moisture meters, balance, germinator, microscope, oven, etc. Of course, efficiency and reliability of these tools and equipment are required.

2. CONSTRAINTS ON SEED QUALITY CONTROL SYSTEM

Seed producers have a responsibility to maintain high varietal purity and then offer the maximum freedom from undesirable contaminants. Seed crops are cultivated by the seed producers under the supervision of agricultural farm technicians and seed inspectors according to the regional seed production program and farming manual.

Seed crop farming practices are prescribed in the manual. If the seed producer observes this manual and technical guidance from the persons concerned, the approving rate of a seed field certification will be at a higher level.

The rejection rate based on the results of seed certification in 1989 is as shown in Table D.1.7. The rejection rate of rice and corn seeds by the kinds of seed producers .is as follows;

	Rice Seed	Corn Seed
Seed Produced by Republic Sector	5.5%	0.2%
Seed Produced by Private Sector	11.7%	2.7%

As indicated above, the approving rate for seeds from the private sector is lower than that of the public sector's. The above might suggest necessity of strengthed guidance for seed crop farming of private seed producers. These matters should be considered in seed production plan under the Model Area Project.

It was observed that most of the facilities which are used as seed storage warehouses, lack the conditions for the seed storage facility such as the prevention measure against the entrance of birds and rodents; exclusive use for seed storage and proper sanitation control, especially in storage facilities of private seed producers, show marked tendency mentioned above.

In connection with this, it is important to note that good seed storage is an important phase of seed processing, and so it is essential for a successful seed production and distribution program. Also, this is the responsibility of seed producers themselves.

In most seed warehouses with concrete floors, seed bags are piled on wooden pallets to prevent considerable seed loss due to moisture build-up and transmission through a

concrete floor. As for seed storage facilities, improvement for inadequate facilities should be considered.

In 1989, 20,934 ha. of seed fields, corresponding to 1.7 times of the previous year, was inspected by the seed inspector. The number of covered seed producers, area of seed field and number of its site and so on, greatly vary depending upon the site situation of the seed field. (refer to Table D.1.2 & D.1.3)

According to the results of interview survey, all seed inspectors interviewed strongly desired to improve their mobility of inspection of vehicles inplace of their present inspection trips using private means of transport. The improvement of the traffic means is necessary for smooth performance of seed and field inspection activities.

The seed Testing Manual for the Philippines (Draft) has adopted as official procedure for seed testing. This manual was complied on the basis of the International Rules for Seed Testing Association. This manual strongly emphasized the necessary for a uniform method in order to obtain the uniformity of test results conducted by the STL, and prescribes the apparatus and supplies to be used for each testing items in principal. However, based on the field survey and list of equipment facilities inventories provided by the BPI, it was clarified that most of the existing equipment was not functioning well.

Replacement and introduction program for the main testing equipment should be considered. Regarding this matter, it will be necessary to coordinate between this project and improvement program of STL's under Rice Action Program (refer to Table D.2.1).

3. BASIC IMPROVEMENT PLAN

3.1 Basic Recognition of Seed Quality Control

The most important factor of seed production is to maintain the purity and variability of seeds produced. The systems of inspection and certification of seeds are executed to obtain these factors.

The seed produced must be strictly controlled by the systems above in separation from ordinary crop production. The seed producer shall have a responsibility to control and manage the germination of seeds planted, the disease and pests of plants and the contamination of different varieties.

The standards of seed inspection for the Philippines are in accordance with international standards. BPI is paying their effort to guide the people concerned to the seeds production to produce seed which can meet the standard above.

The present situation of the Philippines for seed certification is observed as mentioned above, that the rate of approval of seed field was 86% in the government sector and 77% in the private sector, and 13% of seeds produced in the private sector was rejected in STL. The enhancement of seed producing technology and the promotion of this technology shall therefore be progressed basically to improve the seed quality with the mutual cooperation of the government offices concerned and private seed producers at the level of private seed fields.

Various points to be improved and strengthened with the technical instruction are recognized; in particular, the following points are important to improve the rate of approval and rejection:

(1) Rice

1) Increases in Approved Seed Percentage

a) Strengthening to prevent contamination and perform weeding

- Seedling stage	- deterioration and roguing of off-types and removal of undesirable varieties
- First Heading stage	- removal of abnormally headed hills

- Full Heading	- removal of abnormally later headed hills
- Final Stage	- removal of sterile rice, volunteer plants and other varieties

b) In harvesting, when 80 percent of a panicle are straw colored, seed rice is ready for harvesting. It is desirable that the moisture content of seed rice is below 25 percent. Occurrence of damaged seed increases cope with increasing moisture contents of seed and germination capacity that is reduced.

c) Harvested fresh seed rice which has been exposed to the sweltering heat of the sun for a long time, and fresh seed rice temporarily retained in the noon will reduce germination capacity. Fresh seed rice after harvesting shall be dried as soon as possible, especially since deterioration by mold easily occurs when harvesting is done during the season of higher temperature and humidity. Therefore, harvesting at lower moisture content and prompt drying after harvesting shall be recommended.

(2) Corn

1) Corn seed intended for seed production shall follow strictly the field inspection and certification standard to prevent or minimize contamination or mixtures.

2) Planting of other varieties and/or different seed classes must be 200 meters or more away from the surrounding seed corn areas.

3) Border rows are for isolation and these should be harvested for seed purposes.

4) Field inspection shall be done during silking, harvesting and processing.

a) there shall be more than 0.5% of detectable mixture with plant of other varieties.
b) there shall not be more than 0.5% of off-type ear or 1% of ears with kernels or the wrong color at harvest time.

(3) Peanut

1) Field for certified seed production shall be inspected three times:

a) Vegetable stage - determination of off-types through color, size, shape and uniformity of foliage

b) Flowering stage - determination of off-types through flower color

c) At Maturity - 80% of the pod turns brown or at physiological maturity of the crop.

2) Only one variety of the same crop may be grown for seed production on a farm.

3) A 2-5 meter distance will be kept between the seed farm and the land planted to other varieties of peanuts.

4) Improvement of drying and storage method in peanuts.

3.2 Improvement of Seed Quality Control

There are two ways of improving the existing system and improvement facilities. The improvement of existing facilities has already been explained; therefore, the improvement of seed quality control system will be explained in this section.

(1) Seed inspection and certification

At present, the BPI does not have any administrative control over regional STLs and the seed inspectors. Such a situation is undesirable for the execution of the seed certification program. This undesirable executing system is the biggest problem to be improved in the seed certification program.

The administrative position of the seed inspector was transferred to a provincial agricultural officer from supervision under the chief of STK concerned in 1987. It is considered that full-time seed inspectors should work directly under the chief of STL. Also, an increase of both the regular staff of STL and seed inspectors should be considered to cope with the expansion of seed production area and increase of seed samples to be tested.

(2) Seed quality control technology

The SQCS has been conducting research work on improvement and development of quality control techniques in cooperation with the regional STLs. Research on different media in the germination test, on seed dormancy, comprehensive study of certified seed and research

on seed health are conducted and results are reported and instructed to personnels concerned with training and/or workshops. These research activities on improvement and development of quality control should be improved.

3.3 Seed Testing Laboratory Building

The STL Building consists of several room. The room space is 12 sq.m. The Building space as a whole is too small for daily routine work, particularly in the harvesting season. The room designed as a seed storage room is now used for other purpose. On the basis of increasing the number of receiving samples for the certification, expansion or rebuilding the laboratory building is essential in most of STL.

3.4 Seed Testing and Inspection Equipment

The equipment and apparatus to be used for seed testing are prescribed in the seed testing manual for the Philippines. The equipment and apparatus to be used for main testing items can be grouped as follows;

a) Moisture test
   1) Grinder
   2) Moisture meter
      -Pocket type
      -Portable type
      -Infrared type
   3) Heat air oven
   4) Analytical balance
   5) Grain sieve
   6) Desiccator

b) Germination test
   1) Seed counter
   2) Germinater

c) Purity test
   1) Microscope
   2) Balance
   3) Magnifier
      - Illuminated type
      - Ordinary type
   4) Grain sieve
   5) Seed blower

The replacement and reinforcement of laboratory equipment would be considered to improve the function of seed testing based on existing functional equipment shown in Table.D1.8 and the equipment mentioned above and apparatus which are grouped by the testing items.

At present, about 3,400 tests are conducted by each STL annually, and a peak season in concentrated is 3 to 5 months (that is October to March). Prompt arrangement and accurate analysis of the results of seed tests are very important for the execution of a seed certification program. The introduction of computers to prompt arrangement of test results and analysis of quality control problems to be solved will cope with the expected increase of seed tests in the future, and would be considered as new equipment to be introduced in the STL.

Every STL issues about 28,000 sheets of certification tag in average, annually. Printing machines for certification tag were delivered to each STL in 1981 and 1982 under the Expanded Seed Production and Distribution Program. Most of these are no longer functional and every STL issues certification tag written by hand at present. Quickly issues of certified tags are necessary for smooth seed distribution, therefore, replacement of these printing machines should be considered.

The introduction of motorcycles for field inspection should be considered for speedy inspection activity. The motorcycles which may be provided for individual seed inspector, would be operated and maintained by the provincial seed coordinator and an operation and maintenance plan for motorcycle program may be necessary by the province.

Supply of portable seed testing kits for individual seed inspectors should be considered as one of the plans for prevention of seed deterioration by excessive sun-drying.

4. PRESENT SITUATION OF SEED QUALITY CONTROL IN THE MODEL AREA

4.1 Seed Inspection Services

Number of seed inspectors by province in each Model Area (hereinafter M.A.) are as follows;

Region II M.A.		Region VI M.A.		Region XI M.A.	
Nueva Vizcaya	7	Aklan	2	Davao City	1
Isabela	15	Antique	1	Davao del Sur	2
Quirino	2	Capit	2	South Cotabato	3
		Guimaras	1	Davao Norte	3
		Iloilo	4	Davao Oriental	2
		Negros Occ.	1	Surigao Sur	3

Seed inspectors have been working under the supervision of provincial seed coordinator within the administrative organization, while performing seed inspection activity cooperate with STL in the technical matters.

Most of the seed inspectors hold other services or seasonal assignments with the exception of few cases. Most of the seed production in each model area is rice seed production. Peanut seed was certified only 200 cavan (4 samples) which produced from Ilagan ES by STL No. 2 San Mateo, and also 243.2 cavan (16 samples) were certified as the seed by STL No. 15. Davao City according to SQCS Annual Report 1989. Therefore, the additional training for field inspection practices regarding to those two objective seed crops will be necessary in order to familiarize with both seed crops before the commencement of the model area project.

The seed inspectors performed field activity in accordance with the seed inspection manual. The frequency of the annual field inspection trip of seed inspectors to their assigned seed fields is 12 - 18 times at s busy case, and 6 - 9 times at s less case. The round trip distance between the office and assigned seed fields is different depending on the topographic condition and field sites scattered in covering areas. And the provision of transportation for daily trip of seed inspector to inspect seed field and send testing samples is always constraints. Therefore the establishment of new STLs or STL branches are seriously being considered to solve the constraints caused from the remote distance between STLs and seed field which is one of the factors that is impeding the smooth inspection works.

Table D.4.1 shows the actual proceeding of individual seed inspectors in Region VI Model Area based on the answer of questionnaires provided by the survey team. This is example showing real status of seed inspection services. As shown in the following, the sphere of proceeding greatly varies by individual covered areas. From these figures, we can emphasize that improvement of traffic means is the first priority of matter to be considered to perform smooth field activities by seed inspectors.

Province	No.of SI	<1 No.of Munici.	No.of Seed Producer	Planted Area(ha)	<2 Round trip(Km)	<3 Annual frequency	<4 Distance to STL(Km)	<5 Annual frequency
Aklen	2	10	18	115.0	66	16	189	5.5
Antique	1	4	5	44.0	130	11	96	9.0
Capiz	2	8	23	94.8	82	16	110	6.5
Guimaras	1	2	12	65.0	54	14	45	8.0
Iloilo	4	17	42	481.0	73	16.5	49	11.8
Negos Occ	1	5	5	60.0	90	11	60	4.0

Note: <1 No. of Municipality covered <2 average value
<3 average value (inspection frequency)
<4 average value (distance between assigned office and STL)
<5 average value (for sample submitting)

4.2 Seed Certification Services

The seed certification is the main services of STL, and presently, the following number of persons engage in the seed certification services.

	Regular Staff				Part-time Staff
	Seed Analyst	Seed Inspector	Others	Total	
Region II M.A. STL No.2	6	0	5	11	4 * 1989
	5	0	1	6	4 **1990
Region VI M.A STL No.9	8	3	1	12	5 *
	8	3	1	12	5 **
Region XI M.A.STL No. 15	5	1	3	9	3 *
	5	1	2	8	3 **

The certification services are performed by the regular staff who has the multiple roles in cooperation of part-time stuff. It seems that smooth operation of STL could not be performed without the experience of skilled part-time staffs (daily paid). To increase the number of staffs, or to shift part-time staffs to regular staffs shall be seriously considered to success this project which expects the intense increment of testing samples (refer to Table D.4.2).

Table D.4.3 shows the result of seed certification in each model area in 1989. The number of seed samples received for seed certification are shown below:

	Region II M.A.	Region VI M.A.	Region XI M.A.
Peanut	4	0	1
Rice	656	559	653
Corn	37	2	16
Others	3	0	48
Rejection	53	44	31
Total	753	605	749

According to the summary above, all STLs perform the certification service for mainly rice seed. Consequently it deems that the certification techniques for peanuts and corn are not skilled yet with seed analysts, so the training of peanuts and corn seed testing technique shall be performed to all STL analyst (refer to Table D.4.4, D.4.5).

The major reason of rejection of seed certification is low germination caused by insufficient drying i.e. high moisture contents, and it is found during wet season particularly. The testing equipment existing in the STLs are used for more or less 10 years, so the equipment shall be considered to be replaced to strengthen the testing systems of STL.

5 MODEL IMPLEMENT PLAN.

5.1 Seed Inspection Services

In seed production field areas intended by model area, actual production area and seed field area to be inspected are shown as follows:

	Intended Area	Actual Production Area for Objective Crops	Actual Production Area Inspection Area
Region II M.A.	290 ha	7 ha (peanut)	2,794.43 ha
Region VI M.A.	6,439.6	734.8 (rice)	1,798.41
Region XI M.A	548.52	18.8 (corn)	4,702.99

The points to be improved are shown as follows to apply the extension of the seed production area, to increase the seed producer, and to spread seed farms to obtain the multiplication of the objective crop seed.

(1) To provide the retraining seed inspection technique for the seed inspector and to increase the number of seed inspectors.

(2) To provide a kit of seed inspection devices including moisture tester, sampler, and so on, and as a part of strengthening, the training system of seed quality control practice for the seed producer.

(3) To provide one unit each a motor cycle to give the mobility to seed inspectors for improving the efficiency of their work.

5.2 Seed Certification Services

The numbers of seed samples received and tested in the STL in 1988 ~ 1989, are shown as follows. The data show the increment of samples.

	1988		1989	
	Sample Received	Sample Tested	Sample Received	Sample Tested
Region II STL No. 2	691	3,412	2,757	5,174
Region VI STL No. 9	580	9,595	2,146	5,797
Region XI STL No. 15	390	4,182	2,321	7,562
National Total	4,514	56,311	30,690	82,405

The estimated number of samples based on the production plan of model project area brought into the STLs by the seed inspectors for testing will be increased and it might suffer the receiving works of STL occasionally according to the peak season(refer to Table D.5.1).

Furthermore, the number of the above will be increased in accordance with the project of the Rice Action Program and Seed Multiplication, Production, Certification, Testing, Procurement and Distribution of Certified Corn and Sorghum Seed (open pollinated) project starting from 1990.

As mentioned above since the certification works are owed to the part time employee in every STLs, the works shall be strengthened and rearranged by shifting from the part time employee to the permanent employee, and increasing the number of seed analyst. On the other hand, the supplement and introduction of testing equipment to each STL to obtain the smooth certification works against to the forecasted increment of the works are in accordance with the increment of samples to be certified.

The increasing samples and results of certification shall be promptly analyzed, consolidated, and then extended to the related agencies to make it useful for basic data in order to provide any improvement schemes. The set of computers with the related equipment shall be considered to provide the above requirement. Each STL of model area shall consolidate the basic data regarding the control area of seed farms and seed processing, results of seed certification and the other analyzed results through the computer is provided, and then shall study the utilization of these consolidated data with the cooperation of the other STLs or agencies related.

The following improved plan for the seed certification works is provided.

a) To renew and newly provide the seed testing equipment for each STL to improve the accuracy and efficiency of the seed testing works against to the increment of test samples.

b) To provide the computer and related equipment to analyze and consolidate the informations regarding the seed quality control.

c) To distribute appropriate vehicles to each STL to give the mobility for training in the field of provincial seed inspector and seed field survey.

d) To strengthen the STL organization by shifting the employee from part time to permanent, or increasing the number of seed analyst.

5.3 Equipment to be Considered for Improving the Seed Quality Control Services

The equipment will be considered for introduction and replacement to improve the seed certification services are as follows (refer to Table D.5.2).

(1) For seed inspection services (to 49 inspectors)

Region II	M.A.	24
Region VI	M.A.	11
Region XI	M.A.	14
Total		49

1)	Field inspection kit	1 set each
2)	Motor cycle	1 unit each

(2) For seed certification services (to 3 STL)

1)	Moisture test equipment	1 set each
2)	Purity test equipment	1 set each
3)	Germination test equipment	1 set each
4)	Seed pathology test equipment	1 set each
5)	Tag printer set	1 set each
6)	Seed inspection vehicle	1 unit each
7)	Data processing equipment	1 set each

Table D.1.1 LOCATION OF SEED TESTING LABORATORY (STL)
AND COVERED PROVINCES BY STL

Region	Laboratory Number	Province	Municipality	Location	Covered Province
I	1	Pangasinan	Dagupan City	D.A. Pangasinan Provincial Office	Ilocos Norte Ilocos Sur La Union Pangasinan
II	2	Isabela	San Mateo	Cagayan Valley E.S. Malasin, San Mateo	Isabela Nueva Viscaya Quirino
	3	Cagayan	Iguig	A.P.C.	Cagayan Batanes
III	4	Nueva Ecija	Munoz	Phil. Rice Central E.S. MMRTC, Maligaya	Zambales Tarlac Nueva Ecija Pampanga Bataan
IV	5	Laguna	Los Banos	Economic Garden National Crop Center	Aurora Cavite Batangas
	6	Or. Mindoro	Naujan	Barangay Barcenaga	Oriental Mindoro Laguna
	7	Occ. Mindoro	San Jose	Mindoro Integrated Area Development Office	Occidental Mindoro Marinduque Laguna Quezon Romblon Palawan Rizal
V	8	Camarines Sur	Pili	Bicol E.S., San Agustin D.A. Region V Office	Camarines Norte Camarines Sur Albay Catanduanes Masbate Sorsogon
VI	9	Iloilo	Iloilo City	Visayas E.S. Hamungaya, Jaro	Aklan Antique Capiz Iloilo Guimaras
	17	Negros Occidental	La Carlota City	La Granja N.C.C.	Negros Occidental
VII	10	Cebu	Mandaue City	Mandaue E.S., Estancia	Bohol Cebu Negros Oriental Siquijor
VIII	11	Leyte	Tacloban	Romualdez E.S., Babatngon	Leyte Southern Leyte
	12	Samar	Catbalogan City	Gandara Seed Farm	Samar Biliran Eastern Samar Northern Samar
IX	13	Zamboanga del Su	Ipil	Ipil E.S.	Basilan Zamboanga del Norte Zamboanga del Sur Zamboanga City Sulu
X	14	Misamis Oriental	Cagayan de Oro City	D.A. Region X Office	Agusan del Norte Agusan del Sur Bukidnon Camiguin Misamis Occidental Misamis Oriental Surigao del Norte
XI	15	Davao	Bago Oshiro	Davao National Crop Center Bago Oshiro	Davao City Davao del Norte Davao del Sur Davao Oriental South Cotabato Surigao del Sur
XII	16	North Cotabato	Midsayap	Mindanao E.S. Bual, Midsayap	Cotabato City North Cotabato Maguindanao Lanao del Norte Lanao del Sur Sultan Kudarat
Central Offi	Bureau of Plant		Manila	Malate	NCR

Table D.1.2 AREA INSPECTED AND NUMBER OF INSPECTORS BY REGION

Region	(1) Inspected Area (Ha.)	(2) Number of Inspector	(1)/(2) (Ha.)	Quantity of approval seed (Cavan) Rice	Corn
I	1,353.51	9	150.3	2,751.00	33.00
II	3,131.21	11	284.6	106,879.00	2,192.00
III	4,029.85	17	237.1	117,765.00	-
IV	1,274.72	21	48.0	977,829.00	96.25
V	1,420.72	22	64.6	39,573.00	94.00
VI	1,798.41	16	112.4	49,273.94	61.00
VII	251.55	8	31.5	6,469.00	131.36
VIII	766.91	12	63.9	13,724.50	75.00
IX	862.02	9	96.8	22,583.00	2,396.00
X	637.07	13	49.6	20,992.00	100.00
XI	4,702.99	17	276.6	57,950.00	262.20
XII	705.69	8	88.2	17,241.50	569.00
TOTAL	20,934.65	163	128.4	1,433,030.94	6,009.81

Data Source: S.Q.C.S. Annual Report, 1989

Table D.1.3 NUMBER OF SEED INSPECTORS BY REGION/PROVINCE(1990)

Region	Number
REGION I	14
Pangasinan	7
La Union	2
Ilocos Norte	3
Ilocos Sur	2
REGION II	31
Cagayan	7
Isabela	15
Nueva Vizcaya	7
Quirino	2
REGION III	39
Nueva Ecija	9
Bulacan	7
Pampanga	6
Bataan	3
Zambales	5
Tarlac	9
REGION IV	37
Cavite	3
Laguna	3
Batangas	4
Aurora	3
Rizal	3
Marinduque	3
Quezon	4
Romblon	3
Palawan	2
Occidental Mindoro	5
Oriental Mindoro	4
REGION V	24
Albay	5
Camarines Sur	6
Camarines Norte	3
Catanduanes	3
Masbate	2
Sorsogon	5
REGION VI	11
Aklan	2
Antique	1
Capiz	2
Guimaras	1
Iloilo	4
Negros Occidental	1

Region	Number
REGION VII	12
Cebu	2
Bohol	4
Negros Oriental	4
Siquijor	2
REGION VIII	19
Leyte	5
Biliran	3
Southern Leyte	3
Northern Samar	4
Western Samar	2
Eastern Samar	2
REGION IX	10
Zamboanga del Sur	5
Zamboanga del Norte	1
Zamboanga City	2
Basilan	1
Sulu	1
REGION X	26
Agusan Norte	3
Agusan Sur	10
Bukidnon	3
Camiguin	3
Surigao del Norte	3
Misamis Occidental	2
Misamis Oriental	2
REGION XI	14
South Cotabato	3
Davao del Sur	2
Davao City	1
Davao del Norte	3
Davao Oriental	2
Surigao del Sur	3
REGION XII	10
North Cotabato	3
Sultan Kudarat	3
Maguindanao	1
Lanao del Sur	1
Lanao del Norte	1
Cotabato City	1
Total	247

Data source : based on the data offered by S.Q.C.S. BPI. Manila.

Table D.1.4 THE NUMBER OF STL STAFF (1990)

Datas Source: S.Q.C.S. BPL.

REGION	S.T.L. NO.	No. of Staff				Total No. of Samples tested (1989)
		Seed Analyst	Adm. Staff	Other Janitor/Driver.etc	Total	
I	1	5	4	1	10	3,693
II	2	6	4	1	11	5,174
	3	4	2	0	6	3,937
III	4	8	4	1	13	14,619
IV	5	4	3	0	7	2,652
	6	4	2	0	6	306
	7	4	2	0	6	1,251
V	8	4	3	1	8	10,520
VI	9	5	3	1	9	
	17*1	1	1	0	2	5,797
VII	10	4	3	1	8	1,025
VIII	11	5	3	1	9	
	12*2	1	0	0	1	6,989
IX	13	5	2	0	7	1,602
X	14	5	3	1	9	3,111
XI	15	5	3	1	9	7,562
XII	16	4	3	1	8	5,084
CENTRAL OFFICE		9	3	2	14	9,078
CAR REGION*3		0	0	0	0	0
TOTAL		83	48	12	143	82,400

NOTE: *1. Lab.No.17 was established in the site of La Granja NCC.Negros Occ. in 1990,while the Lab. is operating under Lab.No.9.Visayas ES

*2. Lab.No.12 was established in the site of Gandara SF,Samar.in 1989.

*3. Cordillera Automous Region(CAR). Not yet established.

Table D.1.5 SEED CERTIFICATION RESULTS BY STL(1989)

Region SQCS	Producer/ Province	Crop	Approved Seed Class (Cavans) and Number of Samples Submitted						Total	Tagged & Sealed	Remarks
			Breeded	Foundation	Registered	Certified	Good	Rejected			
Region I	Station	Rice		25(1)	74(3)	151(7)		50(1)	300(12)		
	P. Coop	Rice			2150(59)	21477(340)	1239(16)	2345(28)	27211(443)		
Lab. No. 1		Corn			33(2)				33(2)		
	Others			3.4(1)	21(12)	4342.5(32)		88(1)	4454.9(46)		Cotton, Mungo
Dagupan	Total			28.4(2)	2278(66)	25970.5(379)	1239(16)	2483(30)	31988.9(493)	28064	
Region II	Station	Rice		136(9)	1361(39)	120(3)	10(1)	32(3)	1659(55)		
		Corn		259(7)	219(6)	570(10)			1048(23)		
		Peanut				200(1)			200(1)		
Lab. No. 2		Others		6(1)	11(2)				17(3)		Mungo
	P. Coop	Rice			1702(36)	77239(537)	4021(31)	6568(49)	89530(653)		
San Mateo		Corn			25(1)	990(13)		17(1)	1032(15)		
	Total			401(17)	3318(84)	79119(567)	4031(32)	6617(53)	93486(753)	93508	
Lab. No. 3	Station	Rice			918(29)	40(1)			958(30)		
		Corn			20(1)				20(1)		
Ipuig		Peanut			99(5)				99(5)		
		Others			103(6)				103(6)		Mungo
	P. Coop	Rice		23(2)	1918(51)	11034(169)		1727(28)	14732(250)		
		Corn			48(3)	44(1)			92(4)		
		Peanut				130(4)			130(4)		
	Total			23(2)	3136(95)	11248(175)		1727(28)	16134(300)	15268	
Region III	Station	Rice	70(70)	1571(80)	3424.5(103)	390(29)		535(45)	5990.5(327)		
Lab. No. 4	P. Coop	Rice			10319(240)	69076(639)	4422(25)	24524(217)	108341(1121)		
Maligaya		Others				154(2)			154(2)		Cotton
Others		Rice				24(1)	1660(10)	1750(11)	3434(22)		
	Total		70(70)	1571(80)	13743.5(343)	69644(671)	6082(35)	26809(273)	117919.5(1472)	57839	
Region IV	Station	Rice		38.35(9)	309.5(24)	236(8)		140(7)	723.85(48)		
		Corn		46.65(6)	50(1)				96.65(7)		
Lab. No. 5		Others	9(13)	8.41(8)	6(3)				23.41(24)		Mungo, Sorghum
Los Banos	P. Coop	Rice		200(4)	4498(87)	18744(113)	610(3)	1192(9)	252.44(216)		
	Total		9(13)	293.41(27)	4863.5(115)	18980(121)	610(3)	1332(16)	26087.91(295)	23592	
Lab. No. 6	Station	Rice			436(15)	277(11)	9(1)		722(27)		
Buscastga,	P. Coop	Rice			264(10)	4233(69)	227(4)	677(15)	5401(98)		
Or. Mindoro											
	Total				700(25)	4510(80)	236(5)	677(15)	6123(125)	5236	
Lab. No. 7	Station	Rice			158(3)	50(1)			208(4)		
San Jose,	P. Coop	Rice				2476(21)			2476(21)		
Occ. Mindoro											
	Total				158(3)	2526(22)			2684(25)	2097	
Region V	Station	Rice		511(69)	612(31)	640(43)	50(1)	8(1)	1821(145)		
Lab. No. 8		Corn			19(2)				19(2)		
Bicol	P. Coop	Rice			2211(48)	16093(240)	5539(79)	3909(70)	27752(137)		
		Corn			25(1)	50(2)			75(3)		
	Total			511(69)	2867(82)	16783(285)	5589(80)	3917(71)	29667(587)	26090	
Region VI	Station	Rice		561.31(41)	1068.63(45)	62(2)		155(5)	1846.94(93)		
Lab. No. 9		Corn			32(1)	29(1)			61(2)		
Iloilo	P. Coop	Rice			5387(142)	36585(308)	2300(21)	3055(39)	47427(510)		
	Total			561.31(41)	6487.63(188)	36776(311)	2300(21)	3210(44)	49334.94(605)	45499	
Region VII	Station	Rice			100(3)	40(1)		110(2)	250(5)		
Lab. No. 10		Corn		2(1)	33.36(2)				35.36(3)		
Cebu	P. Coop	Rice			715(15)	3528(53)	459(8)	1517(26)	6219(102)		
		Corn			96(4)				96(4)		
	Total			2(1)	944.36(23)	3568(54)	459(8)	1627(28)	6600.36(114)	3734	
Region VIII	Station	Rice			513(15)	57(3)		61(1)	631(19)		
		Corn			75(4)				75(4)		
Lab. No. 11		Others			5(1)	12(1)			17(2)		Mungo
Leyte	P. Coop	Rice			1629.5(72)	8124(155)	585(10)	2755(39)	13093.5(276)		
	Total				2222.5(92)	8193(159)	585(10)	2816(40)	13816.5(301)	7814	
Region IX	Station	Rice			203(37)	6(1)			209(38)		
Lab. No. 12	P. Coop	Rice			1807(53)	18760(179)	960(9)	847(10)	22374(251)		
Ipil, Zamboanga S.		Corn			323(12)	2003(17)		70(1)	2396(30)		
		Others				251(6)			251(6)		Mungo
	Total				2333(102)	21020(203)	960(9)	917(11)	25230(325)	24583	
Region X	Station	Rice		29.5(2)	300(10)	108(2)		57(1)	494.5(15)		
Lab. No. 14		Corn				100(1)			100(1)		
Cagayan de Oro	P. Coop	Rice			1992.5(78)	16654(378)		1951(47)	20497.5(503)		
	Total			29.5(2)	2292.5(88)	16762(381)		2008(48)	21092(519)	17770	
Region XI	Station	Rice		30(1)	452(12)	87(2)	127(3)		696(18)		
		Corn			110(7)				110(7)		
Lab. No. 15		Peanut			2.3(1)				2.3(1)		
		Others			50(1)			25(1)	75(2)		Sorghum
Davao	P. Coop	Rice			2619(79)	48425(498)	4132(58)	2078(27)	57254(662)		
		Corn			119.2(7)	14(2)		19(1)	152.2(10)		
		Others				937(8)	3600(23)		4537(31)		Cotton
	Other Agency	Cotton				1462(16)		127(2)	1589(18)		
	Total			30(1)	3352.5(107)	50925(526)	7859(84)	2249(31)	64415.5(749)	65292	
Region XII	Station	Rice		249.5(11)	2826(80)	1792(44)		141(4)	5008.5(139)		
		Corn			276(5)	288(3)		5(1)	569(9)		
Lab. No. 16	P. Coop	Rice			737(17)	10425(121)		1071(12)	12233(150)		
Midsayap	Total			249.5(11)	3839(102)	12505(168)		1217(17)	17810.5(298)	16713	
Central Office		Rice		675(20)	176(5)			75(4)	926(29)	851	
		Corn		133.2(6)				56.2(2)	189.4(8)	333	
Manila		Others		10(1)					10(1)	10	
	Total			818.2(27)	176(5)			131.2(6)	1125.4(38)	1194	
National Total			79(83)	4518.32(280)	52711.49(1520)	378529.59(4102)	29950(303)	57737.2(711)	523525.51(6999)	434294	

Data Source: Annual Report S.O.C.S., BPI, 1989

Table D.1.6 SEED STANDARD

Seed/Factors	Unit	Breeder seed	oundatic seed	Registered seed	Certified seed
Peanut Seed *1.					
1. Pure seed(min.)	%	-	99	98	98
2. Other crop seed(max.)	%	-	0	0	0
3. Other varieties(max.)	No.of variety/	-	/500 gr. of seed	3/500 gr. of seed	5/500 gr. of seed
4. Weed seed(max.)	%	-	0	0	0
5. Inert matter(max.)	%	-	1	2	3
6. Gemination(min.)	%	-	80	80	80
7. Moisture content(max	%	-	12	12	12
Rice seed					
1. pure seed(min.)	%	98	98	98	97
2. Weed & other crop see	%	0	0	0.05	0.1
3. Inert matter(max.)	%	2	2	2	3
4 redrice grains(max.)	No.of grains	0	0	1/500 gr. of grain	2/500 gr, of grain
5. Other varieties grains(	No.of grains	0	/500 gr. of grain	5/500 gr. of grain	0/500 gr. of grain
6. Gemination(min.) *2.	%	80	80	80	80
7. Moisture content(max	%	14	14	14	14
Com seed *3					
1. Pure seed(min.)	%	99	99	98	98
2. Inert matter(max.)	%	1	1	2	2
3. Other varieties(max.)	No.of grains	0	/500 gr. of grain	3/500 gr. of grain	5/500 gr. of grain
4. Other crops(max.)	%	0	0	0	0.05
5. Weed seed(max.)	%	0	0	0	0
6. Gemination(min.)	%	80	80	80	80
7. Moisture content(max	%	14	14	14	14

Data Source: Minimum Seed Certification Standaeds For Rice,Com and Other Crops In The Philippines

NOTE: *1. The size of peanut sample is 1 Kg. of unshelled peanut seed. *2. Based on pure seed only. *3 Open pollinated corn

TABLE D.1.7 REJECTED AND TAGGING RATE

STL No.	(1) Tested Seed Quantity	(1) Tested Seed No. of Sample	(2) Rejected Seed Quantity	(2) Rejected Seed No. of Sample	(3) (1) - (2)	(4) (2)/(1) (%)	(5) Quantity of tagged & sealed seed	(6) (5)/(3)
1	31,988.90	493	2,483.0	30	29,505.90	7.8	28,064	95.1
2	93,486.00	753	6,617.0	53	86,869.00	7.1	93,508	107.6
3	16,134.00	300	1,727.0	28	14,407.00	10.7	15,268	106.0
4	117,919.50	1,472	26,809.0	273	91,110.50	22.7	57,839	63.5
5	26,087.91	295	1,332.0	16	24,755.91	5.1	23,593	95.3
6	6,123.00	125	677.0	15	5,446.00	11.1	5,236	96.1
7	2,684.00	25	0.0	0	2,684.00	0.0	2,097	78.1
8	29,667.00	587	3,917.0	71	25,750.00	13.2	26,090	101.3
9	49,334.94	605	3,210.0	44	46,124.94	6.5	45,499	98.6
10	6,600 36	114	1,627.0	28	4,973.36	24.7	3,734	75.1
11	13,816.50	301	2,816.0	40	11,000.50	20.4	7,814	71.0
13	25,230.00	325	917.0	11	24,313.00	3.6	24,583	101.1
14	21,092.00	519	2,008.0	48	19,084.00	9.5	17,770	93.1
15	64,415.50	749	2,249.0	31	62,166.50	3.5	65,292	105.0
16	17,810.50	298	1,217.0	17	16,593.50	6.8	16,713	100.7
C.O.	1,125.40	38	131.2	6	994.20	11.7	1,194	120.1
N.T.	523,515.51	6,999	57,737.2	711	465,778.31	11.0	434,294	93.2

Data Soruce: S.Q.C.S Annual Report, BPI, DA 1989

Table D.1.8 EXISTING FUNCTIONAL TSETING EQUIPMENT

Name of Equipment	No of Seed Testing Laboratory															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1 Microscope(Stereoscopic)		1		1		1		1	N.R		1		1		1	1
2 Microscope(Binocular)						1				1	1			1	1	
3 Grinder		1			1	1			1	1	1		1	1	1	
4 Pocket Moisture Tester		1	1			2		2						2		
5 Portable Gen. Moisture Tester					3			1	N.R	2	2		4		1	1
6 Infrared Moisture Tester		1		1				1	1						1	
7 Heater Air Oven		1		1	1	1			1	1	1		1	1		1
8 Seed Sample Divider		2		1	1	2		1	1	3	1		1	1	1	1
9 Analytical Balance									N.R				1	1		
10 Triple Beam Balance						1		1	1							1
11 Seed Trier		3		2	1	1		1	1	2	4		4	1	5	2
12 Weight-to-Volume Balance										1						
13 Seed Counter										1						
14 Germinator								N.R	N.R	1					1	
15 Illuminated Desk Magnifier				1	1					1				1	3	
16 Magnifier										1	1			1		
17 Grain Sieve		3								1					1	
18 Seed Blower		1						1	1	2	1			1	1	1
19 Hotplate				1	1				1	1	1		1	1	1	
20 Refrigerator								1	1		1					
21 Embossing Machine																
22 Printing Machine																
23 Dessicator				1		1			1	1	1		1	1		1
24 Seed Inspection Rit				1	1					1			1	1		1
25 Purified Water Collect Dev.																
26 Autclave				1					1	1	1		1	1	1	1

Table D.2.1 EXISTING STL AND REINFORCEMENT PLAN UNDER THE RICE ACTION PROGRAM

Region	Existing Seed Testing Laboratory			The Rice Action Program	
	Province	Lab. No.	Location	Improvement	Construction (New STL)
CAR					o
I	Pangasinan	No. 1	Dagupan City	o	
II	Isabela,	No.2	San Mateo, C.V.ES	o	
	Cagayan	No.3	Iguig, A.P.C.	o	
III	Nueva Ecija	No.4	Maligaya, Phil. Rice	o	
					Bulacan
					Pampanga
					Tarlac
IV	Laguna	No. 5	Los Banos, EG. NCC.	o	
	Or. Mindoro	No. 6	Barangay Barcenaga	o	
	Occ. Mindoro	No. 7	San Jose, MIAD Office	o	
					Quezon
V	Camarines Sur	No. 8	Pili, Bicol ES	o	
					Albay
					Sorsogon
VI	Iloilo	No. 9	Iloilo City, Visayas ES		
		No. 17	Las Carlota, La Granja NCC, Negros Occidental		
					Capiz
VII	Cebu	No. 10	Estancia, Mandaue ES		
VIII	Leyte	No. 11	Babatngon, Romualdez ES	o	
	Samar	No. 12	Gandara SF		
IX	Zamboanga Sur	No. 13	Ipil ES	o	
X	Misamis Or.	No. 14	D.A. Region X Office		
					Bukidnon
XI	Davao City	No. 15	Bago Oshino, Davao NCC		
					Davao Norte
					Davao Sur
					S. Cotabato
XII	N. Cotabato	No. 16	Midsayap, Mindanao ES	o	
					Maguindanao
					Sultan Kudarat
	Central Office		BPI, Malate, Manila		

Table D.4.1 WORKING SITUATION OF SEED INSPECTOR IN REGION VI M.A.

Region VI Rice Seed Model Area

Province	S.I.	Number of Municipality	Covered Area by Seed Inspectors: Number of Seed Growers: Rice	Corn	Others	Planted Area (ha.): Rice	Corn	Others	Field Inspection Trip: Round Trip (Mileage)*	Annual Frequency	Sample seed delivery to STL: Annual Frequency	Distance from assigned office to STL (Km)
Aklan	A	4	9			60			70	14	6	189
	B	6	9			55			62	18	5	189
Antique	C	4	5			74			130	11	9	96
Capiz	D	4	10			48.8			76	15	8	110
	E	4	13			46			88	17	5	110
Guimaras	F	2	12			65			54	14	8	45
Iloilo	G	5	14			114			85	19	14	22
	H	5	15			167			98	23	17	41
	I	5	9			111			64	14	9	34
	J	2	4			89			45	10	7	98
Negros Occ	K	5	5			60			90	11	4	60

* Round trip mileage : One time field inspection trip in kilometers from assigned office to the given seed field and return to the office

TABLE D.4.2 MANPOWER OF SEED CERTIFICATION SYSTEM AND SITUATION OF TARGET SEED PRODUCTION

Region & Province	STL Concerned	1989: Manpower in STL: Regular Staff: SA	SI	Others	Total	Daily Paid	No. of SI	Covered Seed Grower: No. of Seed Grower: Total	Target Seed	Planted Area (Ha.): Total	Target Seed	1990: Manpower in STL: Regular Staff: SA	SI	Others	Total	Daily Paid	No. of SI	Covered Seed Grower: No. of Seed Grower: Total	Target Seed	Planted Area (Ha.): Total	Target Seed
Region II (Peanut)	No. 2	6	0	5	11	4						5	0	1	6	4					
Nueva Vizcaya	C.V.E.S.						1	30	0	155	0						7				
Isabela							4	81	1*	1156	7						15				
Quirino							1	15	0	60	0						2				
Region VI (Rice)		6	2	2	10	5						8	3	1	12	5					
Aklan	No. 9						3	10	10	95	95						2	18	18	115.0	115.0
Antique							2	5	5	71	71						1	5	5	74.0	74.0
Capiz	Visayas E.S.						2	14	14	60	60						2	24	24	94.8	94.8
Guimaras							1	7	7	46	46						1	12	12	65.0	65.0
Iloilo							4	38	38	427	427						5	41	41	481.0	481.0
Negros Occ							4	5	5	50	50						2	5	5	60.0	60.0
Region XI (Corn)		5	1	3	9	3						5	1	2	8	3					
Davao City	No. 15						1	4	2**		3.3						1	6	2		
Davao del Sur							3	11	0		-						2	19	3		
S. Cotabato	Davao N.C.C.						4	34	3***		10.5						3	133	2		
Davao Norte							4	37	0	-	-						3	100	53		
Davao Oriental							2	20	0	-	-						2	8	0		
Surigao Sur							3	29	0	-	-						3	20	2		

Note:
Data Source: Based on Questionnaires provided by JICA Team

1. SA: Seed Analyst
2. SI: Seed Inspector
3. Others: Driver, Janitor, etc.
4. Daily paid: Temporary staff
5. Target seed: Production of crop seeds to be increased in the Model Area such as peanut seed in Region II, rice seed in Region VI and corn seed in Region XI
6. Number of target seed grower and planted area are based on the field report submitted by Seed Inspector to the STL

* Ilagan ES
** including Davao NCC
*** including Tupi, S.F.

Table D.4.3 SEED CERTIFICATION RESULTS BY THE MODEL AREA(1989)

Region SQCS	Producer/ Province	Crop	Approved Seed Class (Cavans) and Number of samples Submitted						Total	Tagged & Sealed
			Breeder	Foundation	Registered	Certified	Good	Rejected		
II	CVES	Rice		136(9	1361(39	100(2	10(1	32(3	1639(54	
PEANUT	Isabela									
Lab.No.2	IES-Isabela	Rice				20(1			20(1	
San Mateo		Corn		259(7	219(6	570(10			1048(23	
		Mungo		6(1	11(2				17(3	
		Peanut				200(4			200(4	
	Total for Station			401(17	1591(47	890(17	10(1	32(3	2924(85	
	P. Coop									
	Isabela	Rice			1350(28	70742(462	3527(25	6175(44	81794(559	
	Isabela	Corn			25(1	990(13			1015(14	
	N. Viscaya	Rice			262(6	3992(52	379(5	198(3	4831(66	
	N. Viscaya	Corn						17(1	17(1	
	Quirino	Rice			90(2	2505(23	115(1	195(2	2905(28	
	Total for P. Coop				1727(37	78229(550	4021(31	6585(50	90562(668	
	Total for Lab. No. 2			401(17	3318(84	79119(567	4031(32	6617(53	93486(753	93508
VI	VES	Rice		405.31(33	1018.63(44	62(2		55(3	1540.94(82	
RICE	GES	Rice		156(8				100(2	100(2	
Lab. No. 9	LGES	Rice			50(1				206(9	
Iloilo		Corn			32(1	29(1			61(2	
	Total for Station			561.31(41	1100.63(46	91(3		155(5	1907.94(95	
	P. Coop									
	Aklan	Rice			1016(23	5275(34		100(1	6391(58	
	Antique	Rice			672(16	5675(35	175(1		6522(52	
	Capiz	Rice			883(26	4854(50	340(4	868(12	6945(92	
	Guimaras	Rice			268(8	2408(28		322(5	2998(41	
	Iloilo	Rice			2311(61	14737(125	1785(16	1265(14	20098(216	
	Negros Occ.	Rice			237(8	3736(36		500(7	4473(51	
	Total for P. Coop				5387(142	36685(308	2300(21	3055(39	47427(510	
	Total for Region			561.31(41	6487.63(188	36776(311	2300(21	3210(44	49334.94(605	45499
XI	TSF	Rice		30(1	452(12	87(2	127(3		696(18	
CORN	S. Cotabato									
Lab. No. 15		Corn			84(6				84(6	
Davao		Peanut			2.3(1				2.3(1	
		Sorghum			50(1			25(1	75(2	
	DES									
	D.Sur	Corn			26(1				26(1	
	Total for Station			30(1	614.3(21	87(2	127(3	25(1	883.3(28	
	P. Coop									
	D. Norte	Rice			464(17	15545(152	785(17	491(6	17285(192	
	D. Oriental	Rice			564(20	8060(90	940(12	72(1	9636(123	
	D. Sur	Rice			506(15	10912(92	1172(10	927(9	13517(126	
	D. Sur	Corn			68.8(4	-	-	19(1	87.8(5	
	S. Cotabato	Rice			971(23	9182(121	1072(15	331(6	11556(165	
	S. Cotabato	Corn			50.4(3	14(2			64.4(5	
	S. Cotabato	Cotton				937(8	3600(23		4537(31	
	Surigao Sur	Rice			114(4	4726(16	163(4	257(5	5260(56	
	Total for P. Coop				2738.2(86	49376(508	7732(81	2097(28	61943.2(703	
	Other Agency	Cotton				1462(16		127(2	1589(18	
	Total for Region XI			30(1	3352.5(107	50925(526	7859(84	2249(31	64415.5(749	65292

Note: Data Source: Annual Report S.Q.C.S., BPI, DA 1989
CVES: Cagayan Valley Experiment Station (ES)
IES: Ilagan E.S.
P. Coop: Private seed grower/producer
VES: Visayan E.S.
GES: Guimaras E.S.
LGES: La Granja N.C.C.
TSF: Tupi Seed Farm
DES: Davao N.C.C.

Table D.4.4 SEED TESTING RESULTS OF PROPOSED CROP SEED BY STL IN THE MODEL AREA

Region	Name of ES/SF & Province Concerned	Seed Classes	Crop Season	No. of Sample seed for certification			Seed Test Conducted						Total Quantity (Cavan)	Quantity of certified seeds (Cavan)	Quantity of tagged/sealed seed (Cavan)	Rejected Seed											
				received samples	Number of sample	Quantity (Cavan)	Number of Test									Number of Sample						Quantity (Cavan)					
							P	G	M	H	O	T				P	G	M	H	O	T	P	G	M	H	O	T
II (Peanut)	Iligan E.S.	RS	DS	6	6	304	31	28	28	-	-	87	304	304	304						0						0
		CS	WS	2	2	90	6	11	13	-	-	30	90	90	90						0						0
VI (Rice)	Visayas E.S.	BS	D/WS	15	15	405	15	38	15	-	15	83	405	405	405												
		FS	D/WS	72	72	1,100	72	148	72	-	72	364	1,022	1,022	1,022		4						78				78
		RS	WS	1	1	62	1	3	1	-	1	6	62	62	62												
	La Granja E.S.	BS	WS	9	9	156	9	18	9	-	5	41	156	156	156												
		FS	WS	2	2	82																					
	Aklan	RS	D/WS	23	23	1,016	23	50	23	-	23	119	1,106	1,106	1,106												
		CS	D/WS	36	36	5,275	36	88	36	-	36	196	5,275	5,275	5,275												
	Antique	RS	D/WS	12	12	622	12	30	12	-	12	66	622	622	622												
		CS	D/WS	39	39	5,725	39	86	39	-	39	203	5,725	5,725	5,725												
		GS	WS	1	1	175	1	2	1	-	1	5															
	Capiz	RS	D/WS	22	22	883	22	88	26	-	22	158	883	883	883												
		CS	D/WS	58	58	4,894							4,894	4,894	4,894												
		GS	WS	2	2	300																					
		GS	WS	Rejected	11	868											8			3	11						868
	Guimaras	RS	D/WS	7	7	268	7	18	7	-	7	39	268	268	268												
		CS	WS	31	31	2,408	31	86	31	-	31	179	2,408	2,408	2,408												
		GS	WS	Rejected	3	160	3	17	3	-	3	26		-	-												
	Iloilo	RS	D/WS	48	48	2,362	48	120	48	-	48	264	2,362	2,362	2,362												
		CS	D/WS	153	153	16,057	153	505	160	-	153	971	16,057	16,057	16,057												
		GS	D/WS	6	6	749	6	6	6	-	6	24		-	-												
				Rejected	12	1,257	12	45	12	-	12	81		-	-			8		4	12						
	Negros Occ.	RS	D/WS	6	6	237	6	18	6	-	6	36	237	237	237												
		CS	D/WS	40	40	3,736	40	130	40	-	40	250	3,736	3,736	3,736												
				Rejected	5	500	5	74	5	-	5	89		-	-			3		2	5						
XI (Corn)	Davao NCC	RS	DS	7	7	135	7	7	14	-	7	35	134.89	113.78	105.33		1				1		21.11				21.11
	Tupi, SF	RS	DS	6	6	93	6	6	12	-	6	30	93.33	93.33	93.33												
	S. Cotabato	CS	DS	2	2	16	2	2	4	-	2	10	15.55	15.55	15.55												

Data Source: Based on answered questionnaires provided by JICA Team

NOTE: P : Purity test
G : Germination test
M : Moisture test
H : Seed helth test
O : Other specified
T : total

Table D.4.5 NUMBER OF SEED TEST CONDUCTED BY TESTING ITEMS

Crop and No. of Samples Recieved		Test Conducted							
		Germination	Moisture	Purity	Varietal	Seed Health	Vigor	Other Test	Total
Lab. No. 2. Region II									
Peanut	4	4	2	4	-	-	-	-	10
Rice	975	985	1,017	715	717	-	-	-	3,434
Corn	824	824	158	26	-	-	-	-	1,008
Mungo	12	-	12	3	-	-	-	-	15
Vegetable	375	375	7	-	23	-	-	-	405
Other									
Lab. Total	2,190	2,188	1,196	748	740	-	-	-	4,872
Lab. No. 9. Region VI									
Rice	615	1,436	631	615	615	-	-	-	3,297
Other Seed	1380	1,380	490	-	-	-	-	-	1,870
Lab. Total	1995	2,816	1,121	615	615	-	-	-	5,167
Lab. No. 15. Region XI									
Corn	556	561	712	218	15	5	7	73	1,591
Rice	1259	1,395	1,752	689	784	7	-	161	4,788
Soybean	30	37	18	4	-	3	-	12	74
Peanut	8	8	8	3	1	-	-	4	24
Mungo	65	41	36	-	-	-	-	13	90
Others	416	468	338	119	2	-	-	63	990
Lab. Total	2334	2,510	2,864	1,033	802	15	7	326	7,557
Total	6519	7,514	5,181	2,396	2,157	15	7	326	17,596

Data Source: Regional S.Q.C.S. Annual Report, 1989

Table D.5.1 ESTIMATION OF RECEIVING SAMPLES
UNDER PLANNED SEED PRODUCTION

Region II Model Area (PEANUT-STL No.2)

	STATION		P.COOP.		
	F.S	R.S	R.S	C.S	TOTAL
Planned seed production(ton)	2.7	13.3	14.0	260.0	290.0
Gross quantity of seed (ton) *1.	3.0	14.8	15.6	288.9	322.3
Converted to cavan(25Kg/cavan)	150	740	780	14,445	16,115
Estimated No. of samples to be drawn for seed testing *2.	7	7	14	70	98
No. of received sample for seed testing (1989)			PEANUT SEED		4
			OTHER SEED		696
			REJECTED SEED		53
			TOTAL		753

Region VI Model Area (RICE-STL No.9)

	STATION		P.COOP.		
	F.S	R.S	R.S	C.S	TOTAL
Planned seed production(ton)	2.84	80.1	19.5	6,405	6,507.44
Gross quantity of seed (ton)	3.03	85.7	20.9	6,854.5	6,964.13
Converted to cavan(45Kg/cavan)	67	1,904	464	152,322	154,757
Estimated No. of samples to be drawn for seed testing	5	5	10	1,066	1,086
No. of received sample for seed testing (1989)			RICE SEED		559
			OTHER SEED		2
			REJECTED SEED		44
			TOTAL		605

Region VX Model Area (CORN-STL No.15)

	STATION		P.COOP.		
	F.S	R.S	R.S	C.S	TOTAL
Planned seed production(ton)	0.255	21.18	44.4	1,579	1645.135
Gross quantity of seed (ton)	0.29	24.2	50.7	1,804.9	1,880.09
Converted to cavan(50Kg/cavan)	6	484	1,014	36,098	37602
Estimated No. of samples to be drawn for seed testing	6	6	6	200	218
No. of received sample for seed testing (1989)			RICE SEED		16
			OTHER SEED		702
			REJECTED SEED		31
			TOTAL		749

NOTE: *1. Rate of rejection based on the Annual Report.1989(10% in peanut,6.5% in rice, 12.5% in corn) was adopted at calculation.
*2.Estimation of No. of samples refered to No. of varieties planned,the experiences and the No. of received samples for seed testing.1989.

Table D.5.2 LIST OF SEED TESTING EQUIPMENT
AND VEHICLES TO BE PROVIDED UNDER THE PROJECT

Name of Equipment	Number of Unit/Set	Total Cost (Unit:Million P)		Remarks	
A. Moisture Tester:					
1. Rotary Drying Oven	3				
2. Electronic Analitycal Balance	3				
3. Grain Moisture Tester	3				
4. Maize Moisture Tester	3				
5. Infrared Moisture Tester	3				
6. Other necessary Equipment 1 Lot	3	sub-total	1.536		
B. Purity Test:					
1. Rice Grain Counter	3				
2. Multi Auto Counter	3				
3. Magnifier with Circular Flowescent	3				
4. Other necessary Equipment 1 Lot	3	sub-total	2.432		
C. Germination Test:					
1. Thermostatic Germinator	3				
2. Seed Vacuum Counter Heads	3				
3. Sand Media Mixture	3				
4. Other necessary Equipment 1 Lot	3	sub-total	2.960		
D. seed Helth Test:					
1. Drying Oven,Gravity Connection	3				
2. Table Top Centrifuge	3				
3. Water Stills	3				
4. Stainless Steel Aseptic Box	3				
5. Binocular Microscope	3				
6. Other necessary Equipment 1 Lot	3	sub-total	2.416		
E. Tag Print 1Lot	3	sub-total	0.480		
F. Data Treatment and Compilation					
1. Micro Computer with Printer	3				
2. Copy Machine	3				
3. Other necessary Equipment 1 Lot	3	sub-total	1.200		
G. Reinforecement for Field Work Mobility					
1. Vehicles for STL (Pick-up type)	3			No. of Inspector	
2. Motorbick for SI (Off-road type)	49	sub-total	3.120	Region II	24
				Region VI	11
H. Field Inspection Kit	49			Region XI	14
1. Grain Trier	49			Total	49
2. Grain Moisture Tester	49				
3. Dial Thermometer	49				
4. Other necessary tools 1 Lot	49	sub-total	2.384		
		Total	16.528	Million P	

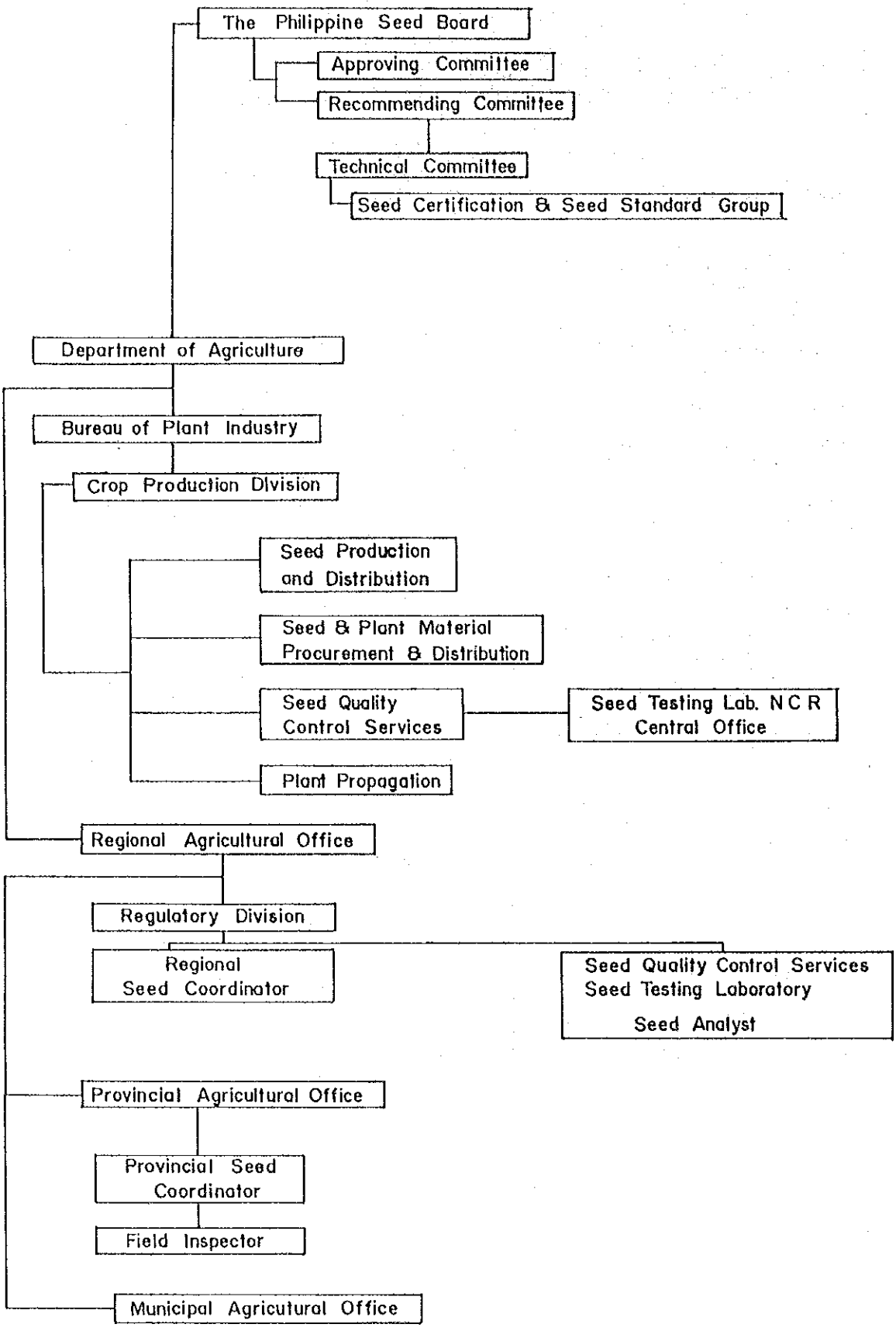
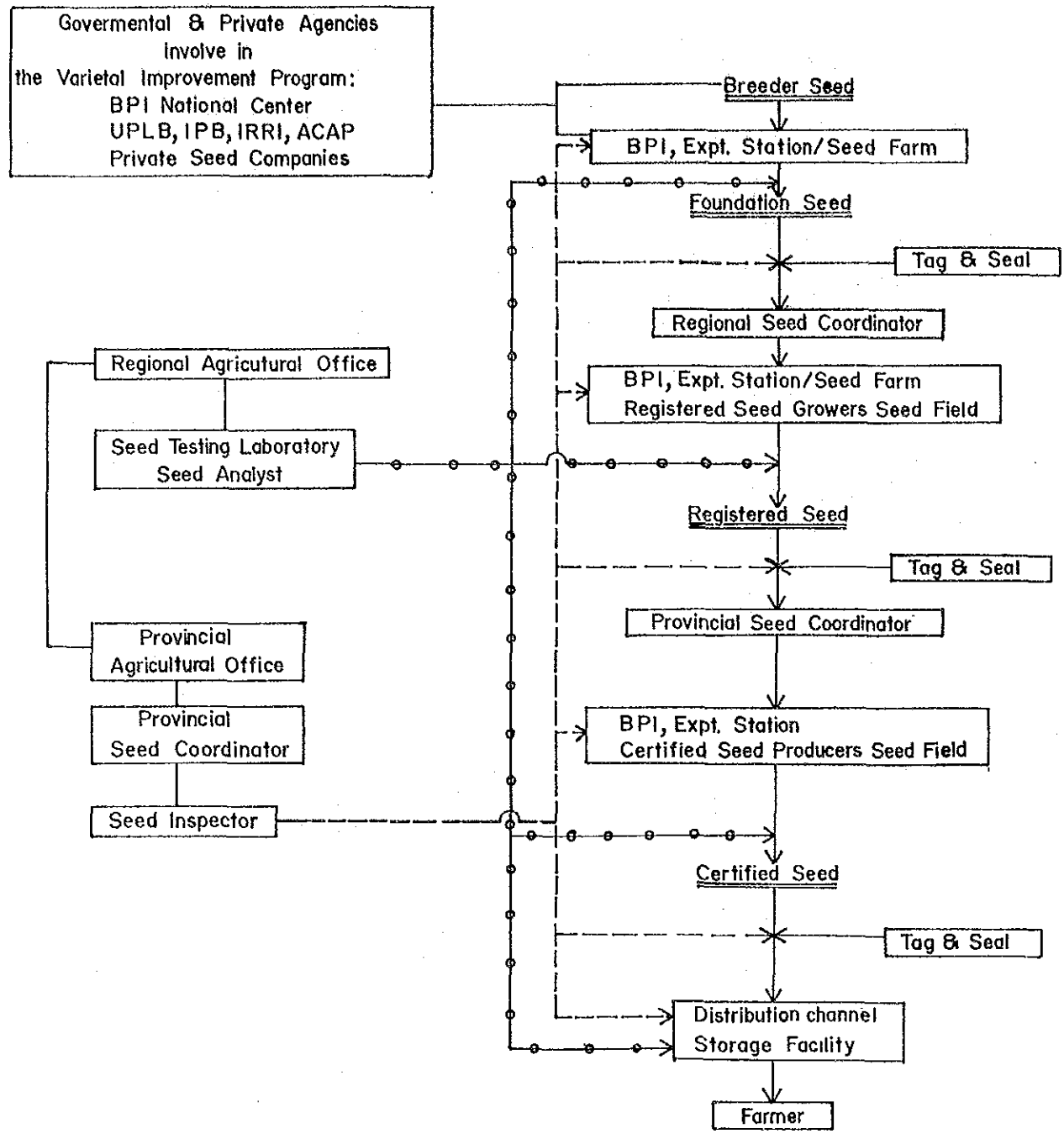


Fig.D.1.1 THE RELATIONSHIP BETWEEN THE QUALITY SERVICES AND AGENCIES CONCERNED



NOTE:

\- - - - - line showing field inspection, sampling, & tagging by Seed Inspector

-o—o- line showing the flow of seed samples collected by the seed inspector to be analyzed by seed analyst at the STL.

Fig.D.1.2 THE CONNECTION BETWEEN SEED PRODUCTION SYSTEM AND QUALITY CONTROL SERVICE

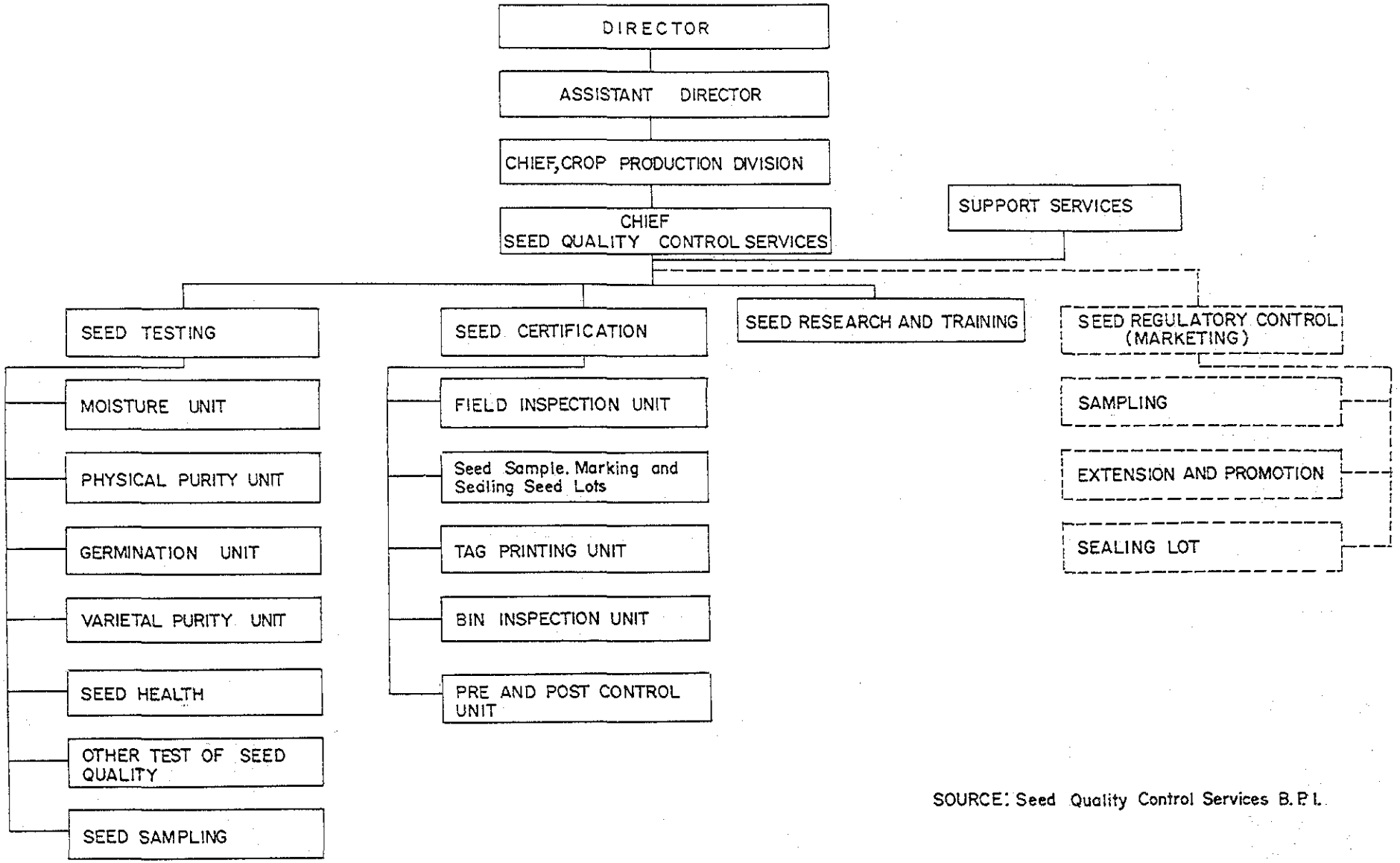


Fig.D.1.3 SEED QUALITY CONTROL SERVICES ORGANIZATION CHART

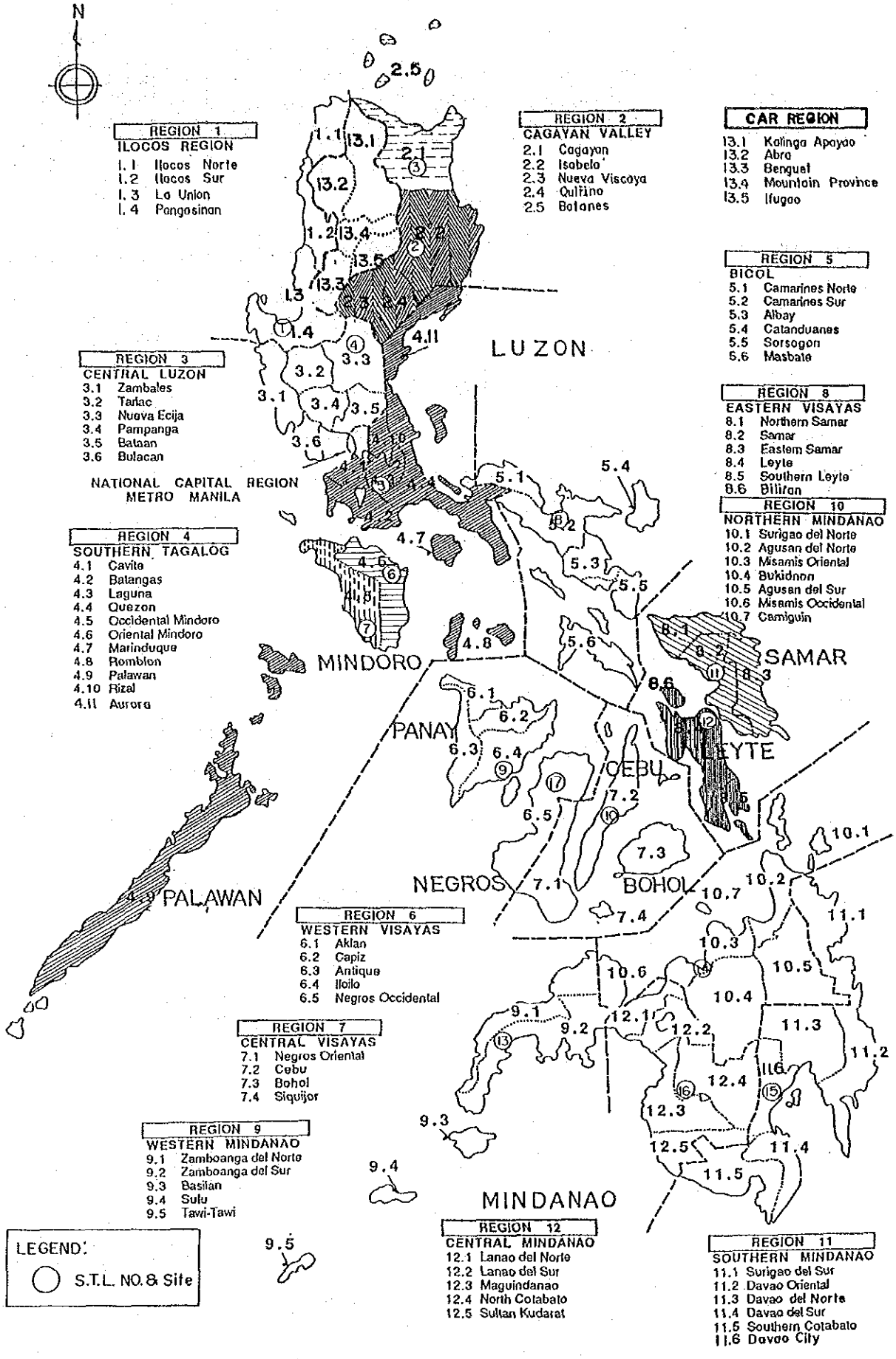
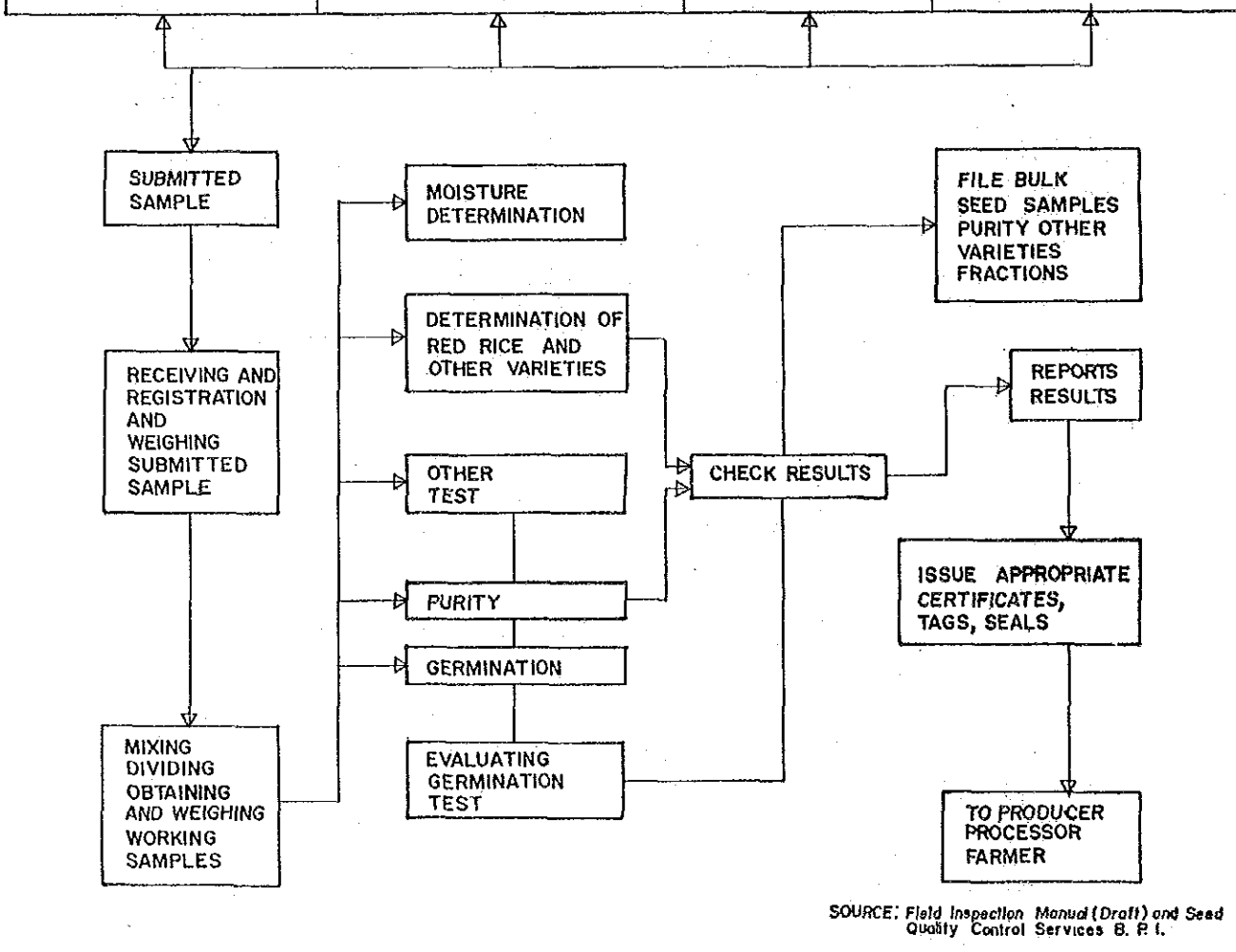


Fig.D.1.4 LOCATION MAP OF SEED TESTING LABORATORY

RICE	CORN		PEANUT
	HYBRID	OPEN POLLINATED	
1st 15-20 days after planting to determine proper planting system, (straight row planting), volunteer plants and presence of weeds	1st during the vegetative phase; to remove off-type plants & to ascertain that the minimum isolation requirement is fulfilled	1st during the silking; to rouge off-types to remove diseased plants	1st Flowering stage 30-40 days after planting to determine diseased plants, growth habit (bunchy or runner type) & color of the plants
	2nd during the flowering phase; 3rd 4th to ensure proper pollination & to remove plants which may show variation tossed and ear characters	2nd harvesting time; to remove immatured cobs and diseased infected ear	2nd Physiological maturity to determine other varieties; tests, color, pod, shape & no. of seed per pod
2nd Tillering Stage to determine the presence volunteers, off-type & presence of pest & diseases	5th during the seed ripening phase; to remove diseased plants and noxious weeds		
3rd Final field inspection 7 days before harvest to determine if the field is eligible for certification	6th before shelling to remove those seed ears which are different from the normal type	3rd processing time; to check / clean equipments	



SOURCE: *Field Inspection Manual (Draft) and Seed Quality Control Services B. P. I.*

Fig.D.1.5 PROCEDURE OF FIELD INSPECTION AND LABOLATORY WEED TEST

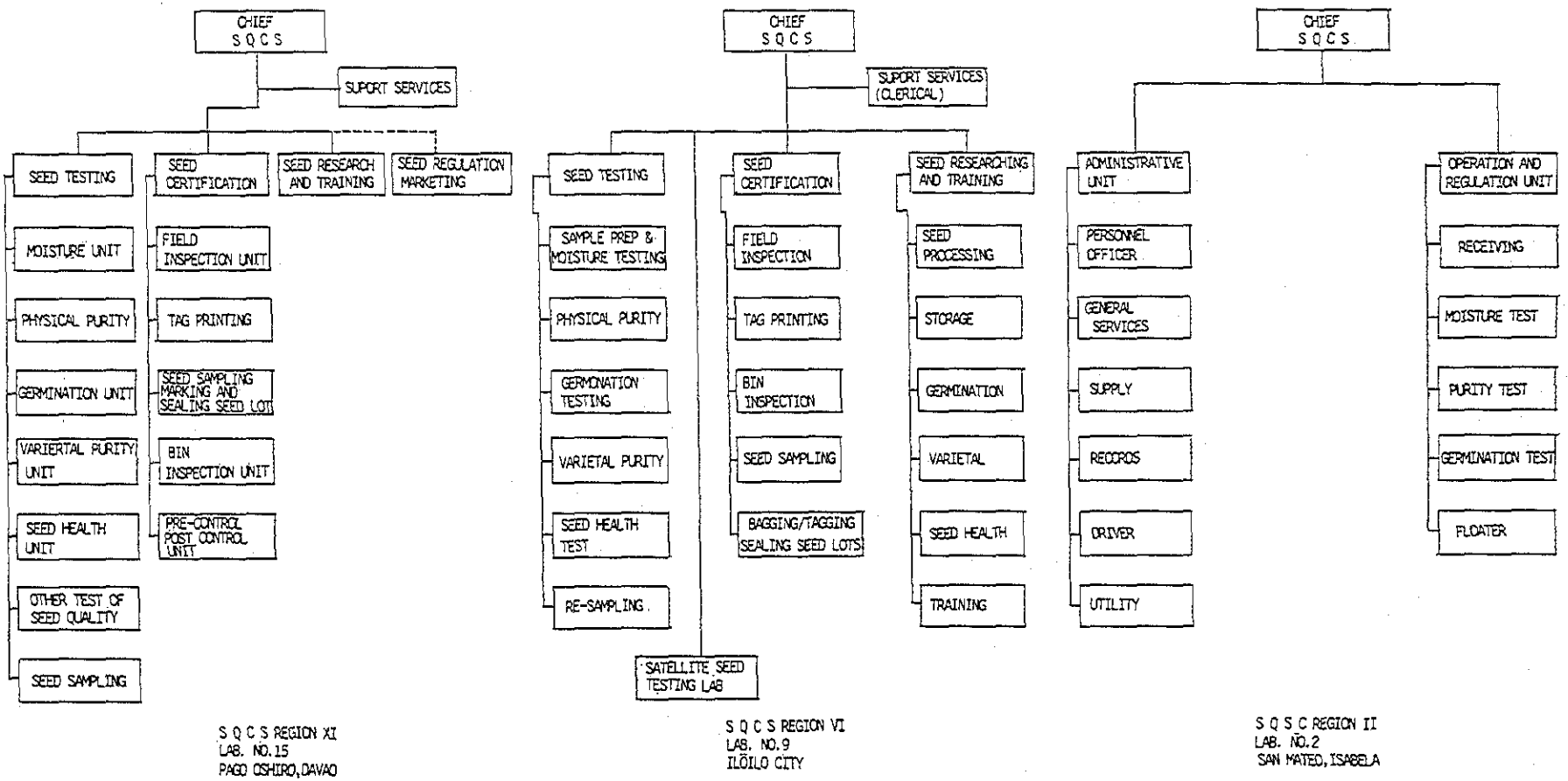


Fig.D.4.1 S.Q.C.S. ORGANIZATION CHART BY STL

Annex E

Seed Production Field

FEASIBILITY STUDY ON
IMPROVEMENT OF SEED PRODUCTION AND DISTRIBUTION, AND
ESTABLISHMENT OF
APPROPRIATE SEED STORAGE SYSTEM

ANNEX E SEED PRODUCTION FIELD

TABLE OF CONTENTS

		Page
1.	SEED PRODUCTION SYSTEM AND FARM	E-1
1.1	Seed Production System	E-1
1.2	Seed Production Field	E-1
1.3	Constraints on Seed Production	E-3
2.	MODEL FARM	E-4
2.1	Present Status	E-4
2.1.1	Model Station Profile	E-4
2.1.2	Present Irrigation Conditions	E-7
3.	PROPOSED MODEL FARM PLAN	E-11
3.1	Formulation of Model Farm Plan	E-11
3.1.1	Basic Concept for Model Farm Plan	E-11
3.1.2	Field Improvement Component	E-12
3.1.3	Irrigation Plan Alternatives	E-13
3.2	Irrigation Improvement Plan	E-15
3.2.1	Designed Water Requirement	E-15
3.2.2	Irrigation Improvement Basic Plan	E-16
3.2.3	Study on the Water Resources Development for the Visayas Model Farm	E-18
3.3	Supplemental Field Improvement Plan	E-19
3.3.1	Drainage Improvement Plan	E-19
3.3.2	On farm Road and Connecting Farm Road Improvement Plan	E-20
4.	FACILITY PLAN	E-21
4.1	Irrigation Facilities	E-21
4.1.1	Sprinkler Irrigation Facility Plan	E-21
4.1.2	Irrigation Facilities	E-24
4.2	On farm Road and Connecting Farm Road	E-31

Page

5. COST ESTIMATION E-32
5.1 Cost Estimate Conditions E-32
5.1.1 General E-32
5.1.2 Construction Cost Estimation E-32
5.1.3 Annual Operation and Maintenance Cost E-32
6. IMPLEMENTATION SCHEDULE E-34
6.1 Plan Execution E-34
6.2 Implementation Schedule E-34

LIST OF TABLES

		Page
E.1.1.1	Seed Production Site by Stations and Seed Farms	E-35
E.1.1.2	Inventory of Seed Production Field by Stations and Seed Farms	E-36
E.1.1.3	Area and Water Resources of Experiment Stations and Seed Farms	E-37
E.1.1.4	Field Design Specification of Stations and Seed Farms	E-38
E.5.1.1	Main Features of the Plan Facilities	E-39
E.5.1.2	Financial Construction Cost	E-40
E.5.1.3	Cost Breakdown for Ilagan Model Farm Improvement Work	E-41
E.5.1.4	Cost Breakdown for Davao Model Farm Improvement Work	E-41
E.5.1.5	Cost Breakdown for Pump Site (Ilagan MF)	E-42
E.5.1.6	Cost Breakdown for Irrigation Facility (Ilagan MF)	E-42
E.5.1.7	Cost Breakdown for Diversion Work (Davao MF)	E-43
E.5.1.8	Cost Breakdown for Water Conveyance Pipeline	E-43
E.5.1.9	Cost Breakdown for Farm Pond Rehabilitation (Davao MF)	E-44
E.5.1.10	Cost Breakdown for Irrigation Facilities	E-44
E.5.1.11	Cost Breakdown for Road Pavement Work	E-45
E.5.1.12	Unit Cost	E-45

LIST OF FIGURES

		Page
E.1.2.1	General Map of Ilagan Model Farm	E-46
E.1.2.2	General Map of Visayas Model Farm	E-47
E.1.2.3	General Map of Davao Model Farm	E-48
E.4.1.1	General Layout of Irrigation System (Ilagan MF)	E-49
E.4.1.2	General Plan of Pump System (Ilagan MF)	E-50
E.4.1.3	General Structure of Pump Site (Ilagan MF)	E-51
E.4.2.1	General Profile of Water Conveyance System (Davao MF)	E-52
E.4.2.2	General Layout of Diversion Works (Davao MF)	E-53
E.4.2.3	General Layout of Irrigation System for No. 11 Lot	E-54
E.4.2.4	General Layout of Irrigation System for No. 9 Lot	E-55
E.4.2.5	General Layout of Sub-Main Line	E-56
E.4.2.6	Sprinkler Lateral Line	E-57

1. SEED PRODUCTION SYSTEM AND FARM

1.1 Seed Production System

At present, Nationwide seed production system for rice, corn, and peanut has basically been organized as follows:

1) Breeder Speed

Rice ; Phile Rice Center Station, IRRI, and Agricultural Colleges and Universities

Corn ; Institute of Plant Breeding, Ilagan Experiment, and Agricultural Colleges and Universities

Peanut ; Institute of Plant Breeding, Economic Garden, and Agricultural Colleges and Universities

2) Foundation Speed

Rice ; Phile Rice Experiment Station, and La Granja Experiment StationCorn & Peanut ; BPI National Crop Centers

3) Registered Seed

Rice, Corn and Peanut;

Experiment Stations and Seed Farms, Selected seed farmers in provinces without experiment station

4) Certified Speed

Private Seed Growers

1.2 Seed Production Field

Breeding, and breeder seed production for the rice, open pollinated corn and peanut are carried out in the field of governmental agencies and Agricultural Collegs and Universities. Foundation seed for rice, open pollinated corn, and peanut are produced for reproduction of them in the field of governmental agencies. Registered seed production are carried out in the field of experiment station, seed farms, and the designated members of the seed producers' association in the provinces. Certified seeds are mainly produced in the field of private seed growers.

General situation of the seed production fields under the governmental agencies and private seed growers are as follows;

1) Governmental Sector

At present, the 40 seed farms under the Department of Agriculture are involved in production of various crops. As shown in Table 1.1.1, out of 40 farms, 24 farms including one farm which produced up-land rice seed only, are producing the rice seeds. There are 24 corn farms and 20 peanut farms respectively overlapping 24 rice seed production farms. Inventory of seed production field by station and seed farms are as shown in Table 1.1.2.

For the 24 rice seed farms, irrigation systems are essential. Almost all the farms already have fulfilled the irrigation systems as shown in Table 1.1.3 and 1.1.4. Out of 24 farms, 20 farms are supplied the required irrigation water from river flow water by diversion weir, pumping system or NIA irrigation system and remaining 4 farms are supplied the required irrigation water requirement from spring or ground water. Some of these farms however, have some problems of water shortage, salt injury, and so on.

Generally, irrigation for the rice seed production is carried out by the ponding and continuous irrigation method; therefore field lots and field blocks for the seed production has readjusted with rectangular shape. There are arranged the irrigation canals, lateral road and drainage canals occasionally. However, it seems that the lot size are sometimes rearranged for the benefit of land use and water management. Maintenance condition of irrigation canals are considerably good, but drainage canals and roads are not always good.

On the other hand, field lots and farm block for corn and peanut seeds production are assigned the hill side area. There are inclined as it is topographically and land grading/levelling are not always in good condition.

In most of these farms, Seed production is carried out under the condition of reinfed due to lack of effective irrigation system to supply the supplemental water requirement for these crops. Accordingly, yield and productivity of seed production in most of the farms are strongly effected rainfall distribution, particularly during the dry season and drought year. Some farms have the irrigation system; however, they do not have sufficient water supply capacity to cover the whole area.

Most of the field lots and field blocks are provided lateral roads 4 to 8 m in width, but generally they do not have branch farm roads. Almost all of the roads are unpaved; in general, maintenance is not so good.

2) Private Sector

Registered and certified seeds of rice, corn, and peanut are produced as commercial business by the private seed growers. Private seed growers are selected and assigned as seed growers by seed coordinator from diligent farmers producing those crop, and are required to be members of the Seed Grower's Association. Therefore almost all of them are rather richer and more highly developed farmers than average farmers, and their fields are also highly developed both technically and physically.

The interview survey was carried out by the Team on 36 seedgrowers in Region II, VI, and XI regarding the present situation of their farming. According to the results of the obtained, all the seed growers have irrigation systems in the low-land rice seed area. Of these, 19 seed growers are supplied water by NIA irrigation systems, 8 seed growers by communal irrigation systems, 5 seed growers by private pumping system, and the remaining 12 seed growers by the personally arranged other systems. This shows that almost all of the lowland rice seed growers have highly irrigated fields and are at a similar level to government seed farms in terms of irrigation and field lot arrangement.

1.1.3 Constraints on Seed Production

However, it is a very important problem that the yield of targeted seed crops are remarkably low in seed production compared to the potential yield of varieties which was tested in the station under the seed production program. No serious constraint is generally observed in rice seed farms under the government sector, while slight problems are observed.

Irrigation water supply conditions in some of the stations do not always fulfil the seed crop water requirement through the year. More than half of the farms have not the stable and sufficient water resources to cover the seed production field especially for the dry season.

On the other hand, there are serious problems in upland crops seed farms under the government sector. Most farms are producing the seeds under conditions of rainfed farming without any adequate irrigation system. Accordingly, there are no cultivation of the seed crops to produce the seeds during the dry season. The yield and productivity of the seed production field shall directly be affected with the distribution of rainfall, especially in drought years.

2. MODEL FARM

2.1 Present Status

2.1.1 Model Station Profile

The Improvement Model Plan has proposed three (3) Model Farms as the center of the model improvement producing foundation seeds for rice, corn, and peanut, respectively. The model farm for the each seed crop to be produced are as follows:

For Peanut	:	Ilagan Experiment Station
For Rice	:	Visayas Experiment Station
For Open Pollinated Corn	:	Davao National Crop Center

1) *Ilagan Experiment Station Profile*

(1) Location
- Barangay San Filip, Ilagan Isavela, Reg. II
  6 km south of the town Isavela, 405 km north-east of Manila.
- Latitude : 17°15 N
  Lagitude : 121°85 E

(2) Topography/Soil
- Building Area: terraced with elevation of 62 m above sea level,
- Farm Block area: Generally level with elevation of 46 m above sea level.
- Soil Type: San Manual Clay Loam with pH 5.7 - 6.3

(3) Climate

a) Climate Type
- Type III.
  Wet months : May - December
  Dry Month : January - April

b) Temperature
- Yearly average : Max. 32.2°C
  Min. 25.6°C

c) Rainfall
- Yearly average (Ave. for 20 yrs.) 1,185 mm

(4) Area - Total 107.36 ha

seed production area	33.00
research area	27.00
building/compound	5.60
fruit tree foundation grove	1.20
road, canals & water impounding	3.56
miscellaneous	37.00

(5) Major Function

- Agricultural Research : Crop improvement, culture, crop protection,
- Seed production : Peanut, corn, up and/lowland rice, mungo bean, and etc.
- Plant Materials Production : Sexual/asexual propagation of fruit tree, ornamentals, and medical plants.

2) Visayas Experiment Station

(1) Location
- Bo. Hamugaya, ILOILO city, Reg. VI
  9 km from city proper, 14 km from Iloilo airport
- Latitude : 10°46 N
  Lagitude : 122°33 E

(2) Topography/Soil
- Almost level or slightly rolling with average elevation of 13.90 m above sea level,
- Soil: Sta. Clay Loam Soil with pH 6.5 - 6.8

(3) Climate

a) Climate Type - Type II

Wet months	May - October
Dry months	November - April

b) Temperature

Yearly average	27.6°C
Average Max.	31.4°C
Average Min.	23.8°C

c) Rainfall - Average monthly rainfall 140.35 mm

d) Rainy days - Average monthly rainy days 12.83 days

(4) Area	- Total area		62.9615 ha
	research area		7.3170
	production area		39.5428
	horticulture area		0.5000
	compound area		6.5000
	road		2.6187
	canal, creech, others		6.4830

(5) Major Function

- Research : variantal improvement, culture, management, crop protection, and socio economic on rice, regumes, and vegetables,
- Breeding : rice and other crops
- Seed Production : breeder seed, foundation seed for rice
- Plant Material Production : sexually/asexually propagation of various fruit tree and ornamentals,
- Demonstration/Extation : results of research, field test demonstration and consultation on agricultural problems.

3) Davao National Crop Center Profile

(1) Location
- Bago Oshiro, Davao. Reg. XI
  17 km west of Davao city proper
- Latitude : 7°05 N
  Lagitude : 125°36 E

(2) Topography/Soil - Inclining toward north to south with 1/25 - 1/30 in slope.

Average elevation 95 - 125 m above sea level
Soil type Tugbok Clay Loam

(3) Climate

a) Climate Type - Type IV

It being characterized as having a well distributed rainfall through the year for agricultural planting.

b)	Temperature	-	Average temperature	26.6°C
			Average Max. temperature	32.8°C
			Average Min. temperature	20.3°C
c)	Rainfall	-	Average monthly rainfall	
			May - November	Exceed 200 mm
			December	110.47 mm
			January	120.54 mm
			February - April	Less than 100 mm

(4)	Area	- Total	115.0 ha
		lowland	1.0 ha
		seed production for corn and peanut research, plant material production,	15.0 ha
		and compound etc.	89.0 ha
		miscellaneous	10.0 ha

(5) Monambulan Sub-station

- Location	:	6 km from Davao NCC	
- Topography	:	Considerably rolling, with 1/2 - 1/25 in slope	
- Soil	:	Tubok Clay Loam	
- Elevation	:	350 - 320 m above sea level	
- Climate	:	Relatively cool, average temperature 26° - 27°C	
- Rainfall	:	Yearly average rainfall	2,000 mm
- Area	:	Total	50.0 ha
		Seed production/research area	29.37 ha
- Major Activity	:	Research for mangosteen and durian Seed production for corn, mungo bean and peanut, etc.	

2.1.2 Present Irrigation Conditions

1) Ilagan Experiment Station's Irrigation Condition

a) Ilagan Experiment Station is of two (2) available irrigation systems at present. One is a gravity irrigation system to serve the lowland rice field; it consists of water impounding and irrigation/drainage canals. The other one is a pumping

irrigation system; it is mainly served to the upland crops seed production field block and research field block (Ref. Fig. 1.2.1).

Existing impounding is provided as the water source for the lowland irrigation. It seems however, that it has lost the initial water storage capacity owing to the heavy sedimentation and weeks.

Although the pumping irrigation system is arranged in order to supply a supplemental water requirement for the upland crops inclusive seed crops, it will be able to say that is too poor to fulfill the water requirement of the production field lots in the whole targeted area. Existing equipments/facilities for the pumping irrigation system are as follows:

- Water Sources : Stream flow water of the Pincanuan River

- Pump Site : Left bank of the Pincanuan river at a distance 300 m from end of east side of seed production field lot

- Pump Unit : Pump/engine mounted on the carrying car
  Pump-Volume type, suction dia 100 mm
  Engine-diesel engine 40 ps

- Water Conveyance/distribution line

Main pipi line	Aluminum pipe	4" x 20'L - 25 nos.	150 m
Sub main pipe line	Aluminum	3"D x 10' - 20L - 25	100 m

- Lateral line Aluminum pipe 2" x 20'L - 20 set 120 m

- Irrigation faciilities Sprinkler/Accessories 20 sets

b) The Pinacanun river runs along the eastern boundary of the farm block in the station, while seed production field lots are extended in the range 300 to 1000 m from the left bank with 8 - 10 m difference of altitude between the bank and riverbed.

Pump site is arranged by cutting open the precipice of left bank of the Pinacanun river without any revetment and protection works to prevent erosion/scouring from the flowing river water. In addition to that, it does not have a suction

sump and suction pipe is thrown into the river channel for pumping up the river flow water; it may pump up alot of sediments from the riverbed.

The seed production field lots are slightly inclined in all directions, and some lots are accompanied with the lower zone partially, water distribution network may be made into an upward line in some lots and it would be impossible to arrange the un-lined canal to distribute the irrigation water.

2) Visayas Experiment Station Irrigation Conditions

Visayas Experiment Station is of two (2) available irrigation systems at present. One is a main system for the station; it is a gravity irrigation system which is supplied with a total water requirement to the station through the Tigum irrigation system of St. Barbara, NIA.

However, this system does not have the capability to supply the seasonal total water requirement of the field in the station for the dry season, sufficiently.

The other one system is provided to reinforce water supply for research project area during "palaged" planting; this system consists of a Lagoon, pumping unit, and canal for the sending back of pumped up water. Lagoon is a rectangular shape that is 12,500 m^2 in area, and 1.5 m in depth (Ref. Fig. E.1.2.2).

3) Davao National Crop Center Irrigation Conditions

a) There is a water tank of 30,000 gallon capacity with one unit of deep tube well and pump. The water is mainly served to the domestic water use for the Center's human and building such as management office, laboratories, and accommodations, etc. Besides, it is also used as a precious water resources to supply the supplemental water requirement for the various fruit trees in the nursery and research lot.

Formally, there were two (2) water supply systems which were arranged by Japanese abaca plantation. One is served to domestic water use and irrigation, the water was conveyed by the pipe line of 2" in dia., 7 km in length from the Lipadas river to the center. The other one was arranged as the irrigation system; the water was diverted from the canal of hydro-power corporation and was conveyed to the center with pipe line of 2" in dia., 2.5 m in length.

Both of the two systems above are degraded and lost the initial function at present due to aging and natural disaster. However, the former is effectively utilized with the Monumbran substation to supply the supplemental water for the seed crops in the station. The latter had carried out the rehabilitation works by the NCC. Several years before, however, the aqueduct crossing the brook was washed away by the flood water leaving it as it is now..

b) The Lipadas River is a mountain stream with a steep slope and around the existing water diversion site is formed big round stones and sandstones; discharge is considerably plenty and clean. If, a diversion work is replaced by the reasonable structural one, it will be possible to divert the designed water continuously and safely.

The length to convey the diverted designed water requires more than 7 km with a slope of 1/25 - 1/30. There is a difference of about 240 m in the elevation level, and the topography along the route of head race to be conveyed a designed water is heavily undulated.

In the other one system, the required length to conveyanced the water from the diversion site to NCC is about 2.5 km with a slope of 1/100. According to the NCC, water right on the diversion water from the National power's canal is vested right and NCC has a right to intake the water in every season of the year.

There are two seed production field lots separately at a distance of 400 m. The area of each field lot is considerably large, there is designed as its topographical conditions and it is sloping land with an incline of 1/25 - 1/35. It is surrounded with the trunk and lateral road, but there are no branch road for the lots (Ref. Fig. 1.2.3).

3. PROPOSED MODEL FARM PLAN

3.1 Formulation of Model Farm Plan

3.1.1 Basic Concept for Model Farm Plan

1) The seed production improvement plan has proposed "Model Farm Plan" as a producing center of the foundation seed to demonstrate the seed production improvement plan in precedence to all other seed farms, and yet the plan is defined that the irrigation to supply the supplemental water requirement for the seed production field is essential in order to increase the yield, productivity, and quality.

In consideration of the above definition and to fulfill the objective, "The Seed Production Field Improvement Plan" will be made on the basis of the "Basic Concept for the Model Plan".

Accordingly, the top-prior component of seed production field improvement is the irrigation improvement plan for the seed production farm block in the proposed model farms respectively. This will be achieved through the water resources development to provide sufficient irrigation water and establishment of an irrigation system for effective utilization of water resources and stable supply of water requirement of the seed production field.

In addition to irrigation improvement, supplementary components functionally related to the same such as farm road and drainage improvement is collaborated with irrigation improvement.

2) The irrigation improvement plan will be made to realize the stable seed production all year round through establishment of irrigation water supply system, especially to supplement the water requirement of seed production field during the dry season. The following specific requirements are considered in the irrigation improvement planning:

a) Water diversion system is planned so as to intake under the low-low water level/discharge at the diversion site. It may arise during the dry season or in the drought year.

b) Irrigation system/facilities including water distribution system are provided so as to equalize the productivity and water supply conditions in the each field lot.

3) Rehabilitation/improvement work for the on-farm roads and field drainage are carried out by use of machines the special supplied under the "Model Farm Plan" with responsibility of model farm respectively to meet the crop rotation and land utilization programs.

3.1.2 Field Improvement Component

1) In consideration of the present conditions on the seed production and production fields, a component of the field improvement plan and policy for the each component are as follows:

a) Ilagan Model Farm
- establishment of a field improvement plan based on improvement of pumping system, pump-site, establishment of irrigation system, and provision of necessary irrigation equipments.

b) Visayas Model Farm
- study of a field improvement plan based on water resources development.

c) Davao Model Farm
- establishment of a field improvement plan based on improvement diversion system, diversion facilities and water conveyance system, facilities, and establishment of irrigation system/provision of necessary irrigation equipments. In addition to that, establishment of on-farm road in association with irrigation system and improvement connecting farm road between the model farm and Monumburan sub-station.

2) An improvement plan on the each component is made as the practical and realistical plan for the respective model farm with discussion in regard to optimum improvement scale and limit with alternatives for the water source, water conveyance systems, and irrigation method.

3.1.3 Irrigation Plan Alternatives

1) Irrigation Method

The following are the main method of up-land irrigation:

(a) Surface irrigation
(b) Sprinkler irrigation or spray irrigation
(c) Drip or trickler irrigation

- surface irrigation has low application efficiency. When water is applied from the end of upstream, it takes time to travel to the end of downstream, the limit of an application gradient of the field is 3 degrees, and the range of applicable length for the furrow irrigation is from 90 m to 190 m,

- Sprinkler irrigation, which simulates the rainfall condition, has much higher irrigation efficiencies if the wind velocities are low,

- Drip or tickler irrigation which waters only in the root zone can achieve even better irrigation efficiencies than that of sprinkler irrigation. The total amount of water apply is less than that of sprinkler irrigation because only a portion of the area is watered.

While, both Ilagan and Davao model farm, the seed production field lots are rolled and inclined, and are very hard to arrange the head ditch to conduct the irrigation water; particularly, the un-lined ditch arrangement will be impossible. If the ditch made of concrete is arranged, it will disturb free farming and farm drainage. Furrow irrigation will be accompanied by heavy erosion due to topographical condition of the field.

The Ilagan model farm will be able to use the benefit of the pumping water intake system for the sprinkler irrigation. Sprinkler or drip irrigation method is advisable to select the proposed irrigation method for the plan.

Although the total irrigation efficiency of the drip irrigation is higher than sprinkle irrigation, the drip irrigation system is more expensive than sprinkler system. Furthermore, required technical level for water application and management is also higher than sprinkler irrigation method.

In consideration of the above, the sprinkler irrigation method is most commonly used in the Philippine, and the sprinkler is the most desirable method for the Plan. Accordingly, the sprinkler irrigation method has proposed the irrigation plan for the seed production field lots in the Ilagan and Davao model farm.

2) Water Source

In the Davao model farm, however, there are two (2) available water sources for the plan. One is National Power Corporation's canal water; diversion site of the water is located at a distance 2.5 km from the farm with difference of altitude 25 m. The other one is the Lipadas river flow water; diversion site is located at a distance 7.5 km from the farm with difference of altitude 240 m.

Although the required construction cost for the water conveyance system is more economical compared with the latter one, the former is not clear of the water right on the water use and is in danger of regulation by the National Power in the critical water discharge condition, and may be said that it is not always stable water resources. Besides, it is muddy water, and will require a serious strainer for the sprinkler irrigation.

For the latter, it may be said that the required length for the designed water conveyance is too long. However, there is no effective hydrological data on the Lipadas River for the plan. In the sight of the actual survey during the field survey period, it seems that low water discharge is considerably plenty to divert the designed water. It will be able to intake the designed water over the dry season sufficiently.

At present, this system has lost the initial function to convey water to the model farm, but the diversion system is useful under the maintenance by this Monanburan sub-station and supplies supplemental water to the Monanburan sub-stations field. In consideration of part of the Monanburan sub-station for the "Seed Production Improvement Plan" in future, proposed field improvement plan should include the Monanburan sub-station. If so, water resources development plan should also include the same.

3.2 Irrigation Improvement Plan

3.2.1 Designed Water Requirement

a) Unit Designed Water Requirement

Unit designed water requirement for the seed production field lot producing the peanut and corn were decided on the basis of the "Recommend for Peanut 1985, Recommended for Corn 1987, issued by the "Philippine Council for Agricultural Research and Development (PC ARD)". Unit designed water requirement for rice seed production field were quoted from the designed water requirement of the Tigum Irrigation System"

Unit designed water requirement of each seed crop production field are as follows:

Peanut	(Ilagan Model Farm)	:	5 mm/day
Corn	(Davao Model Farm)	:	10 mm/day
Rice	(Visayas Model Farm)	:	1.0 l/s/ha

In consideration of the irrigation efficiency at 65%, gross water requirements for the each seed production field is calculated as follows:

Peanut field	:	7.7 mm
Corn field	:	15.4 mm
Rice field	:	1.5 l/s/ha

b) Designed Diversion Water Requirement

The designed diversion water requirements were decided under the following condition:

	Ilagan (Peanut)	Davao (Corn)	Visayas (Rice)
Objective area	8.0 ha	10.0 ha	44.0 ha
Irrigation area per day	1.4 ha	3.4 ha	44.0 ha
Irrigation hour per day	6.8 hour	6.8 hour	24 hour
Irrigation intensity	6.8 mm/hr	6.8 mm/hr	1.5 *l*/s/a
Accordingly, Designed Diversion Unit Water Requirement	12.0 *l*/s	20 *l*/s (35 *l*/s) *	66.0 *l*/s

*: Including distribution water requirement for the Monanburan sub-station field

3.2.2 Irrigation Improvement Basic Plan

The basic plan of the irrigation improvement for each model farm's seed production field are proposed as follows:

1) Ilagan Model Farm

a) Objective area of the plan is 33 ha in total which consists of 8-field lots,

b) Seed production area per one crop season to be irrigated is 8 ha which is extended two-three lots,

c) Irrigation term to be supplied the supplemental water requirement is the dry season (Jan. - Apr.), or whenever in the drought year if required,

d) Water intake system is pumping up system, pump site is permanent structure, however, pump/power unit is travelling system,

e) Power for the pump is engine,

f) Water conveyance system is pipeline system in boost by pump,

g) Irrigation method is sprinkler intermittent, rotation system,

h) Water conveyance lateral pipeline, sprinkler, and other necessary irrigation facilities/equipments is travelling rotation system.

2) Visayas Model Farm

Total water requirement will roughly be estimated and water resources development potentiality will be studied to promote the water resources development.

3) Davao Model Farm

a) Objective area per one crop season to be supplied the supplemental water requirement is 10.0 ha, however, objective area for the water diversion plan is 20 ha inclusive the distribution water to the Monanburan sub-station's seed production field.

b) Irrigation water is supplied all year round.

c) Water resources is the Lipadas River stream flow water,

d) Water diversion system is designed as the mountain stream diversion works,

e) Water conveyance system is a pipeline by gravity,

f) Energy head of water conveyance pipeline is used to the best advantage for the sprinkler irrigation. Provided pump is only used as the reserver.

g) On farm main water distribution pipeline is fixing type,

h) Irrigation method is intermittent sprinkler irrigation,

i) Lateral pipeline, sprinkler, and other irrigation equipments is travelling rotation system,

j) Supplemental water for the Monanburan sub-station is divided at the existing farm pond in the field,

k) Farm pond of the water conveyance pipeline which exists in the Davao model farm carries out rehabilitation works and expansion works for the Plan, and

l) Wast way is provided to discharge into the creek for emergency use.

3.2.3 Study on the Water Resources Development for the Visayas Model Farm

1) Water Supply Capacity of Existing Lagoon

a) - Water Storage Capacity

Area	500 x 25 m	12,500 m^2
Capacity	1.5 m depth	18,750 m^3
	2.0 m depth	25,000 m^3

- Net Irrigation Unit water requirement: 1.0 *l*/s/ha
- Gross irrigation unit water requirement: 1.5 *l*/s/ha
- Irrigable area in the growing stage: 2.3 ~ 3.0 ha
- Under the following assumption
- no evaporation from the surface of the Lagoon
  Excluding pudding water average supplied water 1.2 *l*/s/ha
  Water supply day per one one crop season 80 days

If, 50% of return flow is considered.

Irrigable area 3.5 ~ 4.5 ha

b) Required total water requirement for the 44 ha: 36,500 ~ 45,620 m^3

If, 50% of return flow is considered, 24,000 ~ 30,400 m^3

- Expansion of the existing Lagoon will not be allowed the upward expansion from the seed production field ground level because, it is functioned as the catch pond for area drainage, Expansion of the Lagoon shall be made downward from the field ground level. Practically, Expansion of the Lagoon not always realistically countermeasure for the supplemental water supply.

c) Ground Water Development

Water resources development for the supplemental water supply for the dry season is preferential subject in order to stabilize and increase the yield/productivity in the seed production field.

The Confined Aquifer is the most desirable and reliable water resources for the Visayas Model Farm's seed production field. During the field survey period, many datas were collected; it cannot obtain any effective hydraulical geologic datas for the confined aquifer development.

It is assumed, however, that the availability of the aquifer and development potentiality is considerably high judging from existing deep well conditions and geological conditions in the surrounding area of the farm.

Accordingly, in order to promote the water resources development, it is advisable to make the necessary survey like the electric prospecting survey, or geophysical exploration shall be carried out as early as possible.

In consideration of the existing irrigation canal networks and easiness of distribution of newly developed water resources,, it will require the three (3) Tube-well at least.

Desirable location for the Tube-well is as follows:

- Near the existing settling basin
- Near the existing Lagoon
- In the field block No. 5 or No. 7

3.3 Supplemental Field Improvement Plan

3.3.1 Drainage Improvement Plan

1) Ilagan Model Form

The poor drainage zone arose partially in the wet season by cause of topographical condition and absence of adequate farm drainage system.

There is the necessity of the establishment of systematized drainage system in point of view of the all the farm blocks. Partial improvement, it would be impossible to improve the present conditions. It may be required to make land grading and readjustment of the farm block.

Generally, a provisional farm drainage system is the most desirable method, because, fixing farm drain not only disturbed the practical seed production farming but also caused the drying of effective soil layer in the dry season.

Accordingly, the plan proposed the provisional system for the farm drainage improvement, and is arranged as the temporary drain whenever at the call of the drainage condition and will be backfilled in the dry season to prevent the soil layer drying.

Excavation/arrangement for the farm drain is carried out with use of the ditching machine which is especially supplied under the Improvement Model Plan.

3.3.2 On Farm Road and Connecting Farm Road Improvement Plan

1) Davao Model Farm

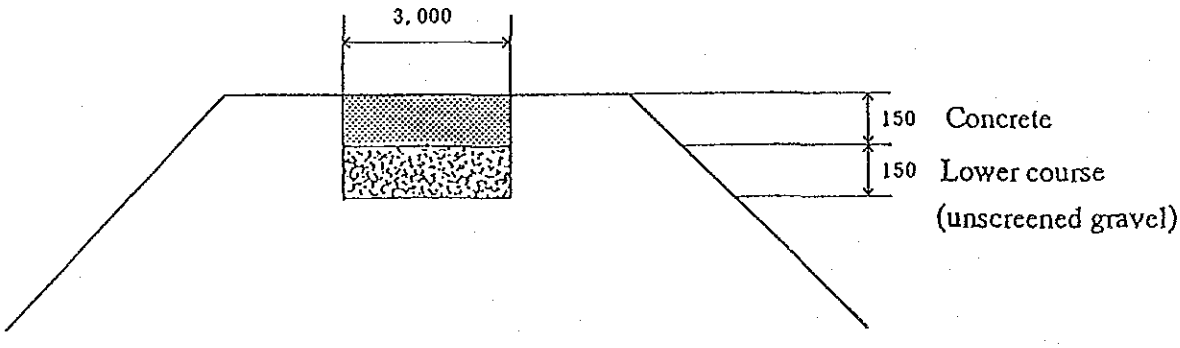
There are no-on-farm branch road. In consideration of the proposed irrigation plan, some branch road plan is made so as to meet the irrigation rotation block program. The proposed branch roads were arranged for the benefit of the installation of the irrigation water distribution pipeline and to maintain the effective water management/irrigation facilities' shifting work. Total length is 750 m for No. 11 lot, 500 m for No. 9 lot. The roads are un-paved earth road with 3 m width at min., hight of road surface is finished on a level with field lot level by mean of rolled compaction.

2) Connecting road between the Davao Model Farm and Sub-station

The road may be required the overall improvement, but the pavement work shall only be made under the "Model Farm Plan". The road surface is eroded completely and the road bed base is washed out. Accordingly, although some subgrade course works are needed, there is no need of the road bed improvement; it is allowed to make the surface course pavement directly.

Pavement work is concrete pavement with subgrade course of unscreened gravel. The following section of pavement is planned.

Typical section is presented below:



4. FACILITY PLAN

4.1 Irrigation Facility

4.1.1 Sprinkler Irrigation Facility Plan

1) Ilagan Model Farm

a) Irrigation Block (Ref. Fig. E.4.1.1)

In order to minimize the required irrigation equipment and facilities for the plan, seed production farm block of 33 ha were divided into 4 rotation blocks as follows:

Block A	:	7.2 ha
Block B	:	8.8 ha
Block C	:	8.8 ha
Block D	:	8.2 ha

Practical seed production will be made of two or three seed production field lots separately according to the crop rotation program. However, designed irrigation equipment will be able to supply the irrigation water effectively, even if it is planted in any lot separately.

b) Irrigation Interval

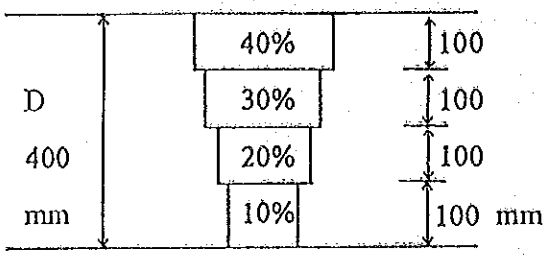
No data on the effective soil layers of the objective area is available. Hence, Irrigation interval is roughly estimated on the assumption of the following condition:

Effective root zoon	:	D 400 mm
Field capacity	:	Fe 24% (weight)
First wilting point	:	Wps 15% (weight)
Available moisture in a soil layer	:	AMi mm

$$AMi = \frac{1}{100}(Fe - Wpf)h.P.$$

where h : Thickness of soil layer 100 mm
P : Specific weight (clay loam) 1.3

Soil moisture extraction Pattern (SMEP) as shown in the following figure:



The maximum irrigation interval is given by the following formula.

$$\text{Maximum irrigation interval (day)} = \frac{\text{Total Readily Available Moisture (TRAM) mm}}{\text{Peak Consumtive Use, mm/day}}$$

$$\text{TRAM} = \frac{1}{100}(24 - 15) \times 1.3 \times 100 \times \frac{1}{40} \times 100 = 29.3$$

$$\text{Irrigation interval} = \frac{29.3}{5} = 6 \text{ day}$$

Consequently, Irrigation area per day is decided at 1.4 ha

c) Discharge Rate/Precipitation Rate

Sprinkler is selected as the following specification;

Type	:	3/4", Impact drive, Full Cycle
Pressure	:	25 kg/cm^2
Discharge	:	21.7 *l*/min
Sprinkler spacing	:	12 m
Sprinkler numbers	:	33 per one rotation lateral

(Ref. Fig. E.4.2.5, 4.2.6)

Therefore, discharge rate is as follows :

$q = 21.7 \times 33 = 716$ *l*/min.

precipitation rate

$$i = \frac{3 \times n}{\phi \, T}$$

where:

d	:	net water applied	5 m/day
ø	:	application efficiency	65%
n	:	irrigation interval	6 day
T	:	Hours of operation per one lateral	6.8 hrs.

$$i = \frac{5 \times 6}{0.65 \times 6.8} = 6.78 \text{ mm/hr.}$$

d) Total Head Requirement

head loss in pump and pipeline (estimated)	38.34
sprinkler working pressure	25.00
evaluation between pumping site and the area	5.00
suction lift	5.00
Misc.	1.66
Total head	75.00 m

e) Required Pump Capacity 720 *l*/min

2) Davao Model Farm

a) Irrigation Rotation Block (Ref. Fig. E.4.2.3, E.4.2.4)

Irrigation block for the seed production field lot No. 11 and No. 9 were proposed as follows :

No. 11 Lot	No. 9 lot
5 rotation block	4 rotation block
1.08 - 1.37 ha	1.0 ha
Total 6 ha	4 ha

b) Discharge Rate/Precipitation Rate

Sprinkler	:	Impact drive, full cycle
Pressure	:	2.5 kg/cm^2
Discharge rate	:	21.7 *l*/min.
Spacing	:	12 m

Number : No. 11 lot 23 Nos.
No. 9 lot 16 Nos.

q_{11} = 21.7 x 23 = 499.1 *l*/min.

q_9 = 21.7 x 16 = 347.2 *l*/min.

Precipitation rate

No. 11 lot : 6.8 mm/hr

No. 9 lot : 6.8 mm/hr

c) Total Dynamic Required Head

	No. 11	No. 9
Sprinkler working pressure	25.00	25.00
Total loss	28.34	21.24
Gains by elevation	(-)16.00	5.00
Total dynamic head	37.34 m	41.24 m

d) Required Pump Capacity 500 *l*/min. 400 *l*/min.

Basically, required dynamic water pressure head for the sprinkler irrigation is given from the conveyed water, distribution main pipeline for the sprinkler irrigation is jointed directly to the water conveyance pipeline. However, one set of pump unit for the sprinkler irrigation is provided as sub-facility. The capacity of the provided pump unit is 500 *l*/min.

4.1.2 Irrigation Facilities

1) Ilagan Model Farm

a) Water Intake Work (Ref. Fig. E.4.1.2)

- Water Intake System proposed the pumping system. In consideration of the stabilization of river channel, required pump-head, and distance from the seed production field to be supplied the supplemental water, intake site was selected the left bank of Panacanuan river from the seed production field at distance 300 m.

- Pump site with suction sump is made by cutting open the precipice of left bank of the Panacanauan river, and the major features of it is as follows: (Fig. E.4.1.2)

Machine base	:	Concrete, 4,000 x 4,000 x 300 t 3-side enclosed by 8 m length of U-1 type steel sheet pile
Suction pump	:	All sides enclosed with 8 ~ 4 m length of U-1 type steel sheet pile.
Waling	:	H - 200 x 200 x 10 t 27.00 m
Access road	:	Concrete 2,000 B x 18,000 L/ x 150 t

- In consideration of the decreasing of the river water level during the dry season, machine base is positioned below 8 m from the left bank ground elevation, and may be submerged under the condition of high water level/discharge occasionally. In addition to that, operation term of pump to be supplied the irrigation water is only in the dry season. Accordingly, proposed pump unit is mounted on the trailer so as to be carried out/in anytime. Furthermore, the pump unit is provided one set of mesh type strainer to remove the trash.

Pump	:	720 l/min., Dia: 75 mm/100 mm, Volt type
Engine	:	Diesel 31 rpm, 1,800 cc
Trailer	:	Two wheel pneumatics tyre

b) Water Conveyance System

Water conveyance system from pump site to seed production field block is a travelling system to shift according to the irrigation rotation program. Designed total length of main pipeline was decided so as to cover the most greatest distance field lot from the pump site; the specifications of each pipeline are as follows: (Ref. Fig. 4.1.1)

Material	:	Aluminum pipe
Main pipeline	:	Dia: 100 m, length 6.00 m, 200 pieces total length 1,200 m
Sub-main pipeline	:	Dia. 75 mm, length 4.00 m, 110 pieces total length 440.0 m

c) Irrigation Facilities/Equipments

Sprinkler

Type	:	Impact type full cycle	
		Diameter of coverage	26.5 m
		Pressure	2.5 kg/cm^2
		Nozzle	2.4 x 40, 30#
		Number	105 set

Lateral pipeline

Material		Aluminum
Space		16.0 m
Diameter x length		50 mm x 6,000
Total length		180 pieces, 1,080 m

2) Davao Model Farm

a) Diversion Work

Diversion site is located in the left bank of Lipadas river. There is about 1.5 km upstream of the Monamburan sub-station, 7.5 km north-west of the Davao Model Farm. There is a mountain stream with gradient of 1/10 ~ 1/15, in consideration of the river land and composition of river channel/bed; diversion system was proposed the mountain stream diversion work (Ref. Fig. E.4.2.2). Water collection work is extended to the water route in order to intake the Low-low water discharge in the dry season, and the work is covered with steel flat bar screen with 5 cm of pitch. Furthermore, there is provided the settling tank to prevent the sand flow into the pipeline.

Major feature of proposed diversion work is as follows:

Type	:	Mountain stream diversion work reinforced concrete, covered by FB screen 50 mm pitch
Intake	:	1000 B x 4000 L x 750 H
Collecting tank	:	1000 x 1000 x 1500 H
Settling tank	:	800 x 2000 x 1500 H with sluice gate 300 ø

b) Water Conveyance Pipeline (Ref. Fig. E.4.2.1)

Designed diversion water level	:	EL.357.40
Designed water level of the farm pond	:	EL.113.00
Designed diversion discharge	:	Diversion site to Monamburan 20 l/s Monamburan to Farm 15 l/s Total 35 l/s

Alternative/Comparison Study on the Water Conveyance System

i) Pipeline type

Two types of pipelines, the closed type and the semiclosed type pipeline is useful type for the proposed pipeline to conveyance the sprinkler irrigation water.

A semiclosed type requires two (2) or three (3) float value stand on the rout of pipeline. A closed type pipeline is required to use high pressure pipe compared to the semiclosed type. However, required diameter of the closed type is smaller than the semiclosed type. Required cost is cheaper than the semiclosed type under the condition of steep gradient in general.

In case of the closed type pipeline, it is able to get the requirement discharge and water pressure by the use of the operation of the hydrant at the end of the pipeline. Therefore, the pump does not need the sprinkler irrigation.

In consideration of the above, the difficulty of land acquisition simplicity of required structure, and required total cost, the proposed pipeline is decided as closed type.

ii) Diameter

As can be clear with the following Hazen-Williams formula, the required diameter of pipeline is regulated by the Hydraulic gradient under the condition of the constant discharge.

$$D = 1.6258 C^{-0.38} Q^{-0.38} I^{-0.205}$$

Where:

D : Diameter of pipe (m)
C : Velocity factor
Q : Discharge (m^3/sec.)
I : Hydraulic gradient

Therefore, comparison study on the hydraulic gradient for pipe of the 150 mm and 100 mm in dia is made to decide the designed diameters of the proposed pipeline. A hydraulic gradient, friction loss, and velocity is acquired by using the following formula:

$$I : 10.666\, C^{-1.85} D^{-4.87} Q^{1.85}$$

$$U : 0.35464\, CD^{0.63} I^{0.54}$$

$$f : 133.7\, C^{-1.852} D^{-0.167} V^{-0.148}$$

$$hf : f \frac{L}{D} \frac{V^2}{2g}$$

where:

I : Hydraulic gradient
V : Velocity (m/sec.)
f : Coefficient of friction loss
hf : Friction head loss
C : Velocity factor (For FRP = 150)
D : Diameter of pipe (m)
Q : Discharge (m^3/sec)
L : Pipeline length (m)
g : Gravitional acceleration (9.8 m/sec^2)

Diameter	150 mm	100 mm
Discharge	0.020 (m^3/sec)	0.020 (m^3/sec.)
Hydraulic gradient	0.00740	0.0535966
Velocity	1.138155 (m/sec.)	2.5681 (m/sec)
Coefficient of friction	0.016799	0.01593625
Friction loss	46.26 (m)	335.1468 (m)

On the other hand, standard velocity for the design of the pipeline is 0.7 ~ 1.0 m/sec. at 75 ~ 100 mm of diameter and allowable average velocity is 5 m/sec. at max.

As can be seen from the above, 100 mm pipe in dia would not be impossible because, friction loss is bigger than hydrostatic pressure head, etc. Accordingly, designed diameter for the proposed pipeline was decided at 150 mm.

iii) Designed internal water pressure head

Difference of elevation head in the proposed pipeline is at 240 m. The pipeline is closed type. Therefore, the potential water pressure at pipeline end is 24 kg/cm^2. Out of 7500 m in total length, about 1200 m is more than 20 kg/m^2, about 1800 m is range of 15 - 20 kg/cm^2.

If consideration of the water hammer pressure is at 40% of hydrostatic pressure, the proposed pipe is needed to use a much higher pressure pipe.

Therefore, the following counter measure is considered for the proposed pipeline, thereby the proposed pipeline used the 15 kg/cm^2 type pipe.

- 4 set relief valve is arranged on the route of pipeline to maintain the internal water pressure below than 10 kg/cm^2.
- However, at the end of pipeline is located the reservoir, and is provided as the reserve, and stop valve is not arranged in place of it. At creek crossing point which is positioned closely to the farm pond, the discharge valve is provided in order to discharge into the creek the surplus water.
- For emergency use the stop valve is arranged at the upstream of the Monamburan division point to prevent the danger of water hummer.
- An exclusive wireless is set up between the Farm and the Monamburan sub-station to manage the emergency stop valve.

c) Irrigation Facilities/Equipments

Number/specification of the sprinkler and related equipments were decided according to the proposed irrigation rotation program (Ref. Rig. E.4.2.3 - 4.2.4).

		For No. 11 Lot	For No. 9 Lot
(1)	Distribution Main Pipeline		
	PVC 3" pipe fixing	640 m	480 m
	(Water conveyance pipeline end to No. 9 lot)		910 m
(2)	Delivery Pipeline		
	Aluminum 3", travelling type	160 m	64 m
(3)	Lateral pipeline		
	Aluminum 2" travelling type	660 m	504 m
(4)	Sprinkler		
	Pressure 2.5 kg/cm^2 Q = 21.7 *l*/m in Nozzle #30, 2.4 x 40 Riser H = 1.00 m	67 set	48 set
(5)	Pump/Engine		
	Mounted on a trailer 500 l/min, H 40 7.5 kW	1 L.S	
	Engine 10.2 rpm Water cooled hopper type		

As mentioned in Chap. 4, required dynamic water pressure for the sprinkler irrigation is given from the conveyanced water, distribution main pipeline is joined directly to the water conveyance pipeline with provided connection device. The sprinkler irrigation is made without a pump; however, it will also be able to make use with the storage water in the farm pond occasionally. Therefore, one unit of pump and engine is provided as sub-facility.

d) Farm Pond Rehabilitation

Existing farm pond is let alone without any maintenance for a long time. It is over spreaded with silt and woods. Although the deteriorated condition is not

clear, it seems that the structural strangeness is not yet lost, and will be able to use for the plan to make the rehabilitation something.

Proposed rehabilitation work is as follows:

- Water proof work 600 m^2
  Except the partition, whole inside concrete surface of the pond is spread with epoxy resin liner

- Raising work of volume
  In order to expand the water storage capacity and to reduce the energy of discharge water, the wall is extended upward at 0.75 m.

4.2 On Farm Road and Connecting Farm Road

1) Proposed on-farm road for the Davao

Model farm is arranged in cooperation with installation work of the irrigation water distribution pipeline. However, the work shall be made by using special supplied construction equipments under the "Model Farm Plan".

Total length	For No. 11 lot	750 m
	For No. 9 lot	500 m
Effective width	3.00 m	
	un-paved earth road	

2) Connecting Farm Road between the Model Farm and Sub-station

Proposed road is as follows:

Total length	6,000 m
Concrete pavement Width	3.0 m
Pavement thickness	0.15 m
Sub-grade course	0.15 m (Un-screened gravel)

5. COST ESTIMATION

5.1 Cost Estimate Conditions

5.1.1 General

All improvement work costs are estimated based on the following conditions.

- The construction cost comprises foreign and local currency portions. The cost estimate is made according to current price as of August 1990.

- The exchange rate used in the estimation is shown as follows:
  US$1.00 = 24 peso = 150 yen

- Civil work is to be carried out on the international contract basis using contractor's own heavy construction machinery and equipment.

- Taxes on the construction materials, equipment to be imported from abroad are exempted from the cost estimate.

- Physical contingency was estimated at 10% of total cost.

5.1.2 Construction Cost Estimation

The total construction costs of the Filed Improvement Plan are estimated at P.31,377,810. Details are shown in Table E.5.1.2 and breakdown of the cost estimate are presented in Table 5.2 through 5.5.

5.1.3 Annual Operation and Maintenance Cost

The annual operation and maintenance costs are estimated as 0.5% of the construction cost for the pump-site of the Ilagan Model Farm and diversion work, water conveyance pipeline, farm pond of the Davao Model Farm and 1.5 for irrigation facilities/equipments on the experience gained from scheme of similar type and magnitude.

	Ilagan Model Farm	Davao Model Farm	Total
Local	153	15,834	15,987
Foreign	59,576	132,203	191,779
Total	59,729	148,037	207,766

6. IMPLEMENTATION SCHEDULE

6.1 Plan Execution

The plan aims to improve the seed production field in the two-demonstrative farms through the establishment or irrigation system as the main component and supplemental components for related infrastructure of the Farm.

The plan is executed as one component of the "Seed Production and Distribution Improvement Plan". Furthermore, the proposed plan consists of two-schemes for the two Model Farms respectively which is located independently at a long distance.

BPI will be responsible for execution of the entire plan including pre-plan planning and designing, as well as construction. For overall execution, BPI will appoint a "Seed Production/Improvement Plan" executive manager. The Manager will be directly responsible for implementation of the Plan and for coordinating the activities of all relevant agencies.

6.2 Implementation Schedule

On the basis of various conditions, construction scale of each scheme, especially the ratio of equipments/materials will be imported from abroad, workable days, etc. The implementation period was determined at three years including a pre-plan stage.

Contract for the procurement equipments/materials to be imported from abroad will be executed. In the first year of the pre-plan stage for: detailed design, investigations and additional surveys, preparation of technical specification, tender document for the international procurement, and execution of the international bid.

Construction work of the pump site in the Ilagan Model Farm, diversion work, rehabilitation work of farm pond, road pavement works and a part of water conveyance pipeline for the Davao Model Farm will commence in the second year. All procured equipments/material will be delivered in the each site up to the end of second year.

For the pump-site, diversion work shall be constructed up to the end of the dry season in the second year.

Table.E.1.1.1 SEED PRODUCTION SITE BY STATIONS AND SEED FARMS

Region	Experiment Stations/Seed Farms	Rice		Corn		Peanut
		Lowland	Upland	Yellow	White	
CAR	Buguias NCC					
	Luna Seed Farm	O			O	O
I	Dingras Expt. Station	O	O			
II	Agricultural Pilot Center					
	Ilagan Expt. Station	O	O	O	O	O
	Cagayan Valley Expt. Station	O				
	Abulug Seed Farm	O	O	O		
III	Phil. Rice Central Expt. Station	O				
NCR	BPI Central Office Manila					
	Quezon City Central Nursery					
IV	Economic Garden NCC			O	O	O
	Dr. M.L. Roxas Memorial Expt. Station			O		
	Tiaong Expt. Station			O		O
	Mindoro Horticultural Center	O	O	O		
	Tanay Seed Farm	O	O	O		O
	Palawan Seed Farm	O		O		O
V	Bicol Expt. Station	O	O			
	Albay Expt. Station			O		O
	Daet Seed Farm			O	O	O
	Virac Seed Farm	O	O	O	O	
VI	La Granja NCC			O	O	O
	Visayas Expt. Station	O				
	Iloilo Seed Farm					
	Guimaras Seed Farm	O				
VII	Mandaue Expt. Station		O			
	Bohol Expt. Station	O	O	O	O	O
	Agricultural Productivity Center					
VIII	Romualdez Expt. Station	O		O	O	O
	Abuyog Expt. Station	O			O	O
	Gandara Seed Farm	O		O	O	O
	Salcedo Seed Farm					
IX	Ipil Expt. Station	O	O	O	O	O
X	Dalwangan Expt. Station	O	O	O	O	O
	Bukidnon Seed Farm			O	O	O
XI	Davao NCC	O		O	O	O
	Tupi Expt. Station	O		O	O	O
XII	Mindanao Expt. Station	O				
	Aroman Seed Farm	O		O	O	O
	Kidapawan Seed Farm					
	Amas Seed Farm			O	O	O

Table.E.1.1.2 INVENTORY OF SEED PRODUCTION FILED BY STATIONS AND SEED FARMS

(Unit: ha)

Region	Experiment Stations/Seed Farms	Total Area	Paddy Land	Corn Land	Peanut Land	Sub-total
CAR	Buguias NCC	45	0	-	-	0
	Luna Seed Farm	251	2	5	9	16
I	Dingras Expt. Station	5	4	-	0	4
II	Agricultural Pilot Center	5	5	-	-	5
	Ilagan Expt. Station	107	4	10	6	20
	Cagayan Valley Expt. Station	24	19	-	-	19
	Abulug Seed Farm	27	24	-	-	24
III	Phil. Rice Central Expt. Station	98	44	-	-	44
NCR	BPI Central Office Manila	4	0	-	-	0
	Quezon City Central Nursery	3	0	-	-	0
IV	Economic Garden NCC	46	0	5	1	6
	Dr. M.L. Roxas Memorial Expt. Station	48	0	5	-	5
	Tiaong Expt. Station	49	26	4	0	30
	Mindoro Horticultural Center	316	26	2	-	28
	Tanay Seed Farm	21	4	1	1	6
	Palawan Seed Farm	68	15	4	2	21
V	Bicol Expt. Station	70	36	-	-	36
	Albay Expt. Station	50	0	4	1	5
	Daet Seed Farm	57	4	7	1	12
	Virac Seed Farm	74	5	1	0	6
VI	La Granja NCC	96	5	8	11	24
	Visayas Expt. Station	63	44	-	-	44
	Iloilo Seed Farm	8	1	-	-	1
	Guimaras Seed Farm	9	8	-	-	8
VII	Mandaue Expt. Station	8	0	3	-	3
	Bohol Expt. Station	100	50	7	7	64
	Agricultural Productivity Center	-	-	-	-	-
VIII	Romualdez Expt. Station	27	4	7	3	14
	Abuyog Expt. Station	145	4	1	1	6
	Gandara Seed Farm	85	7	4	3	14
	Salcedo Seed Farm	20	0	-	1	1
IX	Ipil Expt. Station	24	5	1	1	6
X	Dalwangan Expt. Station	120	1	1	1	3
	Bukidnon Seed Farm	30	0	6	1	7
XI	Davao NCC	105	1	7	8	16
	Tupi Expt. Station	42	5	5	2	12
XII	Mindanao Expt. Station	94	69	-	-	69
	Aroman Seed Farm	485	0	16	4	20
	Kidapawan Seed Farm	50	0	4	-	4
	Amas Seed Farm	281	60	7	3	70

Table.E.1.1.3 AREA AND WATER RESOURCES OF EXPERIMENT STATIONS AND SEED FARMS

Region	Experiment Stations/Seed Farms	Total Area (ha)	Paddy Land (ha)	Upland (ha)	Water Resources (Name of rivers and irrigation systems)
CAR	Baguio NCC	9	0	0	Deep Well, Turbine Pump Irrigation Systems
	Buguias NCC	36	0	0	
	Luna Seed Farm	251	2	6	Irrigation Pump Rainfall
I	Dingras Expt. Station	5	4	0	Pump (Electrical), Rainfall
II	Agricultural Pilot Center	5	5	0	Cagayan River National Irrigation Administration
	Ilagan Expt. Station	107	4	60	Pinacanauan River Pump
	Cagayan Valley Expt. Station	24	19	0	Magat River Irrigation, Deep Well Pump
	Abulug Seed Farm	27	24	0	Abulug-Apayao Irrigation System (Insufficient Water Supply)
III	Phil. Rice Central Expt. Station	98	44	0	
NCR	BPI Central Office Manila	4	0	0	
	Quezon City Central Nursery	3	0	0	Dam, Irrigation Pump
IV	Economic Garden NCC	46	0	16	Deep Well (Dry Season) Rainfall (Wet Season)
	Dr. M.L. Roxas Memorial Expt. Sta.	48	0	0	Deep Well, Rainfall
	Tiaong Expt. Station	49	46	0	Water Pump, Rainfall
	Mindoro Horticultural Center	316	216	11	Deep Well, Rainfall
	Tanay Seed Farm	21	4	4	Water Pump, Rainfall
	Palawan Seed Farm	68	15	0	Water Pump, Rainfall
V	Bicol Expt. Station	70	36	10	Electricity Operated Deep Well Pumps
	Albay Expt. Station	50	0	0	Deep Well, Water Pump, Rainfall
	Daet Seed Farm	57	4	25	Irrigation Pump
	Virac Seed Farm	74	5	0	Deep Well Pumps
VI	La Granja NCC	96	5	0	Gravity Irrigation System
	Visayas Expt. Station	63	44	0	Tigum Irrigation System
	Iloilo Seed Farm	8	1	0	VES Complex Deep Well, Creek
	Guimaras Seed Farm	9	8	6	Irrigation Pump
VII	Mandaue Expt. Station	8	0	0	Water Pump, Rainfall
	Bohol Expt. Station	100	50	0	Earth Dam
	Agricultural Productivity Center				
VIII	Romualdez Expt. Station	27	4	22	Deep Well, Rainfall
	Abuyog Expt. Station	145	4	0	Irrigation Pump, Rainfall
	Gandara Seed Farm	85	7	19	Irrigation Pump, Deep Well, Sapinit River
	Salcedo Seed Farm	20	0	6	Water Pump, Deep Well
IX	Ipil Expt. Station	24	5	0	Domestic Water System with Tank, Rainfall
X	Dalwangan Expt. Station	120	1	0	Water Pump, Rainfall
	Bukidnon Seed Farm	130	0	0	
XI	Davao NCC	105	1	0	Water Pump, Rainfall
	Tupi Expt. Station	42	5	29	Malawi Creek Supply by Water Springs, Mani-dam
XII	Mindanao Expt. Station	94	69	0	Drum Pump, Pil Bucket Pump
	Aroman Seed Farm	485	0	82	Water Pump
	Kidapawan Seed Farm	50	0	0	Water Pump
	Amas Seed Farm	281	60	0	Irrigation Dam, Water Pump

Table.E.1.1.4 FIELD DESIGN SPECIFICATION OF STATIONS AND SEED FARMS

Name	Farm Road	Irrigation Canal	Irrigation Water Source	Drainage Canal	Field Drainage	Farmland Block
National Crop Center (NCC)						
Economic Garden	L = No Dater		Deep Well			
La Granja	L = 4,200 W = 6.0	L = 1,118	Irrigation Canal Pump 800 GPM Reservoir	Creek	Creek	3 - 16 ha (Total: 43 ha)
Davao	L = 5,900 W =	L = 0	Pump Submersible 1 Unit	Creek	Creek	Irregular Shape (Total: 30 ha)
Branch Experiment Station						
Cagayan Valley	L = 3,900 W = 4.0	L = 2,000	Irrigation Canal	Plot to Plot to Irrigation Canal		100m x 100m (Total: 21 ha)
Bicol	L = 5,800	L = 2,615	Reservoir Deep Well 1,800 GPM	Irrigation Canal to Creek	Plot to Plot to Creek	100m x 100m (Total: 47 ha)
Visayas	L = 4,600	L=- 3,650	Irrigation Canal Pump 800 GPM	L = 1,326	Plot to Plot to Buntala Creek	120m x 120m (Total: 47 ha)
Mindanao	L = 4,300	L= 1,450	Pump 1 Unit	L = 2,400 Plot to Plot		200m x 780 m (Total: 70 ha)

Source: BPI

Table.E.5.1.1 MAIN FEATURES OF PLAN FACILITIES

Item		Description		
Ilagan Model Farm				
Pump site		Pinancanun river left bank		
Type		Three sides enclosed with YSP-1 type steel sheet pile 8.0 *l*		
Pump base		Concrete 4.0 x 4.0 x 0.3 t		
Travelling road		Concrete 2.0 x 0.15 t 18.0 *l*		
Suction Sump		4-sides enclosed with YSP-1 sheet pile 4-8 ml 30 m^2 x 50 m^3		
Pump Unit				
Type		Travelling Type, mounted on two wheel trailer		
Pump		Volute, 75/100 720 *l*/min 75 H 25 rpm		
Engine		Diesel 31 ps		
Strainer		Mesh type		
Irrigation Facilities/Equipments		Travelling type		
Main pipeline		Aluminum pipe	100 mm x 6,000 m	1200 m
Sub pipeline		Aluminum pipe	75 mm x 4,000 m	440 m
Lateral pipeline		Aluminum pipe	50 mm x 6,000 m	1,080 m
Sprinkler	Nozzle	Impact drive, full circle, space 12 m, 30# 2.4 x 40 2.5 kg 21.7 *l*/min. 105 set		
	Raiser	1,000 H 105 set 19 m each		
Davao Model Farm				
Diversion Work		Lipadas river left bank Mountain stream diversion work with settling tank 5,000 x 1,000 x 0.75 H, FB. bar 5 cm pitch, Q: 35 *l*/s 0.800 x 2,000 x 0.5 H Settling basin with sluice gate 300 ø		
Water Conveyance System				
Pipeline		Fixing FRP pipe 1,250 m 200 Dia P = 7 kg/m 6,250 m 250 Dia P = 15 kg/cm^2 Relief value: 4 set Emergency stop value, air value, etc.		
Farm pond		Rehabilitation 20 x 15 m x 1.5 H Water proofing and expansion work 600 m^2		
Irrigation Facilities/Equipments				
Distribution pipeline		PVC. fixing pipeline For No. 11 lot : 640 m ..... 75 m/m No. 9 lot : 480 m ..... 75 m/m No. 9 ~ Farm pond : 910 m ..... 75 m/m		

Lateral Pipeline	Travelling Pipeline Aluminum 50 m/m 1,164 m
Delivery Pipeline	Travelling line aluminum 75 mm, 224 mm
Sprinkler	
Nozzle	2.5 kg/cm^2, 115 set, #2.4 x 40
Rises	115 set
Pump Unit	1 No. Travelling type Pump, 40 H, Q = 500 *l*/min, 7.5 kW Eng. Diesel 10.2 rpm
Road Pavement Work	Concretes pavement, 300 m W x 0.15 t, 6000 m Lower course: Sand/gravel 0.15t

Table.E.5.1.2 FINANCIAL CONSTRUCTION COST

(Unit: peso)

Item	Local	Foreign	Total
Ilagan Model Farm Pump Station Civil Works	27,747	595,064	622,811
Irrigation Facilities and Equipment	-	3,412,319	3,412,319
Sub-total	27,747	4,007,383	4,035,130
Davao Model Farm Division Works	42,600	128,510	171,110
Water Conveyance Pipeline	90,242	10,817,617	10,907,859
Farm Pond Rehabilitation	135,475	321,262	456,737
Irrigation Facilities (pipeline, sprinkler, etc.)	-	2,676,691	2,676,691
Road Pavement Work	2,610,630	4,921,290	7,531,920
Sub-total	2,878,947	18,865,370	21,744,317
Total	2,906,694	22,872,753	25,779,447
Land Acquisition	-	-	-
OM Equipment	-	-	-
Administration Expenses	3,600	-	3,600
Engineering Service	890,669	1,851,566	2,742,235
Total	3,800,963	24,724,319	28,525,282
Physical Contingency	380,096	2,472,432	2,852,528
Grand Total	4,181,059	27,196,751	31,377,810

Table.E.5.1.3 COST BREAKDOWN FOR ILAGAN MODEL FARM IMPROVEMENT WORK

(Unit: peso)

Item	Local	Foreign	Total
Damsite Construction Work	27,747	595,064	622,811
Irrigation Facilities/Equipments	-	3,412,319	3,412,319
Total	27,747	4,007,383	4,035,130

Table.E.5.1.4 COST BREAKDOWN FOR DAVAO MODEL FARM IMPROVEMENT WORK

(Unit: peso)

Item	Local	Foreign	Total
Diversion Work	42,600	128,510	171,110
Water Conveyance System	90,242	10,817,617	10,907,859
Farm for Rehabilitation	135,475	321,262	456,737
Irrigation Facilities/Equipments	-	2,676,691	2,676,691
Road Pavement Work	2,610,630	4,921,290	7,531,920
Total	2,878,947	18,865,370	21,744,317

Table.E.5.1.5 COST BREAKDOWN FOR PUMP SITE (ILAGAN MODEL FARM)

(Unit: peso)

Item	Q'ty	Unit	Local	Foreign	Total
Excavation	260	m^3	2,860	13,000	15,860
Sheet Pile Driving (U-1)	187.2	m^2	11,232	486,720	497,952
Waling (H)	27	m	288	24,651	24,939
Concrete	12	m^3	5,796	16,596	22,392
Boulder	8.5	m^3	5,049	-	5,049
Miscellaneous	1	L.S.	2,522	54,097	56,619
Total			27,747	595,064	622,811

Table.E.5.1.6 COST BREAKDOWN FOR IRRIGATION FACILITY
(ILAGAN MODE FARM)

(Unit: peso)

Item	Q'ty	Unit	Local	Foreign	Total
Pump Unit with Standard	1	L.S.	-	632,000	632,000
Main Pipeline	1,200	m	-	1,152,000	1,152,00
Sub Pipeline	440	m	-	299,200	299,200
Lateral Pipeline	1,080	m	-	360,000	360,000
Sprinkler Nozzle	105	Nos.	-	92,399	92,399
Sprinkler Riser	105	Set	-	110,880	110,880
Elbow, etc.	1	L.S	-	322,720	322,720
Spare	1	L.S	-	296,920	296,920
Packing	43	m^3	-	89,440	89,440
Sub-total (FOB Yokohama)			-	3,355,559	3,355,559
Ocean Freight	43		-	56,760	56,760
Total (CIF)			-	3,412,319	3,412,319

Table.E.5.1.7 COST BREAKDOWN FOR DIVERSION WORK
(DAVAO MODEL FARM)

(Unit: peso)

Item	Q'ty	Unit	Local	Foreign	Total
Excavation	23	m^3	2,645	1,771	4,416
Reinforcement Concrete	13	m^3	15,730	47,190	62,920
Flat Bar Screen	840	kg	20,160	20,160	40,320
Fixing Bolt (SUS 16)	82	No.	-	8,200	8,200
Gate Valve (300 ø)	1	L.S	192	37,760	37,952
Check Plate	98	kg	-	1,746	1,746
Miscellaneous	1	L.S	3,873	11,683	15,556
Total			42,600	128,510	171,110

Table.E.5.1.8 COST BREAKDOWN FOR WATER CONVEYANCE PIPELINE

(Unit: peso)

Item	Q'ty	Unit	Local	Foreign	Total
Pipe FRP 200 7 kg/cm^2	1,250	m		1,440,000	1,440,000
150 15 km/cm^2	6,250	m		6,660,000	6,660,000
Emergency Stop value	1	L.S		320,000	320,000
Relief Valve	4	Sts		960,000	960,000
Joint/Heterotypic Pipe	1	L.S		804,000	804,000
Air Valve, Various Valves	1	L.S		402,000	402,000
Installation Work	7,500	m	54,000	126,000	180,000
Excavation	2,000	m^3	22,000	100,000	122,000
Concrete	125	m^3	6,038	17,288	23,326
Miscellaneous (Walkie-talkie, etc.)	1	L.S	8,204	48,329	56,533
Total			90,242	10,817,617	10,907,859

Table.E.5.1.9 COST BREAKDOWN FOR FARM POND REHABILITATION (DAVAO MF)

(Unit: peso)

Item	Q'ty	Unit	Local	Foreign	Total
Excavation/Cleaning	150	m^3	45,000	-	45,000
Water Proofing	600	m^2	57,600	230,400	288,000
Raising Work (Concrete)	21	m^3	20,559	61,656	82,215
Miscellaneous	21	m^3	12,316	29,206	41,522
Total			135,475	321,262	456,737

Table.E.5.1.10 COST BREAKDOWN FOR IRRIGATION FACILITIES

(Unit: peso)

Item	Q'ty	Unit	Local	Foreign	Total
Main Pipeline PVC 3"	640	m		320,000	320,000
Main Pipeline PVC 3"	480	m		240,000	240,000
Hydrant	19	set		141,360	141,360
Fitting	1	L.S		36,800	36,800
Isolation Valve	7	Set		100,800	100,800
Drain Valve	6	Set		81,600	81,600
Lateral Pipe	1,164	m		381,792	381,792
Sprinkler Nozzle	115	Set		95,680	95,680
Sprinkler Riser	115	Set		119,600	119,600
Delivery Pipeline	224	m		147,840	147,840
Coupling	4	Set		22,080	22,080
Connection 7"/3"	1	L.S		119,800	119,800
Pump Unit	1	L.S		256,000	256,000
Spare	1	L.S		204,227	204,227
Packing	25	m^3		54,152	54,152
Sub-total (FOB Yokohama)				2,321,731	2,321,731
Water Conveyance Pipeline end to No. 9 Lot Water Distribution Pipeline					
Polyethylene pipe (PVC)	910	m		193,440	193,440
Joint PE x PE	45	Set		32,400	32,400
Joint PE x Thread	12	Set		11,520	11,520
Isolation Valve/Fitting	2	Set		29,120	29,120
Air Valve, Drain Valve and Ilbo				35,680	35,680
Sub-total				302,160	302,160
Total (FOB Yokohama)				2,623,891	2,623,891
Ocean Freight	40	m^3		52,800	52,800
Grand Total				2,676,691	2,676,691

Table.E.5.1.11 COST BREAKDOWN FOR ROAD PAVEMENT WORK

(Unit: peso)

Item	Q'ty	Unit	Local	Foreign	Total
Road Bed Grading	18,000	m^2	432,000	432,000	864,000
Lower Course	2,700	m^3	637,200	307,800	945,000
Concrete	2,700	m^3	1,304,100	3,734,100	5,038,200
Miscellaneous	1	L.S	237,330	447,390	684,720
Total			2,610,630	4,921,290	7,531,920

Table.E.5.1.12 UNIT COST

(Unit: peso)

Item		Unit	Unit Price	Local	Foreign
Material					
Portland Cement		t	1,870	935	935
Concrete Aggregate	(Manufactured)	t	62	62	
	(Wash sand)	t	69	69	
Sand/Gravel		m^3	140	140	
Boulder		m^3	306	306	
Reinforced Steel Bar		t	9,350	3,273	6,077
Steel Plate		t	13,300		13,300
Check Plate		t	17,820		17,820
H Shape Steel		t	33,900		13,900
Sheet Pile YSP-1		m	(22,500 P/t)		822
Concrete	σ = 125 kg/cm^2	m^3	1,095	329	766
	σ = 175 kg/cm^2	m^3	1,163	350	813
	σ = 210 kg/cm^2	m^3	1,238	371	807
	σ = 245 kg/cm^2	m^3	1,307	392	915
Construction Work					
Excavation	Common	m^3	61	11	50
	with Gravel	m^3	95	17	78
	Rock	m^3	192	115	77
Backfill		m^3	37	5	27
Reinforcement Concrete	σ = 245 kg/cm^2	m^3	4,840	1,210	3,630
	σ = 210 kg/cm^2	m^3	3,915	979	2,936
Concrete	σ = 175 kg/cm^2	m^3	1,869	483	1,383
Sheet Pile Driving YSP-1		m^2	2,660	60	2,600
Installation of Pipe		m	5	5	-
Irrigation Equipment					
FRP 200	7 kg/cm^2	m	CIF 1,152		1,152
150	15 kg/cm^2	m	CIF 1,056		1,056
Aluminum	4" x 6 m	m	FOBY 960		960
	3" x 4 m	m	FOBY 680		680
	2" x 6	m	FOBY 333.3		333.3
Sprinkler	Nozzle 4.0 x 24	Set	FOBY 832		832
	Risen 1 m	Set	FOBY 1,040		1,040
Ocean Freight		m^3	1,320		1,320

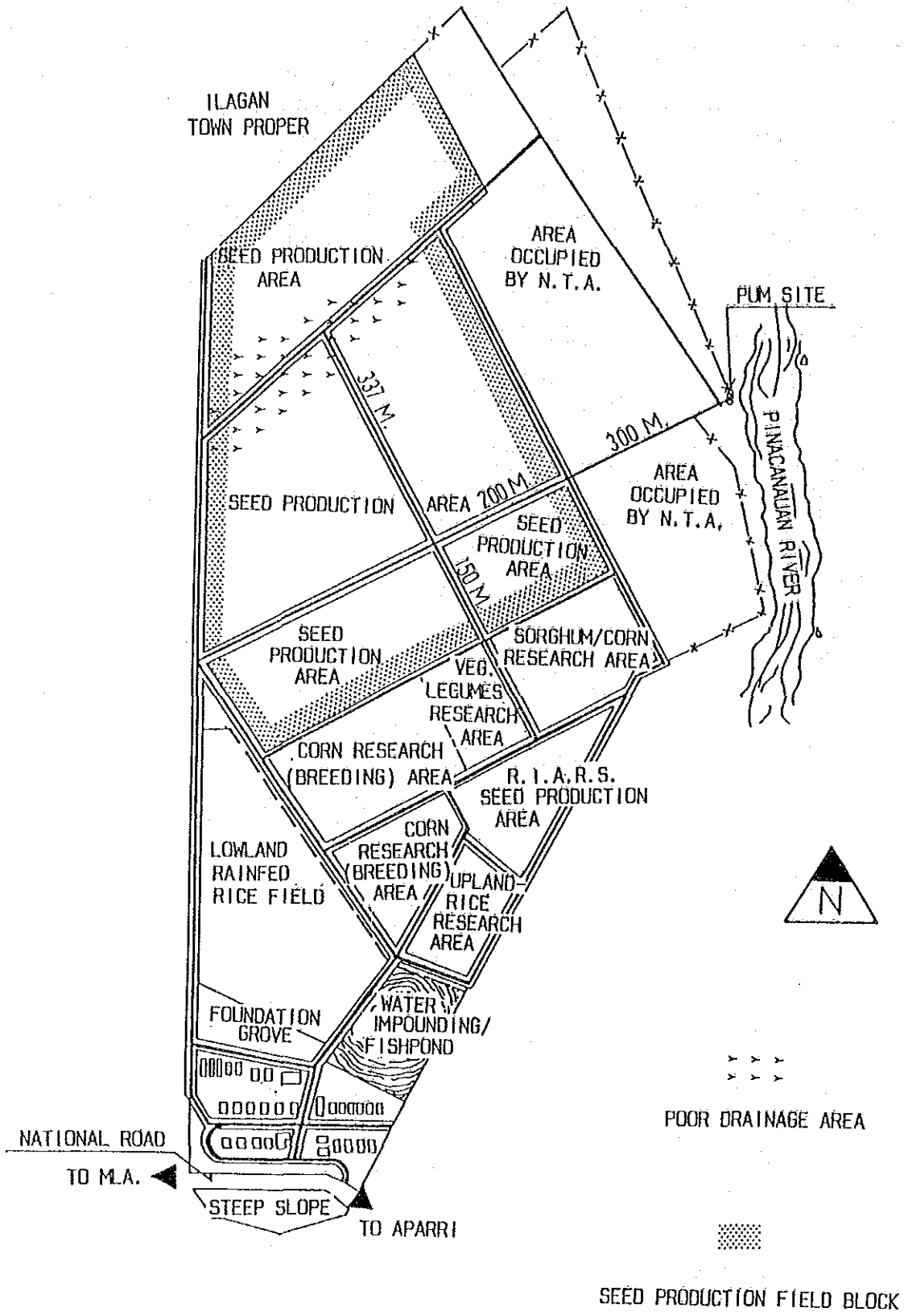


Fig.E.1.2.1 GENERAL MAP OF ILAGAN MODEL FARM

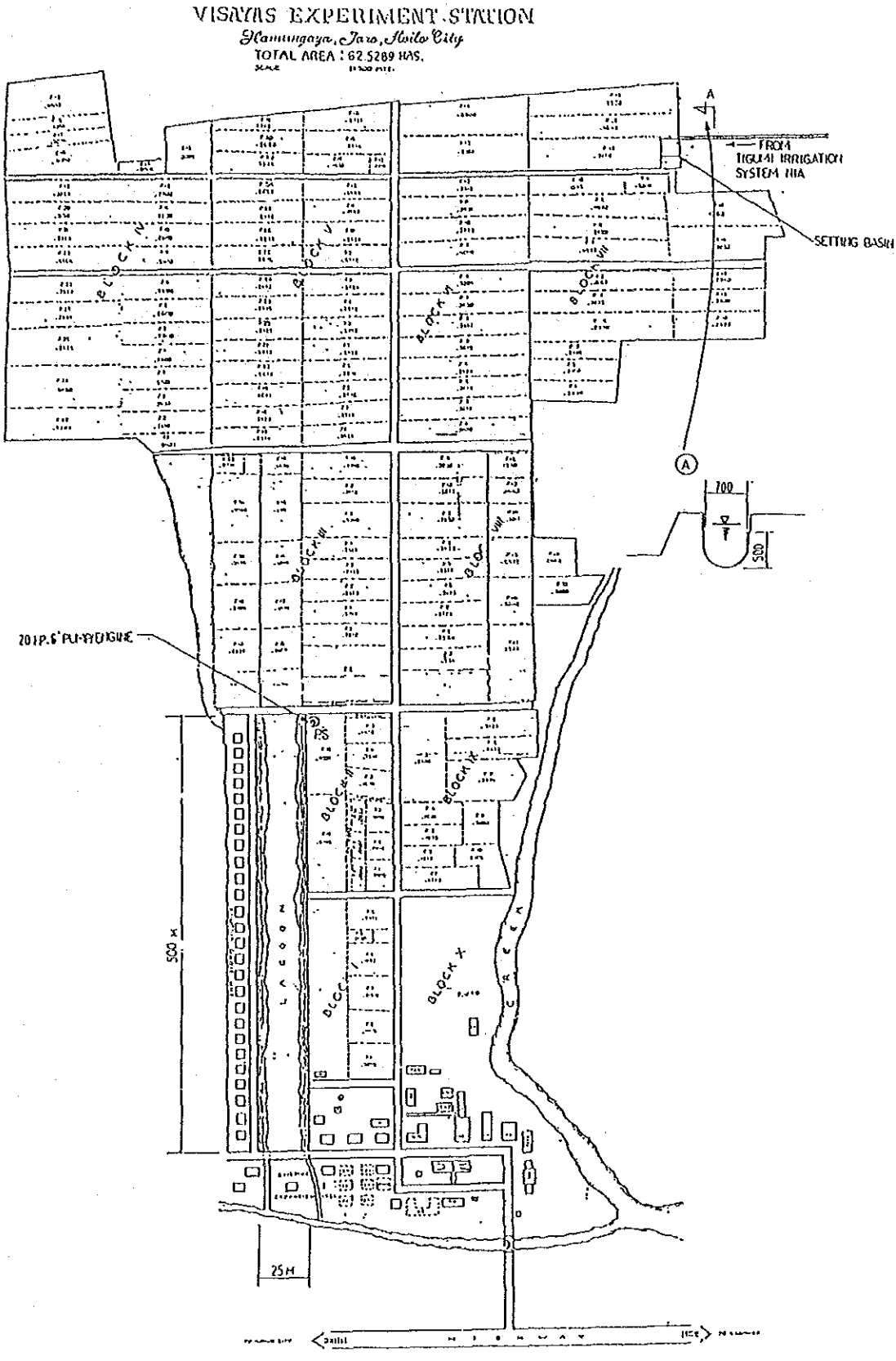


Fig.E.1.2.2 GENERAL MAP OF VISAYAS MODEL FARM

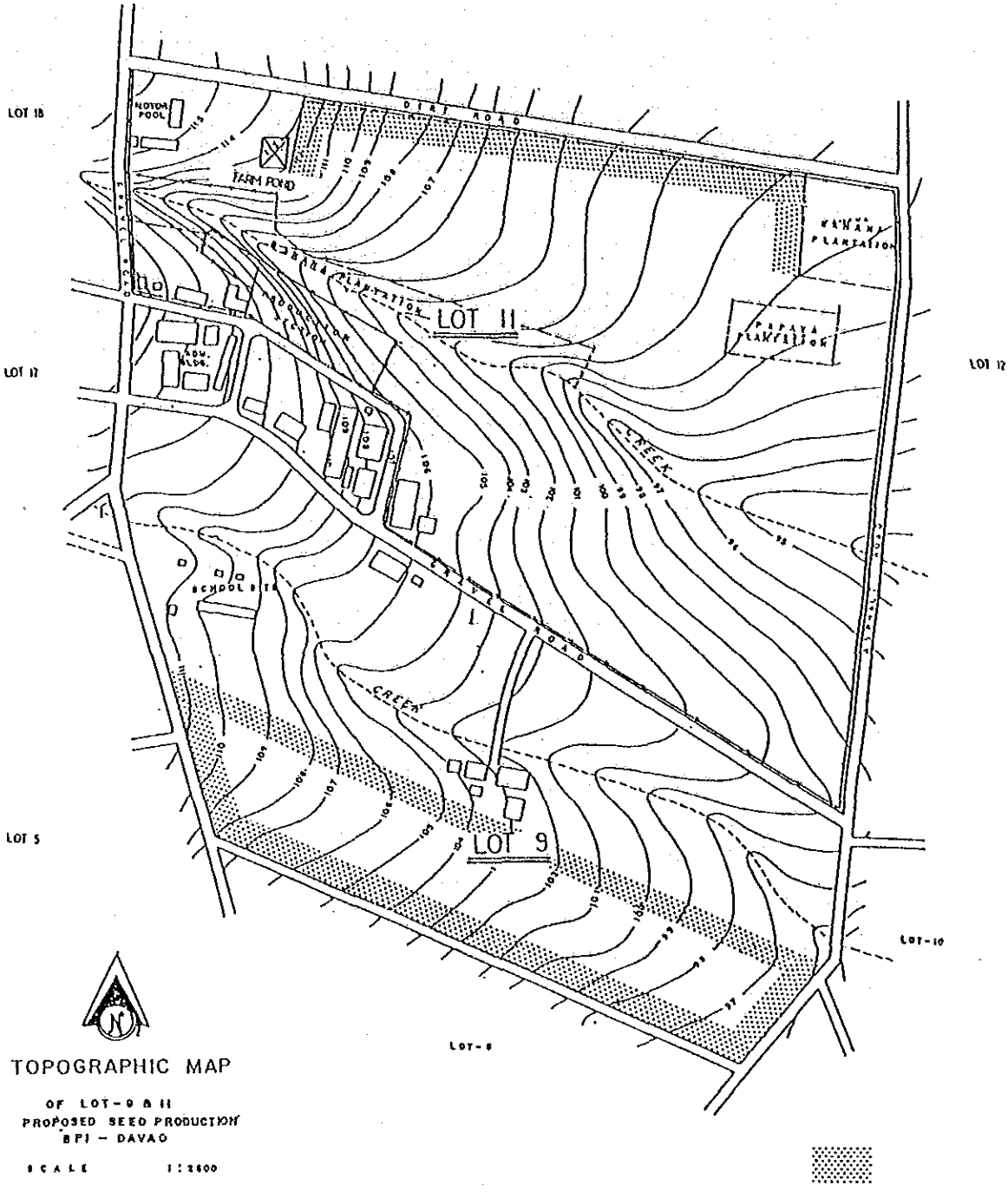


Fig.E.1.2.3 GENERAL MAP OF DAVAO MODEL FARM

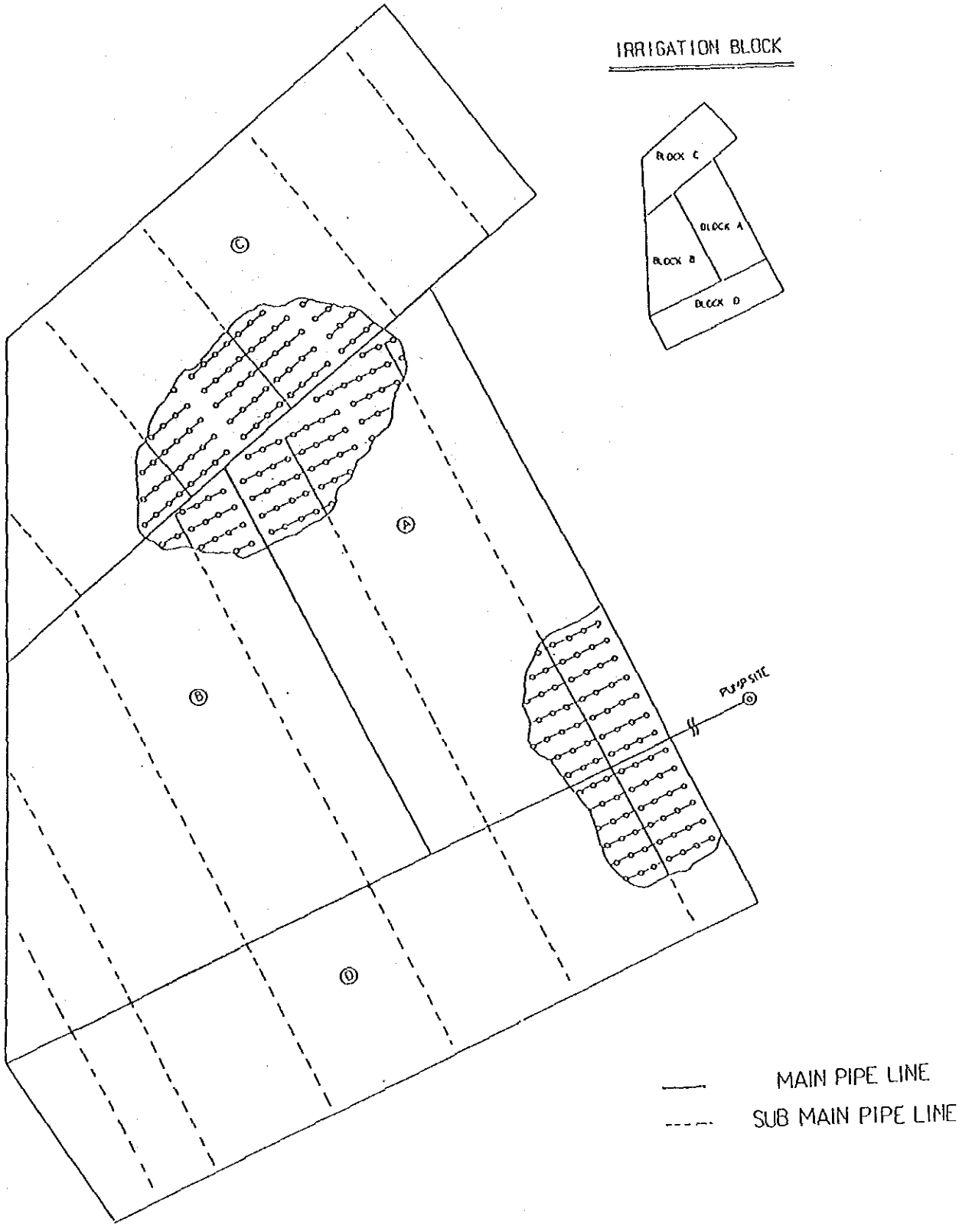


Fig.E.4.1.1 GENERAL LAYOUT OF IRRIGATION SYSTEM (ILAGAN MF)

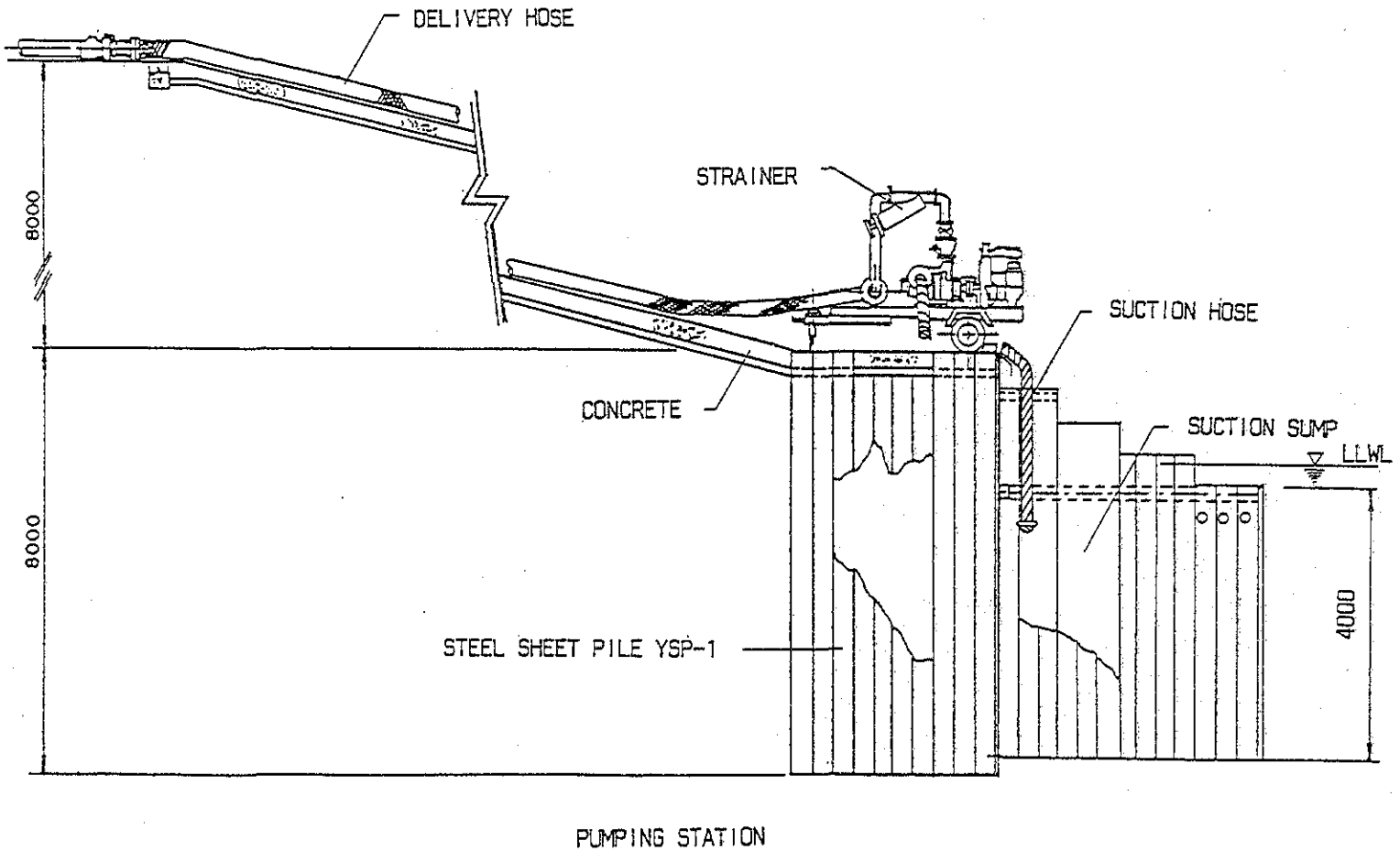


Fig.E.4.1.2 GENERAL PLAN OF PUMP SYSTEM (ILAGAN MF)

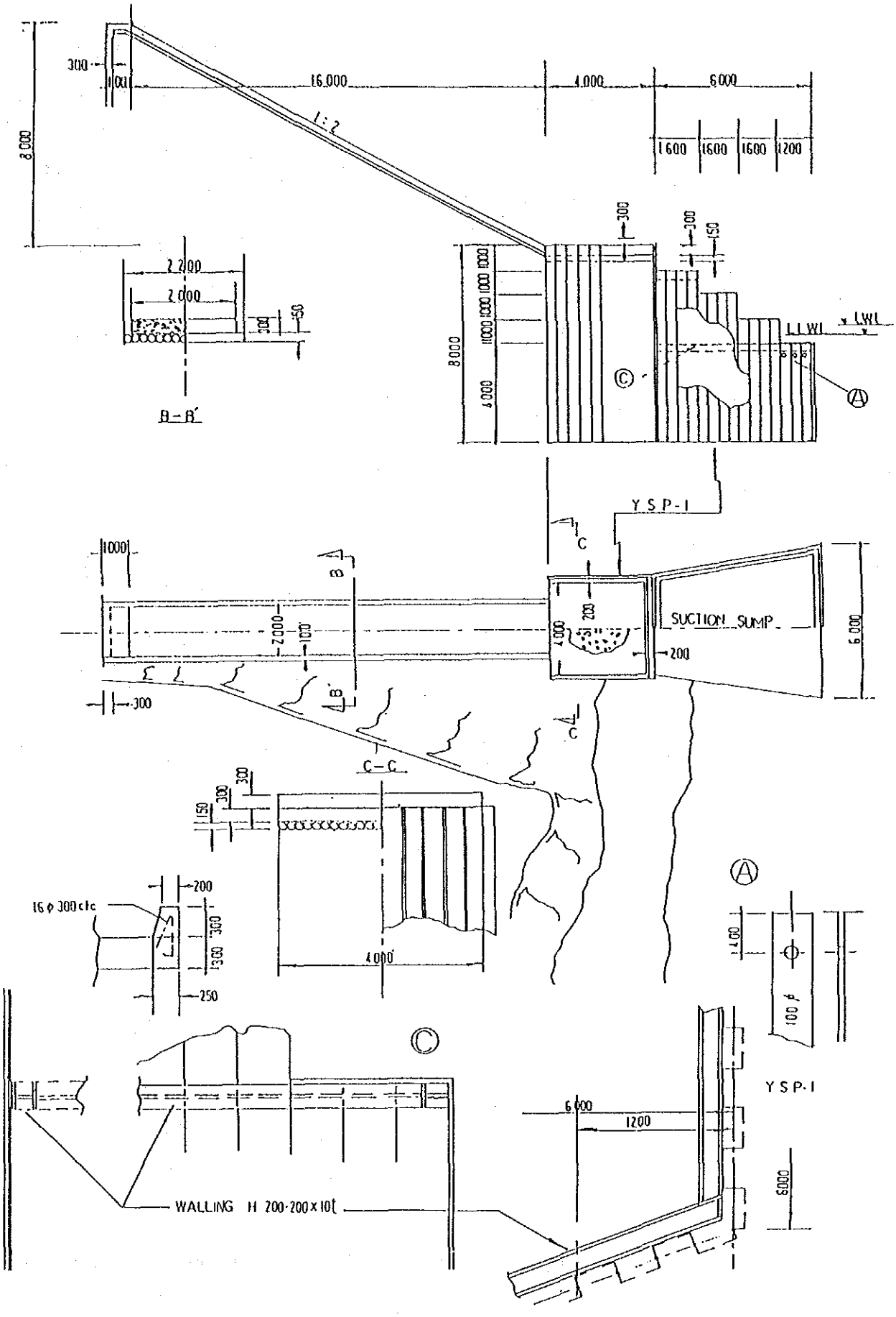


Fig. E.4.1.3 GENERAL STRUCTURE OF PUMP SITE (ILAGAN MF)

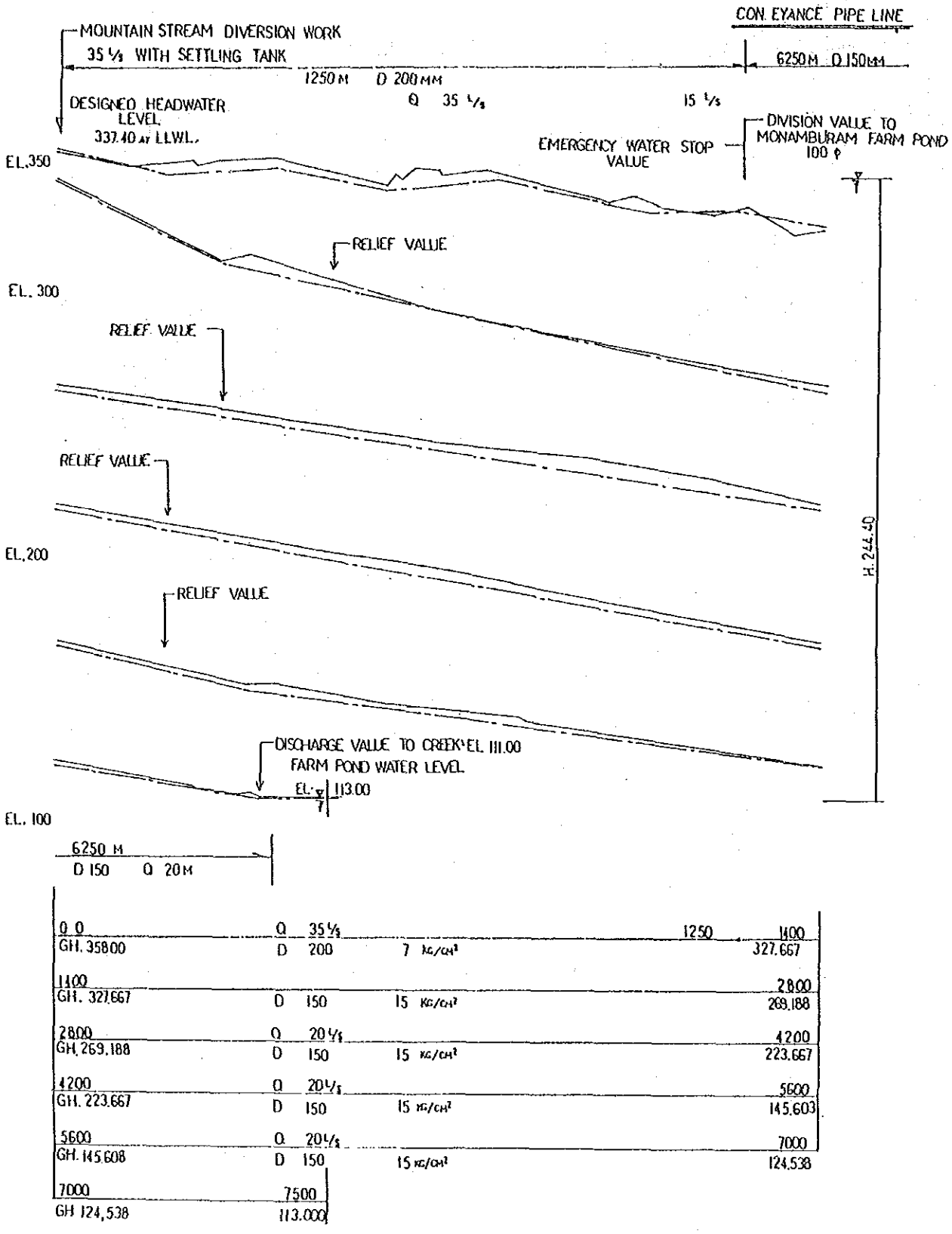
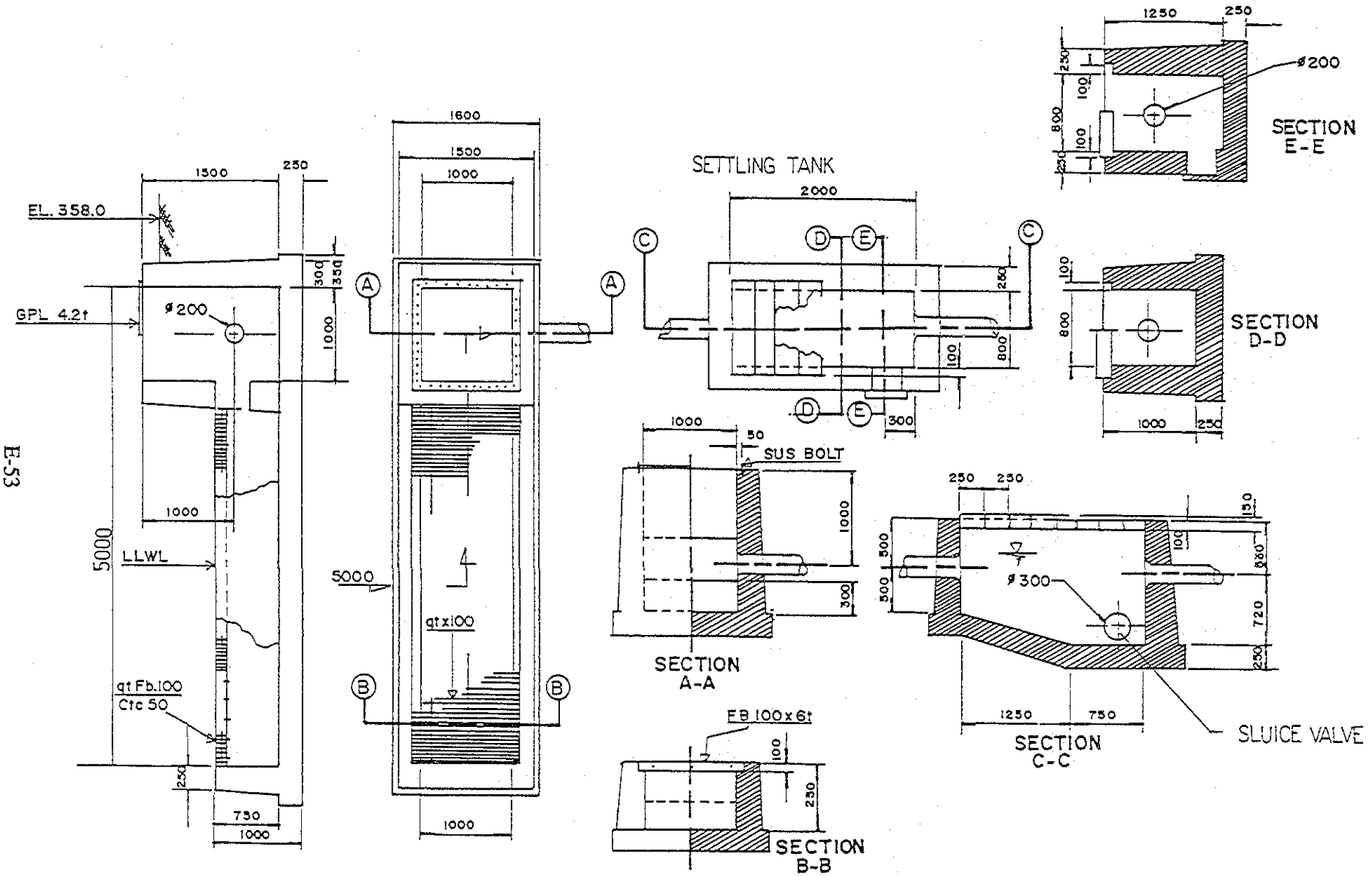


Fig.E.4.2.1 GENERAL PROFILE OF WATER CONVEYANCE SYSTEM (DAVAO MF)



E-53

Fig.E.4.2.2 GENERAL LAYOUT OF DIVISION WORKS (DAVAO MF)

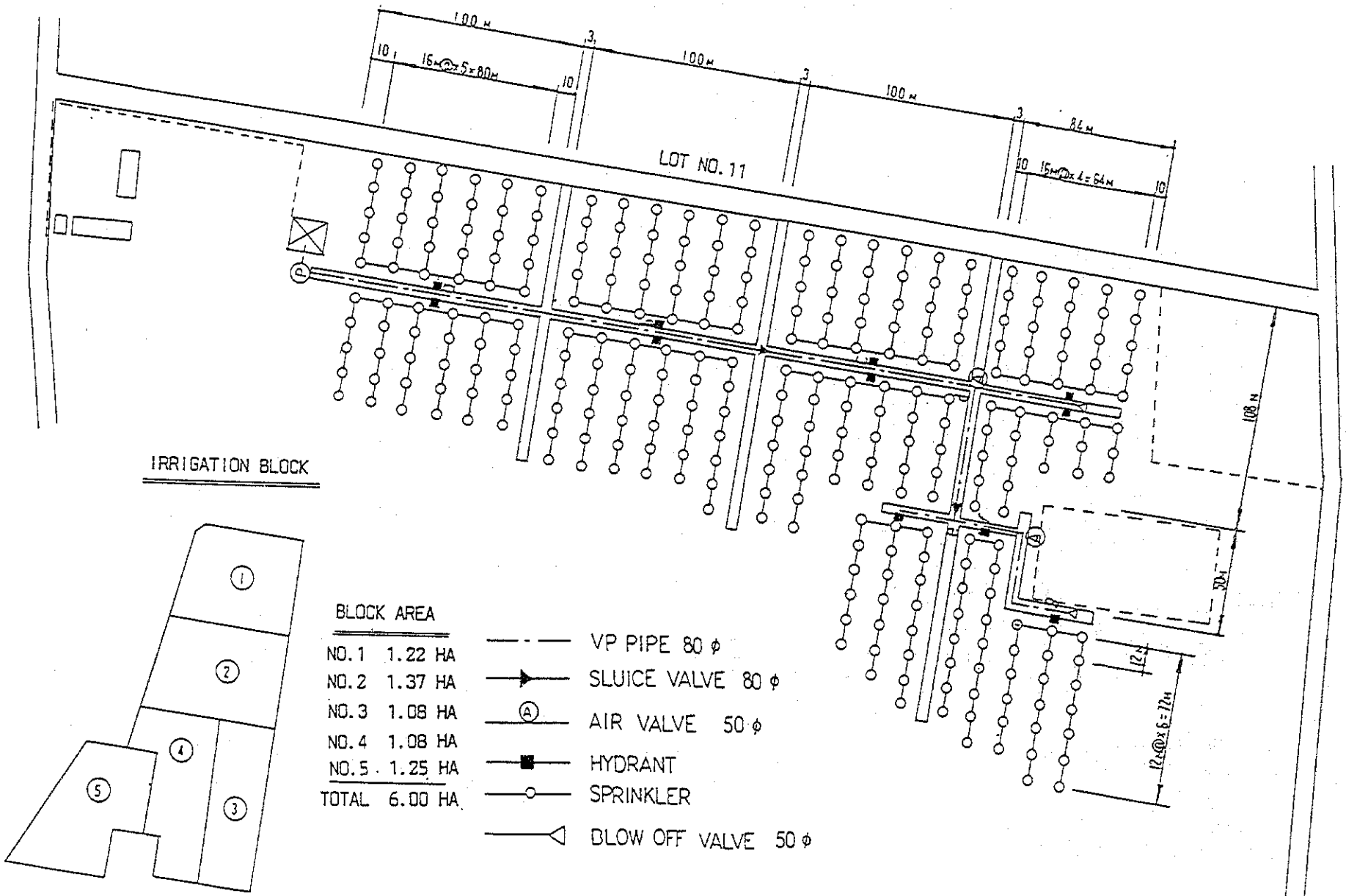


Fig.E.4.2.3 GENRAL LAYOUT OF IRRIGATION SYSTEM FOR NO. 11 LOT

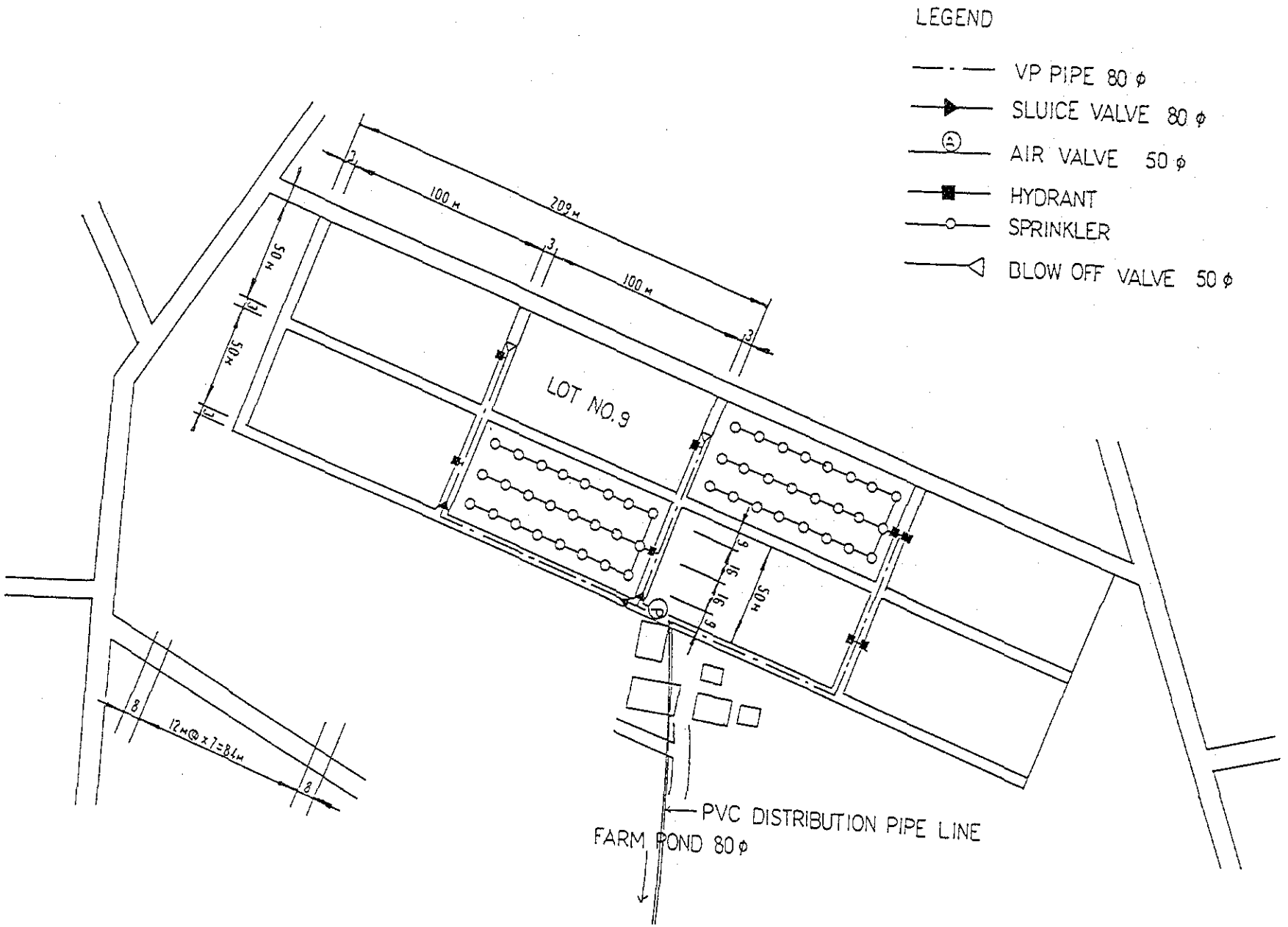


Fig.E.4.2.4 GENRAL LAYOUT OF IRRIGATION SYSTEM FOR NO. 9 LOT

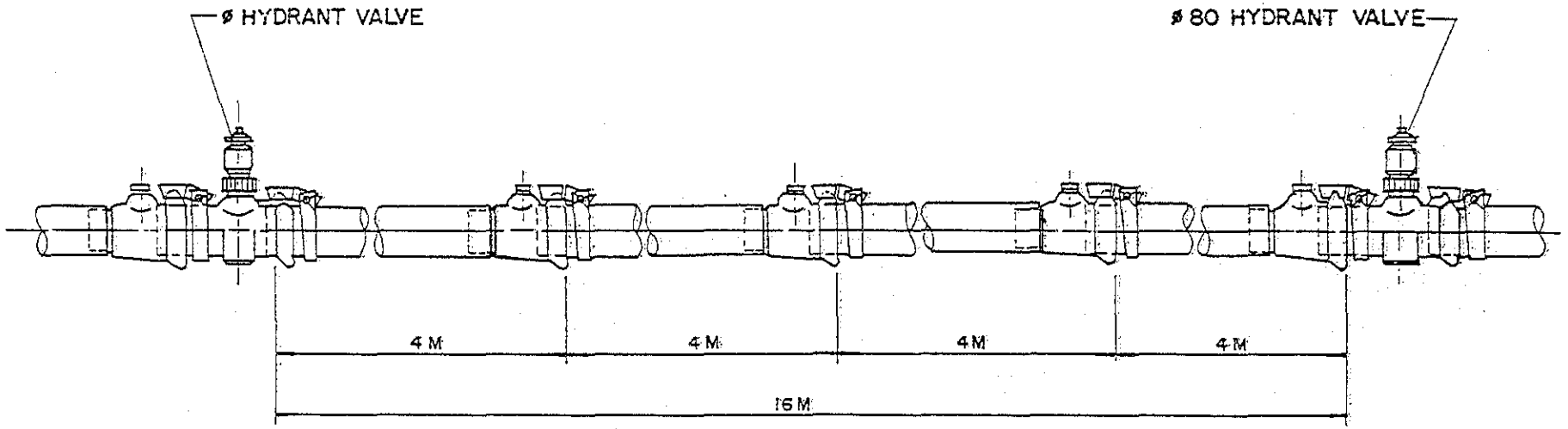


Fig.E.4.2.5 GENERAL LAYOUT OF SUB-MAIN LINE

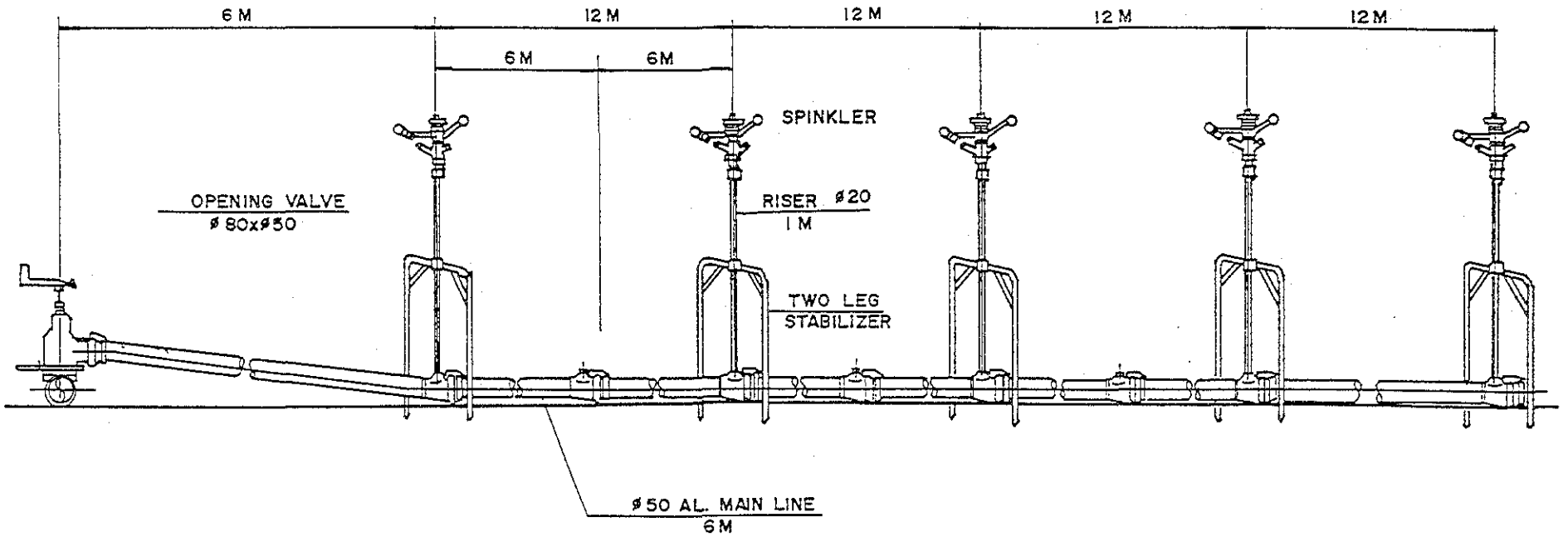


Fig.E.4.2.6 SPRINKLER LATERAL LINE

Annex F

Seed Related Machinery and Equipment

FEASIBILITY STUDY ON
IMPROVEMENT OF SEED PRODUCTION AND DISTRIBUTION, AND
ESTABLISHMENT OF
APPROPRIATE SEED STORAGE SYSTEM

ANNEX F SEED RELATED EQUIPMENT

TABLE OF CONTENTS

		Page
1.	PRESENT CONDITION OF THE COUNTRY	F-1
	1.1 Agricultural Mechanization In The Philippines	F-1
	1.2 Farm Machinery	F-2
	1.3 Seed Processing Facilities	F-4
	1.4 Cold Storage	F-8
	1.5 Transportation Equipment	F-9
2.	PRESENT CONSTTRAINTS OF COUNTRY	F-10
	2.1 Farm Machinery and Transportation	F-10
	2.2 Seed Processing and Conditioned Storage	F-10
3.	MODEL IMPROVEMENT PLAN	F-12
	3.1 Improvement of Farm and Harvesting Machinert	F-12
	3.2 Improvement of Seed Processing Machinery and Facilities	F-13
	3.3 Improvement of Seed Storage Facilities	F-13
	3.4 Rehabilitation of seed processing and storage facilities	F-15
4.	PRESENT CONDITION AND CONSTRAINTS	F-15
	4.1 Farm and Harvesting Machinery	F-15
	4.2 Seed Processing Machinery and Facility	F-19
	4.3 Cold Storage Facilities	F-20
	4.4 Seed Transportation Equipment	F-21
5.	IMPROVED PLAN FOR THE MODEL AREA	F-22
	5.1 Farm and Harvesting Machinery	F-22
	5.2 Seed Processing Machinery and Facilities	F-23
	5.3 Cold Storage	F-24
	5.4 Seed Transportation Equipment	F-25
	5.5 Other Support Equipment	F-26
	5.6 Operation and Maintenance Cost	F-28

LIST OF TABLES

		Page
F.1.1	1978 - 1989 Annual Industry Sales	F-31
F.1.2	Stations Inventory of machinery and Equipment Under ESDP Initial Stage (1975)	F-32
F.1.3	Stations Inventory of Machinery and Equipment ESDP Supplementary stage (1980)	F-33
F.1.4	Institute Inventory of Machinery and Equipment Under KR II	F-34
F.1.5	Stations Inventory of Machinery and Equipment Based on The Questionnaire Survey	F-35
F.1.6	Seed Growers Inventory of Machinery and Storage Facilities Based on Questinnaire Survey	F-36
F.1.7	Sed Processing and Storage Record in PHIL Central Station	F-36
F.4.1	Present Situation of Machinery & Equipment Used by Seed Growers	F-47
F.4.2	Operation of Dryers (A,B,C) in Visayas ES	F-38
F.4.3	Peanut Post - Harvest Works in Region II	F-38
F.4.4	Lowland Rice Seed Post - Harvest Activities in Region VI	F-39
F.4.5	Corn Post - Harvest in Region XI	F-40
F.5.1	Basic Improvement Plant	F-41
F.5.2	Operation Cost	F-42

1. PRESENT CONDITION OF THE COUNTRY

1.1 Agricultural Mechanization In The Philippines

(1) *Agricultural Mechanization Policies*

According to the report of the Regional Network for Agricultural Machinery (RNAM), the policies of farm mechanization in the Philippines is expressed as follows :

a) Mechanization that promotes optimum use of labor or increases productivity rather than displaces labor, to be developed and encouraged.

b) Local production of appropriate farm tools and equipment to be supported.

c) Agro-based employment opportunities among the rural population, particularly the landless workers, to be created/ increased; agro-industries to be encouraged.

d) Post-harvest technology to be developed further and disseminated.

The seed grower's mechanization has been promoted with the land preparation machines such as power tiller and so on.

(2) Agricultural Machinery Sales

The Agricultural Machinery Dealer's Association (AMDA) issues the statistic data regarding the machinery sales of the AMDA member. According to the data as shown in Table F.1.1, the sales of machinery for both of pre and post harvest was peak at 1979, though the sales had been increased gradually. Then the tendency of this could not revive to the level of peak except only the agricultural engines which is reviving to the level of 1980 at 1989. In particular the sales of harvesting machinery was decreased sharply from 3,914 units at 1979 to less than one tenth of 375 units at 1989. This shows the direct affection of deterioration of economic conditions in the Philippines. And this may affect seriously to lower the quality of crops harvested including the seed.

1.2 Farm Machinery

(1) Government Sector

Most of the farm machinery/equipment for the seed farms of the government Sector was provide under the Expanded Seed Production and Distribution Project (ESPDP) and the two times of 2-KR. The inventory of the machinery and equipment provided is shown in Tables F.1.2, F.1.3 and F.1.4, and gives the following information:

a) Initial stage of ESPDP
15 units of 4 wheel Tractor (12 HP) with implements, 17 units of 4 wheel Tractor (35 HP) with implements, 8 units of Grass cutter, 8 units of Power sprayer and 20 units of Pump

b) Supplementary stage of ESPDP
9 units of 4 wheel tractor (31 HP) with implement, 11 units of 4 wheel tractor (65 HP) with implement, 10 units of Trailer, 28 units of Power Tiller with implement, 25 units of Grass cutter, 17 units of Power sprayer, 47 units of Knapsack sprayer, 1 set each of Rice seeding machine and Seed coating machine.

c) First 2-KR
82 units of 4 wheel tractor (12.5 HP) with implement, 6 units of Power sprayer, 38 units of Mist blower, 25 units of Knapsack sprayer.

d) Second 2-KR
15 units of Power sprayer, 4 units of 2-Row harvester, 4 units of 1-Row harvester.

As for the farm tractors above mentioned they usually are defined to have the following capacity according to the standard provided MAFF of Japan.

Class	Number Provided	Capacity (ha/day)	
		For Low Land	For Up Land
10 to 15 PS	97	0.6	1.0
30 to 35 PS	26	1.1	1.6
60 to 65 PS	11	1.6	2.3

* Using for land preparation in standard Japanese field

In the government seed farms, most of farm works are required to finish within a short period because the seed produced in the farm shall be distributed in time for private sector's seed production.

Therefore the working period of a tractor shall be also within a short period. Assuming that the working period of a tractor is within 3 weeks for rainy seasons and 2 weeks for dry season, the total working days of tractor shall be within 35 days per year. According to assumption above, the total capacity of each tractor is as follows;

Class	No.	Total Capacity (ha/year)	
		For Low Land	For Up Land
10 to 15 PS	97	2,037	3,395
30 to 35 PS	26	1,001	1,456
60 to 65 PS	11	616	886
Total	134	3,654	5,737

* Using rotavator for land preparation in standard Japanese field

On the other hand, the average cultivation area for seed production in government sector during the recent 4 to 5 years is as follows;

Low land	241 ha
Up land	236 ha

This figure shows that the capacity of tractors provided under the above programs is sufficient to cultivate the seed production farms of the government sector. The government seed farms cultivate and harvest many experimental crops in their experiment field, and they utilize the farm machinery effectively for them also.

This farm machinery/equipment was delivered to twenty three (23) DA seed farms under the first stage of ESPDP, nineteen (19) DA seed farms under supplemental stage of the ESPDP, thirty-two (32) DA seed farms and thirteen (13) Regional Offices of the DA under first 2-KR, and to the BPI Central Office under second 2-KR.

Questionnaires and interviews were conducted for each government seed farm. The consolidated data shows in Table F.1.5.that out of two hundred and fifty three (253) units, one hundred and forty five (145) units of farm machinery/equipment (about fifty seven (57) % are still functional though the estimated life span is already exceeded. However the

machinery exceeding its life span is nearly retiring, because it is difficult to repair when it is defected. As far as the tractors and the power tillers are concerned, the machinery survival rate is slightly lower than the other equipment though this machinery has a longer estimated life span than the other machinery. It means that this machinery is more utilized than the others.

(2) Private Sector

Traditional land preparation was done by animal or man power. In recent decades, mechanized land preparation has been promoted with 4-wheel tractors or 2-wheel tractors to avoid the drudgery of farm chores, and to increase efficiency and capacity of work. The profitable seed grower has already mechanized his seed farm operation such as land preparation. etc. However major seed cultivation works are actually executed by manual power except the land preparation works. According to the data of BPI, the average seed production area is about 4.75 ha per one seed grower though the average farm size is 2.84 ha (1980, Philippines Agribusiness Factbook and Directory 1987-1988). This figure showed that the level of most seed growers belongs to the rich farmers. Therefore, most seed growers are deemed to have mechanized their seed cultivation. The consolidated data of interviews conducted by the team on several seed farmers in Regions II, VI and XI endorsed these facts (Table F.1.6). According to the data from 139 total interviewees on seed growing, 8 seed growers have 11 units of 4-wheel tractor, 28 have 61 units of 2-wheel tractor, 33 have 111 units of sprayer and 18 have 36 units of irrigation pump.

1.3 Seed Processing Facilities

(1) Government Sector

1) Seed Processing Program

The Bureau of Plant Industry (BPI) has promoted seed processing programs with some foreign assistance. The first program in line with the strengthening of the National Cooperative Seed Improvement Program (NCSIP) was implemented under cooperative assistance from USAID and UNDP during 1970 to 1972. Under this program a pilot seed processing plant was established, and other equipment including some laboratory equipment were provided at Maligaya Rice Research and Training Center, Munoz, Nueva Ecija. The seed processing plant includes drying, cleaning, sorting, storage and other equipment for seeds of rice, corn, vegetables, feeds crops and legumes. The processing plant was used in 1972-1973 and 1973-1974 as shown in Table F.1.7. According to the Table, the plant cleaned about three hundred (320) tons of rice seed, fifty (50) tons of corn seed and forty

(40) tons of legume seed, and dried about four hundred thirty (430) tons of rice and corn seed.

This program was succeeded by the Expanded Seed Production and Distribution Project which was implemented in 1973-1975 and 1978-1980 under the OECF first Japanese Yen Credit and 7th Japanese Yen Credit respectively. Under the Project, various agricultural machinery, equipment and other seed facilities related to the Project such as seed processing plants, were procured and delivered to several seed farms and experiment stations. The seed processing plant machinery and equipment included seed dryers, seed cleaners and separators, power threshers, corn shellers and cold storage. Under the first Yen Credit, three (3) sets of 1.0 TPH seed processing plants with cold storage facilities were established in the project sites of Cagayan Valley Rice Experiment Station, Visayas Rice Experiment Station and Mindanao Rice Experiment Station, respectively. One recirculation type of dryer and one cold storage plant were assembled in Maligaya Rice Research and Training Center. The other equipment was delivered to seventeen (17) project sites all over the country as shown in Table F1.2 Fourteen (14) project sites (seed farms) were also provided with seed processing plants with capacities ranging from 0.4 TPH to 1.0 TPH as shown in Table F 1.3. The total capacity of these processing plants is 6.8TPH for pice and 10.4TPH for corn. Assuming the operation time of these plants is 332 hours (8 hours x 25 day / season x 1.66) per year for 2 seasons, total processing capacity is calculated to be about 2,260 tons per year for rice and 3,450 tons per year for corn. The plants were expected to process the seed produced in the related seed farms by adjacent seed growers, and the harvested crops cultivated as experiment crops in the experimental fields. The average of crops of seeds harvested during the last 4 to 5 years in all government sector seed farms is shown as follows;

Rice	608.34 ton
Corn	212.00 ton
Peanuts	79.16 ton

* Total of 3 classes seeds of Foundation, Registered and Certified

Considering the nation wide seed production of government sector, the total capacity of seed processing capacity is deemed to exceed the actual production, and is enough to process the seed produced in the seed farms. The plants are also utilized for the crops harvested which are planted as experimental cultivation, and for the seed produced in the neighboring private seed growers.

2) Questionnaires and interviews regarding seed processing

The questionnaires on seed processing were sent to various seed farms and experimental stations, and interviews were conducted by the team of enumerators. The replies from thirty (30) seed farms out of forty (40), collected as of January 15, 1990, have indicated the existence of the following seed processing equipment/apparatus;

a) Threshers (manual/power operated)
b) Seed Processing Plants
c) Dryers (flat bed and recirculation type)
d) Pre-cleaners
e) Seed Sorters
f) Weighing Apparatus and
g) Corn Shellers

The consolidated data are shown in Table F1.1.5. Out of the seed processing equipment listed, most of the equipment was provided under the program of Japanese Yen Credit except for the threshers. According to the table, one hundred and thirteen (113) units of post-harvest equipment out of one hundred forty three (143) units [about seventy nine (79) percent are still functional, but they have exceeded their designed life span and some of them are nearly retired.

Regarding the present condition of the Seed Processing Plant provided under the Japanese Yen Credit program, two reports have reached the team, one compiled by BPI officials and the other from periodical inspection reports of the supplier in 1985. According to the information provided by officials of the BPI, even though the periodical inspection reports had reported defects in several plants almost all the plants are entirely or partially functional,if the parts defected are replaced with new ones. But the procurement of these parts is difficult because of a lacking budget. Claveria Experiment Station's processing plant was completely burned down and the plant in Cagayan Valley Rice Experiment Station was completely destroyed by the typhoon of 1988. The function of Claveria ES was sifted to Dalawangan ES completely after the burning out. The main defects were the upper and lower screw conveyors of recirculation dryers, limit switches of weighing machines, bearings and several shafts of seed cleaners, gears, rollers and other parts of Uni-flow separators and some parts of sewing machines, etc.

3) Seed Processing Technology

The modern recommended seed processing flow/methods for rice, corn and peanuts are shown below.

a) Rice

Cutting --- Drying in field --- Threshing --- Pre-cleaning --- Drying paddy --- Cleaning/debearding --- Width/thickness grading --- Length grading --- Gravity grading --- Treating --- Bagging --- Storage

b) Corn

Picking --- Husking --- Drying ear-corn --- Shelling --- Pre-cleaning --- Drying --- Width/thickness grading --- Thickness/width grading --- Length grading --- Gravity grading --- Color sorting ---Treating --- Bagging --- Storage

c) Peanuts

Pulling/digging --- Drying in field --- Picking pods --- Precleaning --- Drying --- Cleaning --- Shape Grading---Gravity grading --- Bagging --- Storage

According to the team's survey, these methods of seed processing are already being employed in respect of rice and corn seeds by plants provided under the Japanese Yen Credit Project.

4) Training Programs in Seed Processing

The BPI has arranged training schemes to improve and maintain seed quality. These have included the subject of seed processing for officials of BPI, Seed Testing Laboratory and so on, and the private sector seed growers. One two-day training program in seed production and quality control for fifty (50) seed growers from Pangasinan were held in September 1988. Several training programs have also been conducted for newly designated seed inspectors from several regions.

(2) Private Sector

As of yet, no training programs have been provided for the private sector except for the program mentioned above which was intended to serve private seed growers in the vicinity of government seed production farms. Private sector seed growers are interested in modernizing this seed processing but have considerably limited seed processing equipment

such as mechanical dryers, seed cleaners, seed separators, and so on. Their seed processing flow/methods may be summarized as follows:

1) Rice
Cutting --- Drying in field --- Threshing --- Winnowing --- Drying paddy --- Recleaning --- Winnowing --- Bagging --- Storage

2) Corn
Picking --- Husking --- Drying ear-corn --- Shelling --- Winnowing --- Drying --- Shape grading --- Winnowing --- Width/thickness grading --- Treating --- Bagging --- Storage

3) Peanuts
Pulling/digging --- Drying in field --- Picking pods --- Winnowing --- Drying --- Size grading --- Bagging --- Storage

Although this approach to processing seed is almost the same with the modern method, though the machines/ apparatus being used are inferior. This is particularly so in the harvesting, drying, cleaning and grading methods because these are done manually. Cleaning for example, is done manually with the use of a basket, locally known as "BILAO" or manually operated winnower is locally known as "HUNKUYANG". For grading, hand held sieves and BILAO are used. For drying, sun drying is popular both in traditional and modernized preparation of seeds in the Philippines.

1.4 Cold Storage

Some of government seed farms that produce breeder, foundation and register seeds, and have to store their seeds for more than six months, are requesting the provision of conditioned storage facilities.

Under the original Japanese Yen Credit Project BPI was provided with three (3) sets of conditioned cold storage, one each in Maligaya Rice Research and Training Center, Visayas Experiment Station and Mindanao Experiment Station. Out of the three (3) storages only the set of Maligaya Rice Research and Training Center was operated. The other sets have the common problem of providing cooling water for the sets. The set requires large volumes of cooling water and electricity for their operation. These were not provided and the storage facilities have remained inoperable at these two (2) sites, and also the sets were designed to achieve storage conditions of 7 degrees C with less than 40% of relative humidity. Such

conditions are not required to store the ordinary seeds for a short period. This was another reason for the sets not being used. However the heat insulated storage chambers are utilized with installing window air-conditioners as the cold storage room.

BPI provided 3 rooms of cold storage rooms with the window air-conditioners, dehumidifiers and heat insulated walls in BPI Central. They are still operational, but often have machine troubles and electric blackout.

On the other hand the conditioned storage facilities in temperature and humidity are existing in IRRI and IPB in UPLB. The facilities in IRRI are always maintained in good condition, however, the facilities in IPB is not operated because of serious defects and no spare parts. Instead of the above facilities IPB provided the room attached with heat insulated board and window air-conditioners.

1.5 Transportation Equipment

Under the ESPDP, most of the transportation equipment was provided to the BPI, and no other projects/programs have provided transportation equipment to the BPI except for pick-up trucks and the station wagons. The consolidated inventory as shown in Tables F.1.2 and F.1.3 together with the inventories of the seed processing equipment and the pre-harvest equipment show the following information: sixty (60) units of Jeeps, two (2) units of Dump trucks and twenty seven (27) units of Cargo trucks have been delivered to twenty four (24) project sites of the BPI.

The questionnaires and interviews for the transportation equipment were conducted, and the consideration is shown in the same table of Table F.1.5 as Transportation Facilities gave the following: regarding the Jeep and the Stake truck provided under the project of ESPDP, eighty (80) % are still functional though the equipment is already more than ten (10) years since the time of delivery. Some of them have been used for over 400,000 km; it means they have exceeded their estimated life span and have been quite efficiently utilized. They are very important for the seed farms. These machines exceed their life span, and are in a condition to retire because of often occurring defects that area not repaired completely.

Usually the seed produced by the private seed grower is sold to seed consumers or to the government agencies. In the case of seed consumers and government agencies the seed is transported by the buyers themselves. No serious problem is therefore observed in the field of seed transportation.

2. PRESENT CONSTTRAINTS OF THE COUNTRY

2.1 Farm Machinery and Transportation

(1) Government Sector

This study observed that more or less half of the farm machinery and transportation provided under the programs mentioned above are still operated. Since the estimated life span of the machinery, however, is also exceeded, the machinery therefore is requiring repair with the replacement of some parts. However, the provision of spare parts is difficult due to the old model, and some farms provided with the same type of machinery are cannibalizing defective machinery to repair the other defective machinery. The total amount of functional machinery is therefore decreasing all the time. Some of the defective but repairable machinery is not repaired due to the shortage of budget and the poor after-sales service network.

As for the implements of tractors, most of these are utilized in either low land or upland. Some of the implements are however not utilized due to the selection being unsuited for the farm.

(2) Private Sector

There is no report regarding any problem on farm machinery and transportation for their seed among the private seed growers. The seed growers mentioned above are generally rich and modernized farmers. They can therefore have farms machinery, transportation and so on by themselves for their seed produced.

2.2 Seed Processing and Conditioned Storage

(1) Government Sector

Out of 40 government sector's seed farms, 17 seed farms have been provided with complete seed processing plant as mentioned earlier. Out of 17 farms, 2 farms had lost their plant due to the calamities of fire and typhoon. The other 15 farms except the 2 farms of above are utilizing the plant though minor repairs are required. However the plant in Visayas ES has been nearly worn out because the plant has been utilized frequently. Therefore there is no serious constraint to require renewals in these government seed farms except two farms where the plants had the calamities and Visayas ES nearly worn out. Three damaged plants should be replaced.

Regarding the capacity of the seed processing plant at the above 17 seed farms, most of the plants have enough capacity for processing the seed produced in the related seed farm. The capacity can be applied to the private sector when the private seed growers are adjacent to the plant; so far the plant however is utilized by few private seed growers for reasons of the processing fee, distance, unrecognized advantages in utilizing the plant for their certification and so on.

Out of 40 DA seed farms, only 15 seed farms except two farms damaged have complete seed processing plants. The other 25 seed farms process their seed by using traditional seed cleaning apparatus. The estimated life span of all plants has been exceeded, but the urgent renewals are not required in the 15 farms above, though partial repair of plants may be required for continued operation of the plants. However the repair of them is difficult, because the spare parts cannot be supplied due to shortage of budget and no local agents for the plant are present.

(2) Private Sector

The private seed growers recognize the necessity of seed processing by advanced seed processing facilities to upgrade the seed quality. A few private seed growers however have seed processing plants on large farms, while most of the seed growers have only traditional seed processing apparatus, though they recognize the necessity for advanced seed processing plant. Promotion of advanced seed processing is not progressing due to the desire for economic seed processing even though quality deterioration occurs.

Seed growers also recognize the effectiveness of the appropriate conditioned storage facilities to avoid the quality deterioration. However they always consider the economic aspects such as cost of construction and operation, of which they always suffer, so the conditioned storage is difficult to promote.

The necessity and importance of seed processing and conditioned storage facilities shall be extended more to the private seed growers to improve and maintain the seed quality, but backup systems on economic aspects or compulsion systems to utilize the rationalized seed processing shall be considered to strengthen the private seed production.

The primal class seeds such as foundation and register of crops which are objects of this study must be stored for a rather long period. Though some seed farms producing these seeds have conditioned storage facilities, these facilities cannot be operated due to the lack of water and electricity supply. BPI Central has also 3 rooms of conditioned storage facilities,

but they are not operated efficiently due to the occurrences of mechanical troubles. The capacity, conditions of conditioned storage and period for safety storage have not been confirmed on the basis of definite experimental data on quality deterioration under the natural atmospheric conditions in the Philippines. The air conditioning is however required for medium and long term seed storage under the natural ambient conditions of the Philippines.

Budgetary arrangements for operation of conditioned storage is necessary, because problems always occur when conditioned storage is implemented.

3. *MODEL IMPROVEMENT PLAN*

3.1 Improvement of Farm and Harvesting Machinery

No serious constraint is generally observed in rice seed farms under the government sector, while slight problems are observed. On the other hand, there are serious problems in terms of stable supply of upland seed crops especially in drought year, due to upland seed farms having almost no irrigation facilities. Therefore, irrigation facilities should be provided as far as possible. Priority should be given to the farms located in main producing Rigging of crop concerned and in which produce foundation seeds and register seeds. Thus some upland seed farms might be rearranged and/or integrated.

The agricultural machinery and transportation vehicles in the seed farms have been distributed largely under ESPDP and 2-KR Program. The estimated life span of most of these machines/vehicles has been exceeded already. These equipment should be renewed under a systematic renewal plan on the basis of the following standards:

Type of Land	Sort of Works	Type of Machinery	Capacity
Plain low land	Land preparation	4WD tractor with rotavator	35 PS class
Terraced low land	Land preparation	Hand tractor with rotavator	7 PS class
Plain upland	Land preparation	2WD-tractor with plow, harrow ridger, cultivator, trailer and etc.	60 PS over class
Plain upland	Plant management	2WD-tractor with cultivator, sprayer, manure spreader, front-end loader and etc.	35 PS class
Hilly upland	Land preparation	4WD-tractor with disc plow, harrow, ridger cultivator, trailer and etc.	60 PS over class
Hilly upland	Plant management	4WD-tractor with cultivator, sprayer manure spreader, front-end loader and etc.	35 PS class
Small field lot hilly upland	For all type	Hand tractor with plow, rotary, ridger, cultivator, trailer and etc.	7 PS class

3.2 Improvement of Seed Processing Machinery and Facilities

Processing plant has been installed in fifteen seed farms under the first or the seventh Japanese Yen Credit. The plants installed under the first Yen Credit, however, have been timeworn after the lapse of more than twenty years. Other plants are also under the condition which the repair or replacement may be required for continual operation of the plants. Furthermore, the plant in Cagayan Valley E.S was completely destroyed by the typhoon of 1988 and the plant in Claveria E.S was burnt.

The remaining 25 seed farms out of 40 seed farms above have no seed processing plant except traditional seed cleaners. These 25 seed farms also are promoted to facilitate appropriate seed processing facilities for their seed under a systematic program.

For implementation of the program to renew or repair the seed processing plants, it is important that the plant is designed with optimum capacity and type. The future plant shall be designed carefully on the basis of the above concept. The provision of the local agent of the manufacturer is required to provide periodical inspection of its products as the after-sales services. A nationwide improvement plan of the seed processing facilities should be established in accordance to the following procedure:

- Reactivation of the plant in Cagayan E.S destroyed by the typhoon,
- Overall rehabilitation or repair of the plants installed by the First Japanese Yen Credit, if necessary, and
- Repair or replacement of the plants installed by the seventh Japanese Yen Credit, if necessary, and improvement of processing facilities in other 25 remaining seed farms.

3.3 Improvement of Seed Storage Facilities

(1) Basic Condition

Air-conditioned seed storage facilities have an important role in terms of seed quality control, likewise seed processing facilities, and are indispensable ones, particularly in those countries which belong to the high temperature and humidity area like the Philippines. The improvement of storage facilities should be implemented systematically in accordance to the followings:

1) The responsibility for the supply and stock of breeder, foundation and registered seeds are under the government. The storage facilities with an appropriate capacity, therefore, should be established in each seed farm taking the production and distribution plan of BPI into account.

2) In order to prevent the deterioration of seeds, storage facility would be desirable to be with the conditioning system. Such a storage facility should be, as a first step, established at the seed farms which produce both foundation and registered seeds, and then gradually expand to other seed farms.

3) Taking the following into consideration, it is also recommended that the Headquarter of BPI should have a conditioned seed storage facility in Manila;

- a long period of time to implement a nationwide seed storage improvement plan.
- the guaranty of seed supply system for breeder seeds.
- the desirability for keeping a certain Quantity of foundation seed in the BPI against emergencies.

(2) Condition of Air-conditioned storage

Limited data is available in the Philippines regarding the conditions for medium terms seed storage except the data collected in UPLB, concerning the half-life period under natural condition storage. According to the data, the rice seed viability drops to it's half-life after 10 to 14 months under the natural condition storage in the Philippines, and the corn seed drops after 6 to 8 months, the beans drop after 5 to 6 months. This data that the half-life period is too short considering the actual seed storage situation in the Philippines. It seems that the data was collected with some special conditions. According to the other reports if the moisture contents are kept with 10 to 13% the viability can be maintained 6 to 12 months with little deterioration, but it is impossible to maintain the high viability. It is said that the viability of the seed can be maintained to the initial level if the moisture contents are kept with the level above mentioned. However, it is reported that the oily seeds such as peanuts seeds are difficult to dry sufficiently and to maintain the high viability compared with cereal seed. On the other hand, the data shows one suggestion that the seed viability can be maintained for about one year under the condition of below 20°C temperature with low relative humidity of atmosphere. Delouche of Mississippi State University offered the following equation to maintain the viability of cereal seeds in the atmosphere under the conditions given

$$100 \geqq {}^{\circ}F + \%RH$$

On the other hand there is an estimation concerning the deterioration of germination rate of cereals seeds on the base of experimental equation of Robert calculated by Itoh.The estimation shows conditions of 18°C and 60% RH reserves 90% of germination rate after one year storage when the initial germination rate is nearly 100%. Therefor the storage condition for cereals is desired above condition for one year storage. However the data collection is recommended to desire the definite safe storage conditions in the Philippines.

3.4 Rehabilitation of seed processing and storage facilities

Almost all of the existing seed processing and storage facilities have exceeded their designed life and have been kept in operation with difficulties. These facilities should be improved through a rehabilitation plan. In the case of the processing facilities belonging to the Cagayan Valley Experimental Station located in Isabela Provice, Cagayan Valley Region, one of the main rice producing regions, these have not been operable for two years due to serious typhoon damage.

4. PRESENT CONDITION AND CONSTRAINTS

4.1 Farm and Harvesting Machinery

The model farms of government sector, Ilagan ES (Region II), Visayas ES (Region VI), Davao NCC and Tupi ES (Region XI) were provided farm and post harvest machinery under ESPDP, Second Kenedy Round and other projects. Although the machinery was provided under appropriate distribution schedule for each farm, the machinery of different models and manufacturer was distributed due to less consideration of the relations between the projects. Most of the Machinery is worn out and lack spare parts due to long spare of service. (Re: Table F.1.2, F.1.3, F.1.4 and F.1.5)

On the other hand, the situation of farm mechanization in the three model areas is similarly developed within the other area of the Philippines; however, the cultivation works for the seed production are being done mainly by animal power except low land rice seed production in Region VI. Most seed producers in Region VI is using mechanical cultivating power.

As far as the harvesting works are concerned, the government sector uses the mechanical harvesting equipment such as rice thresher or corn sheller of locally made, while the private sector uses the manual harvesting tools. The harvesting machinery provided in the government sector is fully used and utilized and therefore renewal & replacement is requested.

Their capacity is shorter from the required capacity. However the harvesting works for peanuts are not mechanized at all in either the government sector or the private sector. The appropriate harvesting machinery is required to be introduced in order to acquire rational harvesting works and higher seed quality.

(1) Ilagan ES in Region II

The farm was provided one large, three medium, and twelve small scale of four wheel tractors. The type of tractors provided are suitable for lowland and upland farming in this farm, however the quantity of them is somewhat over the total area of 55.2 hectare. The half of them, 8 units are worn out and not able to be repaired. The remaining 8 units are still operable but quite often require serious repair, therefore they shall be replaced in the near future. The upland farms in this ES are almost flat, but some areas in the farms are a little lower and sinks in the water when heavily rained, so the water is not drained quickly. The machinery provided at present can not improve this situation that crops get damaged by this water.

The farm prepares the land before seeding the peanuts by hired large tractor with disc harrow at first plowing, then by owned large tractor with disc plow and disc harrow at second plowing. The reason why the hired tractor is utilized at the first plowing is the lack of machinery and labour and the economical reason.

The seed is removed of pods by manual bamboo apparatus, then is cleaned and separated by the manual method. The seed is sown by manual drilling method.

As far as intermediate cropping management is concerned, weeding work is performed once by cultivating inter rows with either manual tools or small rotary removed several center breads mounted to small tractor. Then the insecticide and fungicide are applied once every two weeks by knapsack sprayer.

Harvesting works are performed 100 to 120 days after sowing by all manual methods of dragging out plants, but by no mechanical method. The peanuts plant dragged out from the earth is spread to dry half-way dry so that the pods are easily removed from the plant. Then the plant is brought in the working shed to remove the pods from the half dried plant.

(2) Visayas ES in Region VI

The farm was provided 3 medium and 8 small of 4 wheel tractors and 2 units of hand-tractors (Re: Table F.1.2 and F.1.3). This ES has only the lowland field, therefore the farm works do not require the large scale machinery. The type and capacity of machinery provided are almost suitable to this ES field, but as for the quantity, they are over the field area of 44 hectares in this ES. The seven units, more than half of these machinery are not functional due to the damage of impossible repair. The remaining other 6 units are also in the situation to retire (Re Table F.1.4). The ES utilizes the farm machinery provided to prepare the low land rice field mainly before transplanting, but not to perform any other cropping works for low land rice except the sprayers. The ES requires not only the renewal of existing machinery but the other machinery such as transplanter, mechanical weeder, rice combine and so on. However the transplanter is not recommended to the ES, because the machine requires the sophisticated techniques such as the preparation of uniform nursery growth and density. The technique for the transplant machinery is not adapted to the Philippines farming, and the combine is also not recommended because of similar reason of unfamiliarity in the Philippines. For the harvesting the ES utilizes a few units of engine driven axial flow rice thresher. The farm roads in this ES are well maintained to run the agricultural machinery.

(3) Davao NCC & Tupi SF in Region XI

The farm was provided 1 large, 5 medium and 13 small scale, totalling 19 units of tractors and other machinery under ESPDP and other projects or BPI self. These tractors were distributed to NCC self and neighboring Manamburan farm. The total capacity of them are not sufficient for the total area of 1,000 hectares in both the farms, but both the farms cultivate mainly fruits which do not require the farm machinery. The farms cultivate also crop seeds in the areas of 25 hectares. The total capacity of these machines are some over the required capacity for these areas. Out of 19 units, 11 units have been more to be impossible to repair, and are not utilized. The remaining 8 units are in the similar situation with the other regions, i.e. they require to be renewed. Manamburan farm is located on the gentle hill area, so the farm mechanization is easy to carry on. On the other hand, in Davao NCC farm, there are a plenty of big stones buried. These stones are of much disturbance for the farm mechanization. The removal these stones is necessary for the rational cultivation.

The land preparation for corn seed cropping in both farms is performed by large 4 wheel tractors with disc harrow and disc plow occasionally. The small tractor is not utilized for land preparation, but for inter row cultivation and so on. The small tractor is utilized for inter row cultivation with the rotary removed several center breads, but only until

2 weeks after germination. The E.S requires hand tractors for inter row cultivation after 2 weeks growth. The sowing works are mainly performed by seed planter provided under ESPDP with the small tractor.

The insecticide and fungicide are applied a few times to a crop by mechanical and knapsack sprayer. One of harvesting works, the picking work of ear-corn is performed completely by hand. And then the ear-corn with husk is hulled and shelled after harvest from the plant by double drams engine driven corn husker and sheller which can husk and shell the ear-corn directly when the ear-corn has moisture contents of about 24 to 26% in kernels with out giving serious damages to the kernels. But the farms have a problem that the husker and sheller is not seed model. The machine shall be improved for seed model on shelling tooth, and for trail type with hand tractor so that it can be moved from place to place among private seed producers.

Tupi SF was provided 2 medium and 3 small scale four wheel tractors under ESPDP. The farm is holding 25 hectares upland field and 9 hectares lowland rice field. The total capacity and types of tractors are appropriate for these fields, however only one unit of medium scale tractor is functional. The other tractors have been worn to be impossible to repair, so the farm is very much is lack of mechanical cultivation power. It is said one unit is almost to be replaced due to very old model. The farm utilizes the large scale tractor above to prepare the corn seed producing field with disc plow and disc harrow. Then the tractor makes the seeding furrows with ridger and cultivate inter row with cultivator until the plant grows to the height of ground clearance of tractor. After inter row cultivation, no mechanical method is utilized for other cropping works except the seed processing.

(4) Private Seed Producer

As far as the farm mechanizations for seed production in private Region VI, the rice seed production area is most mechanized among three model areas by local made machines. The other model areas of Region II and XI for peanuts and corn are not mechanized well yet, they cultivate by animal power mainly, as the result of interview.shows only 26 % of seed farmer have tractors or had tractors(Re; Table F.4.1). Most of the areas for peanuts and corn production are located in the hill area or the rough terrain area, so the basic infrastructures such as farm roads are not well provided. Therefore the mechanization in these areas is seemed to be not developed well yet. According to the provision of basic infrastructure will taking a longer time, the farm mechanization for these areas is difficult to promote rapidly.

4.2 Seed Processing Machinery and Facility

17 sets of seed processing plants were provided under ESPDP. The government farms in 3 model areas were also provided 1 set each of seed processing plant. Most of them exceeds their life span and then is almost being superannuated without being utilized sufficiently, due to the back training of operators or budget for operation. On the other hand the rationalization or mechanization for the seed processing in the private sector has not been progressed yet. As far as seed drying is concerned in the private sector, some limited areas utilize the artificial drying method, but most of the area does not utilize it. Most of seed producers is processing their seeds by traditional methods such as sun drying, selecting flat basket, manual winnower, manual sieve and ten other manual tools. The farms rationalized are utilizing big fan driven by electric motor called "Hongkuyan", traditionally for seed cleaning. But it is not called a mechanized method yet.

(1) Ilagan E.S in Region II

The farm was provided corn seed processing plant, but provided no machinery or equipment for peanut seeds which is the objective crop for this station. All the harvesting and processing works for the peanut seeds is being done by manual method. The station has limited labours; therefore, the rationalized seed producing works are required seriously to increase the peanuts seeds, particularly the new provision of peanuts seed processing plant is necessary and important and will contribute to the rationalization of the station.

As for the present post harvest works, the pods removed are dried from about 22% to 12% of moisture contents of entire pods with seeds under sundrying. Then it is selected and cleaned by manual method with flat basket and winnower. The seed with pod is bagged and stored finally in plastic bags and natural ambient storage house.

(2) Visayas ES in Region VI

The farm was provided one ton per hour of processing capacity of rice processing plant, and it is sufficiently utilized. The plant is processing the seeds produced in not only the station-self but also the private seed producers in the province of the station located and the neighboring province Capiz. The demand of processing exceeds the holding capacity of this plant, so the increment of processing capacity is seriously required. The number of variety of seeds processed are more or less 6 varieties as shown in Table F.4.2. The plant and dryer shall be cleaned out at every changing of variety. It takes time for this cleaning and lowers the efficiency of the plant. To improve the efficiency of the plant, the capacity of plant shall be

strengthened by increasing the number of machine sets, not to enlarge the size of machine. The plant is being utilized presently as shown in the same Table above. According to the table, a total of about 700 tons of paddy has been dried and processed for last 3 years in this plant, and the total working time was about 3,419 hrs.The number of variety of seed processed was 4 to 8. The data shows the sufficient utilization of the plant,but the machinery required cleaning at every time of variety changing.

(3) Davao NCC and Tupi SF in Region XI

The farms were provided 0.6 ton corn processing plant. The plant for Davao NCC was transferred to Region XII for the emergency requirement. On the other hand the plant distributed to Tupi SF was utilized entirely when the plant was distributed, however only part of the plant is being utilized now because of the retirement of well trained operators, unskilled present operators, and lack of budget for the plant operation. The requirement of the plant utilization from the neighboring private sector has not been risen up. Several private seed producers in neighboring area to the station and farm have been born in early 1990 because of the project of CPEP started in 1990. The plant is being required to process the seed produced by these seed producers, however, the arrangements of either Davao NCC or Tupi SF are not sufficient to reply these requirements, particularly, provision and maintenance of the plants, training of operators and provision of operation cost are serious requirements.

(3) Private Sector

As shown in Table F.4.3, F.4.4, F.4.5, most of private seed producer has no post-harvest equipment, even in Region VI in where they have rather mechanized seed crops by mainly 2 wheel on wheel-less tractors. The private sector seed producer always considerS the method of seed processing on the base of economic feasibility, so the mechanical seed processing is really difficult to adopt to private sector. However, recently the seed drying is being required due to the rising popularity of frequent croppings in one year . Therefore, it seems that the mechanical seed processing method will be highly required, particularly with the mechanical drying.

4.3 Cold Storage Facilities

The cold and dehumidified seed storage facilities were provided in the model areas of Visayas ES and Davao NCC. The necessary water and electricity supply devices for the operation of sets were not provided with the sets. So the sets were abandoned since the delivery and they are not able to be repaired due to the abandonment of almost 20 years. The set in Visayas ES is utilizing free room from ration bird's damage of seeds. And the set in Davao NCC was installed inversely with top and bottom, but is being utilized as a cold

storage room with equipment of the window air-conditioner. The set in Visayas ES is also utilizing the heat insulated chambers with installed window air-conditioner as the cold storage room.

The seed producing companies for hybrid corn is utilizing cold and dehumidified storage warehouse, but general private seed producers do not utilize any conditioned storage facilities at all. The general private seed producers store their seeds for 6 to 8 months only, so the cold storage is not required for their seeds except peanut seeds.

4.4 Seed Transportation Equipment

The government sector was provided 34 units of 4WD moult-purpose vehicles and 22 units of cargo trucks as the seed transportation equipment under ESPDP. Most of the vehicles have run more or less 400 to 500 thousand kilometers since the delivery, and still function at present. However, almost all of these vehicles are superannuated to be renewed.

As for each government farm in the model area, Ilagan ES in Region II was provided with one unit each of 4 WD multi-purpose vehicle and cargo truck, and both of them have run more than 400 thousand kilometers. They have exceeded their life spans and therefore it requires replacement and renewal.

Visayas ES in Region VI was provided with 2 units of 4WD multi-purpose vehicles and one unit of cargo truck; they are now in the same situation with Ilagan ES. They require renewal.

Davao NCC in Region XI was also provided with 2 units of 4WD multi-purpose vehicles and one unit of cargo truck; they are in the same situation with the above two farms. They require renewal.

The general private seed producer utilizes the public transportation to carry these seeds, however, in most cases of their seed trading, the buyers themselves come to the seed producers to buy seeds. So, owning a seed transportation for private seed producer is not required generally.