Table 3B-2(Estimated Breakdown of Present Land Use in the Project Area

Land Use	Sub-Project Areas						Total	Percentage
	Cura	Nueva Era	Madupayas	Batac-Paoay	Pinili	Badoc-Sinait		
Dry Season Paddy Rice	128	1	10	282	76	185	682	5.3
Garlic	-	-	-	1,227	876	1,808	3,911	30.3
Tobacco	-	18	-	1,337	327	640	2,322	18.0
Corn & Others	8	6	6	56	21	23	120	0.9
Vegetables	21	12	6	44	41	65	189	1.5
Idle Paddy Field	1,315	660	146	2,388	112	987	5,608	43.5
Marsh Land	-	-	-	58	-	-	58	0.4
Brush Land	-	-	-	-	-	10	10	0.1
Total Arable[1/]	1,472	697	168	5,392	1,453	3,718	12,900	100.0
Class 6 Land	65	1,390	330	2,130	1,175	2,470	7,560	84.0
M Land	75	15	15	565[2/]	85	175	930	10.3
ROW	58	28	7	213	57	147	510	5.7
Total Non-Arable	198	1,433	352	2,908	1,317	2,792	9,000	100.0
Grand Total	1,670	2,130	520	8,300	2,770	6,510	21,900	

Note: 1/ Exclude present rights-of-way (ROW)

2/ Include the land to be used for Mariano Marcos University

The procedures on soil classification and soil mapping were based on the criteria which were established in the previous soil survey of this project by NIA and BS.

3. Soils of Alluvial Plain

a) San Manuel Series

This soil series is a member of the fine loamy, deep and well drained soils over stratified sandy strata. Solum thickness ranges from 70 to 150 cm. This soil series is widely distributed in the Cura, Madupayas, Batac-Paoay, Pinili and Badoc-Sinait area.

The surface soils are generally brown to dark brown silt loam, sandy loam, clay loam and silty clay loam and these being used for Paddy rice exhibit gray to grayish brown colors. They are friable when moist and slightly sticky when wet. Subsoils are chiefly brown to yellowish brown clay to sandy loam with sub-angular blocky structure. Underneath the subsoils are yellowish brown to brown silty clay loam to sandy loam. Drainage condition is good internally.

The San Manuel series is subdivided into the four soil types such as San Manuel Silty Clay Loam, San Manuel Silt Loam, San Manuel Clay and San Manuel Sandy Loam. These soils are the most ideal for crop diversification in the Project Area.

Diagramatic representation of the typical profiles of this soil series is shown in Figure 3B-49, Appendix 3B-5. The representative soil profile is shown as follows:

Location: Bo. Sagpatan, Dingras, Ilocos Norte
Pit no. : 14
Sub-area: Cura
Land use: Paddy rice irrigated

Profile Description:

Apg 0 - 15 cm : Moist to wet; grayish yellow brown (10YR 4/2) Silt Loam; slightly sticky when wet; friable when moist; sub-angular blocky structure; common fine to medium distinct reddish brown (5YR 4/8) mottles; common fine roots penetration; diffuse wavy horizon boundary.

B1g 15 - 35 cm : Moist to wet; brown (7.5 YR 4/4) Silt Loam; friable when moist; slightly sticky when wet; granular to sub-angular blocky structure; common fine to medium distinct prominent reddish brown (5YR 4/8) mottles; no concretion; few fine roots penetration; gradual wavy horizon boundary.

B2g 35 - 62 cm : Moist to wet; brown (7.5 YR 4/4) Sandy Loam; friable when moist; slightly sticky when wet; granular to sub-angular blocky structure; common to many medium prominent dark brown (7.5 YR 3/4) mottles; few to common fine soft concretion; few fine roots penetration; clear wavy horizon boundary.

C1 62 - 80 cm : Moist to wet; dull yellowish brown (10 YR 5/6) Loamy Sand; friable when moist; loose when dry; granular structure; no mottles; no concretion; few fine roots penetration; gradual smooth horizon boundary.

C2 80 - 105 cm : Moist to wet; bright yellowish brown (10 YR 6/6) Fine Sand; single grained; no mottles; no concretion; sturctureless; no root penetration; smooth clean horizon boundary.

Below 105 cm : Sub-rounded to rounded pebble size gravels and coarse sand.

Location: Bo. Biran, Paoay, Ilocos Norte
Pit no. : 7
Sub-area: Batac-Paoay
Land use: Paddy rice irrigated (Garlic)

Profile Description:

Ap 0 - 13 cm : Dry; dark olive gray (5 Y 3/2) Clay Loam; hard when dry; sticky when wet; weak coarse sub-angular blocky structure; no mottles and concretion; many medium to to coarse roots penetration; abrupt wavy horizon boundary.

B1g 13 - 32 cm : Moist; dark grawish brown (2.5 Y 4/2) Clay; moderate friable and sticky when wet; weak coarse angular block structure; few fine faint olive yellow (2.5 Y 6/6) mottles; no concretion; common medium roots penetratic abrupt smooth horizon boundary.

B2g 32 - 71 cm : Moist; very dark grayish brown (2.5 Y 3/2) Silty Cla firm when moist; sticky when wet; strong medium block structure; few medurm distinct yellow (10 YR 7/8) mottles; few fine soft black concretion; very few fine roots penetration; diffuse smooth horizon boundary.

C1g 71 - 94 cm : Moist; dark grayish brown (2.5 Y 4/2) Silty Clay Loam; slightly sticky when wet; friable when moist; weak medium granular structure; many prominent brownish yellow (10 YR 6/6) mottles; no concretion; very few fine roots penetration; diffuse irregular horizon boundary.

C2g 94 - 150 cm : Wet; grayish brown (10 YR 5/2) Silty Clay Loam; slightly sticky when wet; weak medium granular structure; many prominant brownish yellow (10 YR 6/8) mottle

no concretion; no root penetration.

b) Maligaya Series

Soils of this series belong to the fine clayey, deep and poorly drained soils. The relief is nearly level to gently undulating. Solum thickness ranges 60 to 150 cm. This soil series is only distributed in the Nueva Era (left bank) Area.

The surface soils are gray to dark brown clay to clay loam with brown mottles and have a sub-angular to angular blocky structure. They are hard when dry and sticky when wet. Subsoils are gray to grayish brown compacted clay or clay loam with fine brown mottles and coarse manganese concretions. Underneath the subsoils are grayish yellow silty clay or clay loam with concretions. The most suitable crop for this soils is rice in the wet season. Tobacco, legumes and vegetables are also grown in a small scale after harvest of rice.

The Maligaya Clay is the only soil type identified in the service area.

c) San Fernando Series

The San Fernando seires belongs to the fine clayey, deep and poorly drained soils. They are generally characterized by gray to dark gray surface soils and subsoils. The relief is generally flat. External and internal drainage are both poor. Because of their clayey, deep and poorly drained characteristics, they are therefore good for the production of lowland rice in both season if enough irrigation water is avairable. This soil series is mainly distributed in the vicinity of Paoay town and the area northwest of Pinili.

The surface soils are dark gray to grayish yellow brown clay. They are sticky and plastic when wet and compact when moist. Subsoils are mostly dark gray to very dark gray clay or clay loam with sub-angular to angular blocky structure. Beneath the subsoil is a dark grayish brown compact clay.

The San Fernando Clay is the only soils type identified in the Project Area. The surface horizon of San Fernando Clay is hard during the dry season and grows open cracks unless the soil is irrigated. Although the soil is difficult to plow when dry, it is widely used for the production of garlic after the rice is harvested. The multing by rice straw and the irrigation by groundwater is indispensable for the dry season cropping of garlic and onion.

Diagramatic representation of the typical profiles of this soil series is shown in Figure 3B-49, Appendix 3B-5. The representative soil profile is shown as follows:

Location: Bo. Cabangaran, Paoay, Ilocos Norte
Pit no. : 3
Sub-area: Batac-Paoay
Land use: Paddy rice irrigated (Garlic)

Profile Description:

Ap 0 - 19 cm : Dry; dark gray (7.5 YR 4/0) sandy Clay; hard when dry; sticky and plastic when wet; coarse strong angular blocky structure; no mottles; no concretion, common fine to medium roots present; presence of calcareous grains; abrupt smooth horizon boundary.

A3g 19 - 58 cm : Moist; very dark gray (7.5 YR 3/0) Clay; firm when moist; sticky and moderately plastic when wet; strong medium angular blocky structure; common fine faint strong brown (7.5 YR 5/6) mottles; no concretion; few fine roots present; presence of calcareous grains; clear smooth horizon boundary.

B1g 58 - 84 cm : Moist; black (7.5 YR 2/0) Clay; firm when moist; sticky and plastic when wet; moderately strong angular blocky structure; few medium distinct brownish yellow

(10 YR 6/8) mottles; no concretion; very fine roots present; presence of calcareous grains; clear wavy horizon boundary.

B2g 84 - 120 cm : Moist; very dark grayish brown (10 YR 3/2) Clay; friable when moist; sticky and slightly plastic when wet; weak fine angular blocky structure; common medium distinct reddish yellow (7.5 YR 7/8) mottles; no concretion; very few fine roots present; presence of calcareous grains; diffuse irregular horizon boundary.

C1g 120 - 132 cm: Wet; very dark gray (10YR 3/1) Clay; sticky and plastic when wet; weak fine angular blocky structure; few fine faint olive yellow (2.5 Y 6/6) mottles; no concretion; no root penetration; abrupt broken horizon boundary.

C2g 132 - 150 cm: Wet; olive brown (2.5 Y 4/4) Clay; sticky and plastic when wet; weak fine angular blocky structure; common medium distinct brownish yellow (10 YR 6/6) mottles; no concretion; no root penetration.

Location: Pinili, Ilocoa Norte
Pit no. : 8
Sub-area: Pinili
Land use: Paddy rice irrigated (Garlic)

Profile Description:

Ap 0 - 17 cm : Moist; dark gray (10YR 4/1) Clay; friable when moist; sticky when wet; moderately strong sub-angular blocky structure; no mottles and concretion; many fine to medium roots present; clear smooth horizon boundary.

A12g 17 - 39 cm : Moist; dark gray (10 YR 4/1) Clay Loam; slightly friable when moist; slightly sticky when wet; medium angular blocky structure; common fine faint brownish yellow (10 YR 6/6) mottles; no concretion; common medium roots present; clear wavy horizon boundary.

A3 39 - 55 cm : Moist; very dark gray (10 YR 3/1) Clay; moderately friable when moist; sticky when wet; weak columnar structure; no mottles and concretion; few fine roots present; diffuse irregular horizon boundary.

B1g 55 - 78 cm : Moist; dark grayish brown (10 YR 4/2) Clay; sticky when wet; medium weak angular blocky structure; common medium distinct yellowish brown (10 YR 5/6) mottles; common fine to mediun black concretions; few fine roots present; clear irregular horizon boundary.

B2g 78 - 108 cm : Moist; grayish brown (10 YR 5/2) Clay; moderately strong fine angular blocky structure; common medium distinct yellowish brown (10 YR 5/8) mottles; common fine to medium black concretions; no root penetration, clear smooth horizon boundary.

B3g 108 - 140 cm: Moist; brown (10 YR 5/3) Clay; sticky when wet; weak fine angular blocky structure; common medium distinct light yellowish brown (10 YR 6/4) mottles; common fine to medium black concretions; no root penetration; clear wavy horizon boundary.

C 140 - 180 cm: Wet; pale brown (10 YR 6/3) Clay; sticky when wet; weak fine angular blocky structure; common fine faint brownish yellow (10 YR 6/6) mottles; few fine soft black concretions.

c) Bantog Series

The soils of this seires belong to the fine loamy, deep and poorly drained soils. Solum thickness ranges from 100 to 150 cm. This soil series is distributed in the area south of Batac and the vicinity of Dingalit town. The principal crop of this soils is lowland rice. After rice, tobacco and garlic are planted which are then followed by mungo or corn.

The surface soils are generally fine to medium textured with color ranging from grayish brown to dark brown and sub-angular to angular structure. Subsoils are yellowish brown to dark grayish brown clay with yellowish brown mottles or manganese concretions. The relief is generally level with minor undulation in some areas transitional to the nearby uplands. Drainage condition is poor both externally and internally. Bantog Clay, Bantog Silty Clay Loam and Bantog Clay Loam are the three soil types developed in the Project Area. These soils are most suitable for the paddy rice cultivation. Tobacco, garlic, onion, legumes and vegetables are also grown after harvest of rice.

Diagramatic representation of the typical profiles of this soil series is shown in Figure 3B-49, Appendix 3B-5. The representative soil profile is shown as follows:

Location: Bo. Nagalisan, Batac, Ilocos Norte
Pit no. : 1
Sub-area: Batac-Paoay
Land use: Paddy rice irrigated (Tobacco)

Profile Description:

Ap 0 - 7 cm : Dry; grayish brown (10 YR 5/2) Clay Loam; hard when dry; weak coarse angular blocky structure; few fine faint yellowish brown (10 YR 5/4) mottles; no concretion; many fine to medium roots present; clear smooth horizon boundary.

A3g 7 - 39 cm : Moist; light brownish gray (10 YR 6/2) Clay Loam; firm when moist; slightly sticky and plastic when wet; medium strong angular blocky structure; few fine faint dark yellowish brown (10 YR 4/4) mottles, no concretion; many fine to medium roots present; clear wavy horizon boundary.

B1g 39 - 81 cm : Moist; graish brown (10 YR 5/2) Silty Clay; slightly sticky when wet; medium weak granular structure; common fine faint dark yellowish brown (10 YR 4/4) mottles; no concretion; common fine roots present; clear smooth horizon boundary.

B2g 81 - 106 cm : Moist; dark grayish brown (10 YR 4/2) Clay; sticky when wet; strong columnar structure; few fine faint pale brown (10 YR 6/3) mottles; few fine black soft concretions; few fine to medium roots present; clear smooth horizon boundary.

C1 106 - 140 cm : Wet; very dark gray (10 YR 3/1) Clay; sticky and plastic when wet; weak columnar structure; no mottles and concretion; very few fine to medium roots present; clear wavy horizon boundary.

C2g 140 - 170 cm: Wet; dark gray (10 YR 4/1) Clay Loam; slightly sticky when wet; weak medium angular blocky structure; few fine faint brownish yellow (10 YR 6/6) mottles; no concretion; no root penetration.

4. Soils of Upland

a) Cervantes Series

This soil series is the residual red soils developed on pyroclastic

flows and terrace gravels in the Nueva Era (left bank) area. Its relief is rolling and hilly. The distinguishing characteristics of this soil are its friable A and B horizon and reddish color. The drainage is good externally and internally.

The surface soils are reddish brown clay loam to clay with gravels, friable when moist and sticky when wet. Subsoils are dull reddish brown to reddish brown clay loam to clay with volcanic gravels.

The Cervantes Clay is the only soil type identified in the service area. The greater portion of the area that Cervantes series developed is an open cogon land with scattered growth of broad leaved trees, spiny bamboo and shrub. The small portion is used for paddy rice field in the wet season. This soil is not suited to most agricultural crops because of its relief, vegetation and low natural fertility.

Diagramatic representation of the typical profiles of this soils series is shown in Figure 3B-49, Appendix 3B-5. The representative soils profile is shown as follows:

Location: Bo. Garnaden, Nueva Era, Ilocos Norte
Pit no. : 17
Sub-area: Nueva Era
Land use: Paddy rice irrigated

Profile Description:

A_{1g} 0 - 20 cm : Moist; dark reddish brown (5 YR 3/4) Clay; slightly friable when moist; sticky and plastic when wet; sub-angular blocky structure; few fine reddish brown (5 YR 4/6) mottles; many fine roots penetration; presence of 1 to 20 cm. size angular andesite gravels; abrupt smooth horizon boundary.

Bg 20 - 70 cm : Moist; reddish brown (2.5 Y 4/4) Clay; slightly friable when moist; slightly sticky and slightly plastic when wet; sub-angular blocky structure; few fine reddish brown (2.5 Y 4/6) mottles; few fine to medium manganese concretions; no root penetration; presence of 1 to 15 cm. size angular andesite gravels; clear smooth horizon boundary.

Cg 70 - 100 cm: Moist; dull reddish brown (5 YR 4/4) Clay Loam; friable when moist; slightly sticky and plastic when wet; sub-angular blocky structure; few fine bright brown (7.5 YR 5/8) mottles; common fine to medium concretions; no root penetration; presence of 1 to 22 cm. size angular andesite gravels.

b) Bantay Series

Bantay series is the primary upland soils developed from the weathered tertiary strata such as shale and sandstone. The soils are generally fine loamy, friable and well drained. The relief is characterized by a hilly, undulating and rolling appearance.

The surface soils range from light brown to dark brown for those along the slopes and dark brown to dark gray for those cultivated in the valleys. The upper subsoils are dark brown to gray clay loam, friable and coarse granular in structure. The lower subsoils consist of loose highly weathered shale. In the lower subsoils numerous lime precipitations are present.

Bantay Clay Loam is the only soil type identified in the hills and gentle slopes of the Madupayas, Batac-Paoay, Pinili and Badoc-Sinait area. This soil type is not agriculturally important. Only a very small portion is cultivated to upland rice, corn, tobacco and vegetables. The rest is covered with grass, brush, bamboo and secondary forest.

Diagramatic representation of the typical profiles of this soil series is shown in Figure 3B-49, Appendix 3B-5. The representative soil profile in the valley bottom is shown as follows:

Location: Bo. Labut, Badoc, Ilocos Norte
Pit no. : 4
Sub-area: Badoc-Sinait
Land use: Paddy rice irrigated (Garlic)

Profile Description:

A1g 0 - 22 cm : Moist; dark gray (5 Y 4/1) Clay; slightly friable when moist; hard when dry; sticky when wet; weak medium angular blocky structure; few fine faint yellowish brown (10 YR 5/8) mottles; presence of reddish streaks; common medium roots present; abrupt irregular boundary.

A3g 22 - 39 cm : Moist; dark grayish brown (10 YR 4/2) Silty Clay; sticky when wet; firm when moist; weak medium granular structure; common medium distinct yellowish brown (10 YR 5/6) mottles; no concretion; common fine to medium roots present; abrupt irregular horizon boundary.

B1g 39 - 64 cm : Moist; dark gray (10 YR 4/1) Clay; sticky and plastic when wet; weak medium angular blocky structure; few fine faint yellowish brown (10 YR 5/8) mottles; few fine concretions; few fine roots present; clear smooth horizon boundary.

B2g 64 - 90 cm : Wet; gray (5 Y 5/1) Clay; sticky when wet; strong angular blocky structure; common fine faint brownish yellow (10 YR 6/8) mottles; no concretion; few fine

roots present; clear smooth horizon boundary.

C1g 90 - 108 cm : Wet; dark grayish brown (10 YR 4/2) Clay; sticky and plastic when wet; strong angular blocky structure; few fine faint light brownish yellow (10 YR 6/4) mottles; few fine to medium black concretions; very few fine roots present; diffuse smooth horizon boundary.

C2g 108 - 150 cm: Wet; grayish brown (10 YR 5/2) Clay; sticky and plastic when wet; massive structure; compact; few fine faint brownish yellow (10 YR 6/6) mottles; few fine black concretions; no root penetration; presence of lime precipitations.

5. Soils of the Dune Land

The soils of dune land are composed of clean sand and loamy sand. Its relief is undulating and rolling. It is at present under barren strip, grass growth, residential area and non-irrigated farm. Paddy rice field is located on a relatively lowlying area in the dune land. The productivity of dune land soil is very low. The fertility and structure of the surface soil can be improved by the addition of compost and animal dung. Irrigation is also indispensable for cropping in this land.

6. Soils of the Riverwash

The riverwash adjacent to the big rivers is usually covered with clean sand and gravels. That lands are no soil profile development and there is at present under barren strip, grass growth and brush with scattered growth of trees such as Agoho.

The riverwash is not suited for farming by the traditional method. This problem could be corrected by flood control works and introducing fine soils to the land.

Aggregated areas of the each soil types are summarized in Table 3B-27, Appendix 3B-5.

Table 3B-27 Hectarage Tabulation of the Project Area by Soil Type

Soil Type	Sub-Project Areas						Total	Major Vegetation
	Cura	Nueva Era	Madupayas	Batac-Paoay	Pinili	Badoc-Sinait		
Cervantes C	-	1,620	-	-	-	-	1,620	grass
Bantay C	-	-	290	1,340	1,170	2,370	5,170	brush, forest
Maligaya C	-	510	-	-	-	-	510	paddy rice
San Manuel SiCL	1,220	-	190	1,840	1,010	1,760	6,020	paddy rice
San Manuel SiL	-	-	-	150	75	275	500	paddy rice
San Manuel CL	-	-	-	1,175	-	-	1,175	paddy rice
San Manuel SL	385	-	-	-	-	-	385	paddy rice
Bantog SiCL	-	-	-	-	-	820	820	paddy rice
Bantog CL	-	-	-	550	-	-	550	paddy rice
Bantog C	-	-	-	95	-	915	1,010	paddy rice
San Ferunando C	-	-	-	2,180	495	-	2,675	paddy rice
Dune Land	-	-	-	910	20	100	1,030	grass, brush
Riverwash	65	-	40	-	-	270	375	grass, brush
March Land	-	-	-	60	-	-	60	grass
Total	1,670	2,130	520	8,300	2,770	6,510	21,900	

G. Physical and Chemical Properties

The summarized physical and chemical properties of the soils in the Project Area was shown in Table 3B-28, Appendix 3B-5. This results show the physical and chemical characteristics of the alluvial and residual upland soils of paddy field in the Project Area.

Most of the soils in the Project Area belong to medium to fine textured soils. The depth of surface soil (Ap horizon) is 10 to 25 cm in paddy field. The effective depth of soil is more than 50 cm except for a part of the uplands. From these facts, it appears that the alluvial plain of the Project Area has enough soil depth for paddy rice production.

Soil reaction in the Project Area has generally different reaction between the two large areas. Namely, the pH of soils in Cura and Nueva Era (left bank) area is less than 6.5. On the other hand, the pH of soils in Batac-Paoay, Pinili and Badoc-Sinait area are more alkaline (7.1 to 8.0) than that of the former. This seems that the soils of the latter have been effected by the geology of surrounding area with limesone. As a rule, the deeper stratum of Paddy field has higher pH than surface soil. This mainly seems due to the leaching by percolating water.

Cation Exchange Capacity (CEC) varies with the content of clay. That of the soils in the Project Area is generally high except for the San Mannuel soils in Cura Area.

Of the exchangeable cations, calcium and magnesium is high in clayey soils. The exchangeable potassium content is also high.

Avairable phosphate is generally low excapt for few samples.

H. Land Classification for Irrigated Paddy Field

1. Objective of the Study

The main objectives of land classification are: i) to identify

Table 3B-5 Physical and Chemical Properties of Soil in the Project Area

Pit No.[1/]	Soil Series	Horizon	Depth (cm)	Particle Size Distribution Sand (%)	Silt (%)	Clay (%)	Texture	Settling Volume (ml)	Soil Reaction PH(H_2O)	Electric Conductivity (mmho/cm)	Available Phosphate (ppm)	Free Iron (ppm)	Organic Carbon (%)	Exchangeable Acidity (me/100g)	Exchangeable Cation (me/100g) Na	K	Ca	Mg	Cation Exchange Capacity (mm/100g)	Available Moisture (%)
1	Bantog	Ap	0- 7	15	32	53	C	30	7.[illegible]	0.14	19.0	0.95	1.63	9.38	1.20	0.81	-	-	-	-
		As	7-39	15	28	57	C	33	8.0	0.17	18.0	0.99	1.70	6.88	1.98	0.92	-	-	-	-
2	San Manulel	Ap	0-19	31	36	33	CL	20	7.7	0.13	13.0	1.34	0.92	5.0	0.24	1.25	-	-	-	-
		B_1	19-52	36	37	27	CL	21	7.9	0.09	14.6	3.92	0.66	7.5	0.41	0.52	-	-	-	-
3	San Fernando	Ap	0-19	19	11	70	C	29	7.7	0.30	11.2	0.28	1.10	5.0	1.26	1.21	-	-	-	-
		A_3	19-58	15	11	74	C	32.4	8.0	0.32	6.3	0.78	1.11	8.13	2.66	0.95	-	-	-	-
4	Bantog	Ap	0-22	41	21	38	CL	-	7.9	0.15	17.0	1.06	0.46	6.88	4.81	-	-	-	-	-
		A_3	22-39	23	31	46	C	-	8.1	0.24	12.6	0.56	0.45	7.50	4.63	-	-	-	-	-
5	San Manuel	Ap	0-21	14	39	47	C	29	7.6	0.08	7.5	1.01	0.42	11.88	1.9	-	-	-	-	-
		A_{12}	21-39	17	37	46	C	27	7.4	0.08	9.0	0.78	0.40	10.00	1.7	-	-	-	-	-
6	Bantog	Ap	0-10	15	21	64	C	29	7.8	0.53	18	3	1.3	-	1.9	-	-	-	-	-
		A_{12}	10-24	15	22	63	C	29	8.0	0.31	6	1	0.8	-	1.7	-	-	-	-	-
7	San Manuel	Ap	0-13	20	22	60	C	38	8.0	0.06	8	3	1.22	5.6	2.5	0.9	-	-	-	-
		B_1	13-32	20	20	58	C	27	7.8	0.31	12	1	0.70	6.2	2.2	0.9	-	-	-	-
8	San Fernando	Ap	0-17	19	27	54	C	31	8.0	0.29	2	0.5>	0.8	3.8	1.2	1.2	-	-	-	-
		A_{12}	17-39	19	36	45	C	24	7.9	0.19	2	1	0.4	0.6	1.0	1.9	-	-	-	-
9	San Manuel	Ap	0-25	25	28	47	C	-	7.7	0.1	3	-	0.7	3.8	2.9	1.1	-	-	-	-
		A_3	25-42	27	38	35	CL	-	7.2	0.08	3	-	0.9	8.1	2.9	0.9	-	-	-	-
A1	San Fernando		0-30	30	12	58	C	-	6.2	0.66	7.88	-	1.99	-	3.16	0.95	64.58	10.32	88.1	14.4
A2	San Manuel		0-35	64	14	22	SCL	-	6.8	0.25	0.32	-	1.45	-	1.31	0.18	13.49	6.78	42.4	6.0
A3	San Manuel		0-30	25	25	50	C	-	6.4	0.24	7.88	-	1.85	-	2.22	0.81	33.50	10.17	70.3	15.3
A4	San Manuel		0-25	39	36	25	L	-	6.8	0.11	0.53	-	1.38	-	1.18	0.15	11.27	6.14	42.2	13.6
A5	Maligaya		0-30	19	19	62	C	-	5.3	0.05	0.53	-	1.92	-	1.32	0.61	-	-	71.6	21.1
A6	San Fernando		0-30	13	28	59	C	-	5.9	0.08	1.93	-	3.68	-	2.24	1.29	63.20	9.57	86.2	13.0
A7	San Manuel		0-25	24	48	28	C	-	6.4	0.04	47.95	-	1.24	-	4.63	1.21	40.78	11.38	76.6	16.5
A8	Bantog		0-30	14	36	50	C	-	6.4	0.35	10.33	-	3.65	-	3.34	1.33	60.75	7.87	77.7	13.5
A9	Bantog		0-25	19	35	46	C	-	6.9	0.37	1.23	-	3.53	-	3.30	1.05	63.14	8.78	76.8	12.4
A10	Bantog		0-25	20	22	58	C	-	6.6	0.17	2.13	-	2.82	-	2.04	1.61	-	-	77.9	13.7
10	San Manuel	Ap	0-14	17	31	52	C	-	7.2	0.22	1.79	-	1.68	-	0.53	1.15	22.94	12.45	42.7	7.4
		B_1	14-42	19	30	51	C	-	7.6	0.13	1.61	-	1.61	-	0.30	1.51	22.26	1.55	43.7	4.2
11	San Manuel	Ap	0-10	15	22	63	C	-	7.3	0.62	1.23	-	2.03	-	0.64	3.48	-	-	58.0	9.6
		B_1	19-79	11	30	59	C	-	7.3	0.57	1.16	-	1.18	-	0.66	6.00	-	-	60.2	10.1
12	Bantog	IAp	0-18	32	25	43	C	-	7.1	0.49	6.83	-	1.25	-	2.29	1.46	32.68	10.03	49.2	5.6
		IB_1	18-30	44	22	34	CL	-	7.3	0.20	6.79	-	0.88	-	0.27	1.37	33.03	7.37	44.9	4.0
13	Bantog	Ap	0-20	39	32	29	CL	-	7.3	0.49	22.09	-	1.43	-	0.83	1.39	35.46	9.44	44.9	4.4
		A_{12}, B_1	20-48	78	10	12	SL	-	7.5	0.16	17.19	-	0.75	-	0.37	1.17	39.10	6.20	38.4	4.5
14	San Manuel	Ap	0-15	19	64	17	SiL	-	5.5	0.14	2.28	-	1.43	-	1.92	0.64	10.09	2.94	16.0	19.5
		B_1	15-35	17	68	15	SiL	-	6.4	0.06	2.17	-	0.90	-	0.03	0.61	12.29	3.94	17.9	16.3
15	San Manuel	Ap, A_{12}	0-19	41	49	10	L	-	5.3	0.25	2.17	-	1.52	-	0.03	0.56	9.67	2.58	13.4	11.8
		B_1	19-39	38	45	17	L	-	6.5	0.05	2.17	-	0.98	-	0 03	0,56	12.68	3.30	18.6	5.3
16	Cervantes	Ap	0-18	25	23	52	C	-	5.9	0.10	1.79	-	1.99	-	0.17	1.08	30.02	13.97	61.0	6.6
17	Cervantes	Ap	0-20	19	29	52	C	-	5.7	0.11	1.44	-	1.97	-	0.19	0.98	21.51	9.40	45.8	7.5
		B	20-70	19	23	58	C	-	6.5	0.07	1.79	-	1.41	-	0.11	0.49	16.14	9.72	31.8	11.7

Note: 1/ A1 - A10: Digged samples

the arable lands which are suited for irrigation development, ii) to separate and identify the arable lands according to classes and their best ultimate use under irrigation.

2. Land Class Symbols

The land classification scheme in the Project Area was in accordance with the land classification standard of the U.S. Bureau of Reclamation with some adjustment to suit local project conditions.

The suitability of the land for irrigation development is greatly affected by crop adaptability, yield and production cost. Crop adaptability and yield are reflected by the physical and chemical characteristics of the soils and topographic limitation, while cost of production is affected by farm labor and cost in connection with cultivation, providing irrigation and capital outlay prior to irrigation development.

Basically, the land classification survey involves identification and delineation of arable and non-arable lands. The land classes were delineated reflecting the production capacity of the lands. They were futher subdivided into appropriate subclasses according to such limitation in soil, topography and drainage condition.

The followings are the land class symbols used in this project study.

Land Class Symbles:

1R	: Highly suitable for irrigated paddy rice
2R	: Moderately suitable for irrigated paddy rice
3R	: Marginally suitable for irrigated paddy rice
1	: Highly suitable for diversified crops
2	: Moderately suitable for diversified crops
3	: Marginally suirable for diversified crops
1R (2)	: Highly suitable for irrigated paddy rice and moderately suitable for diversified crops

2R (2) : Moderately suitable for irrigated paddy rice and moderately suitable for diversified crops

3R (3) : Marginally suitable for irrigated paddy rice and marginally suitable for diversified crops

6 : the lands not suitable for irrigation development, include stream channels, rivers, riverwash, rolling and steep slopes, hilly and mountainous areas and dune land

M : the lands occupied for town, barrio, residential or industrial areas

The specification for land classification which were adapted to the study on irrigation project conducted by NIA, is shown in Table 3B-19, Appendix 3B-5.

The semi-detailed land classification study was conducted to separate the arable lands as those having potential for irrigation development and non-arable land having no potential to be developed in the project scheme.

The arable lands were categorized into three major groups based on their crop suitability with basic consideration on the soil, topography, drainage and other physical factors. These are; i) diversified crop land, ii) rice land and iii) dual class land.

The non-arable lands consist of three major classes namely; i) class 6 land, ii) M land and iii) Rights-of-Way (ROW).

Aggregated areas of each groups and land classes are summarized in Table 3B-30, Appendix 3B-5.

3. Description of Land Classes

a) Diversified Crop Land

This land class is characterized by good external drainage.

Table 3B-29 Land Classification Specification for the Project Area

Land Specification	For Paddy Rice Crops			For Diversified Crops	
	Class 1R	Class 2R	Class 3R	Class 2	Class 3
Soils (dominant texture of surface layer 0-30 cm)	fine sandy loam to clay	fine sandy loam to clay	loamy sand to clay	fine sandy loam to clay	loamy sand to clay
Soil Depth	more than 60 cm	more than 45 cm	more than 20 cm	more than 60 cm	more than 30 cm
Cation Exchange Capacity (CEC at surface layer 0-30 cm)	more than 10 me/100g	more than 5 me/100g	more than 4 me/100g	more than 5 me/100g	more than 4 me/100g
pH (anaerobic)	more than 5.5	more than 5 maybe less	more than 5 maybe less	more than 4.5 less than 8.5	more than 4.5 less than 8.5
Reduction Product	low	low	-	-	-
Topography					
Slope in general gradient	less than 2%	less than 5%	less than 8%	less than 5%	less than 8%
Land leveling	low	medium	high	medium	high
Land clearing	low	medium	high	medium	high
Land terracing	low	medium	high	medium	high
Internal Drainage	slow	slow	slow	moderate to good	moderate to good

Table 3B-30 Hectarage Summary of the Phase II Area by Land Classes

Land Class	Sub-diveded Area						Total
	Cura	Nueva Era	Madupayas	Batac-Paoay	Pinili	Badoc-Sinait	
Arable Lands 1/							
a) Diversified Crop Land	-	-	-	-	-	-	-
b) Rice Land	-	670	-	2,420	490	1,090	4,670
1R	-	320	-	2,160	410	590	3,480
2R	-	250	-	200	80	330	860
3R	-	100	-	60	-	170	330
c) Dual Class Land	1,410	-	160	2,770	910	2,480	7,730
1R (2)	1,350	-	100	2,490	840	1,660	6,440
2R (2)	60	-	60	200	70	820	1,210
3R (3)	-	-	-	80	-	-	80
Total Arable	1,410	670	160	5,190	1,400	3,570	12,400
Non-arable Lands							
M Land	75	15	15	565	85	175	930
Class 6 Land	65	1,390	330	2,130	1,175	2,470	7,560
ROW	120	55	15	415	110	295	1,010
Total Non-arable	260	1,460	360	3,110	1,370	2,940	9,500
Grand Total	1,670	2,130	520	8,300	2,770	6,510	21,900

Note: 1/ Exclude present and future rights-of-way (ROW)

The soils are chiefly medium to coarse texture, or shallow depth underline by sand and gravelly strata which allow excessive water to drain out readily. They appear on small spots on depressed river levves. This land is productive for diversified crops such as corn, root crops and legemes. However, the crop adaptability and yield would be limited because of its soil depth and flooding hazard.

The lands under this class are not developed in the Project Area.

b) Rice Land

These are the lands best suited for paddy rice production both during the wet and dry season under full irrigation water supply. The pre-requisite is a soil which can hold water in a longer time with slow percolation rate. This is attributed by poor internal drainage and slow permeability. In the Project Area, the lands under this class are estimated 4,670 ha which is equivalent to about 38 percent of the whole arable lands.

During the dry season, the large scale area of which classified to these lands in Batac-Paoay, Pinili and Badoc-Sinait area is highly used for diversified crop production such as garlic and tobacco. The fine clayey soils of these fields are difficult to plow when dry. Garlic and onion is cultivated under no plowing, multing by rice straw and groundwater supply. Farmer may be prefferred the ease of planting garlic as compared to the exacting culture of Virginia tobacco. This fact shows that the lands classified to rice land will be also highly used for diversified crop production under good drinage condition or appropriate farm management.

In the Project Area, these are distributed into three major land classes.

Class 1R

This is the lands highly suited for irrigated paddy rice

production both during the wet and dry season. The soils belong to the fine clayey, deep and poorly drained soils with color ranging brown to dark gray. Its relief is very flat. In the dry season, the surface soils of this land are hard and grow open cracks.

The Class 1R lands in Batac-Paoay, Pinili and Badoc-Sinait area are highly used for diversified crop production such as garlic and tobacco, but in Nueva Era area most of them lies fallow during the dry season due to lack of irrigation water supply.

Class 2R

This class is the lands moderately suitable for irrigated paddy rice production. These are good quality lands having moderate production lower than the class 1R lands because of its minor deficiency in topography and drainage. These deficiency factors include surface flooding and topographic irregularity.

Class 3R

This class is the lands marginally suitable for irrigated paddy rice production. The deficiency factors such as surface irregularity or surface flooding are more serious than those in the class 2R lands.

c) Dual Class Land

These are the lands best suited for paddy rice production because of restricted subsurface drainage, however they have good potential for diversified crop production because they could be drained at very feasible cost.

Dual class land differs from rice land in its drainability characteristics. The surface soils and subsoils are fine to medium texture and have moderate to good permeability. In the Project Area,

the lands under this class are estimated 7,730 ha which is equivalent to about 62 percent of the whole arable lands. They are classed in 1R(2), 2R(2) and 3R(3).

Class 1R(2)

This class is the lands highly suitable for irrigated paddy rice production and moderately suitable for diversified crops. For rice it has no deficiency in soil, topography and drainage. The only deficiency is sub-surface drainage which needs to be improved for successful diversified crop production.

Class 2R(2)

This class is the lands moderately suitable for irrigated paddy rice production and moderately suitable for diversified crops. The lands of this class are downgraded because of topographic limitation. Its relief is slightly slooping and undulating with slopes less than five percent.

Class 3R(3)

This class is the lands marginally suitable for irrigated paddy rice production and marginally suitable for diversified crops. The lands of this class have a deficiency of surface irregularity and surface flooding.

d) Class 6 Land

These are the lands not suitable for irrigation development because of various physical and economic limitations. They consist of stream channels, rivers, riverwash, rolling or steep slopes, hilly and mountainous areas and dure land.

Not all class 6 lands are totally non-productive. Some may be valuable for agricultural use, although not suit for farming by the usual method. The sloping and hilly section could be made productive for upland crops and fruit trees.

e) M Land

These are the lands occupied by the town, barrio, residential and industrial areas.

f) Rights-of-Way (ROW)

This includes existing and future public roads and irrigation canals which are part of the project constructions.

The figure of Rights-of-way was derived at about 7.5 percent of the total arable lands surveyed. This is the same percentage used for the Upper Pampanga River Project based on measurements of existing and planned Rights-of-way in representative sample areas.

I. Summary of Conclusions and Recommendations

i) Of the cultivated 13,410 hectares (include existing Rights-of -way), about 4,250 hectares are irrigated paddy field by communal irrigation system, and other 9,160 hectares are rainfed paddy field. The un-cultivated areas consist of residential areas and other non-arable lands such as dune land, riverwash, rolling or steep slopes, hilly and mountanous areas and others. They comprise the gross area of about 8,490 hectares.

ii) Double cropping of rice is practiced within limited area of about 710 hectares. In the remaining paddy fields, the area of about 7,030 hectares are used for diversified crop production such as garlic, tobacco and others, and that of about 5,670 hectares lie mostly idle during the dry season due to lack of irrigation water supply.

iii) The soils of alluvial plain were classified into the four soil series such as the San Manuel, Maligaya, San Fernando and Bantog series. These soils are considered very productive for paddy rice and diversified crop production.

iv) The soils of uplands were classified into the two soil series such as the Cervantes and Bantay series. The productivity and agricultural use of these soils is limited because of its relief, vegetation and low natural fertility.

v) The dune land and riverwash include the lands without any soil cover or soil profile development where lands covered with clean sand and gravels. These lands are not suited for farming by usual method.

vi) According to the land classification study, a total of 4,670 hectares (38 percent of the whole arable lands) are suited for paddy rice and 7,730 hectares (62 percent of the whole arable lands) capable for dual crops. The class 1R and 2R lands cover 11,990 hectares or 97 percent of the total arable lands. This shows as to soils, both paddy and diversified crops will produce fairly good in the most of the Project Area.

vii) The natural fertility of soils in the Project Area is medium to high in root zones of crops, but the content of available phosphate is generally low. This is recommended that the phosphate would be fertilized throughout the area especially for diversified crops.

viii) The riverwash areas developed along the Cura and Badoc river were widen by the big flood which overran even the cultivated area. This shows the vital necessity of flood control works in the main rivers in the Project Area.

ix) The soil profiles in the Project Area were investigated by 9 test pits (NIA, 1978) and 87 stick boring holes and 8 test pits (JICA, 1980). In next stage, it is recommended that the more detailed survey by digging test pits (one pit per 50 hectares) would be given to study.

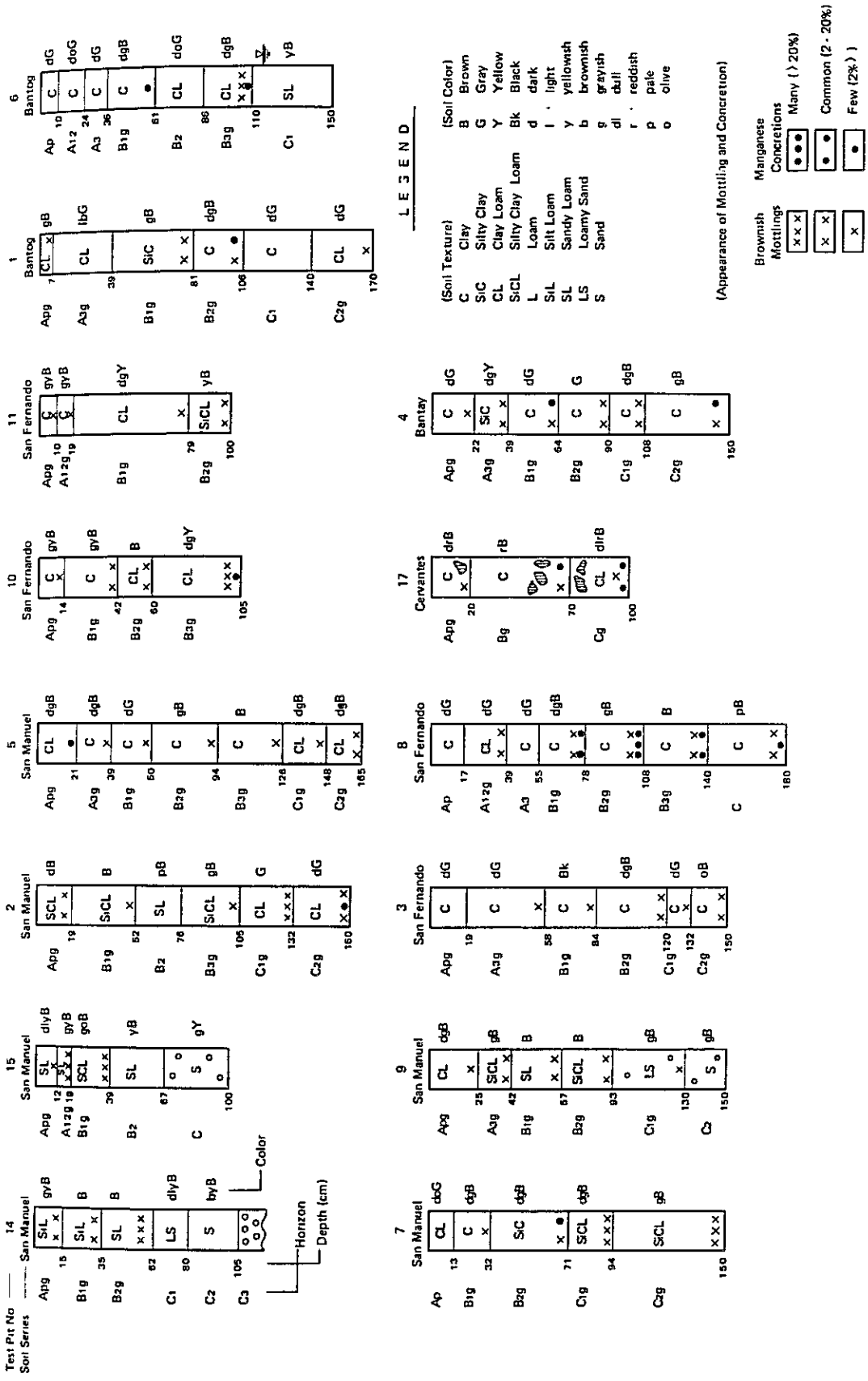

Test Pit No
Soil Series
Color
Horizon
Depth (cm)
LEGEND
(Soil Texture)
C Clay
SiC Silty Clay
CL Clay Loam
SiCL Silty Clay Loam
L Loam
SiL Silt Loam
SL Sandy Loam
LS Loamy Sand
S Sand
(Soil Color)
B Brown
G Gray
Y Yellow
Bk Black
d dark
l light
y yellowish
b brownish
g grayish
dl dull
r reddish
p pale
o olive
(Appearance of Mottling and Concretion)
Brownish Mottlings
Manganese Concretions
Many (>20%)
Common (2-20%)
Few (2%)

FIGURE 3B-50 PRESENT LAND USE MAP (CURA AREA)

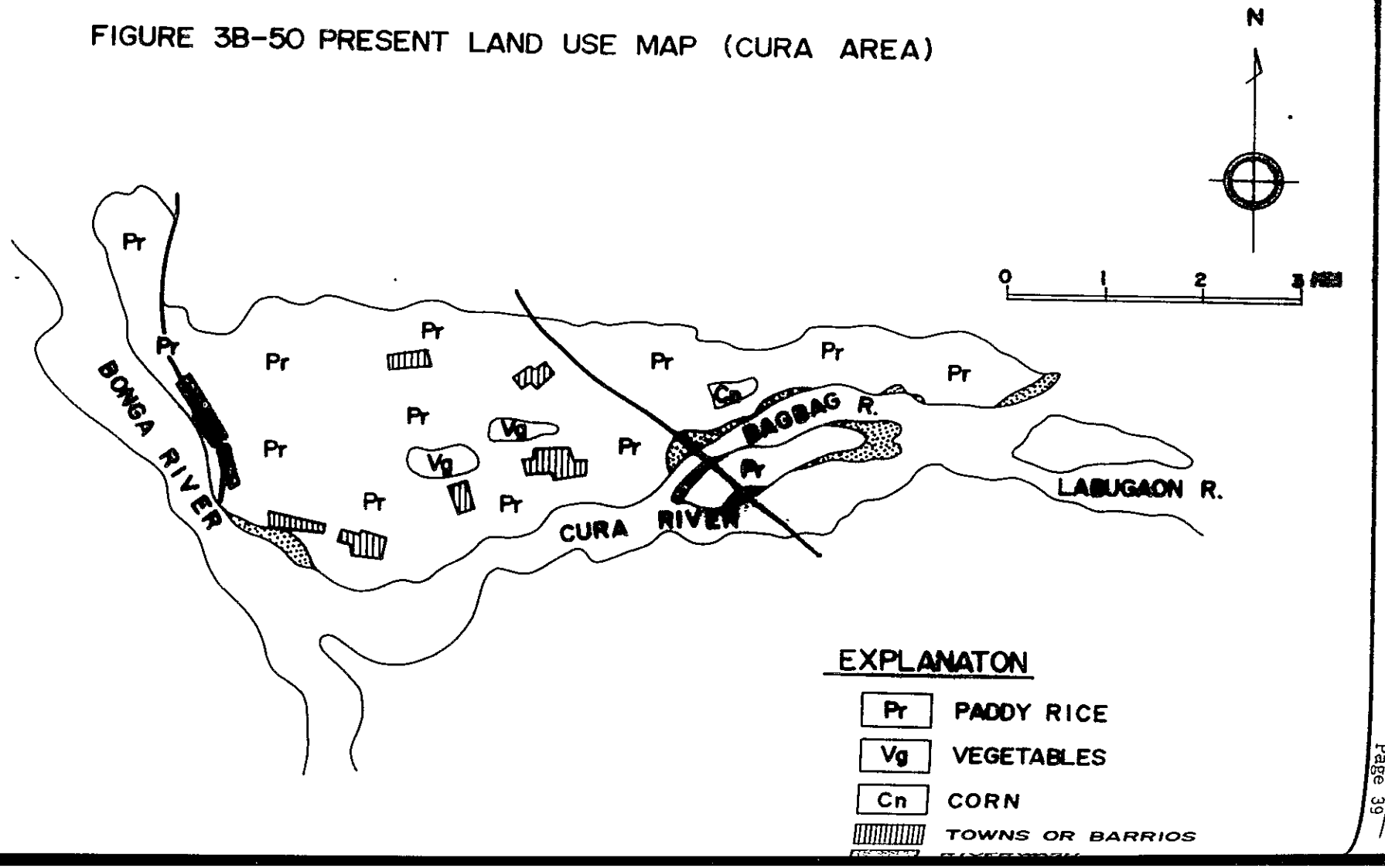


FIGURE 3B-51 PRESENT LAND USE MAP(NUEVA ERA AREA)

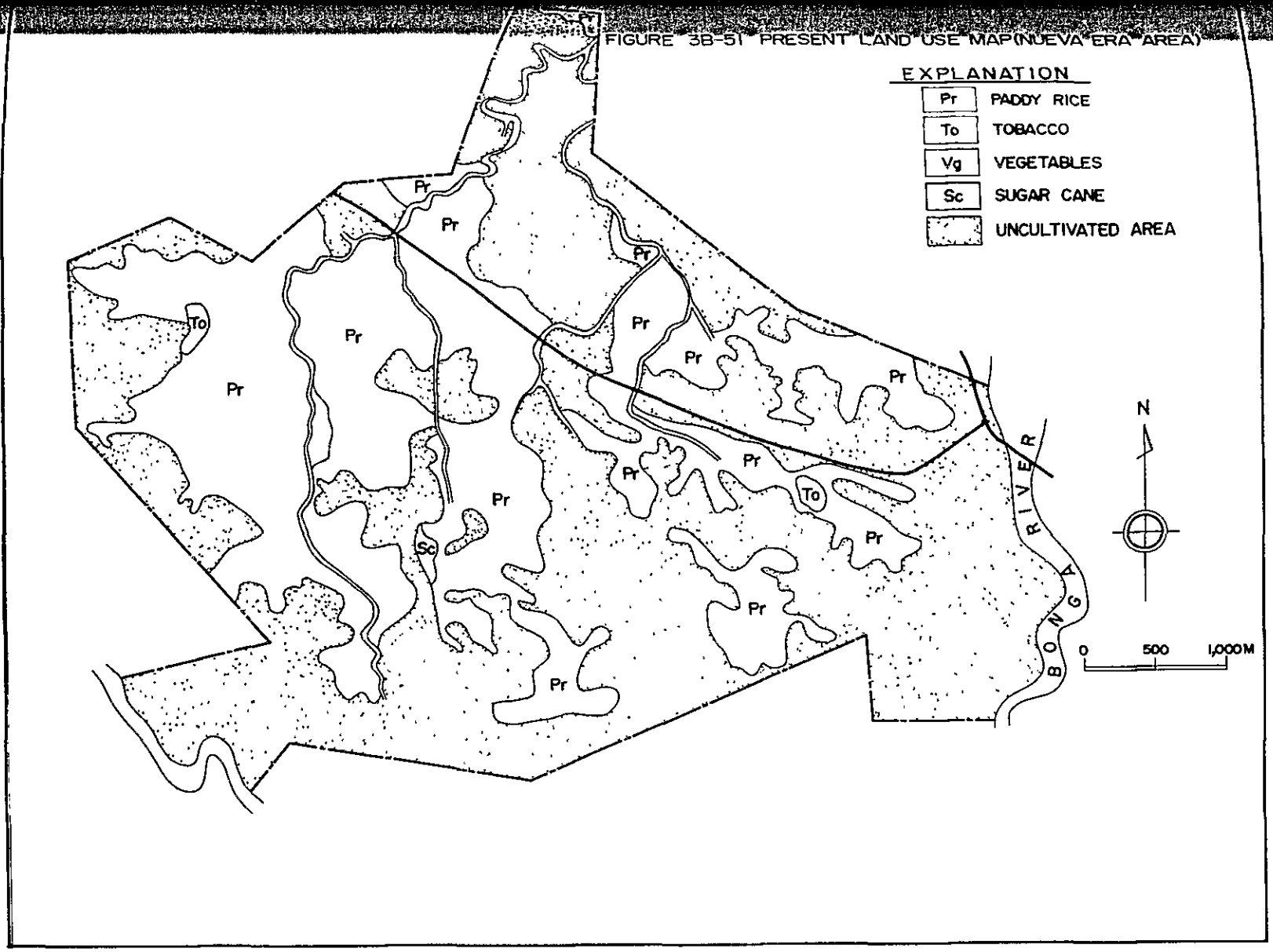
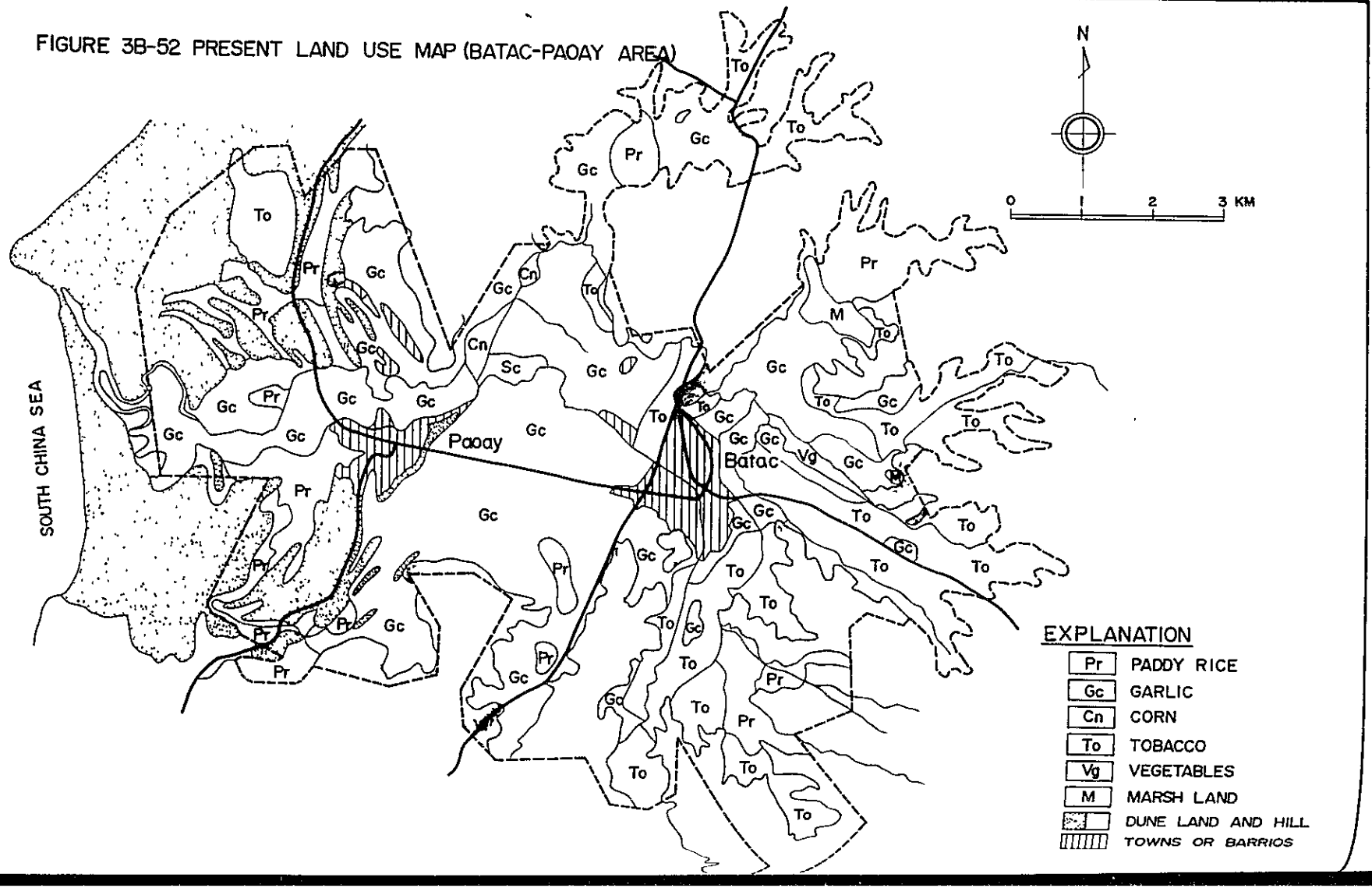


FIGURE 3B-52 PRESENT LAND USE MAP (BATAC-PAOAY AREA)



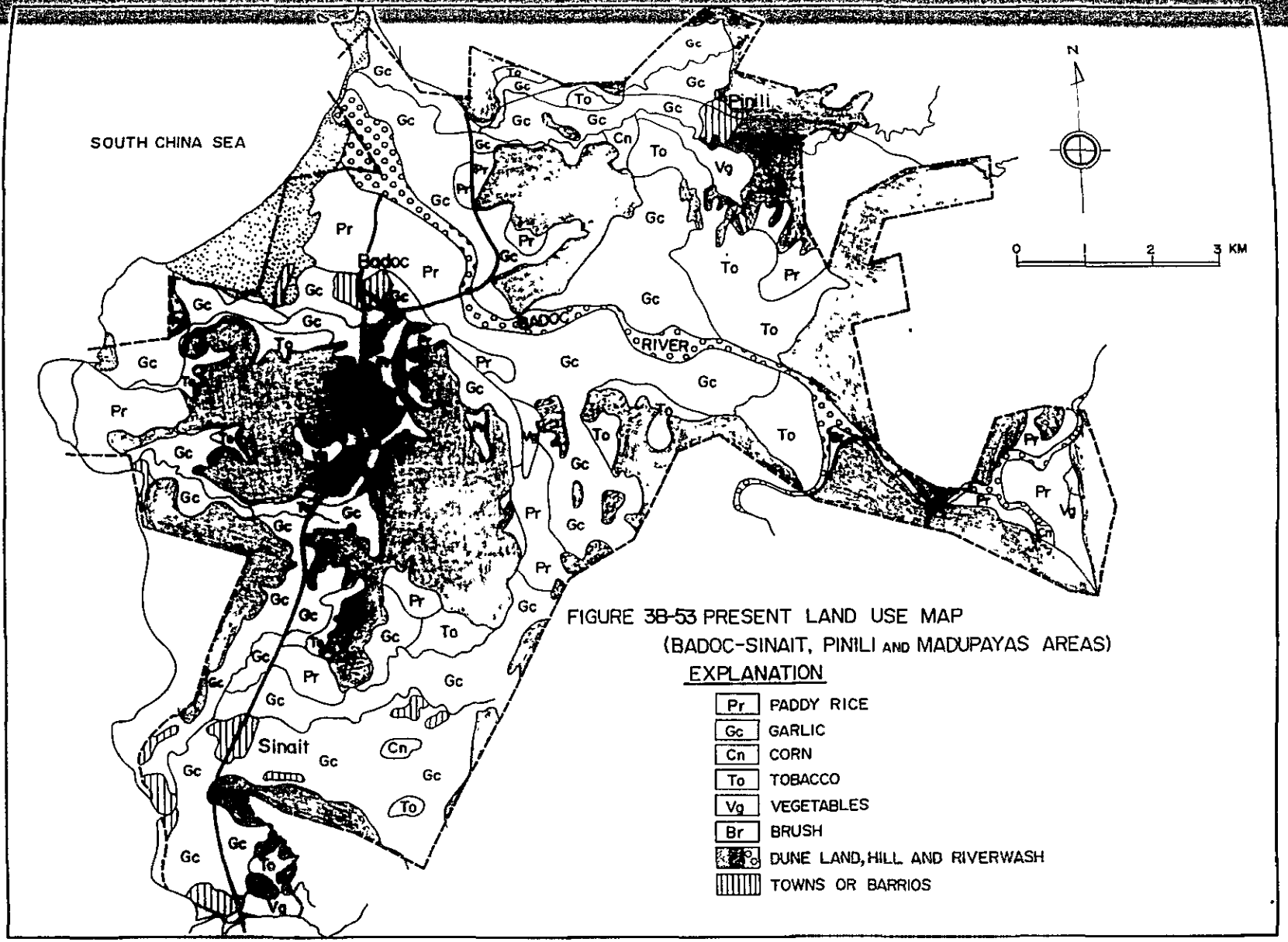
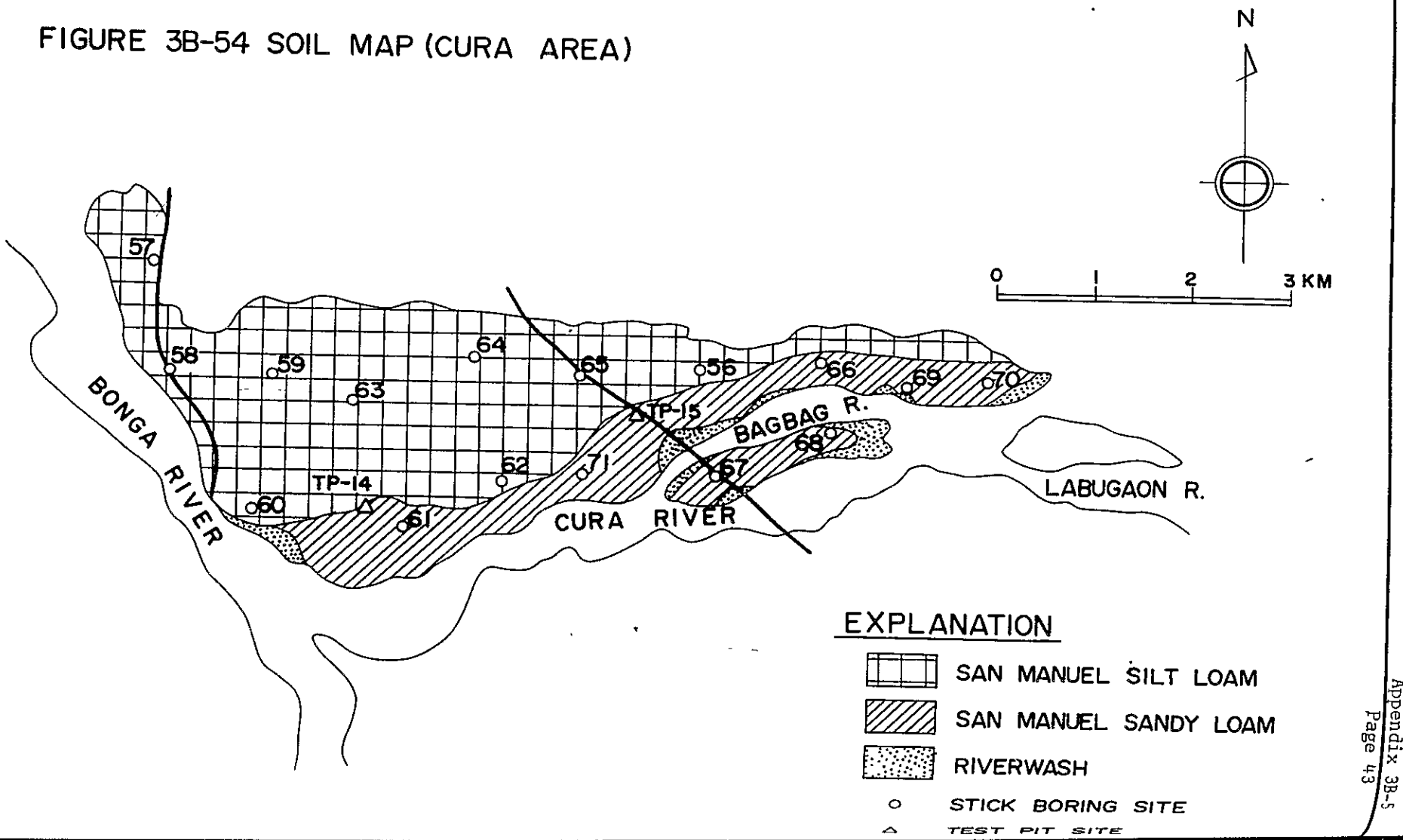


FIGURE 38-53 PRESENT LAND USE MAP
(BADOC-SINAIT, PINILI AND MADUPAYAS AREAS)

FIGURE 3B-54 SOIL MAP (CURA AREA)



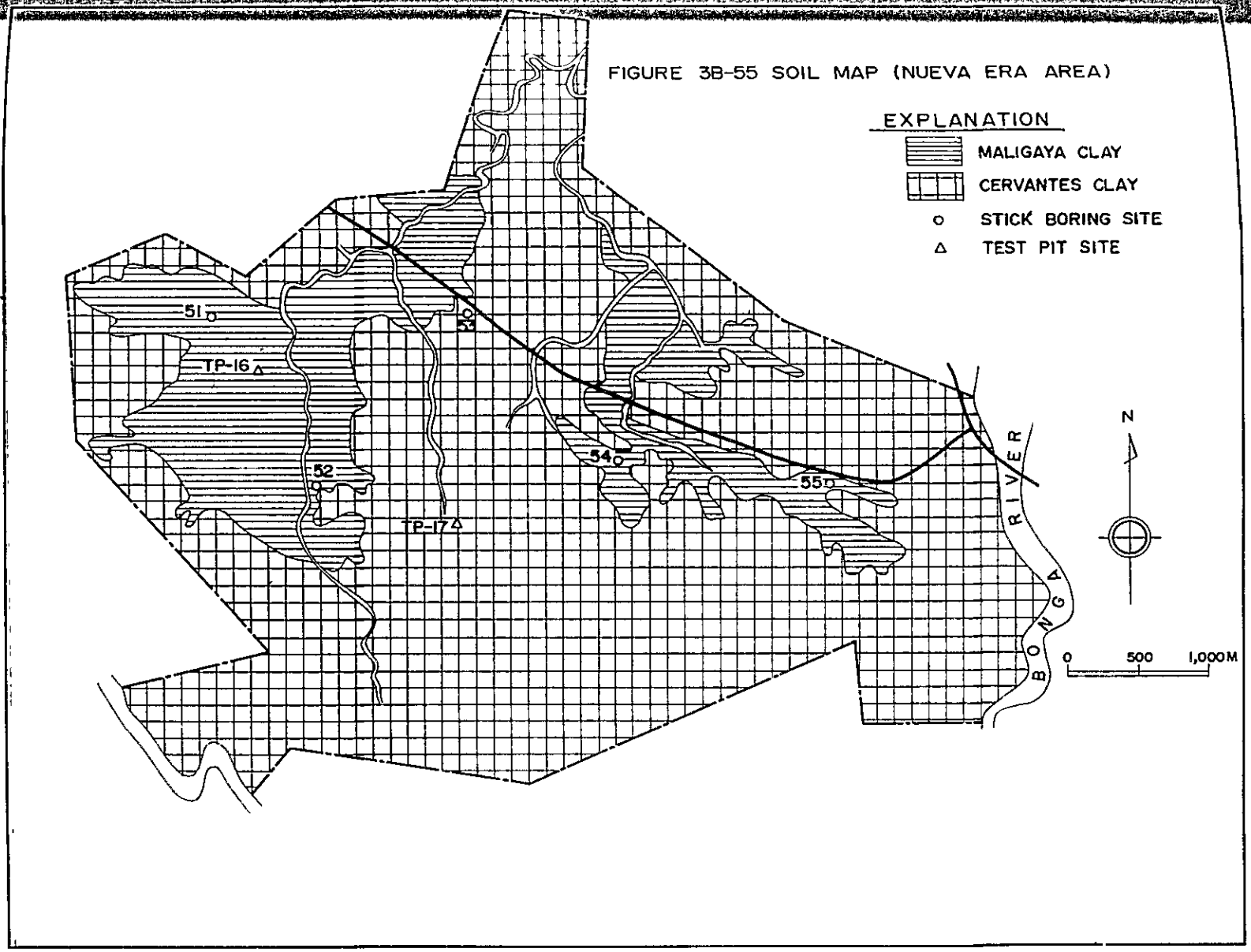
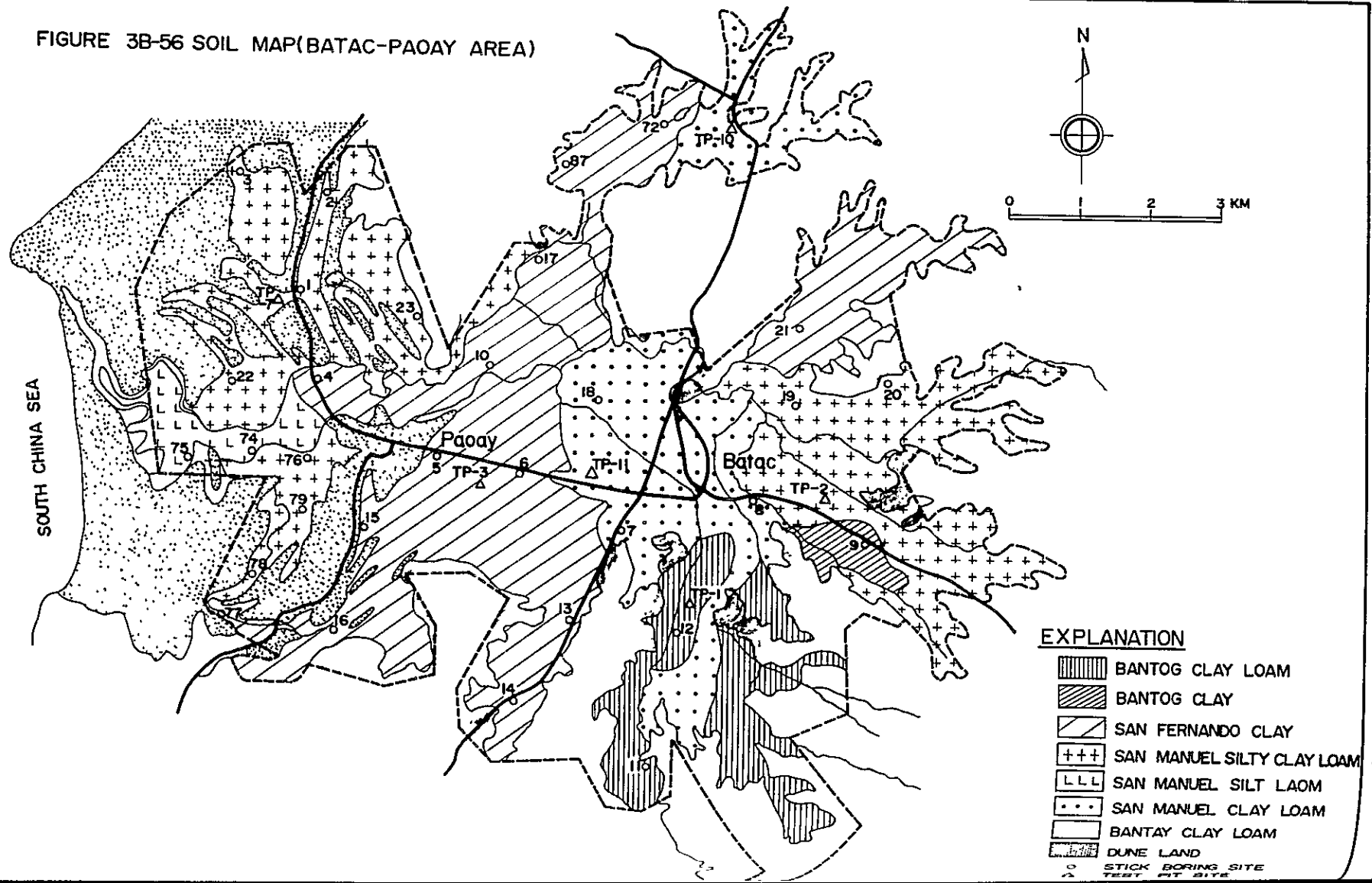


FIGURE 3B-55 SOIL MAP (NUEVA ERA AREA)

FIGURE 3B-56 SOIL MAP(BATAC-PAOAY AREA)



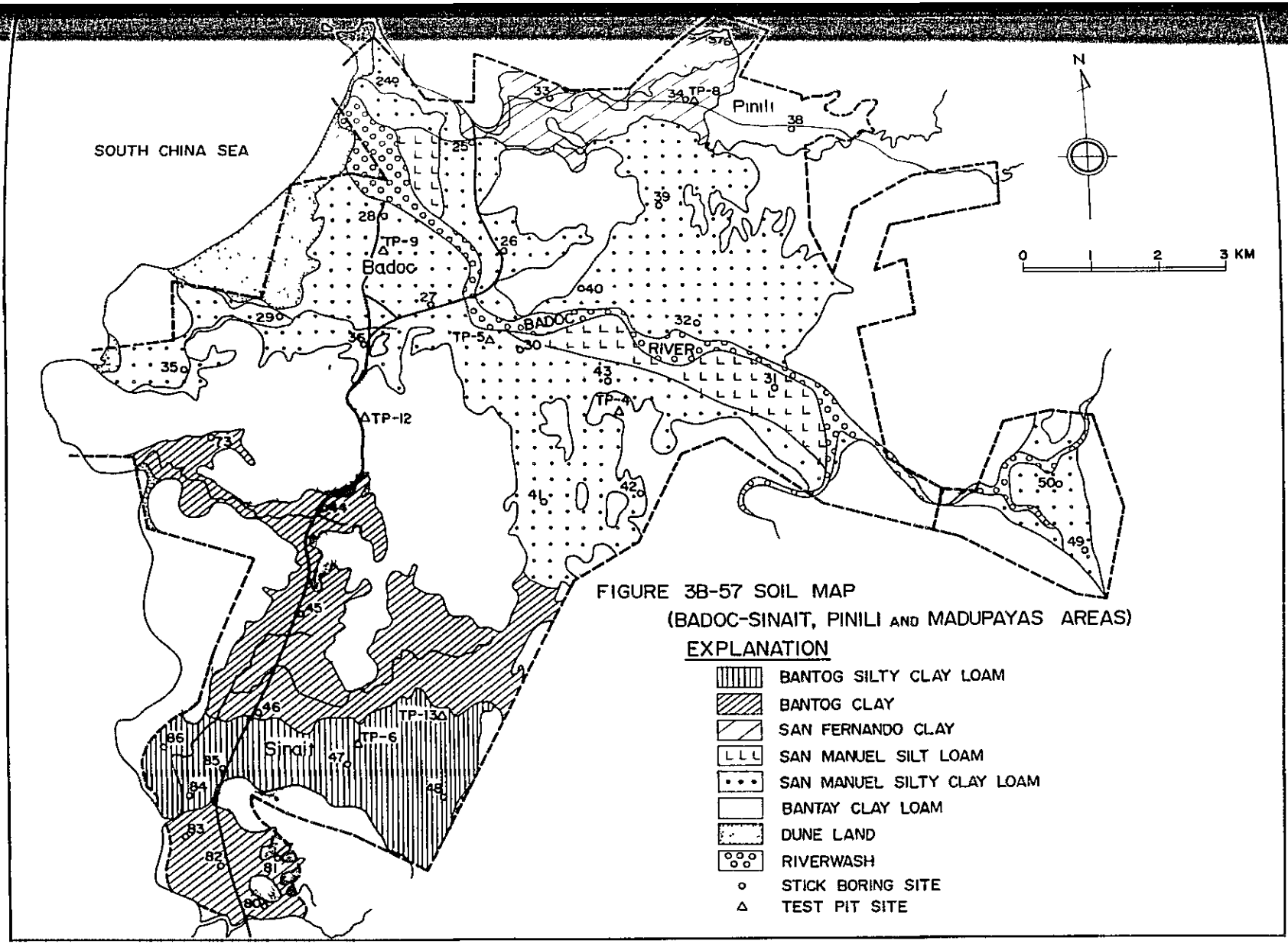


FIGURE 3B-57 SOIL MAP
(BADOC-SINAIT, PINILI AND MADUPAYAS AREAS)

FIGURE 3B-58 LAND CLASSIFICATION MAP (CURA AREA)

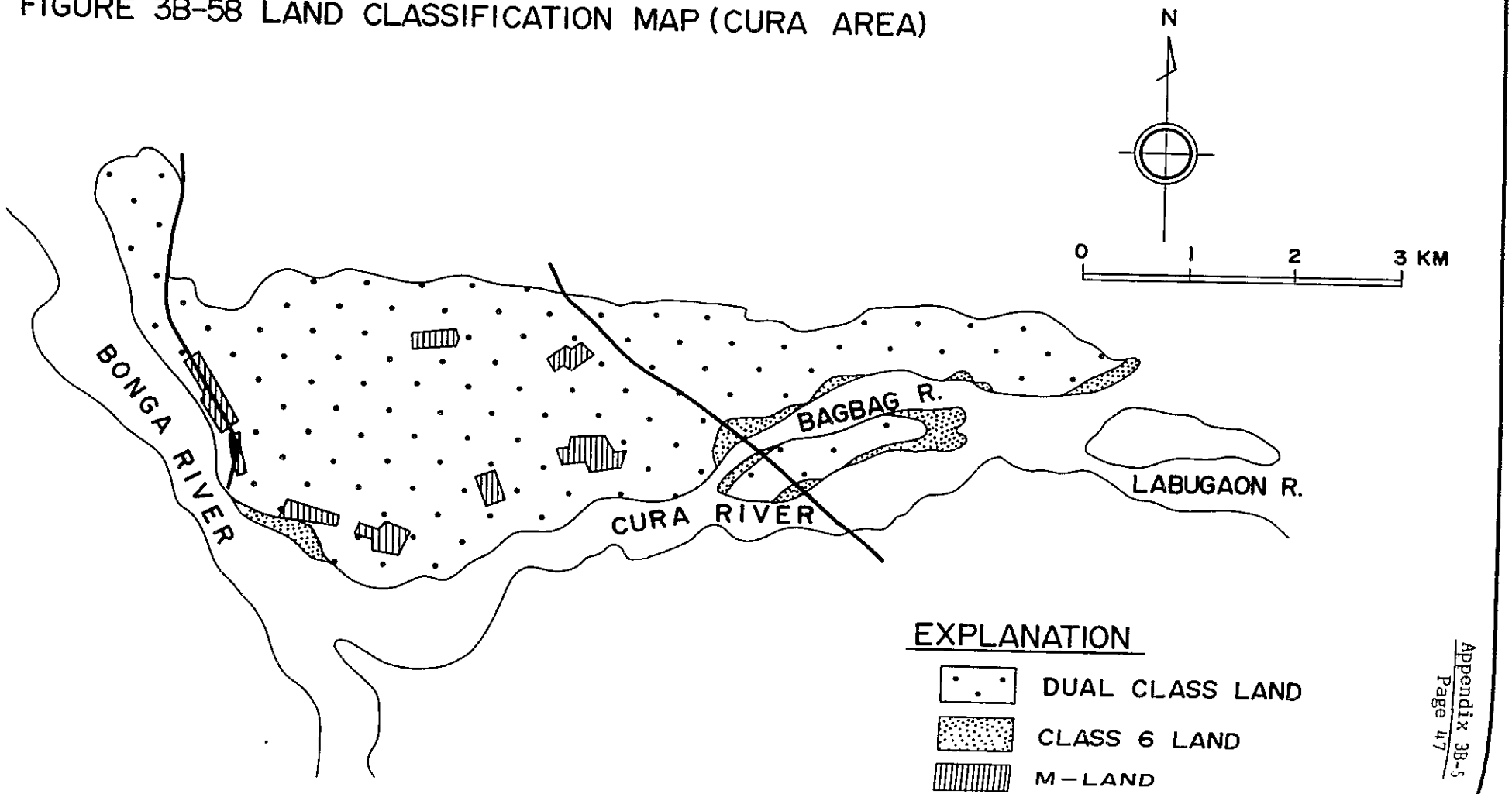


FIGURE 3B-59
LAND CLASSIFICATION MAP (NUEVA ERA AREA)

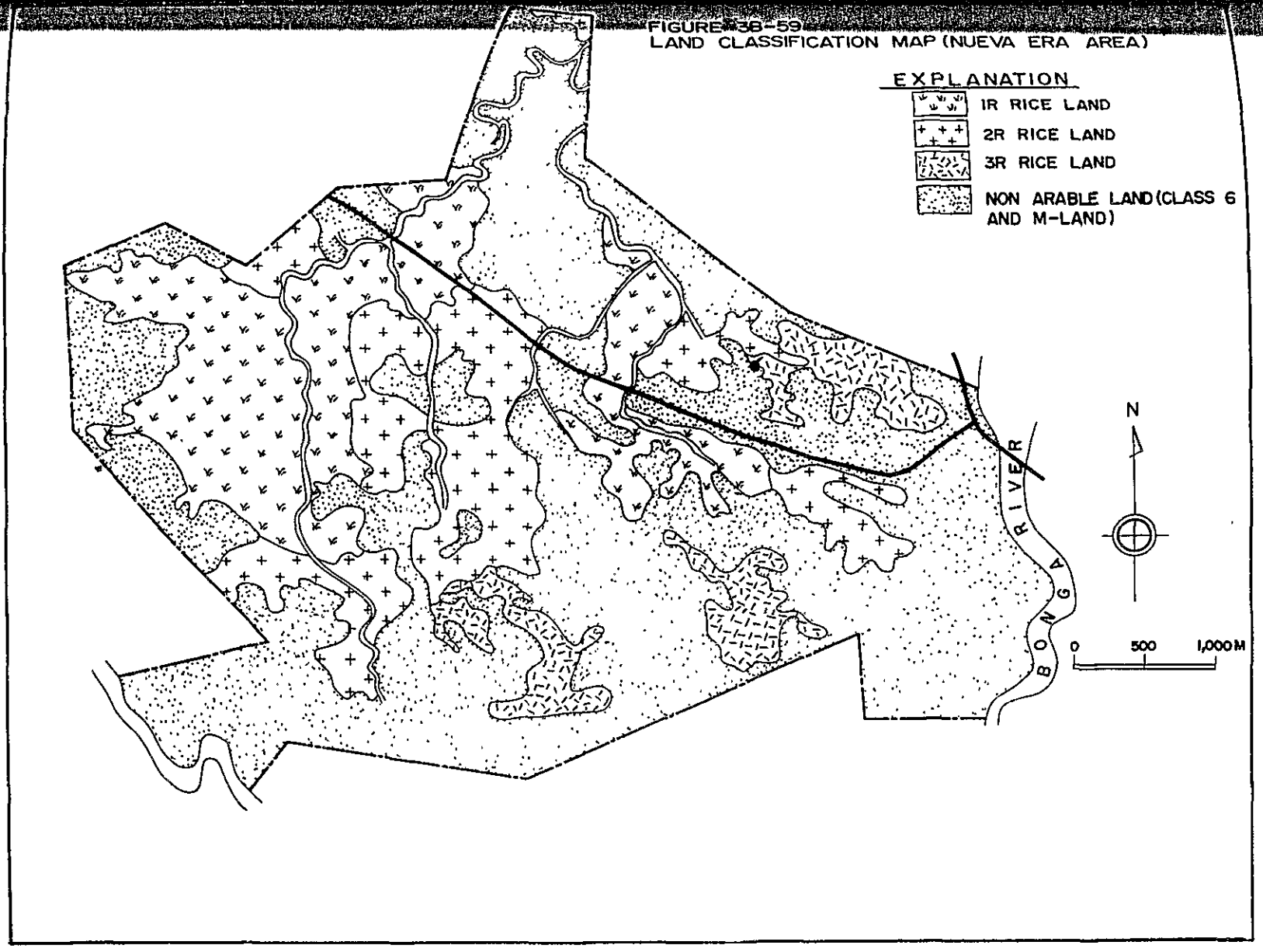
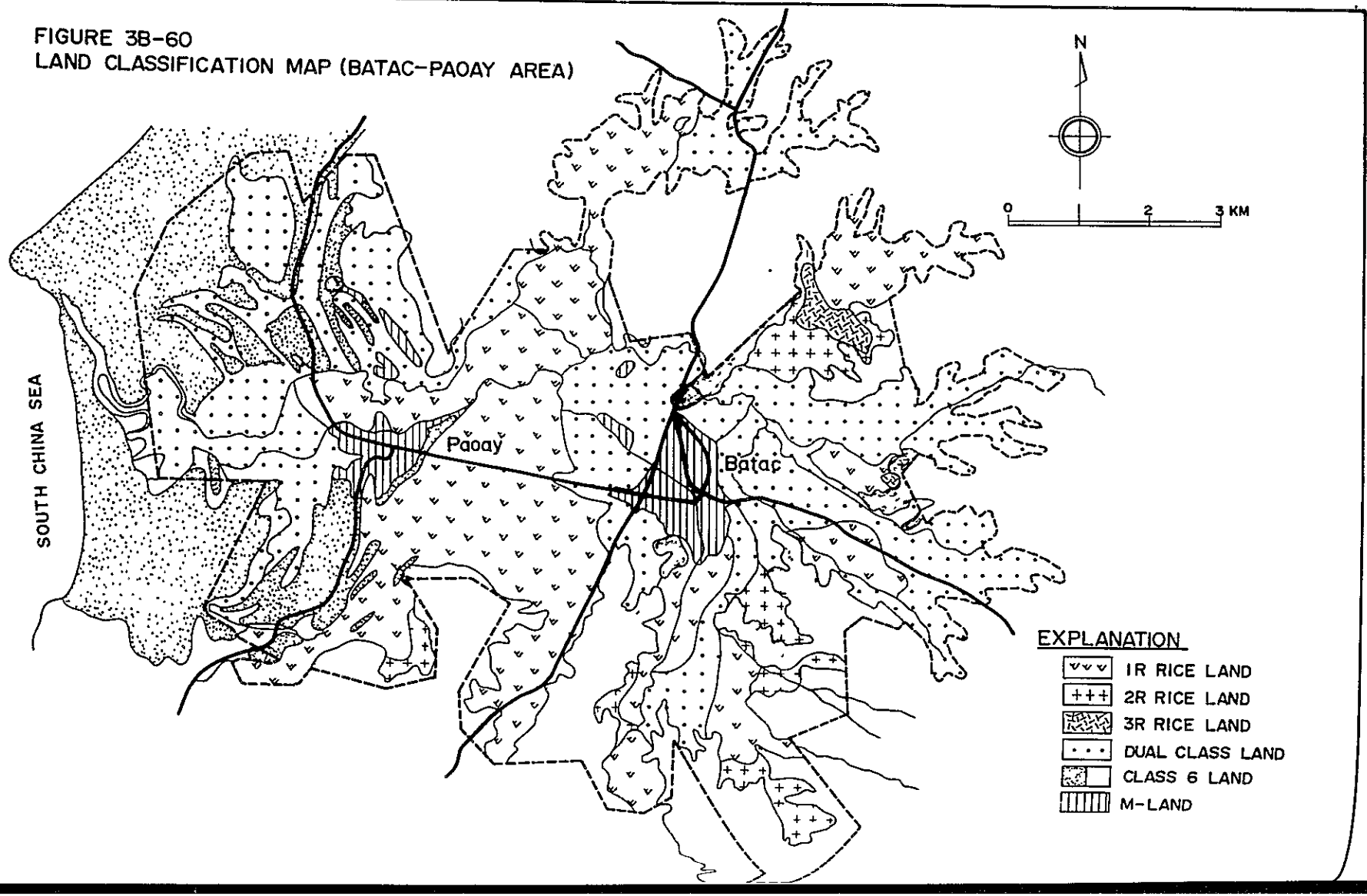


FIGURE 3B-60
LAND CLASSIFICATION MAP (BATAC-PAOAY AREA)



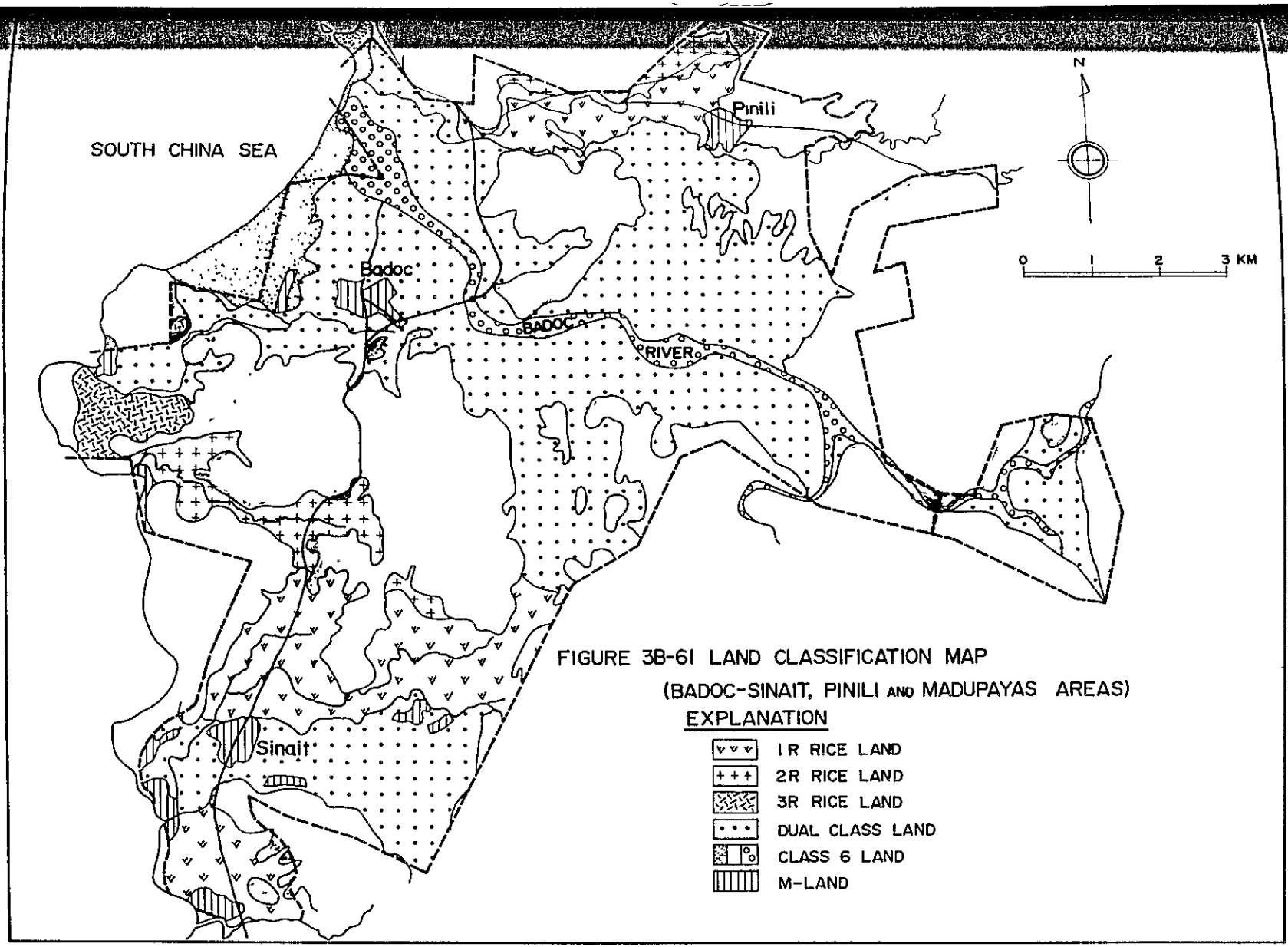


FIGURE 3B-61 LAND CLASSIFICATION MAP
(BADOC-SINAIT, PINILI AND MADUPAYAS AREAS)

Table 3C-1 Area of Communal Irrigation System in the Project Area (unit:ha)

Sub-Project Area	Area Covered	Cropping Area			
		Wet Season	Dry Season		
		Rice 1/	Rice 1/	Others 2/	Total
Cura	447	447	128	-	128
Nueva Era (L.B)	3	3	1	-	1
Sub-total	450	450	129	-	129
Madupayas	53	53	10	-	10
Batac-Paoay	1,439	1,439	282	767	1,049
Pinili	411	411	76	332	408
Badoc-Sinait	1,899	1,899	185	755	940
Sub-total	3,802	3,802	553	1,854	2,407
Total	4,252	4,252	682	1,854	2,536

Note: 1/ Irrigated by Communal Irrigation System

2/ Such other crops as tobacco, garlic and corn are mostly irrigated by Portable pumps.

Table 3C-2 Area of Communal Irrigation System (CIS) in the Project Area (Phase I and Phase II)

Province	Municipality	No. of CIS	Wet Season: Potential Area (ha.)	Wet Season: Irrigated Area (ha.)	Wet Season: Non-Irri. Area (ha.)	Wet Season: Sub-Total (ha.)	Dry Season: Irrigated Area: Gravity: Paddy (ha.)	Dry Season: Irrigated Area: Gravity: Upland (ha.)	Dry Season: Irrigated Area: Pump (ha.)	Dry Season: Non-Irrigated Area: Non-cultivated Area (ha.)	Dry Season: Non-Irrigated Area: Upland Crop (ha.)	Dry Season: Sub-Total (ha.)
Ilocos Norte	Solsona	49	2,373	2,373	-	2,373	1,436	-	-	937	-	2,373
	Dingras	55	2,923	2,923	-	2,923	1,264	-	-	319	1,340(0)[1/]	2,923
	Marcos	22	1,791	1,791	-	1,791	548	100(V.C)[2/]	0(C)	1,123	20(C)	1,791
	Espiritu	16	1,407	1,351	56	1,407	281	-	73(V.T)	953	100(V.T)[3/]	1,407
	Nueva Era	7	53	53	0	53	11	-	-	42	-	53
	Batac	34	1,119	1,119	-	1,119	220	-	647(T.G.M)[4/]	252	-	1,119
	Paoay	9	320	320	-	320	62	-	120(T.G.C)	138	-	320
	Pinili	5	411	411	-	411	76	-	335(T.G)	0	-	411
	Badoc	36	1,007	1,007	-	1,007	185	-	755(T.G)	67	-	1,007
	Sub-Total	233	11,404	11,348	56	11,404	4,083	100	1,930	3,831	1,460	11,404
Ilocos Sur	Sinait	10	945	945	0	945	10	-	-	935	-	945
	Sub-Total	10	945	945	0	945	10	-	-	935	-	945
	Total	243	12,349	12,293	56	12,349	4,093	100	1,930	4,760	1,460	12,349

Source: Provincial Irrigation Office in Ilocos Norte and Ilocos Sur as of 1977 and 1980.

Note: 1/ Other crops
2/ Vegetable, corn
3/ Vegetable, Tobacco
4/ Tobacco, garlic, mungo beans

Table 3D-1 Input Materials per Hectare

	Item	Input Materials	Unit	Paddy Rice 1/ Irrigated, Wet	Paddy Rice 1/ Irrigated, Wet	Paddy Rice 1/ Rainfed, Wet	1/ Virginia Tobacco	1/ Garlic	2/ Mungo
1	Input Materials per Hectare (Planted Area Base)	(a) Fertilizer, N	Kg	53.4	32.7	43.9	65.8	40.6	-
		, P_2O_5	Kg	13.0	7.5	15.5	19.2	14.1	-
		, K_2O	Kg	3.4	6.8	3.1	2.7	2.1	-
		(b) Pesticides, Liquid	qts.	0.57	0.28	0.46	1.82	0.09	-
		, Powder	Kg	2.84	0.11	0.47	-	-	-
		(c) Herbicides, Liquid	qts.	0.19	0.01	0.00	-	-	-
		, Powder	Kg	3.40	-	0.25	-	-	-
2	Ratio of Applied Area to Planted Area	(a) Fertilizer	%	100.0	65.5	96.5	92.5	82.8	N.A
		(b) Pesticides	%	74.3	44.8	55.7	87.0	10.1	N.A
		(c) Herbicides	%	34.5	1.1	11.2	-	-	N.A
3	Input Materials per Hectare (Harrested Area Base)	(a) Fertilizer, N	Kg	53.4	50.0	45.5	71.1	49.1	-
		, P_2O_5	Kg	13.0	11.5	16.0	20.7	17.1	-
		, K_2O	Kg	3.4	10.4	3.2	2.9	2.6	-
		(b) Pesticides, Liquid	qts.	0.77	0.63	0.81	1.93	0.89	0.26
		, Powder	Kg	3.83	0.25	0.84	-	-	-
		(c) Herbicides, Liquid	qts.	0.55	0.01	0.37	-	-	-
		, Powder	Kg	9.87	-	2.24	-	-	-

Source: 1/ Farm Management Survey in the Project Area, NIA LRED, 1978

2/ Based on "Costs and Returns of Palay, Corn and Other Selected Commodities, BAE (on 1975"

Table 3D-2 Input Materials Used in the Project, at Present

Input	Unit	Paddy Rice 1/ Irrigated,Wet (4,252 ha) Per ha	Paddy Rice 1/ Irrigated,Wet (4,252 ha) Amount	Paddy Rice 1/ Irrigated,Dry (682 ha) Per ha	Paddy Rice 1/ Irrigated,Dry (682 ha) Amount	Paddy Rice 1/ Rainfed,Wet (8,580 ha) Per ha	Paddy Rice 1/ Rainfed,Wet (8,580 ha) Amount	Virginia Tobacco 1/ (2,322 ha) Per ha	Virginia Tobacco 1/ (2,322 ha) Amount	Garlic 1/ (3,911 ha) Per ha	Garlic 1/ (3,911 ha) Amount	Mungo 2/ & Others (1,091 ha) Per ha	Mungo 2/ & Others (1,091 ha) Amount	Total (20.838 ha) Amount
								g	Kg	g	ton	Kg	Kg	
1 Seed	cav.	1.40	5,953	1.30	887	1.23	10,553	30.00	70	220.00	860	13.34	14,554	17,393
2 Fertilizer														
-45-0-0	bag	1.52	6,463	1.05	716	1.21	10,382	1.03	2,392	1.40	5,475	-	-	25,428
-21-0-0	"	0.76	3,232	0.17	116	0.36	3,089	0.54	1,254	1.83	7,157	-	-	14,848
-16-20-0	"	0.95	4,039	0.07	48	1.24	10.639	1.20	2,786	1.67	6,531	-	-	24,043
-12-12-12	"	0.49	2,083	0.09	61	0.11	944	0.11	255	0.14	548	-	-	3,891
-14-14-14	"	-	-	0.60	409	0.29	2,448	0.21	488	0.24	939	-	-	4,324
-15-15-15	"	-	-	0.28	191	0.05	429	-	-	0.03	117	-	-	737
Total			15,817		1,541		27,791		7,175		20,767			73,271
3 Pesticides														
-Liquid	qts.	0.57	2,424	0.28	191	0.46	3,947	1.82	4,226	0.09	352	0.26	284	11,424
-Powder	Kg	2.84	12,076	0.11	75	0.47	4,033	-	-	-	-	-	-	16,184
4 Herbicides														
-Liquid	qts.	0.19	808	0.01	7	0.00	0	-	-	-	-	-	-	808
-Powder	Kg	3.40	14,457	-	-	0.25	2,145	-	-	-	-	-	-	16,602

Source: 1/ Farm Management Survey in the Project Area, NIA, LRED, 1978

2/ Based on "Cost and Returns of Palay, Corn and Other Selected Commodities,BAE con 1975"

Note : (1) The figures in the parenthesis show the planted area of repective crops.

(2) Total amount of seed means the amount of paddy seeds only.

Table 3D-3 Crop Production, Paddy

Year	National			Ilocos Region			Ilocos Norte		
	Area ('000 ha)	Yield (ton/ha)	Production ('000 ton)	Area ('000 ha)	Yield (ton/ha)	Production ('000 ton)	Area ('000 ha)	Yield (ton/ha)	Production ('000 ton)
1970	3,113.4	1.7	5,233.4	343.4	1.9	644.2	N.A	N.A	N.A
1971	3,112.6	1.7	5,342.9	321.3	2.0	653.4	N.A	N.A	N.A
1972	3,246.4	1.6	5,100.1	421.5	1.6	652.0	34.7	2.1	72.7
1973	3,111.8	1.4	4,414.6	322.1	1.3	430.2	34.5	2.0	70.0
1974	3,436.8	1.6	5,594.1	351.4	1.5	540.2	35.2	2.4	83.5
1975	3,538.8	1.8	5,660.0	338.5	1.3	422.0	33.3	1.5	50.9
1976	3,579.3	1.7	6,159.5	342.6	1.7	577.5	36.4	2.0	72.4
1977	3,547.5	1.8	6,456.1	310.9	1.6	511.0	37.6	2.2	83.6
1978	3,508.9	2.0	6,894.9	317.7	1.8	575.8	38.5	2.2	83.3
1979	3,468.9	2.1	7,199.0	321.5	1.9	638.7	39.8	2.3	92.4
Average	3,366.4	1.7	5,805.5	339.1	1.7	564.5	36.3	2.1	76.1

Note : BAEcon

Source: Areas mean the harvested areas of respective crops

Table 3D-4 Crop Production, Virginia Tobacco

Year	National			Ilocos Region			Ilocos Norte		
	Area ('000 ha)	Yield (ton/ha)	Production ('000 ton)	Area ('000 ha)	Yield (ton/ha)	Production ('000 ton)	Area ('000 ha)	Yield (ton/ha)	Production ('000 ton)
1970	33.4	0.66	22.0	30.1	0.63	18.9	N.A	N.A	N.A
1971	29.0	0.69	20.0	26.4	0.66	17.4	N.A	N.A	N.A
1972	31.9	0.64	20.5	27.9	0.59	16.4	3.2	0.41	1.3
1973	32.1	0.66	21.1	27.2	0.57	15.6	3.0	0.40	1.2
1974	28.5	0.65	18.6	25.9	0.66	17.1	1.3	0.77	1.0
1975	36.0	0.62	22.2	25.4	0.68	17.3	1.7	0.59	1.0
1976	34.4	0.74	25.5	26.6	0.86	23.0	2.6	0.69	1.8
1977	30.8	0.73	22.5	27.5	0.77	21.2	2.9	0.76	2.2
1978	30.5	0.73	22.2	25.5	0.75	19.2	3.7	0.76	2.8
1979	N.A	N.A	N.A	N.A	N.A	N.A	3.8	0.68	2.6
Average	31.8	0.68	21.6	26.9	0.69	18.5	2.8	0.61	1.7

Note : BAEcon

Source: Areas mean the harvested areas of respective crops

Table 3D-5 Crop Production, Garlic

Year	National			Ilocos Region			Ilocos Norte		
	Area ('000 ha)	Yield (ton/ha)	Production ('000 ton)	Area ('000 ha)	Yield (ton/ha)	Production ('000 ton)	Area ('000 ha)	Yield (ton/ha)	Production ('000 ton)
1970	3.6	2.7	9.8	2.4	2.8	6.6	N.A	N.A	N.A
1971	3.7	2.7	10.2	2.8	2.7	7.5	N.A	N.A	N.A
1972	4.3	3.7	15.7	3.2	4.0	12.7	2.6	3.9	10.2
1973	4.1	3.7	15.1	3.1	3.9	12.2	2.9	3.9	11.3
1974	3.7	3.8	14.2	2.8	4.0	11.3	2.5	4.1	10.3
1975	4.2	3.8	16.0	3.2	3.7	11.8	2.7	3.7	9.9
1976	4.4	3.5	15.2	3.3	3.6	11.9	2.8	3.6	10.0
1977	4.9	3.3	16.0	3.8	3.3	12.4	3.3	3.2	10.5
1978	5.1	3.3	16.8	4.1	3.3	13.6	3.6	3.2	11.5
1979	4.8	2.9	14.0	3.4	2.8	9.6	2.9	3.5	7.4
Average	4.3	3.3	14.3	3.2	3.4	11.0	2.9	3.5	10.1

Note : BAE con

Source: Areas mean the harvested areas of respective crops

Table 3D-6 Crop Production, Mungbeans

Year	National			Ilocos Region			Ilocos Norte		
	Area ('000 ha)	Yield (ton/ha)	Production ('000 ton)	Area ('000 ha)	Yield (ton/ha)	Production ('000 ton)	Area ('000 ha)	Yield (ton/ha)	Production ('000 ton)
1970	38.1	0.4	16.0	1.7	0.5	0.8	N.A	N.A	N.A
1971	36.9	0.4	16.2	2.3	0.5	1.2	N.A	N.A	N.A
1972	37.9	0.5	17.4	2.3	0.6	1.3	1.5	0.5	0.7
1973	40.0	0.5	19.1	2.4	0.5	1.3	1.6	0.4	0.7
1974	37.5	0.4	16.1	11.3	0.5	5.3	1.6	0.3	0.5
1975	39.3	0.6	21.7	12.4	0.5	6.0	2.0	0.4	0.8
1976	43.3	0.6	24.4	12.1	0.9	10.8	2.4	0.4	0.9
1977	43.8	0.6	25.3	12.2	0.9	11.3	2.4	0.4	0.9
1978	45.1	0.6	26.2	N.A	N.A	N.A	2.7	0.4	1.0
1979	47.9	0.6	29.0	N.A	N.A	N.A	3.0	0.3	1.0
Average	41.0	0.5	21.1	7.1	0.7	4.8	2.2	0.4	0.8

Note : BAEcon

Source: Areas mean the harvested areas of respective crops

Table 3D-6-1 Crop Production, Cotton

- Philippines -

Year	Area (ha)	Production (ton)	Yield (ton/ha)
1977/78	3,162	1,700	0.537
1978/79	3,072	2,085	0.679
1979/80	7,083	7,100	1.002

Source: Philippine Cotton Cooperation (P.C.C.)

Table 3D-6-2 Cotton Production by Province

(Unit:tons)

	1977/78	1978/79	1979/80
Ilocos Norte	161	303	836
Ilocos Sur	1,110	886	1,554
Abra	381	82	175
Pangasinan	476	367	1,422
La Union	743	734	1,701
Tarlac	36	225	364
Nueva Ecija	226	487	278
Zambales	29	-	-
Others	-	8	-
Cagayan	-	-	510
Iloilo	-	-	177
Negros Occ.	-	-	34
Total	3,162	3,072	7,083

Source: P.C.C.

Table 3D-6-3 Crop Production, Onion

Year	Area (ha)	Production (ton)	Yield (ton/ha)
Philippines			
1975	12,750	52,854	4.15
1976	11,930	84,279	4.55
1977	11,540	75,355	6.53
1978	12,650	84,748	6.70
Ilocos Region			
1976 Green	3,060	13,842	4.52
Bulb	1,560	6,159	3.95
1977 Green	130	764	5.88
Bulb	1,600	8,291	5.18
1978 Green	160	837	5.23
Bulb	1,650	12,388	7.51
Ilocos Norte			
1977	115	139	1.21
1978	135	167	1.23
1979	137	166	1.21

Source: BAEcon

Table 3D-7 Crop Production Data in the Project Municipalities
(Crop Year 1971, Agricultural Census)

Item		Solsona	Dingras	Nueva Era	Batac	Paoay	Pinili	Badoc	Sinait	Total
1. Paddy Rice	Planted Area (ha)	1,783	2,513	527	2,639	786	1,384	1,926	247	11,805
(Irrigated, wet)	Yield (ton/ha)	1.68	1.61	1.08	1.15	1.15	2.20	1.37	1.43	1.49
	Production (ton)	2,996	4,037	569	3,027	905	3,042	2,637	353	17,566
2. Paddy Rice	Planted Area (ha)	251	819	34	47	17	70	143	0	1,381
(Irrigated, Dry)	Yeild (ton/ha)	1.46	2.09	1.29	1.02	1.00	1.86	1.20	0	1.80
	Production (ton)	367	1,708	44	48	17	130	172	0	2,486
3. Paddy Rice	Planted Area (ha)	5	248	29	3	270	56	73	1,313	1,997
(Rainfed)	Yield (ton/ha)	1.20	0.93	1.28	1.33	1.14	2.05	0.95	0.83	0.93
	Production (ton)	6	231	37	4	308	115	69	1,095	1,865
4. Paddy	Planted Area (ha)	0	6	0	2	0	4	37	0	49
(Upland)	Yield (ton/ha)	0	1.00	0	0.50	0	1.50	0.92	0	0.96
	Production (ton)	0	6	0	1	0	6	34	0	47
5. Virginia	Planted Area (ha)	-	111	3	1,103	55	553	250	542	2,617
Tobacco	Yield (ton/ha)	-	0.43	0.33	0.75	1.18	0.67	0.68	0.58	0.69
	Production (ton)	-	48	1	829	65	374	170	315	1,802
6. Garlic	Planted Area (ha)	-	35	-	130	107	224	880	0	1,376
	Yield (ton/ha)	-	0.46	-	0.82	3.11	2.88	0.72	0	1.26
	Production (ton)	-	16	-	107	333	645	630	0	1,731
7. Mungbeans	Planted Area (ha)	310	227	21	55	24	7	137	1	782
	Yield (ton/ha)	0.24	0.19	0.33	0.21	0.33	0.71	0.23	1.00	0.23
	Production (ton)	75	42	7	12	8	5	31	1	181

Table 3D-8 Crop Production in the Seven Project Municipalities

Year	Paddy												Total		
	Irrigated, Wet			Irrigated, Dry			Rainfed, Wet			Upland, Wet					
	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)
1972	7,921	2.33	18,483	875	2.18	1,905	6,377	1.42	9,041	257	0.94	241	15,430	1.92	29,670
1973	7,908	2.66	21,078	842	1.98	1,670	6,293	1.32	8,317	257	0.91	234	15,300	2.05	31,294
1974	7,780	2.45	19,074	960	2.72	2,610	6,608	2.35	15,551	257	1.05	271	15,605	2.40	37,506
1975	6,708	1.57	10,526	916	2.91	2,669	6,507	1.39	9,036	262	1.03	270	14,393	1.56	22,501
1976	7,407	2.07	15,316	1,740	2.44	4,251	6,384	1.92	12,243	223	1.03	229	15,754	2.03	32,039
1977	7,553	2.46	18,617	2,451	2.06	5,055	6,041	2.16	13,038	231	1.23	284	16,276	2.27	36,994
1978	8,301	2.36	19,572	2,496	1.88	4,690	5,695	2.15	12,253	173	1.52	263	16,665	2.21	36,778
1979	8,674	2.58	22,363	2,880	2.33	6,700	5,580	2.10	11,723	82	1.76	144	17,216	2.38	40,930
Mean	7,782	2.32	18,129	1,645	2.25	3,694	6,186	1.84	11,400	218	1.11	242	15,830	2.11	33,464

Year	Virginia Tobacco			Garlic			Mungbeans			Corn		
	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)
1972	1,691	0.43	722	1,442	3.98	5,741	785	0.47	372	1,121	0.53	590
1973	1,586	0.43	676	1,585	4.11	6,515	837	0.47	397	1,171	0.43	506
1974	690	0.83	570	1,424	4.07	5,801	837	0.29	244	1,583	0.42	663
1975	899	0.63	564	1,494	3.73	5,570	1,095	0.39	429	1,682	0.42	705
1976	1,351	0.77	1,037	1,578	3.55	5,602	1,233	0.38	469	1,633	0.45	736
1977	2,500	0.74	1,849	2,356	3.20	7,532	1,091	0.38	411	1,653	0.49	810
1978	3,138	0.75	2,349	2,559	3.23	8,275	1,251	0.38	474	1,760	0.60	1,054
1979	3,015	0.69	2,084	2,054	2.59	5,321	1,415	0.34	481	1,379	0.64	885
Mean	1,859	0.66	1,231	1,812	3.47	6,295	1,068	0.38	410	1,498	0.50	744

Note : Areas mean the harvested areas of respective crops in the seven Project Municipalities (Solsona, Dingras, Nueva Era, Batac, Paoay, Pinili and Badoc)

Source : BAI-CON, Ilocos Norte

Table 3D-9 Crop Production in Solsona Municipality

Year	Paddy												Total		
	Irrigated, Wet			Irrigated, Dry			Rainfed, Wet			Upland, Wet					
	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)
1972	1,997	2.31	4,614	85	2.52	214	229	1.36	312	38	0.92	35	2,349	2.20	5,175
1973	1,999	2.66	5,319	82	1.95	160	226	1.27	287	38	0.89	34	2,345	2.47	5,800
1974	1,967	2.44	4,803	94	2.63	247	238	2.25	536	38	1.03	39	2,337	2.41	5,625
1975	1,711	1.79	3,063	90	2.81	253	238	1.82	432	38	1.11	42	2,077	1.82	3,790
1976	1,889	2.36	4,462	171	2.35	403	234	2.50	585	32	1.09	35	2,326	2.35	5,485
1977	1,926	2.81	5,421	241	1.99	479	221	2.82	623	33	1.30	43	2,421	2.71	6,566
1978	2,116	2.69	5,701	245	1.60	444	209	2.80	586	25	1.60	40	2,595	2.61	6,771
1979	2,211	2.95	6,514	283	2.24	635	205	2.73	560	12	1.83	22	2,711	2.85	7,731
Mean	1,977	2.52	4,987	161	2.20	354	225	2.17	490	32	1.13	36	2,395	2.45	5,868

Year	Virginia Tobacco			Garlic			Mungbeans			Corn		
	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)
1972	9	0.34	3	12	3.79	46	319	0.48	155	164	0.49	81
1973	8	0.36	3	13	3.85	50	340	0.49	165	170	0.45	76
1974	4	0.61	2	11	4.18	46	340	0.30	102	231	0.43	100
1975	5	0.48	2	12	3.68	44	425	0.42	179	245	0.43	106
1976	7	0.63	4	13	3.42	44	501	0.39	196	238	0.47	111
1977	-	-	-	-	-	-	433	0.38	165	241	0.51	122
1978	-	-	-	-	-	-	497	0.38	190	256	0.62	158
1979	-	-	-	-	-	-	562	0.34	193	201	0.66	133
Mean	-	-	-	-	-	-	427	0.39	168	218	0.51	111

Note : Areas mean the harvested areas of respective crops
Source: BAEcon, Ilocos Norte

Table 3D-10 Crop Production in Dingras Municipality

Year	Paddy														
	Irrigated, Wet			Irrigated, Dry			Rainfed, Wet			Upland, Wet			Total		
	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)
1972	2,353	2.43	5,722	627	2.08	1,302	1,471	1.56	2,292	25	1.00	25	4,476	2.09	9,341
1973	2,354	2.84	6,678	602	2.00	1,209	1,452	1.45	2,105	25	0.92	23	4,433	2.26	10,015
1974	2,316	2.61	6,030	686	2.76	1,897	1,524	2.58	3,939	25	1.08	27	4,551	2.61	11,893
1975	2,116	1.84	3,893	655	2.96	1,940	1,478	1.84	2,719	28	1.25	35	4,277	2.01	8,587
1976	2,337	2.40	5,656	1,244	2.48	3,091	1,450	2.54	3,684	24	1.25	30	5,055	2.46	12,461
1977	2,385	2.88	6,873	1,752	2.10	3,674	1,372	2.86	3,923	25	1.48	37	5,534	2.62	14,507
1978	2,621	2.76	7,228	1,784	1.91	3,409	1,294	2.85	3,687	19	1.79	34	5,718	2.51	14,358
1979	2,739	3.01	8,258	2,059	2.37	4,871	1,268	2.78	3,527	9	2.11	19	6,075	2.75	16,675
Mean	2,403	2.62	6,292	1,176	2.27	2,674	1,414	2.29	3,235	23	1.26	29	5,015	2.43	12,227

Year	Virginia Tobacco			Garlic			Mungbeans			Corn		
	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)
1972	78	0.39	30	264	3.92	1,034	318	0.47	150	301	0.70	212
1973	73	0.39	28	290	3.92	1,137	339	0.47	160	313	0.47	147
1974	32	0.74	24	275	3.80	1,045	339	0.29	98	423	0.46	193
1975	42	0.56	24	274	3.66	1,003	424	0.41	173	450	0.46	205
1976	62	0.70	43	289	3.46	1,009	500	0.38	189	437	0.49	214
1977	282	0.71	199	60	2.97	178	318	0.38	121	442	0.53	235
1978	354	0.71	253	65	3.01	196	365	0.38	140	471	0.65	306
1979	161	0.62	99	52	2.42	126	417	0.35	147	369	0.70	258
Mean	136	0.55	75	196	3.65	716	377	0.39	147	400	0.55	221

Note: Area mean the harvested area of the particular
Source: PAO

Table 3D-11 Crop Production in Nueva Era Municipality

Year	Paddy														
	Irrigated, Wet			Irrigated, Dry			Rainfed, Wet			Upland, Wet			Total		
	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)
1972	252	2.10	529	21	2.57	54	469	1.35	635	49	0.94	46	791	1.60	1,264
1973	252	2.42	609	20	1.75	35	462	1.26	583	49	0.90	44	783	1.62	1,271
1974	248	2.22	550	23	2.04	54	486	2.24	1,091	49	1.04	51	806	2.17	1,746
1975	274	1.72	471	22	0.55	55	462	1.71	792	49	1.12	55	807	1.70	1,373
1976	302	2.25	686	42	1.83	87	453	2.37	1,074	42	1.12	47	839	2.26	1,894
1977	308	2.71	834	59	1.54	104	429	2.66	1,143	43	1.33	57	839	2.55	2,138
1978	339	2.59	877	60	1.60	96	404	2.66	1,074	32	1.66	53	835	2.51	2,100
1979	354	2.83	1,002	69	1.99	137	396	2.60	1,028	15	1.93	29	834	2.63	2,196
Mean	291	2.38	694	40	1.85	74	445	2.09	928	41	1.17	48	817	2.14	1,748

Year	Virginia Tobacco			Garlic			Mungbeans			Corn		
	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)
1972	21	0.36	8	10	3.78	38	25	0.47	12	101	0.47	48
1973	21	0.36	7	11	3.78	42	27	0.46	13	111	0.41	46
1974	9	0.70	6	10	3.82	38	27	0.28	8	151	0.40	60
1975	12	0.52	6	10	3.67	37	33	0.41	14	160	0.40	64
1976	18	0.64	11	11	3.69	37	39	0.38	15	156	0.64	67
1977	3	0.71	2	-	-	-	29	0.70	10	158	0.46	73
1978	4	0.68	3	-	-	-	33	0.36	12	169	0.56	95
1979	17	0.82	14	-	-	-	38	0.32	12	133	0.61	80
Mean	13	0.54	7	-	-	-	31	0.39	12	142	0.70	67

Note : Area mean the harvested areas of respective crops
Source: BAEcon

Table 3D-12 Crop Production in Batac Municipality

Year	Paddy														
	Irrigated, Wet			Irrigated, Dry			Rainfed, Wet			Upland, Wet			Total		
	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)
1972	618	1.14	1,486	53	2.25	119	1,944	1.39	2,716	31	0.94	29	2,646	1.64	4,350
1973	621	2.40	1,711	52	1.91	99	1,918	1.30	2,497	31	0.90	28	2,622	1.65	4,335
1974	611	2.75	1,545	59	2.60	154	2,014	2.30	4,672	31	1.03	32	2,715	2.36	6,403
1975	538	2.53	646	56	2.81	157	2,014	1.22	2,457	33	0.82	27	2,641	1.24	3,287
1976	594	1.20	939	106	2.35	249	1,976	1.70	3,329	28	0.82	23	2,704	1.68	4,540
1977	606	1.60	1,145	149	2.00	298	1,870	1.90	3,545	29	1.03	30	2,654	1.89	5,018
1978	666	1.89	1,199	152	1.82	277	1,762	1.89	3,332	22	1.27	28	2,602	1.86	4,836
1979	696	1.97	1,371	175	2.25	394	1,726	1.85	3,188	10	1.50	15	2,607	1.91	4,968
Mean	619	2.03	1,256	100	2.18	218	1,903	1.69	3,217	27	1.00	27	2,649	1.78	4,717

Year	Virginia Tobacco			Garlic			Mungbeans			Corn		
	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)
1972	977	0.47	455	93	4.02	373	28	0.46	13	173	0.45	78
1973	916	0.47	427	102	4.03	411	30	0.46	14	179	0.41	74
1974	398	0.91	360	90	4.19	377	30	0.28	9	242	0.40	97
1975	518	0.69	356	96	3.77	362	37	0.40	15	257	0.40	103
1976	780	0.84	655	101	3.61	364	44	0.37	16	250	0.43	108
1977	1,246	0.78	965	223	3.31	739	76	0.37	28	252	0.47	119
1978	1,564	0.78	1,226	242	3.35	811	87	0.37	33	268	0.58	155
1979	1,594	0.72	1,153	194	2.69	521	98	0.34	33	210	0.62	130
Mean	999	0.70	700	143	3.46	495	54	0.37	20	229	0.47	108

Note: Areas are the harvested areas of the respective crops in each year.

Table 3D-13 Crop Production in Paoay Municipality

Year	Paddy														
	Irrigated, Wet			Irrigated, Dry			Rainfed, Wet			Upland, Wet			Total		
	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)
1972	1,178	2.28	2,684	12	2.09	25	952	1.30	1,240	67	0.96	64	2,209	1.82	4,013
1973	1,166	2.52	2,942	11	1.90	21	940	1.21	1,143	67	0.93	62	2,184	1.91	4,168
1974	1,147	2.32	2,657	13	2.49	32	987	2.15	2,139	67	1.07	72	2,214	2.21	4,900
1975	1,036	1.11	1,147	12	2.76	33	987	1.13	1,113	67	1.03	69	2,102	1.12	2,362
1976	1,144	1.45	1,671	23	2.30	53	968	1.55	1,508	57	1.02	58	2,192	1.50	3,290
1977	1,167	1.74	2,031	33	1.90	63	916	1.75	1,606	59	1.20	71	2,175	1.73	3,771
1978	1,282	1.67	2,135	34	1.71	58	864	1.75	1,509	44	1.50	66	2,224	1.69	3,768
1979	1,340	1.82	2,440	39	2.13	83	846	1.71	1,444	21	1.71	36	2,246	1.78	4,003
Mean	1,183	1.87	2,213	22	2.09	46	934	1.57	1,463	56	1.10	62	2,193	1.73	3,785

Year	Virginia Tobacco			Garlic			Mungbeans			Corn		
	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)
1972	409	0.37	152	186	3.66	680	46	0.44	20	191	0.44	84
1973	383	0.37	142	204	3.67	948	49	0.44	22	199	0.40	80
1974	167	0.72	120	181	3.80	687	49	0.27	13	268	0.39	104
1975	217	0.55	118	193	3.42	660	61	0.38	23	285	0.39	111
1976	327	0.67	218	204	3.25	664	72	0.36	26	276	0.42	116
1977	62	0.73	45	183	3.20	586	34	0.37	13	279	0.46	127
1978	77	0.75	57	199	3.23	644	39	0.37	14	297	0.56	166
1979	78	0.69	54	160	2.59	414	44	0.33	15	233	0.60	139
Mean	215	0.53	113	189	3.49	660	55	0.33	18	254	0.46	116

Note : Areas mean the harvested areas of respective crops
Source: BAEcon

Table 3D-14 Crop Production in Pinili Municipality

Year	Paddy														
	Irrigated, Wet			Irrigated, Dry			Rainfed, Wet			Upland, Wet			Total		
	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)
1972	798	2.13	1,695	3	2.00	6	793	1.35	1,068	26	0.88	23	1,620	1.72	2,792
1973	795	2.40	1,907	3	1.67	5	783	1.25	982	26	0.85	22	1,607	1.81	2,916
1974	782	2.25	1,762	3	2.67	8	822	2.22	1,837	26	1.00	26	1,633	2.22	3,633
1975	139	1.03	143	3	2.67	8	844	1.06	890	26	0.48	21	1,012	1.05	1,062
1976	154	1.35	208	6	2.10	13	828	1.45	1,205	22	0.82	18	1,010	1.43	1,444
1977	155	1.64	254	9	1.65	15	784	1.64	1,284	23	1.04	24	971	1.62	1,577
1978	172	1.55	267	9	1.52	14	739	1.63	1,206	17	1.29	22	937	1.61	1,509
1979	180	1.69	305	10	2.00	20	724	1.59	1,154	8	1.50	12	922	1.08	1,491
Mean	397	2.06	818	6	1.83	11	790	1.52	1,203	22	0.95	21	1,214	1.69	2,053

Year	Virginia Tobacco			Garlic			Mungbeans			Corn		
	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)
1972	119	0.37	44	309	3.96	1,225	21	0.42	9	110	0.44	48
1973	112	0.37	41	340	3.96	1,348	22	0.43	9	115	0.40	46
1974	48	0.72	34	302	4.10	1,238	22	0.27	6	153	0.39	60
1975	63	0.54	34	320	3.71	1,189	78	0.13	10	163	0.39	64
1976	95	0.66	63	338	3.54	1,196	33	0.34	11	157	0.42	66
1977	625	0.70	439	383	3.18	1,219	10	0.37	4	159	0.46	74
1978	785	0.71	557	416	3.22	1,339	11	0.38	4	169	0.57	96
1979	800	0.65	524	334	2.58	861	13	0.33	4	131	0.61	80
Mean	331	0.66	217	343	3.50	1,203	26	0.27	7	145	0.46	67

Note: Area means the harvested area in hectares.

Table 3D-1 [illegible] Production in Bido Municipality

Year	Paddy														
	Irrigated, Wet			Irrigated, Dry			Rainfed, Wet			Upland, Wet			Total		
	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)
1972	725	2.42	1,753	74	2.49	185	519	1.50	778	21	0.90	19	1,339	2.04	2,735
1973	721	2.65	1,912	72	1.95	141	512	1.39	715	21	1.00	21	1,326	2.10	2,789
1974	709	2.54	1,727	82	2.66	218	537	2.47	1,337	21	1.14	24	1,349	2.45	3,306
1975	894	1.30	1,163	78	2.86	223	484	1.31	633	21	1.00	21	1,477	1.38	2,040
1976	987	1.70	1,694	148	2.40	355	475	1.80	858	18	1.00	18	1,628	1.80	2,925
1977	1,006	2.05	2,059	208	2.03	422	449	2.04	914	19	1.16	22	1,682	2.03	3,417
1978	1,105	1.96	2,165	212	1.85	392	423	2.03	859	14	1.42	20	1,754	1.96	3,436
1979	1,154	2.14	2,473	245	2.29	560	415	1.98	822	7	1.57	11	1,821	2.12	3,866
Mean	913	2.05	1,868	140	2.23	312	477	1.81	865	18	1.11	20	1,540	1.99	3,064

Year	Virginia Tobacco			Garlic			Mungbeans			Corn		
	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)
1972	78	0.39	30	568	4.13	2,345	28	0.46	13	82	0.47	39
1973	73	0.39	28	625	4.13	2,579	30	0.46	14	84	0.44	37
1974	32	0.74	24	555	4.27	2,370	30	0.28	8	115	0.43	49
1975	42	0.56	24	589	3.86	2,275	37	0.40	15	122	0.43	52
1976	62	0.70	43	622	3.68	2,288	44	0.37	16	119	0.45	54
1977	282	0.71	199	1,507	3.19	4,810	191	0.37	70	122	0.49	60
1978	354	0.71	253	1,637	3.23	5,285	219	0.37	81	130	0.60	78
1979	365	0.66	240	1,314	2.69	3,399	248	0.34	82	102	0.64	65
Mean	161	0.65	105	927	3.42	3,169	103	0.36	37	110	0.49	54

Note : Area mean the harvested areas of respective crops
Source: BAEcon

Table 3D-16 Paddy Rice Production under Masagana 99 Program

Municipality	Phase	W/Credit				W/O Credit			
		Nos. of Farmer	Area (ha)	Yield (cav./ha)	Production (cav.)	Nos. of Farmer	Area (ha)	Yield (cav./ha)	Pro...
Solsona	VIII	-	-	-	-	1,198	775	84	
	IX	6	7	82	574	2,524	1,893	80	
	X	17	26	61	1,586	1,365	963	61	
	XI	10	10	80	800	2,200	2,091	80	
	XII	-	-	-	-	785	655	79	
	XIII	-	-	-	-	1,949	1,459	80	
Dingras	VIII	-	-	-	-	2,046	1,535	73	
	IX	50	62	82	5,084	1,774	1,331	80	
	X	-	-	-	-	1,873	1,405	51	
	XI	31	31	80	2,480	2,826	2,116	84	
	XII	-	-	-	-	1,280	1,035	83	
	XIII	-	-	-	-	1,466	1,100	88	
Nueva Era	VIII	-	-	-	-	396	289	67	
	IX	10	12	72	864	1,095	947	66	
	X	-	-	-	-	285	206	63	
	XI	5	5	70	350	1,666	1,248	71	
	XII	-	-	-	-	355	200	79	
	XIII	-	-	-	-	398	299	63	
Batac	VIII	-	-	-	-	-	-	-	
	IX	61	50	65	3,255	1,416	955	64	
	X	-	-	-	-	15	10	50	
	XI	4	4	70	280	1,470	1,190	76	
	XII	-	-	-	-	-	-	-	
	XIII	34	54	70	3,780	880	660	62	
Paoay	VIII	-	-	-	-	-	-	-	
	IX	122	23	68	1,564	1,686	1,242	59	
	X	-	-	-	-	-	-	-	
	XI	-	-	-	-	1,809	1,357	60	
	XII	-	-	-	-	-	-	-	
	XIII	-	-	-	-	1,365	965	70	
Pinili	VIII	-	-	-	-	-	-	-	
	IX	67	75	65	4,875	1,233	931	68	
	X	-	-	-	-	-	-	-	
	XI	29	36	65	2,340	1,585	1,189	64	
	XII	-	-	-	-	-	-	-	
	XIII	74	74	70	5,180	1,180	884	64	
Badoc	VIII	-	-	-	-	191	119	47	
	IX	136	133	72	9,512	2,721	1,907	65	
	X	-	-	-	-	123	55	62	
	XI	-	-	-	-	1,785	1,339	80	
	XII	-	-	-	-	246	138	78	
	XIII	-	-	-	-	1,925	1,444	82	
Sinait	VIII	-	-	-	-	-	-	-	
	IX	-	-	-	-	1,300	1,200	65	
	X	-	-	-	-	-	-	-	
	XI	-	-	-	-	1,300	1,200	65	
	XII	-	-	-	-	-	-	-	
	XIII	38	45	80	3,600	1,230	1,174	75	
Total	VIII	-	-	-	-	3,831	2,718	74	
	IX	452	362	71	25,728	13,749	10,446	69	
	X	17	26	61	1,586	3,661	2,639	55	
	XI	79	86	72	6,250	14,641	11,730	74	
	XII	-	-	-	-	2,666	2,028	81	
	XIII	146	173	73	12,560	10,393	7,985	75	
	Total	694	647	71	46,124	48,941	37,546	72	

Source: BPI, Ilocos Norte, Ilocos Sur

Note : Phase VIII 1976, Nov. - 1977, Apr. (Dry Season)
IX 1977, May - 1977, Oct. (Wet Season)
X 1977, Nov. - 1978, Apr. (Dry Season)
XI 1978, May - 1978, Oct. (Wet Season)
XII 1978, Nov. - 1979, Apr. (Dry Season)
XIII 1979, May - 1979, Oct. (Wet Season)

Table 4.-1. Yield of Dry Clean Paddy Rice at Different Fertilizer Dosages

(Unit: Cavan of 50 kg per ha)

Municipality	Year	Trial		Fertilizer Dosages (kg/ha)										
				0-0-0	0-30-30	35-0-0	70-0-0	70-0-30	70-30-0	70-30-30	70-30-60	70-60-30	105-0-0	105-30-30
Badoc	1978	I	A	-	-	-	-	-	-	-	-	-	-	-
			B	-	-	-	-	-	-	-	-	-	-	-
		II	A	70.4	87.9	-	-	96.2	93.1	99.4	83.9	81.8	-	86.9
			B	93.0	95.1	-	-	111.7	108.1	111.2	113.2	102.8	-	94.1
	1979	I	A	-	-	-	-	-	-	-	-	-	-	-
			B	-	-	-	-	-	-	-	-	-	-	-
		II	A	-	-	-	-	-	-	-	-	-	-	-
			B	-	-	-	-	-	-	-	-	-	-	-
Solsona	1978	I	A	55.6	-	43.3	58.3	71.4	80.1	74.3	-	-	61.0	-
			B	34.6	-	51.6	59.2	60.1	73.1	67.6	-	-	67.4	-
		II	A	-	-	-	-	-	-	-	-	-	-	-
			B	31.1	34.1	-	-	61.9	54.2	57.7	63.0	62.1	-	59.7
	1979	I	A	-	-	-	-	-	-	-	-	-	-	-
			B	-	-	-	-	-	-	-	-	-	-	-
		II	A	-	-	-	-	-	-	-	-	-	-	-
			B	-	-	-	-	-	-	-	-	-	-	-
Dingras	1978	I	A	33.6	-	34.4	48.8	49.1	59.3	56.2	-	-	59.0	-
			B	31.4	-	35.6	39.3	46.9	48.7	53.6	-	-	59.0	-
		II	A	27.1	37.2	-	-	42.8	47.8	53.5	48.1	55.0	-	65.6
			B	29.5	72.0	-	-	46.5	53.4	57.8	53.3	62.3	-	74.9
Average Yield				45.1	65.2	41.2	51.4	65.2	68.6	70.1	72.3	72.8	61.6	76.2

Source: BAExt., Ilocos Norte (FAO/NFAC/JICA Fertilizer Trial)

Table 3D-18 Yield of Wet Season Paddy Rice at Different Fertilizer Dosages

(Unit: Cavan of 50 kg per ha)

Municipality	Year	Trial		Fertilizer Dosages (kg/ha)										
				0-0-0	0-30-30	35-0-0	70-0-0	70-0-30	70-30-0	70-30-30	70-30-60	70-60-30	105-0-0	105-30-30
Badoc	1978	I	A	50.3	-	68.6	74.7	82.7	81.3	82.7	-	-	77.1	-
			B	47.5	-	49.4	77.1	77.6	94.0	72.9	-	-	90.7	-
		II	A	31.5	43.2	-	-	76.6	83.2	84.1	76.6	87.0	-	99.6
			B	88.8	79.4	-	-	94.0	102.9	102.0	83.7	103.4	-	113.7
	1979	I	A	77.1	-	86.5	94.5	94.5	108.1	117.0	-	-	94.9	-
			B	54.1	-	39.0	64.4	60.6	84.1	81.3	-	-	48.9	-
		II	A	81.3	92.6	-	-	110.5	131.6	112.3	94.0	111.4	-	119.9
			B	-	-	-	-	-	-	-	-	-	-	-
Solsona	1978	I	A	26.3	-	55.0	62.0	80.4	69.6	86.5	-	-	87.4	-
			B	70.0	-	63.5	96.4	103.9	107.6	98.7	-	-	106.2	-
		II	A	78.0	95.9	-	-	96.4	99.2	98.2	94.0	103.9	-	102.0
			B	39.0	41.4	-	-	78.0	83.7	85.1	89.3	85.5	-	95.4
	1979	I	A	44.7	-	64.4	111.9	90.7	115.6	96.8	-	-	108.6	-
			B	-	-	-	-	-	-	-	-	-	-	-
		II	A	48.9	61.1	-	-	71.9	80.0	83.7	79.0	104.8	-	103.4
			B	30.1	32.9	-	-	50.3	63.5	63.5	57.8	65.8	-	79.9
Dingras	1979	I	A	79.0	-	83.7	87.0	88.4	95.4	102.9	-	-	113.3	-
			B	-	-	-	-	-	-	-	-	-	-	-
		II	A	46.5	55.0	-	-	70.0	75.7	83.2	78.5	70.1	-	94.0
			B	67.7	72.9	-	-	93.1	79.4	101.1	85.5	84.4	-	95.4
Average Yield				56.5	63.8	64.0	83.1	83.5	91.5	91.3	82.1	90.1	90.8	100.4

Source: BAR I (Q) on North (FAO/UNDP/DCA Fertilizer Trial)

Table 3D-19 Analysis on Contribution Factors to Crop Production Increase

Crop	A (1972 - 1974) Harvested Area (ha) 1/	Yield (ton/ ha) 2/	Production (ton) 3/	B (1977 to 1979) Harvested Area (ha) 4/	Yield (ton/ ha) 5/	Production (ton) 6/	Increase of Production (B-A) Total (ton) 7/	by Area Increase (ton) 8/	by Yield Increase (ton) 9/	Increase of Production per year (kg/year) 10/
1. Paddy	15,445	2.13	32,823	16,719	2.29	38,234	5,411 (100%)	2,917 (54%)	2,494 (46%)	32
2. Virgina Tobacco	1,322	0.50	656	2,884	0.73	2,094	1,438 (100%)	1,140 (79%)	298 (21%)	46
3. Garlic	1,484	4.05	6,019	2,323	3.03	7,043	1,024 (100%)	2,542 (248%)	-1,518 (-148%)	-204
4. Mungbeans	820	0.41	338	1,252	0.36	455	117 (100%)	156 (133%)	-39 (-33%)	-10

Note: 7/ = 6/ - 3/
8/ = 4/ - 1/ x 5/
9/ = 7/ - 8/

Source: BEAcon Crop Production Data in the Seven Project Municipalities

Table 3D-20 Number of Served Farm and Population of Livestock and Poultry
(As of 1979)

Item	Municipality	Carabao	Cattle	Horse	Hogs	Goats	Sheep	Chicken	Ducks
1.Nos.of Served Farm	Solsona	1,450	2,622	98	1,856	134	5	1,340	15
	Dingras	1,152	1,766	31	826	36	10	1,168	6
	Nueva Era	1,116	1,400	14	738	244	38	800	8
	Batac	1,910	776	27	610	142	50	530	6
	Paoay	1,218	1,392	20	968	466	40	360	5
	Pinili	1,454	532	20	1,334	200	30	1,530	10
	Badoc	1,462	1,130	44	1,050	196	200	886	13
	Sinait	2,133	456	18	481	277	-	645	7
	Total	11,895	10,074	272	7,863	1,695	373	7,259	70
2.Population	Solsona	1,539	5,691	110	3,550	158	13	12,584	100
	Dingras	1,643	3,282	31	3,948	210	20	19,503	45
	Nueva Era	849	948	67	1,021	552	115	4,589	29
	Batac	2,411	5,774	32	35,372	1,709	126	63,549	52
	Paoay	1,405	1,836	25	2,696	1,354	80	14,540	40
	Pinili	2,524	1,752	38	2,913	2,905	75	43,797	293
	Badoc	2,483	2,192	53	8,182	1,121	267	45,100	497
	Sinait	2,773	1,003	25	3,749	1,549	-	19,997	125
	Total	15,627	22,478	381	61,431	9,558	696	223,659	1,181
3.Ave.number per Farm		1.3	2.2	1.4	7.8	5.6	1.8	31.0	17.0

Source: BAI, Ilocos Norte, Ilocos Sur

Table 3D-21 Number of Carabao by Municipality

Municipality	Total Number of Farm	Nos.of Farm Rasing Carabao	Nos.of Carabao by Age Group			Nos.of Work Carabao	Nos.of Female Carabao, 3 years and over
			All Ages	Under 3 years	3 years and over		
Solsona	1,738	911	1,244	250	994	874	232
Dingras	2,689	1,754	2,352	203	2,149	1,930	265
Nueva Era	434	364	666	167	499	410	50
Batac	2,851	2,628	3,330	197	3,133	3,031	217
Paoay	1,118	913	1,069	30	1,039	884	47
Pinili	1,703	1,547	2,339	471	1,868	1,714	529
Badoc	2,515	1,781	2,139	167	1,972	1,860	230
Total	13,048	9,898	13,139	1,485	11,654	10,703	1,570
(percent)	(100.0)	(75.9)	(100.0)	(11.3)	(88.7)	(81.5)	(11.9)

Source: Agricultural Census, 1971

Table 3D-22 Number of Cattle by Municipality

Municipality	Total Number of Farm	Nos.of Farm Raising Cattle	Nos.of Cattle by Age Group			Nos.of Work Cattle	Nos.of Female Cattle, 2 years and over
			All Ages	Under 2 years	2 years and over		
Solsona	1,738	1,442	4,096	1,381	2,715	833	1,667
Dingras	2,689	2,065	5,287	1,292	3,995	1,479	1,746
Nueva Era	434	175	727	249	478	34	25
Batac	2,851	796	1,395	324	1,071	411	336
Paoay	1,118	691	1,136	247	889	395	213
Pinili	1,703	742	1,402	425	977	461	429
Badoc	2,515	1,274	1,902	469	1,433	782	467
Total	13,048 (100.0)	7,185 (55.1)	15,945 (100.0)	4,387 (27.5)	11,558 (72.5)	4,395 (62.7)	4,883 (30.6)

Source: Agricultural Census, 1971

Table 3D-23 Population, Households and Farm Households in the Project Area

Sub-project	Municipality	Barangay	*/ Population 1/	Nos. of Households 1/	% of Farm Households 2/	Nos. of Farm Households	Samahang Nayon 3/
1 Cura	a. Solsona	(1) Bagbag	365	69	84	58	S
		(2) Bubuos	423	77	84	65	S
		(3) Capurictan	705	128	83	106	S
		(4) San Juan	376	73	97	71	S
		Sub-total	1,869	347		300	-
	b. Dingras	(1) Bagut	659	121	93	113	S
		(2) Mandaloque	635	120	100	120	S
		(3) Sagpatan	1,250	248	100	248	S
		(4) San Esteban	476	103	94	97	-
		Sub-total	3,020	592		578	-
		Total	4,889	939		878	
2 Nueva Era	a. Espiritu	(1) Binacag	394	88	99	87	-
	b. Nueva Era	(1) Pagpagong	346	61	85	52	-
		(2) Garnaden	200	35	94	33	S
		(3) Bugayong	143	27	78	21	-
		Sub-total	689	123		106	-
	c. Pinili	(1) Lumbean/Bicbica	540	118	100	118	S
		Total	1,623	329		311	
3 Madupayas	a. Nueva Era	(1) Uguis	423	84	81	68	-
	b Badoc	(1) Camnga	661	141	100	141	-
		Total	1,084	225		209	
4 Batac-Paoay	a Batac	(1) Poblacion	9,653	1,672	29	485	-
		(2) Baligat	1,140	245	59	145	S
		(3) Quiling Norte	711	147	86	126	S
		(4) Quiling Sur	1,063	192	70	134	S
		(5) Tabug	1,404	273	80	218	S
4 Batac-Paoay	a. Batac	(6) Magnuang	1,174	244	96	234	S
		(7) Sumader	911	168	81	136	S
		(8) Payao *	495	98	100	98	S
		(9) Paranpong	683	125	100	125	S
		(10) Capacuan *	226	37	89	33	S
		(11) Naguirangan	588	105	96	101	S
		(12) San Mateo	797	125	95	119	S
		(13) San Pedro	715	130	99	129	S
		(14) Baoa East *	245	49	100	49	-
		(15) Baoa West	834	168	91	153	S
		(16) Palongpong	958	161	88	142	S
		(17) Nagbacalan	588	105	94	99	S
		(18) Rayuray	648	122	69	84	S
		Sub-total	22,833	4,166		2,610	
	b. Paoay	(1) Poblacion	3,530	718	65	467	-
		(2) San Juan *	127	27	50	14	S
		(3) Laoa	235	49	85	42	-
		(4) Nalasin	889	166	72	120	S
		(5) Surgui	629	134	95	127	S
		(6) San Agustin	578	111	100	111	S
		(7) San Pedro	350	71	29	21	-
		(8) Cabaguan	234	50	49	25	S
		(9) Cayubog	255	50	100	50	S
		(10) Masintoc	529	108	87	94	S
		(11) Pambaran	291	59	42	25	S
		(12) Bacsil	452	85	92	78	S
		(13) Callaguip	1,404	253	93	235	S
		(14) Waig/Upay	323	66	100	66	S
		(15) Monte	354	71	100	71	-
		(16) Sideg/Magnuang	323	64	97	62	-
		Sub-total	10,503	2,082		1,608	
		Total	33,336	6,248		4,218	

(Cont'd)

Sub-project	Municipality	Barangay	Population 1/	Nos. of Households 1/	% of Farm Households 2/	Nos. of Farm Households
5 Pinili	a. Pinili	(1) Apatut/Lubong	354	70	94	66
		(2) Badio	852	159	81	129
		(3) Barbar	529	99	75	74
		(4) Bulbulala	330	65	98	64
		(5) Bungro*	165	30	93	28
		(6) Capangdanan	555	101	100	101
		(7) Darat	700	123	88	108
		(8) Poblacion	1,820	324	56	181
		(9) Pugaoan*	260	44	95	42
		(10) Puritac	436	83	81	67
		(11) Punzol	229	53	96	51
		(12) Salanap	525	105	99	104
		(13) Tartarabang	707	140	96	135
		Total	7,462	1,396		1,150
6 Badoc-Sinait	a. Badoc	(1) Poblacion	2,516	476	38	181
		(2) Pagsanaan Sur*	405	78	100	78
		(3) Pagsanaan Norte	562	104	96	100
		(4) Morong	605	128	95	122
		(5) Paguetpet*	143	27	89	24
		(6) Sta. Curz Norte	332	69	79	54
		(7) Sta. Curz Sur	518	114	93	106
		(8) Caraitan	873	178	100	178
		(9) Paltit*	398	85	91	78
		(10) Lubigan	726	141	96	135
		(11) Labut*	286	58	100	58
		(12) Turod	515	98	93	91
		(13) Ar-aruship	506	106	97	103
		(14) Bato	569	109	100	109
		(15) Nagrebcan	600	117	95	111
		(16) Balbaldez	306	60	100	60
		(17) Alay/Nangbean	679	120	100	120
		(18) Parang	379	76	69	52
		(19) Pasuc	419	84	100	84
		(20) Mabusag Norte	947	166	73	121
		(21) Mabusag Sur	809	163	97	158
		(22) Napu	1,080	195	87	170
		(23) Gabut Sur	585	113	100	113
		(24) Bangbang/Lacben	629	107	78	83
		Sub-total	15,387	2,972		2,489
	b. Sinait	(1) Poblacion	2,962	555	35	194
		(2) Aguing	283	54	100	54
		(3) Baliu	71	13	98	13
		(4) Barikir	265	57	100	57
		(5) Battog	256	52	92	48
		(6) Binacud	268	57	100	57
		(7) Calingayan	192	39	100	39
		(8) Duyay-yat	259	57	100	57
		(9) Jordan	306	56	98	55
		(10) Marnay*	107	21	86	18
		(11) Nagbalioartian	280	61	100	61
		(12) Pacis	360	60	90	54
		(13) Purag	348	74	95	70
		(14) Ricudo	269	46	98	45
		(15) Sallacapo	289	62	100	62
		(16) Sapriana	395	69	100	69
		(17) Tapao*	326	65	100	70
		(18) Sta. Curz	693	142	98	139
		(19) Paratong	742	134	98	131
		(20) Teppeng	393	67	98	65
		Sub-total	9,064	1,741		1,366
		Total	24,451	4,713		3,855
		Grand Total	72,845	13,850		10,621

Note: * In these barangays, half amount of population and households is assumed to be involved in the pro

Source: 1/ Population census, 1975

2/ BAEcon barangay screening survey, 1976

3/ MLGCD, Ilocos Norte and Ilocos Sur, 1980

Table 3D-24 Population, Numbers of Household and Numbers of Farm Household in the Project

Sub-project	Nos.of Barangay	Population[1/]	Nos.of Household[1/]	Nos.of Farm Household[2/]	Cultivated Land (ha)	Cultivated Land per Farm Household (ha)
1. Cura	8	4,889	939	878	1,472	1.7
2. Nueva Era	5	1,623	329	311	697	2.2
Sub-total	13	6,512	1,268	1,189	2,169	1.8
3. Madupayas	2	1,084	225	209	168	0.8
4. Batac-Paoay	34	33,336	6,248	4,218	5,334	1.3
5. Pinili	13	7,462	1,396	1,150	1,453	1.3
6. Badoc-Sinait	44	24,451	4,713	3,855	3,708	1.0
Sub-total	91	66,333	12,582	9,432	10,663	1.1
Total	104	72,845	13,850	10,621	12,832	1.2

Source: 1/ 1975, Population Census, NCSO

2/ Nos. of household multiplied by the raitio of nos. of farm household in "Barrio Schooling Survey, 1976, BAE con"

Table 3D-25 Farm Number by Size

(Unit: farms)

Municipality	Size of Farm (ha) under 1.0	1.0 and under 3.0	3.0 and under 5.0	5.0 and under 10.0	10.0 and over	Total Number of Farm
Solsona	560	1,070	86	13	9	1,738
Dingras	932	1,549	189	18	1	2,689
Nueva Era	113	264	29	22	6	434
Batac	1,379	1,277	173	17	5	2,851
Paoay	383	600	126	8	1	1,118
Pinili	624	978	94	3	4	1,703
Badoc	1,365	1,000	140	10	-	2,515
Total	5,356	6,738	837	91	26	13,048
(percent)	(41.0)	(51.7)	(6.4)	(0.7)	(0.2)	(100.0)

Source: Agricultural Census 1971, NCSO

Table 3D-26 Farm Area by Size

(Unit: ha)

Municipality	Size of Farm (ha) under 1.0	1.0 and under 3.0	3.0 and under 5.0	5.0 and under 10.0	10.0 and over	Total Area of Farm
Solsona	335	1,691	299	82	162	2,569
Dingras	561	2,456	683	106	90	3,896
Nueva Era	56	378	100	113	570	1,217
Batac	636	1,915	638	95	86	3,370
Paoay	205	998	493	44	12	1,752
Pinili	362	1,589	342	15	126	2,434
Badoc	783	1,524	497	63	0	2,867
Total	2,938	10,551	3,052	518	1,046	18,105
(percent)	(16.2)	(58.3)	(16.9)	(2.9)	(5.7)	(100.0)

Source: Agricultural Census 1971, NCSO

Table 3D-27 Farm Number by Tenure of Operator

(Unit: farms)

Municipality	Full-Owner	Part-Owner	Tenant						Manager	Other Forms of Tenure	Total
			Cash	Share of Produce	Fixed Amount of Produce	Rent Free	Others	Total			
Solsona	166	462	-	1,040	10	20	-	1,070	-	40	1,738
Dingras	252	1,549	38	598	195	16	31	878	-	10	2,689
Nueva Era	129	109	-	196	-	-	-	196	-	-	434
Batac	952	1,197	-	696	-	5	-	701	1	-	2,851
Paoay	554	519	-	45	-	-	-	45	-	-	1,118
Pinili	583	908	-	212	-	-	-	212	-	-	1,703
Badoc	1,712	657	-	125	-	16	-	141	-	5	2,515
Total	4,348	5,401	38	2,912	205	57	31	3,243	1	55	13,048
(Percent)	(33.3)	(41.4)	(0.3)	(22.3)	(1.6)	(0.4)	(0.2)	(24.8)	(0.0)	(0.5)	(100.0)

Source: Agricultural Census 1971, NCSO

Table 3D-28 Farm Area by Tenure of Operator

(Unit:ha)

Municipality	Full-Owner	Part-Owner	Tenant						Manager	Other Forms of Tenure	Total
			Cash	Share of Produce	Fixed Amount of Produce	Rent Free	Others	Total			
Solsona	377	780	0	1,314	30	19	-	1,363	0	49	2,569
Dingras	331	2,183	49	886	332	19	59	1,345	0	37	3,896
Nueva Era	368	401	0	448	0	0	0	448	0	0	1,217
Batac	1,110	1,617	0	622	0	3	0	625	18	0	3,370
Paoay	853	833	0	66	0	0	0	66	0	0	1,752
Pinili	777	1,365	0	292	0	0	0	292	0	0	2,434
Badoc	1,836	908	0	97	0	23	0	120	0	3	2,867
Total	5,652	8,087	49	3,725	362	64	59	4,259	18	89	18,105
(percent)	(31.2)	(44.7)	(0.3)	(20.6)	(2.0)	(0.3)	(0.3)	(23.5)	(0.1)	(0.5)	(100.0)

Source: Agricultural Census 1971, NCSO

Table 3D-29 Landlord-Tenant Sharing Arrangement on Farm Produce

Municipality	Total Farm with Sharing Arrangement	50-50	45-55	40-60	33-67	30-70	Other Ratios
Solsona	1,537	1,522	-	10	-	5	-
Dingras	2,168	1,998	-	26	-	114	30
Nueva Era	305	305	-	-	-	-	-
Batac	1,893	1,883	-	-	-	5	5
Paoay	562	552	-	5	5	-	-
Pinili	1,120	1,109	-	-	-	11	-
Badoc	782	748	6	16	-	-	12
Total	8,367	8,117	6	57	5	135	47
(Percent)	(100.0)	(97.0)	(0.1)	(0.7)	(0.0)	(1.6)	(0.6)

Source; Agricultural Census 1971, NCSO

Table 3D-30 Progress of Land Reform Operation (As of 1979)

Municipality	Land Transfer Operation				Lease Holding Operation			
	Identified Area		Issued Area of Certificate		Identified Area		Issued Area of Certificate	
	Nos.of Tenant	Area (ha)	Nos.of Tenant	Area (ha)	Nos.of Tenant	Area (ha)	Nos.of Tenant	Area (ha)
Solsona	98	70	33	29	1,272	1,105	50	12
Dingras	488	510	284	142	2,054	1,529	173	17
Nueva Era	15	20	6	5	266	256	-	-
Batac	254	397	-	-	3,262	2,458	384	98
Paoay	7	4	-	-	658	114	69	13
Pinili	61	46	15	16	1,117	682	604	892
Badoc	139	118	88	57	1,676	1,636	272	156
Sinait	17	17	-	-	1,263	1,041	30	7
Total (percent)	1,079 (100.0)	1,182 (100.0)	426 (39.5)	249 (23.1)	11,568 (100.0)	8,821 (100.0)	1,582 (13.7)	1,322 (15.0)

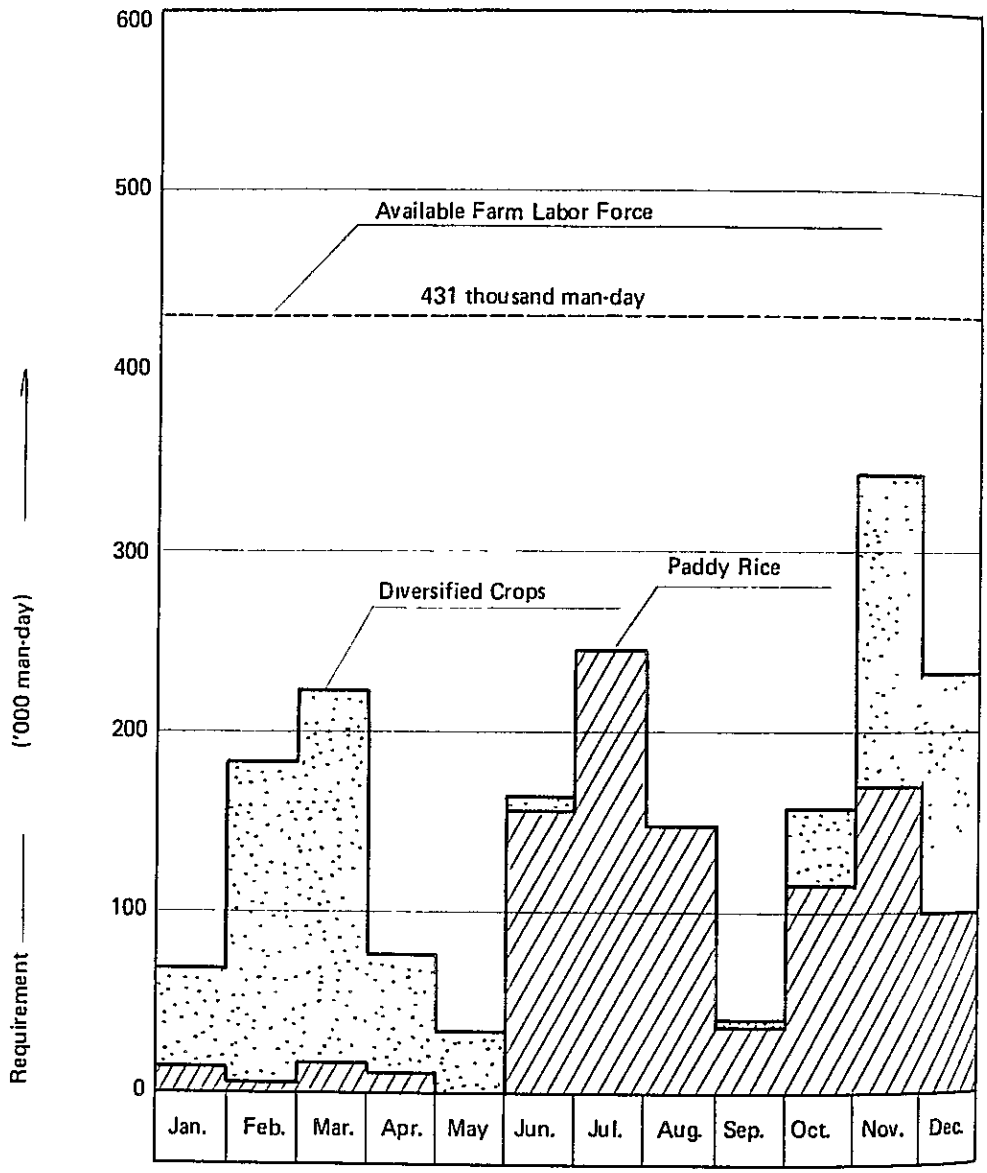
Source: DAR Team Office, Laoag, Dingras, Cabugao

Table 3D-31 Estimated Area Coverage of Farm Mechanization, at Present

Item	Hand Tractor	4-Wheel Tractor	Portable Rice Thresher	Big Powered Thresher	Irrigation Pump
1. Number of Farm Machinery 1/					
- Solsona	0	0	14	0	2
- Dingras	0	0	10	0	3
- Espiritu	0	0	20	0	6
- Nueva Era	0	0	6	0	5
- Batac	27	7	146	0	1,384
- Paoay	3	1	255	0	334
- Pinili	1	0	345	0	77
- Badoc	0	0	858	0	528
Total	31	8	1,654	0	2,339
2. Estimated Area Coverage per Unit (ha)	10	30	5	-	2
3. Estimated Mechanization Area (ha) (1 x 2)	310	240	8,270	-	4,678
4. Area Coverage of Mechanization Area (3 ÷ 11,021 ha 1/ x 100)	5.0		75.0	-	42.4

Source: 1/ "BAEcon Barangay Screening Survey in 1976"

FIGURE 3D - 1 FARM LABOR BALANCE
(WITH PROJECT, AT PRESENT)



Result of Farm Management Survey

The Land Resources Economics Division, NIA, conducted the farm management survey as of 1978. Number of sample were 162 in Phase I area and 133 in Phase II area. The former does not include the farmers who cropped tobacco and garlic but the later include.

In Feb., 1980, the supplemental survey was conducted in each municipality of Phase II area (including Cura and Nueva Era). The up to data information on commodities prices were obtained. The farm income surveyed in 1977 was revised using the new prices obtained as of Feb., 1980.

Durinv 1978 to 1980, the prices of input and output commodities rised up at 18% of palay, 23% of fertilizer, 20% of pesticide.

Farm income per hectare by crop are compared as the follows.

Farm income per Ha

	1980 ₱	1978 ₱	'80/'78 %
Palay			
Irrigated wet season	738	657	112
Irrigated dry season	481	443	109
Rainfed	719	681	106
Tobacco	4,011	3,528	114
Garlic	7,497	5,348	140

Table 3D-32 Cropping Pattern of Sample Farmer

	Batac		Paoay		Badoc, Pinili, Sinait: Irrigated farmer		Badoc, Pinili, Sinait: Non Irrig. farmer		Cura (Solsona)		Nueva Era (Left Side)	
	Area	%	Area	%	Area	%	Area	%	Area	%	Area	%
No. of Sample	(33)		(26)		(20)		(54)		(3)		(2)	
Palay total	0.91	(100)	1.36	(100)	1.20	(100)	1.12	(100)	1.75	(100)	2.25	(100)
Irrigated Palay	-	-	-	-	0.92	(77)	-	-	1.75	(100)	-	-
wet season	-	-	-	-	0.92	(77)	-	-	1.17	(67)	-	-
dry season	-	-	-	-	-	-	-	-	0.58	(33)	-	-
Rainfed Palay	0.91	(100)	1.36	(100)	0.28	(23)	1.12	(100)	-	-	2.25	(100)
Tobacco	0.40	(44)	-	-	0.33	(27)	0.19	(17)	-	-	-	-
Garlic	0.14	(15)	0.48	(35)	0.45	(37)	0.39	(35)	-	-	-	-
Corn	0.02	(2)	-	-	-	-	-	-	0.28	(16)	0.50	(22)
Mungbean	-	-	-	-	-	-	0.01	(1)	0.58	(33)	0.38	(17)
Cropping ratio for dry season	-	(61)	-	(35)	-	(64)	-	(53)	-	(82)	-	(39)

Source: Farm management survey, Jan. to Feb., 1977. NIA.
Sample in Cura and Nueva Era are based on Farm management survey, Feb., 1980. NIA and SCI.

Table 3D-33 Farm Economy at Present

- Batac, Badoc, Pinili, Sinait -

	0.5 ha	1.0 ha	1.5 ha	2.0 ha
Number of Sample	17	29	19	5
Irrigated paddy (ha)	0.12	0.08	0.18	0.25
Rainfed paddy (ha)	0.38	0.92	1.32	1.75
Total paddy (ha)	0.50	1.0	1.5	2.0
Cropping area ratio of Tobacco and Garlic (%)	87	55	55	42
Tobacco area (ha)	0.24	0.25	0.35	0.45
Garlic area (ha)	0.20	0.30	0.48	0.38
Total No. of Population (persons)	4.9	5.0	6.6	6.0
Population engaged in farming (persons)	2.3	2.1	2.1	3.3
Farm income				
Irrigated Palay	89 (3)	59 (1)	133 (2)	185 (3)
Rainfed Palay	273 (10)	661 (16)	949 (15)	1,258 (20)
Tobacco	1,109 (37)	1,155 (28)	1,617 (26)	2,079 (33)
Garlic	1,499 (50)	2,249 (55)	3,599 (57)	2,849 (44)
Total	2,970(100)	4,124(100)	6,298(100)	6,371(100)
Farm income per Ha.	5,940	4,124	4,200	3,185

Table 3D-34 Farm Economy at Present

	Batac	Paoay	Badoc, Pinili, Sinait		Cura	Nueva Era
			Irrigated	Non-Irrig.		
No. of sample	33	26	20	54	3	2
Average size of farm (ha)	0.91	1.36	1.20	1.12	1.75	2.25
Farm income						
Irrigated Palay	-	-	-	-	-	-
Wet season	-	-	679	-	863	-
Dry season	-	-	-	-	279	-
Rainfed Palay	654	978	201	805	-	1,617
Tobacco	1,848	-	1,525	878	-	-
Garlic	1,050	3,599	3,374	2,924	-	-
Corn	2	-	-	-	24	43
Mungbean	-	-	-	6	356	233
Total farm income	3,554	4,577	5,779	4,613	1,522	1,893
Farm income per Ha.	3,905	3,365	4,815	4,119	870	841

Table 3D-3b Profitability by Crops

	Palay				
	Irrigated wet season	Irrigated dry season	Rainfed	Tobacco	Garlic
Yield	34.7 Cav	28.5 Cav	27.6 Cav	1,007 kg	1,372 kg
Unit Price	65 P/Cav	65 P/Cav	65 P/Cav	6.8 P/kg	9.2 P/kg
Gross Income	2,255 ₱	1,853 ₱	1,794 ₱	6,848 ₱	12,622 ₱
Seeds	66	74	74	-	1,352(147 kg)
Fertilizer (123%)	111	102	234	459	271
Pesticides (120%)	41	55	83	94	5
Herbicides (128%)	8	3	3	-	-
Other Materials (120%)	-	-	-	152	125
Harvester/Threshers	(4.73 Cav)	(3.78 Cav)	(1.6 Cav)	-	-
	307	246	104	-	-
Landrent	(11.42 Cav)	(8.67 Cav)	(7.75 Cav)	(130 kg)	(190 kg)
	742	564	504	884	2,052
Animal Hired (150%)	72	93	3	-	-
Irrigation cost	(2 Cav)	(3 Cav)	-	-	-
	130	195	-	600	1,280
Depreciation Cost	40	40	70	40	40
Production Cost	1,517	1,372	1,075	2,229	5,125
Farm Income	738	481	719	4,011	7,497
Labor days	73.75 day	81.96 day	73.25 day	171.4 day	109.5 day
Farm income per labor day	10.0	5.9	9.8	26.9	68.5

Note; Figures in parenthesis indicate Price escalation based on farm survey in 1978.

Table 3D-36 Disposition of Paddy Production
- 1977 Farm Management Survey -

(Unit:Cavan.)

Item	No. of Farms	Area Planted (ha)	Total Production	Disposition of Production								
				Rent to Landload		Harvester/ Thresher	Thresher	Sold/To be Sold	Home use	Seeds	Feeds	Creditor
				Share	Lease							
1. Irrigated Wet												
Phase I	127	154.33	5,117	1,797	-	712	-	84	2,290	175	25	34
Phase II	20	18.37	874	175	-	105	1	10	547	29	7	-
Overall	147	172.70	5,991	1,972	-	817	1	94	2,837	204	32	34
2. Irrigated Dry												
Phase I	53	26.91	767	233	-	102	-	9	377	37	7	2
Phase II	-	-	-	-	-	-	-	-	-	-	-	-
Overall	53	26.91	767	233	-	102	-	9	377	37	7	2
3. Rainfed												
Phase I	38	46.87	1,215	412	8	153	-	62	503	50	14	13
Phase II	120	130.97	3,697	967	-	104	7	44	2,379	170	24	2
Overall	158	177.82	4,912	1,379	8	257	7	106	2,882	220	38	15
4. Total												
Phase I	218	228.09	7,099	2,442	-	967	-	155	3,170	262	46	49
			(100.0)	(34.4)		(13.6)		(2.3)	(44.7)	(3.7)	(0.6)	(0.7)
Phase II	140	149.34	4,571	1,142	8	209	8	54	2,926	199	31	2
			(100.0)	(24.6)	(0.2)	(4.6)	(0.2)	(1.3)	(64.0)	(4.4)	(0.7)	(0.0)
Overall	358	377.43	11,670	3,584	8	1,176	8	209	6,096	461	77	51
			(100.0)	(30.7)	(0.0)	(10.0)	(0.0)	(1.9)	(52.3)	(4.0)	(0.7)	(0.4)

Table 3D-37 Production and Disposition of Tobacco and Garlic
- 1977 Farm Management Survey -

	Area Planted (ha)	Production Total (kg)	Production Yield (kg/ha)	Unit Price (P/kg)	Disposition of Products (kg)							
					Rent to Landload				Operators Share			
					Share	Lease	Harvester	Rental Pogan	Sold/To be sold	Home use	Seed	Creditor
Tobacco	29.76	29,108 (100)	1,007	4.70	3,863 (13.3)	-	-	2,229 (7.7)	23,106 (79.0)	-	-	-
Garlic	47.09	61,379 (100)	1,372	5.5	8,985 (14.6)	-	-	-	45,111 (73.5)	328 (0.6)	6,955 (11.3)	-

Note; Unit Price : ₱/kg

	Badoc-Pinili	Batac-Paoay
Tobacco	5.15	4.15
Garlic	5.10	5.80

Table 3D-38 Average Yield of Paddy
- 1977 Farm Management Sruvey -

Item	No. of Farms	Total Production (Cav.)	Total Area Planted (ha)	Average Yield Planted (Cav.)	Total Area Harvested (ha)	Average Yield Harvested (Cav.)
1. Irrigated Wet						
Phase I	127	5,117	154.33	33.2	151.88	33.7
Phase II	20	874	18.37	47.6	17.92	48.8
Overall	147	5,991	172.70	34.7	169.80	35.3
2. Irrigated Dry						
Phase I	53	767	26.91	28.5	25.52	30.1
Phase II	-	-	-	-	-	-
Overall	53	767	26.91	28.5	25.52	30.1
3. Rainfed						
Phase I	38 1/	1,215	46.85	25.9	44.65	27.2
Phase II	120 1/	3,697	130.97	28.2	121.39	30.5
Overall	158	4,912	177.82	27.6	166.04	29.6
4. Average						
Phase I	218	7,099	228.09	31.1	222.05	32.0
Phase II	140	4,571	149.34	30.6	139.31	32.8
Overall	358	11,670	377.43	30.9	361.36	32.3

Note: 1/ 3 farms included in irrigated farms.
2/ 7 farms included in irrigated farms.

Table 3D-34 Paddy Procurement and Rice Distribution by NGA for the Last Five Years

(Unit:bag)

Year	Ilocos Norte		Ilocos Sur	
	Paddy Procurement (bags of 50 kg)	Rice Distribution (bags of 50 kg)	Paddy Procurement (bags of 50 kg)	Rice Distribution (bags of 50 kg)
1975	11,012	10,598	4,794	28,297
1976	24,837	8,649	13,879	16,188
1977	50,301	10,127	20,891	26,106
1978	95,981	4,279	26,451	10,624
1979	135,627	2,034	65,405	917

Source: NGA, Ilocos Norte and Ilcos Sur.

Table 3D-40 Number and Capacity of Ricemills and Cornmills in the Project Municipalities

(Unit: tons/ha)

Municipality	Ricemills				Cornmills	
	Kiskisan		Cono			
	Number	Capacity	Number	Capacity	Number	Capacity
Solsona	57	201	-	-	-	-
Dingras	71	236	-	-	-	-
Espiritu	49	83	-	-	-	-
Nueva Era	10	29	-	-	-	-
Pinili	27	84	-	-	-	-
Batac	41	128	-	-	-	-
Paoay	18	56	-	-	-	-
Badoc	30	91	-	-	-	-
Sinait	32	34	-	-	1	0.25
Total	335	942	-	-	1	0.25
Province-wide, Ilocos Norte	839	1,085	1	30	1	0.25
Province-wide, Ilocos Sur	542	1,316	16	96	16	19.75

Source: NGA, Ilocos Norte and Ilocos Sur

Table 3D-41 Number and Capacity of NGA-Owned and Private-Owned Warehouses in the Project Municipalities (As of 1980)

Municipality	NGA-Owned		Private-Owned		Total	
	Number	Capacity (ton)	Number	Capacity (ton)	Number	Capacity (ton)
Solsona	-	-	-	-	-	-
Dingras	1	5,000	1	125	2	5,125
Espiritu	-	-	-	-	-	-
Nueva Era	-	-	-	-	-	-
Pinili	-	-	-	-	-	-
Batac	-	-	3	90	3	90
Paoay	-	-	-	-	-	-
Badoc	-	-	-	-	-	-
Sinait	-	-	-	-	-	-
Total	1	5,000	4	215	5	5,215
Province-wide, Ilocos Norte	3	15,000	15	808	17	15,808

Source: NGA, Ilocos Norte and Ilocos Sur

Table 3D-42 Number and Capacity of Transportation Facilities in the Project Municipalities (As of 1980)

(Unit:cavan of 50 kg)

Municipality	NGA-Owned		NGA-Leased		Private	
	Number	Capacity	Number	Capacity	Number	Capacity
Solsona	-	-	-	-	3	350
Dingras	-	-	-	-	3	85
Espiritu	-	-	-	-	1	100
Nueva Era	-	-	-	-	-	-
Pinili	-	-	-	-	-	-
Batac	-	-	12	2,880	3	1,750
Paoay	-	-	-	-	-	-
Badoc	-	-	-	-	-	-
Sinait	-	-	-	-	1	180
Total	-	-	12	2,880	11	2,465
Province-wide, Ilocos Norte	2	230	15	3,520	31	6,002

Source: NAG, Ilocos Norte and Ilocos Sur

Table 3D-43 Number of Retailers and Wholesalers for Marketing Outlets of Rice in the Project Municipalities

Municipality	Retailer	Wholesaler	Total
Solsona	2	1	3
Dingras	9	3	12
Espiritu	2	-	2
Nueva Era	-	-	-
Pinili	1	-	1
Batac	20	13	33
Paoay	4	-	4
Badoc	5	-	5
Sinait	26	4	30
Total	69	21	90
Province-wide, Ilocos Norte	113	40	153

Source: NGA, Ilocos Norte and Ilocos Sur.

Table 3D-44 Certified Seed Production of Paddy Rice in Ilocos Norte

Year	Municipality	Nos.of Growers	Harvested Area (ha)	Yield (car./ha)	Production (car.)	Major Varieties
1977	Batac	2	8.0	72	576	IR-42
	Paoay	3	5.0	70	350	IR-42
	Badoc	1	2.0	70	140	IR-42
	Pinili	1	3.0	71	213	IR-36,IR-4
	Nueva Era	1	6.0	80	480	IR-42
	Dingras	2	3.0	78	234	IR-42
	Solsona	1	4.0	78	312	IR-36,IR-4
	Others	-	-	-	-	-
	Total Province	11	31.0	74	2,305	
1978	Batac	2	8.0	80	640	IR-36,IR-4
	Paoay	3	5.0	78	390	IR-36,IR-4
	Badoc	1	2.0	75	150	IR-36,IR-42
	Pinili	1	3.0	72	216	IR-36,IR-4
	Nueva Era	1	6.0	82	492	IR-36,IR-4
	Dingras	2	3.0	75	225	C-22
	Solsona	1	4.0	78	312	IR-36,IR-42
	Others	8	22.0	78	1,709	IR-36,IR-42
	Total Province	19	53.0	78	4,134	
1979	Batac	2	8.0	81	650	IR-36,IR-42, IR-44,IR-46, & BPI R-4
	Paoay	3	5.0	81	405	
	Badoc	1	2.0	77	155	
	Pinili	1	3.0	82	245	
	Nueva Era	1	6.0	84	509	
	Dingras	2	3.0	84	253	
	Solsona	1	4.0	82	327	
	Others	9	23.0	86	1,976	
	Total Province	20	54.0	83	4,520	

Source: BPI, Ilocos Norte
Note: In sinait, Ilocos Sur, no certified seed was produced in respective years.

Table 3D-45 Number of Extension Staff in the Project Municipalities (As of 1978)

Municipality	Nos.of Farmer Supervised	BPI, Production Technician		BALx, Farm Management Technologist	
		Nos.of Staff	Nos.of Farmer/Staff	Nos.of Staff	Nos.of Farmer/Sraff
Solsona	1,365	4	341	10	136
Dingras	2,362	4	591	18	131
Nueva Era	1,426	2	713	8	178
Batac	1,800	3	600	12	150
Paoay	2,570	3	857	19	135
Pinili	1,366	2	683	8	170
Badoc	1,610	3	537	12	134
Sinait	854	4	214	5	171
Total	13,353	25	534	92	145
Whole Ilocos Norte	15,161	66	230	108	140

Source: BPI and BAEx, Ilocos Norte and Ilocos Sur

Table 3D-46 Number of Farmers Supervised, Number of Production Technicians and Area Financed under Masagana 99 Rice Production Program, Phase IX (May - October 1977)

Province	Supervised Farmers (SP)	Production Technician (PT)	SF/PT	Supervised Farmers with Credit			Area Financed (ha)
				RB	PNB	ACA	
Ilocos Norte	32,394	254	128	119	632	-	730
Ilocos Sur	30,157	254	123	1,049	211	73	1,220
Total	62,551	499	126	1,168	843	73	1,950

Source: WFAC, Quezon City

Table 3D-47 Amount of Loans Granted by the Different Lending Institutions for Masagana 99 (Phase IX May - October 1977) in the Project Provinces

(Pesos)

Bank	Ilocos Norte	Ilocos Sur	Total
RP	121,000	1,054,000	1,175,000
PNB	755,000	296,000	1,051,000
ACA	-	25,000	25,000
Total	876,000	1,375,000	2,251,000

Source: NFAC, Quezon City

Table 3D-48 Major Cooperatives in the Project Municipalities

Name	Location	Year of Establishment	Nos. of Member	Major Activities
1. Paoay Lake Development Cooperatives Inc.	Paoay	1977	749	Consumer Poultry and Livestock Producers Loan/Credit Fishery
2. Batac Livestock and Poultry Raisers' Cooperative Marketing Inc.	Batac	1975	238	Producers Consumers
3. Batac Producers' Cooperative Marketing Association (Procoma) Inc.	Batac	1953	2,000	Consumer, Marketing, Trucking Credit/Loan Tractor Service
4. Sinait Samahang Nayon Consumers Cooperative Inc.	Sinait	1977	340	Consumer

Source: DLDCD, Ilocos Norte and Ilocos Sur.

Table 3D-49 Different Associations under Jurisdiction of BAEx

Association	Municipality	Nos.of Group	Nos.of Total Member	Major Activities
1.Farmer's Association	Solsona	-	-	(1) Assist technicians
	Dingras	15	1,064	in the more use and
	Nueva Era	--	-	planting of HYV's and
	Batac	18	617	in increasing farm
	Paoay	14	328	productivity
	Pinili	12	497	(2) Regular meeting in
	Badoc	14	477	all municipal Federation
	Sinait	14	306	of the associations
	Total	87	3,289	
2.Rural Yuth Club	Solsona	-	-	
	Dingras	5	111	Swine, Goat, Vegetables
	Nueva Era	-	-	
	Batac	-	-	
	Paoay	7	151	Cattle, Swine, Goat, Wearing
	Pinili	5	104	Vegetables,
	Badoc	5	102	Swine, Goat
	Sinait	4	99	Vegetables, Poultry, Swine
	Total	26	567	
3.Rural/Home Improvement Club	Solsona	-	-	(1) Nutrition Education
	Dingras	9	270	(Projects of backyard
	Nueva Era	-	-	garden, poultry and swine)
	Batac	6	180	(2) Development of Home
	Paoay	18	540	industries
	Pinili	6	180	(3) Improvement of Home
	Badoc	6	180	Management
	Sinait	5	150	
	Total	50	1,500	

Source: BAEx, Ilocos Norte, Ilocos Sur

Table 3E-1 Luzon Grid 230 KV Transmission Lines
October, 1979

Transmission Lines From — To	Type	No. of Circuits	Conductor Size	Length (km)
Ambuklao - Binga	ST	SC	795 MCM ACSR	10.57
Binga - San Manuel	ST	DC - 1	795 MCM ACSR	43.20
San Manuel - VOA	ST	SC	795 MCM ACSR	85.60
VOA - Mexico	ST	SC	795 MCM ACSR	37.60
Mexico - Balintawak	ST	SC	795 MCM ACSR	58.30
Binga - San Manuel	ST	DC - 2	795 MCM ACSR	42.30
San Manuel - Cabanatuan	ST	SC	795 MCM ACSR	83.30
Cabanatuan - Bustos	ST	SC	795 MCM ACSR	45.95
Cruz-na-Dann - Mexico	ST	DC	795 MCM ACSR	23.31
Bustos - Kaybiga	ST	SC	795 MCM ACSR	37.89
Kaybiga - Balintawak	ST	DC	795 MCM ACSR	8.00
Mexico - Bataan Thermal	ST	DC	795 MCM ACSR	71.70
Hermosa Tap - Olongapo	ST	DC	795 MCM ACSR	28.00
Bataan Thermal - EPZA	ST	DC	795 MCM ACSR	21.00
Binga - Baguio	ST	DC - 1	795 MCM ACSR	10.90
Baguio - Bauang	ST	DC - 1	795 MCM ACSR	37.85
Pantabangan - Muñoz Tap	ST	DC	795 MCM ACSR	22.88
Malaya - Tayabas	ST	DC - 1	795 MCM ACSR	63.78
Tayabas - Gumaca	ST	DC - 1	795 MCM ACSR	57.45
Gumaca - Labo	ST	DC - 1	795 MCM ACSR	88.73
Labo - Naga	ST	DC - 1	795 MCM ACSR	98.50
Naga - San Antonio	ST	DC - 1	795 MCM ACSR	28.44
San Antonio - Tiwi Geo	ST	DC	795 MCM ACSR	31.80
San Antonio - Legaspi	ST	DC - 1	795 MCM ACSR	42.65
Sta. Maria Tap - San Jose	ST	DC	795 MCM ACSR	9.83
Kalayaan Tap - Mak-Ban	ST	DC	795 MCM ACSR	44.00
Mak-Ban - Batangas	ST	DC	795 MCM ACSR	36.00
Mak-Ban - Biñan	ST	DC	795 MCM ACSR	32.00
			Total - SC	359.21
			DC	370.82
			DC - 1	428.30

ST - Steel Tower Structure
SC - Single Circuit
DC - Double Circuit
DC-1 - Double Circuit, 1st circuit strong
DC-2 - Double Circuit, 2nd stringing only

Table 3E-2 Luzon Grid 115 KV Transmission Lines
October, 1979

Transmission Lines From	To	Type	No. of Circuits	Conductor Size	Length (km)
Sucat - Biñan*		ST	SC	4/0 AWG CU	22.00
Angat Hydro - Pole#1-3E		WPH	SC	795 MCM ACSR	1.00
Pole#1-3E - Novaliches		WPH	SC	795 MCM ACSR	29.00
Novaliches - Balintawak	1/	ST	DC	795 MCM ACSR	8.00
Bantay - Laoag		WPH	SC	336.4 MCM ACSR	81.30
Angat Hydro-Balintawak		ST	DC	795 MCM ACSR	38.00
Bantay - Narvacan		WPH	SC	336.4 MCM ACSR	28.20
Narvacan - San Esteban		WPI	SC	336.4 MCM ACSR	11.40
San Esteban - Sta. Cruz		WPH	SC	336.4 MCM ACSR	27.00
Sta. Cruz - Tagudin		WP	SC	336.4 MCM ACSR	21.00
Tagudin - BCI		WP	SC	336.4 MCM ACSR	28.00
BCI - Bauang		WP	SC	336.4 MCM ACSR	20.50
Calamba - Batangas		WPI	SC	336.4 MCM ACSR	47.47
Biñan - Dasmariñas		WPH	SC	336.4 MCM ACSR	14.47
Dasmariñas - Ternate		WP	SC	336.4 MCM ACSR	30.00
Dasmariñas - Tagaytay		WP	SC	336.4 MCM ACSR	25.00
				Total SC	386.34
				DC	38.00

* - Biñan-Caliraya Portion Retired in 1979
ST - Steel Tower Structure
WP - Wood Pole Structure
SC - Single Circuit
DC - Double Circuit
1/ - Strung to 230 KV Line 2

Table 3E-3 Luzon Grid 69 KV Transmission Lines
October, 1979

Transmission Lines From To	Type	No. of Circuits	Conductor Size	Length (km)
Itogon - Philex	WP-3T	SC	500 MCM ACSR	10.50
Mexico - Balibago (CAFB)	ST	DC	795 MCM ACSR	22.40
	WP	DC	795 MCM ACSR	10.00
Batabgas - Fortune Cement	WPT	SC	336.4 MCM ACSR	25.00
San Manuel - Mangaldan	WP	SC	336.4 MCM ACSR	28.40
San Manuel - Northern Cement	WP	SC	336.4 MCM ACSR	16.50
[illegible] - Sto. Niño	WPH	SC	500 MCM ACSR	26.82
Bataan Ther. - Bataan Ref.	WPI	SC	336.4 MCM ACSR	2.00
San Esteban - Bangued	WPH	SC	336.4 MCM ACSR	44.00
Longapo - San Antonio	WPI	SC	336.4 MCM ACSR	27.50
[illegible]alit - United Pulp & Paper	WP	SC	336.4 MCM ACSR	7.00
[illegible]al - Balayan	WPI	SC	336.4 MCM ACSR	39.50
[illegible]bag - Dingras	WPH	SC	336.4 MCM ACSR	18.00
Dingras - Marcos	WPH	SC	336.4 MCM ACSR	6.66
[illegible]ngras - Pidding	WPH	SC	336.4 MCM ACSR	5.08
San Antonio - Botolan	WPI	SC	336.4 MCM ACSR	44.00
Muñoz - Pantabangan	WPH	SC	336.4 MCM ACSR	20.16
San Manuel - Carmen	WP	SC	336.4 MCM ACSR	26.00
Carmen Tap - Tayug	WP	SC	336.4 MCM ACSR	21.00
[illegible]arangas Tap - Pacific Flour Mills	WPI	SC	336.4 MCM ACSR	7.26
[illegible]alasiao - Bani	WP	SC	336.4 MCM ACSR	71.00
[illegible]aral Tap - Bataan Pulp & Paper	WPI	SC	4/0 ACSR	4.00
[illegible]aan Tap - LMG Chemical	WPI	SC	336.4 MCM ACSR	0.98
[illegible]alayan - Nasugbu	WPI	SC	336.4 MCM ACSR	19.02
[illegible]otolan - salaza	WPI	SC	336.4 MCM ACSR	19.97
[illegible]maca - Pitogo	WP	SC	336.4 MCM ACSR	11.08
[illegible]maca - Atimonan	WP	SC	336.4 MCM ACSR	23.41
[illegible]abo - Talisay	WP	SC	336.4 MCM ACSR	18.64
[illegible]abo - Batobalani	WP	SC	336.4 MCM ACSR	8.20
[illegible]atobalani - Phil. Smelter	WP	SC	336.4 MCM ACSR	9.59
[illegible]orsogon Irosin - Trece Bulan	WP	SC	336.4 MCM ACSR	45.39
Naguilian Tap - PCFC	WP	SC	336.4 MCM ACSR	0.50
[illegible] - Feedrich Agro Ind.	WPI	SC	336.4 MCM ACSR	0.10
[illegible]lar Tap - Bagac	WPI	SC	336.4 MCM ACSR	18.00
[illegible]agac - Napot Pt. (PNPP)	WPI	SC	336.4 MCM ACSR	8.00
[illegible]guio - Itogon	WP-3T	SC	336.4 MCM ACSR	10.90
[illegible]maca - Hondagua	WP	SC	336.4 MCM ACSR	31.37

Table 3E-4 Luzon Grid 69 KV Transmission Lines
October, 1979

Transmission Lines From	To	Type	No. of Curcuits	Conductor Size	Length (km)
Ambuklao	Beckel	ST	SC	500 MCM	12.86
Beckel	Bauang	WPH	SC	500 MCM	38.80
Bauang	Agoo	WP	SC	4/0 ACSR	24.10
Agoo	Calasiao	WP	SC	4/0 ACSR	41.80
Bauang	San Fernando	WP	SC	2/0 CU	5.90
San Fernando	BCI	WP	SC	2/0 ACSR	20.40
Mangaldan	Urdaneta	WP	SC	2/0 ACSR	24.00
Calamba	Tanauan	WP	SC	4/0 ACSR	13.16
Tanauan	Lipa	WP	SC	4/0 ACSR	15.87
Lipa	Batangas	WP	SC	4/0 ACSR	17.77
Batangas	Bolboc	WP	SC	4/0 ACSR	6.34
Mexico	San Fernando	WP	SC	266.8 MCM ACSR	5.00
San Fernando	Guagua	WP	SC	266.8 MCM ACSR	8.00
Guagua	Balanga	WP	SC	4/0 ACSR	40.87
Mexico	Tarlac	WP	SC	4/0 ACSR	48.75
Balanga	Bataan Thermal	WP	SC	4/0 ACSR	19.00
Bataan Thermal	Mariveles	WP	SC	4/0 ACSR	21.60
Guagua Tap	Basa Air Base	WP	SC	2/0 ACSR	11.60
Mexico	Cruz-na-Daan	WP	SC	4/0 ACSR	25.10
Cruz-na-Dann	Sta. Rosa	WP	SC	4/0 ACSR	44.73
Sta. Rosa	Cabanatuan	WP	SC	4/0 ACSR	1.40
San Jose Tap	Ibaan	WP	SC	3/0 ACSR	6.18
Half Moon	USN Base	WPH	SC	336.4 MCM ACSR	1.60
Half Moon	Kalaklan	WPH	SC	4/0 ACSR	1.50
Magalang Tap	Angeles	WP	SC	2/0 ACSR	9.36
Bataan Thermal	Planter Pro.	WPI	DC	4/0 ACSR	9.70
Mexico	Apalit	WP	SC	4/0 ACSR	11.75
Cabanatuan	Talavera	WPH	SC	336.4 MCM ACSR	14.30
Ibaan Tap	Rosario	WP	SC	4/0 ACSR	7.00
Batangas	Taal	WP	SC	336.4 MCM ACSR	29.12
Talavera	Muñoz	WPH	SC	336.4 MCM ACSR	17.92
Cruz-na-Daan	Luzon Cement	WPH	SC	336.4 MCM ACSR	14.40
Binga	Itogon	WP-3T	SC	500 MCM ACSR	6.50
				Total SC	1242.21
				DC	42.10

Table 3E-2 Luzon Grid, Transmission Line Additions Program
March, 1980

Year	Transmission Line	Voltage (KV)	Circuit & Structure	No. & Size of Cond. (MCM)	Length (KM)	Project Identification	1979 Direct Cost Foreign ($x10^6$)	Local (₱x10^6)	Total (₱x10^6)
1980	Malaya-Gumaca	230	ST-DC-2	1-795	138	7th Power Project	0.97	4.42	11.70
	Gumaca-Labo	230	ST-DC-2	1-795	89	-do-	0.62	2.85	7.50
	Labo-Naga	230	ST-DC-2	1-795	97	-do-	0.68	3.10	8.20
	Naga-Legaspi	230	ST-DC-2	1-795	71	-do-	0.50	2.27	6.02
	Binga-Baguio	230	ST-DC-2	1-795	11	6th Power Project	0.08	0.35	0.95
	Tiwi 3&4-Switchyard	230	ST-DC-1	1-795	1.0	Tiwi Project	0.04	0.33	0.63
	Baguio-Boneng	69	ST-DC-1	1-336.4	24	6th Power Project	0.25	1.23	3.08
	Boneng-Guinaoang	69	ST-DC	1-336.4	46	-do-	0.78	2.36	8.21
	BCI-Balaoan	69	WP-SC	1-336.4	14	-do-	0.16	1.32	2.52
	Bauang-San Fernando	69	WP-SC	1-336.4(R)	5	7th Power Project	0.03	0.10	0.33
	San Fernando-BCI	69	WP-SC	1-336.4(R)	21	-do-	0.13	0.42	1.40
5/80	Bongabon Tap-Baler	69	WP-SC	1-336.4	53	-do-	0.34	3.99	6.54
6/80	Sorsogon Tap-Gubat	69	WP-SC	1-336.4	8	-do-	0.09	0.75	1.43
10/80	Naga-Tinambac	69	WP-SC	1-336.4	32	-do-	0.37	3.11	5.89
	Lagonoy-Caramoan	69	WP-SC	1-336.4	45	-do-	0.27	3.55	5.58
	Cabanatuan-Crus-na-Daan	69	WP-SC	1-336.4(R)	42	-do-	0.26	0.84	2.79
	Biñan-Sucat	115	ST-DC	1-795	22	Special Project	0.79	5.50	11.43
	Makban 3&4-Swirchyard	230	ST-DC-1	1-795	2	Mak-Ban Ptoject	0.08	0.65	1.25
11/80	Anbuklao-Solano	230	ST-DC-1	1-795	63	Cag. Valley Elect.	2.35	20.54	38.17
	Solano-Santiageo	230	ST-DC-1	1-795	44	-do-	1.71	14.34	27.17
	Santiago-Tuguegarao	230	ST-SC	1-795	118	-do-	2.56	14.99	34.19
	Santiago-Cauayan	69	WP-SC	1-336.4	41	-do-	0.42	3.86	7.09
	Cauayan-Ilagan	69	WP-SC	1-336.4	29	-do-	0.30	2.73	4.95
	Tuguegarao-Camalaniugan	59	WP-SC	1-336.4	71	-do-	0.33	6.68	12.91
	Santiageo-Jones	69	WP-SC	1-336.4	27	7th Power Project	0.30	2.54	4.79
	Jones-Saguday	69	WP-SC	1-336.4	13	-do-	0.34	1.22	2.27
	Cauayan-Roxas	69	WP-SC	1-336.4	37	-do-	0.41	3.48	6.56
	Dasmariñas-Biñan 1/	230	ST-DC	1-795	14	-do-	1.18	6.95	15.80
	PNPP-Prado	230	ST-DC	2-795	46	PNPP Trans.	3.21	18.50	42.58
	Dolores-San Jose*	230	ST-DC	4-795	38	6th Power Project	4.61	14.86	49.44
	TAP-Kalayaan 2/	230	ST-DC	1-795	1.5	7th Power Project	0.15	0.94	2.07
	Baguio-Lubuagan (Batong Buhay)	230	ST-DC-1	1-795	114	Batong Buhay Mines	4.79	37.16	73.09

Year	Transmission Line	Voltage (KV)	Curcuit & Structure	No. & Size of Gold (MCM)	Length (KM)	Project Identification	1980 Direct Cost Foreign ($x10^6$)	Local (₱x10^6)	Total (₱x10^6)
1/81	Panicui-Carmen	69	WP-SC	1-336.4	30	Special Project	0.22	1.88	3.53
2/81	Tuguegarao-Capsan	69	WP-SC	1-336.4	27	7th Power Project	0.30	2.54	4.79
3/81	Masiway-Pantabangan	69	WP-SC	1-336.4	5	Masiway Project	0.06	0.47	0.92
4/81	Olongapo-Sta. Cruz**	230	ST-SC	1-795	116	7th Power Project	2.52	14.78	33.68
5/81	Bangued-Licuan	69	WP-SC	1-336.4	34	-do-	0.38	3.20	6.05
	Tap-Manabo	69	WP-SC	1-336.4	23	-do-	0.26	2.16	4.11
	Tuguegarao-Solana	69	WP-SC	1-336.4	10	-do-	0.11	0.94	1.77
	Solana-Casingsingan	69	WP-SC	1-336.4	13	-do-	0.14	1.22	2.27
6/81	Siniloan-Baras	69	WP-SC	1-336.4	24	-do-	0.27	2.26	4.29
	Camalaniugan-Gonzaga	69	WP-SC	1-336.4	33	-do-	0.37	3.11	5.89
	Tap-Baggao	69	WP-SC	1-336.4	10	-do-	0.11	0.94	1.77
7/81	Lubuagan-Narvacan**	230	ST-DC-1	1-795	83	-do-	3.21	18.91	42.99
8/81	Dasmariñas-Rosario**	115	WP-SC	1-336.4	15	-do-	0.17	0.90	2.18
	PNPP-Balanga Tap	230	ST-DC	1-795	34	PNPP Trans.	1.47	10.44	21.47
	Prado-San Jose**	230	ST-DC	2-795	76	-do-	5.81	30.78	74.36
	Siniloan-Infanta	69	WP-SC	1-336.4	49	7th Power Project	0.54	4.61	8.66
10/81	Binga-Ambuklao	230	ST-SC	1-795	10	-do-	0.36	2.12	4.82
	Ambuklao-Solano	230	ST-DC-2	1-795	63	Cag. Valley Elec.	0.89	2.05	8.73
	Solano-Santiago	230	ST-DC-2	1-795	44	-do-	0.62	1.43	6.08
	Golana Tap-Piat	69	WP-SC	1-336.4		-do-	0.37	3.10	5.88
	Tuguegarao-Tabuk	69	WP-SC	1-336.4	45	Cag. Valley Elec.	0.50	4.23	7.98
	Lal-lo-Lucban	69	WP-SC	1-336.4	16	-do-	0.18	1.50	2.85
	Luchan-Abulog	69	WP-SC	1-336.4	30	-do-	0.34	2.82	5.37
	Guinaoang-Bontoc	69	WP-SC	1-336.4	47	7th Power Project	0.53	4.42	8.40
12/81	Bontoc-Lagawe	69	WP-SC	1-336.4	39	-do-	0.44	3.67	6.97
4/82	Tiwi 5&6-Tiwi 3&4	230	ST-DC	1-795	2	Tiwi Project	0.08	0.65	1.25
	Tiwi 3&4-Tiwi Switchyard	230	ST-DC-2	1-795	1	-do-	0.02	0.03	0.18
6/82	Baguio-Bauang	230	ST-DC-2	1-795	38	8th Power Project	0.50	1.22	4.97
	San Manuel-Labrador	230	ST-SC-1	1-795	62	-do-	2.11	12.67	34.25

Year	Transmission Line	Voltage (KV)	Circuit & Structure	No. & Size of Cond. (MCM)	Length (KM)	Project Identification	1980 Direct Cost Foreign ($x10^6$)	Local (₱x10^6)	Total (₱x10^6)
6/82	Labrador-Sta. Cruz	230	ST-SC	1-795	56	8th Power Project	1.43	10.13	20.86
	Bantay-Cabugao	69	WP-SC	1-336.4	27	-do-	0.28	2.40	4.50
	Laoag-Pasuguin	69	WP-SC	1-336.4	15	-do-	0.16	1.33	2.53
	Pasuguin-Dumalneg	69	WP-SC	1-336.4	37	-do-	0.39	3.28	6.21
	San Esteban-Sta. Cruz	69	WP-SC	1-336.4	30	-do-	0.31	2.66	4.99
	Laoag-Currimao	69	WP-SC	1-336.4	28	-do-	0.29	2.48	4.66
	Abulog-Sanchez Mira	69	WP-SC	1-336.4	29	-do-	0.30	2.57	4.82
	Solano-Bambang	69	WP-SC	1-336.4	19	-do-	0.20	1.69	3.19
	Labrador-Dasol	69	WP-SC	1-336.4	29	-do-	0.30	2.79	5.04
	Baao Tap-Balatan	69	WP-SC	1-336.4	23	8th Power Project	0.24	2.21	4.01
	Oas Tap-Pio Duran	69	WP-SC	1-336.4	38	-do-	0.40	3.65	6.65
	Junction-Pantao	69	WP-SC	1-336.4	14	-do-	0.15	1.35	2.48
1983	Magat-Santiago	230	ST-DC	1-795	19	Magat Loan	0.82	5.84	11.99
1984	Coal Ther. I 3/- Bantagas	230	ST-DC	1-795	43	9th Power Project	1.86	13.20	27.15
	Coal Ther. I-Tagaytay	115	WP-SC	1-336.4	29	-do-	0.37	2.97	5.75
	Bauang-Labrador	230	ST-DC	1-795	92	-do-	3.99	28.24	58.17
	Labrador-San Manuel	230	ST-DC-2	1-795	62	-do-	0.82	1.99	8.14
	Talavera Tap-Quezon	69	WP-SC	1-336.4	14	-do-	0.15	1.34	2.47
	Cruz-Na-Daan-Plaridel	69	WP-SC	1-336.4	19	-do-	0.20	1.82	3.32
	Pila-Tap-Nagcarlan	69	WP-SC	1-336.4	12	-do-	0.13	1.15	2.13
	Tayabas-Sampaloc	69	WP-SC	1-336.4	18	-do-	0.19	1.73	3.16
	Tayabas-Candelaria	69	WP-SC	1-336.4	22	-do-	0.23	2.11	3.84
	Naga-Magarao	69	WP-SC	1-336.4	7	-do-	0.07	0.67	1.20
1985	San Jose-Kalayaan 6/	500	ST-DC	2-795	97	9th Power Project	6.96	48.02	100.22
	Kalayyan-Gumaca	230	ST-DC	2-795	120	-do-	8.37	42.00	103.73
	Gumaca-Naga	230	ST-DC	2-795	117	-do-	8.17	40.95	102.23
	Naga-Tiwi	230	ST-DC	2-795	77	-do-	5.37	26.95	67.23

Year	Transmission Line	Voltage (KV)	Circuit & Structure	No. & Size of Cond. (MCM)	Length (KM)	Project Identification	1980 Direct Cost Foreign ($x10^6$)	Local (₱x10^6)	Total (₱x10^6)
1985	Geo. 1-4[4/]-Legaspi	230	ST-DC	1-795	28	9th Power Project	1.21	9.80	18.88
	Baguio-Lubuagan	230	ST-DC-2	1-795	114	-do-	1.61	3.71	15.79
	Lubuagan-Narvacan	230	ST-DC-2	1-795	83	-do-	1.17	2.70	11.48
	Bataac-PNOC	230	ST-DC	1-795	5	Customer's Finance	0.22	1.54	3.19
	Calumpit-Hagonoy	69	WP-SC	1-336.4	10	9th Power Project	0.13	1.01	2.00
	Tuguegarao-Lal-lo	230	ST-SC	1-795	65	-do-	1.66	11.76	24.21
1986	Coal Ther.II[5/]-Santiago	230	ST-DC	1-795	36	10th Power Project	1.56	11.67	23.37
1988	Gened-Chico IV	500	ST-DC	2-795	89	10th Power Project	6.39	44.06	91.99
	Chico IV-Solano	500	ST-DC	2-795	107	-do-	7.68	52.97	110.57
	Solano-Cabanatuan	500	ST-DC	2-795	130	-do-	9.33	64.36	134.34
	Cabanatuan-San Jose	500	ST-DC	2-795	76	-do-	5.46	37.62	78.57
	Gened-Ballesteros	230	ST-DC	1-795	52	-do-	1.33	9.41	19.39
	Ballesteros-Lal-lo	230	ST-SC	1-795	40	-do-	1.02	7.24	14.89
	Ballesteros-Claveria	115	ST-SC	1-795	49	-do-	1.15	8.58	17.21
	Claveria-Bangui	115	ST-SC	1-795	45	-do-	1.06	7.88	15.83
	Bangui-Laoag	115	ST-SC	1-795	40	-do-	0.94	7.00	14.05
1989	Kanan-Malaya	230	ST-DC	1-795	50	11th Power Project	2.17	15.35	31.63
1991	San Roque-San Manuel	230	ST-DC	1-795	9	11th Power Project	0.44	2.86	6.16
	Coal Fired III-Legaspi	230	ST-DC	1-795	48	do-	2.08	14.74	30.34
1992	Chico II-Chico IV	230	ST-DC	1-795	30	12th Power Project	1.30	9.21	18.96

Notes;
* - Previously programmed to be completed in 1979
** - Previously programmed to be completed in 1980
DC-1 - Double circuit strung
DC-2 - Second circuit stringing only
1U.S.$ = ₱7.50
1/- to be initially energized at 115 KV
2/- Two (2) double circuit on a total of four (4) circuits
3/- Tentative site at Balavan Bay Area
4/- Tentative site at Manito, Albay
5/- Tentative site at Cauayan, Isabela
6/- Initially energized at 230 KV

Ilocos Norte Electric Cooperative, Inc.
Dingras, Ilocos Norte

STATISTICAL REPORT

(As of December 31, 1979)

Particulars	1978	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
KWH Purchased	24,175,488	2,113,223	2,131,335	1,925,129	2,436,925	2,344,949	2,228,139	2,324,750	2,181,027	2,092,221	2,192,253	2,399,291	2,166,112	50,764,022
KWH Sold	19,455,409	1,458,752	1,558,155	1,486,648	1,852,953	1,680,618	1,727,334	1,773,232	1,714,395	1,600,985	1,830,068	1,891,056	1,631,602	39,661,207
Coop. Consumption(KWH)	28,299	9,360	8,960	9,560	11,840	11,920	17,100	14,760	11,972	9,660	17,172	17,332	16,970	184,905
System loss(KWH)	4,690,780	645,111	564,218	429,121	572,132	664,311	536,885	536,756	454,660	481,635	345,013	400,903	417,440	10,058,065
System loss(%)	19.23	30.53	26.47	22.29	23.48	28.33	23.53	23.09	20.09	27	15.73	16.70	19.27	22.75
Average Load (KWH)	3,266,958	284,035	143,226	258,754	327,544	315,181	316,850	322,882	302,920	290,586	304,480	333,235	2,911,441	9,378,092
Maximum Demand (KWH.Ave)	7,547	7,448	6,935	7,076	7,231	7,349	7,194	7,262	7,023	7,230	7,483	7,699	7,589	7,318
Load Factor (% Ave.)	43.29	38.14	20.65	36.57	43.30	43.48	44.04	44.46	43.14	40.19	40.70	30.29	38.36	38.97
Conductor(km):														
Retied	51.71	13.11	0.81	0.73		1.99	0.23	0.50	0.15	0.27	0.83	3.76	1.65	75.74
Resagged	52.20	13.11	0.81	0.73	2.8	0.35	5.22	0.50	0.15	0.42	0.83	5.26	2.20	84.58
Replaced	1.62						0.20	0.30			0.08	1.45	0.20	3.85
Poles:														
Erected	15,440	133	113	224	210	162	107	579	220	380	37	85	175	17,865
Replaced	79		2	2	70		4		7	5	3		4	176
Retired	25		2	2	2		4			2	3		2	42
Meters:														
Installed	32,172	165	433	391	210	526	1,103	483	87	273	269	259	159	36,530
Replaced	1,650	75	89	144	70	96	110	126	87	35	91	10	56	2,564
Calibreated	26,154	200	735	158	422	336	451	1,211	634	132	758	457	150	31,798
Transformers:														
Installed	1,043		5	1	6	35	22	6	2	22	20	7	26	1,195
Replaced	124	3	2	2			2				3			136
Existing(KVA)	13,321	13,351	13,466	13,491	13,501	14,021	14,386	16,156	16,506	16,836	17,096	17,181	17,461	17,461
Km of lines energized:														
3Ø	342.74				1.63	4.12			1.05	1.54	2.92	1.05		355.05
VØ	6,195						3.61		2.19	0.26	3.61	1.37	1.40	74.39
1Ø	30,934	6.49	13.38	5.72	4.34	14.42	8.34	12.35	4.82	9.15	4.40	5.03	18.98	684.33
Underbuilt	31,976	3.29	8.39	3.77	4.17	14.16	8.84	11.62	4.50	5.65	7.49	3.92	10.89	406.45
Open secondary	30,400	3.52	8.66	6.57	6.57	12.04	6.11	11.31	3.68	8.85	4.68	3.25	9.13	888.38
Service drop	794.89	1.79	8.53	7.23	6.09	9.67	18.83	13.53	2.11	10.24	5.61	5.51	10.15	894.18

Table 3E-7 Daily Report (Laoag Sub-Station)

20 - MVA Sub-station

Time in hours	115 KV Control				69 KV Bus			Feeder-1 (51LG4)					
	Kilo volts	Load current (Amperes)			Bus voltage (KV)			Load current (Amperes)			MVAR	MW	KWH
		A	B	C	RS	ST	TR	A	B	C			
00.00													032127
01.00	117	5	5	5	70	70	70	5	5	5	0.6	10.0	28
02.00	117	5	5	5	70	70.5	70	5	5	5	0.6	10.0	29
03.00	117	5	5	5	70	70.5	70	5	5	5	0.6	10.0	30
04.00	117	5	5	5	70	70.5	70	5	5	5	0.6	10.0	31
05.00	116	5	5	5	60	60.5	60	5	5	5	0.65	10.0	32
06.00	114	14	14	14	68.5	69	68.5	6	6	6	0.9	10.0	32
07.00	117	5	5	5	70	70	70	5	5	5	0.85	10.0	33
08.00	118	5	5	5	70	70.5	70	5	5	5	0.8	10.0	032134
09.00	116	5	5	5	69.5	70	69.5	5	5	5	0.85	10.0	35
10.00	115	5	5	5	68.5	69	68.5	5	5	5	0.85	10.0	36
11.00	114	6	6	6	68	68.5	68	5	5	5	0.9	10.0	37
12.00	116	5	5	5	69.5	69.5	69.5	6	6	6	1.0	10.0	38
13.00	116.5	5	5	5	70	70	70	6	6	6	1.0	10.0	40
14.00	116	5	5	5	70	70	70	6	6	6	1.0	10.0	41
15.00	116.5	6	6	6	70	70	70	6	6	6	1.05	10.0	43
16.00	117	6	6	6	70	70	70	6	6	6	1.05	10.0	032144
17.00	117	6	6	6	70	70	70	6	6	6	1.05	10.0	45
18.00	117	25	28	28	69	69	69	16	17	18	1.6	10.0	47
19.00	101	51	50	51	68	68	68.5	23	24	24	1.85	10.0	49
20.00	104	45	44	45	69	69	69	21	22	22	1.70	10.0	51
21.00	110	30	30	30	69	69	69	18	18	18	1.35	10.0	53
22.00	114	10	10	10	70	70.5	70	10	10	10	1.10	10.0	54
23.00	116	6	6	6	70	70.5	70	6	6	6	0.8	10.0	56
24.00	116	5	5	5	70	70.5	70	5	5	5	0.7	10.0	032157

FIGURE 3E-1 PERFORMANCE GRAPH FOR 1979
(LAOAG SUB-STATION)

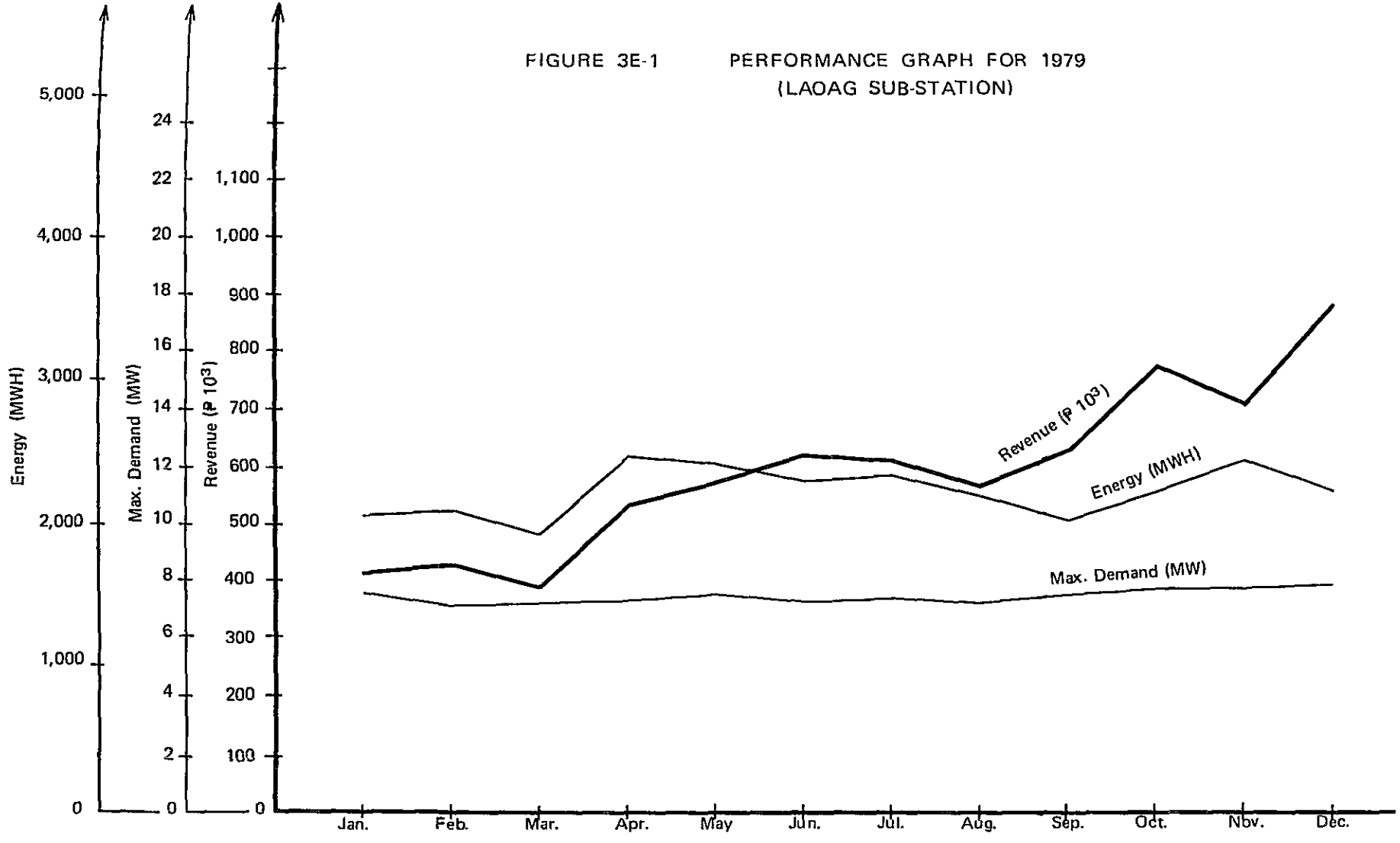


FIGURE 3E-2 PERFORMANCE GRAPH FOR 1979
(BANTAY SUB-STATION)

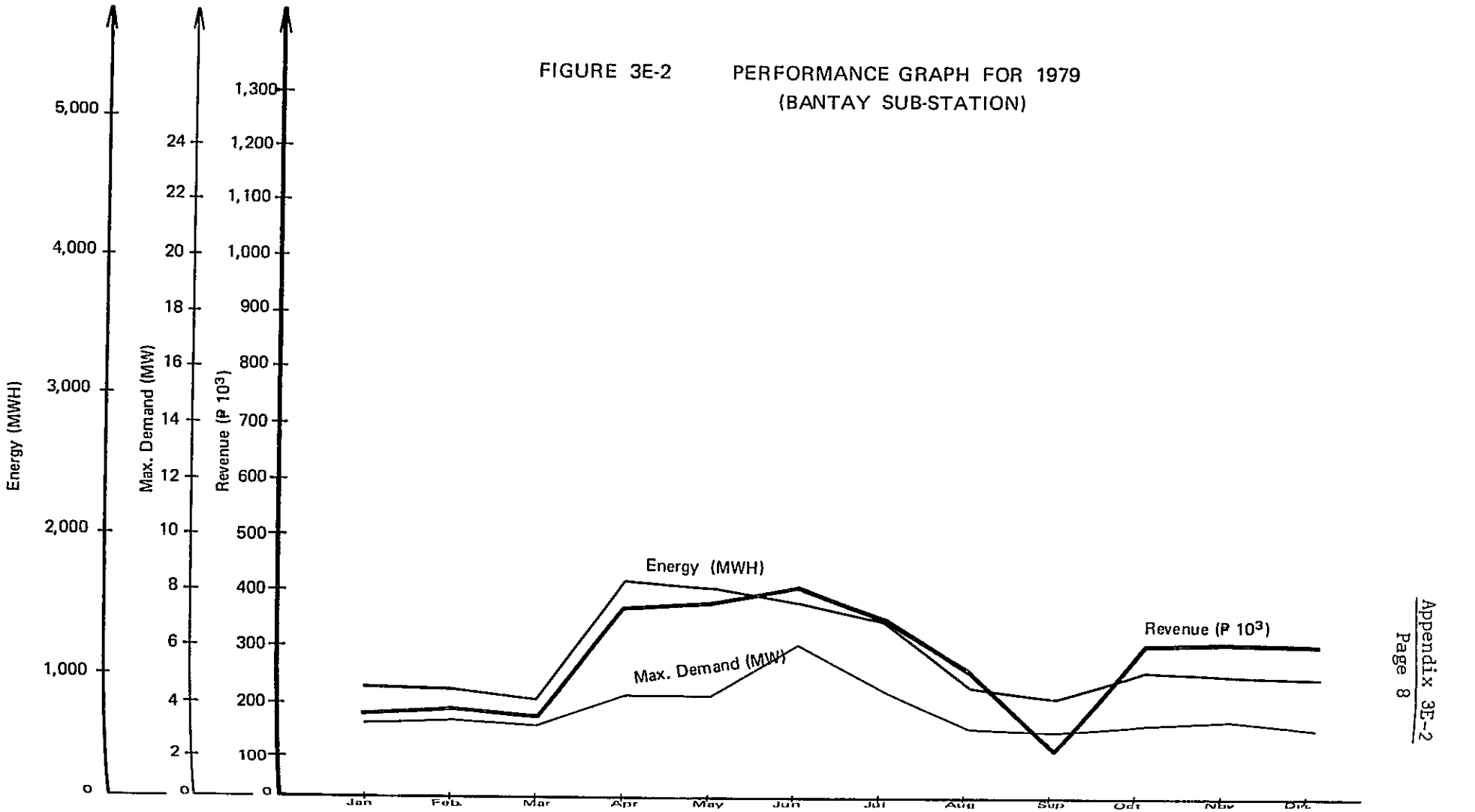


Table 3E-8 Napocor Power Generation Expation Program (Lozon Grid)

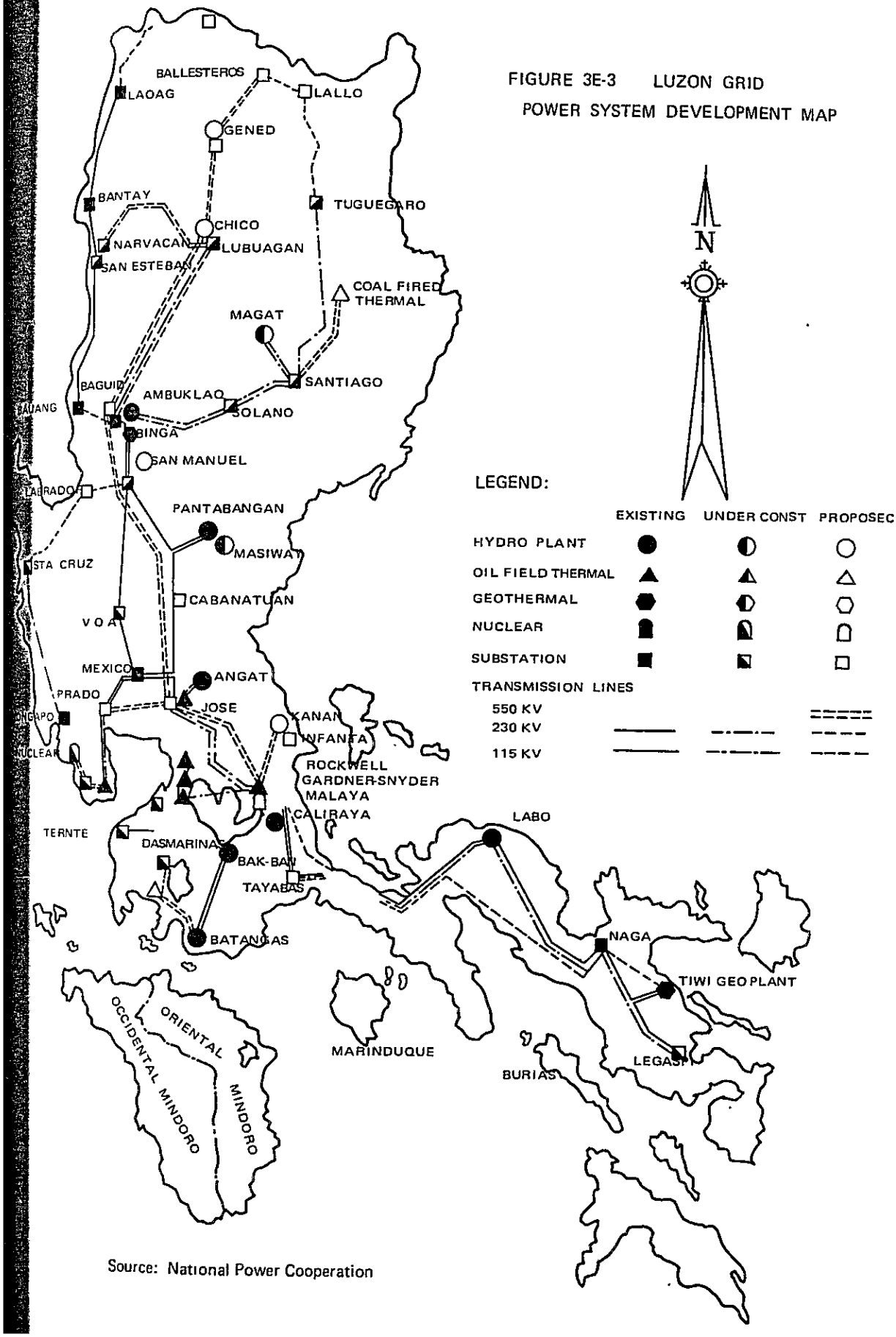
Year	Installed Capacity (MW)						Peak Demand(MW)	Energy Capability(MWH)	Energy Requirement(MWH)
	Hydro.	Geo.	Coal	Nuculear	Oil	Total			
1979	541	220			2,230	2,991	1,905	16,686	11,785
1980	541	440			2,230	3,211	2,038	18,176	12,497
1981	553	440			2,230	3,233	2,180	20,381	13,368
1982	553	550			2,230	3,333	3,034	20,886	14,306
1983	1,033	570			1,935	3,503	3,230	20,481	15,320
1984	1,215	650	300		1,575	3,630	3,417	20,436	16,407
1985	1,213	770	300		1,575	3,858	3,497	22,124	17,554
1986	1,393	770	600	620	1,075	4,458	3,497	23,234	18,836
1987	1,653	770	600	620	1,075	4,718	4,397	24,651	20,184
1988	1,953	880	600	620	1,075	5,123	5,550	27,115	21,525
1989	2,533	880	600	620	875	5,503	6,365	26,784	23,127
1990	3,023	880	600	620	875	5,998	7,169	27,583	24,724

Table 3E-9 Historical and Projected Energy Generation and Peak Demand (Lozon Grid)

Calendar Year	Total Grid Energy Request (GWH)	Total Grid Peak Load (MW)	Total Grid Load Factor (%)
Actual			
1968	5,387	903	68.1
1969	6,087	1,020	68.1
1970	6,386	1,111	65.6
1971	7,048	1,205	66.8
1972	7,555	1,331	64.8
1973	8,212	1,335	70.2
1974	8,240	1,379	68.2
1975	9,014	1,513	68.0
1976	9,626	1,659	66.2
1977	10,357	1,709	69.2
1978	11,223	1,780	71.9
1969-1978 1/	7.6%	7.0%	
Forecast			
1979	11,843	1,958	69.0
1980	12,667	2,096	69.0
1981	13,545	2,243	68.9
1982	14,489	2,400	68.9
1983	15,500	2,569	68.9
1979-1983 1/	6.8%	7.6%	
1984	16,581	2,849	68.9
1985	17,739	2,940	68.9
1986	18,977	3,146	68.9
1987	20,303	3,368	68.8
1988	21,721	3,603	68.8
1989	23,236	3,856	68.8
1990	24,859	4,127	68.8
1984-1990 1/	7.0%	7.0%	
1979-1990 1/	6.9%	7.3%	

Note: 1/ Average annual compound growth.
Energy Loss:NPC-10% MECO-13.4%
Load Factor:NPC-63% MECO-66.5%
Coincidence Factor between NPC-MECO-95%

FIGURE 3E-3 LUZON GRID
POWER SYSTEM DEVELOPMENT MAP



Source: National Power Cooperation

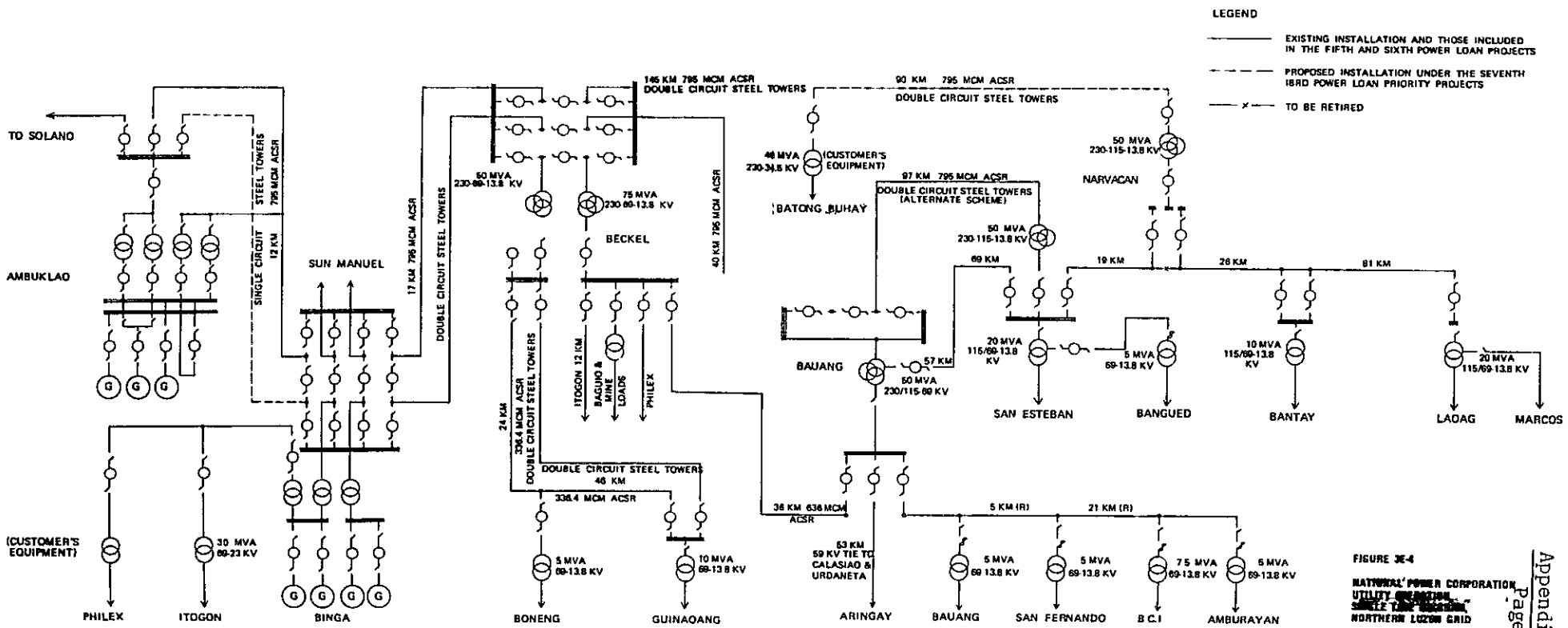


FIGURE 3E-4

NATIONAL POWER CORPORATION
UTILITY OPERATIONS
SINGLE LINE DIAGRAM
NORTHERN LUZON GRID

Table 3E-10 Narvacan, Ilocos Sur Demand Energy Sales Forecast by Bulk Sub-station

Year	Demand (MW)	Energy (GWH)
1981	30.08	85.38
1982	36.68	109.32
1983	39.27	132.78
1984	48.75	170.00
1985	55.90	194.55
1986	63.97	221.49
1987	72.26	247.66
1988	81.63	274.24
1989	92.98	313.26
1990	96.40	331.74

Source; National Power Corporation

FIGURE 3E-5 DEMAND AND ENERGY SALES FORECAST
IN ILOCOS REGION (AS OF JUNE 1979)

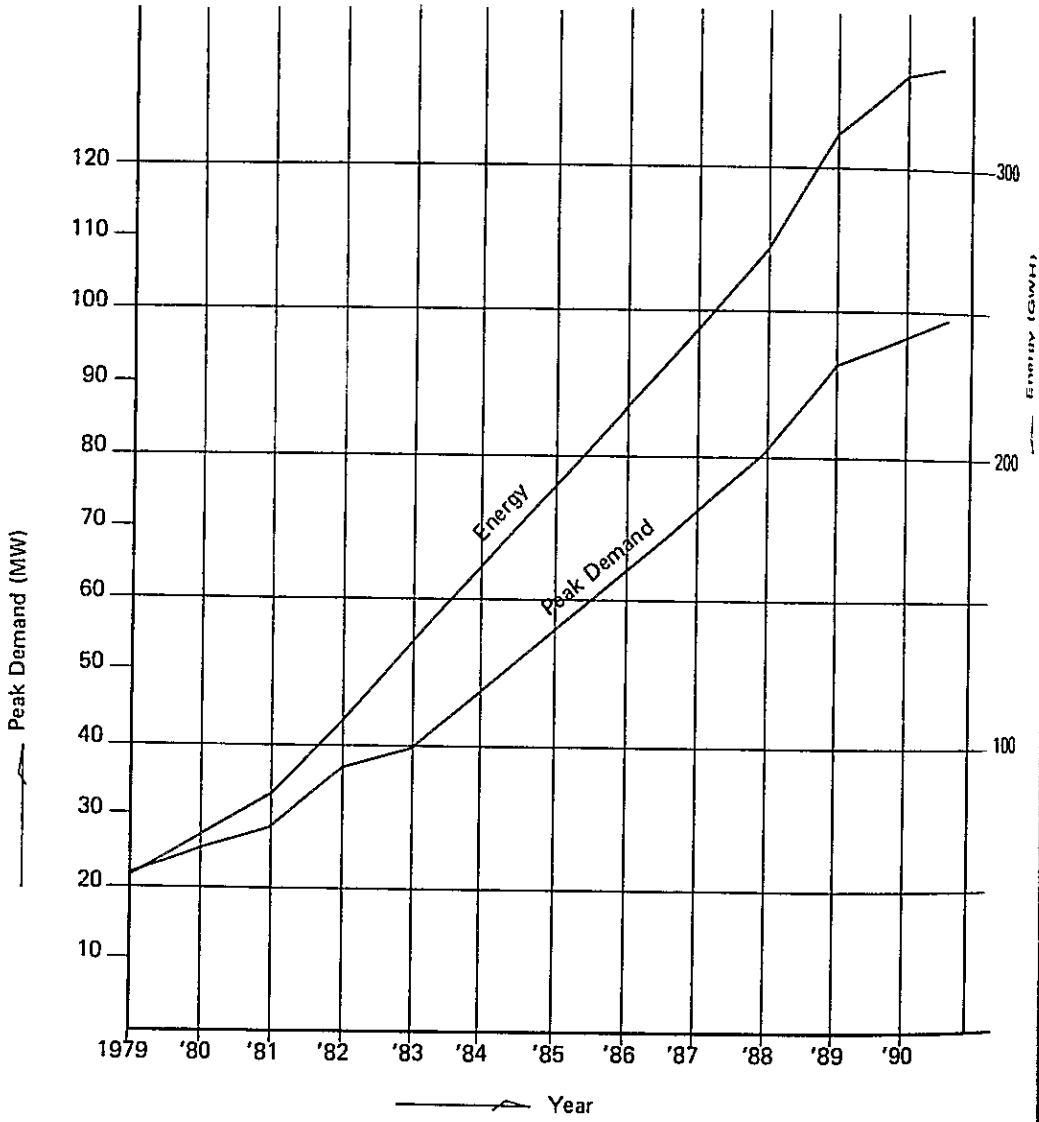


Table 3E-11 Luzon Grid Rate Schedule

Utilities

Applicable to electric power and energy supplied to electric utilities in Luzon served by the Luzon Grid of NPC.

Demand Charge	Per Meter Per Month
First 500 KW of Billing Demand	₱ 12.00 per KW
Next 19,500 KW of Billing Demand	16.00 per KW
Over 20,000 KW of Billing Demand	22.00 per KW

Energy Charge

First 200 KWH per KW of Billing Demand	₱ 0.2900 per KWH
Next 200 KWH per KW of Billing Demand	0.3100 per KWH
Over 400 KWH per KW of Billing Demand	0.3320 per KWH

Industries and Non-utilities

Applicable to electirc power and energy supplied to industris and non-utilities in Luzon served by the Luzon Grid of NPC.

Demand Charge	Per Meter Per Month
First 1,000 KW of Billing Demand	₱ 18.00 per KW
Next 9,000 KW of Billing Demand	19.00 per KW
Over 10,000 KW of Billing Demand	20.10 per KW

Energy Charge

First 200 KWH per KW of Billing Demand	₱ 0.3650 per KWH
Next 250 KWH per KW of Billing Demand	0.3300 per KWH
Over 450 KWH per KW of Billing Demand	0.3000 per KWH

Source; National Power Corporation

Table 3E-12 Fuel Cost Adjustment Clause 1/

Applicable to both Utilities and Non-Utilities /Industries Rates Schedules in the Luzon Grid.

The FCA charge per kilowatthour shall be correspondingly increased or decreased by the following adjustment, rounded to the nearest ₱ 0.0001:

$$\text{Adjustment per kwh} = \frac{A \times B}{C}$$

Where A = The weighted average price increase above (or decrease below) ₱ 30.29 per MBTU base price of fuel oil actually burned during the billing period, net of all taxes, duties, fees and all other charges imposed by the Republic of the Philippines and its various instrumentalities to the extent that NPC is able to avail of or otherwise benefit from such exemption.

B = Million BTU or liters of fuel oil actually burned in the Luzon Grid's oil-burning generating plants during the billing period.

C = Kilowatt-hour sales by NPC in the Luzon Grid during the billing period.

1/; Prepared by National Power Corporation

Table 3E-13 Rates Schedule

		Rate
-Residential		
Minimum	1-10 kwh	₱ 4.50
Excess		0.50/kwh
-Commercial		
Small		
Minimum	1-25 kwh	₱ 15.00
Excess		0.52/kwh
Large		
Minimum	25-50 kwh	₱ 28.00
Excess		0.52/kwh
Demand Charge		12.00/kw
-Public Buildings		
Minimum	1-10 kwh	₱ 4.5
Excess		0.50/kwh
-Industrial		
A. Below 25 kw Demand		
Minimum		₱200.00/month
Demand Charge		12.00/kw
Energy Charge		0.46/kwh
B. 25 kw Above Demand		
Demand Charge		₱ 12.00/kw
Excess		0.46/kwh
-Irrigation		
A. Big Pumps (75 HP Above)		
Demand Charge		₱ 12.00/kw
Energy Charge		0.45/kwh
B. Bisa Pumps (FSDC Assisted)		
As is energy charge		₱ 0.35/kwh
-Big Hotels		
1st 3,000 kwh		₱ 0.50/kwh
3,001 to 5,999 kwh		0.475/kwh
6,000 Above		0.45/kwh
Demand Charge		12.00/kw

Source; Ilocos Norte Electric Cooperative, Inc.
Dingras, Ilocos Norte

Table 3E-14 Rate Schedule

		Rate
-Residential		
Minimum	1-12 kwh	₱ 4.50
Excess		0.48/kwh
-Commercial		
Minimum	1-25 kwh	₱ 13.00
Excess		0.51/kwh
-Public Buildings		
Minimum	1-12 kwh	₱ 6.00
Excess		0.48/kwh
-Industrial		
Minimum		
Light	(5-25 kwh)	₱ 50.00/month
Medium	(25-50 kwh)	250.00/month
Heavy		Case to case
Demand Charge		10.00/kw
Energy Charge		0.46/kwh
-Irrigation		
Minimum		₱ 5.00/Hp/month
Rate		0.35/kwh
-Street light		0.50/kwh

Source; Ilocos Sur Electric Cooperative, Inc.
Santiago, Ilocos Sur

Table 3E-15 Rates Schedule

		Rate
-Residential		
Minimum	1-12 kwh	₱ 5.00
Excess		0.55/kwh
-Commercial		
Minimum	1-20 kwh	₱ 11.40
Excess		0.57/kwh
-Public Building		
Minimum	1-15 kwh	₱ 8.50
Excess		0.57/kwh
-Industrial		
Demand Charge		₱ 10.00/kw
Energy Charge		0.57/kwh
-Irrigation		
Energy Charge		₱ 0.33/kwh
-Street Lights		
MVL (175 w)		₱ 32.00/month
FL (20 w)		14.00/month
Incandescent bulb		14.00/month
-Special lighting		
50 w		₱ 4.00/bulb/night
Service fee		20.00

Source; Abra Electirc Cooperative, Inc.
Bangued, Abra

CHAPTER IV. THE PROJECT

Table 4B-1. Water Requirement for Land Soaking and Land Preparation

Land to be prepared in May, June and July

1.	First irrigation	:	175
	Top soil saturation 150 mm depth, 60% void, 70% dry	: 150 mm x 0.6 x 0.7	65
	Percolation (2 mm/day)	: 2 mm x 25 days	50
	Standing water	:	60
2.	Second and third irrigation	:	75
	Evaporation in 12 days	: 6.1 mm x 12 days	75
	Total		250

Land to be prepared in October, November and December

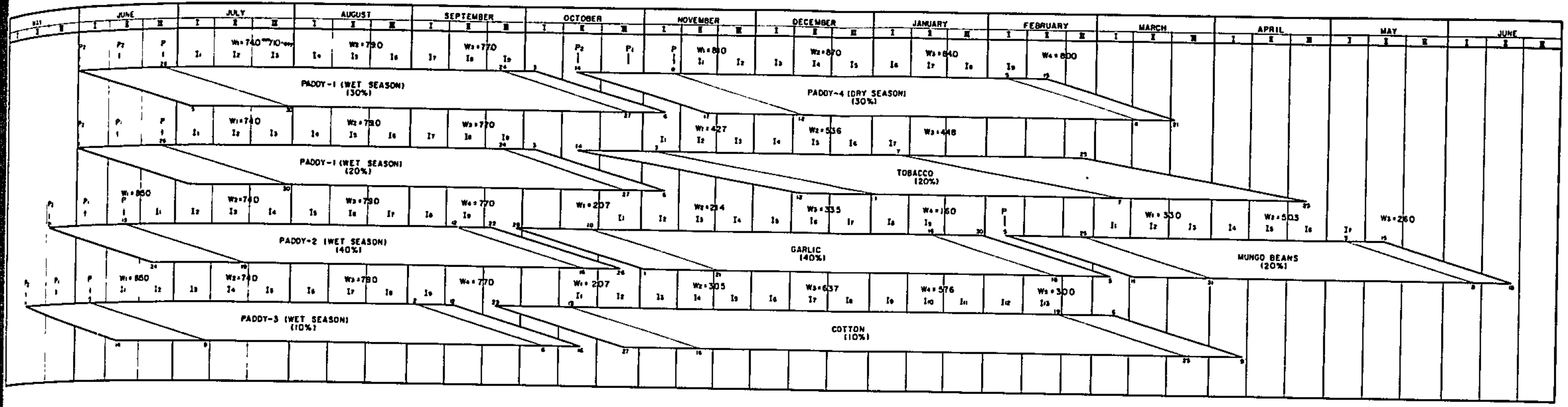
1.	First irrigation	:	150
	Top soil saturation 150 mm depth, 60% void, 40% dry	: 150 mm x 0.6 x 0.4	40
	Percolation (2 mm/day)	: 2 mm x 25 days	50
	Standing water	:	60
2.	Second and third irrigation	:	80
	Evaporation in 12 days	: 6.6 mm x 12 days	80
	Total		230

Table 4B-2. Daily Average Crop Water Requirement by Season

Month	Wet Season			Dry Season				
					Upland Crops			
	Paddy-1 (mm/day)	Paddy-2 (mm/day)	Paddy-3 (mm/day)	Paddy-4 (mm/day)	Tobacco (mm/day)	Garlic (mm/day)	Mungo Bean (mm/day)	Cotton (mm/day)
May I							4.3	
II			4.5				2.9	
III		5.0	7.0				1.5	
June I	5.0	6.5	8.2				0.4	
II	6.5	8.2	9.2					
III	8.2	8.7	8.7					
July I	8.9	8.4	9.1					
II	8.1	8.8	*7.9					
III	9.1	*8.2	7.5					
Aug. I	*7.3	7.3	7.3					
II	7.5	7.5	7.5					
III	7.5	7.5	7.5					
Sep. I	7.6	7.6	7.6					
II	7.6	7.6	5.4					
III	7.5	5.3	3.1					
Oct. I	5.5	3.3	1.1					
II	3.3	1.1		3.9				0.4
III	1.1			5.6		0.7		1.-
Nov. I				7.0	1.2	1.2		2.1
II				8.2	2.1	1.8		2.3
III				9.2	2.8	2.1		2.-
Dec. I				9.6	3.7	2.5		4.7
II				*9.1	4.1	2.8		5.
III				9.4	5.8	3.5		7.-
Jan. I				8.4	4.9	2.8		6.7
II				8.3	4.1	2.3		5.9
III				8.9	4.0	1.4		6.8
Feb. I				8.1	2.4	0.6	0.7	4.8
II				5.7	1.5	0.1	1.1	4.0
III				2.8	0.7		0.6	1.8
Mar. I				1.6	0.1		2.1	1.5
II							2.0	0.7
III							3.1	
Apr. I							3.7	
II							4.2	
III							4.7	

Note: 10-day average water requirement by crops is given in Figure 4B-..
* shows the start of crop maintenance stage.

FIGURE 4B-1 CALCULATION OF CROP WATER REQUIREMENT



PADDY-1 (WET SEASON)

IRRIGATION REQ	EQUATION FOR 10-DAY WEIGHTED IRRIGATION REQUIREMENT		DAILY AVERAGE WATER REQ (mm/day)
P_2	$WR=\frac{10}{35}P_2$	$=\frac{10}{35}P_2$	500
P_1	$WR=\frac{10}{35}P_2+\frac{7}{35}P_1$	$=\frac{1}{35}(10P_2+7P_1)$	650
P	$WR=\frac{10}{35}P_2+\frac{10}{35}P_1+\frac{5}{35}P$	$=\frac{1}{35}(10P_2+10P_1+5P)$	821
I_1	$WR=\frac{5}{35}P_2+\frac{10}{35}P_1+\frac{10}{35}P+\frac{10}{35}I_1$	$=\frac{1}{35}(5P_2+10P_1+10P+10W_1)$	890
I_2	$WR=\frac{8}{35}P_1+\frac{10}{35}P+\frac{10}{35}I_1+\frac{10}{35}I_2$	$=\frac{1}{35}(8P_1+10P+20W_1)$	809
I_3	$WR=\frac{10}{35}P+\frac{11}{35}I_1+\frac{11}{35}I_2+\frac{11}{35}I_3$	$=\frac{1}{35}(10P+33W_1)$	912
I_4	$WR=\frac{4}{35}I_1+\frac{10}{35}I_2+\frac{10}{35}I_3+\frac{10}{35}I_4$	$=\frac{1}{35}(24W_1+10W_2)$	733
I_5	$WR=\frac{4}{35}I_2+\frac{10}{35}I_3+\frac{10}{35}I_4+\frac{10}{35}I_5$	$=\frac{1}{35}(14W_1+20W_2)$	747
I_6	$WR=\frac{4}{35}I_3+\frac{11}{35}I_4+\frac{11}{35}I_5+\frac{11}{35}I_6$	$=\frac{1}{35}(4W_1+33W_2)$	754
I_7	$WR=\frac{4}{35}I_4+\frac{10}{35}I_5+\frac{10}{35}I_6+\frac{10}{35}I_7$	$=\frac{1}{35}(24W_2+10W_3)$	762
I_8	$WR=\frac{4}{35}I_5+\frac{10}{35}I_6+\frac{10}{35}I_7+\frac{10}{35}I_8$	$=\frac{1}{35}(14W_2+20W_3)$	756
I_9	$WR=\frac{4}{35}I_6+\frac{10}{35}I_7+\frac{10}{35}I_8+\frac{10}{35}I_9$	$=\frac{1}{35}(4W_2+30W_3)$	750
	$WR=\frac{5}{35}I_7+\frac{10}{35}I_8+\frac{10}{35}I_9$	$=\frac{25}{35}W_3$	550
	$WR=\frac{5}{35}I_8+\frac{10}{35}I_9$	$=\frac{15}{35}W_3$	330
	$WR=\frac{5}{35}I_9$	$=\frac{5}{35}W_3$	110
	TOTAL CROP WATER REQUIREMENT (TCWR) = 1028 mm		

PADDY-2 (WET SEASON)

IRRIGATION REQ	EQUATION FOR 10-DAY WEIGHTED IRRIGATION REQUIREMENT		DAILY AVERAGE WATER REQ (mm/day)
P_2	$WR=\frac{11}{35}P_2$	$=\frac{11}{35}P_2$	500
P_1	$WR=\frac{10}{35}P_2+\frac{7}{35}P_1$	$=\frac{1}{35}(10P_2+7P_1)$	650
P	$WR=\frac{10}{35}P_2+\frac{10}{35}P_1+\frac{5}{35}P$	$=\frac{1}{35}(10P_2+10P_1+5P)$	821
I_1	$WR=\frac{4}{35}P_2+\frac{10}{35}P_1+\frac{10}{35}P+\frac{10}{35}I_1$	$=\frac{1}{35}(4P_2+10P_1+10P+10W_1)$	871
I_2	$WR=\frac{8}{35}P_1+\frac{10}{35}P+\frac{10}{35}I_1+\frac{10}{35}I_2$	$=\frac{1}{35}(8P_1+10P+10W_1+10W_2)$	840
I_3	$WR=\frac{10}{35}P+\frac{10}{35}I_1+\frac{10}{35}I_2+\frac{10}{35}I_3$	$=\frac{1}{35}(10P+10W_1+20W_2)$	880
I_4	$WR=\frac{5}{35}I_1+\frac{11}{35}I_2+\frac{11}{35}I_3+\frac{11}{35}I_4$	$=\frac{1}{35}(5W_1+33W_2)$	819
I_5	$WR=\frac{4}{35}I_2+\frac{10}{35}I_3+\frac{10}{35}I_4+\frac{10}{35}I_5$	$=\frac{1}{35}(24W_2+10W_3)$	733
I_6	$WR=\frac{4}{35}I_3+\frac{10}{35}I_4+\frac{10}{35}I_5+\frac{10}{35}I_6$	$=\frac{1}{35}(14W_2+20W_3)$	747
I_7	$WR=\frac{4}{35}I_4+\frac{11}{35}I_5+\frac{11}{35}I_6+\frac{11}{35}I_7$	$=\frac{1}{35}(4W_2+33W_3)$	754
I_8	$WR=\frac{4}{35}I_5+\frac{10}{35}I_6+\frac{10}{35}I_7+\frac{10}{35}I_8$	$=\frac{1}{35}(24W_3+10W_4)$	762
I_9	$WR=\frac{4}{35}I_6+\frac{10}{35}I_7+\frac{10}{35}I_8+\frac{10}{35}I_9$	$=\frac{1}{35}(14W_3+20W_4)$	756
	$WR=\frac{4}{35}I_7+\frac{10}{35}I_8+\frac{10}{35}I_9$	$=\frac{1}{35}(4W_3+20W_4)$	530
	$WR=\frac{5}{35}I_8+\frac{10}{35}I_9$	$=\frac{15}{35}W_4$	330
	$WR=\frac{5}{35}I_9$	$=\frac{5}{35}W_4$	110
	TCWR = 1,031 mm		

PADDY-3 (WET SEASON)

IRRIGATION REQ	EQUATION FOR 10-DAY WEIGHTED IRRIGATION REQUIREMENT		DAILY AVERAGE WATER REQ (mm/day)
P_2	$WR=\frac{9}{35}P_2$	$=\frac{9}{35}P_2$	450
P_1	$WR=\frac{11}{35}P_2+\frac{7}{35}P_1$	$=\frac{1}{35}(11P_2+7P_1)$	700
P	$WR=\frac{10}{35}P_2+\frac{10}{35}P_1+\frac{5}{35}P$	$=\frac{1}{35}(10P_2+10P_1+5P)$	821
I_1	$WR=\frac{5}{35}P_2+\frac{10}{35}P_1+\frac{10}{35}P+\frac{10}{35}I_1$	$=\frac{1}{35}(5P_2+10P_1+10P+10W_1)$	921
I_2	$WR=\frac{8}{35}P_1+\frac{10}{35}P+\frac{10}{35}I_1+\frac{10}{35}I_2$	$=\frac{1}{35}(8P_1+10P+20W_1)$	871
I_3	$WR=\frac{10}{35}P+\frac{10}{35}I_1+\frac{10}{35}I_2+\frac{10}{35}I_3$	$=\frac{1}{35}(10P+20W_1+10W_2)$	911
I_4	$WR=\frac{5}{35}I_1+\frac{10}{35}I_2+\frac{10}{35}I_3+\frac{10}{35}I_4$	$=\frac{1}{35}(15W_1+20W_2)$	787
I_5	$WR=\frac{5}{35}I_2+\frac{11}{35}I_3+\frac{11}{35}I_4+\frac{11}{35}I_5$	$=\frac{1}{35}(5W_1+33W_2)$	745
I_6	$WR=\frac{4}{35}I_3+\frac{10}{35}I_4+\frac{10}{35}I_5+\frac{10}{35}I_6$	$=\frac{1}{35}(24W_2+10W_3)$	733
I_7	$WR=\frac{4}{35}I_4+\frac{10}{35}I_5+\frac{10}{35}I_6+\frac{10}{35}I_7$	$=\frac{1}{35}(14W_2+20W_3)$	747
I_8	$WR=\frac{4}{35}I_5+\frac{11}{35}I_6+\frac{11}{35}I_7+\frac{11}{35}I_8$	$=\frac{1}{35}(4W_2+33W_3)$	754
I_9	$WR=\frac{4}{35}I_6+\frac{10}{35}I_7+\frac{10}{35}I_8+\frac{10}{35}I_9$	$=\frac{1}{35}(24W_3+10W_4)$	762
	$WR=\frac{4}{35}I_7+\frac{10}{35}I_8+\frac{10}{35}I_9$	$=\frac{1}{35}(14W_3+10W_4)$	536
	$WR=\frac{4}{35}I_8+\frac{10}{35}I_9$	$=\frac{1}{35}(4W_3+10W_4)$	310
	$WR=\frac{5}{35}I_9$	$=\frac{5}{35}W_4$	110
	TCWR = 1,035 mm		

PADDY-4 (DRY SEASON)

IRRIGATION REQ	EQUATION FOR 10-DAY WEIGHTED IRRIGATION REQUIREMENT		DAILY AVERAGE WATER REQ (mm/day)
P_2	$WR=\frac{6}{35}P_2$	$=\frac{9}{35}P_2$	386
P_1	$WR=\frac{11}{35}P_2+\frac{4}{35}P_1$	$=\frac{1}{35}(11P_2+4P_1)$	563
P	$WR=\frac{10}{35}P_2+\frac{10}{35}P_1+\frac{2}{35}P$	$=\frac{1}{35}(10P_2+10P_1+2P)$	703
I_1	$WR=\frac{8}{35}P_2+\frac{10}{35}P_1+\frac{10}{35}P+\frac{10}{35}I_1$	$=\frac{1}{35}(8P_2+10P_1+10P+10W_1)$	823
I_2	$WR=\frac{10}{35}P_1+\frac{10}{35}P+\frac{10}{35}I_1+\frac{10}{35}I_2$	$=\frac{1}{35}(10P_1+10P+20W_1)$	920
I_3	$WR=\frac{1}{35}P_1+\frac{10}{35}P+\frac{10}{35}I_1+\frac{10}{35}I_2+\frac{10}{35}I_3$	$=\frac{1}{35}(P_1+10P+20W_1+10W_2)$	963
I_4	$WR=\frac{3}{35}P+\frac{5}{35}I_1+\frac{10}{35}I_2+\frac{10}{35}I_3+\frac{10}{35}I_4$	$=\frac{1}{35}(3P+15W_1+20W_2)$	913
I_5	$WR=\frac{5}{35}I_2+\frac{11}{35}I_3+\frac{11}{35}I_4+\frac{11}{35}I_5$	$=\frac{1}{35}(5W_1+33W_2)$	936
I_6	$WR=\frac{4}{35}I_3+\frac{10}{35}I_4+\frac{10}{35}I_5+\frac{10}{35}I_6$	$=\frac{1}{35}(24W_2+10W_3)$	837
I_7	$WR=\frac{4}{35}I_4+\frac{10}{35}I_5+\frac{10}{35}I_6+\frac{10}{35}I_7$	$=\frac{1}{35}(14W_2+20W_3)$	828
I_8	$WR=\frac{4}{35}I_5+\frac{11}{35}I_6+\frac{11}{35}I_7+\frac{11}{35}I_8$	$=\frac{1}{35}(4W_2+33W_3)$	891
I_9	$WR=\frac{4}{35}I_6+\frac{10}{35}I_7+\frac{10}{35}I_8+\frac{10}{35}I_9$	$=\frac{1}{35}(24W_3+10W_4)$	805
	$WR=\frac{4}{35}I_7+\frac{10}{35}I_8+\frac{10}{35}I_9$	$=\frac{1}{35}(14W_3+10W_4)$	565
	$WR=\frac{4}{35}I_8+\frac{8}{35}I_9$	$=\frac{1}{35}(4W_3+8W_4)$	279
	$WR=\frac{7}{35}I_9$	$=\frac{7}{35}W_4$	160
	TCWR = 1,066 mm		

TOBACCO

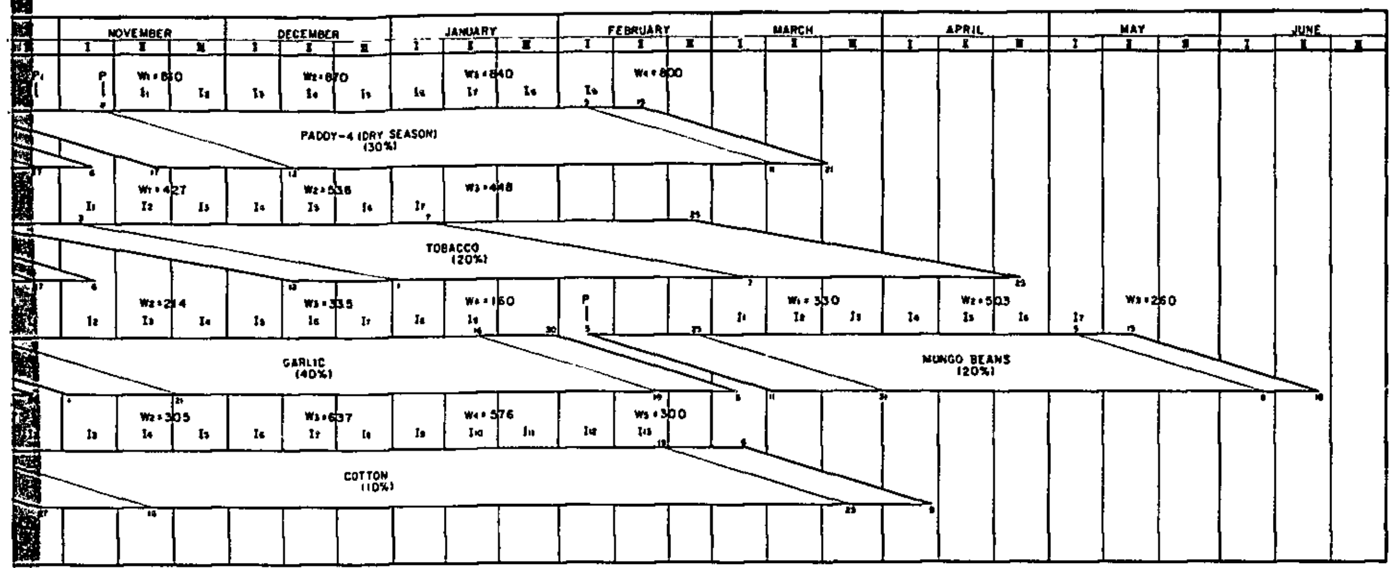
IRRIGATION REQ	EQUATION FOR 10-DAY WEIGHTED IRRIGATION REQUIREMENT		DAILY AVERAGE WATER REQ (mm/day)
I_1	$WR=\frac{10}{60}P_1+\frac{7}{60}I_1$	$=\frac{1}{60}(10P_1+7W_1)$	116
I_2	$WR=\frac{10}{60}P_1+\frac{10}{60}I_1+\frac{10}{60}I_2$	$=\frac{1}{60}(10P_1+20W_1)$	209
I_3	$WR=\frac{10}{60}P_1+\frac{10}{60}I_1+\frac{10}{60}I_2+\frac{10}{60}I_3$	$=\frac{1}{60}(10P_1+30W_1)$	280
I_4	$WR=\frac{10}{60}P_1+\frac{10}{60}I_1+\frac{10}{60}I_2+\frac{10}{60}I_3+\frac{10}{60}I_4$	$=\frac{1}{60}(10P_1+30W_1+10W_2)$	370
I_5	$WR=\frac{3}{60}P_1+\frac{10}{60}I_1+\frac{10}{60}I_2+\frac{10}{60}I_3+\frac{10}{60}I_4+\frac{10}{60}I_5$	$=\frac{1}{60}(3P_1+30W_1+20W_2)$	412
I_6	$WR=\frac{11}{60}I_1+\frac{11}{60}I_2+\frac{11}{60}I_3+\frac{11}{60}I_4+\frac{11}{60}I_5+\frac{11}{60}I_6$	$=\frac{1}{60}(33W_1+33W_2)$	583
I_7	$WR=\frac{2}{60}I_1+\frac{9}{60}I_2+\frac{10}{60}I_3+\frac{10}{60}I_4+\frac{10}{60}I_5+\frac{10}{60}I_6+\frac{10}{60}I_7$	$=\frac{1}{60}(21W_1+30W_2+10W_3)$	492
	$WR=\frac{9}{60}I_3+\frac{10}{60}I_4+\frac{10}{60}I_5+\frac{10}{60}I_6+\frac{10}{60}I_7$	$=\frac{1}{60}(9W_1+30W_2+10W_3)$	407
	$WR=\frac{9}{60}I_4+\frac{11}{60}I_5+\frac{11}{60}I_6+\frac{11}{60}I_7$	$=\frac{1}{60}(31W_2+11W_3)$	395
	$WR=\frac{8}{60}I_5+\frac{10}{60}I_6+\frac{10}{60}I_7$	$=\frac{1}{60}(18W_2+10W_3)$	235
	$WR=\frac{8}{60}I_6+\frac{10}{60}I_7$	$=\frac{1}{60}(8W_2+10W_3)$	146
	$WR=\frac{8}{60}I_7$	$=\frac{8}{60}W_3$	066
	$WR=\frac{1}{60}I_7$	$=\frac{1}{60}W_3$	008
	TCWR = 319 mm		

GARLIC

IRRIGATION REQ	EQUATION FOR 10-DAY WEIGHTED IRRIGATION REQUIREMENT	
I_1	$WR=\frac{11}{35}I_1$	$=\frac{11}{35}I_1$
I_2	$WR=\frac{10}{35}I_1+\frac{10}{35}I_2$	$=\frac{1}{35}(10W_1+10W_2)$
I_3	$WR=\frac{10}{35}I_1+\frac{10}{35}I_2+\frac{10}{35}I_3$	$=\frac{1}{35}(10W_1+20W_2)$
I_4	$WR=\frac{4}{35}I_1+\frac{10}{35}I_2+\frac{10}{35}I_3+\frac{10}{35}I_4$	$=\frac{1}{35}(4W_1+30W_2)$
I_5	$WR=\frac{5}{35}I_2+\frac{10}{35}I_3+\frac{10}{35}I_4+\frac{10}{35}I_5$	$=\frac{1}{35}(25W_2+10W_3)$
I_6	$WR=\frac{5}{35}I_3+\frac{10}{35}I_4+\frac{10}{35}I_5+\frac{10}{35}I_6$	$=\frac{1}{35}(15W_2+20W_3)$
I_7	$WR=\frac{5}{35}I_4+\frac{11}{35}I_5+\frac{11}{35}I_6+\frac{11}{35}I_7$	$=\frac{1}{35}(5W_2+33W_3)$
I_8	$WR=\frac{4}{35}I_5+\frac{10}{35}I_6+\frac{10}{35}I_7+\frac{10}{35}I_8$	$=\frac{1}{35}(24W_3+10W_4)$
I_9	$WR=\frac{4}{35}I_6+\frac{10}{35}I_7+\frac{10}{35}I_8+\frac{10}{35}I_9$	$=\frac{1}{35}(14W_3+20W_4)$
	$WR=\frac{4}{35}I_7+\frac{11}{35}I_8+\frac{11}{35}I_9$	$=\frac{1}{35}(4W_3+22W_4)$
	$WR=\frac{4}{35}I_8+\frac{10}{35}I_9$	$=\frac{14}{35}W_4$
	$WR=\frac{4}{35}I_9$	$=\frac{4}{35}W_4$
	TCWR = 223 mm	

NOTE: P ADDITIONAL WATER SUPPLY FOR LAND SOAKING AND LAND PREPARATION (mm)
W WATER REQUIREMENT (mm/10-day)
TCWR TOTAL CROP WATER REQUIREMENT

ON OF CROP WATER REQUIREMENT



DAILY AVERAGE WATER REQ (mm/day)
5 00
6 50
9 21
8 71
8 40
6 80
8 19
7 33
7 47
7 54
7 62
7 56
5 30
3 30
1 10

PADDY-3 (WET SEASON)

IRRIGATION REQ	EQUATION FOR 10-DAY WEIGHTED IRRIGATION REQUIREMENT	DAILY AVERAGE WATER REQ (mm/day)
P_2	$WR = \frac{9}{35}P_2 = \frac{9}{35}P_2$	4 50
P_1	$WR = \frac{11}{35}P_2 + \frac{7}{35}P_1 = \frac{1}{35}(11P_2 + 7P_1)$	7 00
P	$WR = \frac{10}{35}P_2 + \frac{10}{35}P_1 + \frac{5}{35}P = \frac{1}{35}(10P_2 + 10P_1 + 5P)$	8 21
I_1	$WR = \frac{5}{35}P_2 + \frac{10}{35}P_1 + \frac{10}{35}P + \frac{10}{35}I_1 = \frac{1}{35}(5P_2 + 10P_1 + 10P + 10W_1)$	9 21
I_2	$WR = \frac{8}{35}P_1 + \frac{10}{35}P + \frac{10}{35}I_1 + \frac{10}{35}I_2 = \frac{1}{35}(8P_1 + 10P + 20W_1)$	8 71
I_3	$WR = \frac{10}{35}P + \frac{10}{35}I_1 + \frac{10}{35}I_2 + \frac{10}{35}I_3 = \frac{1}{35}(10P + 20W_1 + 10W_2)$	9 11
I_4	$WR = \frac{5}{35}I_1 + \frac{10}{35}I_2 + \frac{10}{35}I_3 + \frac{10}{35}I_4 = \frac{1}{35}(15W_1 + 20W_2)$	7 87
I_5	$WR = \frac{5}{35}I_2 + \frac{11}{35}I_3 + \frac{11}{35}I_4 + \frac{11}{35}I_5 = \frac{1}{35}(5W_1 + 33W_2)$	7 45
I_6	$WR = \frac{4}{35}I_3 + \frac{10}{35}I_4 + \frac{10}{35}I_5 + \frac{10}{35}I_6 = \frac{1}{35}(24W_2 + 10W_3)$	7 33
I_7	$WR = \frac{4}{35}I_4 + \frac{10}{35}I_5 + \frac{10}{35}I_6 + \frac{10}{35}I_7 = \frac{1}{35}(14W_2 + 20W_3)$	7 47
I_8	$WR = \frac{4}{35}I_5 + \frac{11}{35}I_6 + \frac{11}{35}I_7 + \frac{11}{35}I_8 = \frac{1}{35}(4W_2 + 33W_3)$	7 54
I_9	$WR = \frac{4}{35}I_6 + \frac{10}{35}I_7 + \frac{10}{35}I_8 + \frac{10}{35}I_9 = \frac{1}{35}(24W_3 + 10W_4)$	7 62
	$WR = \frac{4}{35}I_7 + \frac{10}{35}I_8 + \frac{10}{35}I_9 = \frac{1}{35}(14W_3 + 10W_4)$	5 36
	$WR = \frac{4}{35}I_8 + \frac{10}{35}I_9 = \frac{1}{35}(4W_3 + 10W_4)$	3 10
	$WR = \frac{5}{35}I_9 = \frac{5}{35}W_4$	1 10
	TCWR = 1,035 mm	

PADDY-4 (DRY SEASON)

IRRIGATION REQ	EQUATION FOR 10-DAY WEIGHTED IRRIGATION REQUIREMENT	DAILY AVERAGE WATER REQ (mm/day)
P_2	$WR = \frac{6}{35}P_2 = \frac{9}{35}P_2$	3 86
P_1	$WR = \frac{11}{35}P_2 + \frac{4}{35}P_1 = \frac{1}{35}(11P_2 + 4P_1)$	5 63
P	$WR = \frac{10}{35}P_2 + \frac{10}{35}P_1 + \frac{2}{35}P = \frac{1}{35}(10P_2 + 10P_1 + 2P)$	7 03
I_1	$WR = \frac{8}{35}P_2 + \frac{10}{35}P_1 + \frac{10}{35}P + \frac{10}{35}I_1 = \frac{1}{35}(8P_2 + 10P_1 + 10P + 10W_1)$	8 23
I_2	$WR = \frac{10}{35}P_1 + \frac{10}{35}P + \frac{10}{35}I_1 + \frac{10}{35}I_2 = \frac{1}{35}(10P_1 + 10P + 20W_1)$	9 20
I_3	$WR = \frac{1}{35}P_1 + \frac{10}{35}P + \frac{10}{35}I_1 + \frac{10}{35}I_2 + \frac{10}{35}I_3 = \frac{1}{35}(P_1 + 10P + 20W_1 + 10W_2)$	9 63
I_4	$WR = \frac{3}{35}P + \frac{5}{35}I_1 + \frac{10}{35}I_2 + \frac{10}{35}I_3 + \frac{10}{35}I_4 = \frac{1}{35}(3P + 15W_1 + 20W_2)$	9 13
I_5	$WR = \frac{5}{35}I_2 + \frac{11}{35}I_3 + \frac{11}{35}I_4 + \frac{11}{35}I_5 = \frac{1}{35}(5W_1 + 33W_2)$	9 36
I_6	$WR = \frac{4}{35}I_3 + \frac{10}{35}I_4 + \frac{10}{35}I_5 + \frac{10}{35}I_6 = \frac{1}{35}(24W_2 + 10W_3)$	8 37
I_7	$WR = \frac{4}{35}I_4 + \frac{10}{35}I_5 + \frac{10}{35}I_6 + \frac{10}{35}I_7 = \frac{1}{35}(14W_2 + 20W_3)$	8 28
I_8	$WR = \frac{4}{35}I_5 + \frac{11}{35}I_6 + \frac{11}{35}I_7 + \frac{11}{35}I_8 = \frac{1}{35}(4W_2 + 33W_3)$	8 91
I_9	$WR = \frac{4}{35}I_6 + \frac{10}{35}I_7 + \frac{10}{35}I_8 + \frac{10}{35}I_9 = \frac{1}{35}(24W_3 + 10W_4)$	8 05
	$WR = \frac{4}{35}I_7 + \frac{10}{35}I_8 + \frac{10}{35}I_9 = \frac{1}{35}(14W_3 + 10W_4)$	5 65
	$WR = \frac{4}{35}I_8 + \frac{8}{35}I_9 = \frac{1}{35}(4W_3 + 8W_4)$	2 79
	$WR = \frac{7}{35}I_9 = \frac{7}{35}W_4$	1 60
	TCWR = 1,066 mm	

TOBACCO

IRRIGATION REQ	EQUATION FOR 10-DAY WEIGHTED IRRIGATION REQUIREMENT	DAILY AVERAGE WATER REQ (mm/day)
I_1	$WR = \frac{10}{60}P_1 + \frac{7}{60}I_1 = \frac{1}{60}(10P_1 + 7W_1)$	1 16
I_2	$WR = \frac{10}{60}P_1 + \frac{10}{60}I_1 + \frac{10}{60}I_2 = \frac{1}{60}(10P_1 + 20W_1)$	2 09
I_3	$WR = \frac{10}{60}P_1 + \frac{10}{60}I_1 + \frac{10}{60}I_2 + \frac{10}{60}I_3 = \frac{1}{60}(10P_1 + 30W_1)$	2 80
I_4	$WR = \frac{10}{60}P_1 + \frac{10}{60}I_1 + \frac{10}{60}I_2 + \frac{10}{60}I_3 + \frac{10}{60}I_4 = \frac{1}{60}(10P_1 + 30W_1 + 10W_2)$	3 70
I_5	$WR = \frac{3}{60}P_1 + \frac{10}{60}I_1 + \frac{10}{60}I_2 + \frac{10}{60}I_3 + \frac{10}{60}I_4 + \frac{10}{60}I_5 = \frac{1}{60}(3P_1 + 30W_1 + 20W_2)$	4 12
I_6	$WR = \frac{11}{60}I_1 + \frac{11}{60}I_2 + \frac{11}{60}I_3 + \frac{11}{60}I_4 + \frac{11}{60}I_5 + \frac{11}{60}I_6 = \frac{1}{60}(33W_1 + 33W_2)$	5 83
I_7	$WR = \frac{2}{60}I_1 + \frac{9}{60}I_2 + \frac{10}{60}I_3 + \frac{10}{60}I_4 + \frac{10}{60}I_5 + \frac{10}{60}I_6 + \frac{10}{60}I_7 = \frac{1}{60}(21W_1 + 30W_2 + 10W_3)$	4 92
	$WR = \frac{9}{60}I_3 + \frac{10}{60}I_4 + \frac{10}{60}I_5 + \frac{10}{60}I_6 + \frac{10}{60}I_7 = \frac{1}{60}(9W_1 + 30W_2 + 10W_3)$	4 07
	$WR = \frac{9}{60}I_4 + \frac{11}{60}I_5 + \frac{11}{60}I_6 + \frac{11}{60}I_7 = \frac{1}{60}(31W_2 + 11W_3)$	3 95
	$WR = \frac{8}{60}I_5 + \frac{10}{60}I_6 + \frac{10}{60}I_7 = \frac{1}{60}(18W_2 + 10W_3)$	2 35
	$WR = \frac{8}{60}I_6 + \frac{10}{60}I_7 = \frac{1}{60}(8W_2 + 10W_3)$	1 46
	$WR = \frac{8}{60}I_7 = \frac{8}{60}W_3$	0 66
	$WR = \frac{1}{60}I_7 = \frac{1}{60}W_3$	0 08
	TCWR = 319 mm	

GARLIC

IRRIGATION REQ	EQUATION FOR 10-DAY WEIGHTED IRRIGATION REQUIREMENT	DAILY AVERAGE WATER REQ (mm/day)
I_1	$WR = \frac{11}{35}I_1 = \frac{11}{35}I_1$	0 65
I_2	$WR = \frac{10}{35}I_1 + \frac{10}{35}I_2 = \frac{1}{35}(10W_1 + 10W_2)$	1 20
I_3	$WR = \frac{10}{35}I_1 + \frac{10}{35}I_2 + \frac{10}{35}I_3 = \frac{1}{35}(10W_1 + 20W_2)$	1 81
I_4	$WR = \frac{4}{35}I_1 + \frac{10}{35}I_2 + \frac{10}{35}I_3 + \frac{10}{35}I_4 = \frac{1}{35}(4W_1 + 30W_2)$	2 07
I_5	$WR = \frac{5}{35}I_2 + \frac{10}{35}I_3 + \frac{10}{35}I_4 + \frac{10}{35}I_5 = \frac{1}{35}(25W_2 + 10W_3)$	2 49
I_6	$WR = \frac{5}{35}I_3 + \frac{10}{35}I_4 + \frac{10}{35}I_5 + \frac{10}{35}I_6 = \frac{1}{35}(15W_2 + 20W_3)$	2 83
I_7	$WR = \frac{5}{35}I_4 + \frac{11}{35}I_5 + \frac{11}{35}I_6 + \frac{11}{35}I_7 = \frac{1}{35}(5W_2 + 33W_3)$	3 46
I_8	$WR = \frac{4}{35}I_5 + \frac{10}{35}I_6 + \frac{10}{35}I_7 + \frac{10}{35}I_8 = \frac{1}{35}(24W_3 + 10W_4)$	2 75
I_9	$WR = \frac{4}{35}I_6 + \frac{10}{35}I_7 + \frac{10}{35}I_8 + \frac{10}{35}I_9 = \frac{1}{35}(14W_3 + 20W_4)$	2 25
	$WR = \frac{4}{35}I_7 + \frac{11}{35}I_8 + \frac{11}{35}I_9 = \frac{1}{35}(4W_3 + 22W_4)$	1 39
	$WR = \frac{4}{35}I_8 + \frac{10}{35}I_9 = \frac{14}{35}W_4$	0 64
	$WR = \frac{4}{35}I_9 = \frac{4}{35}W_4$	0 11
	TCWR = 223 mm	

MUNGO BEANS

IRRIGATION REQ	EQUATION FOR 10-DAY WEIGHTED IRRIGATION REQUIREMENT	DAILY AVERAGE WATER REQ (mm/day)
I_7	$WR = \frac{5}{35}I_4 + \frac{10}{35}I_5 + \frac{10}{35}I_6 + \frac{10}{35}I_7 = \frac{1}{35}(25W_2 + 10W_3)$	4 34
	$WR = \frac{5}{35}I_5 + \frac{10}{35}I_6 + \frac{10}{35}I_7 = \frac{1}{35}(15W_2 + 10W_3)$	2 90
	$WR = \frac{5}{35}I_6 + \frac{10}{35}I_7 = \frac{1}{35}(5W_2 + 10W_3)$	1 46
	$WR = \frac{5}{35}I_7 = \frac{5}{35}W_3$	0 37
	TCWR = 316 mm	
P	$WR = \frac{6}{35}P = \frac{6}{35}P$	0 69
	$WR = \frac{10}{35}P = \frac{10}{35}P$	1 14
	$WR = \frac{8}{35}P = \frac{8}{35}P$	0 57
I_1	$WR = \frac{10}{35}P + \frac{10}{35}I_1 = \frac{1}{35}(10P + 10W_1)$	2 09
I_2	$WR = \frac{1}{35}P + \frac{10}{35}I_1 + \frac{10}{35}I_2 = \frac{1}{35}(P + 20W_1)$	2 00
I_3	$WR = \frac{11}{35}I_1 + \frac{11}{35}I_2 + \frac{11}{35}I_3 = \frac{33}{35}W_1$	3 11
I_4	$WR = \frac{4}{35}I_1 + \frac{10}{35}I_2 + \frac{10}{35}I_3 + \frac{10}{35}I_4 = \frac{1}{35}(24W_1 + 10W_2)$	3 70
I_5	$WR = \frac{4}{35}I_2 + \frac{10}{35}I_3 + \frac{10}{35}I_4 + \frac{10}{35}I_5 = \frac{1}{35}(14W_1 + 20W_2)$	4 19
I_6	$WR = \frac{4}{35}I_3 + \frac{10}{35}I_4 + \frac{10}{35}I_5 + \frac{10}{35}I_6 = \frac{1}{35}(4W_1 + 30W_2)$	4 69

COTTON

IRRIGATION REQ	EQUATION FOR 10-DAY WEIGHTED IRRIGATION REQUIREMENT	DAILY AVERAGE WATER REQ (mm/day)
I_1	$WR = \frac{7}{35}I_1 = \frac{7}{35}W_1$	0 41
I_2	$WR = \frac{11}{35}I_1 + \frac{11}{35}I_2 = \frac{22}{35}W_1$	1 43
I_3	$WR = \frac{10}{35}I_1 + \frac{10}{35}I_2 + \frac{10}{35}I_3 = \frac{1}{35}(20W_1 + 10W_2)$	2 05
I_4	$WR = \frac{7}{35}I_1 + \frac{10}{35}I_2 + \frac{10}{35}I_3 + \frac{10}{35}I_4 = \frac{1}{35}(17W_1 + 20W_2)$	2 75
I_5	$WR = \frac{4}{35}I_2 + \frac{10}{35}I_3 + \frac{10}{35}I_4 + \frac{10}{35}I_5 = \frac{1}{35}(4W_1 + 30W_2)$	2 85
I_6	$WR = \frac{5}{35}I_3 + \frac{10}{35}I_4 + \frac{10}{35}I_5 + \frac{10}{35}I_6 = \frac{1}{35}(25W_2 + 10W_3)$	4 00
I_7	$WR = \frac{5}{35}I_4 + \frac{10}{35}I_5 + \frac{10}{35}I_6 + \frac{10}{35}I_7 = \frac{10}{35}(15W_2 + 20W_3)$	4 95
I_8	$WR = \frac{5}{35}I_5 + \frac{11}{35}I_6 + \frac{11}{35}I_7 + \frac{11}{35}I_8 = \frac{1}{35}(5W_2 + 33W_3)$	7 09
I_9	$WR = \frac{4}{35}I_6 + \frac{10}{35}I_7 + \frac{10}{35}I_8 + \frac{10}{35}I_9 = \frac{1}{35}(24W_3 + 10W_4)$	6 01
I_{10}	$WR = \frac{4}{35}I_7 + \frac{10}{35}I_8 + \frac{10}{35}I_9 + \frac{10}{35}I_{10} = \frac{1}{35}(14W_3 + 20W_4)$	5 84
I_{11}	$WR = \frac{4}{35}I_8 + \frac{11}{35}I_9 + \frac{11}{35}I_{10} + \frac{11}{35}I_{11} = \frac{1}{35}(4W_3 + 33W_4)$	6 77
I_{12}	$WR = \frac{4}{35}I_9 + \frac{10}{35}I_{10} + \frac{10}{35}I_{11} + \frac{10}{35}I_{12} = \frac{1}{35}(24W_4 + 10W_5)$	4 81
I_{13}	$WR = \frac{4}{35}I_{10} + \frac{10}{35}I_{11} + \frac{10}{35}I_{12} + \frac{10}{35}I_{13} = \frac{1}{35}(14W_4 + 20W_5)$	4 02
	$WR = \frac{4}{35}I_{11} + \frac{8}{35}I_{12} + \frac{8}{35}I_{13} = \frac{1}{35}(4W_4 + 16W_5)$	1 62
	$WR = \frac{7}{35}I_{12} + \frac{10}{35}I_{13} = \frac{17}{35}W_5$	1 46
	$WR = \frac{7}{35}I_{13} = \frac{7}{35}W_5$	0 70
	TCWR = 579 mm	

Irrigation Efficiency

Water losses for paddy field consist of the following two losses;

i) Farm application losses

ii) Conveyance losses

The former is considered to be on-farm losses (farm wastes) due mostly farmer's capacity of farm management and topographic condition, then in the Project the 35 percent of an average crop water requirement for the wet season paddy and 25 percent for the dry season additive respectively is taken as on-farm losses.

On the other hand, the latter which is water losses during the conveyance stage, furthermore, can be classified into two factors, namely physical and non-physical factors. Physical factors are composed of seepage, leakage and evaporation losses (conveyance losses) while non-physical losses are rather related to operational factors such as over-application of irrigation water in the fields inscheduled drainage and illegal diversion (operation losses).

However, in the Project Area, no data on the water losses exist entirely, so that the following losses are adopted after making reference to the Report on the Workshop in Water Management prepared by WB in September 1978, although the Morits empirical formula[1/] could be considered as the procedure for estimation of seepage losses of canal.

Description	Water Losses
Conveyance losses	20 %
Operation losses	10 %

As a result, overall irrigation efficiency for paddy field are decided at 46.8[2/] percent for the wet season paddy and 54[3/] percent for the dry season paddy.

1/: Morits Formula: water losses (cu.m/sec/km) = 0.04 C. $(Q/V)^{1/2}$ where, Q=discharge (cu.m/sec), V=Velocity of flow (cu.m/sec) and C=0.16

2/: (100 - 35%) x (100 - 20%) x (100 - 10%) = 46.8%

3/: (100 - 25%) x (100 - 20%) x (100 - 10%) = 54.0%

TABLE 4B-3 IRRGATION WATER REQUIREMENT IN DESIGN YEAR FOR PHASE II AREA

ITEM	MAY	JUN	JUI	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	WET SEASON CROP	DRY SEASON CROP	TOTAL	REMARKS
A CROPPING PATTERN																		
BATAC-BADOC AREA		PADDY-1 (30%)					PADDY-4 (30%)											
		PADDY-1 (30%)					TOBACCO (30%)											
		PADDY-2 (40%)					GARLIC (40%)			MUNGO BEANS (20%)								
		PADDY-3 (10%)					COTTON (10%)											
CURA-NUEVA ERA AREA		PADDY-1 (20%)					PADDY-2 (20%)											
		PADDY-1 (24%)					TOBACCO (30%)											
		PADDY-1 (23%)					GARLIC (35%)											
		PADDY-1 (33%)					ONION (35%)											
B WATER REQUIREMENT FOR PADDY (BATAC-BADOC AREA)																		
CROP WATER REQUIREMENT (mm)																		
PADDY-1		277 1	276 5	272 8	254 9	107 4									1,188 7	—	1,188 7	
PADDY-2	73 7	329 1	252 6	272 8	215 1	37 0									1,180 3	—	1,180 3	
PADDY-3	169 3	326 7	252 6	272 8	153 2	4 5									1,181 1	—	1,181 1	AVE 1,1834 mm
PADDY-4						37 4	279 2	283 0	263 2	193 2	58 7				—	1,114 7	1,1147	1,1147 mm
EFFECTIVE RAINFALL (mm)																		
PADDY-1		69 0	206 7	271 7	153 3	17 1									717 8	—	7178	
PADDY-2	8 5	92 2	206 7	271 7	123 5	9 6									7122	—	7122	
PADDY-3	16 9	103 0	309 7	271 7	76 2	2 1									7796	—	7796	AVE 736 5 mm
PADDY-4						0	0	0	9 4	2 8	1 9				—	14 1	14 1	14 1 mm
CROP IRRIGATION REQUIREMENT (mm)																		
PADDY-1		208 1	122 0	0	82 1	41 0									453 2	—	453 2	
PADDY-2	65 2	236 9	98 1	0	54 9	1 5									456 6	—	456 6	
PADDY-3	152 4	225 7	98 1	0	30 3	2 4									508 9	—	508 9	AVE 472 9 mm
PADDY-4						44 0	292 5	283 0	253 8	181 8	45 5				—	1,100 6	1,100 6	1,100 6 mm
DIVERSION WATER REQUIREMENT 1/																		
PADDY-1		444 6	260 8	0	175 5	87 6									968 5	—	968 5	
PADDY-2	139 4	506 2	209 7	0	117 3	3 4									976 0	—	976 0	
PADDY-3	325 7	482 4	209 7	0	64 7	5 7									1,088 2	—	1,088 2	AVE 1,010 9 mm
PADDY-4						81.5	541 7	524 1	486 5	336 7	84 3				—	2,036 8	2,036 8	2,036 8 mm
AVERAGE WET SEASON	88 3	473.0	235 3	0	141 1	45 7									983 4	---	983 4	
DRY SEASON						81 5	541 7	524 1	486 5	336 7	84 3				—	2,036 8	2,036 8	
C WATER REQUIREMENT FOR PADDY (CURA-NUVA ERA AREA) 2/																		
CROP WATER REQUIREMENT (mm)																		
PADDY-1	40.3	192 3	286 2	242.7	206 4	125.3									1,073 2	—	1,073.2	
PADDY-2						86 6	223 5	275 2	259 9	173 7	86 7				—	1,085 6	1,085 6	
EFFECTIVE RAINFALL (mm)																		
PADDY-1	60 9	208 8	223 6	206 1	120 2	4 4									824 0	—	824 0	
PADDY-2						0	45 2	2 0	0	0 3	0				—	47 5	47 5	
CROP IRRIGATION REQUIREMENT (mm)																		
PADDY-1	—	—	42 6	36 6	86 2	120 9									286 3	—	286 3	
PADDY-2						66 6	178 3	273 2	259 9	173 7	86 7				—	1,038 4	1,038 4	
DIVERSION WATER REQUIREMENT (mm)																		
PADDY-1 (WET SEASON)			91 0	78 2	184 2	258.3									611 7	—	611 7	
PADDY-2 (DRY SEASON)						123 3	330 2	505.9	481 3	321 7	160 6				—	1,923 0	1,923.0	

NOTE, 1/ : DIVERSION WATER REQUIREMENT = CROP IRRIGATION REQUIREMENT / IRRIGATION EFFICIENCY

IRRIGATION EFFICIENCY,

WET SEASON PADDY . 0 466

DRY SEASON PADDY 0 540

2/ DERIVED FROM PHASE I FEASIBILITY STUDY REPORT, PREPARED BY JICA IN 1979

IN THE ABOVE ESTIMATION, FOLLOWING DESIGN YEAR IS ADOPTED,

BATAC - PAOAY AREA . 1968-1969

CURA - NUEVA ERA AREA . 1965-1966

TABLE 4B-4 IRRGATION WATER REQUIREMENT IN DESIGN YEAR FOR PHASE II AREA

ITEM	MAY	JUN	JUI	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	WET SEASON CROP	DRY SEASON CROP	TOTAL	REMARKS
D WATER REQUIREMENT FOR UPLAND CROPS (BATAC-BADOC AREA)																		
CROP WATER REQUIREMENT (mm)																		
TOBACCO							58 2	142 3	133 4	43 4	0 6				—	377 9	377 9	
GARLIC						7 2	50 8	91 3	65 3	7 3					—	221 9	221 9	
MUNGO BEANS										20 1	72 0	125 8	88 5	3 0	—	309.4	309 4	
COTTON						19 0	76 5	167 5	193 0	101 3	18 1				—	575 4	575 4	AVE 405 6 mm
EFFECTIVE RAINFALL (mm)																		
TOBACCO							0	0	8 0	0					—	8 0	8 0	
GARLIC						0	0	0	8 0	0					—	8 0	8 0	
MUNGO BEANS										0	4 0	0	12 0	18 0	—	34 0	34 0	
COTTON						0	0	0	4 0	0	4.0				—	8 0	8 0	
CROP IRRIGATION REQUIREMENT (mm)																		
TOBACCO							66 8	135 0	111.0	38 0	0 7				—	351 5	351 5	
GARLIC						11 1	56 0	152 0	50.0	11 0					—	280 1	280 1	
MUNGO BEANS										29 8	79 0	120 0	64 0	0	—	292 8	292 8	
COTTON						23 2	89 0	278 0	171 0	85 0	4 7				—	650 9	650 9	AVE 437 3 mm
DIVERSION WATER REQUIREMENT (mm) 3/															—			
TOBACCO							111 3	225 0	185 0	63 3	1 2				—	585 8	585 8	
GARLIC						18 5	93 3	253 3	83 0	18 3					—	466 4	466 4	
MUNGO BEANS										49 6	131 7	200 0	106 7	0	—	488 0	488 0	
COTTON						38 7	148 3	463 3	285.0	141 7	7 8				—	1084 8	1084 8	
AVERAGE (DRY SEASON)						16 1	106 3	275 2	141 1	63 0	39 1	57 2	30 5	0	—	728 5	728 5	
E WATER REQUIREMENT FOR UPLAND CROPS (CURA - NUEVA ERA AREA) 4/																		
CROP WATER REQUIREMENT (mm) 5/																		
TOBACCO						12 0	156 2	142.8	146 5	105.8	36 4				—	597 9	597 9	
GARLIC						13 2	124 5	91 5	65 3	37 4	7 3				—	339 2	339 2	
ONION						14 6	176 1	171 8	133 2	33 6					—	529 3	529 3	AVE 483 3 mm
EFFECTIVE RAINFFALL (mm)						0	0	0	0	0	0				-	0	0	
CROP IRRIGATION REQUIREMENT (mm)																		
TOBACCO						12 0	156 2	142 8	146 5	105 8	36 4				—	597 9	597.9	
GARLIC						13 2	124 5	91 5	65.3	37 4	7 3				—	339 2	339 2	
ONION						14 6	176 1	171 8	133 2	33 6	0				—	529 3	529 3	AVE 483 3 mm
DIVERSION WATER REQUIREMENT (mm)																		
TOBACCO						20 0	260 3	238 0	244 2	176 3	60 7				—	999 5	999 5	
GARLIC						22 0	207 5	152.5	108 8	62 3	12 2				—	565 3	565 3	
ONION						24 3	293 5	286 3	222 0	56 0	0				—	882 1	882 1	AVE 806 4 mm
AVERAGE (DRY SEASON)						22.2	253 5	225 0	189 0	94 3	22.5				—	806 5	806 5	
F IRRIGATION WATER REQUIREMENT (mm)																		
BATAC - BADOC AREA																		
WET SEASON	88 3	473 0	235 3	0	141 3	45 7									983 3	—	983 3	
DRY SEASON						35 7	236 9	350 0	239 3	145 1	72 1				—	1,079 1	1,079 1	
CURA - NUEVA ERA AREA																		
WET SEASON			91 0	78 2	184 2	123 3									611 7	—	611 7	
DRY SEASON						114 5	320 9	490 3	457 1	303 0	151 8				—	1,837 6	1,837 6	

NOTE, 3/ DIVERSION WATER REQUIREMENT = CROP IRRIGATION REQUIREMENT / IRRIGATION EFFICIENCY
IRRIGATION EFFICIENCY 0 6

4/ DERIVED FROM PHRASE I FEASIBILITY STUDY REPORT, PREPARED BY JICA IN 1979

5/ INCLUSIVE OF FOLLOWING LAND PREPARATION WATER

TOBACCO	200 mm
GARLIC AND ONION	100 mm

6/ WEIGHTED DIVERSION WATER REQUIREMENT IN THE DRY SEASON ON THE BASIS OF THE FOLLOWING DIVERSIFICATION RATIO;

	PADDY	UPLAND CROP
BATAC - BADOC AREA	30 %	70 %
CURA - NUEVA ERA AREA	90 %	10 %

Design Discharge of Terminal Canals

Land Soaking and Land Preparation Schedule for Paddy Cultivation

According to the natural environments and cultivational habit of farmers, the process of land soaking and land preparation is designed to comprise one plowing followed by three times of harrowing with an interval of six days for each time for land preparation.

The first irrigation is proposed for seven days before plowing for land soaking, then second irrigation will be given for 3 days later to prevent the field from drying. The last irrigation will be applied just before the last harrowing which will be followed by transplanting immediately.

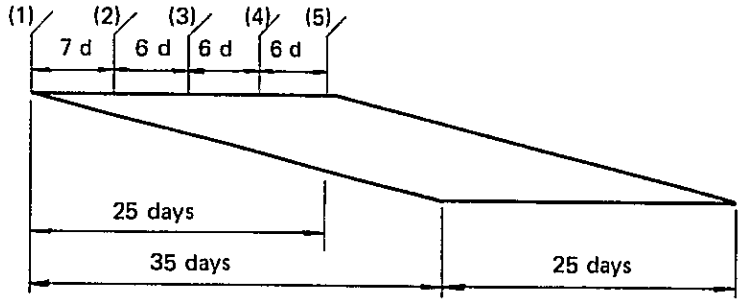
Generally the periods to complete the land preparation for the Batac-Badoc area are decided at 35 days, and the land preparation in one irrigation rotation area of about 40 ha can be finished within 35 days.

On the other hand, for the area of Cura-Nueva Era area in the Phase II and the whole areas in the Phase I, the land preparation periods are decided at 50 days. However the area of one irrigation rotational area covering about 30 ha will be finished within 25 days. Therefore, within these 25 days, transplanting schedule will be one half of the said area in the 25 days period.

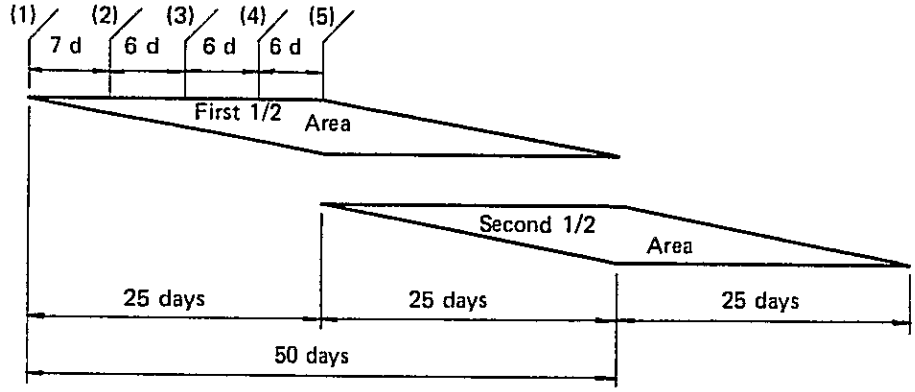
Irrigation and preparation schedule so arranged can be illustrated in the following figure.

Illustration of Working Schedule for Land Soaking and Preparation

Batac-Paoay Area



Cura-Nueva Era Area



(1) First irrigation for land soaking
(2) Land plowing
(3) First harrowing and second irrigation
(4) Second harrowing
(5) Third harrowing and third irrigation

The major figures for determining the design discharge of terminal canals are as follows;

- One rotational area

  Batac-Badoc area : 40 ha

  Cura-Nueva Era area : 30 ha

- Land preparation period for one rotational area

  Batac-Badoc area : 35 days

  Cura-Nueva Era area : 25 days

- Water requirement for land soaking and preparation

  Wet Season Paddy : 250 mm

  Dry Season Paddy : 230 mm

- Application losses

  Wet Season : 35 %

  Dry Season : 25 %

.. Design Discharge

The maximum daily irrigation water requirements for paddy cultivation on the 10-day average are tabulated as shown below, based on the estimation of crop water requirement.

Maximum Irrigation Water Requirement

Description	Crop Water Requirement (mm/day)	Irrigation Water Requirement (mm/day)	(lit/sec/ha)
a) Batac-Badoc Area			
Wet Season			
Paddy-1			
Land preparation stage	8.9	13.7 1/	1.59
Crop maintenance stage	7.6	11.7	1.35
Paddy-2			
Land preparation stage	8.8	13.5	1.56
Crop maintenance stage	8.2	12.6	1.46(max.)
Paddy-3			
Land preparation stage	9.2	14.2	1.64(max.)
Crop maintenance stage	7.9	12.2	1.41
Dry Season			
Paddy-4			
Land preparation stage	9.6	12.8	1.48
Crop maintenance stage	9.4	12.5	1.45

Description	Crop Water Requirement (mm/day)	Irrigation Watter Requirement (mm/day)	(lit/sec/ha)
b) Cura-Nueva Era Area			
Wet Season			
Land preparation stage	10.0	15.4	1.78(max.)
Crop maintenance stage	7.9	12.2	1.40(max.)
Dry Season			
Land preparation stage	9.2	12.3	1.42
Crop maintenance stage	8.4	11.2	1.30

Note: 1/ wet season: crop water requirement/(1-0.35)
dry season: crop water requirement/(1-0.25)

Crop Water Requirement [1/]

Month	Paddy-1 + Paddy-4 Wet Season (mm)	Paddy-1 + Paddy-4 Dry Season (mm)	Paddy-1 + Tobacco Wet Season (mm)	Paddy-1 + Tobacco Dry Season (mm)	Paddy-2 + Garlic Wet Season (mm)	Paddy-2 + Garlic Dry Season (mm)	Paddy-2 + Garlic + Mungbeans Wet Season (mm)	Paddy-2 + Garlic + Mungbeans Dry Season (mm)	Paddy-3 + Cotton Wet Season (mm)	Paddy-3 + Cotton Dry Season (mm)	Weighted Average [2/] (mm)	Diversion Water Requirement [3/] (mm)	Diversion Water Requirement [3/] (lit/sec/ha)
Apr.1								3.70			0.74	1.23	0.14
2								4.19			0.84	1.40	0.16
3								4.69			0.94	1.57	0.18
May 1								4.34			0.87	1.45	0.17
2								2.90	4.50		1.03	1.93	0.22
3					5.00		5.00	1.46	7.00		2.35	4.94	0.57
June1	5.00		5.00		6.50		6.50	0.37	8.21		5.31	11.34	1.31
2	6.50		6.50		8.21		8.21		9.21		7.46	15.94	1.85
3	8.21		8.21		8.71		8.71		8.71		8.46	18.08	2.09
July1	8.90		8.90		8.40		8.40		9.11		* 8.72	18.63	2.16 (max)
2	8.09		8.09		8.80		8.80		* 7.87		8.35	17.84	2.06
3	9.12		9.12		* 8.19		* 8.19		7.45		8.58	18.33	2.12
Aug.1	* 7.33		* 7.33		7.33		7.33		7.33		8.06	17.22	1.99
2	7.47		7.47		7.47		7.47		7.47		7.47	15.96	1.85
3	7.54		7.54		7.54		7.54		7.54		7.54	16.11	1.86
Sep.1	7.62		7.62		7.62		7.62		7.62		7.62	16.28	1.88
2	7.56		7.56		7.56		7.56		5.36		7.34	15.68	1.81
3	7.50		7.50		5.30		5.30		3.10		6.18	13.21	1.53
Oct.1	5.50		5.50		3.30		3.30		1.10		4.18	8.93	1.03
2	3.30	3.86	3.40		1.10		1.10			0.41	2.24	4.36	0.51
3	1.10	5.63	1.10			0.65		0.65		1.43	1.63	3.06	0.35
Nov.1		7.03		1.16		1.20		1.20		2.05	3.03	5.43	0.63
2		8.23		2.09		1.81		1.81		2.75	3.89	6.93	0.80
3		9.20		2.80		2.07		2.07		2.85	4.43	7.90	0.91
Dec.1		9.63		3.70		2.49		2.49		4.00	5.03	8.91	1.03
2		* 9.13		4.12		2.83		2.83		4.95	5.19	9.16	1.06
3		9.35		5.83		3.46		3.46		7.09	6.06	10.63	1.23
Jan.1		8.37		4.92		2.75		2.75		6.01	5.20	9.13	1.06
2		8.29		4.07		2.29		2.25		5.84	4.78	8.43	0.98
3		8.91		3.95		1.39		1 39		6.77	4 70	8.32	0.96
Feb.1		8.05		2.35		0.64		0.64	0.69	4.81	3.63	6.71	0.78
2		5.65		1.46		0.11		0 11	1.14	4.02	2.54	4.75	0.55
3		2.79		0.66					0.57	1.62	1.25	2.23	0.26
Mar.1		1.60		0.08					2.09	1.46	1.06	1.86	0.22
2									2.00	0.70	0.47	0.78	0.09
3									3.11		0.62	1.04	0.12

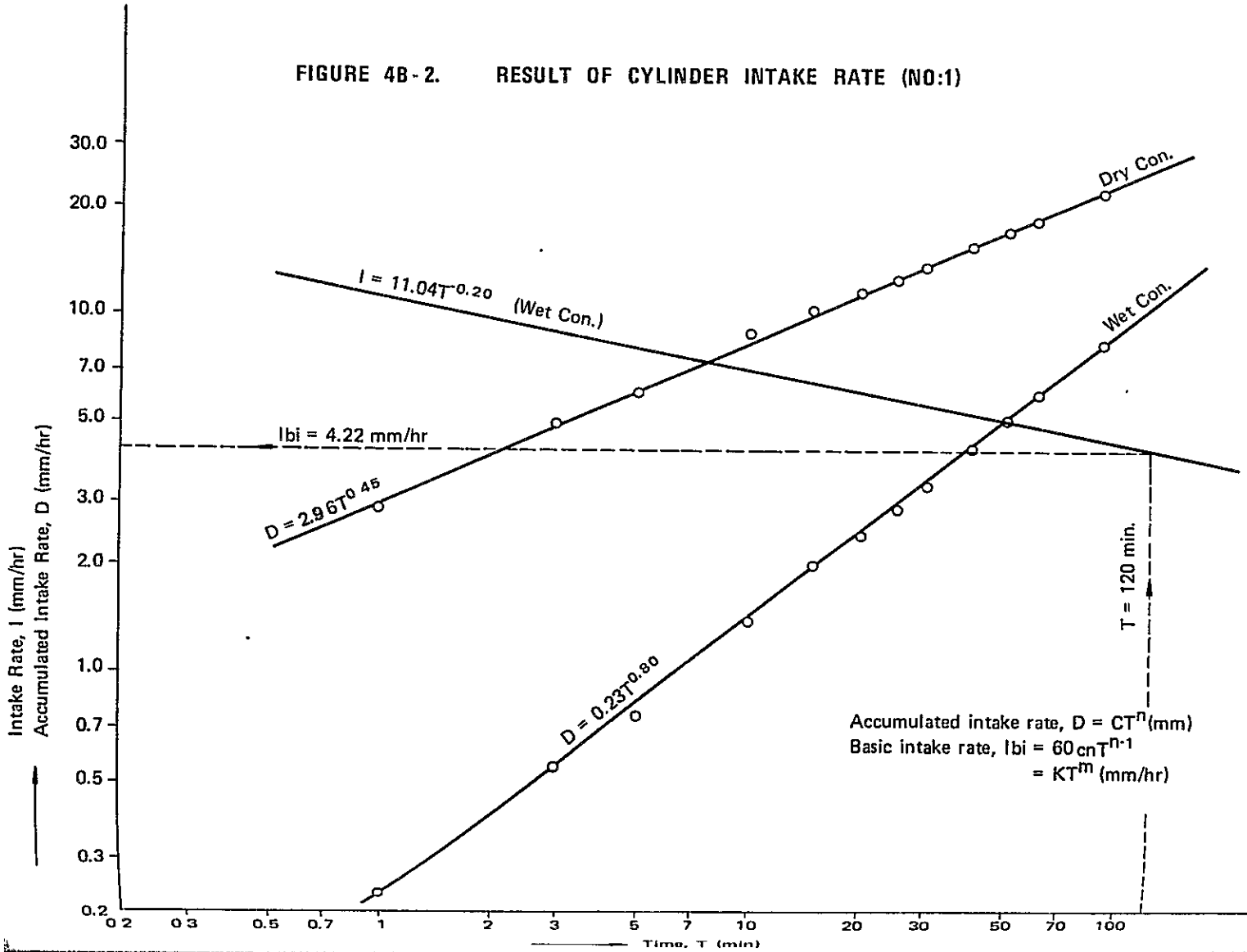
Note: 1/ referred to Figure .

2/ estimated based on the following cropping ratio;
- paddy + paddy : 30%
- paddy + tobacco : 20%
- paddy + garlic : 20%
- paddy + garlic + mungbeans : 20%
- paddy + cotton : 10%

3/ obtained taking into account the follow irrigation efficiency;
- paddy; wet season : 46.8%
- dry season : 54.0%
- upland crop : 60.0%

* show the start of crop maintenance stage

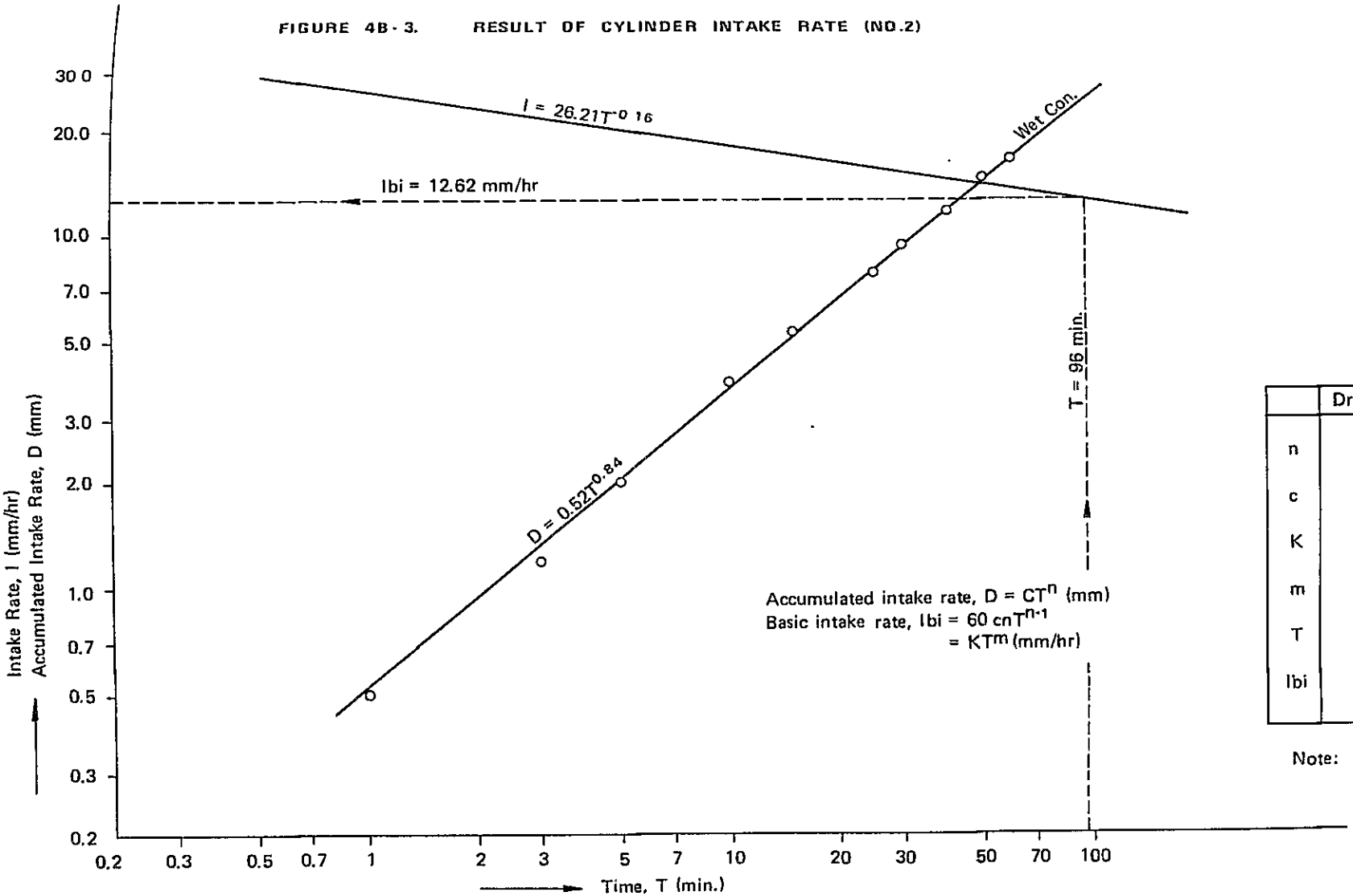
FIGURE 4B-2. RESULT OF CYLINDER INTAKE RATE (NO:1)



	Dry Con.	Wet Con.
n	0.450	0.800
c	2.960	0.230
K	79.92	11.04
m	- 0.55	- 0.20
T	330.0	120.0
Ibi	3.29	4.22

Note: K = 60.cn
m = n-1
T = 600 (n-1)

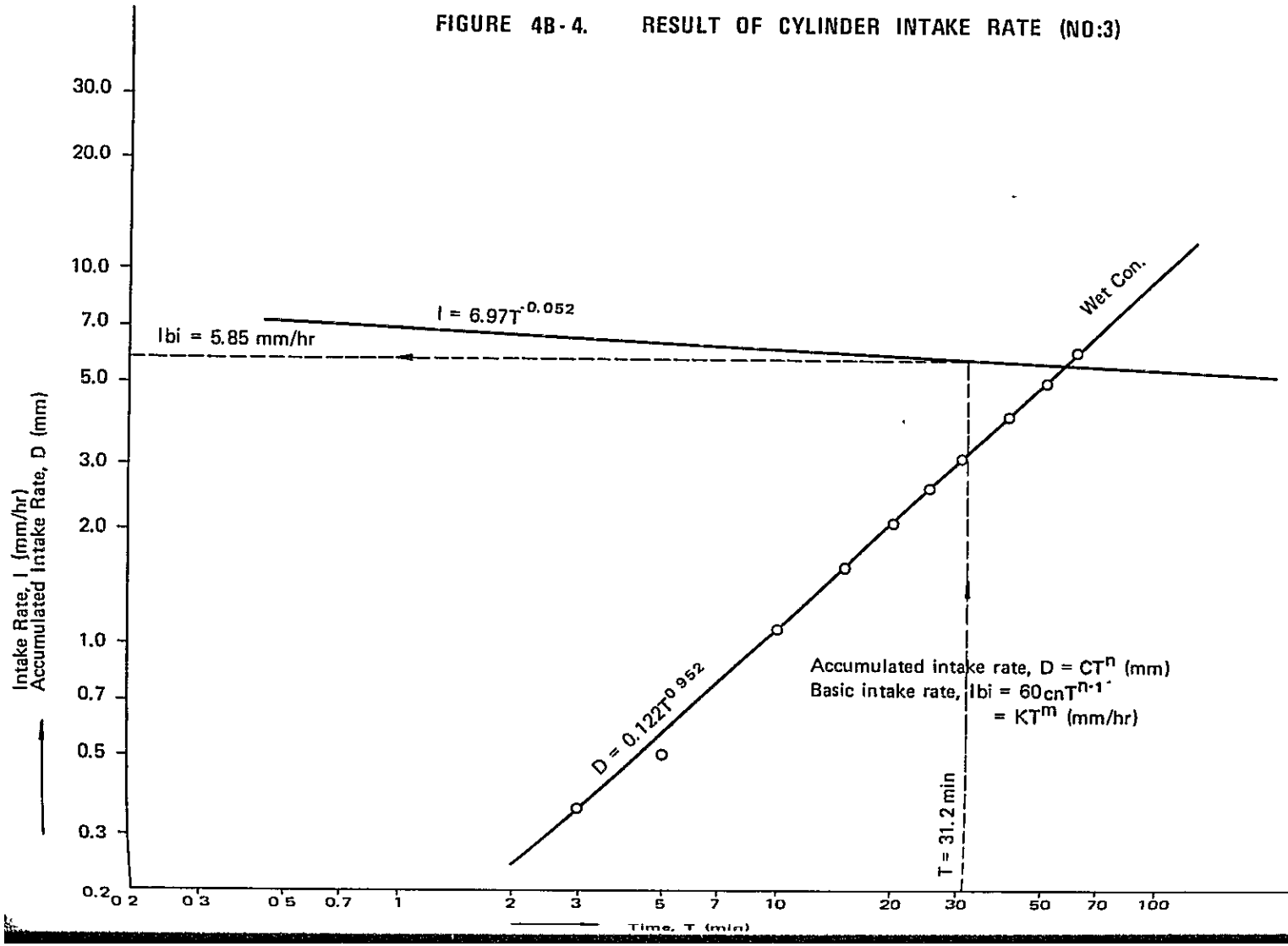
FIGURE 4B-3. RESULT OF CYLINDER INTAKE RATE (NO.2)



	Dry Con	Wet Con.
n		0.840
c		0.520
K		26.21
m		- 0.160
T		96.0
Ibi		12.62

Note: K = 60 cn
m = n-1
T = 600 (n-1)

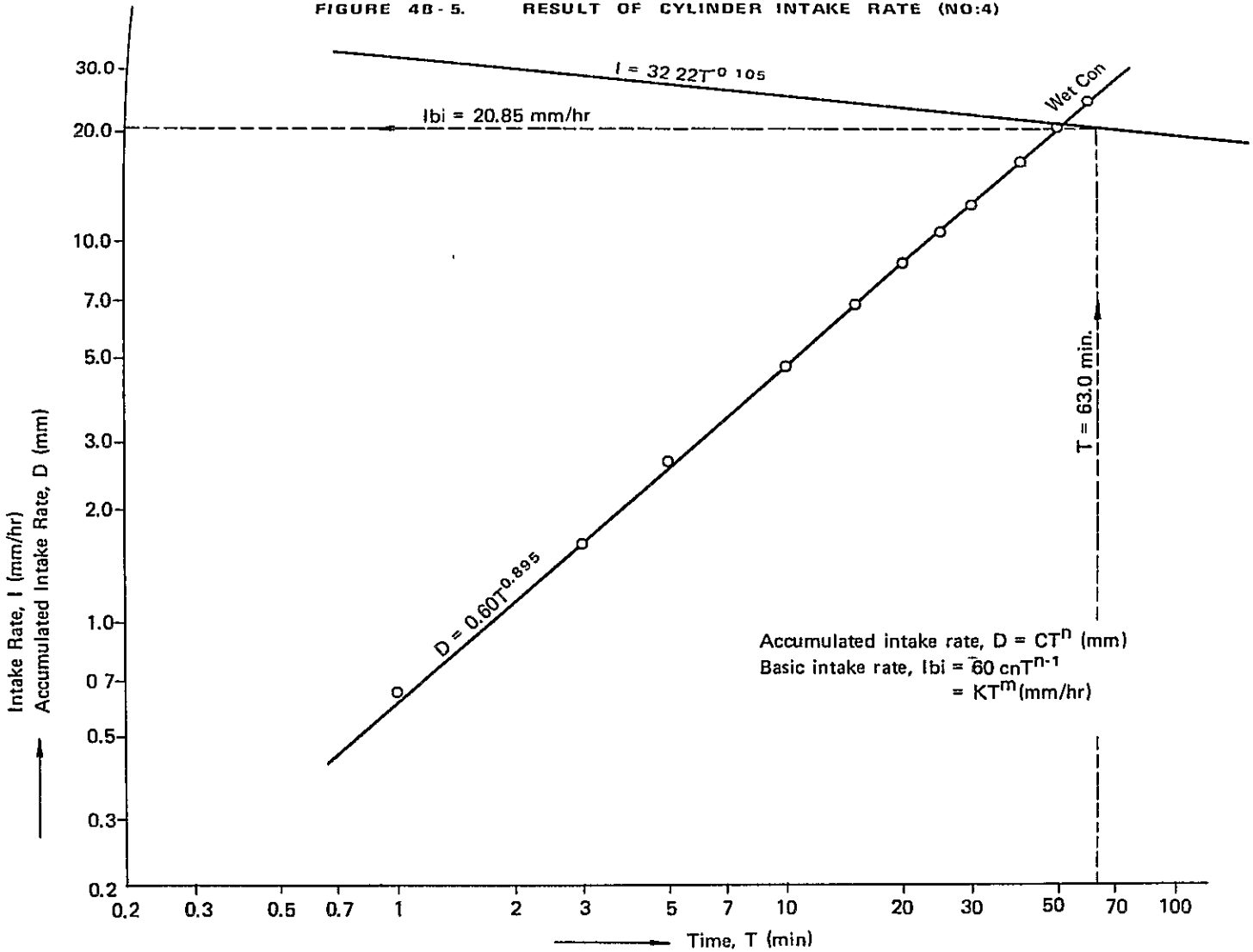
FIGURE 4B-4. RESULT OF CYLINDER INTAKE RATE (NO:3)



	Dry Con.	Wet Con.
n		0.952
c		0.122
K		6.97
m		-0.052
T		31.2
Ibi		5.83

Note: K = 60 cn
m = n-1
T = 600(n-1)

FIGURE 4B-5. RESULT OF CYLINDER INTAKE RATE (NO:4)



	Dry Con.	Wet Con.
n		0.895
c		0.60
K		32.22
m		-0.105
T		63.0
Ibi		20.85

Note: K = 60 cn
m = n-1
T = 600 (n-1)

Table 4B-6. Physical Features of Soil

Location	Condition	Soil Depth (cm)	Real Specific Gravity (Sr) (g/cm³)	Aparent Specific Gravity (Sa) (g/cm³)	Prosity (P) (%)	Field Capacity (Fc) (%)	Wilting Point (Wp) (%)
Bario Aracura, Batac	Dry Condition	10	2.58	1.04	59.6[2/]	29.9	14.1[3/]
		20	2.53	1.05	58.5	35.3	16.9
		30	2.62	1.03	60.7	38.7	18.7
		40	2.68	1.06	60.4	40.4	19.6
		50	2.58	1.08	58.1	42.0	20.4
	Wet Condition	10	2.60	1.14	56.2	43.7	21.3
		20	2.63	1.20	54.4	41.4	20.1
		30	2.60	1.22	53.1	38.9	18.8
		40	2.59	1.19	54.1	39.9	19.3
		50	2.67	1.15	56.9	41.1	19.9
Bario Linang, Paoay	Dry Condition	10	2.56	1.16	54.7	51.6	25.5
		20	2.58	1.05	59.3	52.1	25.7
		30	2.67	1.13	57.7	47.7	23.4
		40	2.62	1.13	56.9	47.6	23.3
		50	2.64	1.12	57.6	47.4	23.2
	Wet Condition	10	2.57	1.04	59.5	53.1	26.3
		20	2.69	1.08	59.9	50.1	24.7
		30	2.62	1.12	57.3	45.9	22.4
		40	2.66	1.15	56.8	45.6	22.3
		50	2.60	1.13	56.5	48.2	23.7
Bario Napo, Badoc	Wet Condition	10	2.67	1.18	55.8	44.9	21.9
		20	2.58	1.28	50.4	38.7	18.7
		30	2.62	1.19	54.6	34.7	16.6
		40	2.66	1.21	54.5	39.0	18.8
		50	2.63	1.25	52.5	35.8	17.2
Bario Pactit, Badoc	Wet Condition	10	2.61	1.46	44.1	28.9	13.6
		20	2.63	1.30	50.6	27.2	12.8
		30	2.65	1.20	54.7	35.2	16.8
		40	2.61	1.20	54.0	37.1	17.8
		50	2.56	1.14	55.5	39.5	19.1
Average[1/]		10	2.61	1.21	53.9	42.7	20.8
		20	2.63	1.23	53.8	39.4	19.0
		30	2.64	1.18	54.9	38.7	18.7
		40	[illegible]	[illegible]	[illegible]	40.4	19.6
		50	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Note: 1/ Including figure in the dry condition

2/ Porosity = 100/2r (%)

Table 4B-7. Net Amount of Water to be Replaced for Crops
(Tobacco, Corn, Mungo Beans)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Depth (cm)	Available Moisture (AM) (mm) [1/]	Ration of Moisture Extraction	(2)/(3) (mm)	Restricting Layer of Moisture	TRAM [2/] (mm)	Net Amount of Water to be Replaced (mm)
0 -12.5	19.9	0.4	49.8	*	49.8	49.8
12.5-25.0	17.7	0.3	59.0			
25.0-37.5	18.6	0.2	93.0			
37.5-50.0	18.6	0.1	186.0			

Note; 1/ : $AM = \frac{1}{100} (Fc-Wp) \cdot Sa \cdot D$

Fc : Field capacity (%)
Wp : Wilting point (%)
Sa : Aparent Specific Gravity (g/cm^3)
D : Depth (mm)

2/ : TRAM : Total Readily Available Moisture

Table 4B-8. Net Amount of Water to be Replaced for Crops (Garlic)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Depth (cm)	Available Moisture (AM) 1/ (mm)	Ratio of Moisture Extraction	(2)/(3) (mm)	Restricting Layer of Moisture	TRAM 2/ (mm)	Net Amount of Water to be Replaced (mm)
0 - 7.5	19.9	0.4	49.8	*	49.8	49.8
7.5-15.0	18.7	0.3	62.3			
15.0-22.5	17.7	0.2	88.5			
22.5-30.0	17.7	0.1	177.0			

Note; 1/ : $AM = \frac{1}{100} (Fc-Wp) \cdot Sa \cdot D$

Fc : Field capacity (%)
Wp : Wilting point (%)
Sa : Aparent Specific Gravity (g/cm^3)
D : Depth (mm)

2/ : TRAM : Total Readily Available Moisture

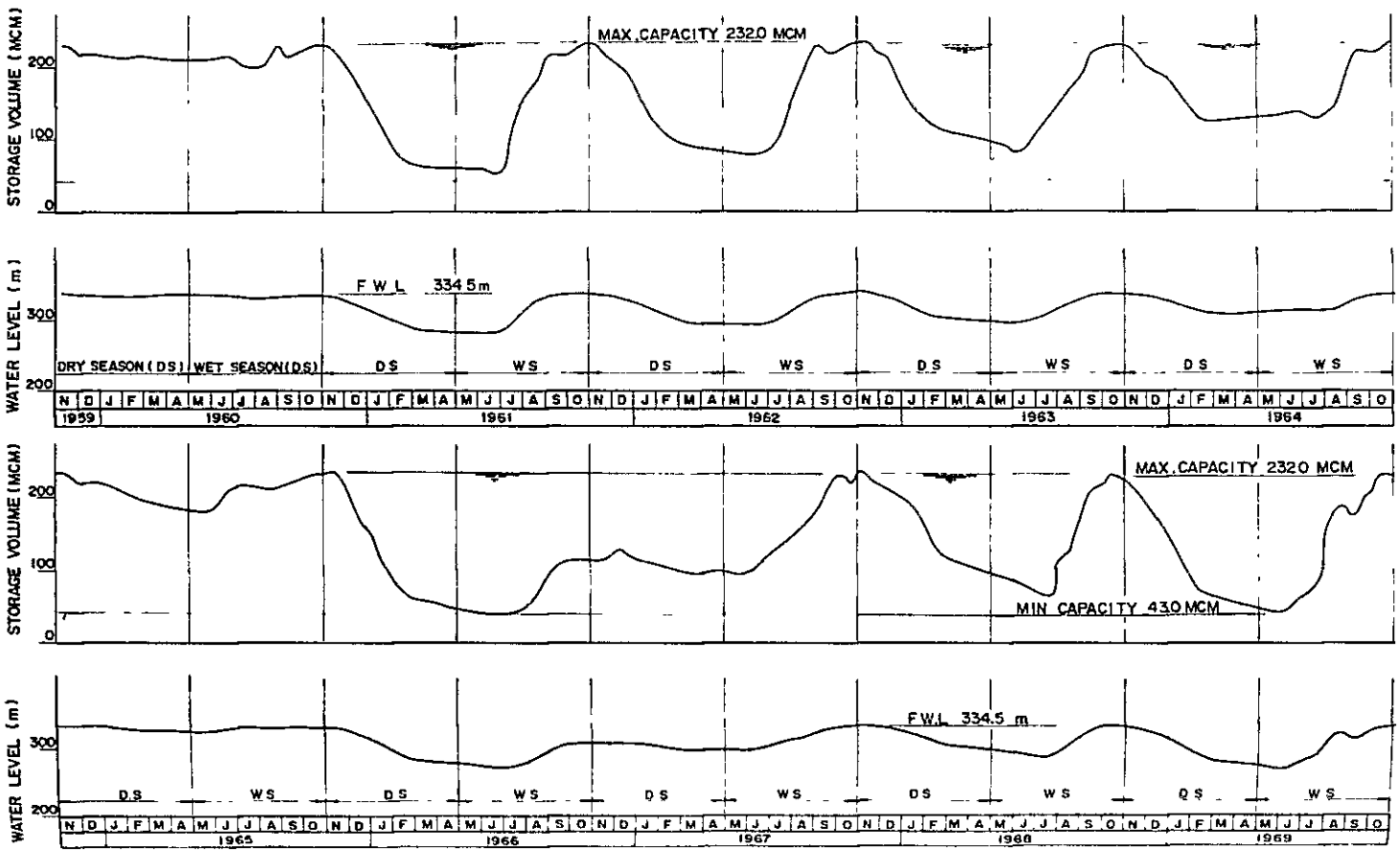
Table 4B-9. Upper and Lower Limit in Balsiguan Reservoir Operation Rules

(Unit: MCM)

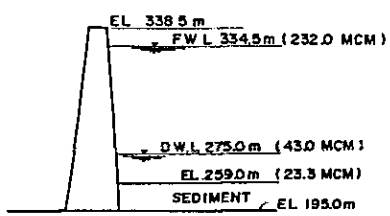
Period	Upper Limit	Lower Limit
Nov. 1[1/]	232.0	200.0
2	225.0	200.0
3	220.0	200.0
Dec. 1	215.0	188.0
2	210.0	175.0
3	205.0	161.0
Jan. 1	199.0	148.0
2	194.0	135.0
3	188.0	121.0
Feb. 1	183.0	108.0
2	178.0	94.0
3	172.0	80.0
Mar. 1	167.0	77.0
2	162.0	73.0
3	157.0	70.0
Apr. 1	152.0	67.0
2	147.0	63.0
3	141.0	60.0
May 1	136.0	64.0
2	132.0	67.0
3	139.0	71.0
Jun. 1	148.0	75.0
2	157.0	79.0
3	166.0	83.0
Jul. 1	175.0	96.0
2	185.0	109.0
3	195.0	123.0
Aug. 1	203.0	136.0
2	211.0	149.0
3	220.0	162.0
Sep. 1	222.0	175.0
2	224.0	188.0
3	227.0	200.0
Oct. 1	229.0	200.0
2	231.0	200.0
3	232.0	200.0

Note: 1/ First 10 days

FIGURE 4B-6 RESULT OF PALSIGUAN RESERVOIR OPERATION STUDY



SCHIMATC CHART OF DAM
(NO SCALE)



Elev. (m)	Area (sq.km)	Capacity (MCM)
375	8.426	498.727
360	6.685	385.794
350	6.169	320.124
335	5.088	235.696
325	4.391	188.301
310	3.459	129.426
375	2.863	87.816
285	2.037	61.066
275	1.576	43.001
260	1.018	23.946
250	0.757	14.621
235	0.412	5.778
225	0.271	2.383
210	0.033	0.083
205	0	0

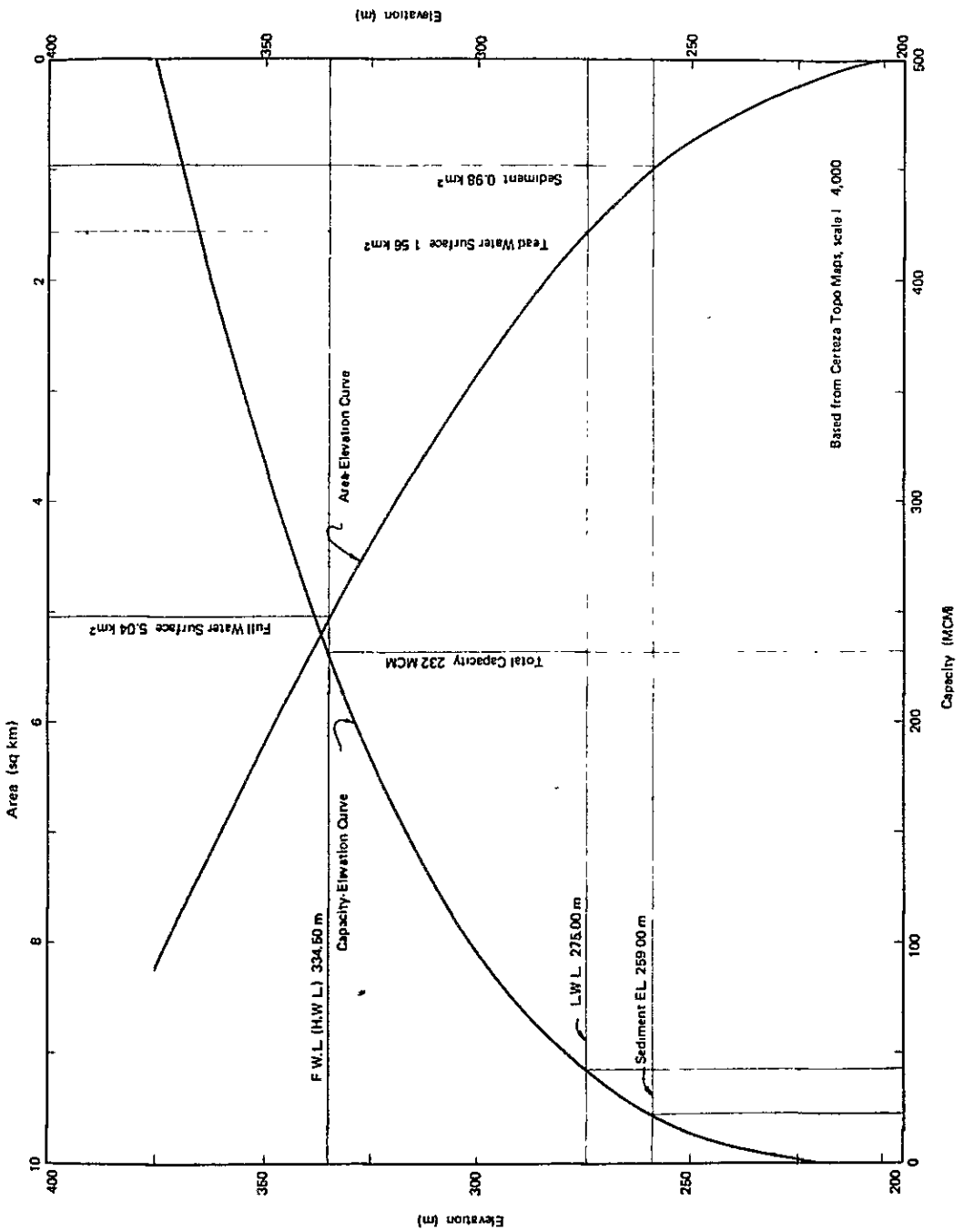
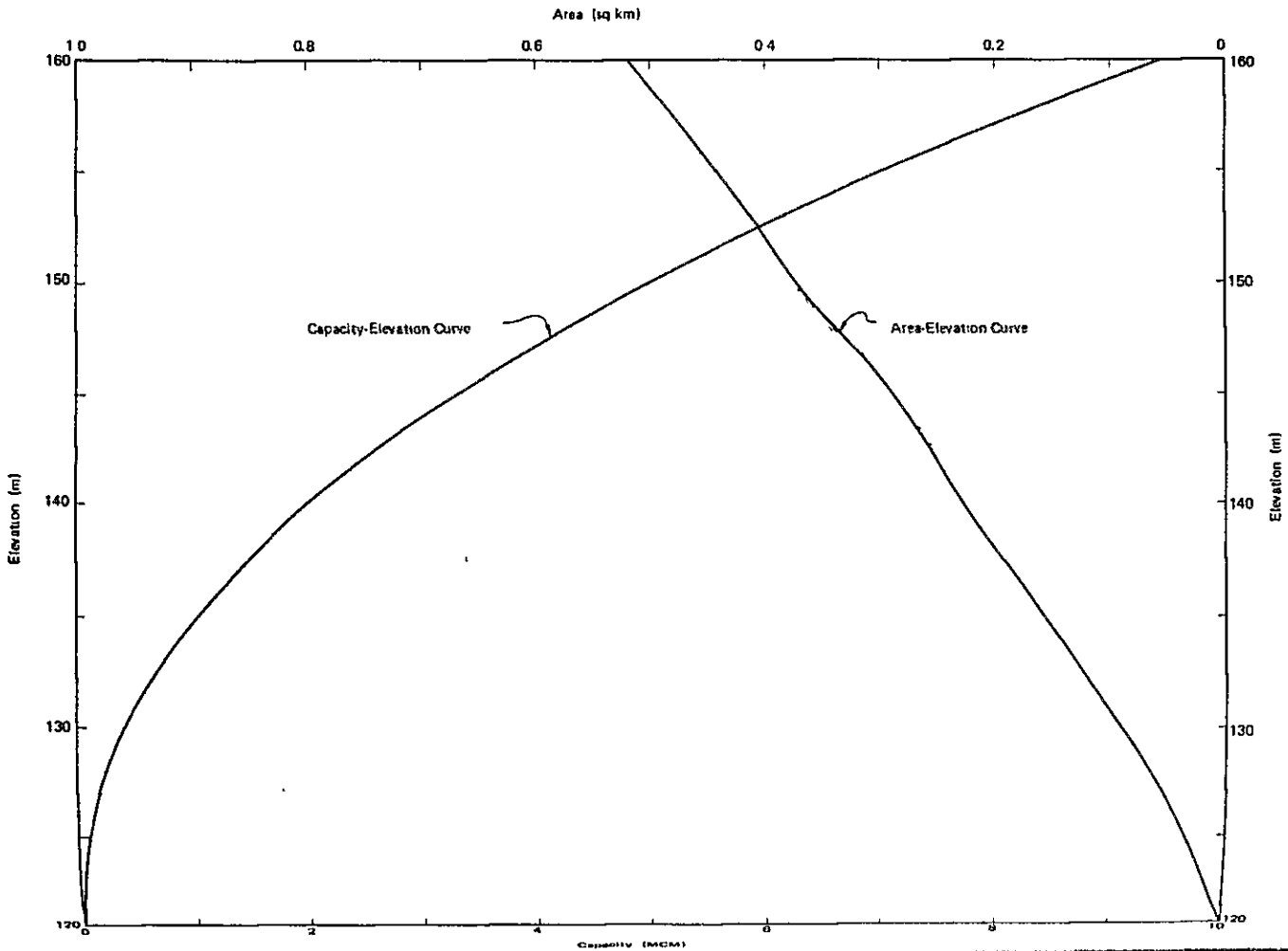


FIGURE 4B 7 AREA CAPACITY CURVE FOR PALSIGUAN DAM SITE

Catchment Area 153 sq km

FIGURE 4B-8. AREA-CAPACITY CURVE FOR NUEVA ERA DAM SITE

Catchment area: 52.4 sq.km



Elevation (m)	Area (sq.km)	Capacity (MCM)
160	0.5194	9.4340
155	0.4426	7.0289
150	0.3731	4.9097
145	0.2905	3.3308
140	0.2297	2.0303
135	0.1593	1.0578
130	0.0953	0.4213
125	0.0363	0.0930
120	0.0012	0

Drainage Plan

A Drainage Discharge from Paddy Fields

1. Design Rainfall

a) Probable Daily and Consecutive Rainfall

Daily maximum rainfall data observed at Laoag station from 1951 to 1979 were collected and based upon the data, probability analysis was made in order to estimate the return periods and corresponding magnitude of rainfall. The results are tabulated as follows;

Probable Daily and Consecutive Rainfall

(unit: mm)

Return Periods	1-day	2-day	3-day	4-day	5-day
1/5	313.5	436.1	493.3	533.4	568.9
1/10	389.1	520.0	597.2	650.5	694.0
1/15	433.6	566.9	657.5	719.5	768.0

Note: Rainfall data and result of probability analysis are given in Table 4B-10 and Figure 4B-9.

As the design rainfall, 493.3 mm of 3-day consecutive rainfall in the return period of 5-year is decided, considering the rainfall characteristic and permissible inundation periods and depth of water.

b) Hourly Rainfall Distribution

Out of the available hourly rainfall records, rainfalls above 100 mm/day were collected and the mass curve of each rainfall was drawn as shown in Figure 4B-10. As is seen in Figure 4B-10, the distribution of rainfall shows no distinct difference for small and high rainfall intensities. Only one rainfall pattern, therefore, was adopted. The obtained distribution percentage on each hour is shown as follows;

Table 4B-10. Maximum Consecutive Rainfall (1951-1979)

Station: Laoag Rainfall Gauging Station

Year	1-Day	2-Day	3-Day	4-Day	5-Day	6-Day	7-Day
1951	253.7	305.3	332.0	335.0	336.3	349.5	372.6
1952	254.0	257.6	257.9	264.0	312.7	321.1	333.5
1953	392.4	515.6	515.6	515.6	516.1	516.1	516.1
1954	170.9	268.4	268.4	294.9	300.5	318.5	319.5
1955	71.9	81.5	127.5	142.5	163.6	199.2	219.8
1956	173.7	320.0	381.2	388.3	412.0	435.4	441.0
1957	186.2	371.4	426.8	450.8	511.7	539.4	551.1
1958	127.0	237.5	321.6	366.0	391.9	409.4	422.6
1959	250.7	337.6	345.5	349.8	366.8	374.7	480.5
1960	122.2	183.9	200.4	250.4	287.5	343.1	363.4
1961	494.8	670.8	785.1	810.5	821.2	895.1	1,009.4
1962	409.2	491.3	672.1	778.0	879.1	893.3	901.4
1963	294.9	471.7	629.4	736.3	842.5	931.9	934.4
1964	162.9	221.3	268.6	268.6	301.8	405.0	407.5
1965	280.6	304.5	317.3	320.1	320.4	320.4	338.7
1966	136.2	229.2	261.2	273.9	295.5	306.7	324.6
1967	510.3	557.2	557.5	576.0	584.1	584.4	587.0
1968	248.5	308.2	337.1	384.9	404.5	434.5	454.1
1969	323.6	482.1	526.6	629.1	718.0	803.3	879.8
1970	93.5	165.6	226.8	271.6	318.0	362.8	394.1
1971	225.2	393.3	472.1	474.6	474.6	476.4	483.9
1972	249.7	358.7	438.7	557.0	615.2	666.8	716.9
1973	320.6	496.4	516.8	524.0	527.1	544.1	561.9
1974	176.5	274.7	359.3	382.9	394.6	431.4	498.3
1975	125.7	221.5	262.4	275.1	330.8	371.7	448.3
1976	128.4	219.1	228.2	231.6	234.7	236.3	237.1
1977	243.0	396.2	428.5	463.0	495.3	509.3	516.9
1978	157.8	195.2	233.2	278.6	279.7	280.7	280.7
1979	183.4	226.3	258.7	274.2	310.0	343.1	354.7

FIGURE 4B-9. FREQUENCY FOR EACH MAXMUM CONSECUTIVE RAINFALL AT LAOAG

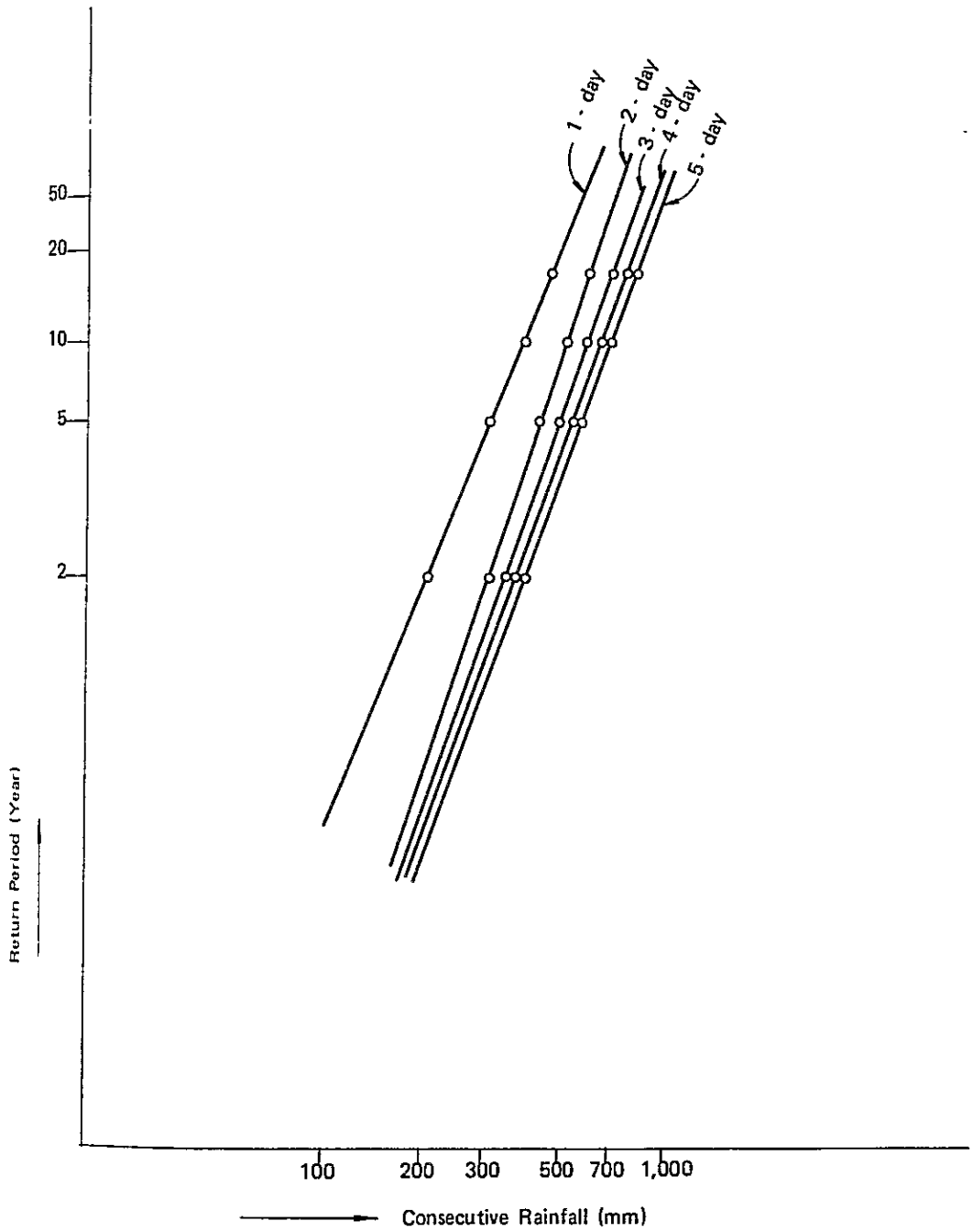
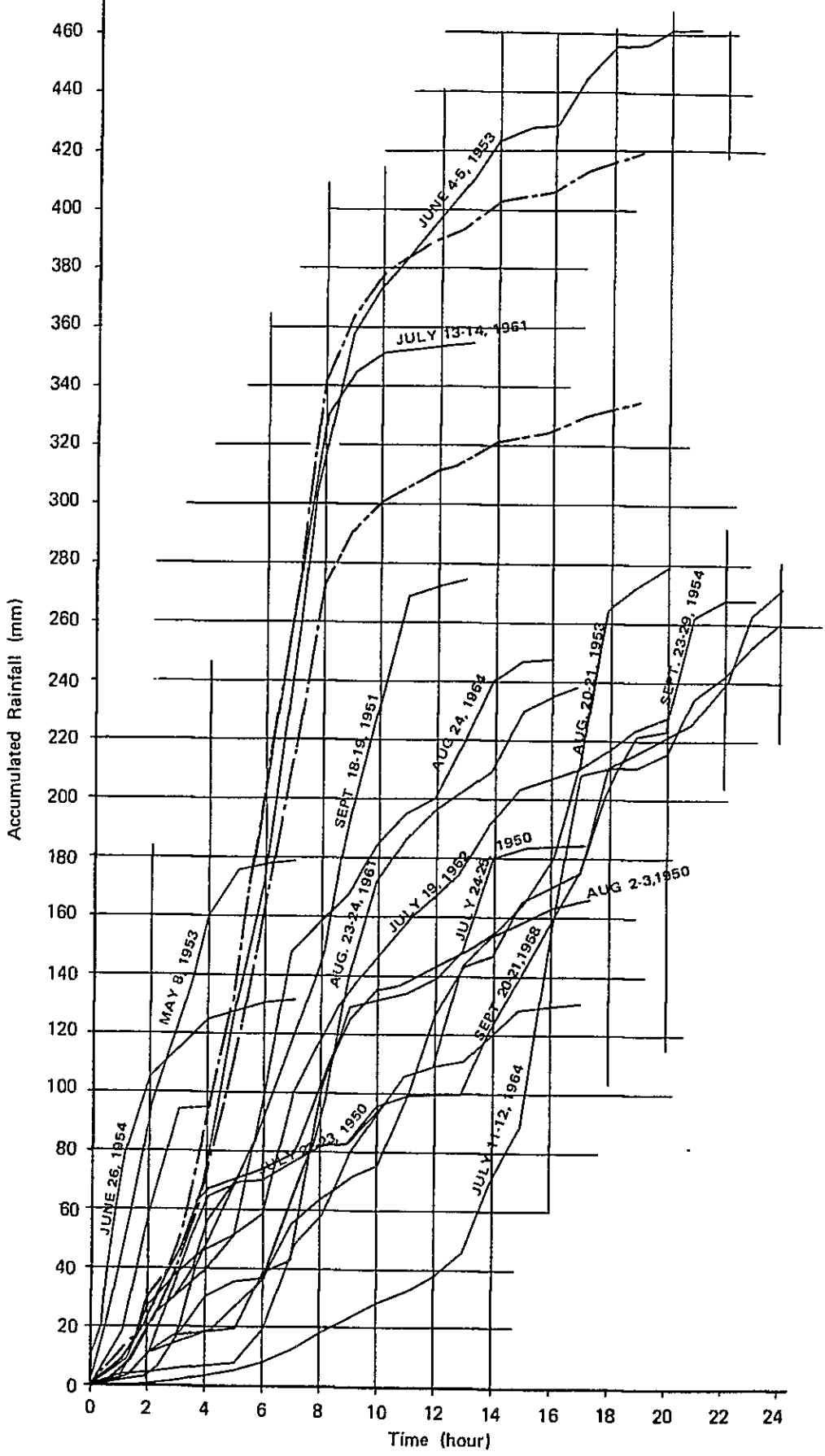
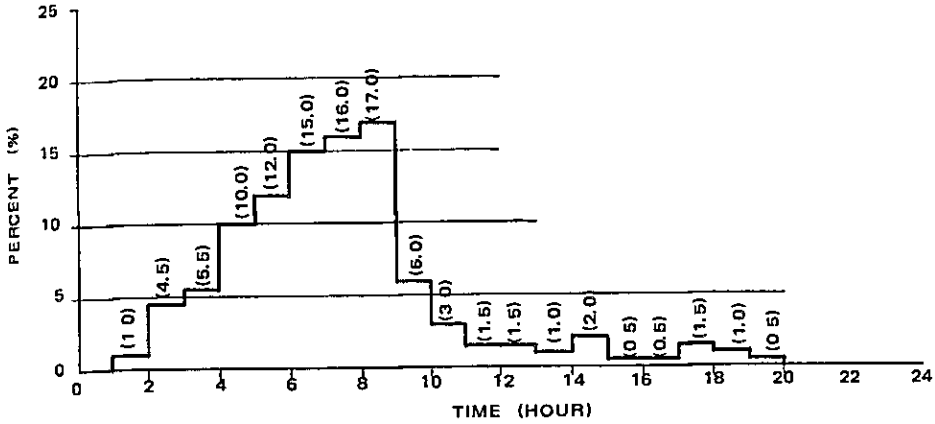


FIGURE 4B-10. ACCUMULATIVE HOURLY RAINFALL (LAOAG STATION)



HOURLY RAINFALL DISTRIBUTION



The hourly rainfall distribution on design rainfall is given as follows;

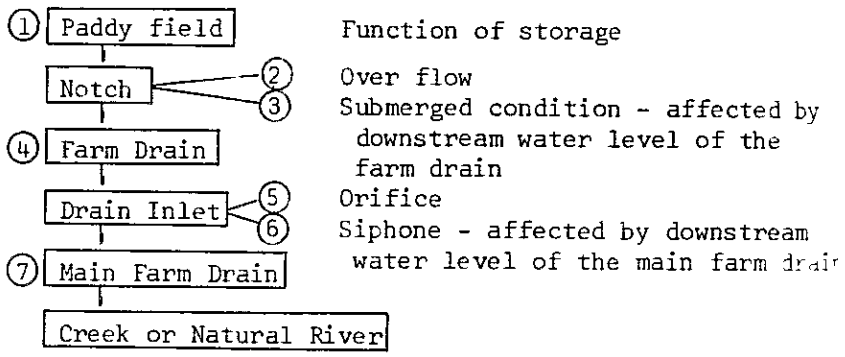
Hourly Rainfall Distribution for Design Rainfall

(Unit: mm)

Hour	Percent of Distribution	1st-day	2nd-day	3rd-day	
0	0	0	0	0	
1	1.0	1.2	3.1	0.6	
2	4.5	5.5	14.1	2.6	
3	5.5	6.7	17.2	3.2	
4	10.0	12.3	31.4	5.7	
5	12.0	14.7	37.6	6.9	
6	15.0	18.4	47.0	8.6	
7	16.0	19.6	50.2	9.2	
8	17.0	20.8	53.3	9.7	
9	6.0	7.4	18.8	3.4	
10	3.0	3.7	9.4	1.7	
11	1.5	1.9	4.7	0.9	
12	1.5	1.9	4.7	0.9	
13	1.0	1.2	3.1	0.6	
14	2.0	2.5	6.3	1.1	
15	0.5	0.6	1.6	0.3	
16	0.5	0.6	1.6	0.3	
17	1.5	1.8	4.7	0.9	
18	1.0	1.2	3.1	0.6	
19	0.5	0.6	1.6	0.3	
20	0	0	0	0	
21	0	0	0	0	
22	0	0	0	0	
23	0	0	0	0	
24	0	0	0	0	
Total		122.6	313.5	57.2	493.3

2. Run-off Mechanism of Paddy Fields

Normally, paddy field has a function of storage of rainfall. The stored rainfall in the paddy field is discharged through a notch to a farm drain. The farm drain is connected to a main farm drain by drain inlet which is facilitated by means of reinforced concrete pipe. The drainage from paddy field should be considered the mechanism of drainage system. The notch can control the drainage discharge from the Paddy fields and the drain inlet at the end of farm drain can control the discharge to the main farm drain, because as the water level in the main farm drain rises, the pipe of drain inlet being in submerged condition functions as a siphon. Considering these drainage mechanism, the drainage system can be illustrated as below and Figure 4B-11.



In the above drainage mechanism in the paddy fields, the most critical capacity is caused by the notch under the over flow condition and the drain inlet in syphone conditions which is affected by the water level in the main farm drain.

In a given time interval, the difference between inflow and outflow is equal to the change in storage of the Paddy fields;

$$I - O = \Delta S$$

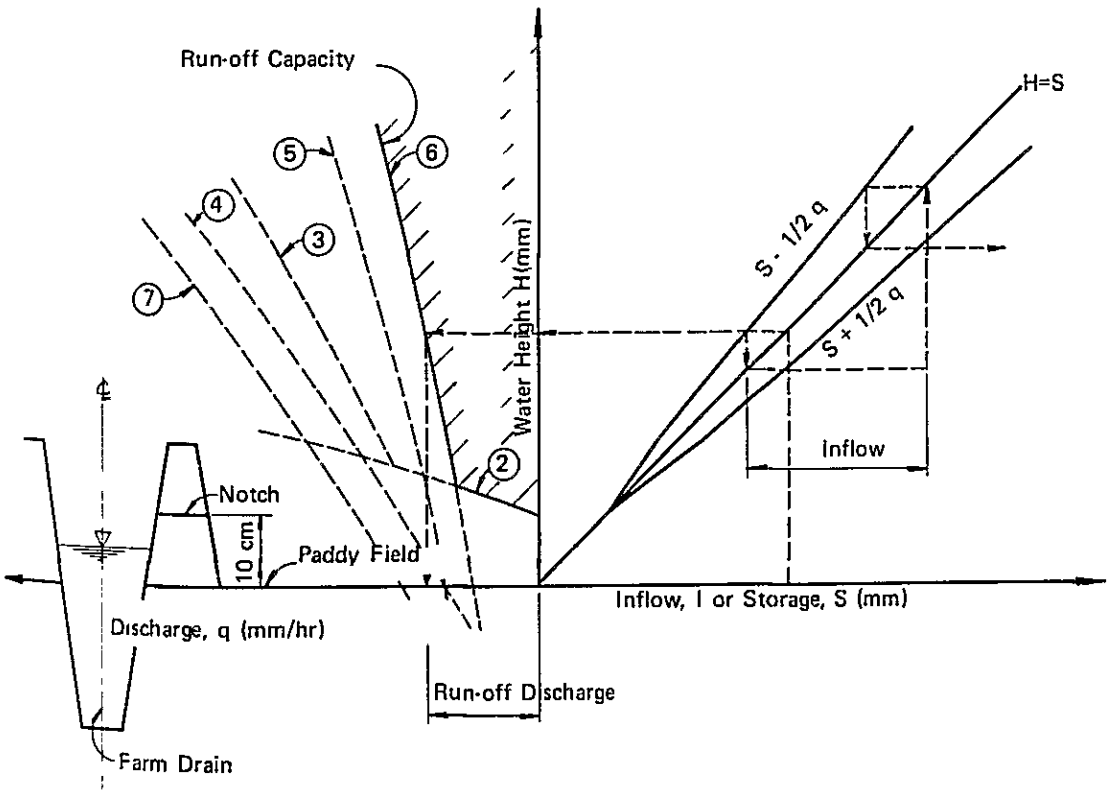
) if expressed in definite time intervals,

$$1/2(I_1 + I_2)\Delta t - 1/2(O_1 + O_2)\Delta t = S_2 - S_1$$
$$1/2(I_1 + I_2)\Delta t = (S_2 - S_1) + \tfrac{1}{2}(O_2 + O_1)\Delta t$$
$$= (S_2 + \tfrac{1}{2}O_2\Delta t) - (S_1 + \tfrac{1}{2}O_1)\Delta t$$

where, the subscripts indicate the routing periods of paddy storage, and I, O, and S and instantaneous values of inflow, outflow, and storage respectively, at the beginning of the routing periods indicated. In the case of unit area of paddy fields, the storage, S should be equal to water depth, H and unit time, t equals to one (1) hour, inflow, I equals to hourly rainfall (mm/hr) and the outflow, O equals to discharge from paddy field, q (mm/hr) which are considered as run-off capacity controled by notches and drain inlets mentioned previously.

From the above equations, the following figure can be drawn to estimate the q and S by using the obtained hourly rainfall.

FIGURE 4B-11. ILLUSTRATION OF RUN-OFF MECHANISM OF PADDY FIELD



According to the field survey, the average height of farm dike is 30 cm, and the size of notch is 30 cm width and 20 cm depth located at 10 cm height above field surface. The average size of farm plot is 0.06 ha, 20 m x 30 m. The initial depth of water in the paddy field is decided at 80 mm. Figure 4B-12 shows the major dimensions of fields used for estimation of run-off discharge.

Fun-off discharge in the Paddy field being located on low-lying area was calculated by applying the above mentioned procedures. Figure 4B-13 indicates run-off capacity controled by notches and drain inlets provided in fields, and the diagram of run-off routing by using the obtained run-off capacity and design rainfall is shown in Figure 4B-14.

As the results of studies on the run-off discharge, the maximum run-off discharge, which is caused by the maximum spot three day consecutive rainfall of 493.3 mm, corresponding to the return period of 5-year, is estimated at 1.223 cum/sec/sq.km, equivalent to 105.7 mm/24 hr. Table 4B-11 and Figure 4B-15 show the result of these studies.