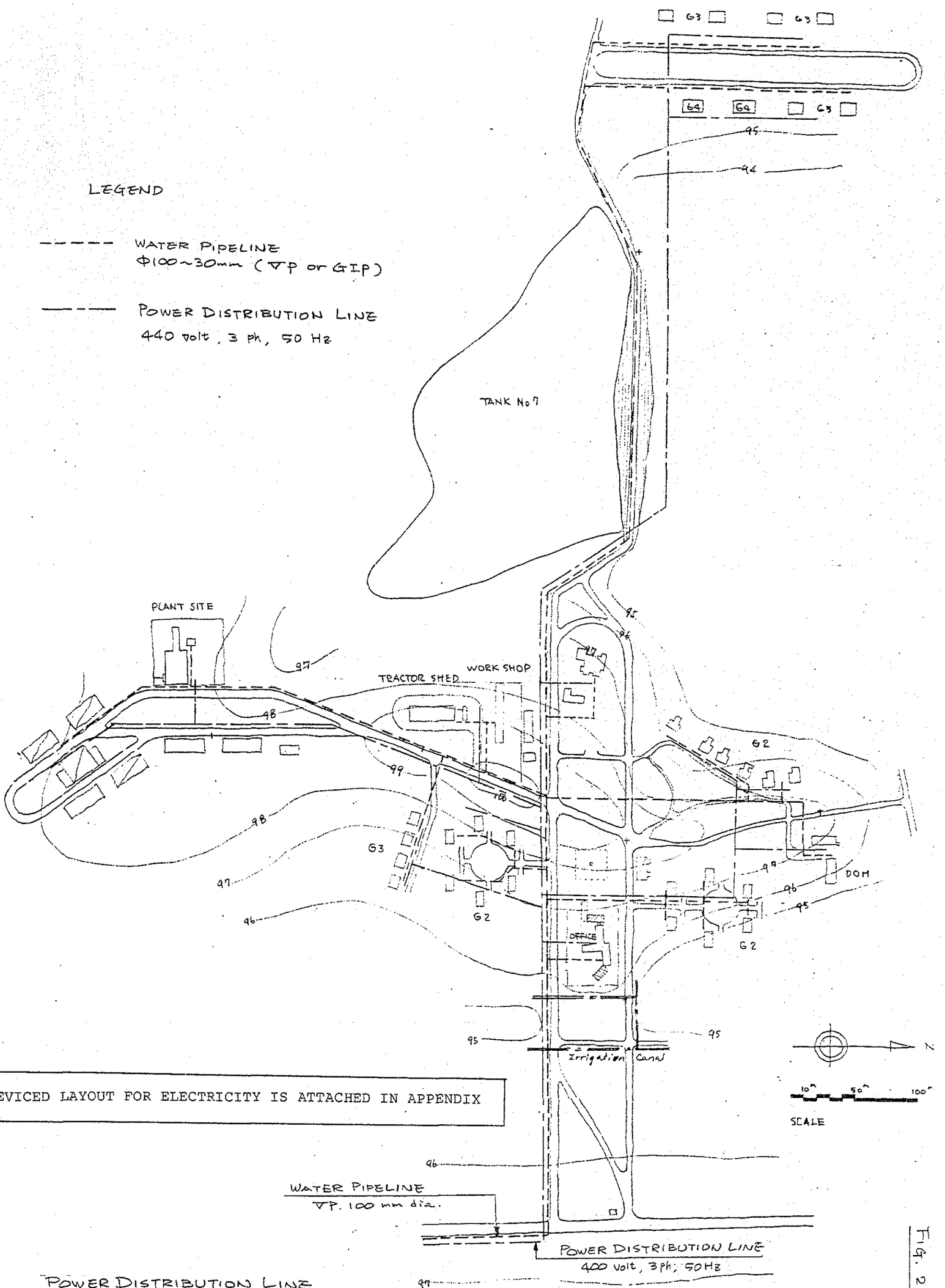
FRONT ELEV.
S : 1/200



SIDE ELEV.
S : 1/200

GRADE III TWIN HOUSE


WATER TANK
Fig.2-6(C)
RATEINDA DAM.
WATER PIPELINE GIP 100mm L=720 m
POWER DISTRIBUTION LINE 400 Volt 3Ph.
Ø100mm GIP
440 Volt
OLD SUBSTATION SITE FOR DAM CONSTRUCTION
33 kV POWER TRANSMISSION LINE (EXISTING)
D1-7
D1-6
400 V
33 kV
REVICED LOCATION OF SUBSTATION IS ATTACHED IN APPENDIX
SD2-1
SD2
D1-8
see Fig.2-6(B)
SD1
CA
POWER DISTRIBUTION LINE AND WATER PIPELINE (1)
SCALE
0 100 200 300 M
Fig. 2-6(A)
- 17 -

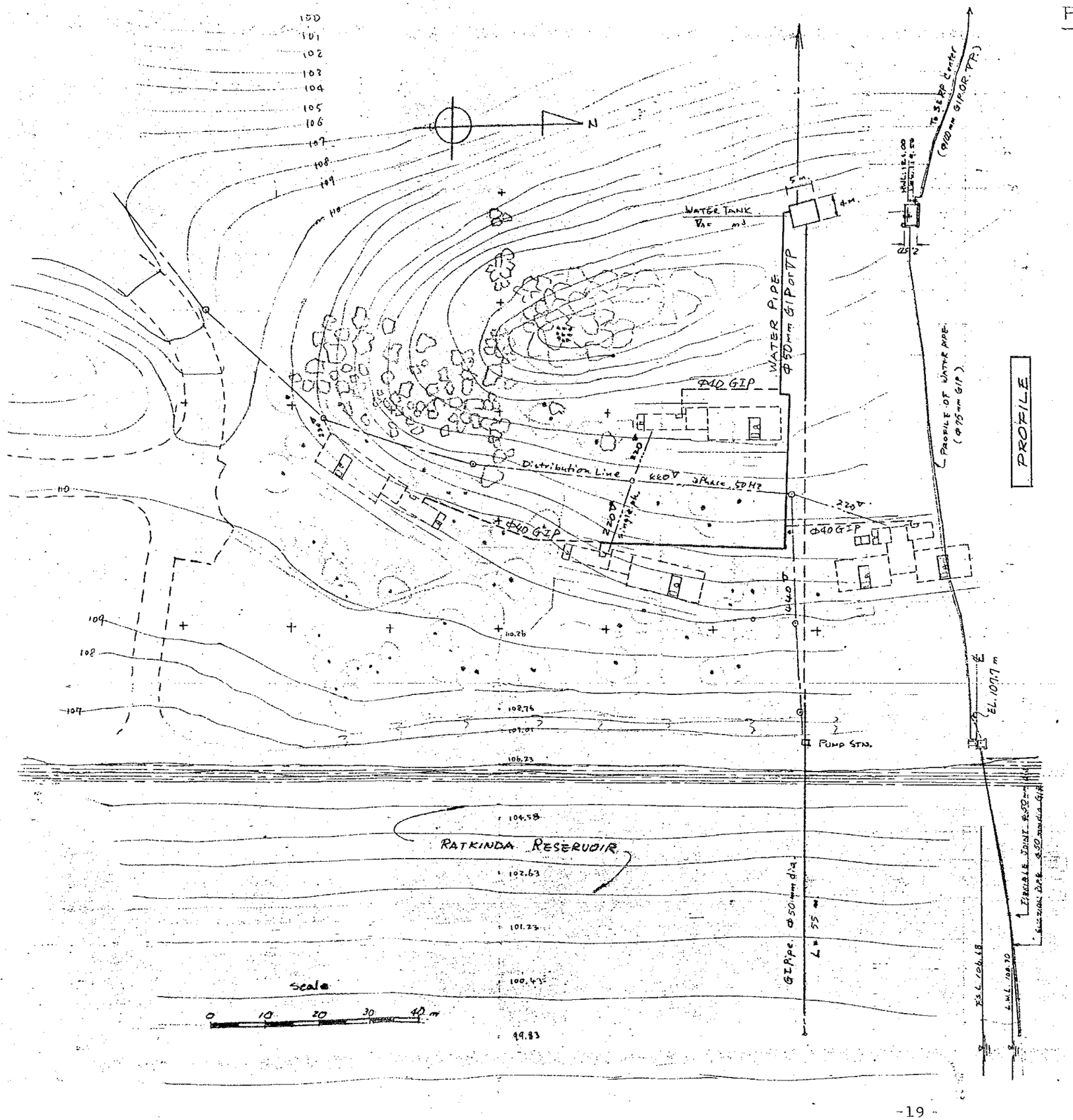


REVICED LAYOUT FOR ELECTRICITY IS ATTACHED IN APPENDIX

POWER DISTRIBUTION LINE AND WATER PIPELINE (2)

FIG. 2-6(B)

FIG. 2-6(c)



POWER DISTRIBUTION LINE AND WATER PIPELINE (3)

CHAPTER III PRELIMINARY DESIGN

3.1 General

This chapter abstracts the tentative layout of the facilities which will be finalized in home office as a detaile design.

3.2 Rice Processing Plant.

3.2.1 Cropping Pattern for Seed Farm

Development of an organized production scheme for rice seed has been the focal point of Government of Sri Lanka it it's agricultural development programme. The present rate of renewal of the certified seed of improved varieties of paddy in use is insufficiently about 10% in entire Sri Lanka. This level is too low for a systematic seed production, therefore in System 'C', MEA has planned to establish a Government Seed Farm for 22000 ha. of newly developed land. The paddy area of the seed farm is 194 ha, and the cropping pattern, cropping programme and varieties are as follows;

Cropping Pattern
(refer to Fig. 3-1)

Cropping Programme:

Age Group (months)	Season	
	Maha	Yala
4-4½	10%	60%
3½	30%	30%
3	60%	10%

Varieties:

Age group (months)	Variety
4-4½	Bg 11-11
	Bg 400-1
3½	Bg 94-1
3	Bg 34-8
	Bg 276-5

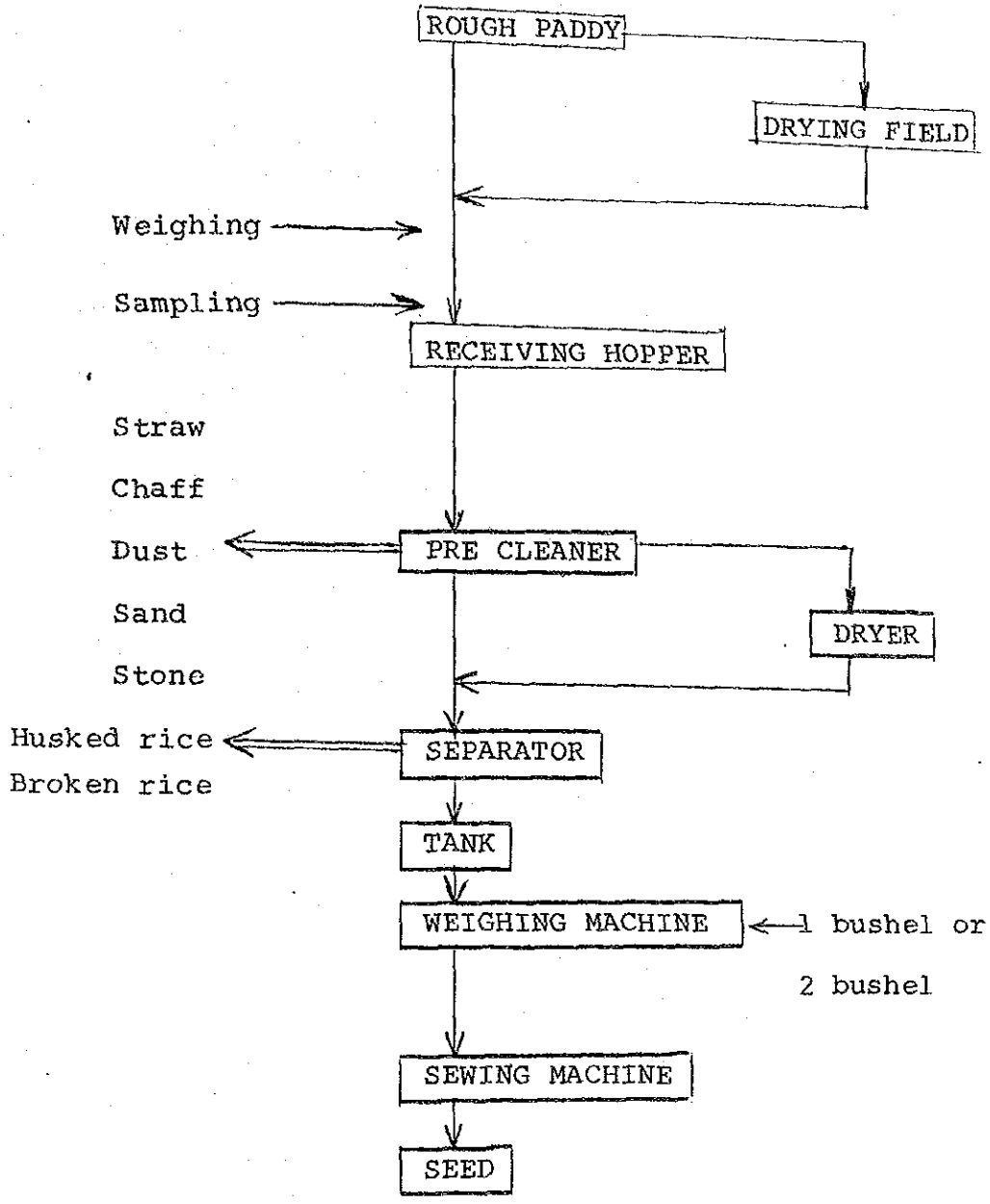
MEA will provide this certified seed for each farmers every 4 seasons. Therefore the expectant rate of renewal of the certified seed is 25% and this is the target for the renewal rate in entire Sri Lanka.

3.2.2 Seed Processing Plant

In this plan, the high quality seed harvested in the seed farm is to be distributed to the farmers for their sowing in subsequent crop season. Accordingly it is necessary to clean the paddy within 45 days as is judged from the fig. 3-1. The capacity of this Seed Processing Plant is as follows;

Seed Requirement Area in System 'C'	22000 ha.
Cropping Intensity	175%
Seed Requirement	5 bushel/ha
Renewal Pattern	25%
Seed Requirement per year	1000t
per season	500t
Available Seed Processing Days per Season	45 days
Max. Cleaning Quantity per Day	12t
Capacity of Seed Processing Plant	1t/hr. (at 14% W.E. paddy)
Operating Hours	12 hrs. (2 shift at peak tim

The flow-chart for Seed Processing Plant is as follows;



Notes: Traditional threshing method (using cow or tractor) is not recommended for the seed and proposed plant. Since this method not only causes to damage to seed, but also produces heavy impure paddy. The application of the Power thresher or Manual Thresher is recommended.

3.2.3 Parboiling Plant

On the Demonstration Farm, one of the most important purpose is to demonstrate parboiling and milling plant for production of high-quality rice.

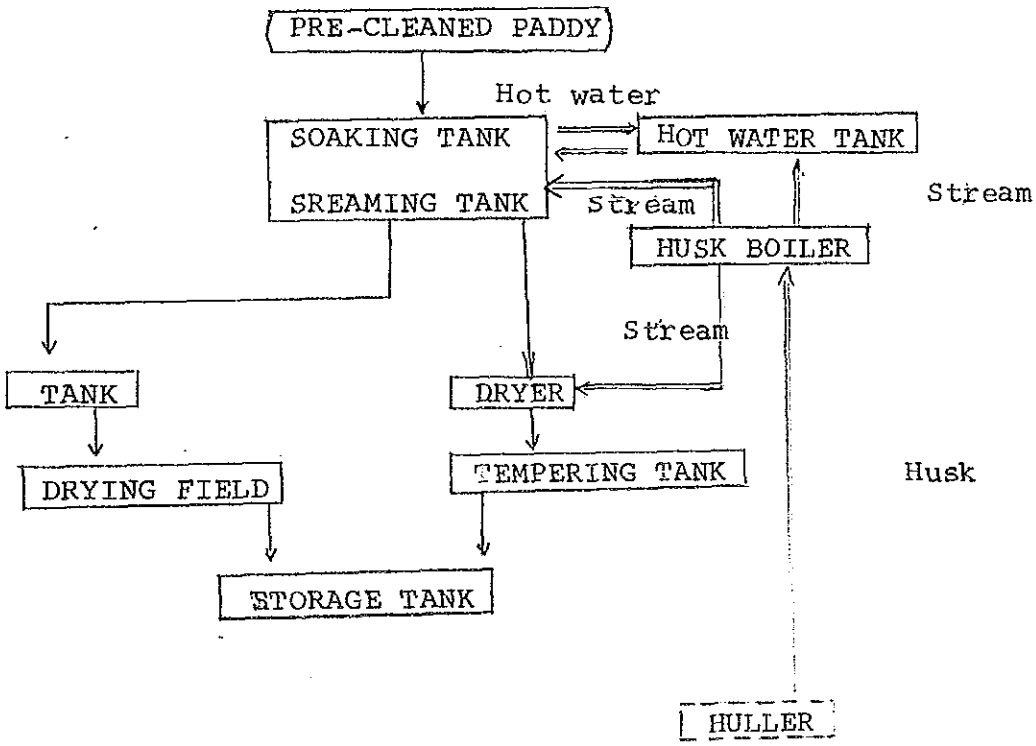
The method of parboiling are Traditional Process, C.F.T.R.I. Process, Avorio Process, Converted Rice Process, Malek Process, Fernandes Process etc. The most popular method is Traditional Process in Sri Lanka, but this method is disadvantageous to produce the high quality rice because of the strong smell by fermentation. C.F.T.R.I. method is mainly employed by PMB which produces comparatively high quality parboiling rice. The proposed plant will be designed based on the further study in home office with due consideration of operation and maintenance experiences in Sri Lanka, etc.

Paddy for Parboiling in the proposed plant uses the surplus paddy from seed farm. The capacity of the Parboiling Plant is as follows:

Paddy Yield in Seed Farm	100 bushel/acre
Paddy Area for Seed Farm	194 ha
Paddy Yield	997 t
Seed Requirement in System 'C'	500.5t
Surplus of Paddy	496.5t
Available Parboiling Days per season	100 days
Design Processing Capacity	5t/day
Capacity of Parboiling Plant	2.5t/batch-2 units

Operating Hours	Soaking	4.5 h
	Steaming	0.5 h
	Drying (1st)	5h
	Tempering	8h
	Drying (2nd)	4h
	Loading , Unloading	2h
		24h
	(3 shift)	

The flow-chart for Parboiling Plant is as follows:



Notes: Concerning the runing cost, Husk Boiler is recommended for heat supply.

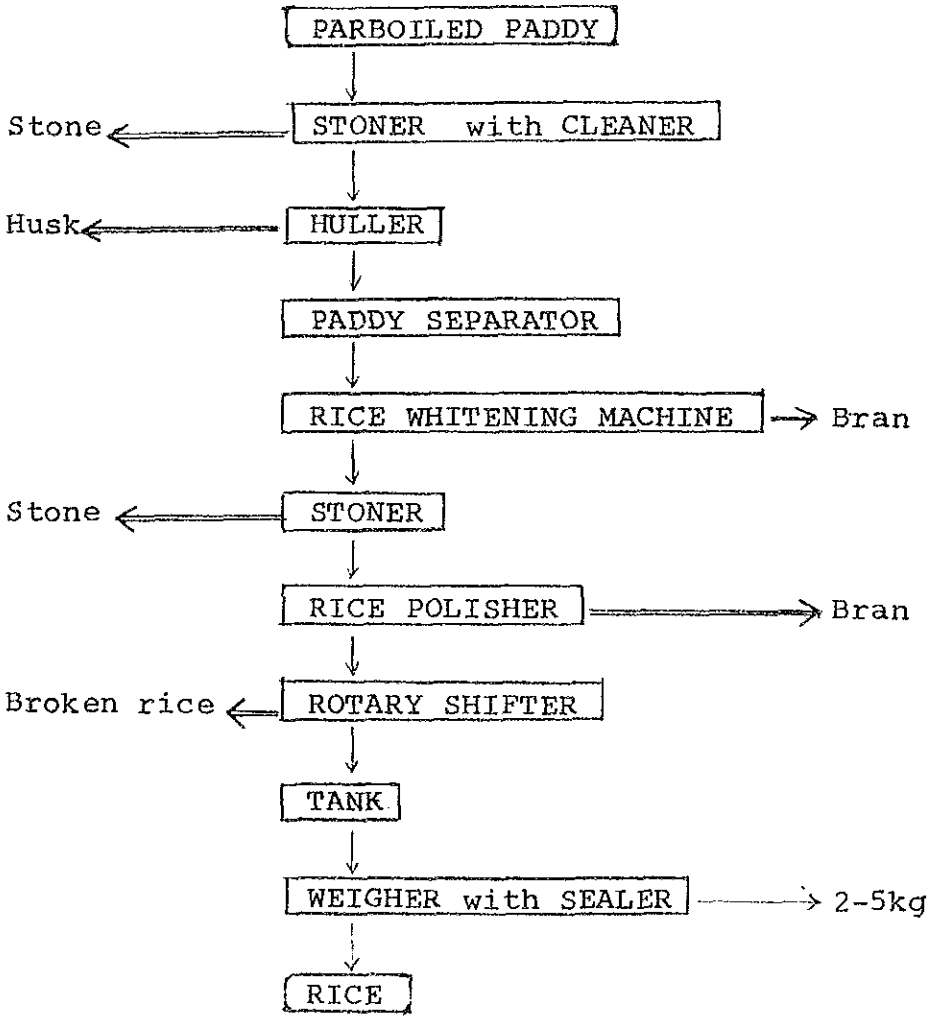
3.2.4 Rice Milling Plant

For the purpose of production of high-quality rice, Rice Milling Plant need rubber roll huller, some variety of separator including de-stoner and rice whitening machine that can be used for Parboiled Paddy.

The capacity for Rice Milling Plant is as follows:

Milling quantity per Day	5t/day
Capacity of Milling Plant	1t/h
Operating Hours	5h

And the flow-chart of Rice Milling Plant is as follows:



3.2.5 Plant Layout

A tentative lay out is illustrated in Fig.3-2

notes: Requirement area of drying field is estimated at as follows

Existing Drying Feild Area	432 m^2
Initial Moisture of Paddy	22%
Drying Quantity of paddy per Day	12t(at 14% w.b.)
Bulk Density (paddy)	580 Kg/m^3
Drying Quantity Parboiled paddy per day	5t(at 14% w.b.)
Bulk Density (parboiled paddy)	600Kg/m^3
Recommended spread Height	2 cm
Necessity Area of Drying Field for paddy	1138m^2
for parboiled paddy	550m^2
Total Requirement of Drying Area	1688m^2
Short-age of Drying Area	1256m^2
	(48m x 26m)

3.3 Plant Building

Based on the aforementioned plant layout, the tentative dimension and basic design has been illustrated as Fig.3-3 (A) & (B).

3.4 Other Buildings

3.4.1 Workshop

After reviewing the necessary working spaces the accommodate all the workshop equipment and machinery, the dimension of 6 meter wide and 36 meter long space has been obtained as Fig.3-4.

3.4.2 Tractor Shed

The dimension of 12 meter wide and 36 meter long space has been employed as Fig.3-5, based on the study of the number and space for each tractor, tractor equipment etc.

3.4.3 On-Farm shed

Based on the discussion with concerned personnels of the existing farm, 5 meter wide and 10 meter long space has been hired as Fig. 3-6.

3.5 Demonstration/Experimental Farm

3.5.1 Existing Condition

The present plan of the proposed demonstration/ Experimental farm is presented in Fig. 3-7.

3.5.2 Preliminary Design

Based on the field investigation, survey and discussion with concerned personnel, the terminal on-farm facilities

such as inspection path, farm ditch, field drain, fencing and minor improvement facilities have been recommended to construct for future demonstration, experiment and water management practices.

CROPPING PATTERN (FARMARS IN SYSTEM 'C' AND SEED FARM)

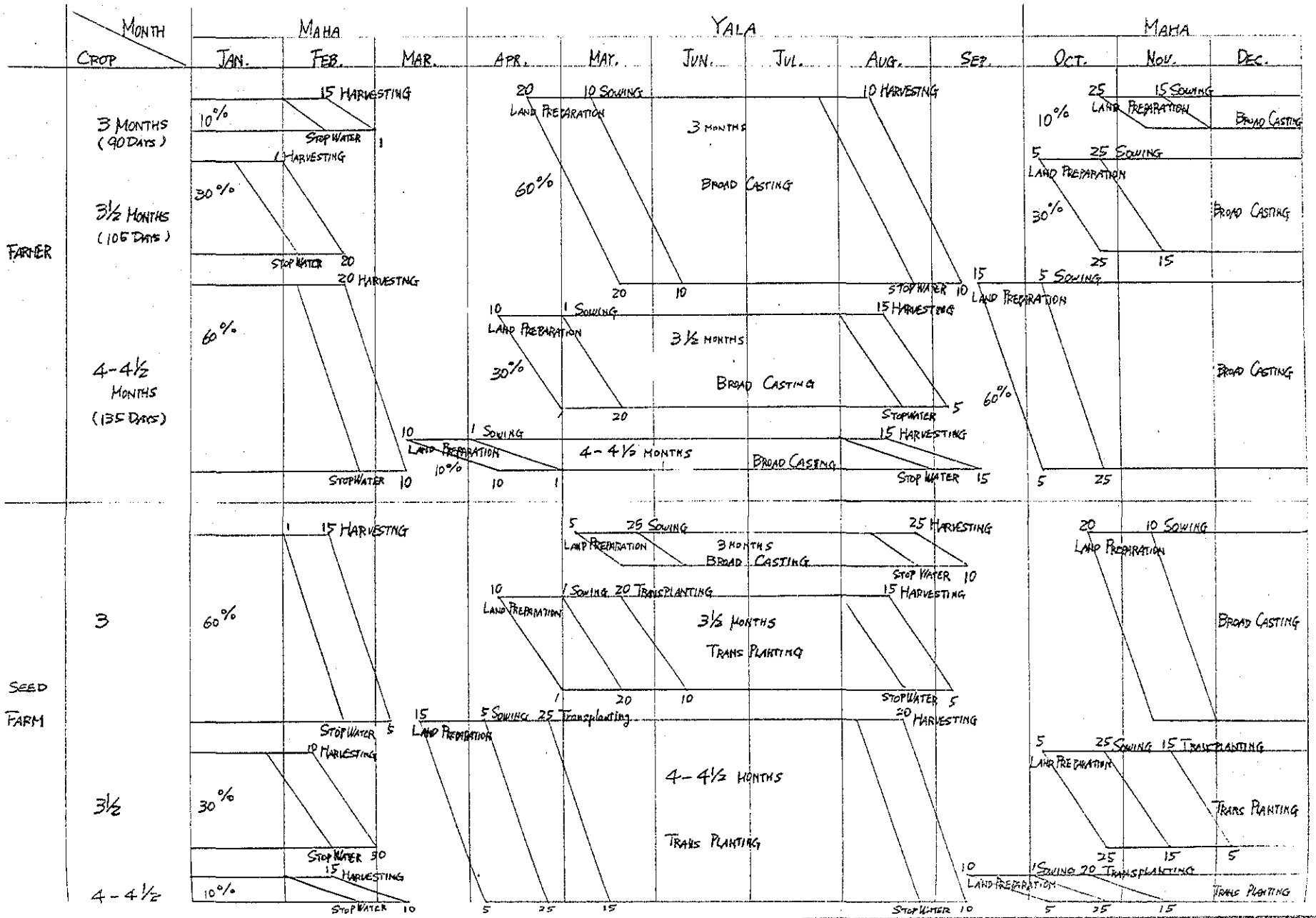
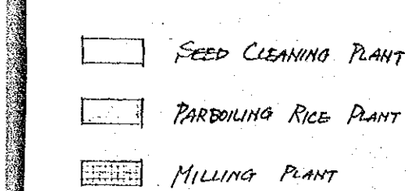
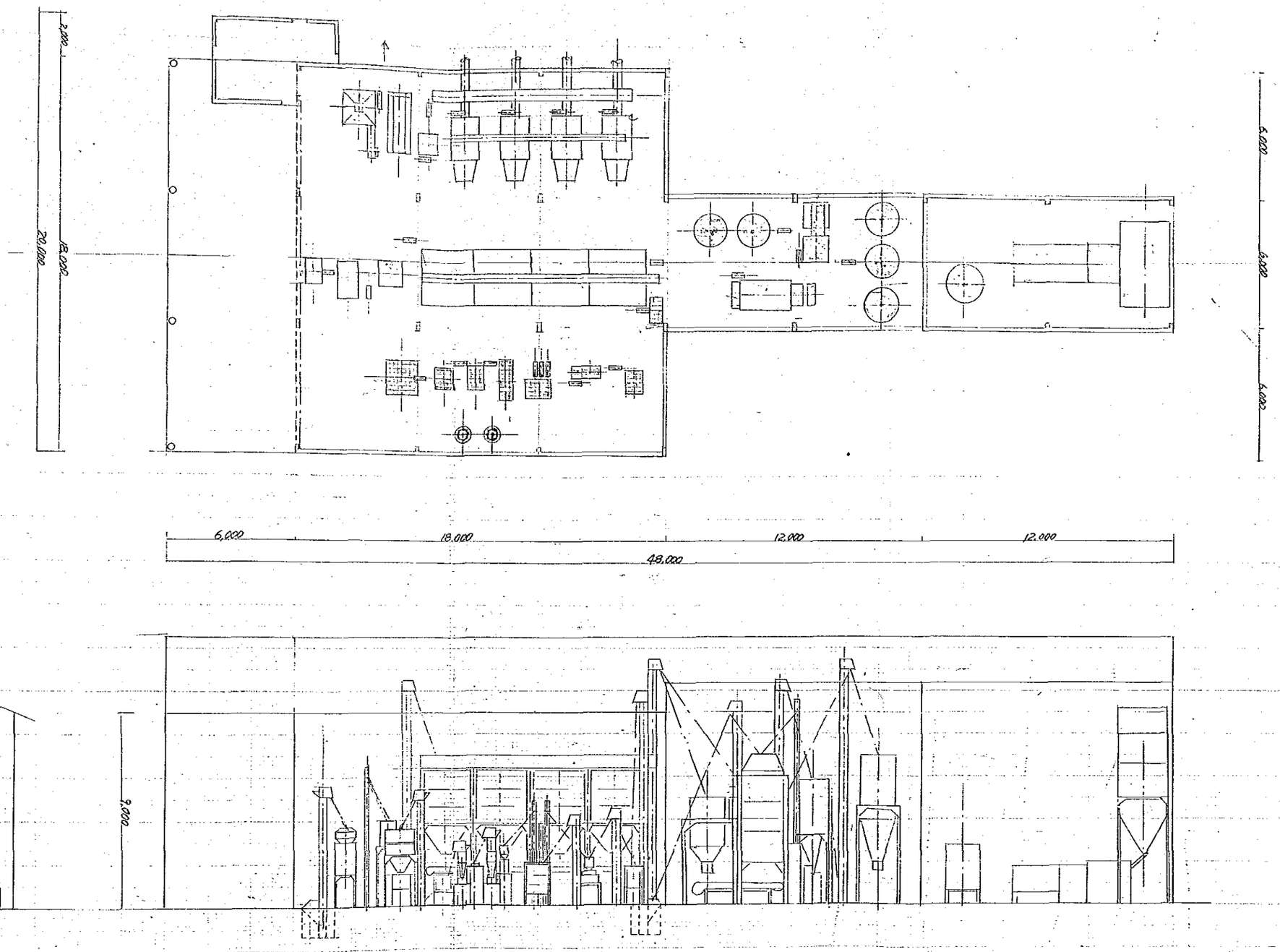


FIG. 3-1

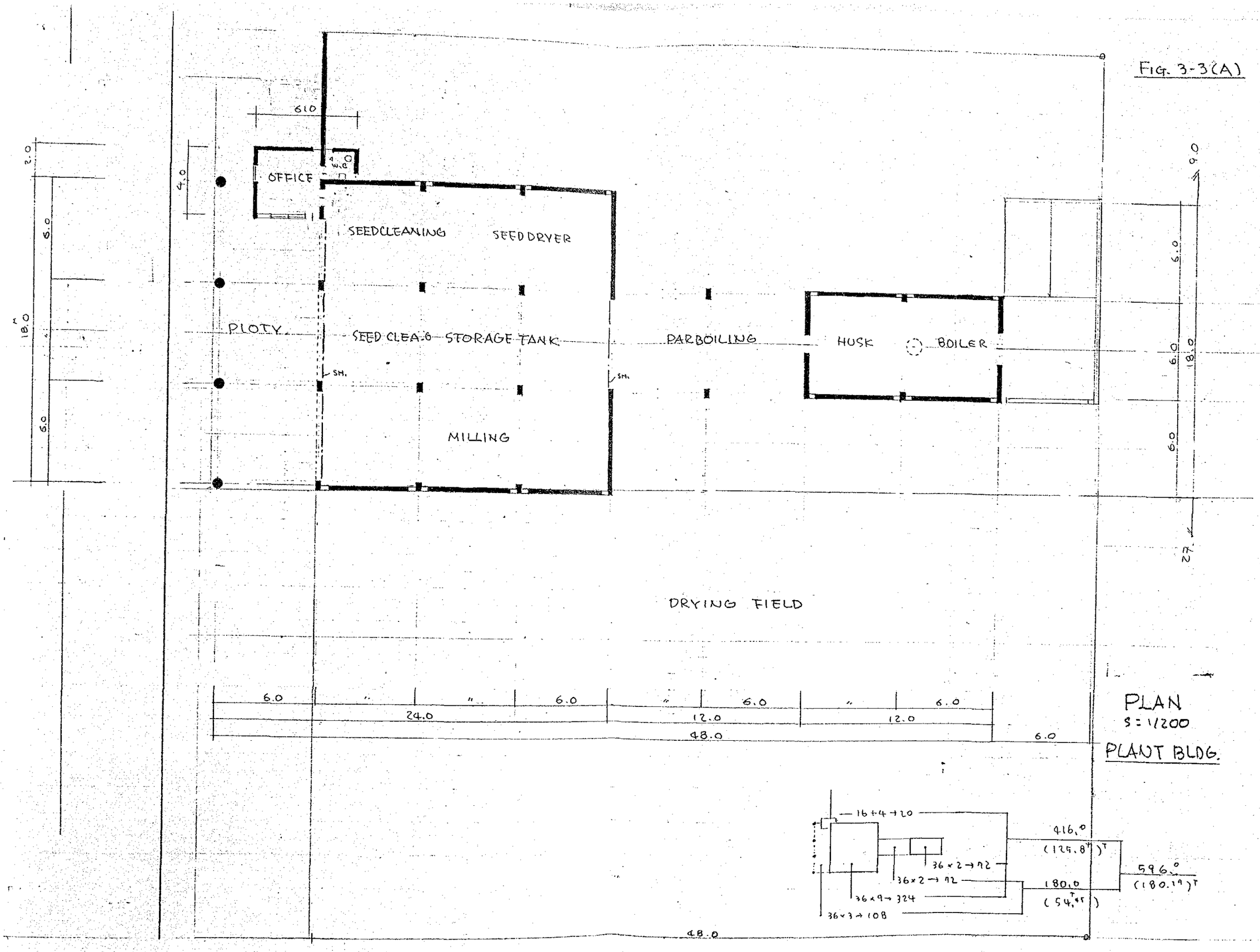
FIG. 3-2





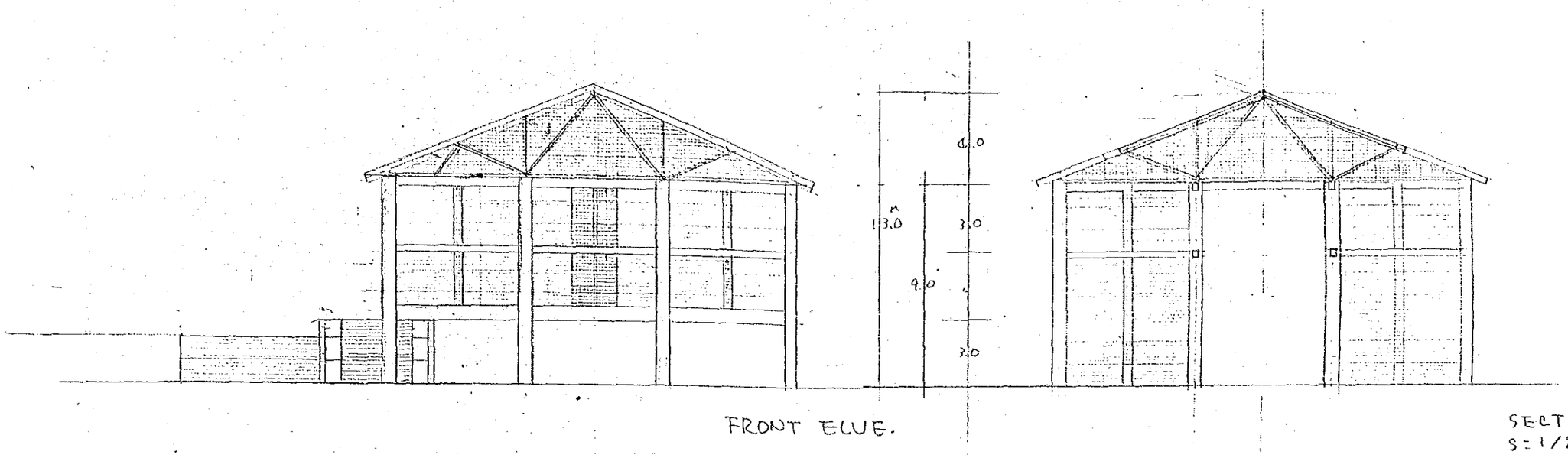
TENTATIVE PLANT LAYOUT

FIG. 3-3(A)



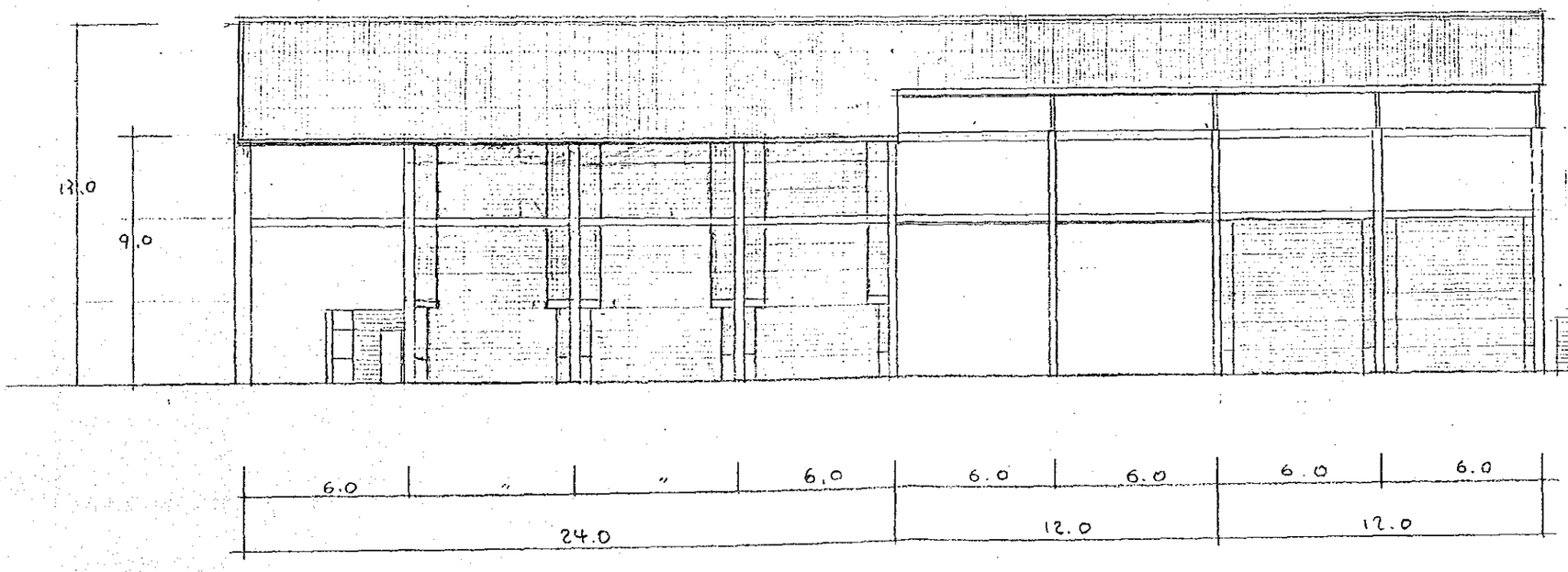
PLAN
S = 1/200
PLANT BLDG.

FIG. 3-3 (B)



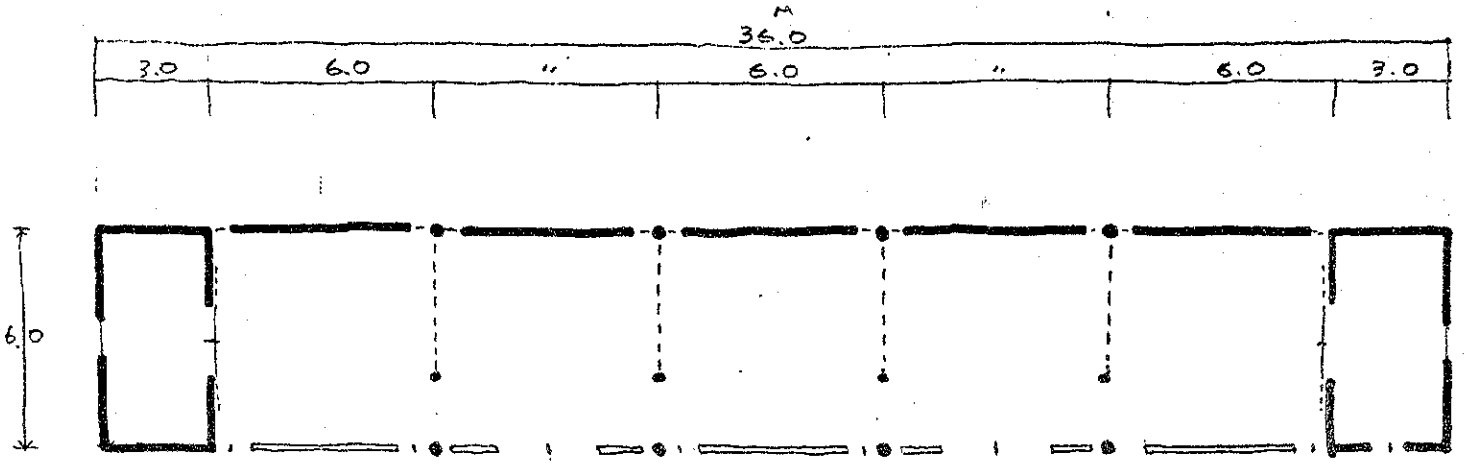
FRONT ELVE.

SECT.
S = 1/200

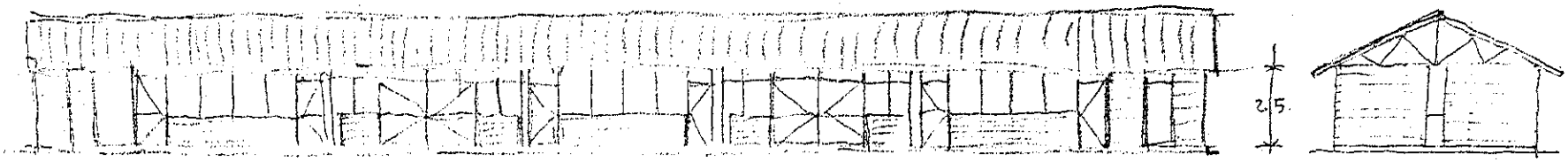


SECT.
S = 1/200

PLANT BLDG.



PLAN.



FRONT ELVE.

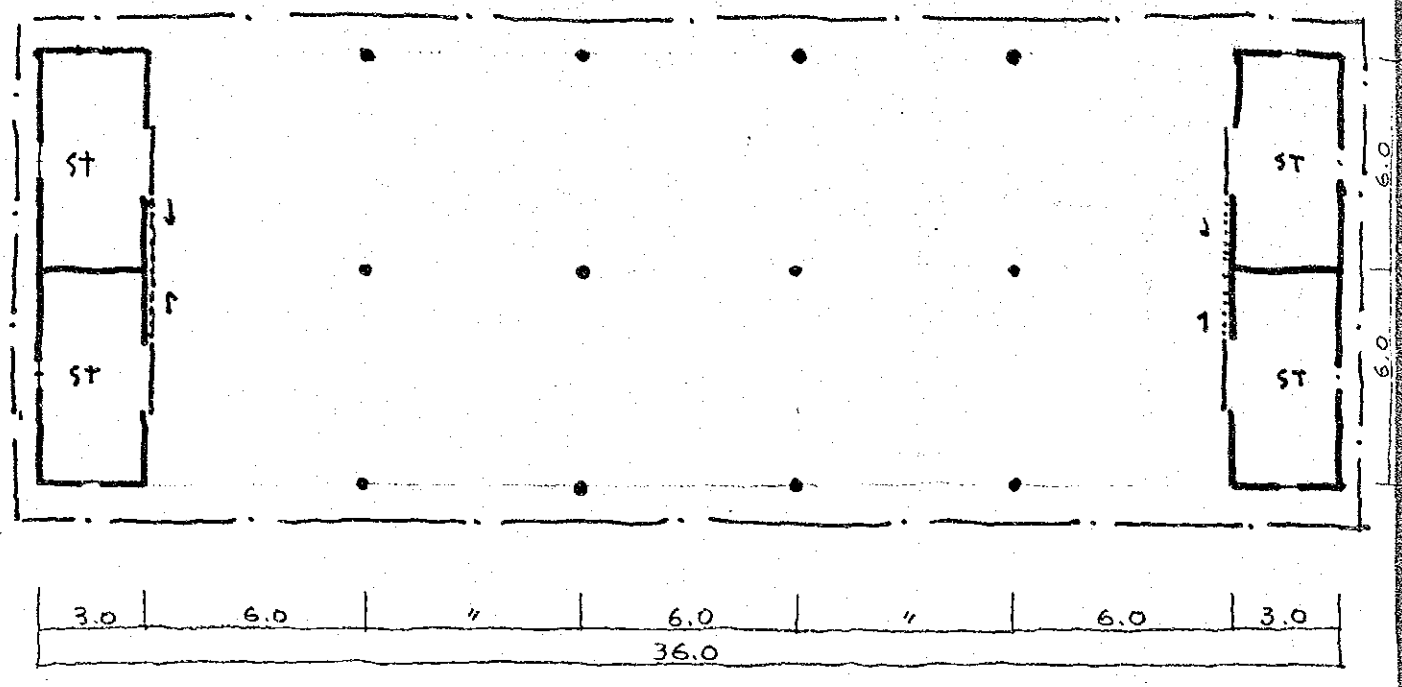
SIDE ELEV.

S : 1/200

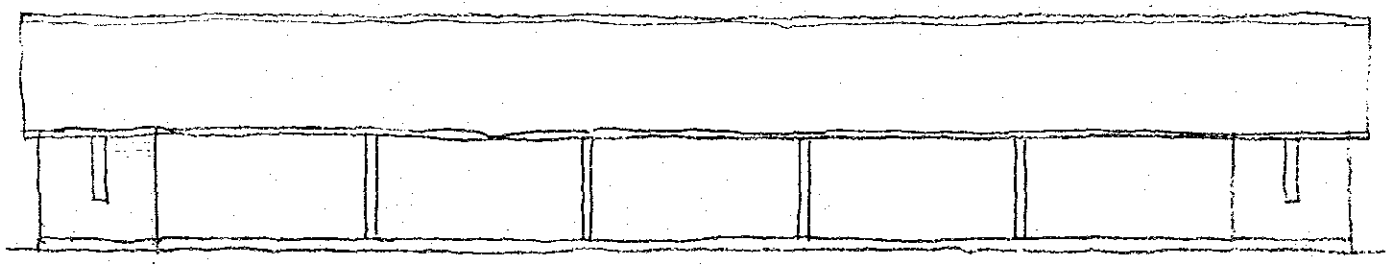
WORK SHOP

FIG. 3-4

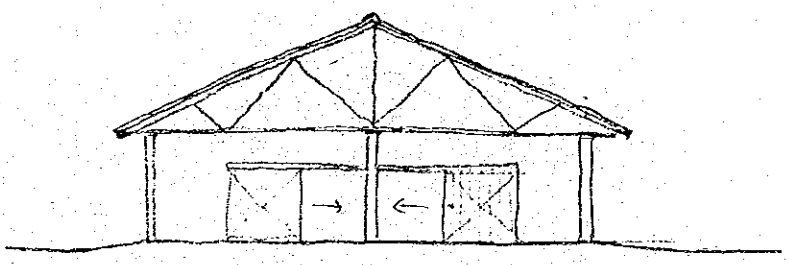
FIG. 3-5



PLAN
S = 1/200



ELEV.
S = 1/200



SECT.
S : 1/200

TRACTOR SHED

ON-FARM SHED

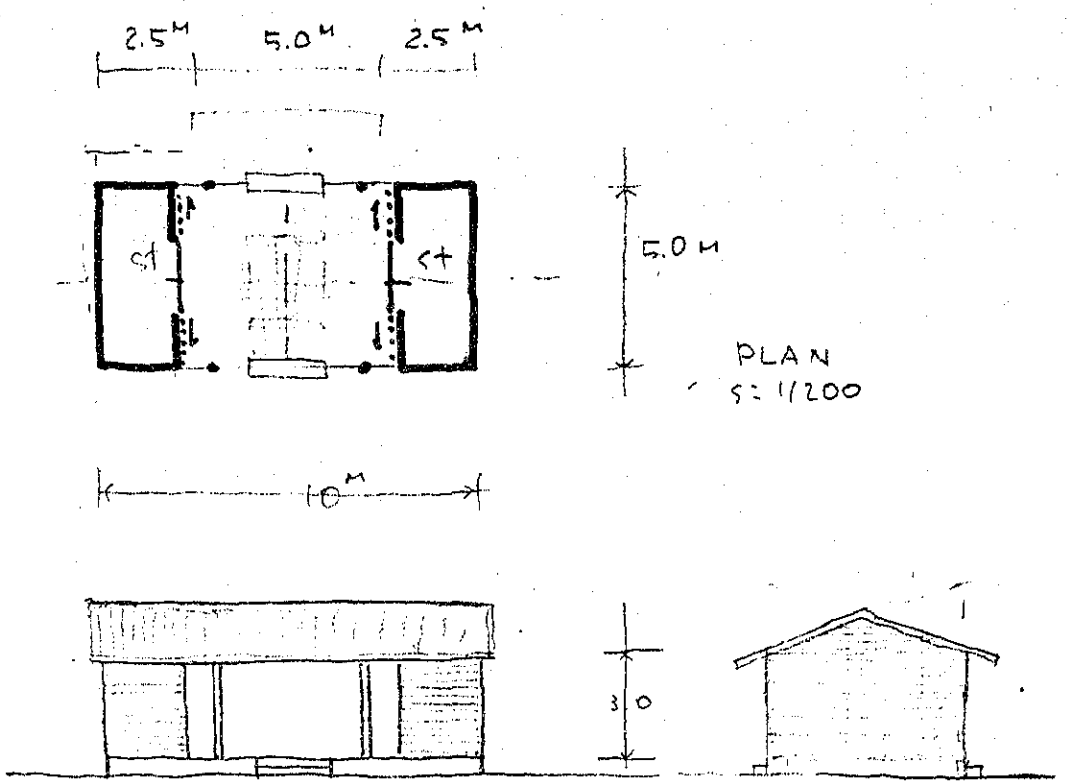


FIG. 3-6

FIG. 3-7

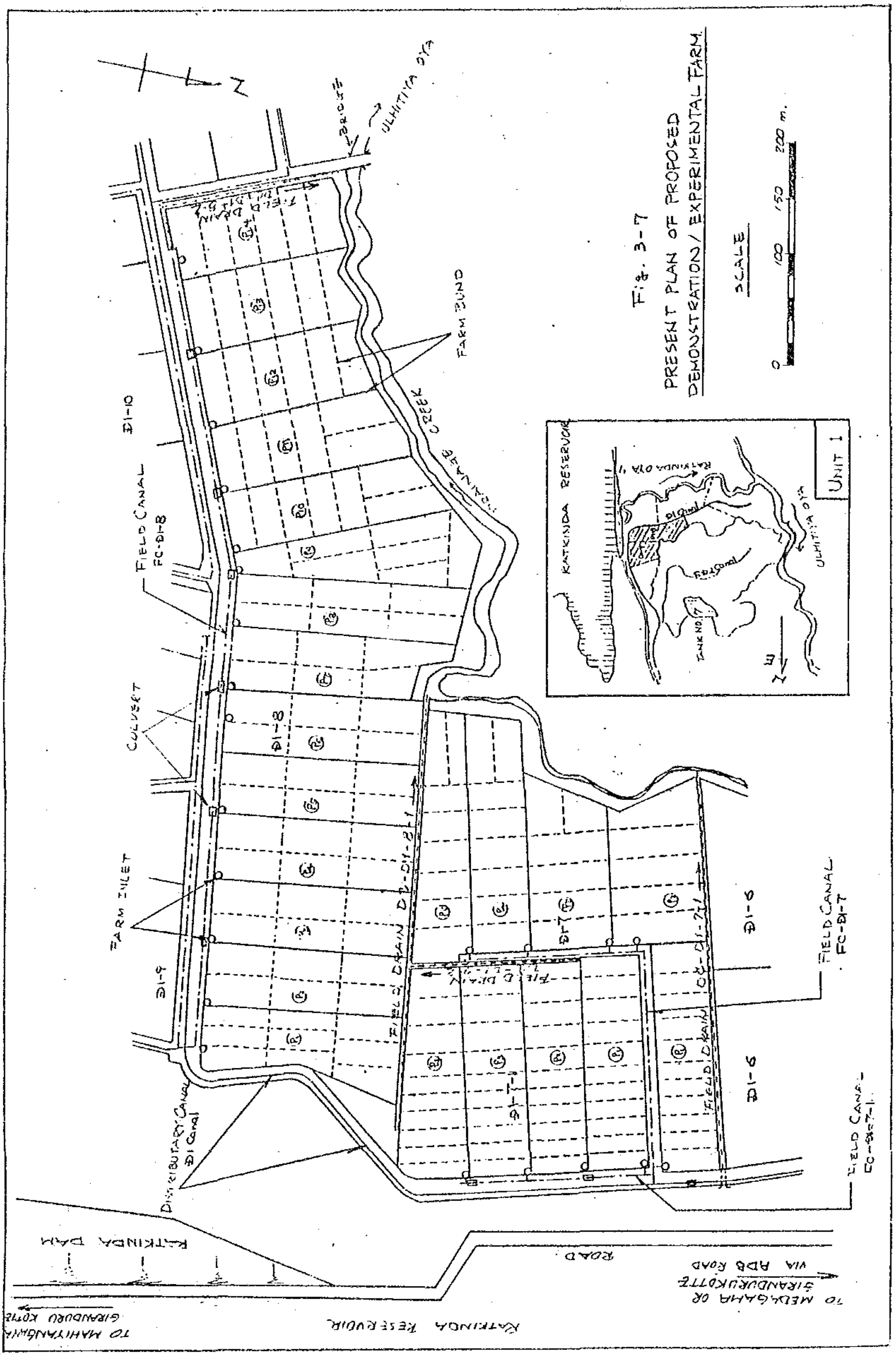


Fig. 3-7 PRESENT PLAN OF PROPOSED DEMONSTRATION/EXPERIMENTAL FARM

FIG. 3-B

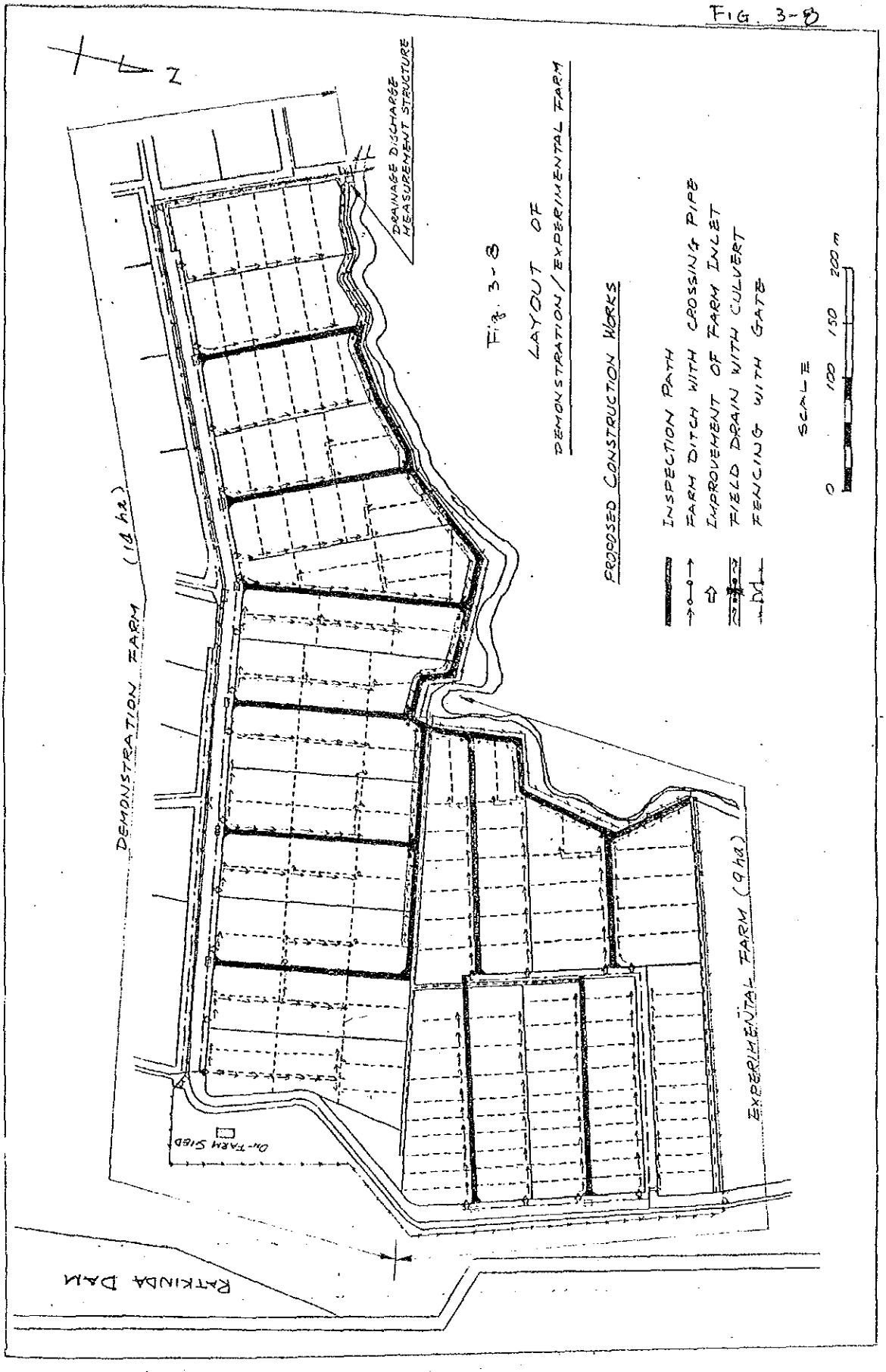


Fig. 3-3
LAYOUT OF
DEMONSTRATION/EXPERIMENTAL FARM

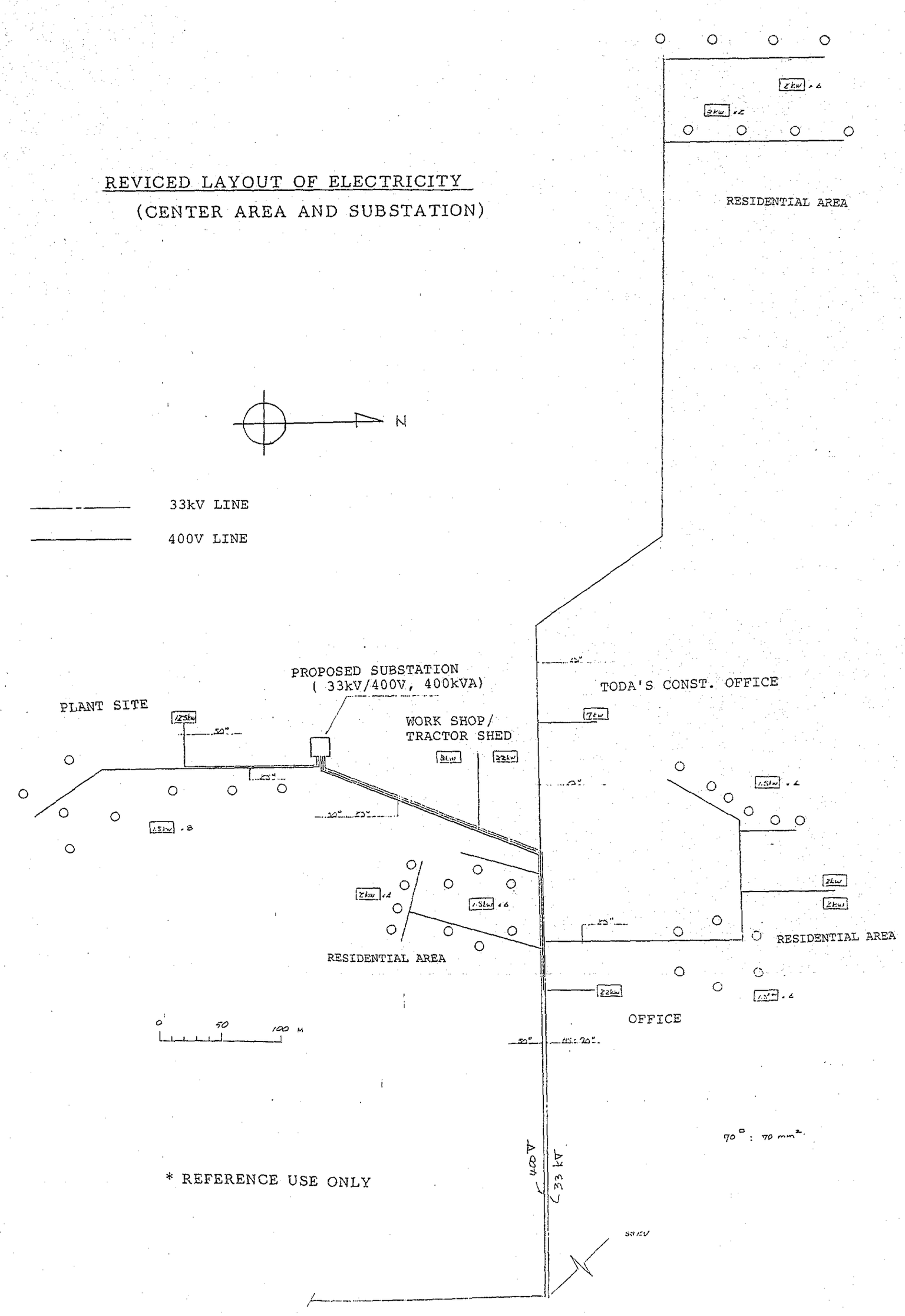
Ⅲ．修正電気系統設計助言

現地調査期間中、新設変電所(33KV/400V) については旧ラトキンダダム建設現場の250KVA変電所跡地利用を提案され、これによって設計助言を行った。しかし、帰国後の詳細検討により、新設変電所位置はプラント建屋周辺とすることが最も経済的であることが明らかになったため、これにもとづき修正系統図を次図のとおり作成した。

REVICED LAYOUT OF ELECTRICITY
(CENTER AREA AND SUBSTATION)

33kV LINE

400V LINE

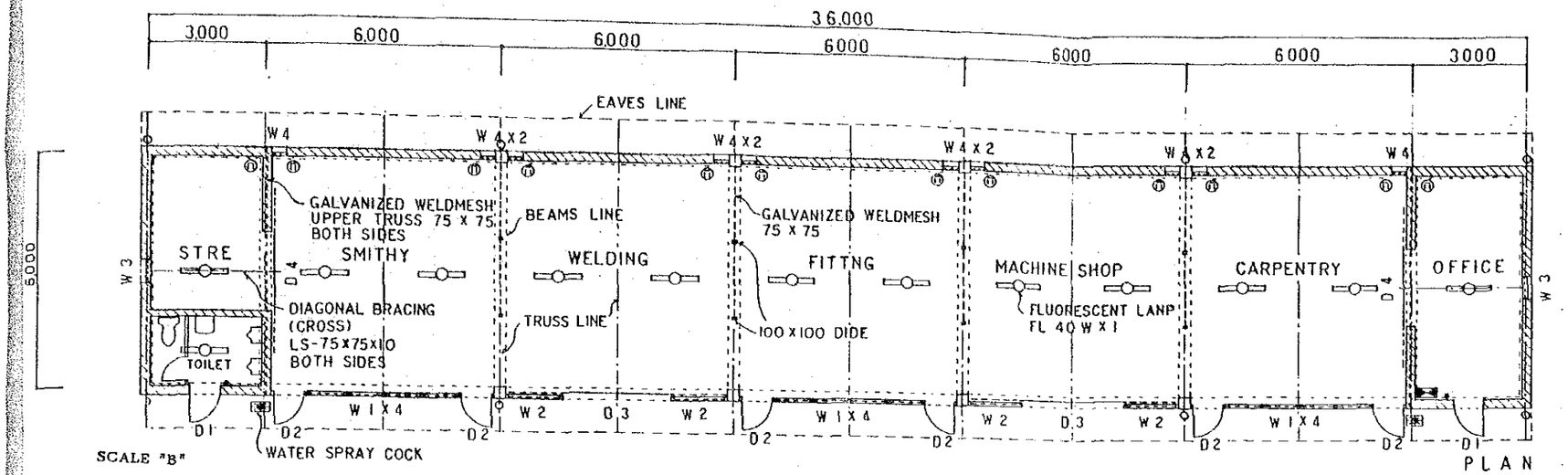


Ⅳ. 追加設計助言

追加設計助言としては下記のとおりである。

1. ワークショップ
2. トラクターシェッド
3. 農作業棟

これらはスリランカ側の資金により建設される。



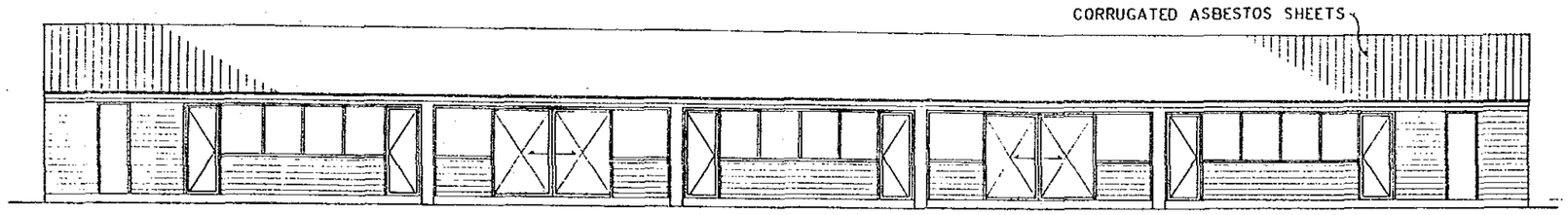
SCALE "B"

PLAN

SCHEDULE OF DOORS & WINDOWS

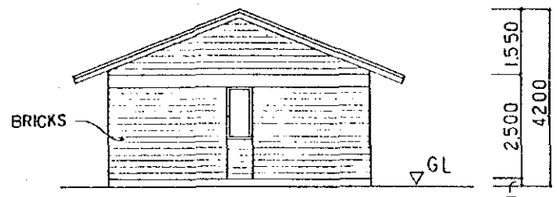
TIPE	SIZE	DESCRIPTION	NO.
D 1	800 x 2200	FLASH PANEL MARINE PLYWOOD	2
D 2	800 x 2200	GALVANIZED WELDMESH WITH WELDED BRRACING L-45-45	6
D 3	2800 x 2000	—DO— (SLIDING DOOR HANG OVER)	2
D 4	2000 x 2000	—DO— (—DO—)	2
W 1	1000 x 1300	GALVANIZED WELDMESH WITH WELDED BRRACING L-45-45	12
W 2	1400 x 1300	—DO—	4
W 3	600 x 1300	GALVANIZED WELDMESH	2
W 4	400 x 1700	—DO—	10

※ GALVANIZED WELEDMESH / 50 X 50 3.15 ϕ

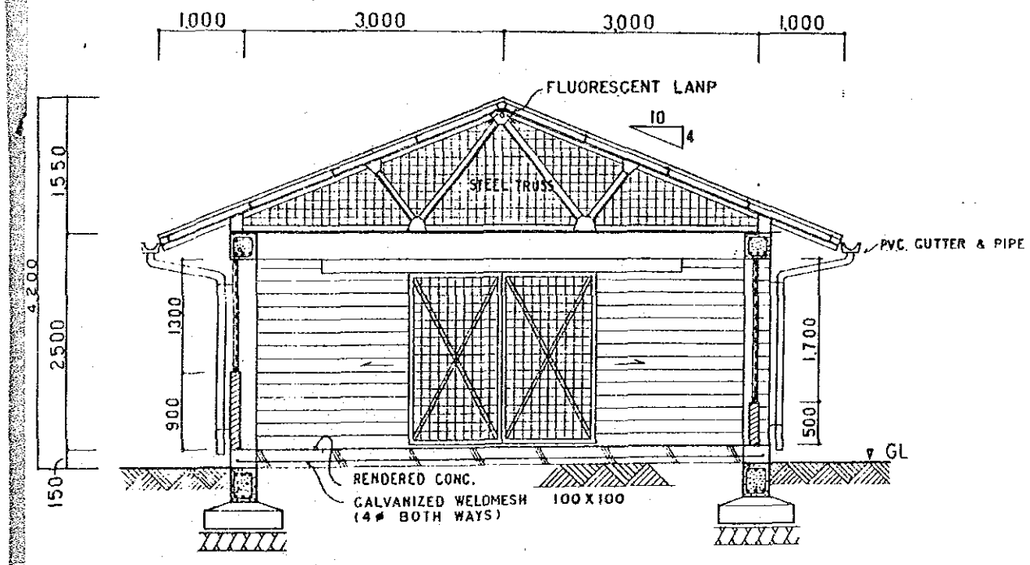


SCALE "B"

FRONT ELEV.



SIDE ELEV.



SCALE "A"

SECT.

MOTE: STRUCTURE SEE THE DETAL FOR TRACTOR SHED.
CONCRETE STRUCTURAL FRAMES (POST & BEAM) / PAINTED WHITE.
STEEL TRUSS / PAINTED (VERMILION)
BRICK WALL (FACE BRICK) / TWO COATS OF COLORED WASH IN LIME. QUARITY & STRENGTH FOR STRUCTURAL USE.

INDEX:

SYMBOL	ITEM
	POWWER PANELBOARD
	FLUORESCENT LAMP
	WALL MOUNT RECEPTACLE
	TUMBLER SWITCH
	WATER SPRAY COCK

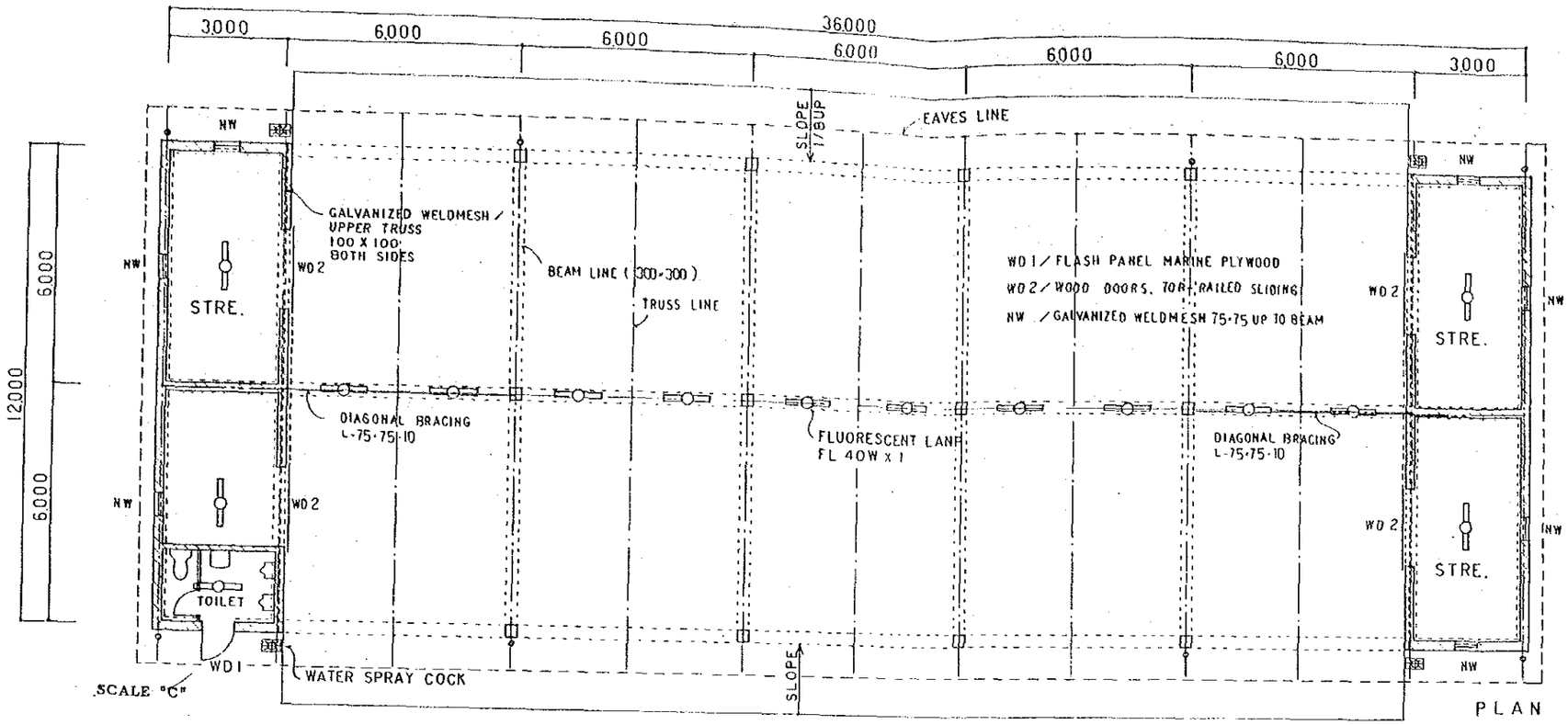
0 1 5 M
S:1/50 SCALE "A"

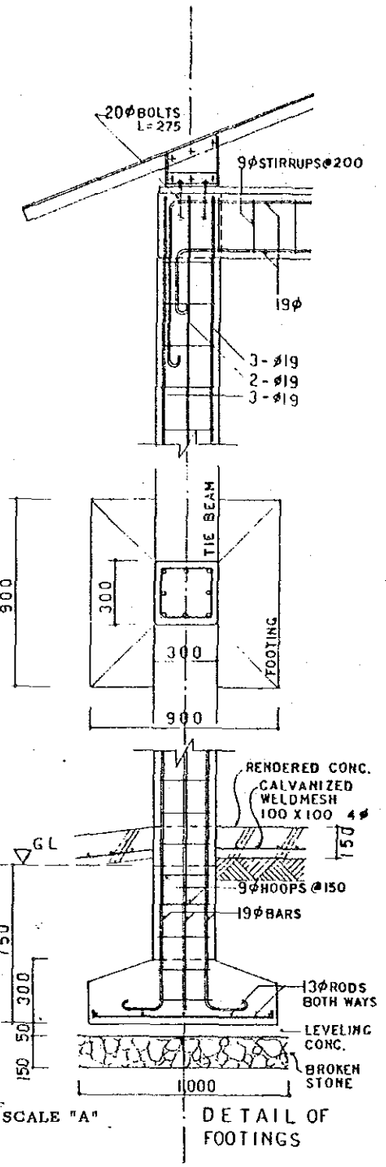
0 1 5 10 M
S:1/100 SCALE "B"

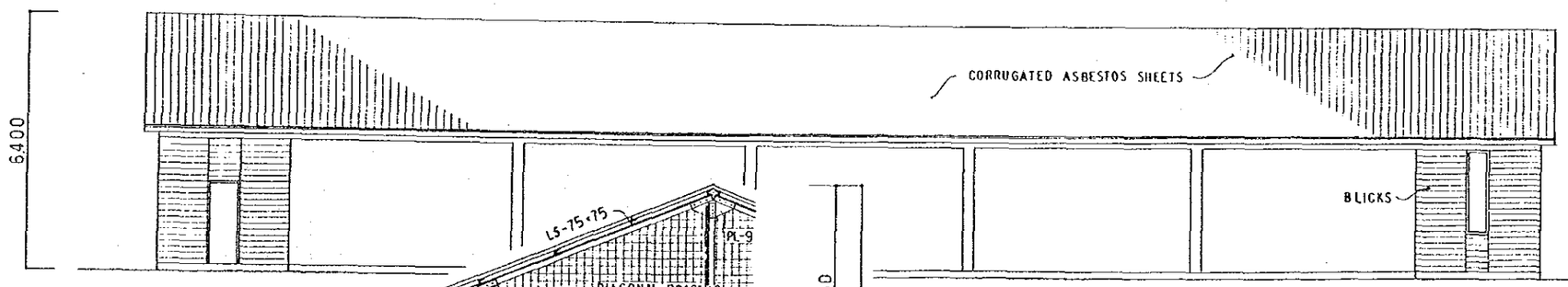
MAHAWELI AUTHORITY OF SRI LANKA
INTEGRATED AGRICULTURE DEVELOPMENT DEMONSTRATION PROJECT IN MAHAWELI AREA

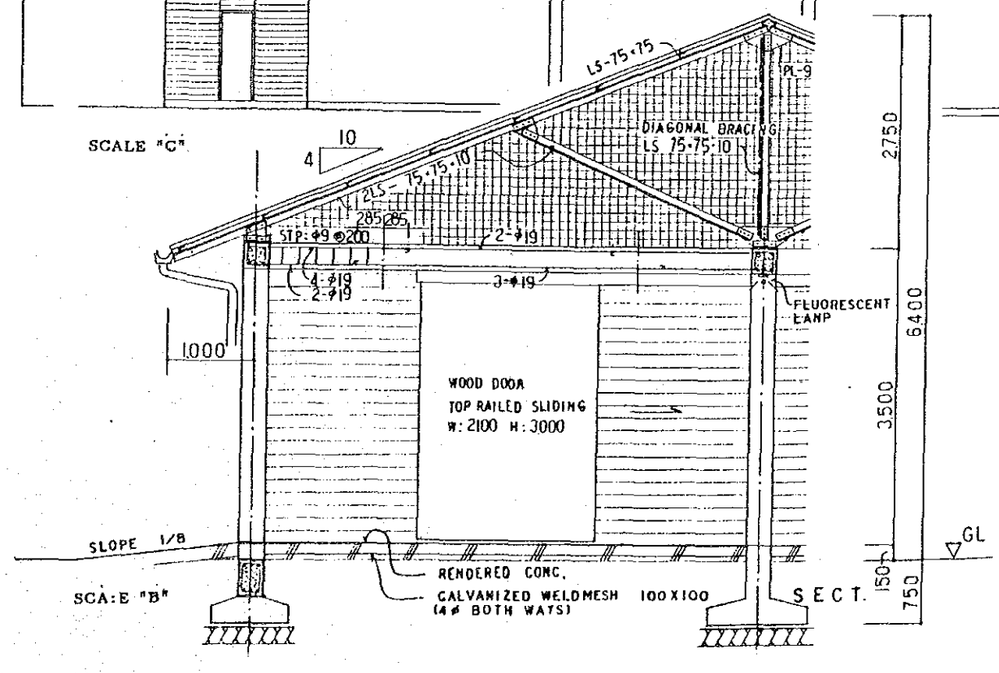
WORKSHOP

JAPAN INTERNATIONAL COOPERATION AGENCY
TOKYO, JAPAN DWG No. 0-1

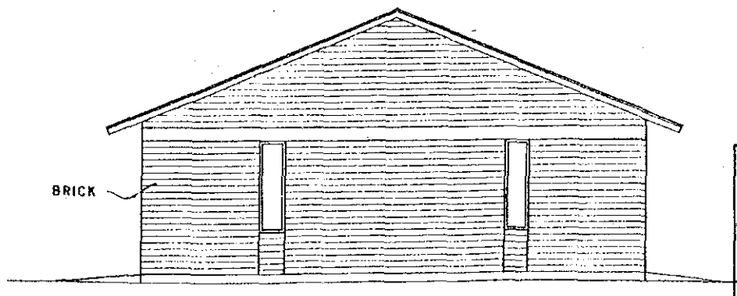








NOTE : CONCRETE STRUCTURAL FRAMES (POST & BEAM) / PAINTED(WHITE)
STEEL TRUSS / PAINTED (VERMILION)
BRICK WALLS / FACE BRICK. TWO COATS OF COLORED WASH IN LINE
/ QUALTY & STRENGTH FOR STRUCTURAL USE



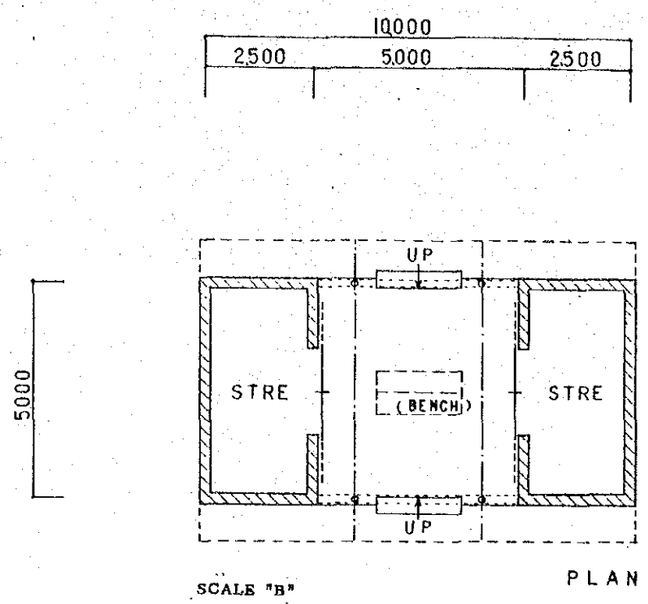
0 1 5
S:1/50 SCALE "B" M

0 5 10
S:1/100 SCALE "C" M

MAHAWELI AUTHORITY OF SRI LANKA
INTEGRATED AGRICULTURE DEVELOPMENT DEMONSTRATION PROJECT IN MAHAWELI AREA

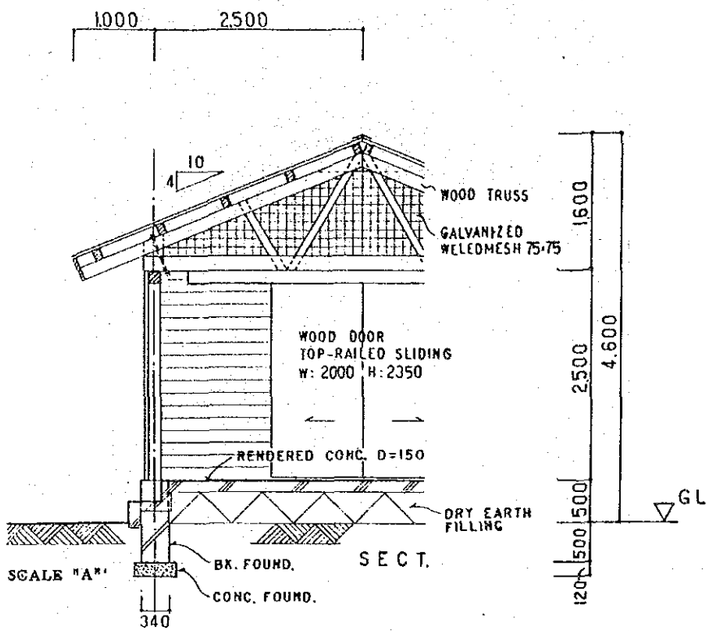
TRACTOR SHED

JAPAN INTERNATIONAL COOPERATION AGENCY
TOKYO, JAPAN DWG No. O-2



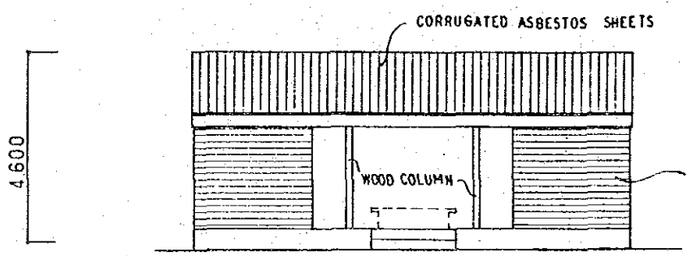
SCALE "B"

PLAN



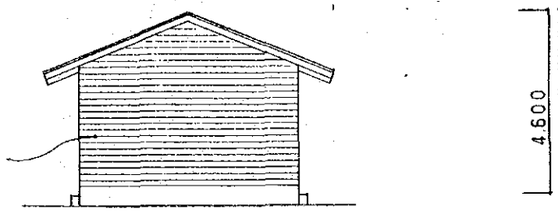
SCALE "A"

SECT.



SCALE "B"

FRONT ELEV.



SIDE ELEV.

0 1 5
S:1/50 SCALE "A" M

0 1 5 10
S:1/100 SCALE "B" M

MAHAWELI AUTHORITY OF SRI LANKA INTEGRATED AGRICULTURE DEVELOPMENT DEMONSTRATION PROJECT IN MAHAWELI AREA
ON FARM SHED
JAPAN INTERNATIONAL COOPERATION AGENCY
TOKYO, JAPAN DWG No. O-3