

If the Contractor fails to commence the Works by the above commencement date, or should in the course of the construction any event occur which may reasonably cause the JICA to believe that the Contractor will not be able to complete the Works on the completion date, or should the Contractor fail to complete the Works by the completion date, or should the Contractor fail to meet any of the Contract requirement, the JICA shall have the right to terminate this Contract by giving written notice to the Contractor.

However, in case that the Contractor fails to complete the Works by the completion date, or to meet any of the Contract requirement, if the Inspection Committee thinks that the Contractor has the ability for completion of the Works within reasonably extended period, the Contractor may be permitted by the JICA to continue the Works beyond the completion date but within the extended time.

#### Article 5      Penalty

In case that the Contractor is in default as mentioned in Article 4, the Contractor agrees to be responsible to the JICA as follows :-

5.1 In case of the termination by the default of commencement for the Works, the Contractor shall pay a penalty of \_\_\_\_\_ Baht ( \_\_\_\_\_ Baht) per day counting from the commencement date until the new Contract is completely executed with a new Contractor for this Works, the period of which is included the time spent for finding the new Contractor and executing the new Contract etc.

5.2 In case the JICA thinks that the Contractor will not be able to complete the Works within the completion time and thereby terminates this Contract, the Contractor shall pay a penalty of \_\_\_\_\_ Baht ( \_\_\_\_\_ Baht) per day counting the number of days in the same manner as prescribed in 5.1 above. However, the JICA may reduce such number of days according to the ratio between the completed Works and the total Works as may be decided by the Inspection committee.

5.3 In case the Contractor fails to complete the Works by the completion date or to meet any Contract requirement, the Contractor shall pay a penalty of \_\_\_\_\_ Baht ( \_\_\_\_\_ Baht) per day counting from the date following the completion date until the Works satisfactorily completed and accepted by the Inspection Committee.

Article 6      Compensation

If the JICA sustains any losses as direct or indirect damages caused by the Contractor's failure, the Contractor shall compensate the JICA for such losses. The parties agree that time is essential for the completion of the Works.

Article 7      The JICA's right for default

The JICA has the sole and absolute right to decide whether to terminate the Contract, to impose only the penalty on the Contractor or to claim the compensation for the damage as stated in Article 5 or Article 6. The money due to the JICA exercising its right under this article shall be retained and deducted from any money due to the Contractor but yet unpaid, including from the performance bond. If the total amount of the loss is larger than the money above-mentioned, the Contractor agrees that the JICA has the right to retain the construction equipment, materials and supplies etc. and demand payment of the balance from such equipment etc. or proceeds of sale thereof.

Article 8      Contractor's responsibility on termination of this Contract

After the contract has been terminated in accordance with the foregoing Article 4, the JICA shall have the right to employ another Contractor (hereinafter referred to as "New Contractor") to carry on the remaining parts of the Works, and the payment for the Contractor that fail to complete the work shall be made out of the necessary Contract price for the remaining Works. Should the remaining amount after payment of the advance and interim payment from the Contract price, be insufficient to effect payment to the new Contractor, the difference between such remaining amount and actual cost estimated by the JICA for the satisfactory completion Works carried out by the new Contractor, shall be deemed as direct loss sustained by the JICA, and the Contractor shall pay such difference to the JICA within ten (10) days from the date of request by the JICA, failing which interest at the rate of eighteen (18) percent per annum shall be charged thereon.

Article 9      Inspection Committee

The Inspection committee, authorized to act on behalf of the JICA will be appointed by the JICA and the Inspection Committee is entitled to do all things that the JICA may do so. The Inspection Committee shall control and supervise the Works all the times whether it is in the preparation or implementation of the Works and the Contractor shall promptly furnish all necessary facilities for proper inspections of the Works in accordance with the Inspection Committee's request. At any moment the Inspection Committee can request the Contractor to stop the Works, if necessary and the Contractor shall have no claim on the JICA for extension of the completion time due to such suspension of the Works under this Article.

The inspection will not be deemed as the acceptance of the Works, and the Contractor shall not be relieved from his responsibility to meet the Contract requirements by the fact that the Inspection Committee exercise their duties. Should it be found that the Works have not been satisfactorily performed in the faithful manner, the Contractor shall correct any part of the Works indicated by the Inspection Committee within the period specified by the Inspection Committee.

Article 10      Prohibition for the equipment removal

Should the Contractor fail to complete the Works during the completion time or the Inspection Committee thinks that the Contractor will not be able to satisfactorily complete the Works, any equipment and materials brought to the site for use on the Works shall not be removed without the prior approval of the Inspection Committee in writing.

Article 11      Rectification of the defective construction

For a further period of One (1) year after satisfactory completion and final acceptance of the Works by the JICA, whether completed by the Contractor or by the new Contractor in case of termination of Contract under Article 4, any damage to the Works which is caused by the Contractor's fault, either because of defective workmanship or the use of inferior materials or any other cause, shall be made good as necessary by the Contractor to the satisfaction of the JICA at no extra cost.

In case of the termination of the Contract, the JICA may decide which part of the Works should come under the Contractor's responsibility, and requests the Contractor to make good of the damaged Works. Should the Contractor fail to do so within period specified after receipt of written request to do so from the JICA, the JICA shall have the right to employ another Contractor to carry out such work and the Contractor agrees to bear all expenses incurred.

#### Article 12     Discrepancies among the Contract Documents

If, prior to or during the course of the Works, any discrepancies are found in the drawings and/or the Technical Specifications etc. attached to this Contract, the Contractor shall follow the ruling given by the Inspection Committee at no additional cost to the JICA.

#### Article 13     Construction Method and Temporary Works

The construction method including implementation schedule and plan of the temporary works such as installation of temporary facilities, offices, ware houses, construction road, electric wiring, etc. shall be submitted by the Contractor and approved by the Inspection Committee at least ten (10) days in advance of the commencement of the Works.

Should the cost of the above temporary works be estimated in the unit cost of each work items of Bill of Quantities in this Contract, the Contractor is not entitled to claim any amount of charges for the temporary works.

#### Article 14     Modification of Plant

If the Inspection Committee finds it necessary to make modification of construction design and/or materials and so forth during the course of construction, the JICA has the right to order the modification of the Works to the Contractor, and such order shall be made in writing from the Inspection Committee to the Contractor.

The JICA agrees to adjust upwards or downwards the necessary expense for such modification to the Contractor, which will be estimated by unit price in the Bill of Quantities of this Contract in case of modification of quantities of construction works. In the case of additional works which are not quoted by unit price in the Bill of Quantities of this Contract, the Inspection Committee will make estimation thereof and the JICA will pay to the Contractor for such additional works accordingly. But if the Contractor does not agree to such estimation, the Contractor is then entitled to negotiate with the JICA. Also the extension of the completion time due to the modification shall be given by the JICA who shall have the sole right to decide the number of days of such extension.

#### Article 15     Acceptance of the Works

When the entire Works have been completed, the Contractor shall submit the invoice in written form indicating the Work actually completed to the Inspection Committee. If there are compliance with drawings or Technical Specifications, the JICA shall accept the Works as the final acceptance of satisfactory completion Works within ten (10) days after the receipt of the written form and it shall be deemed that the final acceptance has been made on such date of the receipt of the written form.

On the other hand, should non-compliance with drawings or Technical Specifications or defects be found in the Works executed by the Contractor, the Inspection Committee will have the right not to accept the Works and to order the rectification of the Works. If the required period for the rectification of the Works is beyond the completion date, the Contractor shall not be relieved from its responsibility to pay the penalty as stipulated under Clause 5.3, and after the completion of rectification of the Works, then the final acceptance will be made in the same manner as described in the first paragraph of this Article.

During the course of construction, whether in the completion time or of extended time specified in the last paragraph of Article 4, the JICA has the right to accept a part of the Works already completed in the written form which shall be considered as a part of final acceptance. However, both parties shall negotiate with each other for the maintenance and usage of the accepted part of the Works, and the Contractor is not entitled to request the extension of the completion time due to any interruption caused by the use of such accepted Works by the JICA, or any delay in repairing such accepted Works.

Article 16      Construction Engineer

The Contractor shall appoint a construction engineer at his own expense for the supervision of the Works performance, who shall be authorized to act on behalf of the Contractor, and the instructions given to him shall be deemed as given to the Contractor. Such construction engineer shall be a well English-speaking person and accepted by the JICA, who shall stay at the job site all the time and shall not leave without obtaining the prior approval of the Inspection Committee. If the Contractor replaces the construction engineer, the Contractor shall obtain the prior approval from the Inspection Committee in writing.

Article 17      Replacement of Labour, Engineer and Foreman

The Inspection Committee may request the Contractor to remove any of the Contractor's labours, foremen or engineers if it appears to the Inspection Committee that such labour, foreman or engineer is incompetent for his job or is not suitable or is not capable of handling his workmen or staff, and the Contractor shall promptly replace any such labour, foreman or engineer. No extra cost or claim for extension of time will be allowed because of such replacement.

Article 18      Sub-Contractor

The Contractor shall not sub-contract or assign any portion of the Works under this Contract without obtaining the prior approval of the JICA who has the sole right to decide which portion of the Works may be sub-contracted or assigned to the Sub-Contractor. However, the Contractor shall be fully responsible for the Works done by the Sub-Contractor.

Article 19      Notice

All notices required by this Contract shall be effective only at the time of receipt thereof, and only when received by the parties concerned at following address :-

The JICA

Thailand Office

1674/1, New Petchburi Road, Bangkok 10310, Thailand

The Contractor

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

All Notices required by the terms of this Contract shall be made in writing in English Language, and delivered by registered mail or hand delivery.

Article 20      Dispute

In the event of any dispute arising from the interpretation and performance of the terms of this Contract, both parties agree to make the best attempt with sincerity and in good faith to negotiate and amicably settle such dispute, failing which the parties agree to refer such dispute to arbitration under Thai Commercial Arbitration Rules and Regulation, Bangkok, by 2 arbitrators, each of which is to be appointed by each party. If either party fails to appoint its arbitrator within seven (7) days or should the arbitrators fail, within fifteen (15) days after their appointment, to agree upon the decision of the dispute or no decision is reached on the appointment of an umpire, then the dispute shall be brought before the Court of Thailand for decision under the laws and procedures of the Kingdom of Thailand.

This Contract is executed in duplicate of the same tenor, one of the original copy to be kept by JICA and the other original copy to be kept by the Contractor. Both the JICA and the Contractor have set their signatures and affixed the seals thereto in the presence of the witnesses.

JICA

Mr.

Resident Representative,  
Japan International Cooperation Agency, Thailand Office.

Contractor

Witness

Witness



**TECHNICAL SPECIFICATIONS**  
**ON**  
**CONSTRUCTION WORK OF THE DEMONSTRATION FARM**  
**FOR**  
**THE AGRICULTURAL DEVELOPMENT RESEARCH PROJECT**  
**PHASE II**  
**IN**  
**NORTHEAST THAILAND**

**JAPAN INTERNATIONAL COOPERATION AGENCY**  
**THAILAND OFFICE**

## TECHNICAL SPECIFICATIONS

### PART 1 SPECIAL PROVISION

1-01 The contractor shall exercise utmost care so that his construction operations will not damage any existing structure except such structures as specified to be dismantled, or will not cause the disturbances on the personal cultivation land of the other project. Any damages on the such existing structure or facilities shall be made good by the Contractor at his expense.

1-02 If it is necessary in the prosecution of the work to interrupt or obstruct the drainage of the surface, the flow of artificial drains and the flow of irrigation canal, the contractor shall provide for the same during the progress of the work in such a way that no damage shall result to either public or private interest. For any neglect to provide for either natural or artificial irrigation or drainage which he may interrupted, he shall be held liable for all damages which may result therefrom during the progress of the work.

1-03 The Contractor is expected to visit the location of the work and make his own estimate of the facilities needed for the work. In the successful execution of the contract, the Contractor is expected to familiarize himself with local conditions, availability of labor, transportation facilities, uncertainties of weather, and other contingencies. From investigation, made at site, it is believed that topographical conditions are approximately shown on the drawings, but the nature of the materials and the depth of satisfactory foundations, are not guaranteed. It is expressly understood that JICA will no be responsible for any deduction, interpretation, or conclusions made by the Contractor.

JICA does not guarantee that other materials will not be encountered or that the proportions of the several materials will not vary from those indicated by the drawings.

1-04 Elevation referred to the datum plane are to be determined from bench marks established by JICA or the Inspection Committee at the site of the work.

1-05 The Inspection Committee will establish the necessary survey monuments and bench marks at convenient points in the area covered by this contract for use of the Contractor in laying the lines and grades required for the proper conduct and execution of the work. All stakes, bench marks, etc., placed by the Inspection Committee in laying out the work, shall be carefully guarded and preserved by the Contractor, and in

such case stakes or marks are misplaced or rendered useless through the carelessness or negligence of the Contractor or his agents, employees or workmen, they will be replaced by the Inspection Committee at the expense of the Contractor.

1-06 The Contractor shall execute the work to the lines and grades given by the drawings and/or the Inspection Committee. The Contractor shall, at his own expense, furnish all stakes, templates, patterns, platforms and labor that may be required in setting or laying cut any part of the work.

## PART 2 GENERAL CONSTRUCTION FACILITIES

### 2-01 SCOPE

This part covers the construction and/or maintenance of access roads, setting up of Contractor's camp facilities, providing camp security and the disposition of the Contractor's various facilities at the end of the contract.

### 2-02 ROADS

- (a) The Contractor shall improve, repair and widen, if necessary, existing roads to satisfactorily meet his haulage requirements. He shall also construct all other roads within the construction area which he deems necessary in the prosecution of his work. The improving, widening and maintaining of existing roads and constructing and maintaining new roads shall be made without cost to JICA, and same shall be made on the responsibility of the Contractor during and up to the completion of all construction work under the contract.

### 2-03 CONTRACTOR'S CAMP FACILITIES

- (a) If the Contractor deems necessary, he shall grade his camp site; construct his office, employee's housing, warehouses, machine and repair shops, fuel storage tanks ; and provide such other facilities that the Contractor deems necessary for maintaining health, peace and order in the camp and work area.
- (b) The location, construction, operation and maintenance of such camps and facilities within the areas of the site shall be subject to the approval of the Inspection Committee. At least ten (10) calender days prior to the date on which the Contractor desires to begin to work in feature of camp construction, the Contractor shall submit for the approval of the Inspection Committee drawings and specifications, in sufficient detail to permit determination of

suitability of the construction in compliance with these specification, and no camp construction of any kind shall be undertaken until such drawings and specification have been approved by the Inspection Committee.

#### 2-04 CAMP SECURITY

The Contractor shall provide his own security force to the extent that he deems necessary for maintaining peace and order in the camps and work areas and to safeguard materials and equipment.

#### 2-05 DISPOSITION OF CAMP AND CONSTRUCTION FACILITIES

After the completion of the work covered by the Contract, the entire camp of the Contractor, including its water supply system, quarters, warehouses, shops and other facilities therein ; and all other temporary installations at work areas shall be removed by the Contractor and the site shall be cleaned.

#### 2-06 PAYMANT

There will be no separate payment for complying with the requirements of this part. The expenses incurred by the Contractor shall be included in the item of Common Temporary Works as indicated in the Priced Bill of Quantity.

### PART 3 CARE OF WATER DURING CONSTRUCTION

#### 3-01 SCOPE

In accordance with specifications contained in this part, the Contractor shall care the water during construction so that construction work can be performed in areas free from water. Care of water during construction shall include provision for drainage and pumping system for dewatering the foundation areas and the construction of temporary bulkheads necessary for the protection of construction operations form encroachment by water.

#### 3-02 DRAINAGE AND PUMPING

The Contractor shall be responsible for dewatering the foundation areas so that work may be carried on in a suitable dry condition, draining and/or pumping all water during the process of construction until its completion. The Contractor shall construct drainage ditches, holes, or culverts ; furnish, operate, and maintain at his own expense

all necessary pumps, to keep all work areas in amply dry condition, and prior to final acceptance of the work by the Contracting Officer, the Contractor shall remove, fill or plug all temporary drainage structures and pumping equipments at his expense.

### 3-03 PAYMENT

No separate payment shall be made for the care of water during construction. But the cost of furnishing, constructing, operating, maintaining, and removal of temporary drainage structures, canals, and pumping system necessary to keep construction operations free from water shall be included in item of Common Temporary Works.

## PART 4 OPEN EXCAVATION AND FOUNDATION PREPARATION

### 4-01 SCOPE

In accordance with the Specifications, contained in this part, and as shown on the drawings, or otherwise directed by the Inspection Committee, the Contractor shall perform all required open excavation and foundation preparation pertinent to the construction of reservoir, farm, road, irrigation pipe-line, drainage canal, and other construction work where open excavations are to be made.

### 4-02 OPEN EXCAVATION

#### (a) General

Open excavation under these Specifications consists of the removal, hauling, dumping, and satisfactory disposal of all materials from required excavations for reservoir, farm road, drainage canals and miscellaneous excavations for other structures included under this contract. Open excavation shall be performed to the lines and grades shown on the drawings or established by the Inspection Committee. The Inspection Committee may modify slopes of excavation to fit conditions encountered during construction. Such changes or modifications shall not be considered by the Contractor as a basis for additional compensation over and above the unit prices bid. All necessary precautions shall be taken to preserve the ground outside the specified lines and grades in the soundest possible condition.

(b) Foundation in Loose Material

When the surfaces of excavation upon or against which concrete or embankment fill is to be placed consist of loose material, the said loose materials shall be removed or replaced with suitable materials and compacted in a manner satisfactory to the Inspection Committee. The cost of removing the loose materials shall be paid for under the pertinent bid items for open excavation. The cost for the replacement with suitable materials and the compaction of the same shall be paid for under the pertinent bid items for fill.

4-03 DISPOSITION OF EXCAVATED MATERIALS

(a) Spoil Areas

The Contractor shall submit for the approval of the Inspection Committee locations, areas, drawings and other necessary specifications of spoil area which the Contractor proposes to use for the work under this Contract, and any kind of disposition shall not be undertaken before obtaining the said approval. Excavated material not suitable for fill or otherwise not needed shall be wasted in approved spoil area. Spoil piles shall be constructed to the stable slopes of the material being wasted.

Any spoil pile exceeding two (2) meters in height shall not be performed. Spoil material shall be spread and graded so that surface drainage will not be concentrated and will not create and/or accelerate undesirable erosion in spoil areas.

4-04 DEMOLITION, REMOVAL, AND DISMANTLING

When specified in the drawing or the Inspection Committee, existing concrete structures, such as concrete masses, stones, etc., shall be demolished and disposed of accordingly.

4-05 FOUNDATION PREPARATION

(a) Fill on Earth

All horizontal and sloped earth surfaces, upon which embankment material is to be placed or other foundation surfaces whose locations are specifically indicated by the Inspection Committee, shall consist of undisturbed or compacted material and shall be clean, damp, free from standing or running

water and free from organic matter ; and shall be suitable as a foundation for the material to be placed upon them.

(b) Concrete

All horizontal and sloped earth surfaces upon which concrete is to be placed shall be undisturbed or of approved compaction, clean and damp, free from standing or running water, and shall be otherwise suitable as a foundation for the concrete to be placed upon them.

4-06 MEASUREMENT FOR PAYMENT

(a) Open Excavation

A survey of the areas to be excavated shall be made by the contractor prior to the commencement of the work under this contract, and all measurements of excavation shall be based on this survey without regard to any change that may occur during the prosecution of the work. All such surveys shall be the subject to check and approval by the Inspection Committee. Volumes will be computed and shall be the amount between the original ground determined by the survey and the slopes, lines and grades shown on the drawings or established by the Inspection Committee.

(b) Foundation Preparation

No separate payment will be made for all foundation preparation specified under Paragraph 4-05 (a). The entire cost of foundation preparation for 4-05 (a), shall be included in the unit price for the pertinent item of embankment or fill in the Bill of Quantity. The cost of foundation preparation specified under Paragraph 4-05 (b), shall be paid for under the pertinent item shown in the Bill of Quantity, and the measurement shall be made by the acceptable method to the Inspection Committee.

(c) Demolition, Removal and Dismantling

Demolition, removal and dismantling work will be measured by the acceptable method to the Inspection Committee and paid for under the items shown in the Bill of Quantity.

## PART 5 FILL AND BACKFILL

### 5-01 SCOPE

In accordance with the specifications contained in this part and as shown in the drawings or otherwise directed by the Inspection Committee the Contractor shall furnish and place the earth fill for dam, farm road embankment and for ground embankment ; backfill for related structures. Any work of fill and backfill shall not be commenced without prior approval of the Inspection Committee. The slope of the embankment shall be finished to the designed gradient by providing fixed rules.

### 5-02 BACKFILL

Backfill, as used herein, is defined as refill for structures. The materials used for backfill for structures shall be free from roots, stones of more than five (5) centimeters in diameter, and other objectionable materials and subject the approval of the Inspection Committee. Backfill materials shall be placed in layers, each layer being not more than twenty (20) centimeters thick before compaction, thoroughly compacted by means of power tampers or other means of approved by the Inspection Committee.

### 5-03 FILL

#### (a) Lines and Grades

The fills shall be constructed to the lines, grades and cross sections indicated on the drawings, unless otherwise directed by the Inspection committee. The Inspection committee may increase or decrease the slopes of the fill or make such other change in the design as may be deemed necessary to produce a stable structure. Change in quantities of materials, resulting from prescribed changes in section, shall not make cause for claims for increased unit prices. Generally, a tolerance of plus or minus 0.05 meter from the slope lines and grades shown on the drawings will be allowed in the finished surfaces of the embankments except that the tolerances shall not be continuous over an area greater than twenty (20) square meters.

#### (b) Conduct of the Work

- 1) The contractor shall maintain and protect the fills in a satisfactory condition at all times until final completion and acceptance of all work under the Contract. Any approved fill material which is rendered unsuitable after being placed in the fills shall be replaced by the Contractor



and no additional payment will be made there. The Contractor shall excavate and remove from the fills any material which the Inspection Committee considers objectionable and shall also dispose of such material and refill the excavated as directed, all at no additional cost to JICA. The Contractor may be required to remove at his own expense any fill material placed outside of prescribed slope lines.

- 2) When the excavation of suitable fill material from required excavation and approved borrow sources progresses at a faster rate than placement in the fills, such excavated materials may be stockpiled at approved locations until use is authorized.

No separate payment will be made for stockpiling or reloading and hauling of this material to its place in the fills and all costs in connection therewith shall be included in the applicable contract unit price for the fill materials.

#### 5-04 MATERIALS

##### (a) Sources

The Contractor shall submit for the approval of the Inspection Committee locations, areas, drawings and other necessary specifications of borrow area which the Contractor proposes to use for obtaining fill material. Materials for fills shall be secured from required excavations and from the borrow areas as approved. There is no guarantee that all the materials in any borrow area will be suitable for use in the fills and the Contractor shall move or modify his operations to avoid unsuitable material. The Contractor shall maintain and operate sufficient excavating and hauling equipment so that an adequate amount of fill material from all sources is available as required. Operations in borrow areas shall not be on danger roads, building, or structures. Borrow areas shall be graded to provide drainage from all parts of the excavated areas. When operations in a borrow area have terminated, the area shall be dressed to a neat and orderly appearance, as approved by the Inspection Committee. Any additional material needed shall be obtained from sources approved by the Inspection committee.

(b) Suitability

Materials containing brush, roots, sod or other perishable material will not be considered suitable for fills. The suitability of the materials shall be subject to the approval of the Inspection Committee.

5-05 PLACEMENT

(a) General

No fill material shall be placed on any part of the fill foundations until such areas have been inspected and approved by the Inspection Committee and until after completion of foundation preparation as specified in PART 4. The gradation and distribution of materials shall be such that the fills will be free from lenses, pockets, and streaks.

(b) Earth Fill

The fill material shall be dumped spread in horizontal layers having an uncompacted thickness of not over 20 cm. When material is spread, chunks larger than 10 cm in size shall be broken down by approved means or removed.

5-06 COMPACTION

(a) General

After a layer of fill material has been dumped and spread, it shall be compacted by hand operated mechanical tampers or by other compaction machine approved by the Inspection Committee, to a density more than 85 percent of the maximum dry density of the material or to a density specified by the Inspection Committee.

(b) Fill on or against Culverts and Concrete Structure

No fill shall be placed on or against concrete surface before a period of fourteen (14) days has elapsed after placing the concrete. Before passage of hauling equipment over the top of culverts or other structures will be permitted, the depth of fill over the concrete shall be sufficient to permit such passage without harmful stresses or vibrations in the structure. Fill placed around and over culverts or other structures shall be compacted by hand operated

mechanical tampers or by man power to a density equal to that specified for the other earth fill.

#### 5-07 ADDITIONAL COMPACTION

If in the opinion of the Inspection Committee, the desired compaction of portion of the embankment is not secured, additional compacting operation shall be made over the surface area of such designated portion until the desired compaction has been obtained, without additional cost to JICA.

#### 5-08 QUALITY CONTROL

If it is required, tests for moisture content and density, and other all necessary tests will be made by the Inspection Committee, and from these tests, corrections, adjustments, and modifications of methods, materials, and moisture contents may be made in order to secure satisfactory density of the fill materials. The Contractor shall provide necessary unskilled labor in obtaining and preserving samples.

#### 5-09 MEASUREMENT FOR PAYMENT

##### (1) Fill

##### (a) Measurement

Measurement for payment of fill will be calculated on the number of cubic meters of material placed between the foundation lines as determined on the basis on drawings or a survey made after completion of the excavation and foundation preparation and the lines, grades and slopes shown on the drawings. No allowance will be made for foundation or embankment settlement.

##### (b) Payment

Payment shall constitute full compensation for all work in connection with the excavation from borrow areas including clearing, grubbing and stripping of borrow areas, hauling, stock-piling, rehandling, foundation preparation, placing, spreading, sprinkling, drying, breaking up, compacting, removal of objectionable material, and all other work required for the construction, protection and maintenance of the fills. No adjustment in payment will be made for substitution of materials and for additional compaction.

(2) Backfill

Measurement for payment of backfill shall be calculated on the number of cubic meters of materials placed among the original ground line, or designated line of backfill and the structure and the neat pay lines of excavation shown in the drawing. Payment will be made on the unit price bid per cubic meter of backfill.

PART 6 CONCRETE WORKS

6-01 SCOPE

In accordance with the Specifications contained herein and as shown on the detail drawings or otherwise directed, the Contractor shall -

- (a) Furnish all materials, and manufacture, transport, place, finish, protect and cure concrete ;
- (b) Furnish, construct, erect and dismantle forms ;
- (c) construct expansion and construction joints and furnish and place waterstops, joint fillers, and sealing compound, if required : and
- (d) Prepare, clean, cut, bend and place steel reinforcement.

6-02 CEMENT

(a) General

Cement for mortar and concrete work shall be Portland Cement which conforms to the requirements of the Standard Specifications for Portland Cement (A.S.T.M. Designation C150-69).

(b) Storage

Cement shall be stored in a dry, weather tight and properly ventilated warehouse with adequate provisions for the prevention of absorption of moisture. All storage facilities shall be subject to approval and shall be such as to permit easy access for inspection and identification. Cement which has been stored for more than one month or which is suspected to be damp shall not be used unless otherwise approved by the Inspection Committee.

## 6-03 FINE AGGREGATE

### (a) Composition

Fine aggregate shall be natural sand not including organic matter and other foreign substances.

### (b) Quality and Grading

- 1) **Quality** -- Fine aggregate shall consist of hard, tough, durable, uncoated particles. The shape of the particles shall be generally rounded or cubical and reasonably free from flat or elongated pieces. The fine aggregate shall conform to the following specific requirements :
- 2) **Grading** -- Fine aggregate shall be well graded from fine to coarse and the gradation shall conform to the following requirements as delivered to the mixers :

Sieve Designation <u>U.S. Std. Square Mesh</u>	Cumulative Percentage <u>by Weight Passing</u>
No. 4	95 - 100
No. 16	60 - 75
No. 100	2 - 10

In addition to the grading limits shown above, the fineness modules shall be in the range from 2.30 to 3.00.

### (c) Storage

Fine aggregate shall be stored in such a manner as to avoid the inclusion of any foreign material in the concrete. Sufficient live storage shall be maintained at all times to permit continuous placement of concrete at the rate specified.

## 6-04 COARSE AGGREGATE

### (a) Composition

Coarse aggregate shall consist of gravel, crushed gravel or rock, or a combination of gravel and crushed gravel or rock.

(b) Quality and Grading

- 1) Quality -- Coarse aggregate shall consist of hard, tough, durable, clean and uncoated particles. All foreign materials and dust shall be removed by adequate processing. The particle shape of the smallest size of crushed coarse aggregate shall be generally rounded or cubical, and the coarse aggregate shall be reasonably free from flat and elongated particles in all sizes.
- 2) Grading -- The coarse aggregate shall be well graded from fine to coarse. The grading of the aggregate as delivered to the mixer shall be as follows:

Sieve Designation <u>U.S. Std. Square Mesh</u>	Per Cent by Wt. Passing Individual Sieves <u>3/4" Max.</u>
1 "	100
3/4 "	90 - 100
3/8 "	20 - 50

- 3) Size -- Unless otherwise directed, the maximum sizes of coarse aggregate to be used in the various parts of the work shall be 3/4 inch.
- 4) Storage -- Storage of coarse aggregates shall be as that specified in Paragraph 6-03 (c) for fine aggregates.

6-05 AGGREGATE SAMPLES

Samples of the aggregate shall be furnished at a point designated by the Inspection Committee for his approval at least ten (10) days in advance of the time when the placing of concrete is expected to begin.

6-06 WATER

Water used in mixing concrete shall be fresh, clean and free from injurious amount of oil, acid, alkali, salts, or organic matter.

## 6-07 PROPORTIONING OF CONCRETE

- (a) The Contractor shall design the mix proportion for every class of concrete placing for the approval of the Inspection Committee. The Contractor shall carry out the mix test in case of being requested by the Inspection Committee. The test is to be made at the expense of the Contractor.
- (b) The compressive strength of the age of 28 days shall be as follows and desirable mix proportion is also indicated.

Class	Minimum 28 days Compressive strength	Mixing proportion by volume cement : fine aggregates : coarse aggregates
A (Reinforced concrete)	210 kg/cm <sup>2</sup>	1 : 2 : 3
B (Plain concrete)	160 kg/cm <sup>2</sup>	1 : 2 : 4
C (Concrete layer)	135 kg/cm <sup>2</sup>	1 : 3 : 4

Other proportions for mixed design may be indicated by the Inspection Committee at the site of work, if it is necessary.

## 6-08 MIXING

- (a) Equipment

Concrete shall be mixed by portable concrete mixer unless otherwise approved by the Inspection Committee.

- (b) Measurement

The measurement of every ingredient of concrete shall be made in weight. Nevertheless, the measurement in volume is admitted subject to the approval of the Inspection Committee.

- (c) Mixing Time and Method

The mixing time of concrete shall be more than two (2) minutes and less than five minutes. Over mixing, requiring the introduction of additional water to preserve the required consistency, will not be permitted. The mixer shall be completely emptied before receiving the materials for the succeeding batch and shall be kept clean and washed out after stopping work at the end of each shift.

On commencing work, the first batch shall contain sufficient excess of cement, sand and water to coat the inside of the drum to avoid the reduction of the required mortar content of the mix.

#### 6-09 CONVEYING

##### (a) General

Concrete shall be conveying from mixer for forms, as rapidly as practicable, by methods which will prevent segregation or loss of ingredients. There shall be no vertical drop greater than 1.5 meters except where suitable equipment is provided to prevent segregation and where specifically authorized. Belt conveyors, chutes or other similar equipment in which the concrete is delivered to the structure in a thin, continuously exposed flow, will not be permitted except for very limited or isolated sections of the work. Such equipment shall be arranged to prevent objectionable segregation.

#### 6-10 PLACING

##### (a) Approval

Approval of the Inspection Committee shall be obtained before starting any concrete pour.

##### (b) General

Concrete shall be worked into the corners and angles of the forms and around all reinforcement and embedded items without permitting the material to segregate. Not more than three (3) cubic meters shall be deposited in one pile for compaction. Free water shall be collected in depressions away from the forms and removed by bailing prior to placement of additional concrete. All concrete placing equipment and methods shall be subject to approval.

##### (c) Cooling of Aggregates

The aggregate shall be cooled by wetting if it is drier than the condition known as saturated, surface dry.



(d) Concrete on Earth Foundation

All concrete shall be placed upon clean, damp surface free from standing or running water. Prior to placing concrete, the earth foundation shall be satisfactorily compacted in accordance with approved methods.

(e) Concrete on Other Concrete

Surface upon or against which concrete is to be placed shall be clean, free from oil, standing or running water, mud, drummy rock, objectionable coatings, debris, and loose, semidetached or unsound fragments. To insure a firm and tight bond between fresh concrete and other concrete, concrete surfaces, wherever necessary, shall be chipped or roughened as directed by the Inspection Committee. All surfaces shall be wetted thoroughly to keep them in a completely moist condition before placing concrete. All approximately horizontal surfaces shall be covered with a layer of mortar of the same cement-sand ration as used in the concrete mix before the concrete is placed.

6-11 FORMS

(a) General

Forms shall be used, wherever necessary, to confine the concrete and shape it to the required lines, or insure against contamination of the concrete. Forms shall have sufficient strength to withstand the pressure resulting from placement and vibration of the concrete, and shall be maintained rigidly in correct position. Forms shall be sufficiently tight to prevent loss of mortar from the concrete. Forms for exposed surfaces against which backfill is not to be placed shall be lined with a form grade plywood or sheet steel. Steel panel forms may also be used.

(b) Cleaning and Oiling of Forms

At the time concrete is placed in the forms, the surfaces of the forms shall be free from incrustations of mortar, grout, or other foreign material that would contaminate the concrete or interfere with the fulfillment of the Specifications' requirements relative to the finish of formed surfaces. Before concrete is placed, the surfaces of the forms shall be oiled with a commercial form oil that will effectively prevent sticking and will not stain the concrete surfaces.

(c) Removal of Forms

Forms shall be removed as soon as practicable in order to avoid delay in curing and to make possible earliest practicable repair of surface imperfections, but in no case shall they be removed before approval. Any needed repair or treatment shall be performed at once, and shall be followed immediately by the specified curing. Forms shall be removed with care so as to avoid injury to the concrete, and any concrete so damaged shall be repaired.

6-12 CURING AND PROTECTION

(a) General

All concrete shall be moist cured for a period of not less than seven (7) consecutive days by an approved method or combination of methods applicable to local conditions, except that the curing period may be reduced to three days for concrete made with high-early-strength cement. The Contractor shall have all equipment needed for adequate curing and protection of the concrete on hand and ready to install before actual concrete placement begins.

(b) Water Curing

Concrete shall be kept wet by covering with an approved, watersaturated material or by a system of perforated pipes or mechanical sprinklers or by any other approved method which will keep all surfaces continuously (not periodically) wet. Water for curing shall be generally clean and free from any element which might cause objectionable staining or discoloration of the concrete.

6-13 REPAIR OF CONCRETE

Repair of imperfections in formed concrete shall be completed within twenty four (24) hours after removal of forms at no additional cost to JICA. Fins shall be neatly removed from exposed surfaces. Concrete that is damaged or honeycombed must be removed to sound concrete and replaced with drypack mortar, or concrete as hereinafter specified. Where large bulges and abrupt irregularities protrude, the protrusions shall be reduced by bush-hammering and grinding. Drypack filling shall be used for holes left by the removal of fasteners from the ends of form tie rods.

#### 6-14 DRYPACK MORTAR

Drypack shall consist of a mixture (by dry volume or weight ) of one (1) part cement to 2-1/2 parts of sand conforming to Paragraph 6-03. Fine Aggregate, except that, in gradation, 100 % shall pass a No. 16 sieve. Only enough water shall be used to produce a mortar which, when used, shall stick together on being molded into a ball by a slight pressure of the hands, and shall not extrude water but will leave the hands damp.

#### 6-15 STEEL REINFORCEMENT

##### (a) General

The Contractor will furnish all steel reinforcement in accordance with the drawings and these specifications. The Contractor shall prepare, clean, cut, bend and place all reinforcements, as shown on the detail drawings or as otherwise directed. The Contractor shall furnish all chains, supports and ties. All reinforcement shall be reasonable free from loose, flaky rust and scale, and free from oil, grease and other coating which might destroy or reduce its bond with concrete.

##### (b) Relationship of Reinforcement to Concrete Surfaces

The distance from the edge of the main reinforcement to the concrete surface shall be 5 cm except such portions as shown in the drawings. The concrete covering the stirrups, spacer bars, and similar secondary reinforcement may be reduced by the diameter of such bars, unless otherwise indicated.

##### (c) Lapping

Lapping length at joints of the reinforcing bar shall be at least thirty times of the diameter of bar and shall be bound by steel wire.

##### (d) Supports

All reinforcements shall be secured in place by use of metal or concrete supports, spacers or ties. Such supports shall be of sufficient strength to maintain the reinforcement in place throughout the concreting operation. The supports shall be used in such a manner that they will not be exposed or contribute in any way to the discoloration or deterioration of the concrete.

## 6-16 MEASUREMENT FOR PAYMENT

### (a) Concrete

- 1) Measurement for payment for plain or reinforced concrete, will be based on the volume of concrete in place within the lines and grades shown on the drawings.
- 2) No deduction will be made for rounded or bevelled edges, or space occupied by metal work, or embedded items such as supports, spacers or ties. The cost of construction joint treatment with the attendant loss of material shall be included in the unit price bid per cubic meter of concrete.
- 3) Payment at the unit prices bid shall constitute full payment for all costs for concrete work. The costs of any dewatering required to maintain dry conditions during the pouring of concrete, furnishing materials, and installing and removing formwork, shall be included in the unit cost.

### (b) Steel Reinforcement

Measurement for payment for furnishing, preparing bar cleaning, cutting, bending, and placing steel reinforcement by the Contractor will be based on the number of kilograms placed in accordance with the detail drawings or as otherwise directed. Payment will be made for steel in laps as shown on the drawings ; where bars are welded, payment will be made as if they were lapped. Payment will not be made for steel in laps or used which are solely for the convenience of the Contractor. Payment will be made at the unit price bid for steel reinforcement. No separate payment will be made for steel reinforcement supports, and the cost thereof shall be included in the unit price bid.

## PART 7 RESERVOIR WORKS

### 7-01 SCOPE

The scope under this part shall consist of the preparation works, excavation, embankment in accordance with the drawings and specifications or as directed by the Inspection Committee.

Specification of removal of surplus soil shall be indicated in part 4, 4-03 (a).

#### 7-02 EARTH MATERIALS FOR EMBANKMENT

The excavated earth materials shall be used for the embankment material for the dam, and if those excavated soil are deemed unsuitable for the purpose, the embankment materials shall be borrowed from pits with soils in suitable texture.

#### 7-03 COMPACTION

The dam section shall be compacted with roller carefully. Thickness for one compaction shall be spread about 20 cm in spread. Also compaction water shall be sprinkled for keeping optimum moisture content of the materials.

#### 7-04 SLOPE PROTECTION

Finishing work of embankment slopes shall be made by compacted with hand rammer for protection of slopes from erosion. Where shown on the drawings or as directed by the Inspection Committee, the Contractor shall construct slope protection by the sod at the part of the down slope. Also under constructing the sod shall be sprinkled until rooted by the Contractor.

### PART 8 DRAINAGE CANAL

#### 8-01 GENERAL

Drainage canal shall be constructed at the locations shown on the drawings or as directed by the Inspection Committee. Protecting the soil erosion, gradient of slop shall be gentle as shown on the drawings. Also in order to slow down the velocity of flow drops shall be constructed in several points of the canal. The Contractor shall execute these to the location and elevation as shown on the drawing and/or indication by the Inspection Committee.

#### 8-02 GABIONADE

Gabionade shall consist of wire-net boxes packed with gobble stones. Wire-net box shall be made by galvanized wire-mesh (#11, 2"). Gabionade shall be fixed by the pile of iron bar ( $\phi 25$ ) inserted to the hole drilled by hand auger ( $\phi 100$ ) and filled by mortar. Upper part of the pile on the ground shall be cased with PVC pipe and filled by mortar.

### 8-03 SLOPE PROTECTION

Protecting the slope sod facing shall be executed at the top of slope in width of 1 m. The time of sod facing shall be indicated by the Inspection Committee.

### PART 9 FARM ROAD

- (a) The farm road shall be constructed by using earth materials near the site and be completed by compaction with tire roller after a layer of laterite has been dumped and spread.
- (b) The surface of farm road shall be finalized by constructing middle portion of the road higher in height than each side of the road, of which the cross sectional gradient is shown in the drawings.
- (c) During the period of construction for farm road, the Contractor will always pay attention on drainage of rain water to prevent the surface of road from becoming muddy.

### PART 10 IRRIGATION FACILITIES

#### 10-01 PUMP FACILITIES

- (a) Volute pump designated in the drawings will be prepared by the Contractor. The Contractor shall furnish all labour, materials, equipment and incidentals required for installation of the pumps, fittings and appurtenances as shown on the drawings and/or directed by the Inspection Committee. The fittings are shown as a convenience for the Contractor. It may be necessary to supply and install additional fittings other than those shown on the drawings or to install fittings in different locations. Work to be done shall include hauling, installing, jointing and all other works necessary to produce completed facilities.
- (b) The Contractor shall furnish and install pump house, electric wiring, pipes, couplings, fittings, gaskets, flanges, bolts, nuts and all other materials necessary to properly install the works shown on the drawings and as specified.
- (c) These facilities shall be strictly in accordance with the manufacture's technical data and printed instruction and permitted by the Inspection Committee. For all

kinds of earth works required for the works, the specification for earth and foundation works shall be applied.

## 10-02 PIPE WORK

### 10-02-1 General

The Contractor shall install all piping and fittings as specified herein and shown on the Drawings or as directed by the Inspection Committee.

The intention of the Specifications is to cover all types of pipe. Any pipe of a material not specifically mentioned in this Chapter shall be installed in the same manner as the closest listed pipe.

### 10-02-2 Installation of Pipe Underground

#### (1) General

Proper instruments, tools, and facilities satisfactory to the Inspection Committee shall be provided and used by the Contractor for the safe and convenient performance of the work. All pipe, fittings, and valves shall be carefully put into the trench piece by piece by suitable tools or equipment, in such manner as to prevent pipe and protective coatings from damage. Under no circumstances shall pipe and other materials be dropped or dumped into the trench.

#### (2) Inspection before Installation

All pipe and fittings shall be carefully examined for cracks and other defects while suspended above the trench immediately before installation in final position.

#### (3) Cleaning of Pipe and Fittings

All lumps, blisters, and excess coating shall be removed from the end of each pipe. The outside of the joint end and the inside of the joint shall be wiped clean, dry and free from oil and grease before the pipe is laid.

#### (4) Laying of Pipe

Every precaution shall be taken to prevent foreign material from entering the pipe while it is being placed in the line. During laying operations, no debris, tools, clothing, or other materials shall be placed in the pipe.

The pipe shall be secured in place with approved backfill material tamped under it except at the joint. Precautions shall be taken to prevent dirt from entering the joint space.

At times when pipe laying is not in progress, the open ends of pipe shall be closed.

(5) Cutting of Pipe

The cutting of pipe for inserting tees or valves shall be done in a neat and workmanlike manner without damage to the pipe.

(6) Installation and Connection

- a) Installation of pipe shall be carefully conducted so as not to be concussed pipe.
- b) As for means of connection between steel pipes, screwed type socket or welding connection shall be basically adopted for the pipe with less than 150 mm diameter, and more than 200 mm diameter, respectively. However, welding connection may be adopted even for the pipe less than 150 mm diameter with the Inspection Committee's approval.
- c) Welded surface of pipe shall be kept clean avoiding adhesion of refuse, soil, etc. and shall be painted by zinc coating approved by the Inspection Committee.

10-02-3 Filling Water-Test

After completion of installation of pipe and backfilling, filling water test shall be taken in each certain interval, in order to ensure the leakage of water within allowable range.

Testing pressure shall be taken by normal design water pressure at the site, and 25 lit/day per 1 km length and 1 cm diameter of pipe shall be set up as a standard.

10-02-4 Installation of Valves and Accessories

The valves, taps, accessories, stoppers and caps shall be placed and assembled to the pipeline in the above specified way for pipeline cleaning and laying, and as shown on the drawings. The tap placement shall be approved by the Inspection Committee.



## 10-03 WATER TANK

The water tank shall be constructed by reinforced concrete on the place indicated in the drawings and elevation of its bottom will be specified. Specification of concrete work shall be indicated in Part 6.

## PART 11 RUN-OFF PLOT

Gradient of the part of run-off passage in the frame will have two kinds: one is 3 degree and another is 5 degree. It depends on the direction of the Inspection Committee which gradient shall the Contractor choose in process of construction.

## PART 12 FINISHING OF FIELD

The Contractor shall execute finishing of the field after all earth moving works have been over. Finishing of the field involves levelling the small uneven part of the field face and spreading the spoiled soil on the field. It does not mean to modify the natural gradient of the field by cutting and banking the soil.

## PART 13 BUILDING WORK

### 13-01 GENERAL

- (1) This Part shall cover the construction work of the Demonstration Farm Facilities proposed at Khao Suan Kwang.
- (2) Prior to commencement of any building work of the farm facilities and pump house, the Contractor shall provide and furnish shop drawings for the Inspection Committee's approval. The shop drawings shall include temporary works and dimension of structures in accordance with the Drawings and Specifications provided hereinafter.
- (3) The Contractor shall provide all labor, plant, materials, tools and equipment and other facilities necessary to complete all operations under this division including excavation, backfilling, filling, and grading in accordance with the Drawings and as specified herein or as directed by the Inspection Committee.

(4) Stakes and Batter Boards

- 1) Stake out the building accurately and establish grade lines as shown on the Drawings or as directed by the Inspection Committee.
- 2) Erect batter boards and basic references as directed by the Inspection Committee at such places where they will not be disturbed during construction.
- 3) Storage of materials and work shall be conducted in such a manner as to preserve all reference marks set by the Contractor. The Contractor shall re-establish all lines and grade that get dislocated at his expense.
- 4) The Contractor shall construct two (2) permanent bench marks of previously known elevation near or within the site of construction for the purpose of determining any settlements that may occur during the progress of construction.

13-02 EARTH WORK

13-02-1 Excavation

- (1) The Contractor shall make all necessary excavations for foundations to grades indicated on the approved drawings. Excavations shall include levelling the bottom of the footing, compacting and tamping of same.
- (2) Excavate rock, earth and other materials of every nature, or description encountered in obtaining indicated lines and grades, which, in the Inspection Committee's opinion can be loosened, removed by hand with hand tools or power shovels.
- (3) The Contractor shall excavate all trenches to a neat size, levelled to a line at the bottom ready to receive foundations. Remove all loose rock, dirt and debris prior to pouring concrete.
- (4) No footing shall rest on fill. Where excavations reveal that footing will rest on fill, the Contractor shall carry excavations deeper until desired stratum is reached for safe bearing power of soil.
- (5) Make all excavations with proper allowance for floor slabs, forms and centers. Bottom of foundations shall be approximately level and clear of loose materials and lower sections true to size.

- (6) If the required bearing power is not obtained at the excavation, the excavation shall be continued until such safe bearing power is obtained, with piers and walls being lengthened accordingly to suit the conditions for which the Contractor shall be paid at the unit price bid for excavation.
- (7) When the nature of soil is such that foot bearing (safe bearing) is found to exist at higher grades than indicated sub-grades, the Inspection Committee may decide to stop excavation work at these levels, but request should be done by writing.
- (8) Where walls or footings are to be poured without forms, trench sides shall be sharp and true.

#### 13-02-2 Backfilling

- (1) Use all suitable materials removed from excavation, including materials from suppliers, insofar as practicable, in the formation of backfills.
- (2) Deposit no excavated material at any time in any manner that may endanger a partly finished structure by direct pressure, by overloading bands contiguous to the operations, or in any other way detrimental to the completed work.
- (3) After forms have been removed from footings, piers, foundation walls, etc., and when concrete work is hard enough to resist pressure resulting from fill, the materials from excavations shall be used for backfilling around them in horizontal layers not exceeding 15 cm with each layer being thoroughly compacted and rammed by wetting.

#### 13-02-3 Filling and Grading

- (1) Use filling material suitable for structural earthfilling work as mentioned in the preceding Part 5.
- (2) Provide granular fill beneath all concrete building slabs on grade. Granular fill shall be clean crushed stone or gravel placed to a depth of 10 cm.

#### 13-02-4 Disposal of Waste Materials

All excess waste and other unused excavated materials shall be used for site grading or levelling if required by the Inspection Committee, and shall not be removed from the Site without approval of the Inspection Committee. Surplus materials except

used for above mentioned shall be disposed to the spoil bank as directed by the Inspection Committee.

### 13-03 REINFORCED CONCRETE WORK

#### 13-03-1 General

All reinforced concrete work shall be completed as shown on the Drawings and as specified herein.

#### 13-03-2 Concrete

- (1) Concrete shall consist of Portland Cement, fine aggregates, coarse aggregate, water, and where specified admixtures; proportioned, mixed, placed, cured and finished as specified in the preceding Part 6 "Concrete Work".
- (2) Miscellaneous:
  - 1) Shop drawings or form work, where required by the Inspection committee, shall be submitted for approval before fabrication and erection of such formwork.
  - 2) Provide temporary openings where necessary to facilitate cleaning and inspection immediately before depositing concrete.
  - 3) Side forms of footing may be omitted and concrete placed against the neat excavation only when approved by the Inspection Committee and when an appropriate credit is allowed.
  - 4) All exposed corners shall be square. Exercise due care while stripping forms and protect corners subsequently against chipping or other damage by approved means.
  - 5) Always provide continuous vertical supports for formwork directly below any pour line.
  - 6) On completion of the work under this divisions, the Contractor shall clean down all exposed concrete work and remove from the premises form-lumber, cement sacks, and other debris caused by this work.

## 13-04 SCOPE OF WORK

### 13-04-1 General

- (1) All work described herein shall be governed by Thailand codes besides standards mentioned in other Part.
- (2) Submit to the Inspection Committee for approval, all shop drawings prior to fabrication. Any material fabricated before final approval of the shop drawings will be done at the risk of the Contractor.
- (3) The Contractor shall be responsible for the correct fitting of all structural members and for the elevation and alignment of the finished structure.
- (4) Substitutions of sections or modifications of details shall be made only when approved by the Inspection Committee, and at no additional cost to the JICA.

### 13-04-2 Materials

- (1) Structural Steel, welding electrodes, bolt and nut, etc. shall be governed by Thailand codes.
- (2) Paint: Prime coat shall be iron oxide or red lead paint
- (3) Grout: Portland Cement and sand mixed in the proportion of 1:2 by volume

### 13-04-3 Fabrication

- (1) Material shall be properly match-marked where field assembly is required
- (2) Connections and details not shown but necessary to develop member or joint are subject to the Inspection Committee's approval.
- (3) Welding shall be done by the shielded arc method in accordance with the applicable standard and code.

Sequence of welding in assembling built-up sections shall be such that warping of the finished product is prevented or jigs shall be used to achieve the same purpose. Welded connections of equal value may be substituted for riveted or bolted connections if not shown on the Drawings, subject to the Inspection Committee's approval.

- (4) Unfinished bolts shall be used for field connections. Lock washers shall be used under all nuts.
- (5) All structural steel members shall be thoroughly cleaned, with all rust and mill scale removed and shall receive one prime coat of paint before delivery. Unpainted areas left to preserve shop marks will not be permitted. After erection, all abrasions, rivets and bolt heads, and surfaces left unpainted for welding shall be painted with one prime coat of paint.

#### 13-04-4 Inspection

- (1) Provide access to places where materials are being fabricated or produced for the purpose of inspection.
- (2) The Inspection Committee reserves the right to reject any materials at anytime before final acceptance which does not conform to all of the requirements of the approved drawings and specifications.
- (3) The Contractor shall engage the services of an approved testing laboratory at his expense to perform any required tests and shall submit 3 copies of all reports to the Inspection Committee. Correct measures, including additional and more complete testing which may result from these tests shall be the responsibility of the Contractor.
- (4) All welds shall be visually inspected prior to painting. Unless otherwise noted, individual members of the structure shall be levelled and plumbed to an accuracy of 1 to 500. Drift pins shall not be used to enlarge unfair holes in main material. Holes that must be enlarged to admit bolts shall be reamed.
- (5) Burning and drifting may be used to align unfair holes in secondary bracing members only upon approval of the Inspection Committee.
- (6) Upon completion of erection and before final acceptance, the Contractor shall remove all falsework, rubbish and waste material.

#### 13-04-5 Erection

- (1) The Contractor shall completely outline a proposed method and sequence of erection to the Inspection Committee for approval before delivery of any material to the jobsite. The outline shall be prepared to avoid delay of and damage to the work of other trades.

- (2) Temporary bracing and guy lines shall be provided to adequately protect all persons and property to insure proper alignment.
- (3) The Contractor shall be responsible for the accurate setting and levelling of all bearing plates or setting plates. Bearing plates or setting plates shall be levelled on steel wedges or shims or as otherwise detailed and then grouted in place before erection of structural members.

### 13-05 CEMENT AND MASONRY WORKS (Architectural Works)

#### 13-05-1 General

- (1) The works include concrete masonry unit work, completed with cement plaster finish.
- (2) The following are specifically included under this section:
  - 1) All concrete hollow block curtain walls including mortar filling.
  - 2) Setting and incorporating into masonry bolts, anchors, metal attachments, pipe sleeves, inserts, frames for openings in masonry, and other divisions, and the location of which are shown in the Drawings and included in said other divisions.
  - 3) Chiselling, grouting, joint fillers.
  - 4) All cement plaster finishes for floors, walls, and ceiling indicated on the approved Drawings.
  - 5) Protective measures for the prevention of damage of completed masonry and other work.
  - 6) Removal of dirt, stain, etc., from finished masonry surfaces.

#### 13-05-2 Materials

- (1) All materials necessary for the work such as Portland Cement, sand, gravel and water, shall conform to the specifications under Part 6.

#### 13-05-3 Mortar

- (1) All cement mortar shall be one (1) part Portland cement and two (2) parts sand by volume, but not more than 1:3 by volume.

- (2) Positive measuring methods shall be agreed upon for all cementing materials and aggregates. The aggregates shall be introduced and mixed uniformly throughout the mass after which a gradually and mixed further until a mortar of the plasticity necessary for the intended purpose is obtained. Mortar shall be used so that it will be in place before the initial setting of the cement has taken place.
- (3) No mortar containing Portland cement shall be re-mixed or retempered after one (1) hour, except as specified for repainting.
- (4) The material and compound for waterproofing and damproofing plaster and the location where to be applied shall be approved by the Inspection Committee.

#### 13-05-4 Concrete Hollow Blocks and Brick

- (1) The load bearing concrete hollow blocks (CHB) shall have a minimum compressive strength of 70 kg/sq.cm for the individual unit respectively; all based on gross area. All bricks shall be the first class unless otherwise directed by the Inspection Committee.
- (2) All units shall be sound and free from cracks or other defects that would interfere with the proper placing of the unit or impair the strength or performance of the construction.
- (3) Sampling:
  - 1) Specimens shall be representative of the whole lot of units from which they are selected. If test specimens are selected at the site of work, units for moisture content tests shall be taken within 48 hours after delivery.
  - 2) In sampling the blocks for the strength, absorption and moisture determination, ten (10) individual units shall be selected. Provided, however, that in the case of the non-load bearing type of CHB or brick, three (3) samples for tests shall be required.
- (4) Testing:

The units shall be selected in accordance with Thailand or other applicable standard. No blocks shall be used unless results of tests are known and duly approved by the Inspection Committee.



(5) Rejection:

In case the shipment of units fails to conform to the requirements, the manufacturer may sort it and new specimens shall be selected again at random from the retained lot and tested at the expense of the Contractor. In case the second set of specimens fails to conform to the test requirements, the entire lot shall be rejected.

### 13-05-5 Laying of Blocks and Brick

- (1) Wet CHB thoroughly before using. The first row of blocks must be thoroughly anchored to the concrete walls, columns or slabs. Courses shall be laid straight and uniform with regular running bond and with vertical faces truly vertical, plumb, true to line with level, and accurately spaced.
- (2) All horizontal and vertical reinforcing bars shall be anchored 20 diameters into the concrete walls, column and slabs. Dowel bars properly spaced shall be placed into the walls, columns or slabs during pouring and hooked to the vertical bars, leaving another 20 diameter exposed to splice with the reinforcing bars of the CHB walls during construction.
- (3) Unless otherwise specified or detailed on the plans, horizontal and vertical joints shall be 3/8" (0.94 cm) thick. Joints shall be solidly filled from the face of the blocks to the depth of the face pointing where necessary to completely and compactly fill the joints. Reinforcement will consist of 3/8" (0.94 cm)  $\emptyset$  at 0.60 m vertical bars (or at every other block) and 3/8" (0.94 cm)  $\emptyset$  horizontal bars every third course for both, 4" (10 cm) and 6" (15 cm) walls. Block cells with reinforcement shall be solidly filled with cement mortar grout.
- (4) The Contractor shall leave the work clean and in perfect condition removing all incidental rubbish. Keep floor dry as possible during laying of CHB and mortar plastering operations and protection from plaster dropping.
- (5) The brick work shall be carried out in the same manner and workmanship specified hereabove or as directed by the Inspection Committee.

### 13-06 CARPENTRY AND JOINERY

#### 13-06-1 Scope of Work

The work includes carpentry and joinery work.

### 13-06-2 General Requirements

#### (1) Quality of Lumber:

Lumber shall be of the best grade available, well-seasoned, thoroughly dry and free from loose or unsound knots, cup shakes or other imperfections that will impair strength, durability or appearance. Exposed surfaces shall be smooth unless otherwise indicated or specified.

#### (2) Protection and Storage

Protect lumber from dampness during and after delivery at the site. Lumber shall be delivered to the site at least 30 days before use, immediately piled in stack in such a manner as to provide air circulation around surfaces of each piece to ensure thorough air seasoning. Stacks shall be covered with well ventilated sheds and enough protection from driving rain.

### 13-06-3 Rough Carpentry

- (1) Work shall be well fitted, accurately set, and rigidly secured in place. Anchors and bolts (with nuts and washers), straps and tie rods shall be provided as required.
- (2) Framing and structural lumber shall be well-seasoned, straight, square-edge stacks and free from defects that will impair its strength.
- (3) Plates for walls and partitions shall be of the same width as the studs.
- (4) Lumber surfaces in contact with concrete or masonry shall be given two (2) brush coats of bituminous paint.

### 13-06-4 Joinery Work

- (1) Lumber used for joinery work shall be of the kinds specified and shall be of contours, patterns, and profile as indicated.
- (2) Joints shall be made as per approved drawing, installed tight and securely fastened. Exterior joints shall be mitered and interior angles coped. Panels shall be fitted to allow for shrinkages, avoid swelling and insure that the work shall remain in place without warping, splitting and opening of joints.

- (3) Interior trims shall be of approved standard stuck-moulding except where special patterns or profiles are indicated in the approved drawings.
- (4) Joints for cabinet work shall be glued aside from nails or other fastening device required. Nailing shall be concealed where practicable.
- (5) Exposed surfaces shall be machined or hand sanded to an even smooth surface, ready for finish. No hammer marks or other unsightly marks shall be allowed on wood panel or veneer.

#### 13-06-5 Materials

Locally available lumber, plywood, glue, etc. can be acceptable after getting approval of the Inspection Committee.

#### 13-07 OTHERS

##### 13-07-1 Plumbing and Sewerage Works

The Work includes all necessary plumbing and sewerage works including septic tank in accordance with the working drawings submitted to and approved by the Inspection Committee.

##### 13-07-2 Duct and Other Works

The Work includes duct for electric cable and drain, additional floor concrete to bury thereof and all other relevant works on the floor of the pump house, etc. in accordance with the working drawings submitted to and approved by the Inspection Committee.



### 7.3 Tender Drawings



DRAWING LIST

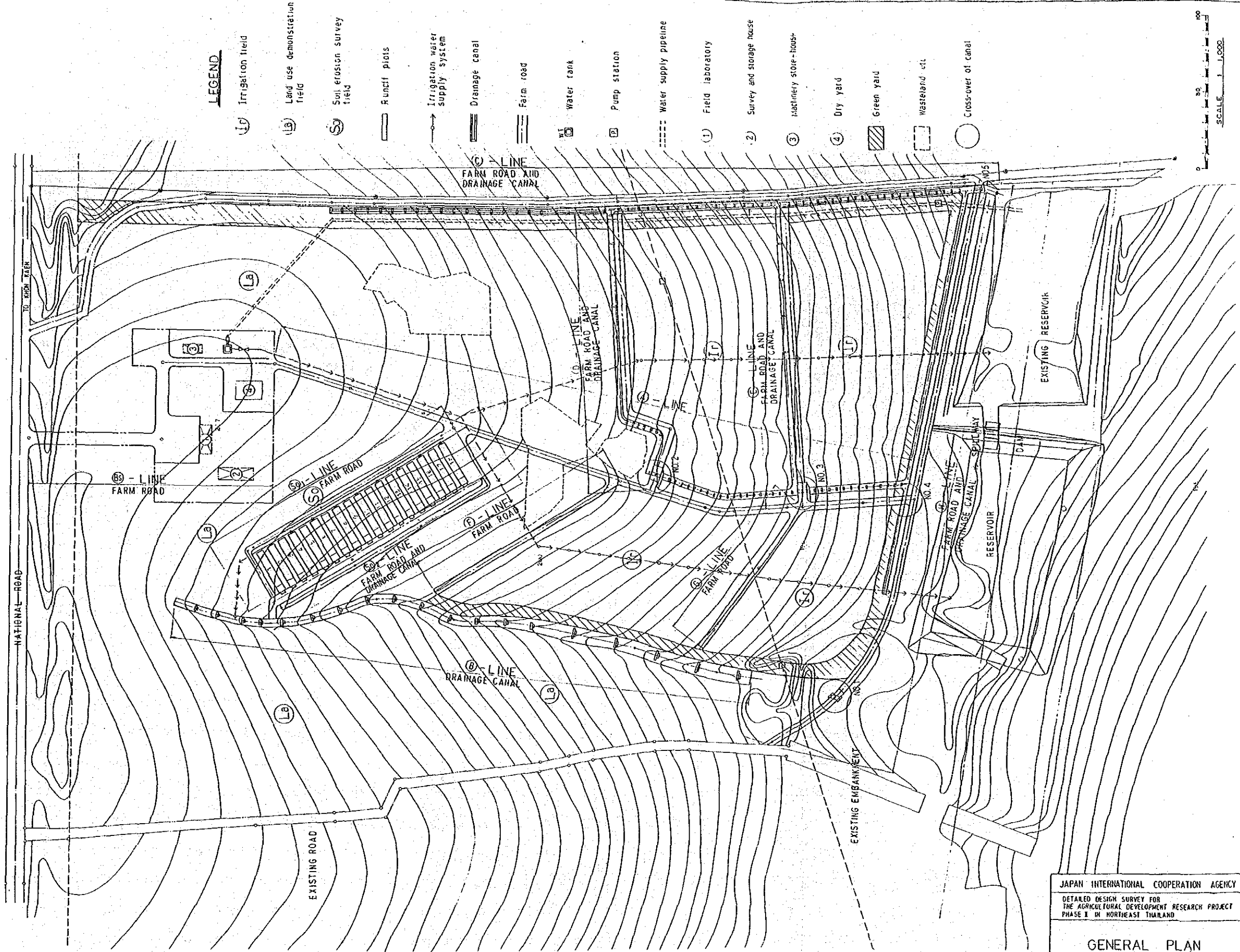
DRAWING NO.	TITLE
--- GENERAL ---	
1.	GENERAL PLAN
-- FARM ROAD AND DRAINAGE CANAL --	
2.	FARM ROAD (A) LINE, DRAINAGE CANAL (A) LINE PLAN AND PROFILE
3.	DRAINAGE CANAL (B) LINE PLAN AND PROFILE
4.	FARM ROAD (C) LINE, DRAINAGE CANAL (C) LINE PLAN AND PROFILE
5.	FARM ROAD (D), (E) LINE, DRAINAGE CANAL (D), (E) LINE PLAN AND PROFILE
6.	FARM ROAD (F), (G) LINE PLAN, PROFILE AND STANDARD SECTION
7.	FARM ROAD (H) LINE, DRAINAGE CANAL (H) LINE PLAN, PROFILE AND STANDARD SECTION
8.	FARM ROAD (SO1), (SO2) LINE, DRAINAGE CANAL (SO2) LINE PLAN AND PROFILE
9.	ROAD (BS) LINE PLAN, PROFILE AND STANDARD SECTION
10.	FARM ROAD (A) LINE, DRAINAGE CANAL (A) LINE STANDARD SECTION AND WIRE BOX FOR GABIONADE
11.	DRAINAGE CANAL (B) LINE STANDARD SECTION AND WIRE BOX FOR GABIONADE TYPE B-1
12.	DRAINAGE CANAL (B) LINE WIRE BOX FOR GABIONADE TYPE B-2 AND B-3
13.	FARM ROAD (C) LINE, DRAINAGE CANAL (C) LINE STANDARD SECTION AND WIRE BOX FOR GABIONADE
14.	FARM ROAD (D), (E) LINE, DRAINAGE CANAL (D), (E) LINE STANDARD SECTION AND WIRE BOX FOR GABIONADE
15.	CROSSOVER OF CANAL NO.1 (1/5)
16.	CROSSOVER OF CANAL NO.2 (2/5)
17.	CROSSOVER OF CANAL NO.3 (3/5)
18.	CROSSOVER OF CANAL NO.4 (4/5)
19.	CROSSOVER OF CANAL NO.5 (5/5)

DRAWING NO.	TITLE
--- RESERVOIR ---	
20.	RESERVOIR PLAN AND TYPICAL CROSS SECTION OF DAM
21.	CROSS SECTION OF RESERVOIR (1/5)
22.	CROSS SECTION OF RESERVOIR (2/5)
23.	CROSS SECTION OF RESERVIOR (3/5)
24.	CROSS SECTION OF RESERVOIR (4/5)
25.	CROSS SECTION OF RESERVOIR (5/5)
26.	SPILLWAY PLAN, CROSS SECTON AND BAR ARRANGEMENT
-- RUNOFF PLOT --	
27.	RUNOFF PLOT PLAN AND STANDARD SECTION
-- IRRIGATION FACILITIES --	
28.	WATER TANK, PLAN OF PIPELINE AND STANDARD SECTION OF PIPE SETTING
-- FARM FACILITIES --	
29.	INTERIOR, EXTERIOR FINISH SCHEDULE ELECTRICAL, PLUMBING INSTALLATION
30.	FIELD LABORATORY
31.	SURVEY AND STORAGE HOUSE
32.	MACHINERY STORE-HOUSE, PUMP STATION AND DRY YARD



DEMONSTRATION FARM  
FOR PROPER LAND USE

5M EL-209.330

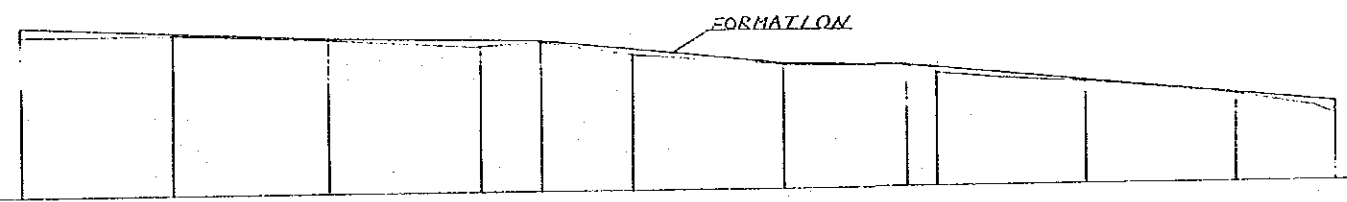
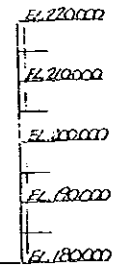
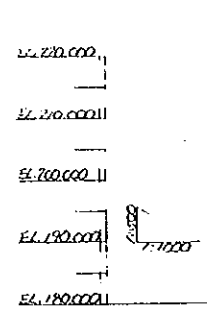
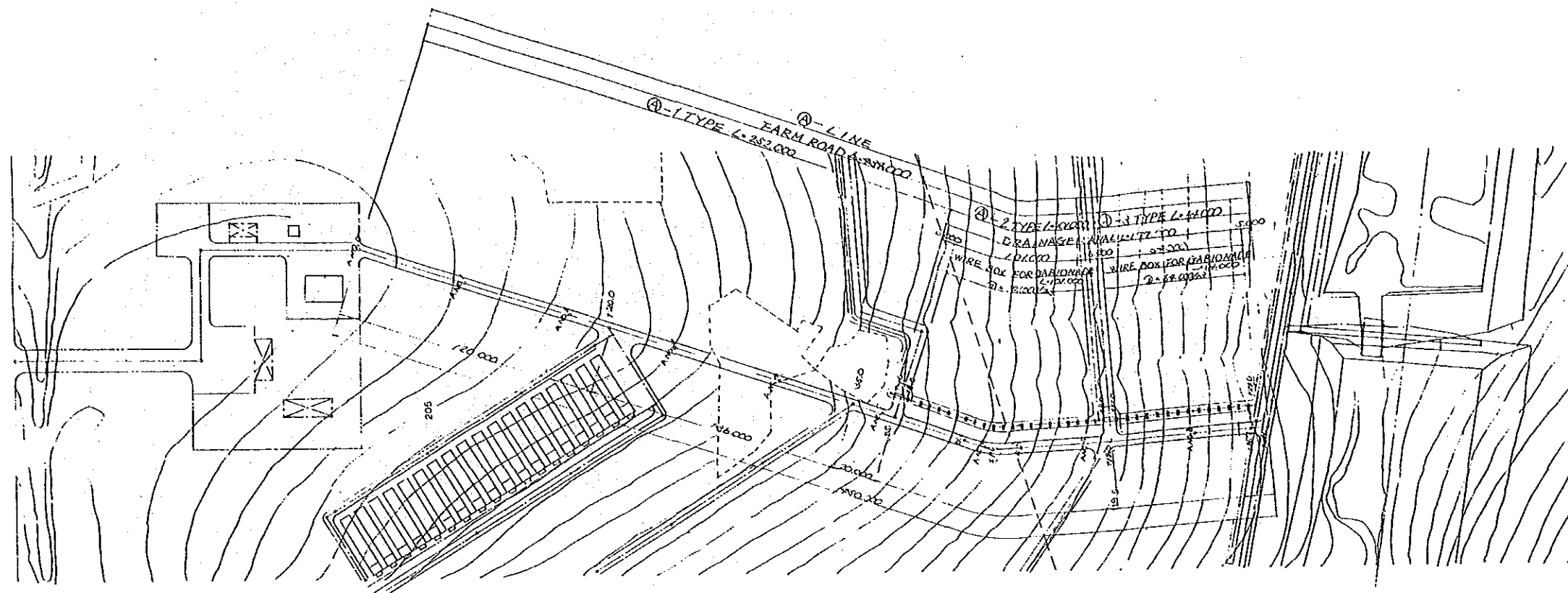


LEGEND

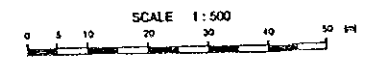
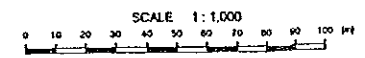
- (1) Irrigation field
- (2) Land use demonstration field
- (3) Soil erosion survey field
- (4) Runcif plots
- (5) Irrigation water supply system
- (6) Drainage canal
- (7) Farm road
- (8) Water tank
- (9) Pump station
- (10) Water supply pipeline
- (11) Field laboratory
- (12) Survey and storage house
- (13) Machinery store-house
- (14) Dry yard
- (15) Green yard
- (16) Waste land etc.
- (17) Cross-over of canal



JAPAN INTERNATIONAL COOPERATION AGENCY	
DETAILED DESIGN SURVEY FOR THE AGRICULTURAL DEVELOPMENT RESEARCH PROJECT PHASE I IN NORTHEAST THAILAND	
GENERAL PLAN	
PREPARED BY	DRAWING NO.
CHECKED BY	1



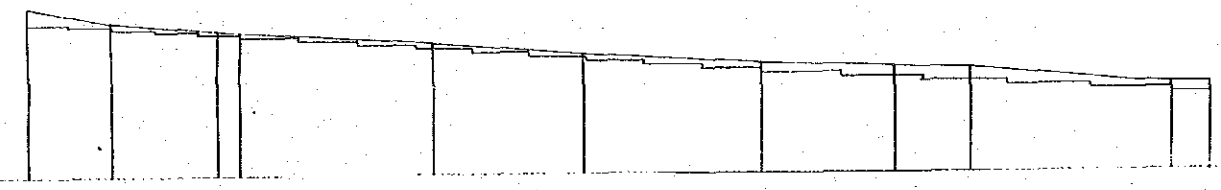
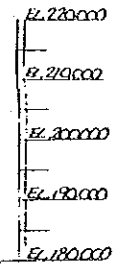
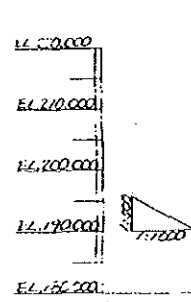
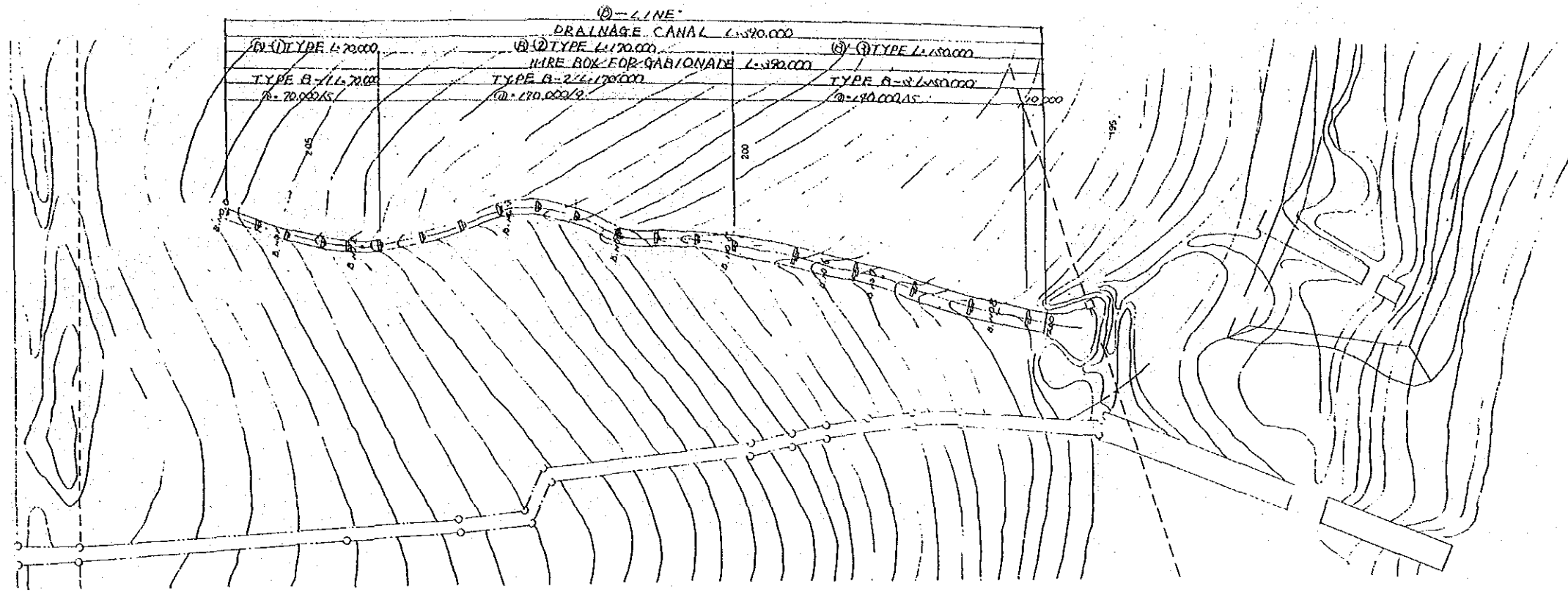
GRADE	0.273	0.456	0.100	0.312	0.100	0.721	0.662	0.100	0.867	1.022	0.100	0.873	0.477	1.500	1.504
EMBANKMENT															
CUTTING															
GROUND LEVEL	180.000	180.000	180.000	180.000	180.000	180.000	180.000	180.000	180.000	180.000	180.000	180.000	180.000	180.000	180.000
ACCUMULATED DISTANCE	0.000	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000	100.000	110.000	120.000	130.000	140.000
DISTANCE	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000
STATION	1+000	1+100	1+200	1+300	1+400	1+500	1+600	1+700	1+800	1+900	2+000	2+100	2+200	2+300	2+400
CURVE															
FORMATION OF FARM ROAD															
FORMATION OF DROP															
ACCUMULATED DISTANCE															
DISTANCE															
STATION															
FORMATION OF DRAINAGE CANAL															



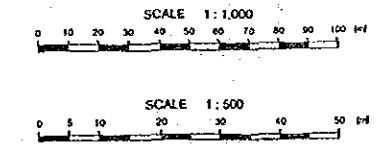
JAPAN INTERNATIONAL COOPERATION AGENCY  
 DETAILED DESIGN SURVEY FOR  
 THE AGRICULTURAL DEVELOPMENT RESEARCH PROJECT  
 PHASE II IN NORTHEAST THAILAND

FARM ROAD @ LINE, DRAINAGE  
 CANAL @ LINE PLAN AND PROFILE

PREPARED BY \_\_\_\_\_ DRAWING NO. 2  
 CHECKED BY \_\_\_\_\_



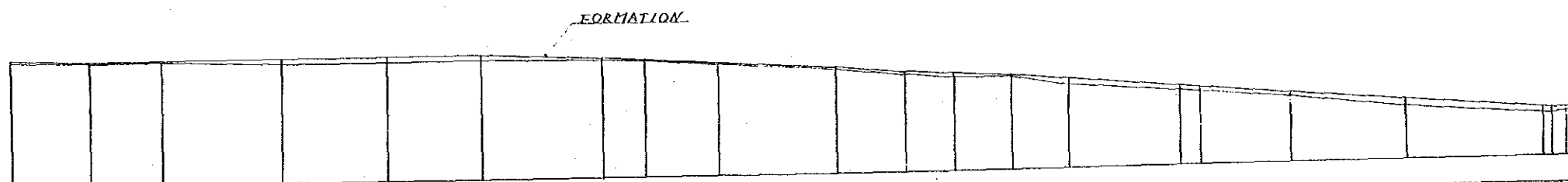
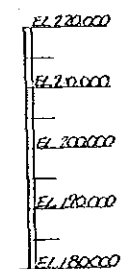
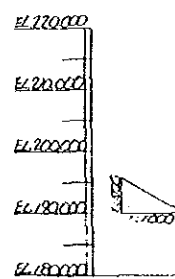
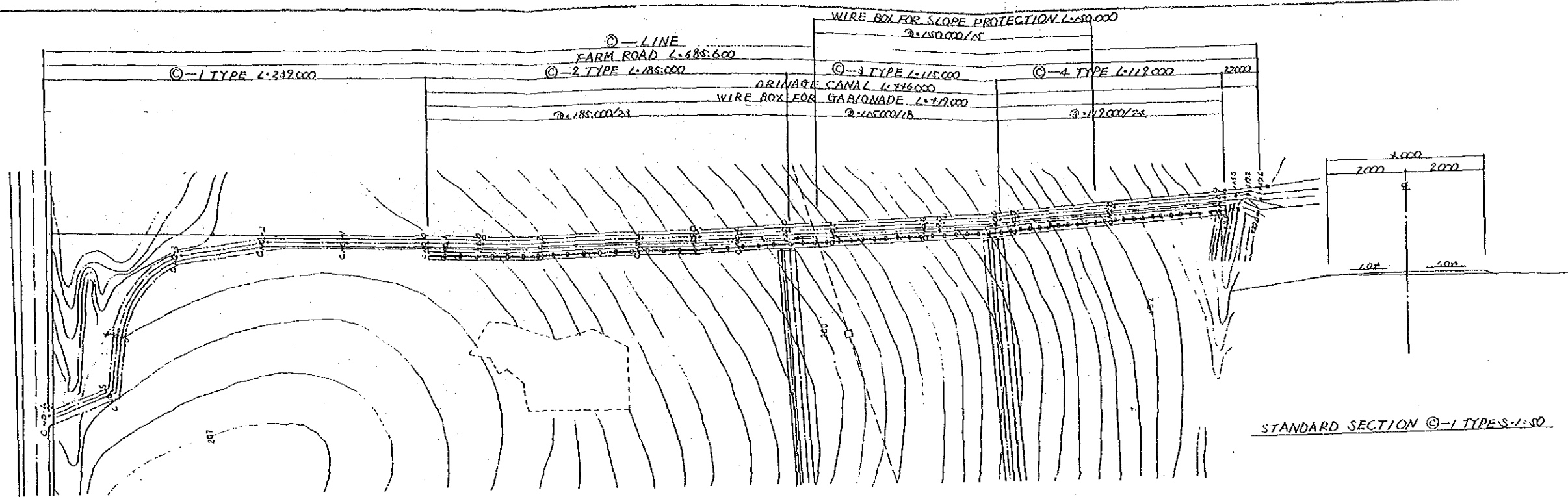
FORMATION OF DROP	A-2068		A-2728		A-3702		A-2728		A-2728	
EMBANKMENT										
CUTTING	0.850									
GROUND LEVEL	204.750	207.000	203.500	201.000	199.700	198.700	197.700	196.700	195.700	194.700
ACCUMULATED DISTANCE	0.000	27.000	62.000	70.000	152.000	182.000	240.000	280.000	340.000	410.000
DISTANCE	0.000	27.000	35.000	8.000	62.000	82.000	130.000	148.000	172.000	210.000
STATION	0+000	0+270	0+305	0+313	0+375	0+457	0+587	0+735	0+907	1+117
CURVE	VERTICAL CURVE									
FORMATION OF DRAINAGE CANAL	204.750	207.000	203.500	201.000	199.700	198.700	197.700	196.700	195.700	194.700



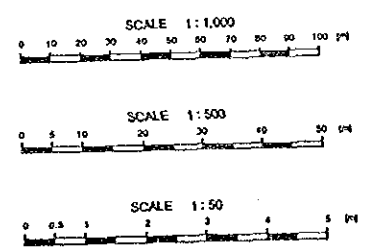
JAPAN INTERNATIONAL COOPERATION AGENCY  
 DETAILED DESIGN SURVEY FOR  
 THE AGRICULTURAL DEVELOPMENT RESEARCH PROJECT  
 PHASE II IN NORTHEAST THAILAND

**DRAINAGE CANAL @ LINE  
 PLAN AND PROFILE**

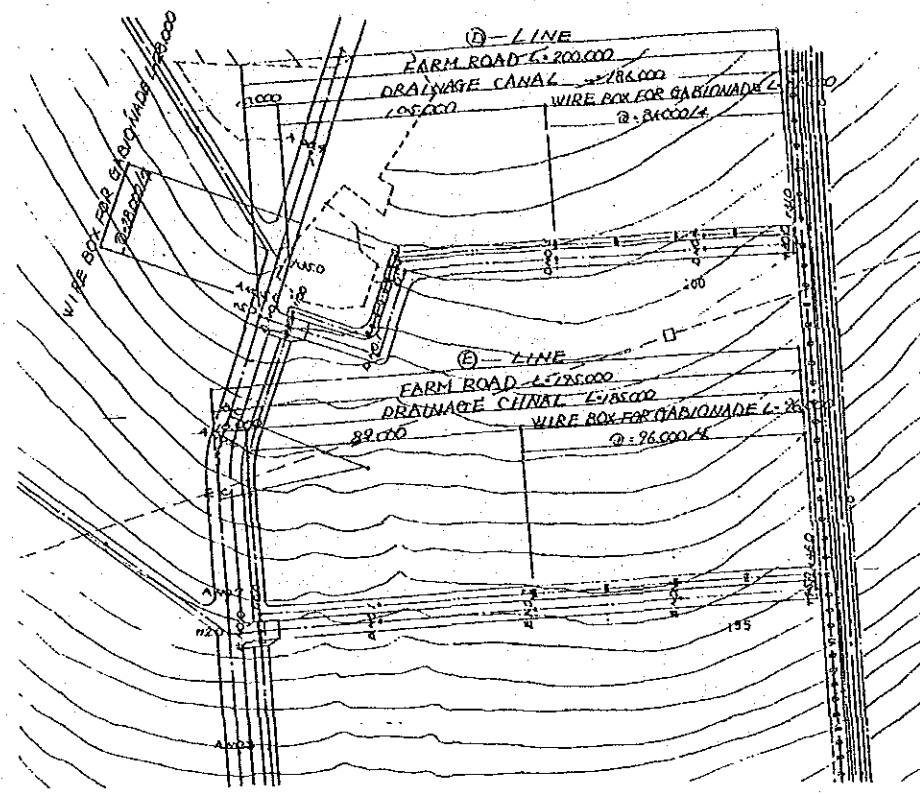
PREPARED BY \_\_\_\_\_ DRAWING NO. 3  
 CHECKED BY \_\_\_\_\_



FORMATION OF DRAINAGE CANAL	STATION	DISTANCE	ACCUMULATED DISTANCE	GROUND LEVEL	CUTTING	EMBANKMENT	SLOPE
207.250	CA 0.0	0.000	0.000	207.250		0.000	1:1
207.250	CA 0.1	0.250	0.250	207.250		0.000	1:1
207.250	CA 0.2	0.500	0.500	207.250		0.000	1:1
207.250	CA 0.3	0.750	0.750	207.250		0.000	1:1
207.250	CA 0.4	1.000	1.000	207.250		0.000	1:1
207.250	CA 0.5	1.250	1.250	207.250		0.000	1:1
207.250	CA 0.6	1.500	1.500	207.250		0.000	1:1
207.250	CA 0.7	1.750	1.750	207.250		0.000	1:1
207.250	CA 0.8	2.000	2.000	207.250		0.000	1:1
207.250	CA 0.9	2.250	2.250	207.250		0.000	1:1
207.250	CA 1.0	2.500	2.500	207.250		0.000	1:1
207.250	CA 1.1	2.750	2.750	207.250		0.000	1:1
207.250	CA 1.2	3.000	3.000	207.250		0.000	1:1
207.250	CA 1.3	3.250	3.250	207.250		0.000	1:1
207.250	CA 1.4	3.500	3.500	207.250		0.000	1:1
207.250	CA 1.5	3.750	3.750	207.250		0.000	1:1
207.250	CA 1.6	4.000	4.000	207.250		0.000	1:1
207.250	CA 1.7	4.250	4.250	207.250		0.000	1:1
207.250	CA 1.8	4.500	4.500	207.250		0.000	1:1
207.250	CA 1.9	4.750	4.750	207.250		0.000	1:1
207.250	CA 2.0	5.000	5.000	207.250		0.000	1:1
207.250	CA 2.1	5.250	5.250	207.250		0.000	1:1
207.250	CA 2.2	5.500	5.500	207.250		0.000	1:1
207.250	CA 2.3	5.750	5.750	207.250		0.000	1:1
207.250	CA 2.4	6.000	6.000	207.250		0.000	1:1
207.250	CA 2.5	6.250	6.250	207.250		0.000	1:1
207.250	CA 2.6	6.500	6.500	207.250		0.000	1:1
207.250	CA 2.7	6.750	6.750	207.250		0.000	1:1
207.250	CA 2.8	7.000	7.000	207.250		0.000	1:1
207.250	CA 2.9	7.250	7.250	207.250		0.000	1:1
207.250	CA 3.0	7.500	7.500	207.250		0.000	1:1
207.250	CA 3.1	7.750	7.750	207.250		0.000	1:1
207.250	CA 3.2	8.000	8.000	207.250		0.000	1:1
207.250	CA 3.3	8.250	8.250	207.250		0.000	1:1
207.250	CA 3.4	8.500	8.500	207.250		0.000	1:1
207.250	CA 3.5	8.750	8.750	207.250		0.000	1:1
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207.250	CA 3.7	9.250	9.250	207.250		0.000	1:1
207.250	CA 3.8	9.500	9.500	207.250		0.000	1:1
207.250	CA 3.9	9.750	9.750	207.250		0.000	1:1
207.250	CA 4.0	10.000	10.000	207.250		0.000	1:1
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207.250	CA 5.3	13.250	13.250	207.250		0.000	1:1
207.250	CA 5.4	13.500	13.500	207.250		0.000	1:1
207.250	CA 5.5	13.750	13.750	207.250		0.000	1:1
207.250	CA 5.6	14.000	14.000	207.250		0.000	1:1
207.250	CA 5.7	14.250	14.250	207.250		0.000	1:1
207.250	CA 5.8	14.500	14.500	207.250		0.000	1:1
207.250	CA 5.9	14.750	14.750	207.250		0.000	1:1
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207.250	CA 6.3	15.750	15.750	207.250		0.000	1:1
207.250	CA 6.4	16.000	16.000	207.250		0.000	1:1
207.250	CA 6.5	16.250	16.250	207.250		0.000	1:1
207.250	CA 6.6	16.500	16.500	207.250		0.000	1:1
207.250	CA 6.7	16.750	16.750	207.250		0.000	1:1
207.250	CA 6.8	17.000	17.000	207.250		0.000	1:1
207.250	CA 6.9	17.250	17.250	207.250		0.000	1:1
207.250	CA 7.0	17.500	17.500	207.250		0.000	1:1
207.250	CA 7.1	17.750	17.750	207.250		0.000	1:1
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207.250	CA 8.9	22.250	22.250	207.250		0.000	1:1
207.250	CA 9.0	22.500	22.500	207.250		0.000	1:1
207.250	CA 9.1	22.750	22.750	207.250		0.000	1:1
207.250	CA 9.2	23.000	23.000	207.250		0.000	1:1
207.250	CA 9.3	23.250	23.250	207.250		0.000	1:1
207.250	CA 9.4	23.500	23.500	207.250		0.000	1:1
207.250	CA 9.5	23.750	23.750	207.250		0.000	1:1
207.250	CA 9.6	24.000	24.000	207.250		0.000	1:1
207.250	CA 9.7	24.250	24.250	207.250		0.000	1:1
207.250	CA 9.8	24.500	24.500	207.250		0.000	1:1
207.250	CA 9.9	24.750	24.750	207.250		0.000	1:1
207.250	CA 10.0	25.000	25.000	207.250		0.000	1:1

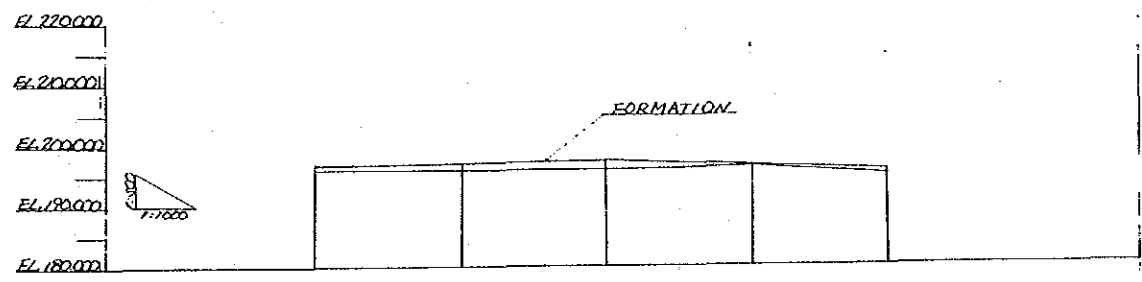
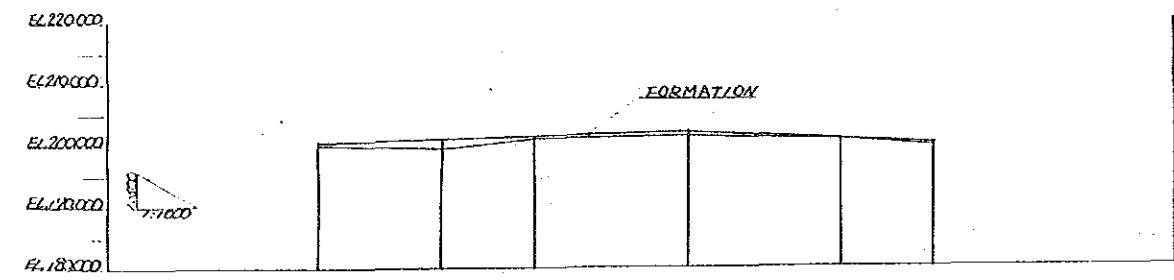


JAPAN INTERNATIONAL COOPERATION AGENCY  
 DETAILED DESIGN SURVEY FOR  
 THE AGRICULTURAL DEVELOPMENT RESEARCH PROJECT  
 PHASE II IN NORTHEAST THAILAND  
**FARM ROAD ① LINE**  
**DRAINAGE CANAL ② LINE**  
**PLAN AND PROFILE**  
 PREPARED BY \_\_\_\_\_ DRAWING NO. 4  
 CHECKED BY \_\_\_\_\_



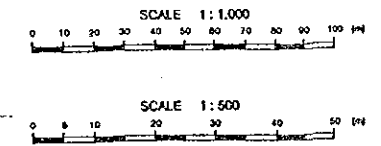
D - LINE

D - LINE

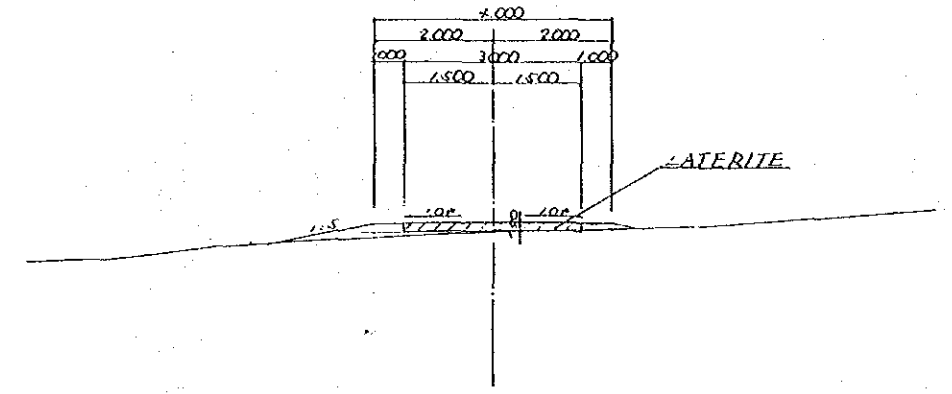
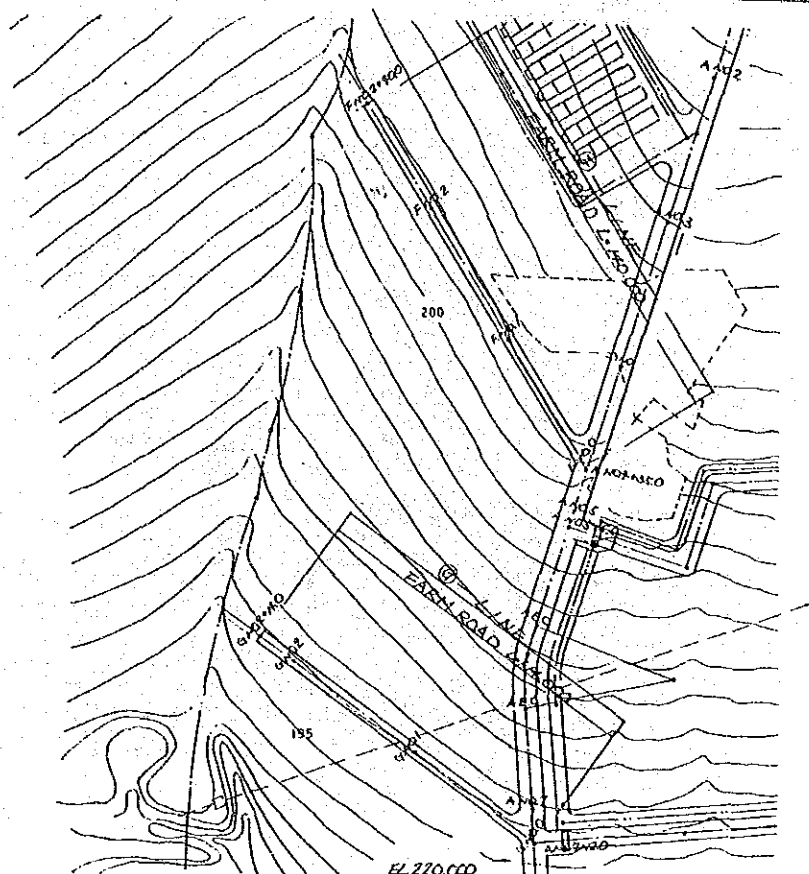


SLOPE					
EMBANKMENT	0.530	1.616	0.250	0.700	0.273
CUTTING					
GROUND LEVEL	199.879	199.451	199.289	199.129	199.048
ACCUMULATED DISTANCE	0.000	10.000	20.000	27.000	30.000
DISTANCE	0.000	10.000	10.000	7.000	3.000
STATION	0+000	0+100	0+200	0+270	0+300
CURVE					
FORMATION OF FARMROAD	199.879	199.451	199.289	199.129	199.048
SLOPE AND FORMATION OF DROP					
ACCUMULATED DISTANCE	0.000	2.000	8.000	10.000	13.000
DISTANCE	0.000	2.000	6.000	2.000	3.000
STATION	0+000	0+020	0+080	0+100	0+130
FORMATION OF DRAINAGE CANAL	199.879	199.451	199.289	199.129	199.048

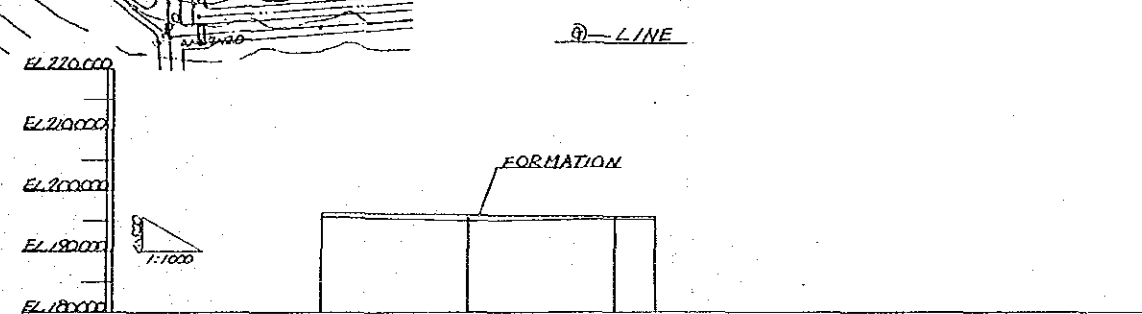
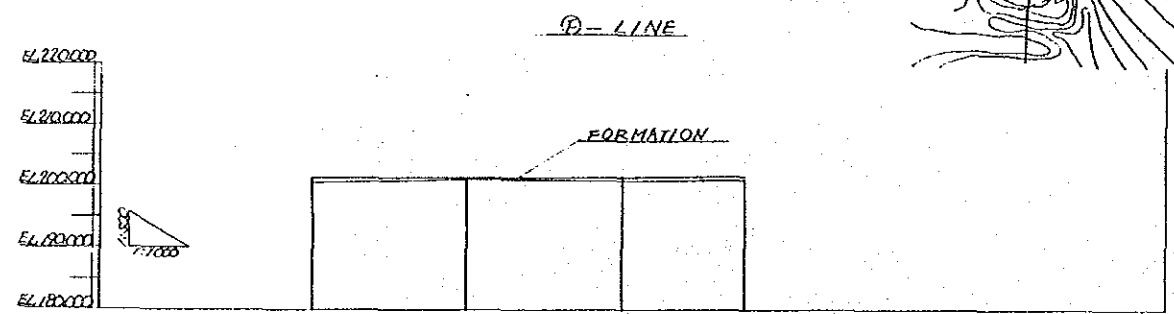
SLOPE					
EMBANKMENT					
CUTTING					
GROUND LEVEL	199.879	199.451	199.289	199.129	199.048
ACCUMULATED DISTANCE	0.000	10.000	20.000	27.000	30.000
DISTANCE	0.000	10.000	10.000	7.000	3.000
STATION	0+000	0+100	0+200	0+270	0+300
CURVE					
FORMATION OF FARMROAD	199.879	199.451	199.289	199.129	199.048
SLOPE AND FORMATION OF DROP					
ACCUMULATED DISTANCE	0.000	2.000	8.000	10.000	13.000
DISTANCE	0.000	2.000	6.000	2.000	3.000
STATION	0+000	0+020	0+080	0+100	0+130
FORMATION OF DRAINAGE CANAL	199.879	199.451	199.289	199.129	199.048



JAPAN INTERNATIONAL COOPERATION AGENCY  
 DETAILED DESIGN SURVEY FOR  
 THE AGRICULTURAL DEVELOPMENT RESEARCH PROJECT  
 PHASE II IN NORTHEAST THAILAND  
**FARM ROAD D-D LINE  
 DRAINAGE CANAL D-D LINE  
 PLAN AND PROFILE**  
 PREPARED BY \_\_\_\_\_ DRAWING NO. 5  
 CHECKED BY \_\_\_\_\_

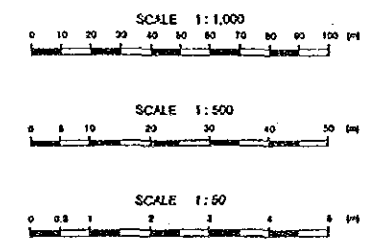


STANDARD SECTION S-1-50



SLOPE	1:0.4571			
EMBANKMENT	0.662	0.718	0.888	0.971
CUTTING				
GROUND LEVEL	192.381	190.541	188.845	188.171
ACCUMULATED DISTANCE	0.000	0.000	0.000	0.000
DISTANCE	0.000	0.000	0.000	0.000
STATION	1+000 (1+000.000)	1+000.000	1+000.000	1+000.000
CURVE				
FORMATION OF FARMROAD	192.381	190.541	188.845	188.171

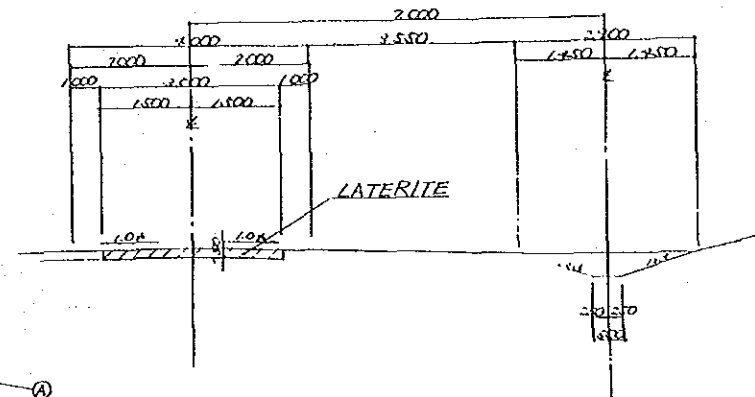
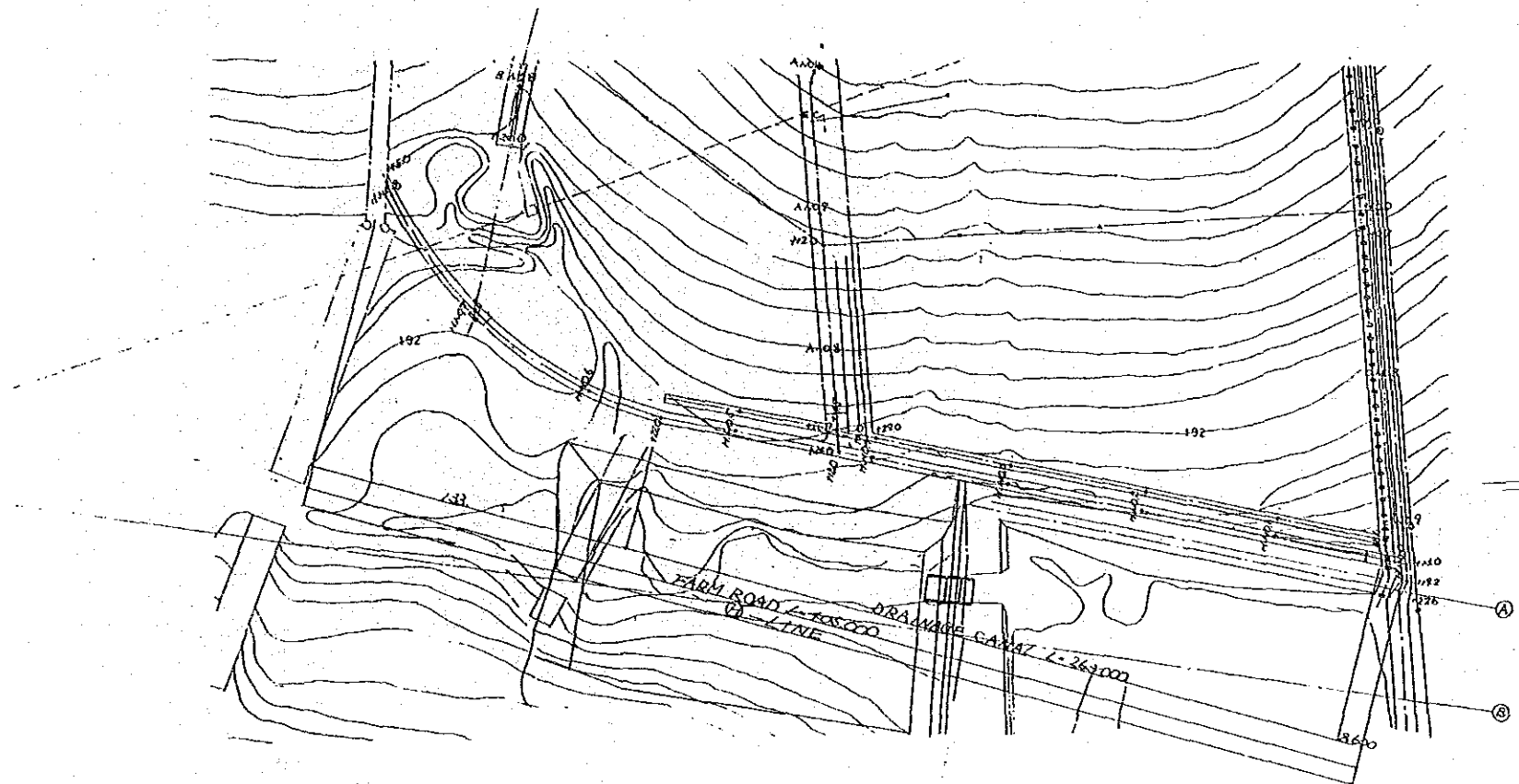
SLOPE	1:0.4571			
EMBANKMENT	0.662	0.718	0.888	0.971
CUTTING				
GROUND LEVEL	192.381	190.541	188.845	188.171
ACCUMULATED DISTANCE	0.000	0.000	0.000	0.000
DISTANCE	0.000	0.000	0.000	0.000
STATION	1+000 (1+000.000)	1+000.000	1+000.000	1+000.000
CURVE				
FORMATION OF FARMROAD	192.381	190.541	188.845	188.171



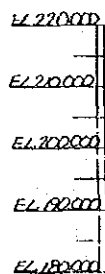
JAPAN INTERNATIONAL COOPERATION AGENCY  
 DETAILED DESIGN SURVEY FOR  
 THE AGRICULTURAL DEVELOPMENT RESEARCH PROJECT  
 PHASE II IN NORTHEAST THAILAND

FARM ROAD @ @ LINE  
 PLAN, PROFILE AND STANDARD SECTION

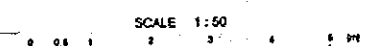
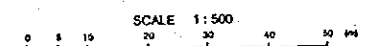
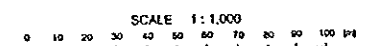
PREPARED BY \_\_\_\_\_ DRAWING NO. 6  
 CHECKED BY \_\_\_\_\_



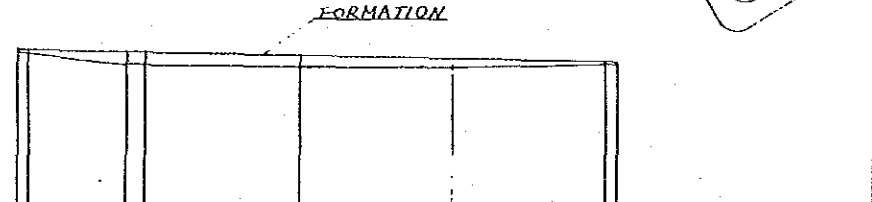
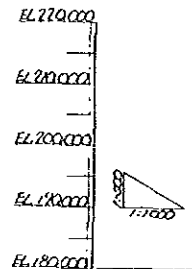
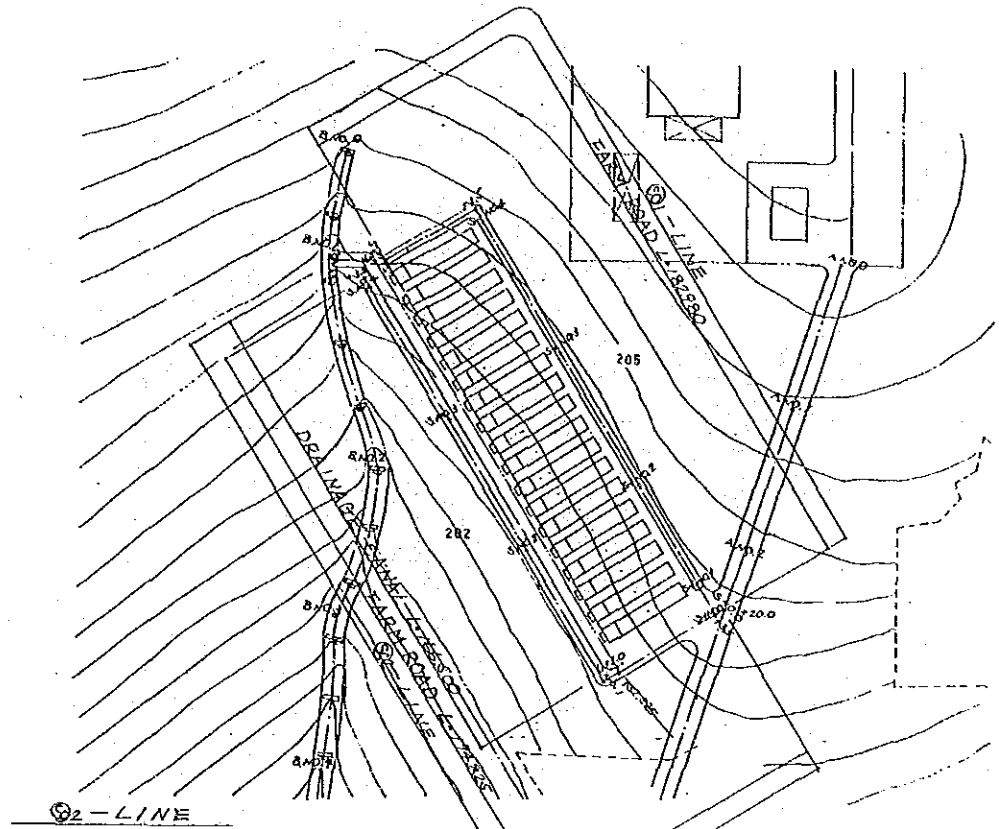
STANDARD SECTION S-1-50



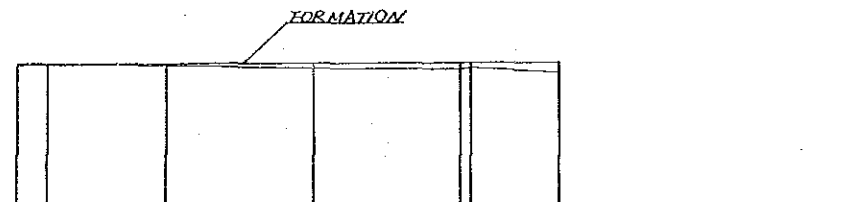
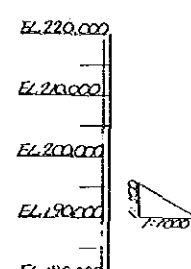
FORMATION	
SLOPE	1:0.9124
EMBANKMENT	1.000, 0.829, 0.208, 0.322, 0.906, 0.897, 0.197, 1.227, 1.942, 1.711, 0.326
CUTTING	
GROUND LEVEL	197.766, 197.807, 197.046, 197.385, 197.058, 197.058, 197.258, 197.258, 197.458, 197.458, 197.758, 197.758
ACCUMULATED DISTANCE	0.000, 10.000, 20.000, 30.000, 40.000, 50.000, 60.000, 70.000, 80.000, 90.000, 100.000, 110.000, 120.000, 130.000, 140.000, 150.000, 160.000, 170.000, 180.000, 190.000, 200.000
DISTANCE	0.000, 10.000, 20.000, 30.000, 40.000, 50.000, 60.000, 70.000, 80.000, 90.000, 100.000, 110.000, 120.000, 130.000, 140.000, 150.000, 160.000, 170.000, 180.000, 190.000, 200.000
STATION	1+000, 1+010, 1+020, 1+030, 1+040, 1+050, 1+060, 1+070, 1+080, 1+090, 1+100, 1+110, 1+120, 1+130, 1+140, 1+150, 1+160, 1+170, 1+180, 1+190, 1+200
CURVE	
FORMATION OF FARM ROAD	197.766, 197.807, 197.046, 197.385, 197.058, 197.058, 197.258, 197.258, 197.458, 197.458, 197.758, 197.758
SLOPE	1:0.9124
ACCUMULATED DISTANCE	0.000, 10.000, 20.000, 30.000, 40.000, 50.000, 60.000, 70.000, 80.000, 90.000, 100.000, 110.000, 120.000, 130.000, 140.000, 150.000, 160.000, 170.000, 180.000, 190.000, 200.000
DISTANCE	0.000, 10.000, 20.000, 30.000, 40.000, 50.000, 60.000, 70.000, 80.000, 90.000, 100.000, 110.000, 120.000, 130.000, 140.000, 150.000, 160.000, 170.000, 180.000, 190.000, 200.000
STATION	1+000, 1+010, 1+020, 1+030, 1+040, 1+050, 1+060, 1+070, 1+080, 1+090, 1+100, 1+110, 1+120, 1+130, 1+140, 1+150, 1+160, 1+170, 1+180, 1+190, 1+200
FORMATION OF DRAINAGE CANAL	197.766, 197.807, 197.046, 197.385, 197.058, 197.058, 197.258, 197.258, 197.458, 197.458, 197.758, 197.758



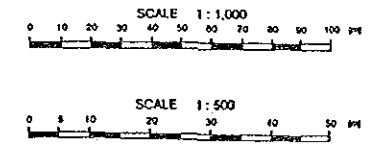
JAPAN INTERNATIONAL COOPERATION AGENCY  
 DETAILED DESIGN SURVEY FOR  
 THE AGRICULTURAL DEVELOPMENT RESEARCH PROJECT  
 PHASE II IN NORTHEAST THAILAND  
**FARM ROAD ① LINE  
 DRAINAGE CANAL ② LINE**  
 PLAN, PROFILE AND STANDARD SECTION  
 PREPARED BY  
 CHECKED BY  
 DRAWING NO.  
**7**



SLOPE	1:1000				
EMBANKMENT	0.100	0.384	1.500	1.500	0.384
CUTTING					
GROUND LEVEL	207.581	207.581	207.581	207.581	207.581
ACCUMULATED DISTANCE	0.000	3.000	15.000	30.000	33.000
DISTANCE	0.000	3.000	12.000	27.000	33.000
STATION	1+00.00	1+03.00	1+15.00	1+42.00	1+75.00
CURVE					
FORMATION OF FARRHOND					
SLOPE	1:1000				
ACCUMULATED DISTANCE	0.000	15.000	30.000	45.000	58.000
DISTANCE	0.000	15.000	15.000	15.000	23.000
STATION	1+00.00	1+15.00	1+30.00	1+45.00	1+68.00
FORMATION OF DRAINAGE CANAL					



SLOPE	1:1000				
EMBANKMENT	0.208	0.082	0.192	0.227	0.227
CUTTING					
GROUND LEVEL	207.581	207.581	207.581	207.581	207.581
ACCUMULATED DISTANCE	0.000	10.000	20.000	30.000	42.000
DISTANCE	0.000	10.000	10.000	10.000	18.000
STATION	1+00.00	1+10.00	1+20.00	1+30.00	1+48.00
CURVE					
FORMATION					



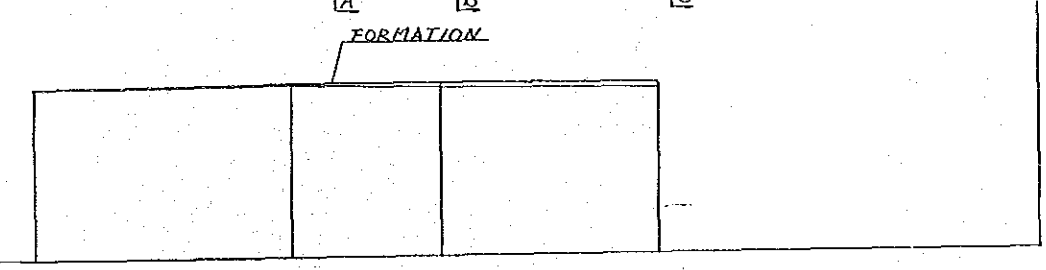
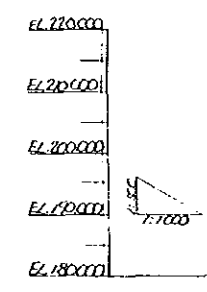
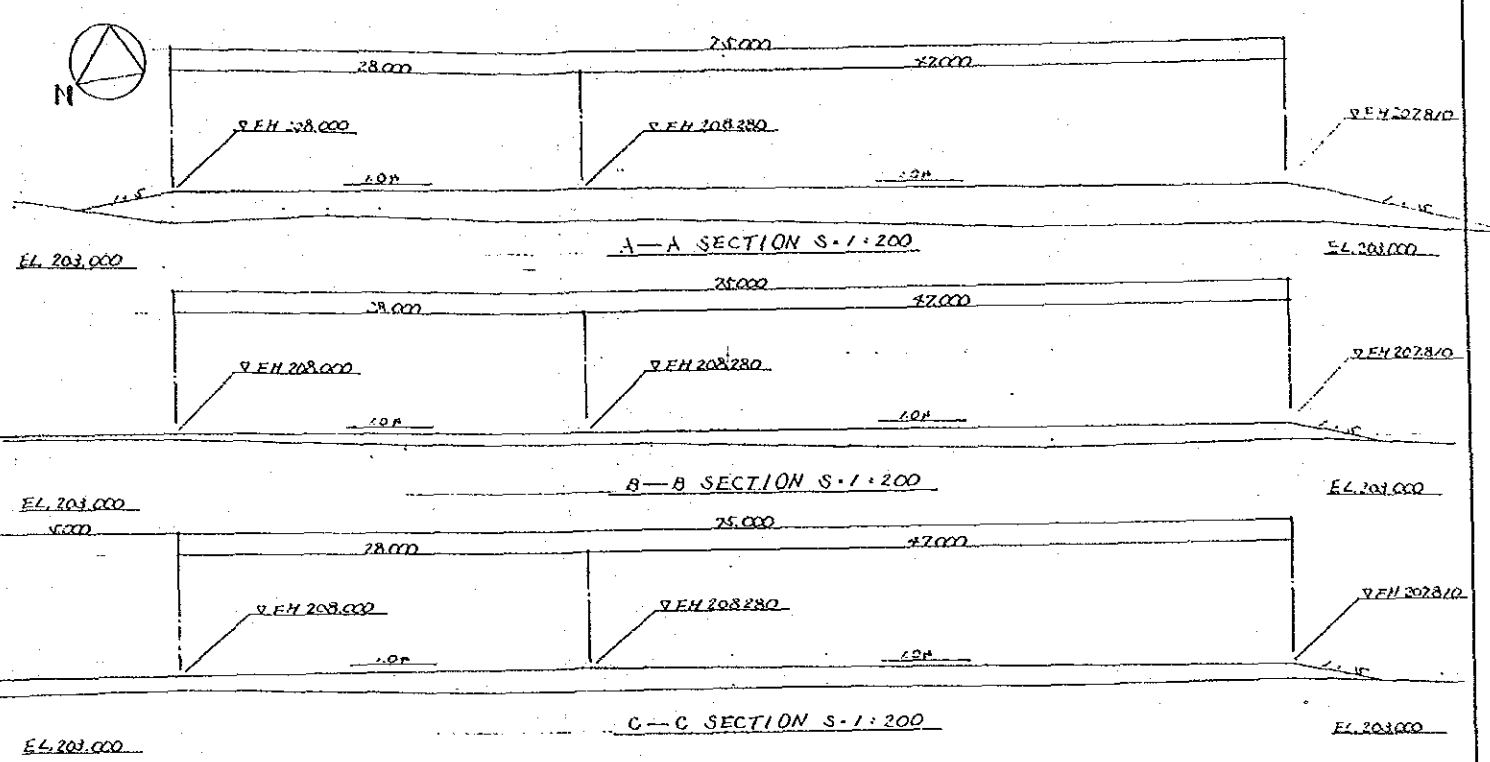
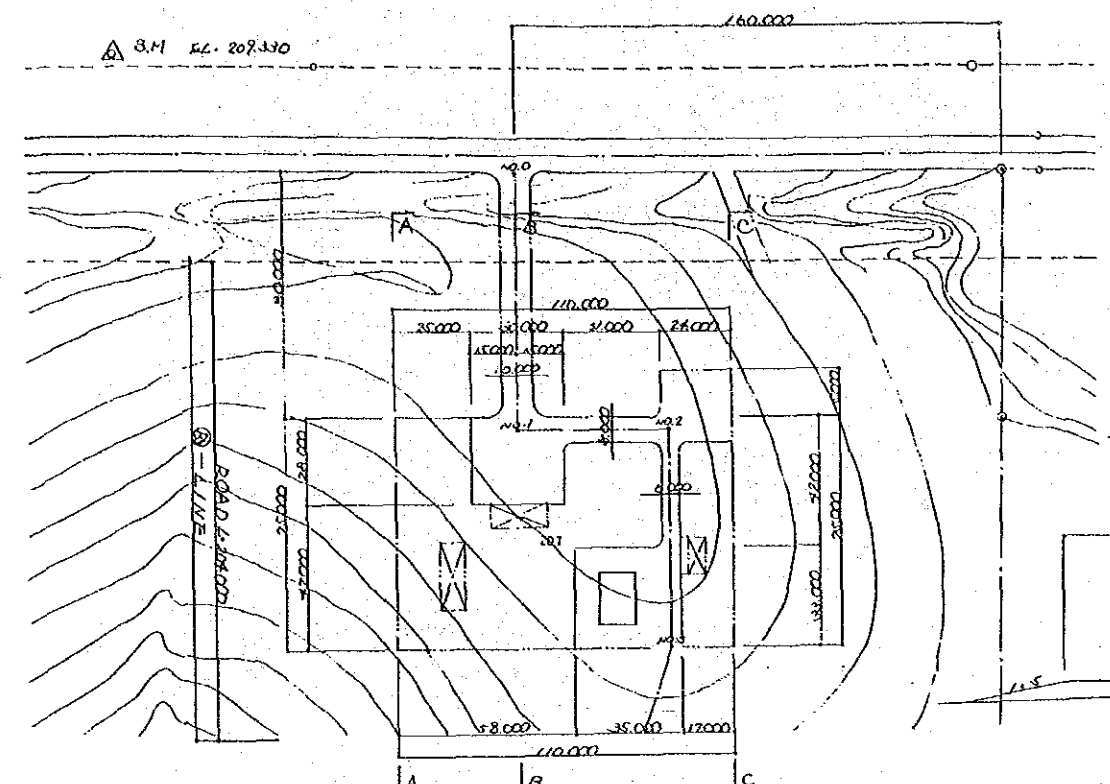
JAPAN INTERNATIONAL COOPERATION AGENCY  
 DETAILED DESIGN SURVEY FOR  
 THE AGRICULTURAL DEVELOPMENT RESEARCH PROJECT  
 PHASE II IN NORTHEAST THAILAND

FARM ROAD 500/500 LINE  
 DRAINAGE CANAL 500 LINE  
 PLAN AND PROFILE

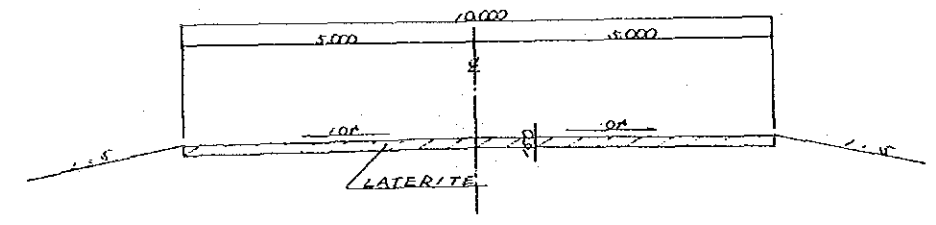
PREPARED BY \_\_\_\_\_ DRAWING NO. 8  
 CHECKED BY \_\_\_\_\_



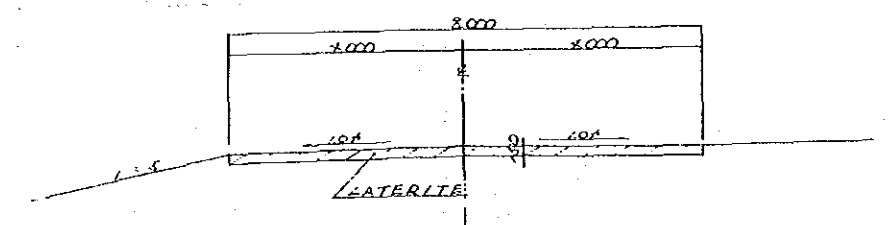
PLAN S-1:1,000



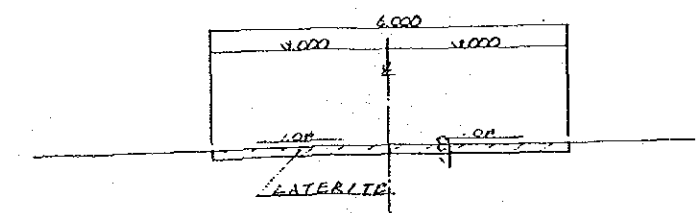
SLOPE	1:0.921	1:0.828	1:0.828	1:0.828
EMBANKMENT	0.000	0.000	0.000	0.000
CUTTING				
GROUND LEVEL	207.250	207.250	207.250	207.250
ACCUMULATED DISTANCE	0.000	59.000	118.000	177.000
DISTANCE	0.000	59.000	118.000	177.000
STATION	No. 0	No. 1	No. 2	No. 3
CURVE				
FORMATION	207.250	208.000	208.000	208.000



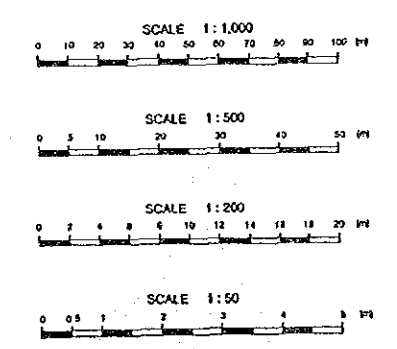
STANDARD SECTION ① TYPE S-1:50



STANDARD SECTION ② TYPE S-1:50



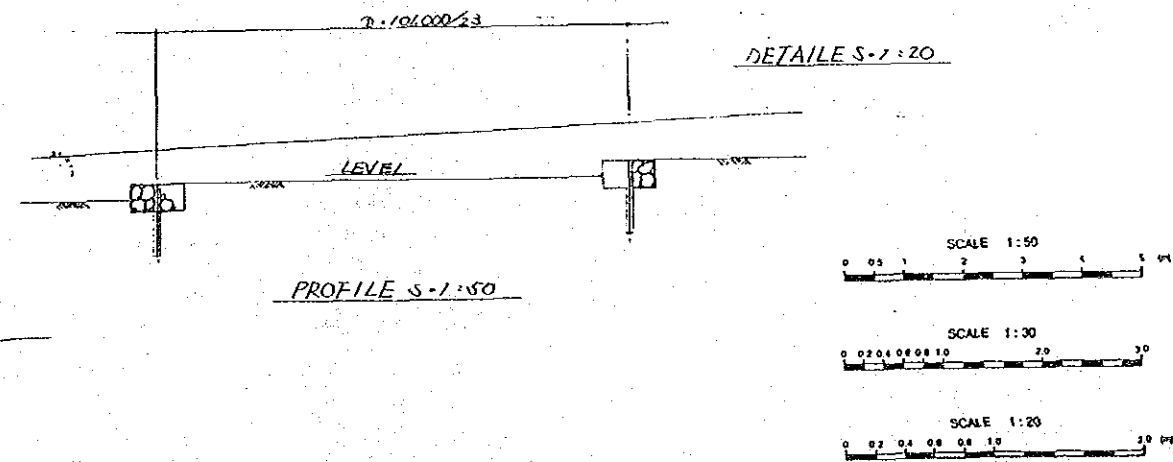
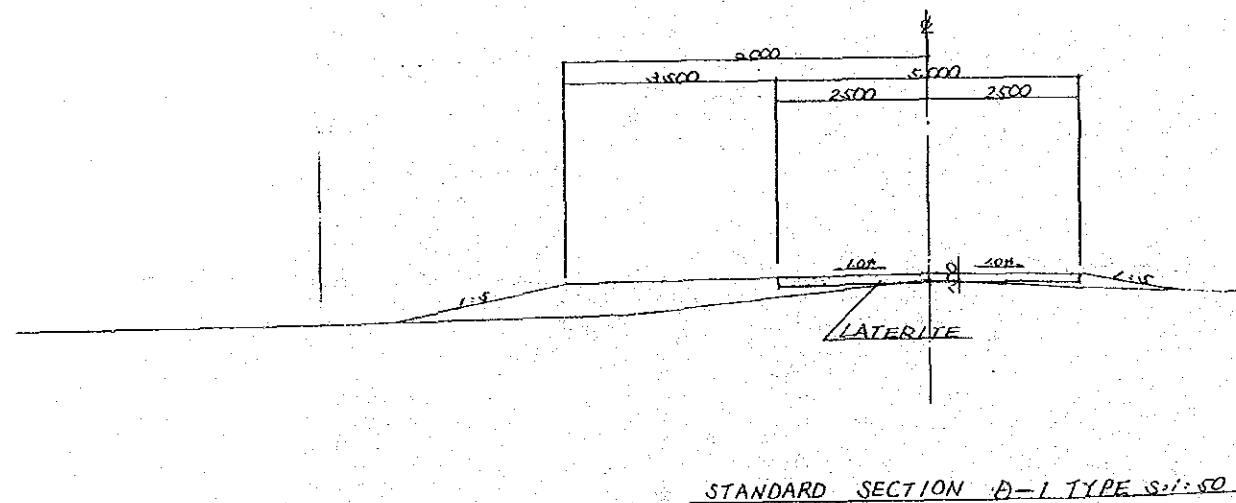
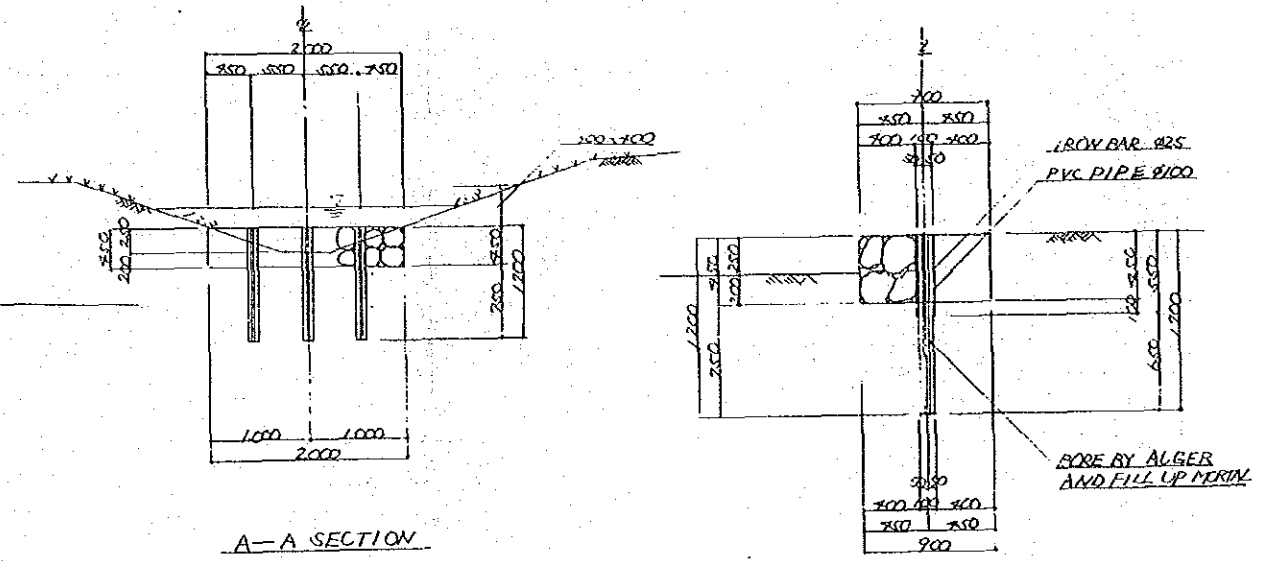
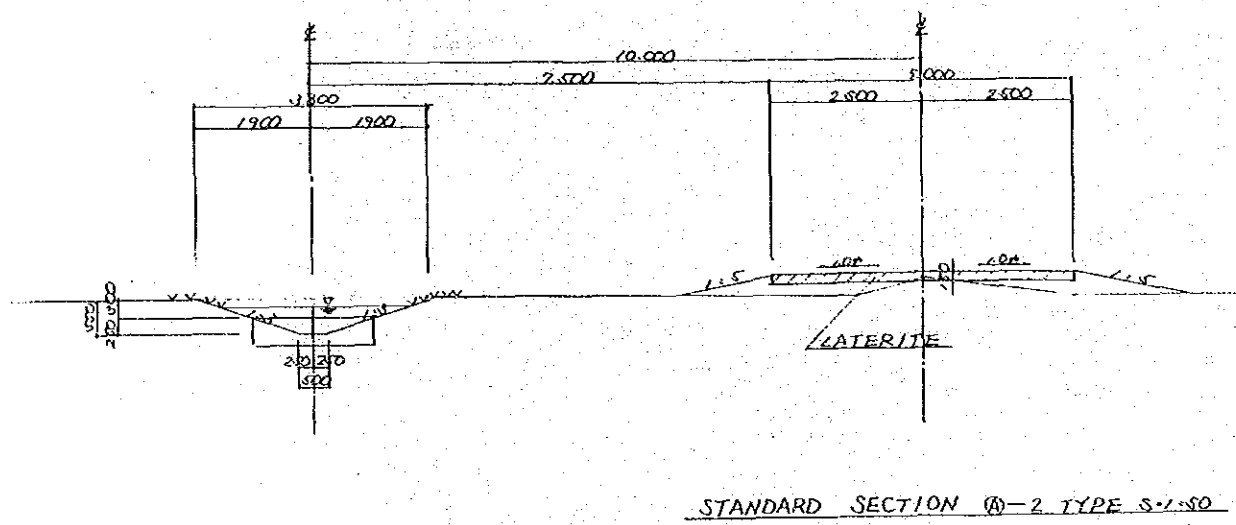
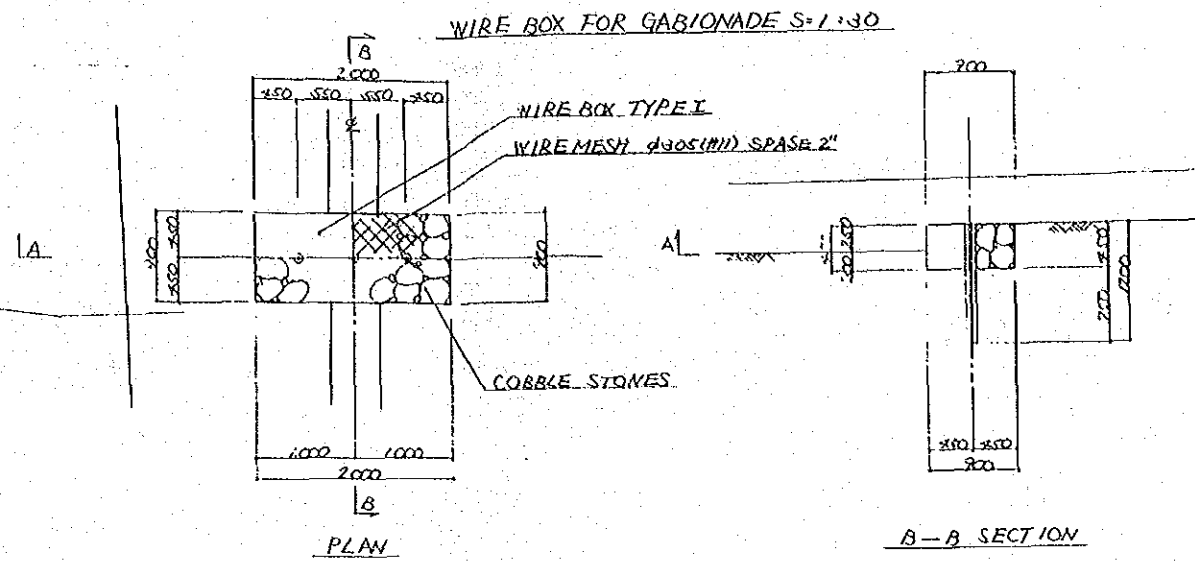
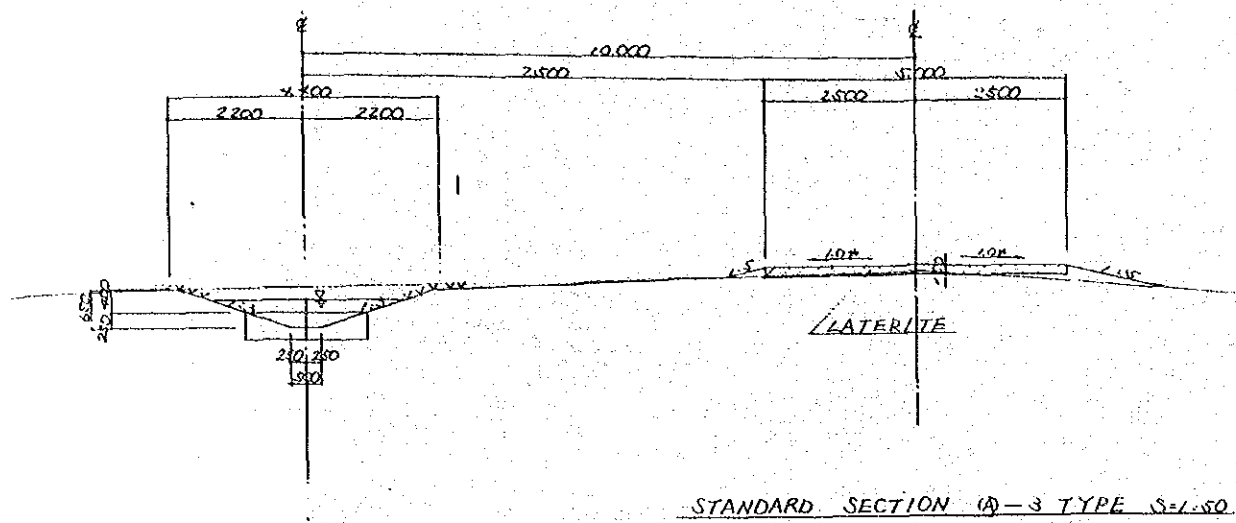
STANDARD SECTION ③ TYPE S-1:50



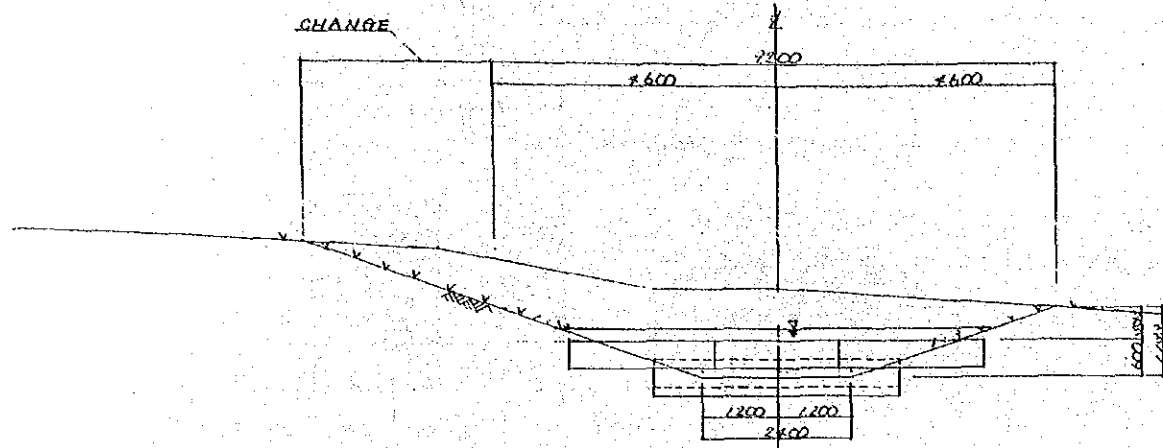
JAPAN INTERNATIONAL COOPERATION AGENCY  
 DETAILED DESIGN SURVEY FOR  
 THE AGRICULTURAL DEVELOPMENT RESEARCH PROJECT  
 PHASE II IN NORTHEAST THAILAND

**ROAD LINE**  
 PLAN, PROFILE AND STANDARD SECTION

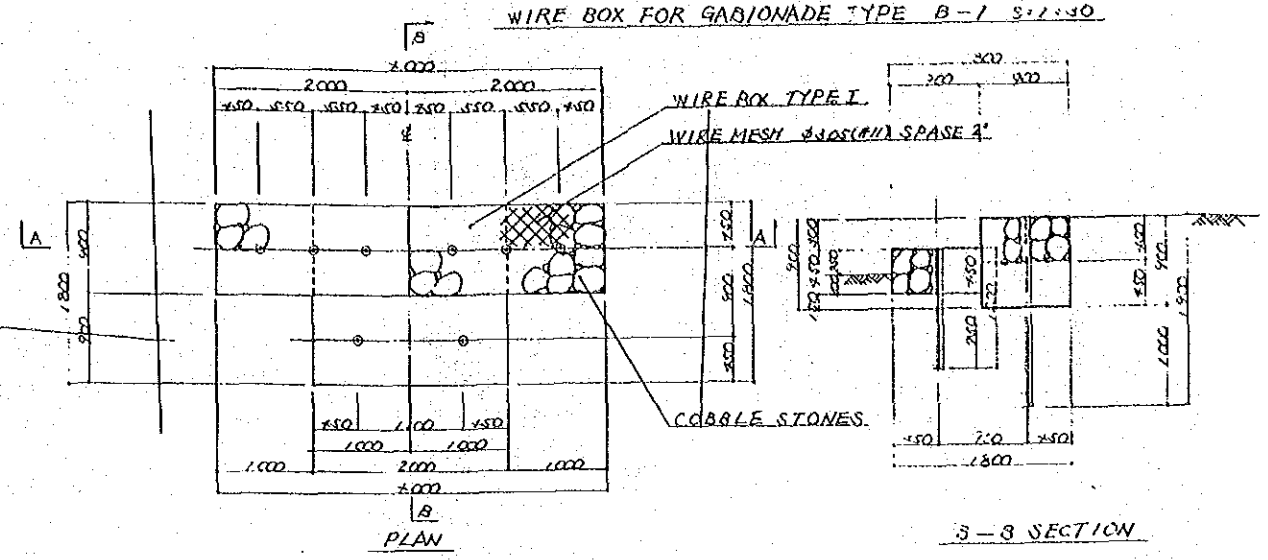
PREPARED BY	DRAWING NO.
CHECKED BY	9



JAPAN INTERNATIONAL COOPERATION AGENCY	
DETAILED DESIGN SURVEY FOR THE AGRICULTURAL DEVELOPMENT RESEARCH PROJECT PHASE II IN NORTHEAST THAILAND	
FARM ROAD (A) LINE DRAINAGE CANAL (A) LINE STANDARD SECTION AND WIRE BOX FOR GABIONADE	
PREPARED BY	DRAWING NO.
CHECKED BY	10

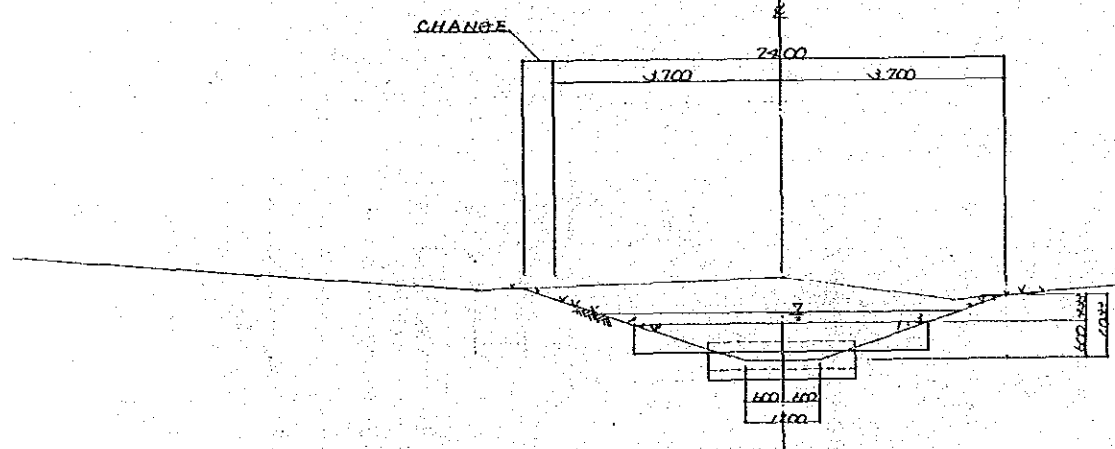


STANDARD SECTION ⑤-⑤ TYPE S-1:50

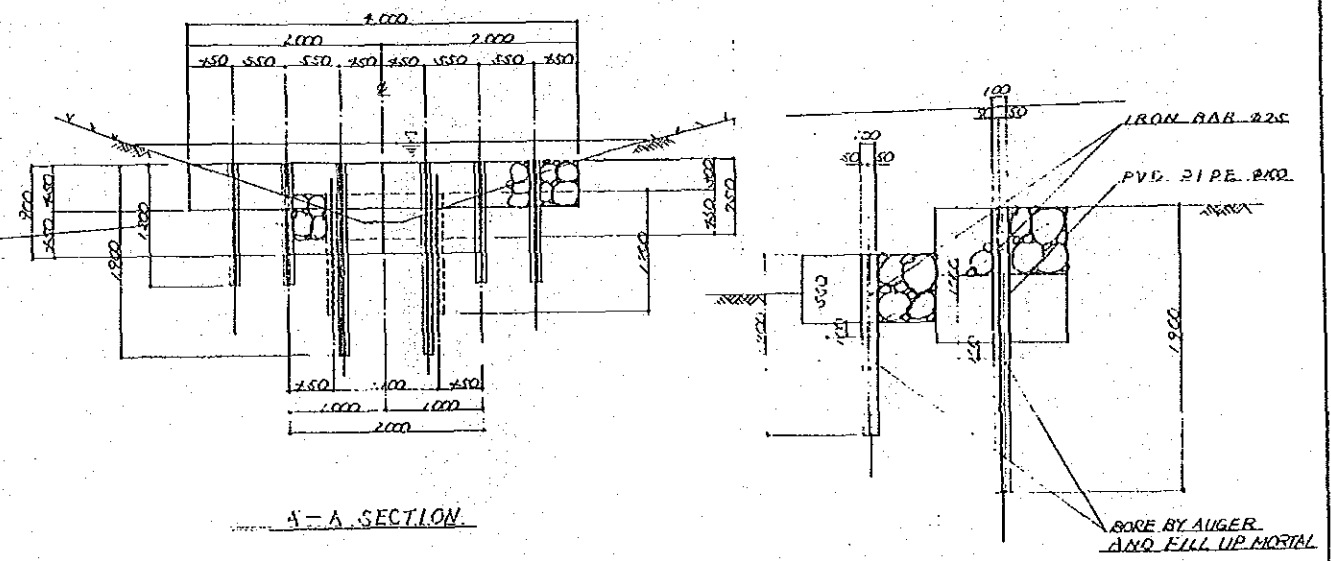


PLAN

B-B SECTION

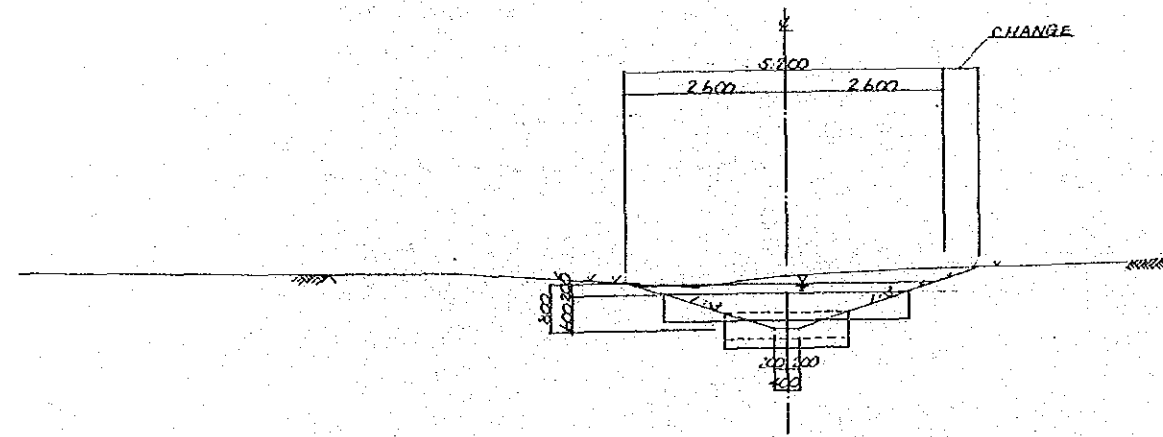


STANDARD SECTION ⑥-⑥ TYPE S-1:50

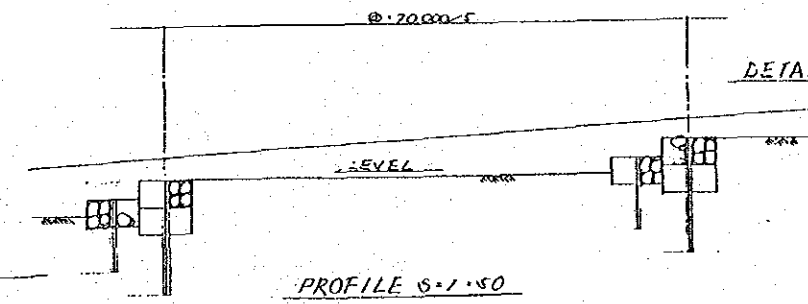


A-A SECTION

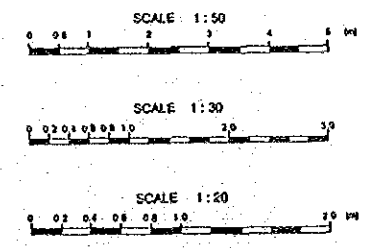
DETAIL 3-1:20



STANDARD SECTION ⑦-⑦ TYPE S-1:50

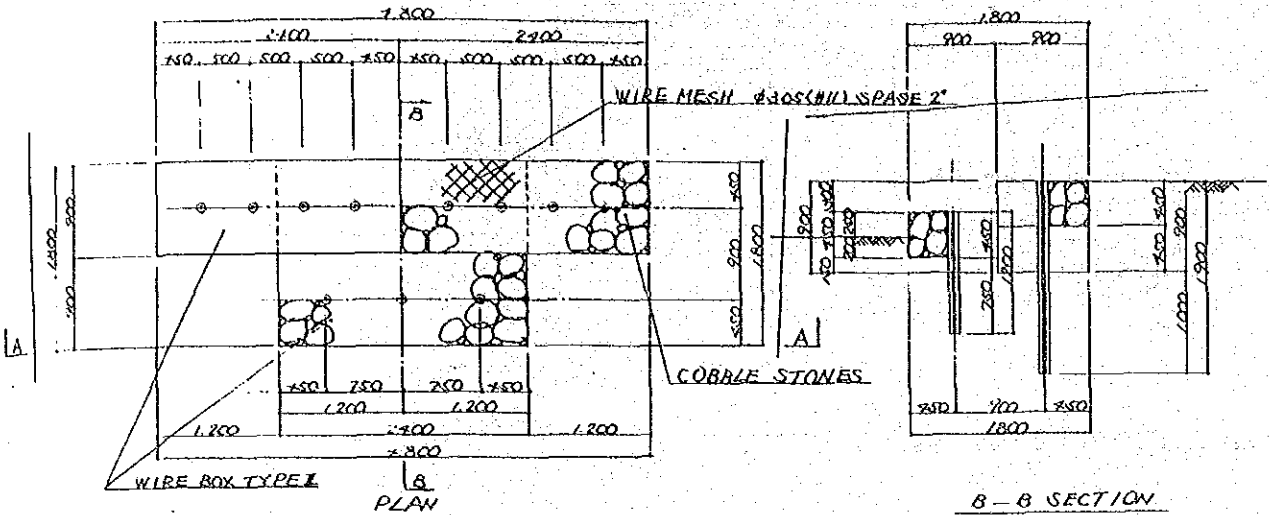


PROFILE ⑥-1:50

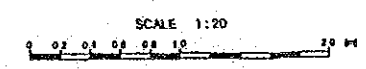
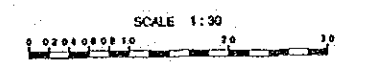
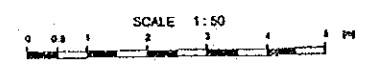
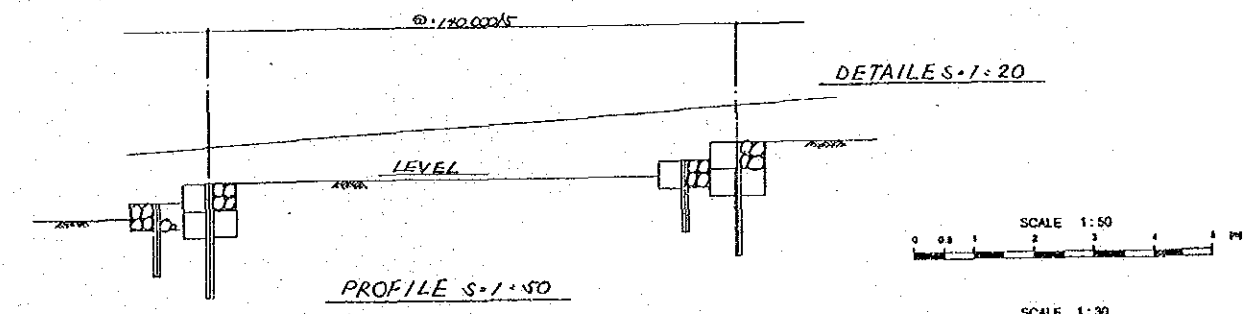
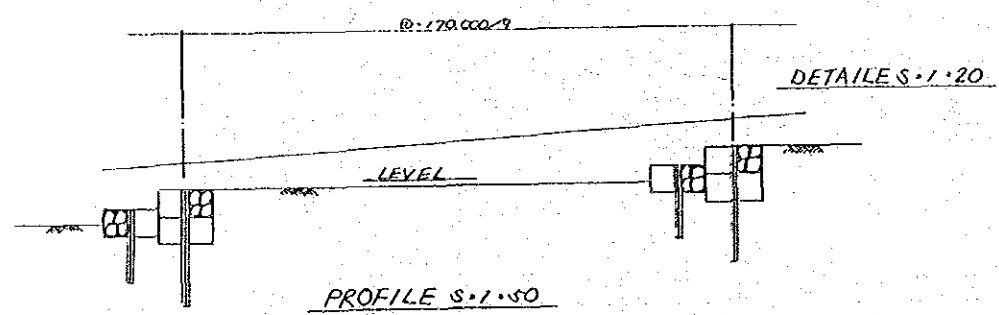
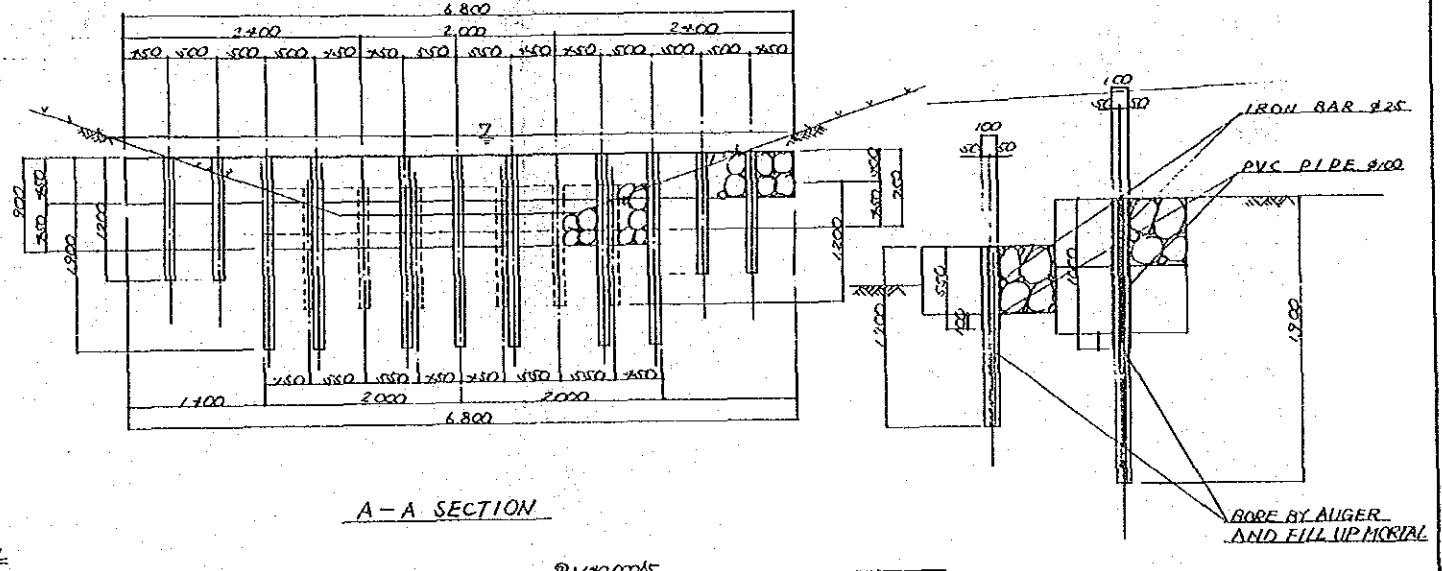
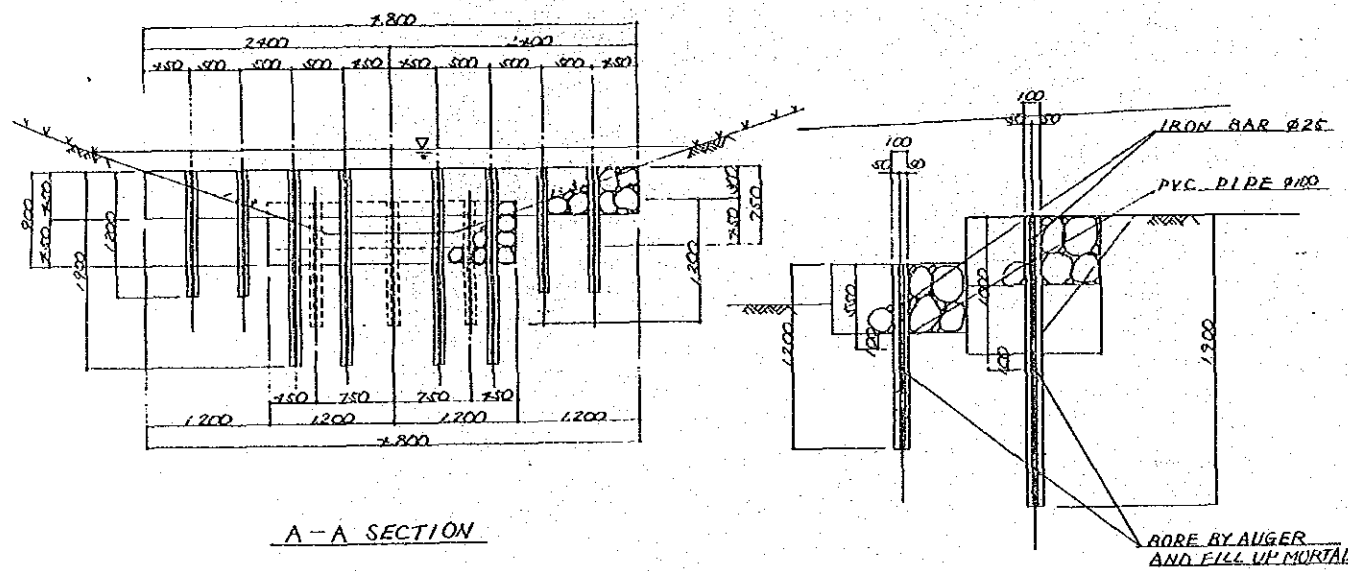
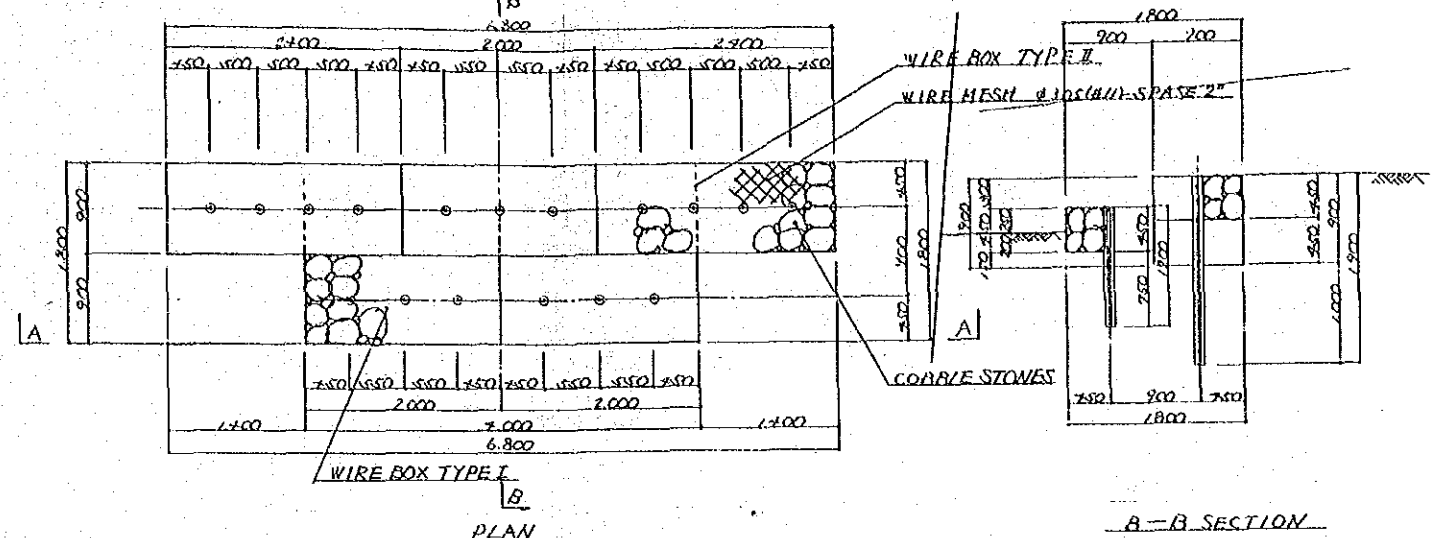


JAPAN INTERNATIONAL COOPERATION AGENCY	
DETAILED DESIGN SURVEY FOR THE AGRICULTURAL DEVELOPMENT RESEARCH PROJECT PHASE II IN NORTHEAST THAILAND	
DRAINAGE CANAL ⑥ LINE STANDARD SECTION AND WIRE BOX FOR GABIONADE TYPE B-1	
PREPARED BY	DRAWING NO.
CHECKED BY	11

WIRE BOX FOR GABIONADE TYPE B-2 S-1.50

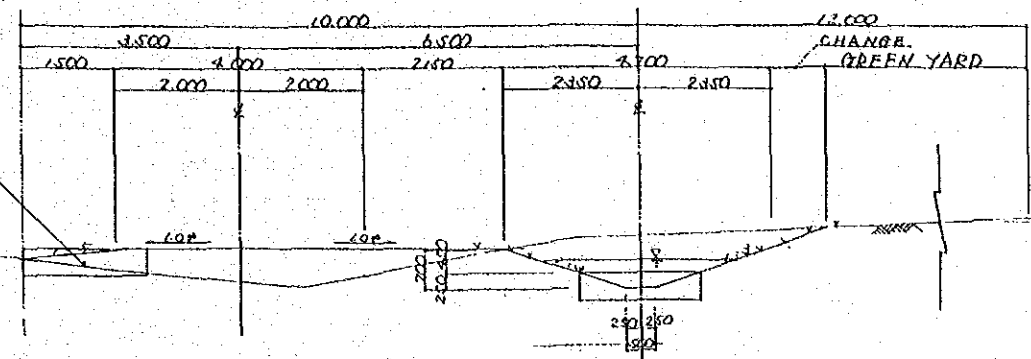


WIRE BOX FOR GABIONADE TYPE B-3 S-1.50



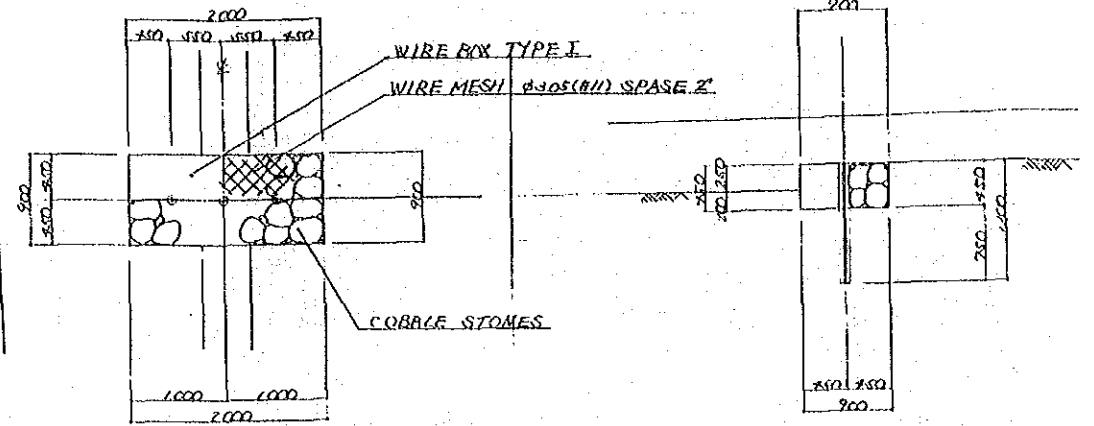
JAPAN INTERNATIONAL COOPERATION AGENCY	
DETAILED DESIGN SURVEY FOR THE AGRICULTURAL DEVELOPMENT RESEARCH PROJECT PHASE II IN NORTHEAST THAILAND	
DRAINAGE CANAL @ LINE WIRE BOX FOR GABIONADE TYPE B-2 AND B-3	
PREPARED BY	DRAWING NO.
CHECKED BY	12

WIRE BOX FOR SLOPE PROTECTION  
WIRE BOX TYPE I



STANDARD SECTION ©-1 TYPE S-1:30

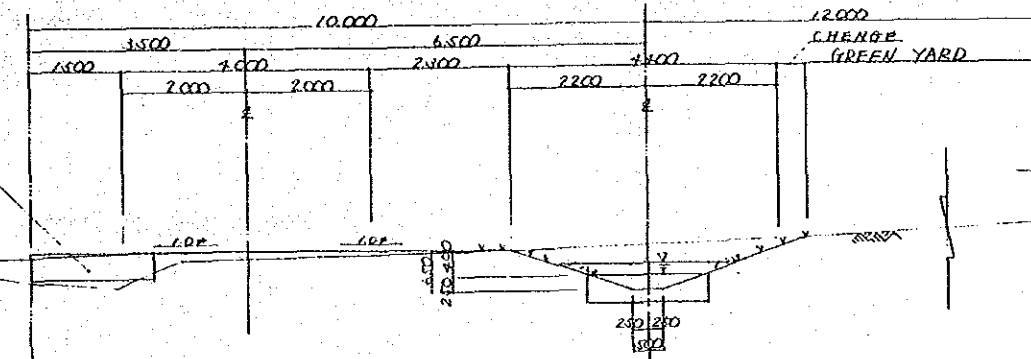
WIRE BOX FOR GABIONADE S-1:30



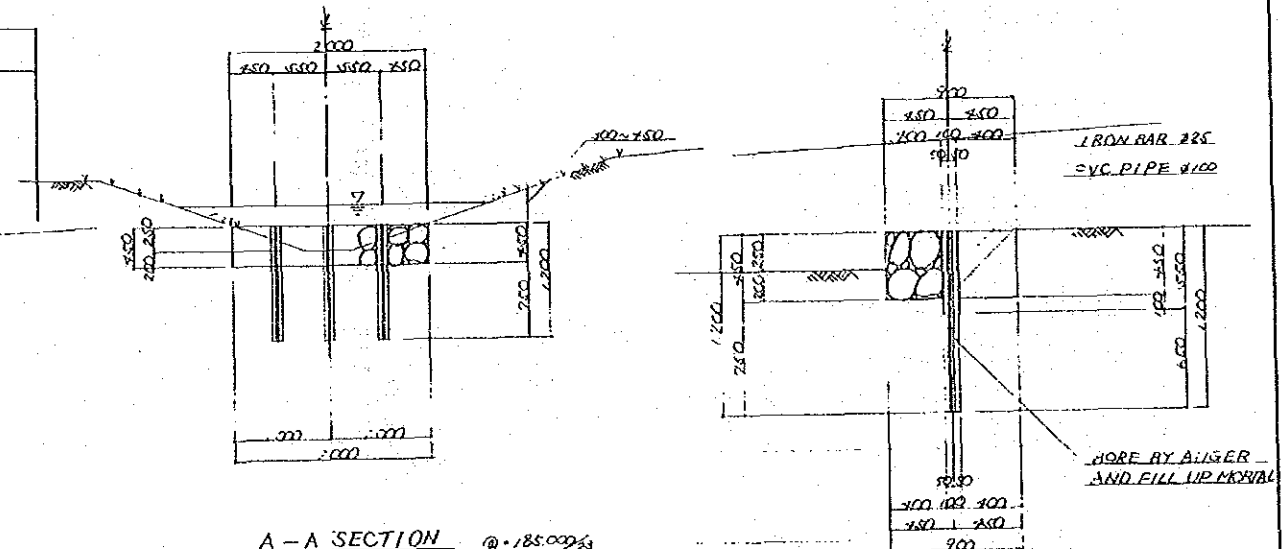
PLAN

B-B SECTION

WIRE BOX FOR SLOPE PROTECTION  
WIRE BOX TYPE I



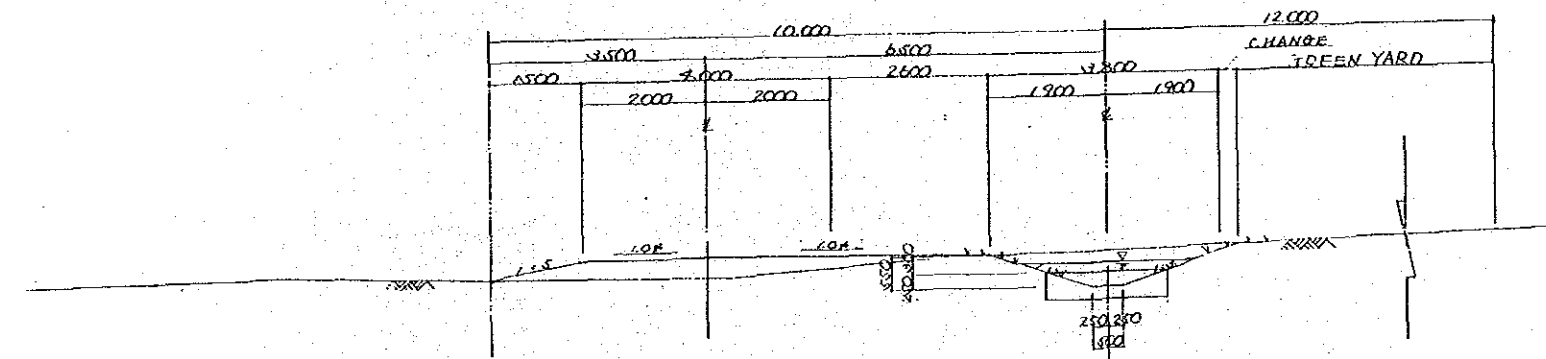
STANDARD SECTION ©-3 TYPE S-1:30



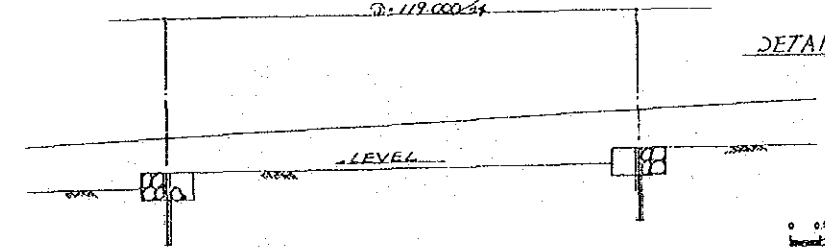
A-A SECTION

①: 185.000/8  
②: 115.000/8  
③: 119.000/8

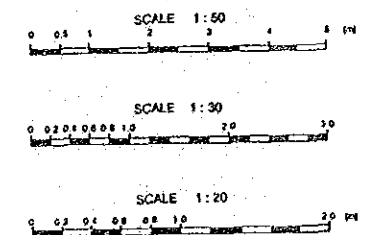
DETAILS S-1:20



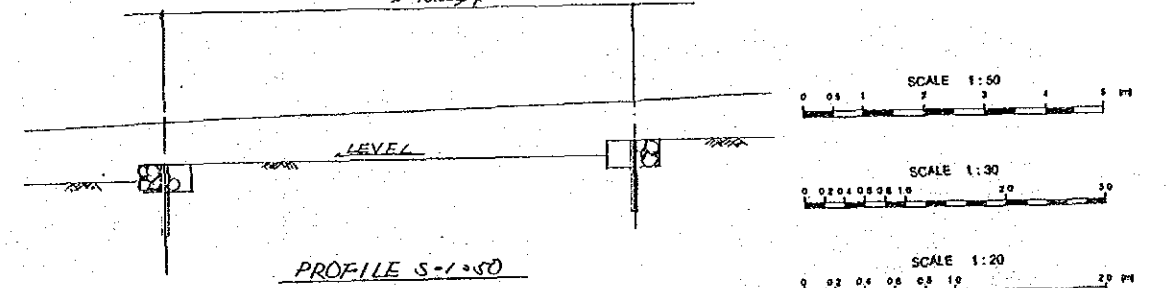
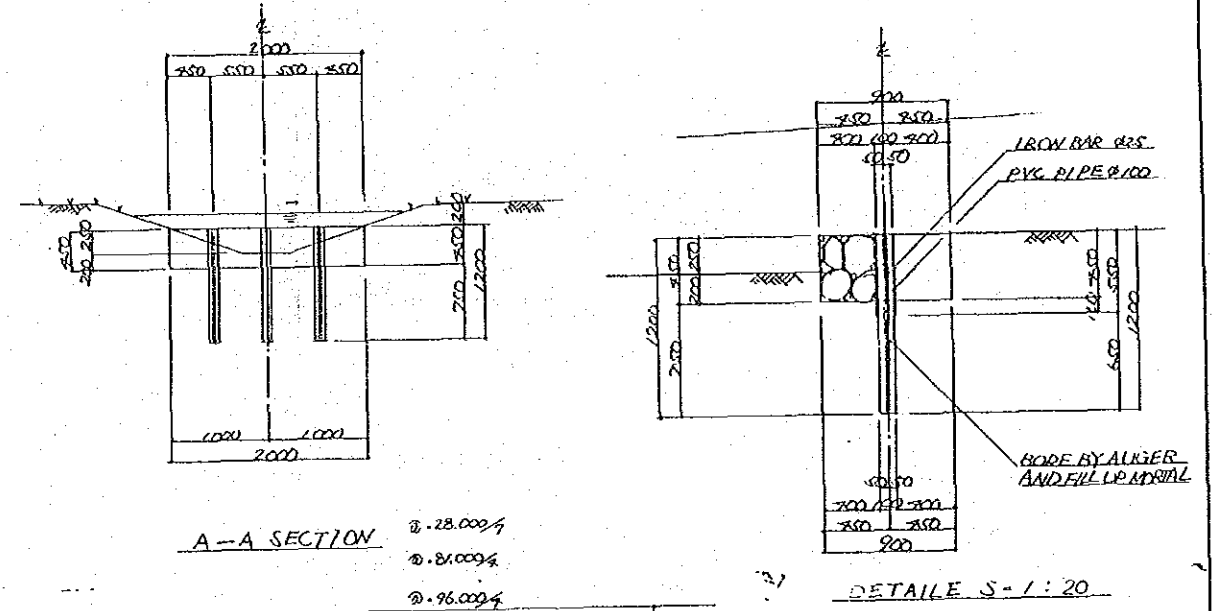
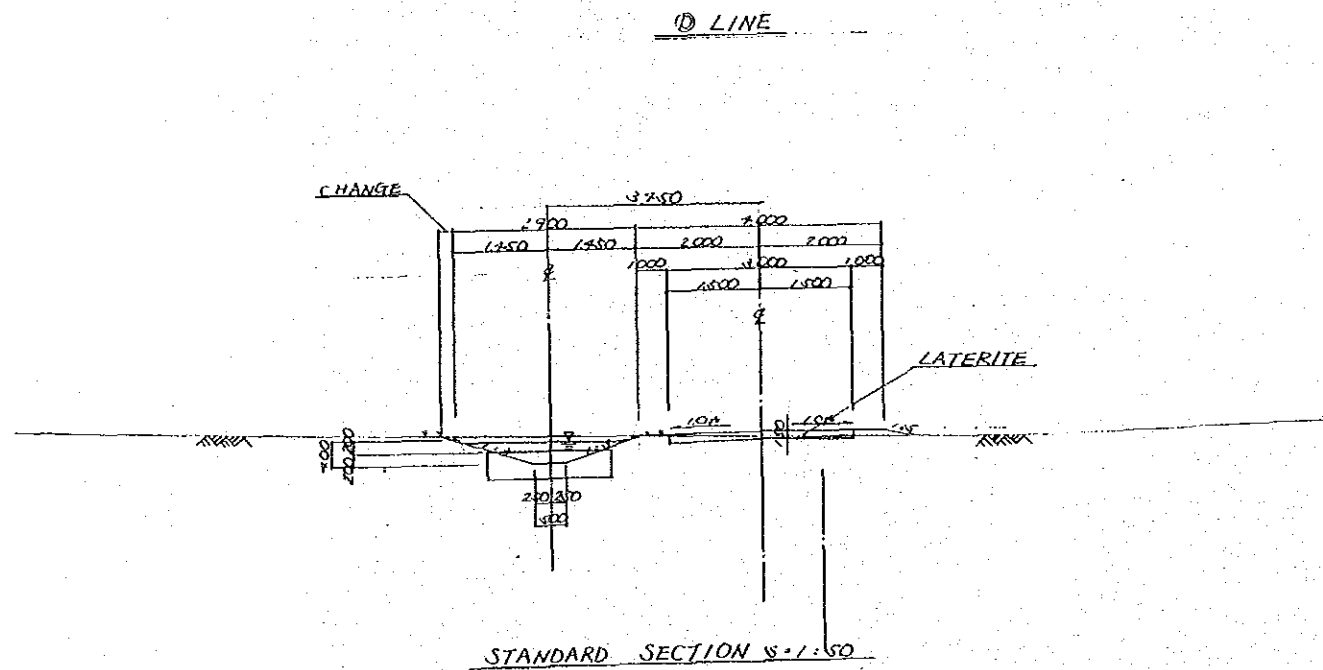
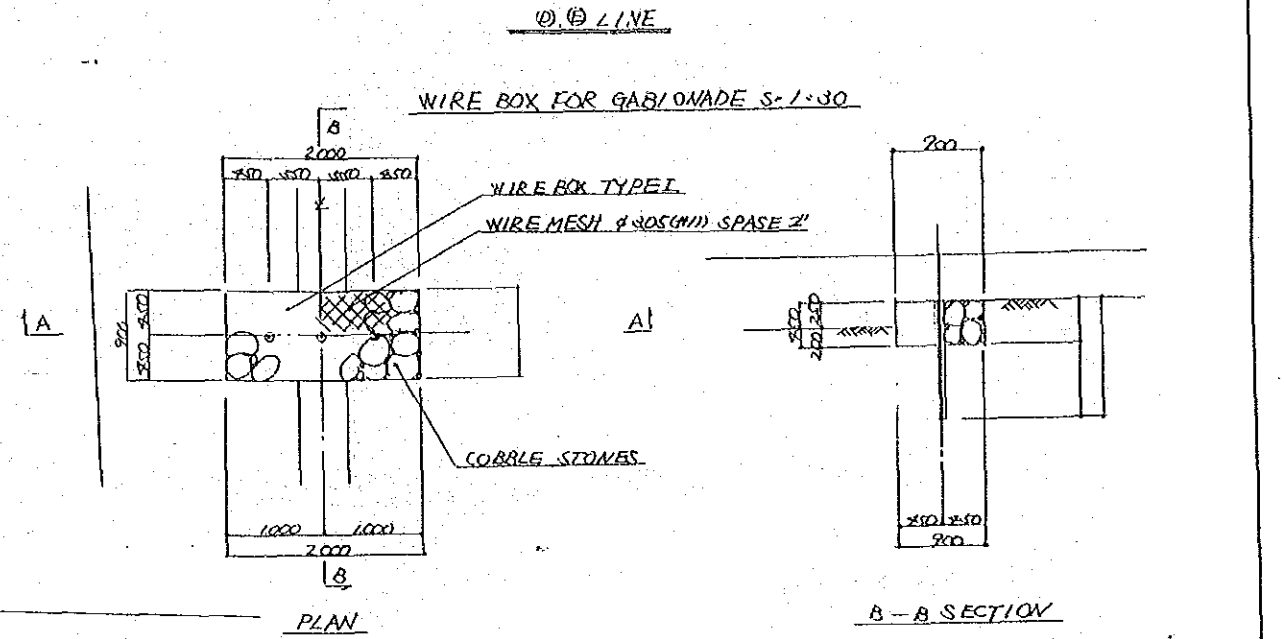
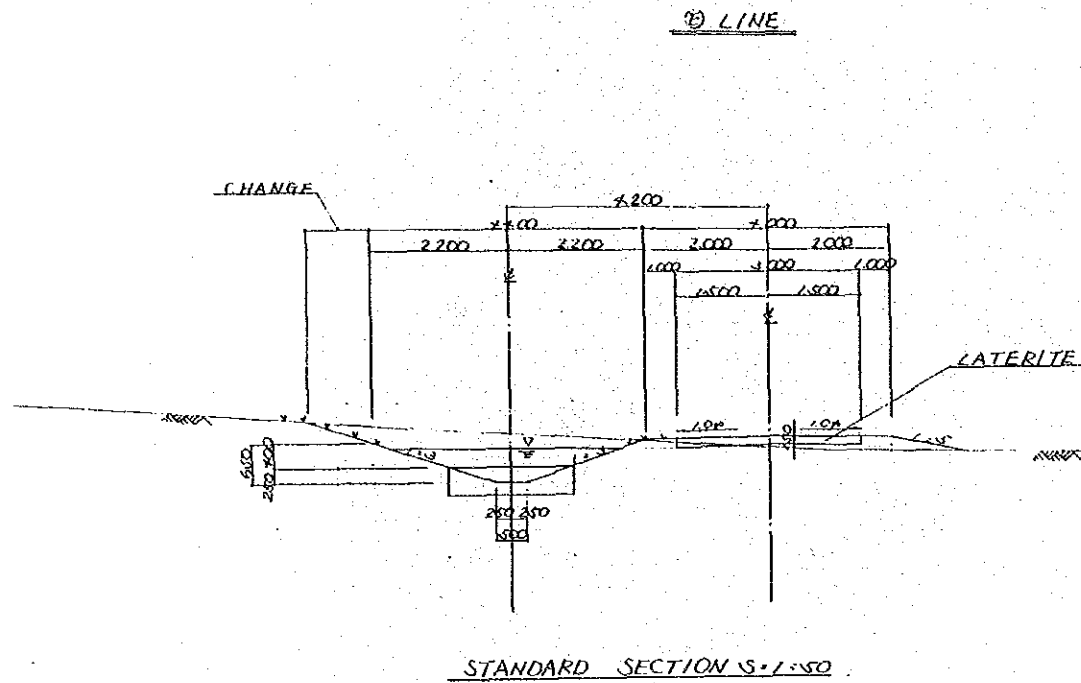
STANDARD SECTION ©-2 TYPE S-1:30



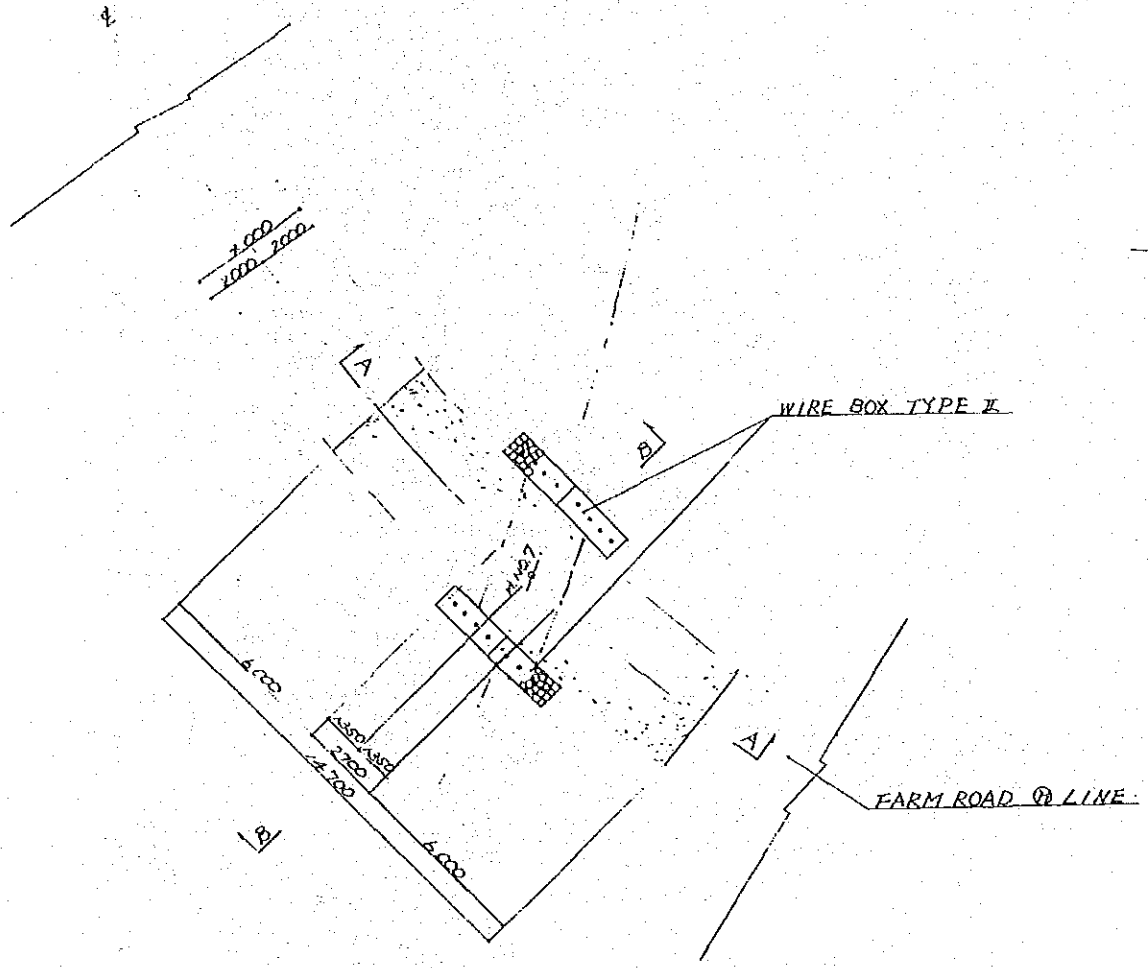
PROFILE S-1:30



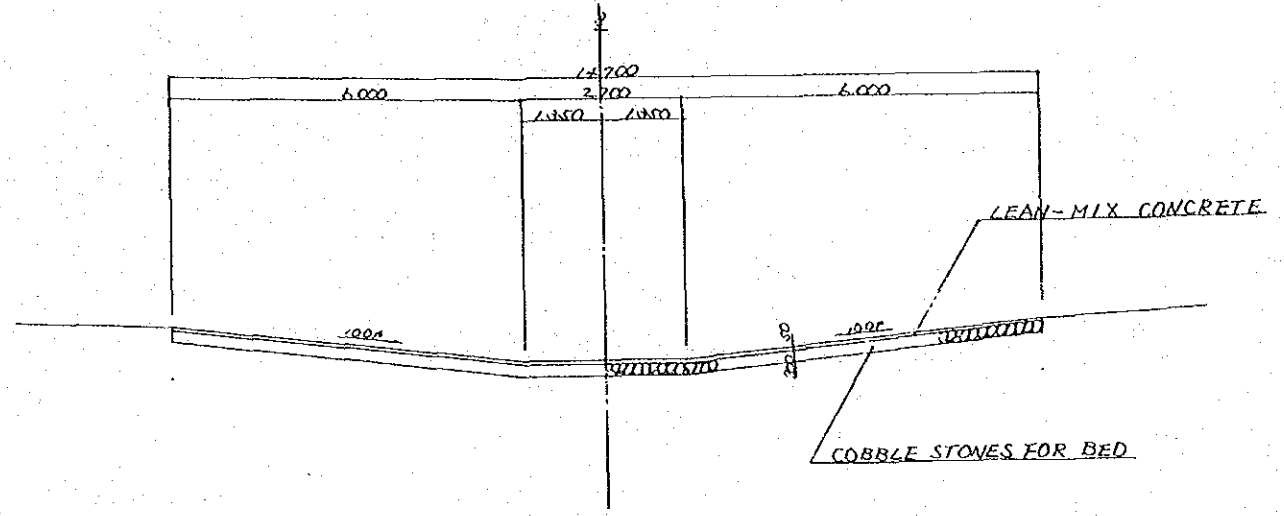
JAPAN INTERNATIONAL COOPERATION AGENCY	
DETAILED DESIGN SURVEY FOR THE AGRICULTURAL DEVELOPMENT RESEARCH PROJECT PHASE II IN NORTHEAST THAILAND	
FARM ROAD © LINE, DRAINAGE CANAL © LINE	
STANDARD SECTION AND WIRE BOX FOR GABIONADE	
PREPARED BY	DRAWING NO.
CHECKED BY	13



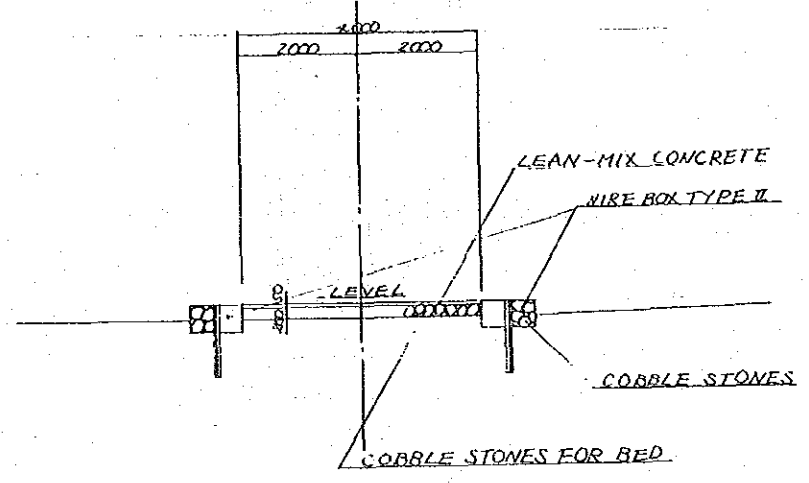
JAPAN INTERNATIONAL COOPERATION AGENCY	
DETAILED DESIGN SURVEY FOR THE AGRICULTURAL DEVELOPMENT RESEARCH PROJECT PHASE II IN NORTHEAST THAILAND	
FARM ROAD ② LINE DRAINAGE CANAL ② LINE STANDARD SECTION AND WIRE BOX FOR GABIONADE	
PREPARED BY	DRAWING NO.
CHECKED BY	14



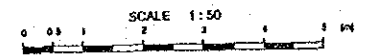
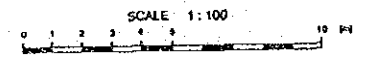
PLAN S-1:100



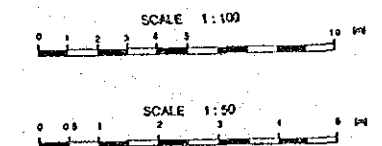
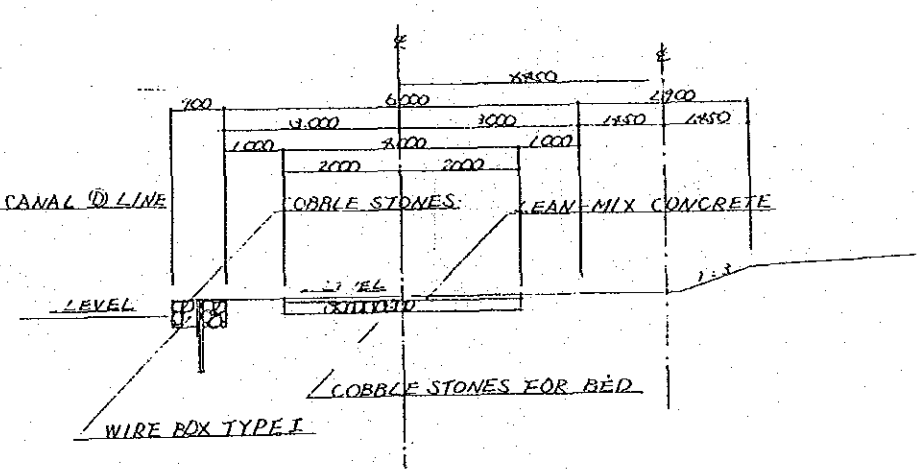
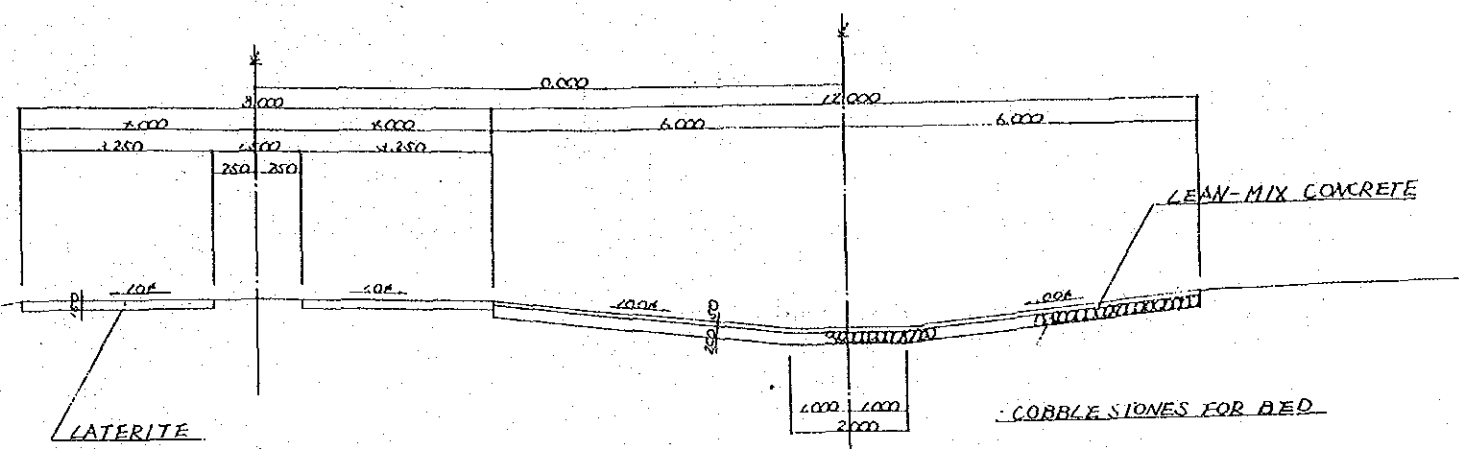
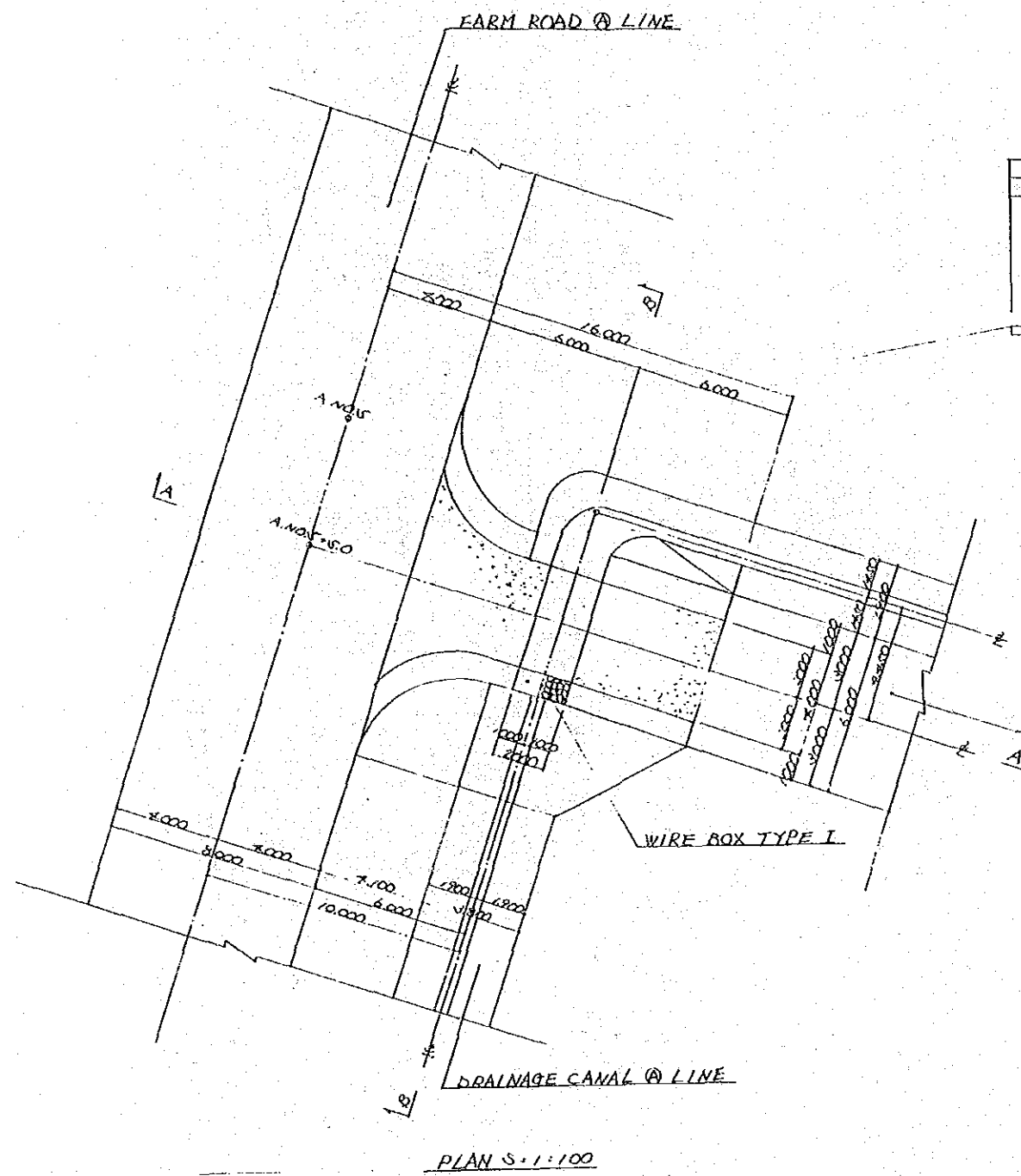
A-A SECTION S-1:50



B-B SECTION S-1:50

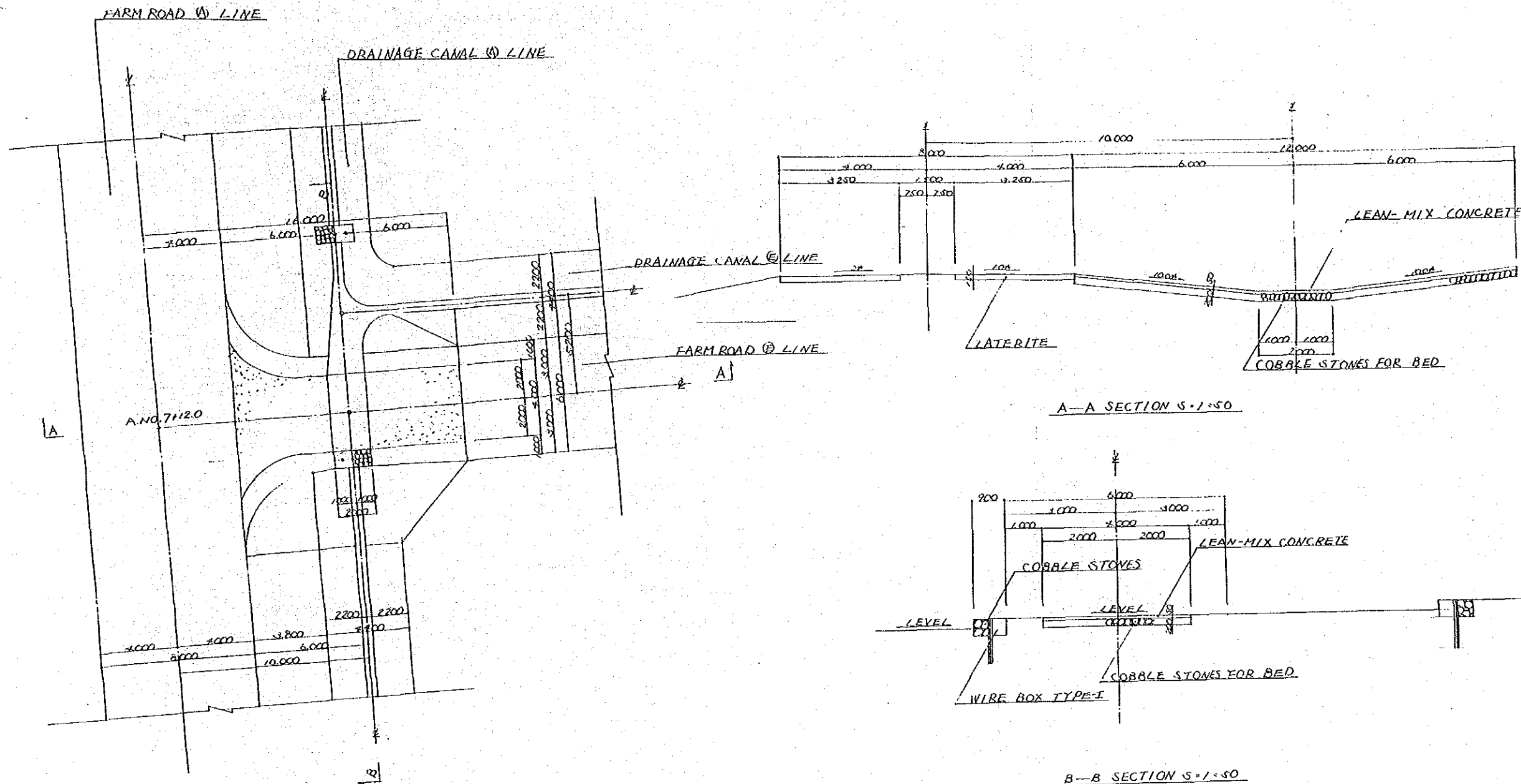


JAPAN INTERNATIONAL COOPERATION AGENCY	
DETAILED DESIGN SURVEY FOR THE AGRICULTURAL DEVELOPMENT RESEARCH PROJECT PHASE II IN NORTHEAST THAILAND	
CROSSOVER OF CANAL NO.1	
PREPARED BY	DRAWING NO.
CHECKED BY	15



JAPAN INTERNATIONAL COOPERATION AGENCY	
DETAILED DESIGN SURVEY FOR THE AGRICULTURAL DEVELOPMENT RESEARCH PROJECT PHASE II IN NORTHEAST THAILAND	
CROSSOVER OF CANAL NO. 2	
PREPARED BY	DRAWING NO.
CHECKED BY	16

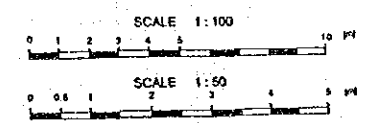




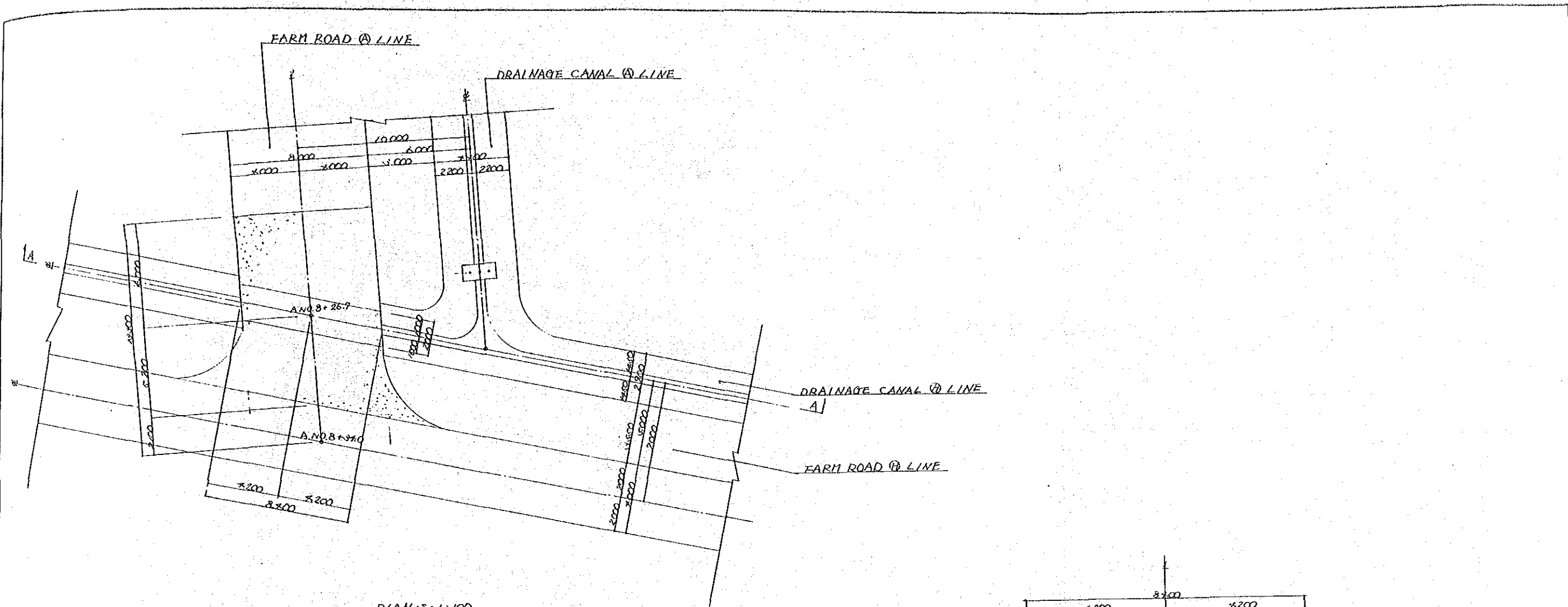
PLAN S-1:100

A-A SECTION S=1:50

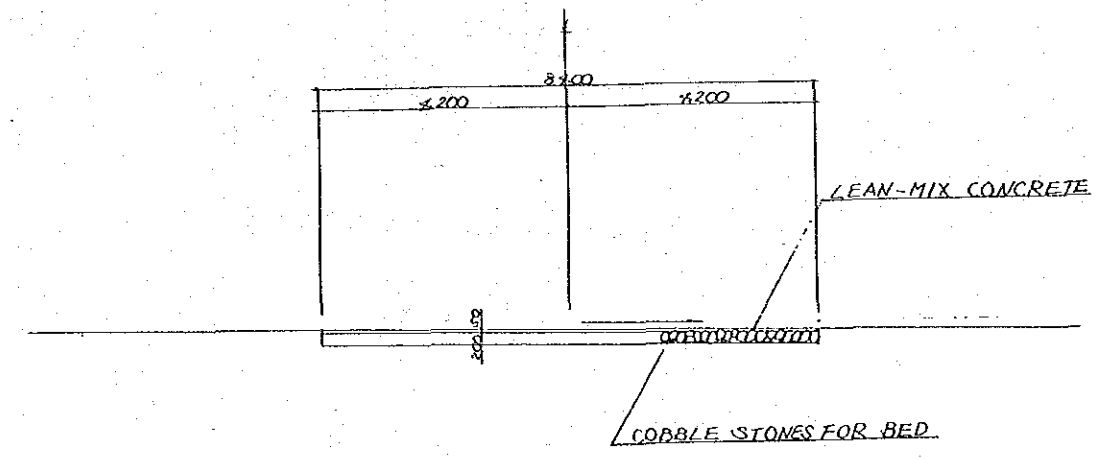
B-B SECTION S=1:50



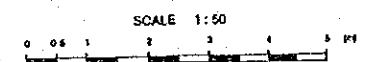
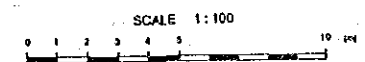
JAPAN INTERNATIONAL COOPERATION AGENCY	
DETAILED DESIGN SURVEY FOR THE AGRICULTURAL DEVELOPMENT RESEARCH PROJECT PHASE II IN NORTHEAST THAILAND	
CROSSOVER OF CANAL NO.3	
PREPARED BY	DRAWING NO.
CHECKED BY	17



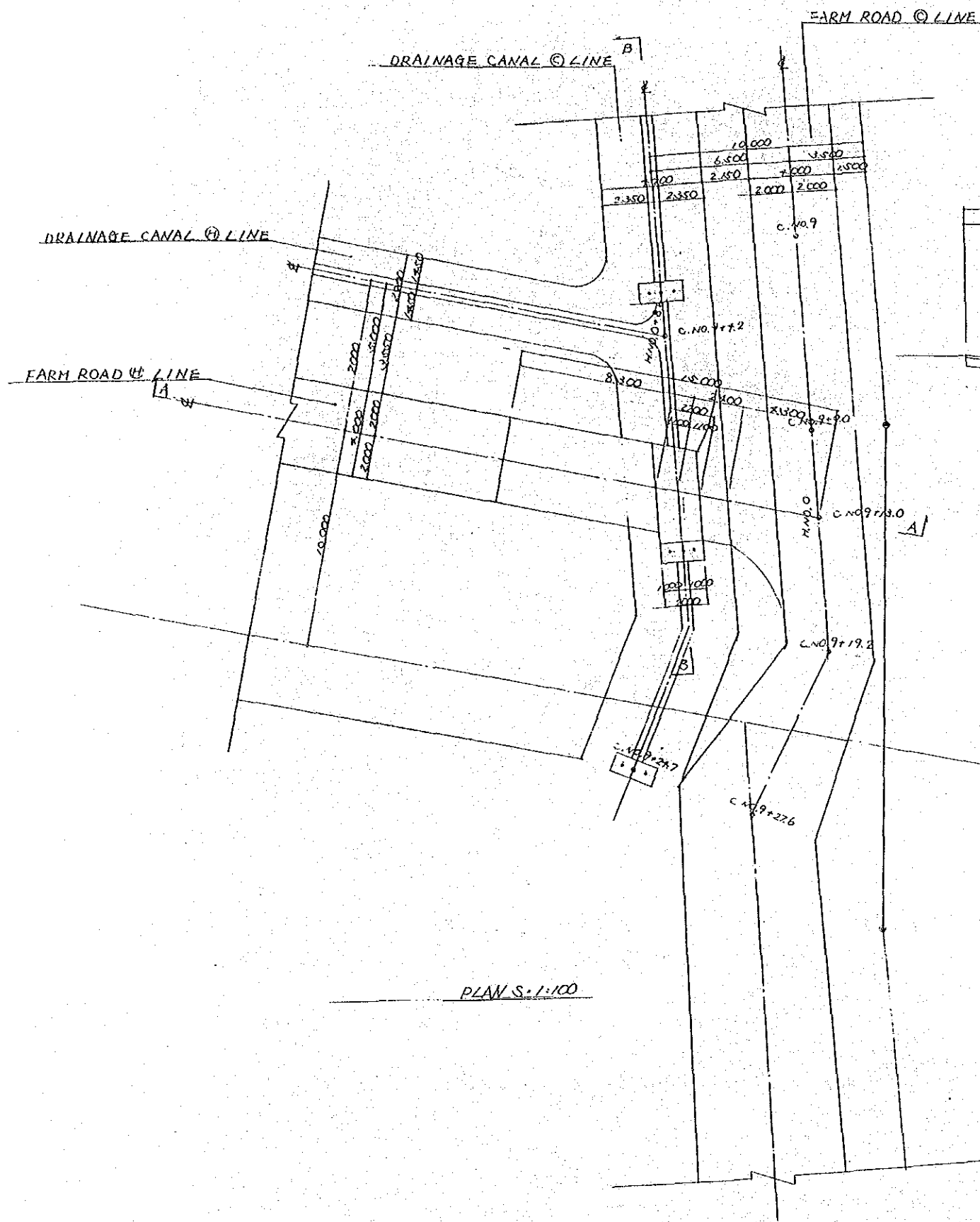
PLAN S=1:100



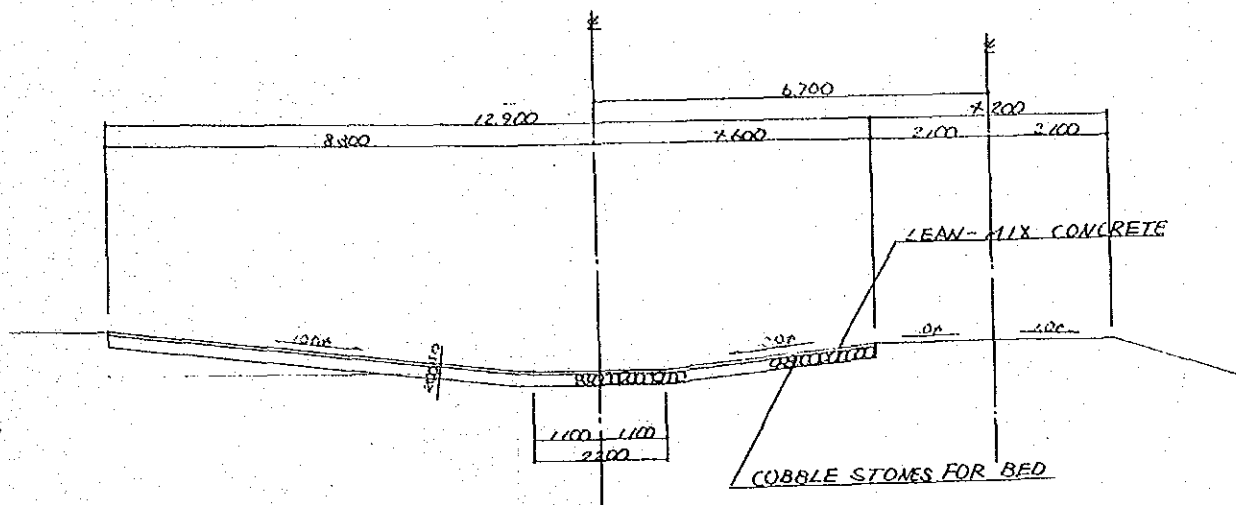
A-A SECTION S=1:50



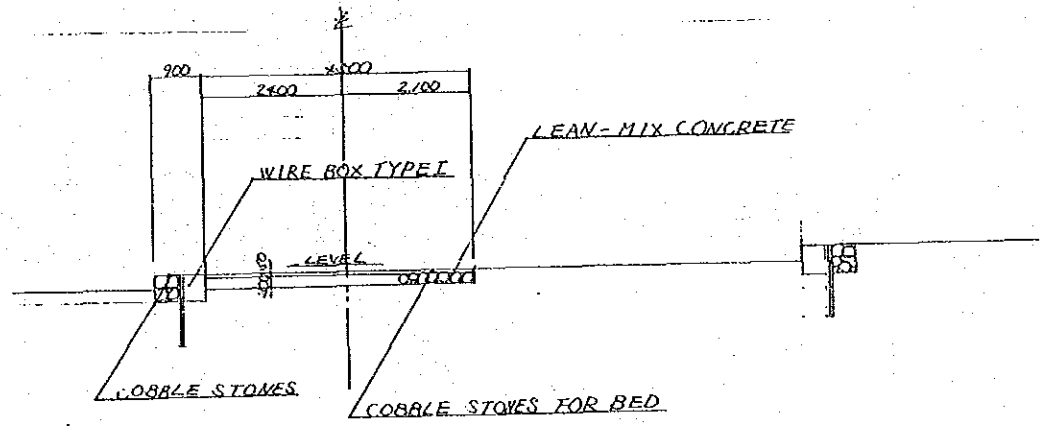
JAPAN INTERNATIONAL COOPERATION AGENCY	
DETAILED DESIGN SURVEY FOR THE AGRICULTURAL DEVELOPMENT RESEARCH PROJECT PHASE II IN NORTHEAST THAILAND	
CROSSOVER OF CANAL NO.4	
PREPARED BY	DRAWING NO.
CHECKED BY	18



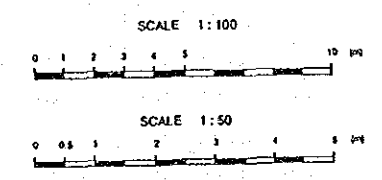
PLAN S=1:100



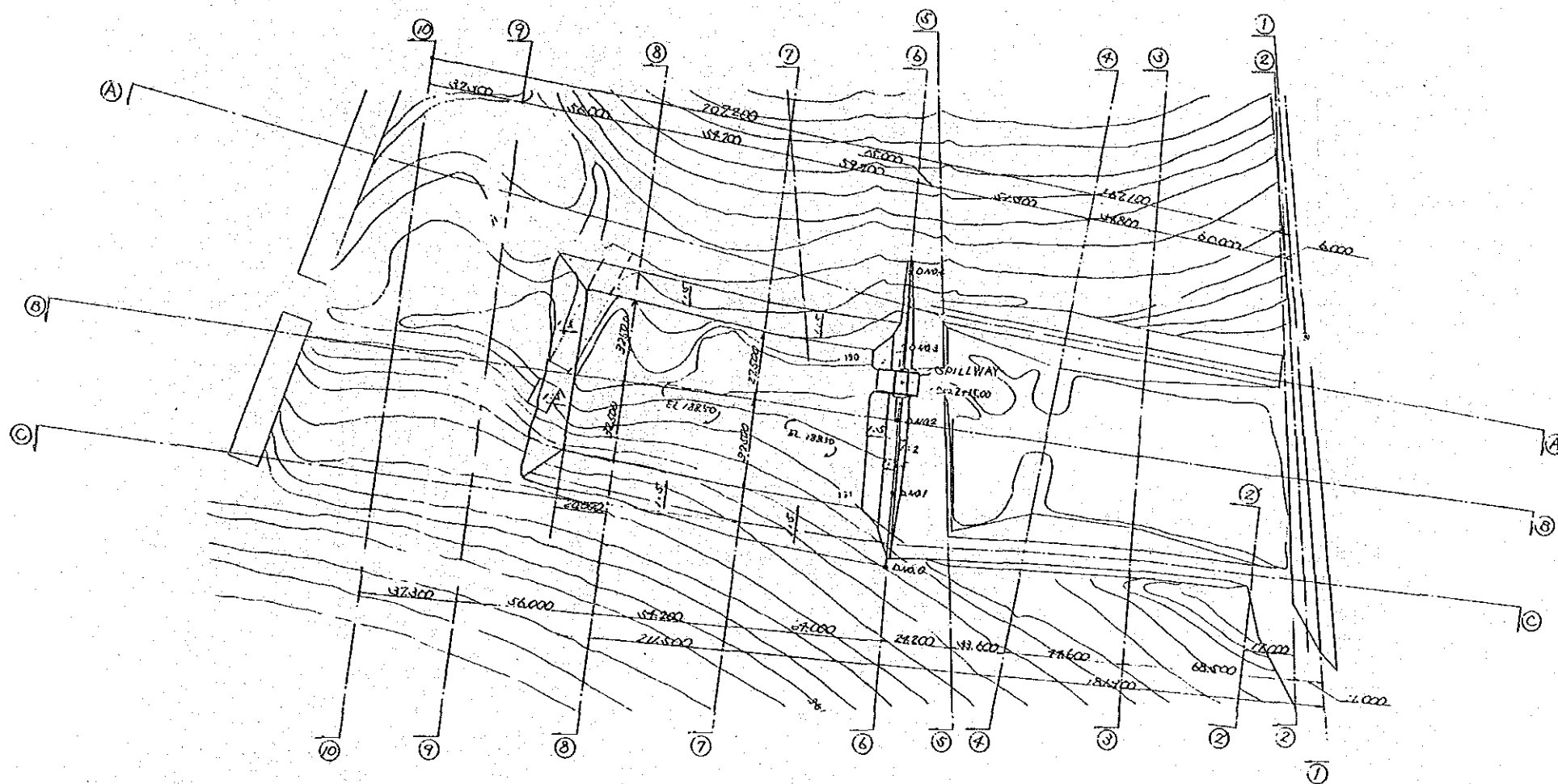
A-A SECTION S=1:50



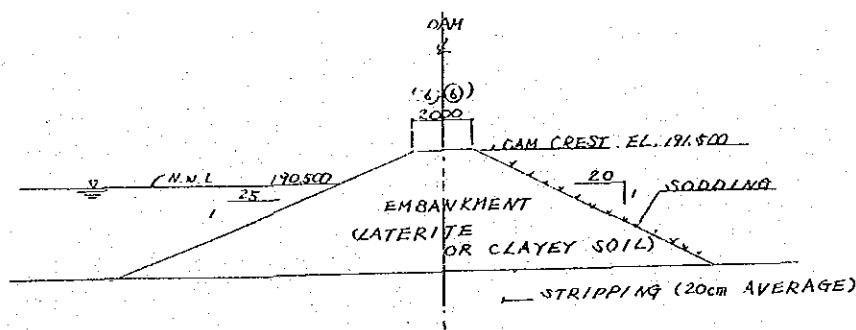
B-B SECTION S=1:50



JAPAN INTERNATIONAL COOPERATION AGENCY	
DETAILED DESIGN SURVEY FOR THE AGRICULTURAL DEVELOPMENT RESEARCH PROJECT PHASE II IN NORTHEAST THAILAND	
CROSSOVER OF CANAL NO5	
PREPARED BY	DRAWING NO.
CHECKED BY	19

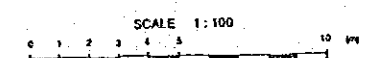
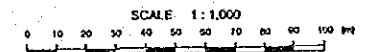


PLAN 1:1,000

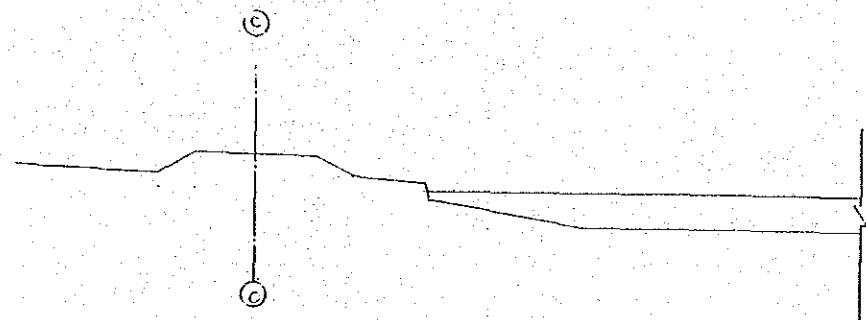


TYPICAL CROSS SECTION OF DAM 1:100

NOTE EMBANKMENT MATERIALS: COEFFICIENT OF PERMEABILITY SHOULD BE SMALLER THAN  $1 \cdot 10^{-4}$  CM/SEC AT FIELD TEST.



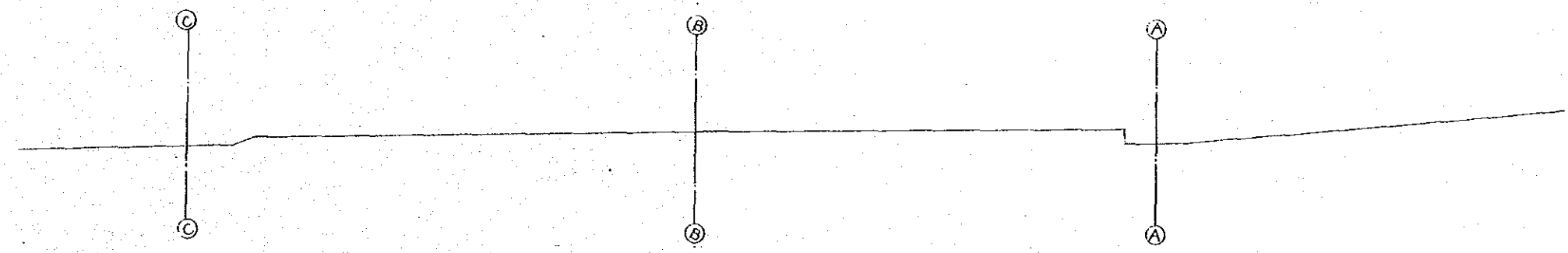
JAPAN INTERNATIONAL COOPERATION AGENCY	
DETAILED DESIGN SURVEY FOR THE AGRICULTURAL DEVELOPMENT RESEARCH PROJECT PHASE II IN NORTHEAST THAILAND	
RESERVOIR	
PLAN AND TYPICAL CROSS SECTION OF DAM	
PREPARED BY	DRAWING NO.
CHECKED BY	20



EL. 180.000

EL. 180.000

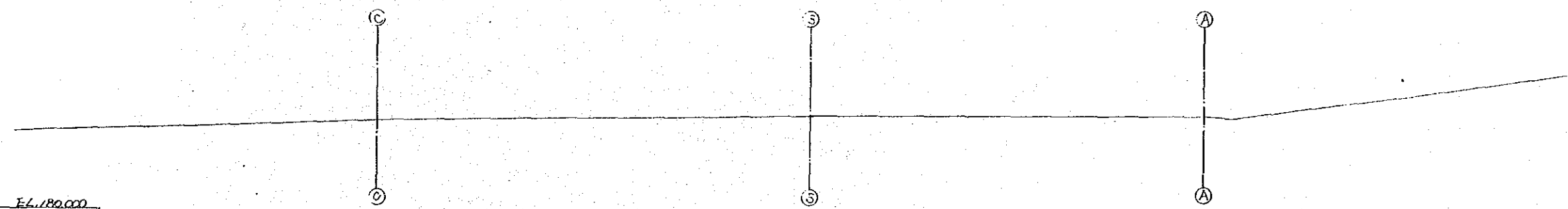
②-② SECTION S-1:200



EL. 180.000

EL. 180.000

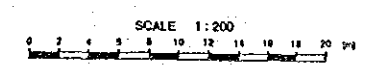
②-② SECTION S-1:200



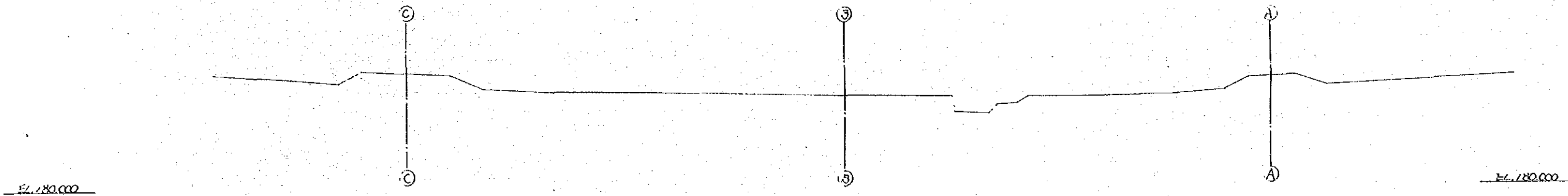
EL. 180.000

EL. 180.000

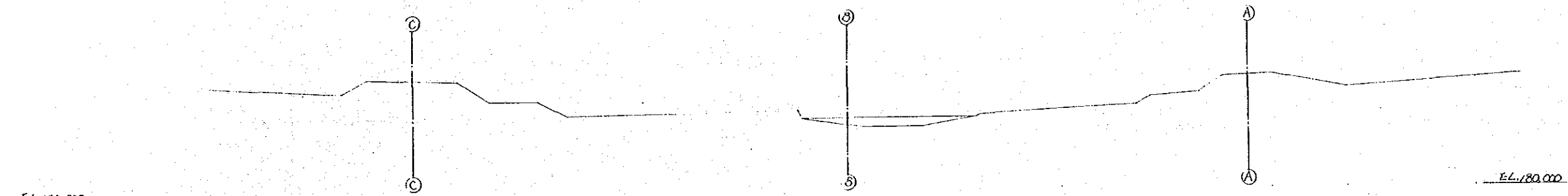
①-① SECTION S-1:200



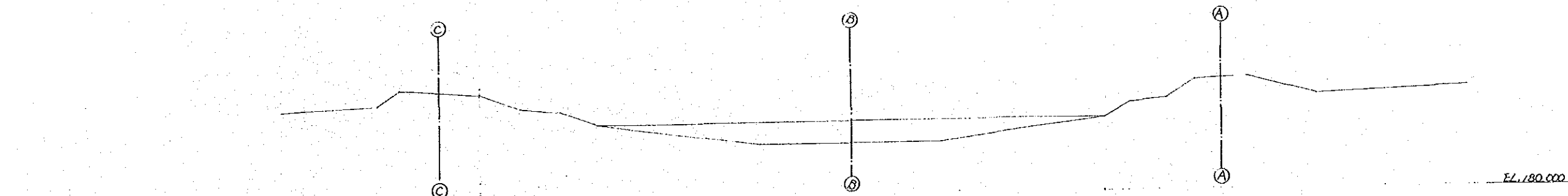
JAPAN INTERNATIONAL COOPERATION AGENCY	
DETAILED DESIGN SURVEY FOR THE AGRICULTURAL DEVELOPMENT RESEARCH PROJECT PHASE II IN NORTHEAST THAILAND	
CROSS SECTION OF RESERVOIR (1/5)	
PREPARED BY	DRAWING NO.
CHECKED BY	21



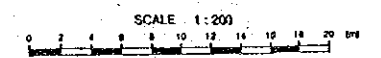
5-5 SECTION S=1:200



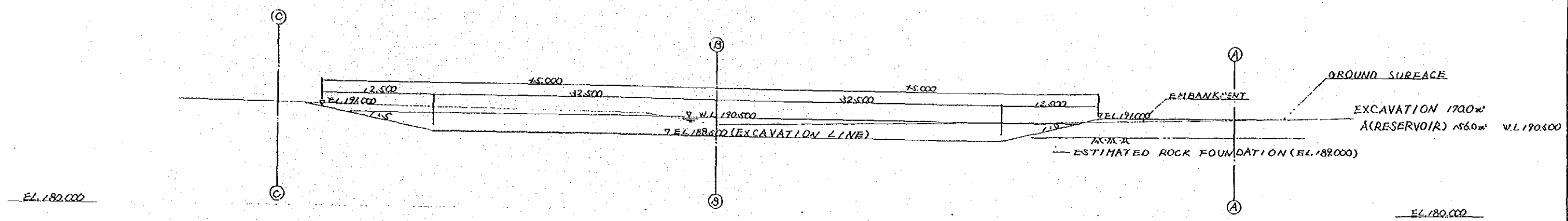
4-4 SECTION S=1:200



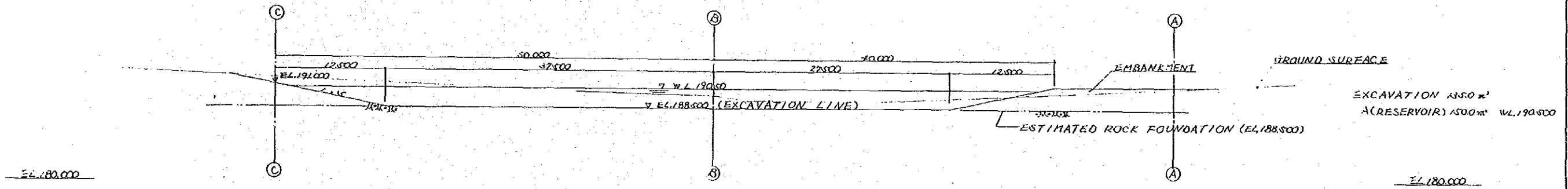
3-3 SECTION S=1:200



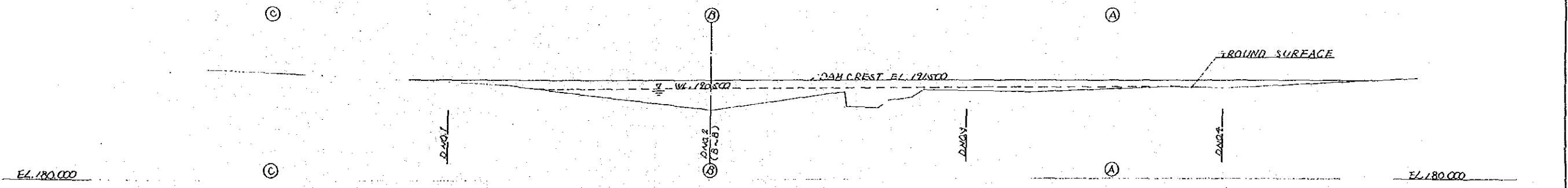
JAPAN INTERNATIONAL COOPERATION AGENCY	
DETAILED DESIGN SURVEY FOR THE AGRICULTURAL DEVELOPMENT RESEARCH PROJECT PHASE II IN NORTHEAST THAILAND	
CROSS SECTION OF RESERVOIR (2/5)	
PREPARED BY	DRAWING NO.
CHECKED BY	22



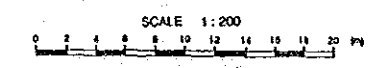
⑧-⑧ SECTION S=1:200 (FOR EXCAVATION)



⑦-⑦ SECTION S=1:200 (FOR EXCAVATION)



⑥-⑥ SECTION S=1:200 (FOR DAM)  
(NEW DAM AXIS)



JAPAN INTERNATIONAL COOPERATION AGENCY	
DETAILED DESIGN SURVEY FOR THE AGRICULTURAL DEVELOPMENT RESEARCH PROJECT PHASE II IN NORTHEAST THAILAND	
CROSS SECTION OF RESERVOIR (3/5)	
PREPARED BY	DRAWING NO.
CHECKED BY	23

EL. 180.000

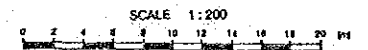
EL. 180.000

③—④ SECTION S=1:200

EL. 180.000

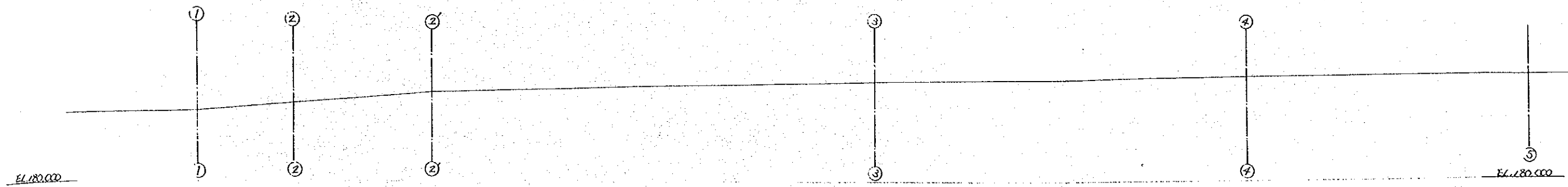
EL. 180.000

⑦—⑧ SECTION S=1:200

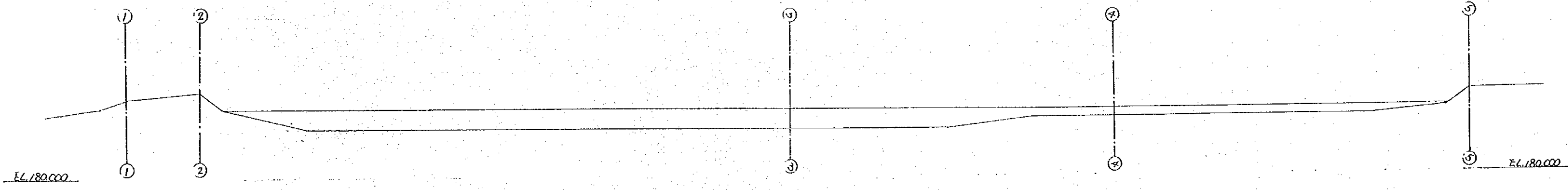


JAPAN INTERNATIONAL COOPERATION AGENCY	
DETAILED DESIGN SURVEY FOR THE AGRICULTURAL DEVELOPMENT RESEARCH PROJECT PHASE II IN NORTHEAST THAILAND	
CROSS SECTION OF RESERVOIR (4/5)	
PREPARED BY	DRAWING NO.
CHECKED BY	24

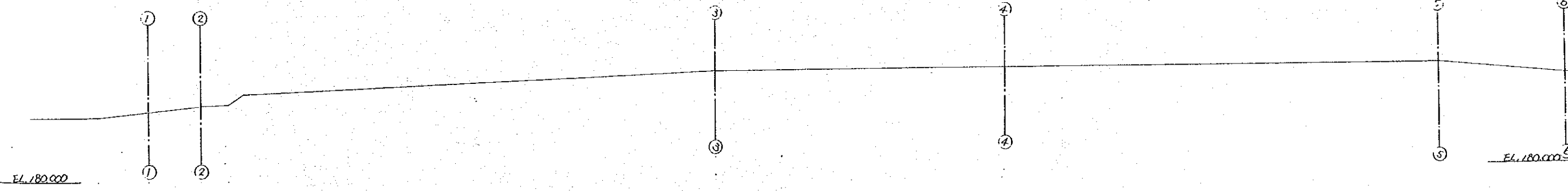




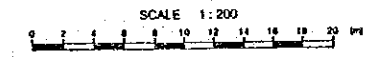
① — ① SECTION S-1:200



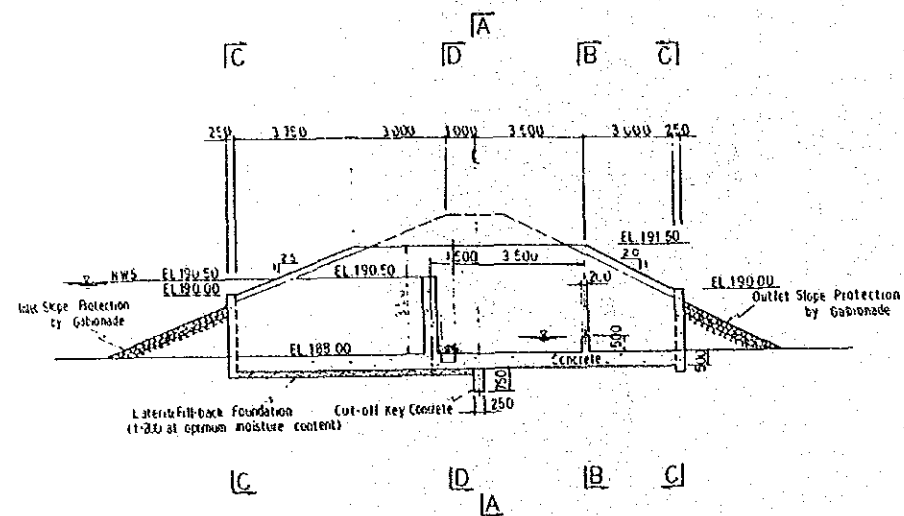
② — ② SECTION S-1:200



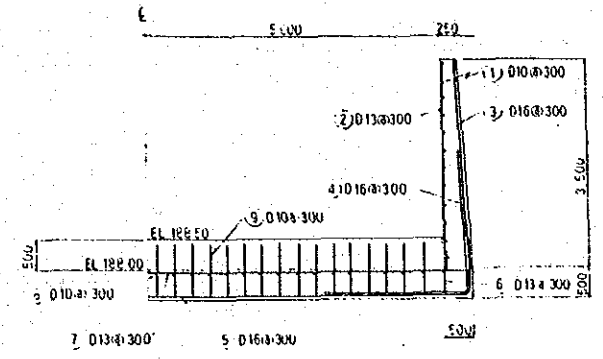
③ — ③ SECTION S-1:200



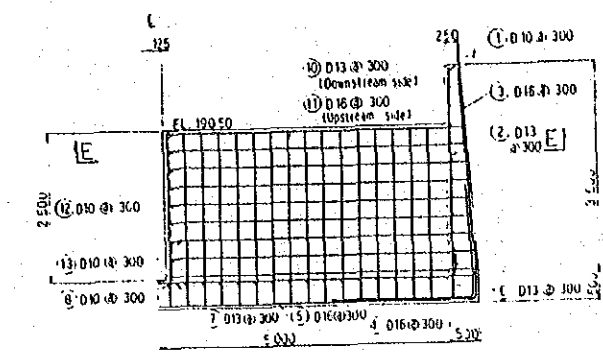
JAPAN INTERNATIONAL COOPERATION AGENCY	
DETAILED DESIGN SURVEY FOR THE AGRICULTURAL DEVELOPMENT RESEARCH PROJECT PHASE II IN NORTHEAST THAILAND	
CROSS SECTION OF RESERVOIR (5/5)	
PREPARED BY	DRAWING NO.
CHECKED BY	25



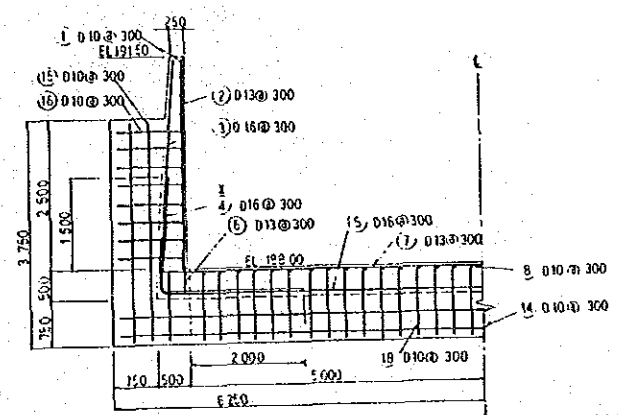
**Spillway Cross Section**  
 (C No. 2115)  
 S=1:100



**B-B Section**  
 S=1:50

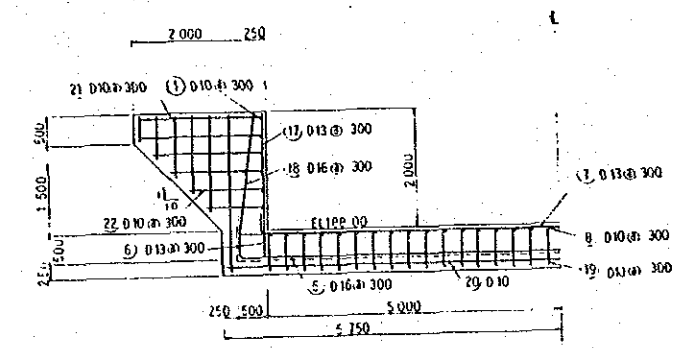


**D-D Section**  
 S=1:50

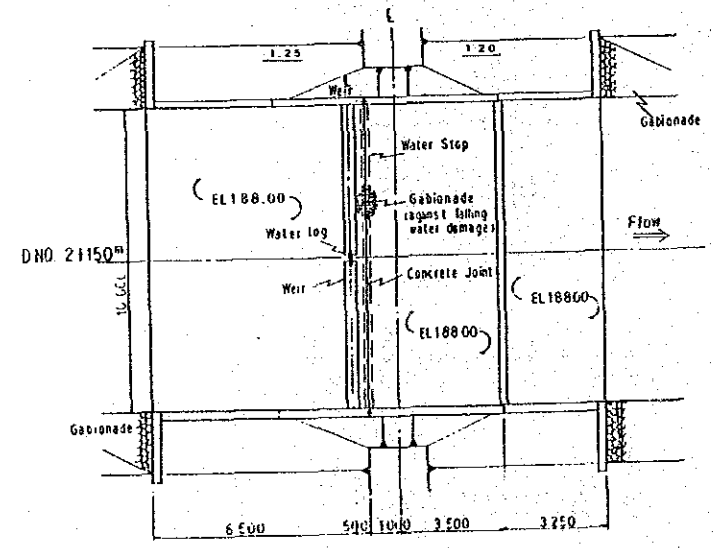


**A-A Section**  
 S=1:50

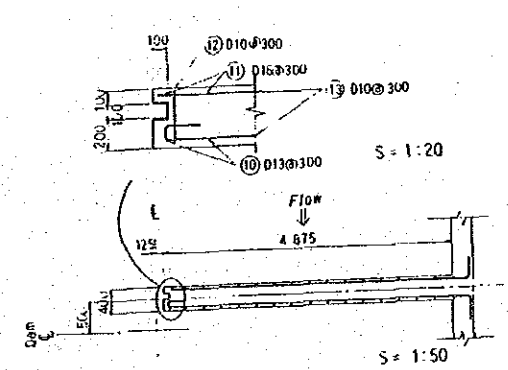
Reinforcing bars #4 are installed within 5m upstream side and 5m downstream side from jam ans



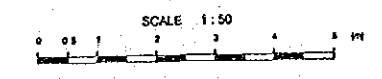
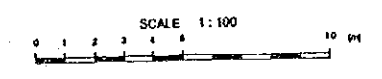
**C-C Section**  
 S=1:50



**Plan of Spillway**  
 S=1:100



**E-E Section**  
 S=1:50



JAPAN INTERNATIONAL COOPERATION AGENCY	
DETAILED DESIGN SURVEY FOR THE AGRICULTURAL DEVELOPMENT RESEARCH PROJECT PHASE II IN NORTHEAST THAILAND	
<b>SPILLWAY</b>	
<b>PLAN, CROSS SECTION AND BAR ARRANGEMENT</b>	
PREPARED BY	DRAWING NO.
CHECKED BY	26