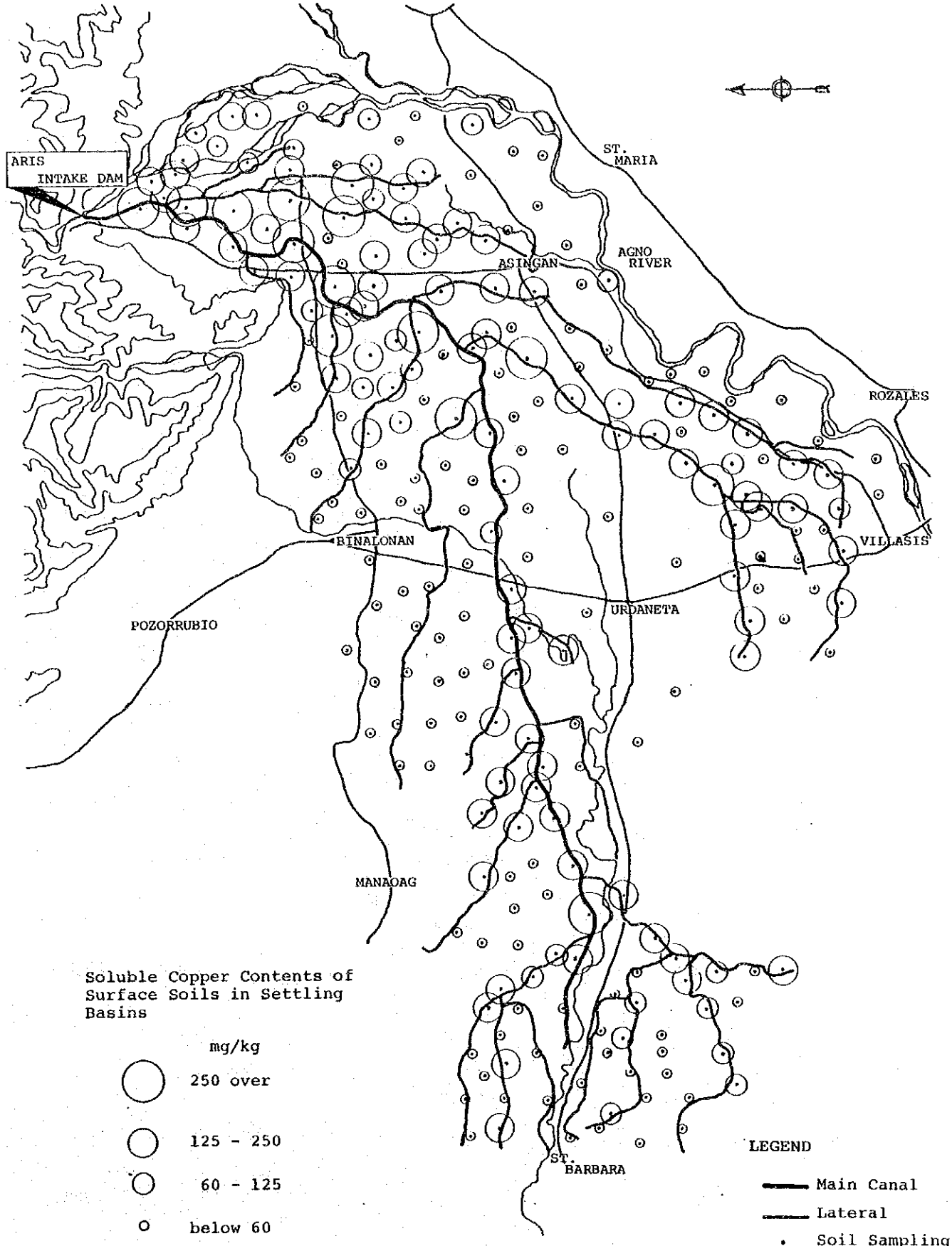


Fig. F-3 Soluble Copper Contents of Surface Soils in ARIS

APPENDIX "G"

MINING ACTIVITIES IN THE WATERSHED OF THE AGNO RIVER

CONTENTS FOR APPENDIX "G"

MINING ACTIVITIES IN THE WATERSHED OF THE AGNO RIVER

APPENDIX "G" MINING ACTIVITIES IN THE WATERSHED OF THE AGNO RIVER

The southern section of the Cordillera Central Mountain Range is the most important mining district in the Philippines, dotted with copper and gold mines including those listed in the following table that are located in the watershed of the Agno River. The following is an outline of these mines with particular stress laid on mill operation and tailings disposal.

Mining company	Mine	Principal Commodity	Location
Philex Mining Corp.	Sto. Tomas II	Cu	Tuba Itogon, Benguet
Benguet Corp.	Acupan	Au	Itogon, Benguet
	Antamok	Au	– ditto –
	Baco	Au	– ditto –
	Kelly	Au	– ditto –
Itogon-Suyoc Mines Inc.	Itogon	Au	Itogon, Benguet
Baguio Gold Mining Co.	St. Niño	Cu	Tublay, Benguet (closed in 1982)

1. Sto. Tomas II Mine of the Philex Mining Corp.

The mine is located about 20 km south of Baguio City and is accessible from Baguio City by a well maintained mine road.

The mining activities started in 1958. By progressively increasing its capacity, the mine is operated at a rate of 27,000 t/day at present. The following figures show the summary of the accomplishment for the past two years.

MINE OPERATION FIGURES	1983	1982
Metric Tons Mined and Treated	9,131,657	9,634,660
Copper, Kilograms Produced	21,432,298	23,146,049
Gold, Grams in Concentrate and Bullion	4,287,872	4,229,416
Percent Copper Recovery	81.90	87.14
Percent Gold Recovery	85.44	84.05
Broken Ore Reserve as of December 31, 1983	22,435,000	23,697,000
Grade of Broken Ore, Copper %	0.265	0.268
Gold, Gm/MT	0.468	0.466
Dry Metric Tons of concentrate	84,051	90,683

*Source: Annual Report 1983

The plan for constructing the 745 ML concentration was withdrawn and the existing 1020 ML concentrator will operate at a rate of 32,000 t/day, higher by 5,000 t/day, by September, 1985.

Ore reserves estimated as of December 31, 1983 are tabulated below.

	% Cu	G/T Au	Tonnage (DMT) x 1000
1) Above 1020 ML			
Positive Ore	0.30	0.65	63,928
Probable Ore	0.28	0.458	11,981
TOTAL	0.30	0.62	75,909
2) Below 1020 ML			
Positive Ore			
975 ML	0.42	0.768	17,449
908 ML	0.38	0.776	16,722
840 ML	0.33	0.686	16,480
790 ML	0.28	0.56	12,118
SUB-TOTAL	0.36	0.708	62,769
Probable Ore			
975 ML	0.29	0.456	22,361
908 ML	0.29	0.457	13,638
840 ML	0.27	0.443	7,807
790 ML	0.25	0.346	3,342
SUB-TOTAL	0.28	0.446	47,148
TOTAL	0.32	0.596	109,917
GRAND TOTAL	0.31	0.606	185,826

Source: Annual Report 1983

According to these ore reserves with broken ore reserves in pits, mine life could have a bit longer ore life of 18 years.

The Sto. Tomas II deposit is of porphyry copper type and its copper ores which occur as disseminations and veinlets of chalcopyrite in silicified rock are mined by the block caving method.

A concentrator of the Philex Mining Corp. called "Banget Concentrator" is producing copper concentrates by floatation method with a capacity of 27,000 t/day. Crude ores are crushed in three stages by crushers followed by primary grinding by ball mills to about 50% −200 mesh. The ground materials are fed into the main floatation circuit and rougher-floated. The rougher concentrates are cleaned in cleaner cells to produce the final concentrate. The slime which is separated at the primary crusher is fed into a gold recovery circuit then floated to

produce copper concentrate. The copper concentrates from the main and the slime circuits are pumped into concentrate cyclones. The cyclone over flow is fed to thickners. Then the thickner underflow is fed together with cyclone underflow to drum filters. At the drum filters the final copper concentrate cake assaying 24 to 30% Cu, 35 to 50g/t Au and 55 to 60 g/t Ag is produced.

Main chemical reagents used in the concentration are as follows:

Collector	Sodium Isobutyl Xanthate	20– 35 g/ton ore
Frother	Serabon MF 605	10– 30 g/ton ore
	Repoforth	10– 30 g/ton ore
Conditioning	Lime	100–175 g/ton ore

Water consumption is more or less 3–4 m^3/ton ore.

The Philex Mining Corp. constructed the tailings dams No. 1 in the Albian Creek and No. 2 in the Manaa Creek adopting the downstream method, utilizing the tailings themselves to build up the dam body. The mill tailings are fed to cyclones where they are separated to 40% coarse sand and 60% slime. The coarse sand is discharged at the downstream side of the dam to build up the dam body and the slime is discharged into the pond. Water from the catchment area of the dam is diverted by diversion tunnels and water in the pond is decanted by culverts, a penstock or a spillway.

The tailings dam No. 1 has been operated since 1972, and is already filled in up to 95% of its designed capacity (60×10^6 DMT). It is now being built to increase capacity. The tailings dam No. 2 has been operative since 1981, and is filled in up to 40% of its designed capacity(50×10^6 DMT).

2. Gold Mines of the Benguet Corp.

The Acupan Mine started production in 1906 and the Antamok in 1933. Lately, the Baco Mine which is now separated from the Atok Big Wedge Mining Co., began production in 1980 and the Kelly Mine was also opened in 1981. These mines are located east of Baguio City along the Ambalanga River and are easy to reach from Baguio City by paved roads.

Gold-bearing quartz-clay veins are mined in these four mines and gold ores are conveyed to be treated at the centralized Balatoc Mill through haulage tunnels.

The summary of the operation for the past two years is:

	1983	1982
Ore Milled (000 tonnes)	1,151	1,112
Gold Content per Tonne Milled (grams)	3.88	3.66
Gold Recovery	86%	84%
Gold Produced (000 ounces)	124	110
Silver Produced (000 ounces)	116	104

Source: Annual Report 1983

Ore reserves as of December 31, 1983 are;

	Au g/T	Tonnage (DMT) x 1000
Proven and Probable ore	5.85	1,648
Possible ore	5.30	1,753
Sub total	5.57	3,401
Potential geologic ore	3.0	11,800
Total	3.6	15,201

Source: Annual Report 1983

According to these ore reserves, their mine life could be calculated to last about 13 years.

The Balatoc Mill is producing gold bullion by the cyanidation method with a capacity of 3,250 t/day. The mill reduced the run-of-mine ore to 75% – 200 mesh in crushers and ball mills. Elution of gold starts at the ball mill; further eluted in thickeners and agitators. The gold-cyanide solution is separated from tailings at the standard thickners and further at the counter current decantation high capacity thickners, then clarified by filters. Gold precipitated with zinc dusts is dried and smelted at the refinery producing gold bullion of 500 – 600 fineness.

Main chemical reagents used in the mill are as follows;

Sodium cyanide	0.8–1.0 Kg/Ton ore
Lime	5.0–5.2 Kg/Ton ore
Zinc dust	0.08 Kg/Ton ore

Mill water is needed at a rate of 7 ~ 8m^3 per ton ore treated (water recycled is 75 ~ 80% of above figure)

The tailings are fed into the sand-fill plant to recover coarser sand which is about 30% of the tailings. Finer tailings are disposed in the phase II tailings pond through a channel on the phase I tailings pond which has been inoperative since 1978. Water from the upper reaches is diverted by upstream dam and diversion tunnels and seepage water is discharged through culverts and clarified water through penstocks.

The phase II tailings dam is filled in up to 67% of its designed capacity (6×10^6 DMT).

3. Itogon Mine of the Itogon-Suyoc Mines, Inc.

The Itogon Mine faces the eastern border of the Acupan Mine and is accessible from Baguio city by road via the Itogon village.

The mining activities started in 1926. The mine operation had been expanded to 320 t/day by 1976. The mine had been operated at a rate of 250 ~ 300 t/day till recent times, and expanded up to 350 /day from the 3rd quarter of 1984.

The accomplishment for the past two years is;

		1983	1982
Tons Milled		164,083	104,443
Mill HDS (gr/MT)		4.66	4.71
Percent Recovery		87	87
Production	Au (oz)	13,587	13,742
	Ag (oz)	5,316	5,747

Source: Annual Report 1983

Ore reserves as of December 31, 1983 are;

	M. TONS	GM/MT	GRAMS AU
IMMEDIATELY AVAILABLE			
Positive Ore	25,219	4.09	103,244
Probable Ore	50,459	4.31	217,481
Possible Ore	48,476	4.64	224,703
	124,154	4.39	545,428
NOT IMMEDIATELY AVAILABLE			
Positive Ore	208,833	4.20	876,787
Probable Ore	195,309	4.26	831,794
Possible Ore	589,156	4.11	2,217,860
	943,298	4.16	3,926,441
GRAND TOTAL	1,067,425	4.19	4,471,869

Mine life calculated according to the ore reserves is 8.5 years.

Gold-bearing quartz veins are pit mined and gold bullion is being produced by the cyanidation method.

The run-of-mine ore is reduced by crushers and ball mills. Gold is eluted from the ground material in thickners and agitators.

Gold-cyanide solution is separated from tailings and led to a solution tank as the thickener overflows and is clarified and precipitated. Gold precipitates are dried and smelted at the refinery producing gold bullion.

Main chemical reagents used in the mill are;

Sedium cyanide	1.5 Kg/Ton ore
Lime	1.8 Kg/Ton ore
Zinc dust	0.06 Kg/Ton ore

Mill water are consumed 1,100 m^3/day, and 600 m^3/day are reclaimed at the thickener in dry season. Mill tailings are impounded in No. 6 tailings pond in the downstream.

4. Sto. Niño Mine of the Baguio Gold Mining Co.

The mine is located at Tublay Benguet, northeast of Baguio City, and can be reached by following the Mountain Trail up to KM 21 and then by the mine access road to the mine.

The mine started operation in 1972 by the engineering staff of the Philex Mining Corp. at a rate of 3,300 t/day but closed in 1982. At present, discharge treatment is not carried out.

In the Sto. Niño, there are two porphyry copper type ore bodies, the Southwest ore body and Ulman ore body. The Southwest ore body was mainly mined by an open pit and copper ores were floated to produce copper concentrates.

APPENDIX "H"

OUTLINE OF THE PROJECT STUDIED BY ELECTROCONSULT

APPENDIX "H"
OUTLINE OF THE PROJECT STUDIED BY ELECTROCONSULT

Purposes of the San Roque project are;

(1) Power generation

Every year the project will generate 780 GWh of primary energy plus up to 434 GWh of secondary energy. The project will contribute to the supply of electric power to Manila Metropolitan Area through existing high tension power line which is extended at the point 9 km to the proposed damsite.

(2) Irrigation

A single-corp farming using rain water is accepted in the most of the Pangasinan plain at the moment. The project will render the year-round irrigation to the land about 52,500 to 87,000 ha.

(3) Water quality improvement

The project will improve the quality of the water in the Agno River by trapping all mine tailings produced in the river watershed.

(4) Flood control

The Pangasinan plain is troubled by occasional floods at the moment. The project will produce a marked attenuation in the floods by its flood control space.

The principal features of the project studied by Electroconsult is as follows.

HYDROLOGY	
Drainage area	1,250 km^2
Average flow	94.2 m^3/s
Design flood	12,800 m^3/s
RESERVOIR	
Capacity	990 10^6 m^3
Active storage	670 10^6 m^3
Flood cushion (el. 290–300)	150 10^6 m^3
Max. Normal Water Level	290 m a.s.l.
Min. Normal Water Level	225 m a.s.l.

DAM

Type	gravel fill – central clay core
Max. height	210 m
Crest el. (incl. camber)	307 m a.s.l.
Crest length	1,130 m
Fill volume (incl. cofferdams)	43.15 10^6 m^3

SPILLWAY

Type	open chute – gated
Capacity	15,600 m^3/s

POWER PLANT

Type	shaft
Installed capacity	130x3 MW
Primary generation	780 GWh/year
Secondary generation	377–434 GWh/year

IRRIGATION HEADWORKS

Intake	– type	parallel – pressure flow flushing
	– number of gates	10 5 x 4 m
	– sill el.	95 m a.s.l.
	– capacity	290 m^3/s

IRRIGATION SYSTEMS

Min. Net Irrigable Area (2 rice crops)	52,000 ha
Max. Net Irrigable Area (diversified crops)	87,000 ha

The economic rate of return of the project, with a maximum reservoir operating water level of 290 m and installed capacity of 3x130 MW, is forecasted as 16.7% for a total project cost of US$505 million.

APPENDIX "I"

ORGANIZATION AND LAWS ON THE POLLUTION CONTROL

APPENDIX "I"
ORGANIZATION AND LAWS ON THE POLLUTION CONTROL

1. Organization

The National Environmental Council has been positioned as the supreme organization for the pollution control administration and the National Pollution Control Commission has been organized under the Council by the Presidential Decree No. 1121.

2. Law and Regulations

The mining activities are stipulated by Presidential Decree No. 463, otherwise known as the "Mineral Resources Development Decree of 1974" and Consolidated Mines Administrative order, rules and regulation implementing P.D. No. 463.

As to the pollution control, Section 42-B "Environmental Protection in Mining Areas" of the Consolidated Mines Administrative order is provided.

The following is a part of the Section 42-B.

Mill Waste and Tailings Disposal and Water Conservation

1) All mine/quarry operators are prohibited from directly or indirectly disposing tailings or mill waste into natural drainage systems including rivers and tributaries.
2) Impounding of mill tailings shall be far from water-shed areas and free from spillage, slides and/or washing-away of tailings by surface run-off during heavy rains into drainage systems, creeks or rivers. Flushing of tailings is likewise prohibited.
3) All mine tailings-covered areas if found not suitable for agricultural, industrial or commercial use must first be resoiled, cover-cropped, or reforested.
4) Mill effluents shall be treated such that obnoxious odor and poisonous chemicals are removed before disposal.
5) Mining companies shall at all times conserve water by recyling, developing and maintaining watershed areas, by reforestation and afforestation, and by constructing water reservoirs for domestic, industrial or aqua culture uses.

As to the water quality criteria, Section 68 "Water Usage and Classification" and Section 69 "Water quality criteria" of the Rules and Regulations of the National Pollution Control Commission (1978) is provided.

The following is parts of the Section 68 and Section 69.

Classification for Frash Surface Water

Class AA	For source of public water supply. This class is intended primarily for waters having watersheds which are uninhabited and otherwise protected and which require only approved disinfection in order to meet the National Standards for Drinking Water (NSDW) of the Philippines.
Class A	For source of water supply that will require complete treatment (coagulation, sedimentation, filtration and disinfection) in order to meet the NSDW.
Class B	For primary contact recreation.
Class C	For the propagation and growth of fish and other aquatic resources.
Class D	For agriculture, irrigation, livestock watering and industrial cooling and processing.
Class E	For navigational use.

Water quality criteria for Class "D" Waters

Quality Parameter		Specifications
1)	Temperature	The maximum rise above natural temperature shall not exceed 3°C outside the mixing zone as determined by the Commission
2)	Dissolved Oxygen	Not less than 3 mg/l.
3)	Transparency	Secchi disk shall be visible at a minimum depth of 1 m.
4)	Total Dissolved Solids	Not more than 1000 mg/l.
5)	pH	Not less than 6.0 nor greater than 8.5.
6)	Trace Elements	Not to exceed the following limits:
	Aluminum	5.0 mg/l
	Arsenic	0.1 mg/l
	Beryllium	0.01 mg/l
	Boron	0.75 mg/l
	Cadmium	0.01 mg/l
	Chromium	0.10 mg/l
	Cobalt	0.05 mg/l
	Copper	0.20 mg/l
	Fluoride	1.0 mg/l
	Iron	5.0 mg/l
	Lead	5.0 mg/l
	Lithium	2.5 mg/l Recommended maximum concentration for irrigating citrus is 0.075 mg/l)
	Manganese	0.20 mg/l
	Molybdenum	0.01 mg/l
	Nickel	0.2 mg/l
	Selenium	0.02 mg/l
	Vanadium	0.1 mg/l
	Zinc	2.0 mg/l
7)	Sodium Absorption Ration (SAR)	Not less than 8 nor more than 18.
8)	Organic Chemicals	
	Oil and Grease	5 mg/l
9)	Nutrients	Shall not be present in amounts to cause deleterious or abnormal biotic growth.

APPENDIX "J"

IMPLEMENTING ARRANGEMENT ON

THE PROJECT

APPENDIX "J" IMPLEMENTING ARRANGEMENT
ON THE PROJECT

IMPLEMENTING ARRANGEMENT ON THE TECHNICAL COOPERATION BETWEEN THE JAPAN INTERNATIONAL COOPERATION AGENCY AND THE PHILIPPINE AUTHORITIES CONCERNED FOR THE RE-STUDY OF THE SAN ROQUE MULTI-PURPOSE PROJECT AGREED BETWEEN THE JAPAN INTERNATIONAL COOPERATION AGENCY AND THE PHILIPPINE AUTHORITIES CONCERNED

October 21, 1983

(Sgd.)	(Sgd.)
MICHIMOTO GOTO	JOSE U. JOVELLANOS
Team Leader	Chairman
Preliminary Survey Team	Philippine Joint Technical
Japan International Cooperation	Committee for the San Roque
Agency	Multipurpose Project

I. INTRODUCTION

In response to the request of the Government of the Republic of the Philippines (hereinafter referred to as "GOP"), the Government of Japan (hereinafter referred to as "GOJ") has decided to conduct the Re-Study of the San Roque Multi-Purpose Project (hereinafter referred to as "the Study") and exchanged the Note Verbale with GOP concerning the implementation of the Study.

The Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for the implementation of technical cooperation programs of GOJ, will undertake the Study, in accordance with the relevant laws and regulations in force in Japan.

On the part of GOP, the National Power Corporation (hereinafter referred to as "NPC") shall act as counterpart agency to the Japanese study team and also as coordinating body in relation with other governmental and non-governmental organizations concerned for the smooth implementation of the Study.

The present document constitutes the implementing arrangements between JICA and NPC under the above-mentioned Note Verbale exchanged between the two Governments.

II. IMPLEMENTATION OF THE STUDY

The study shall be implemented in accordance with the Scope of Work attached herewith (Appendix I).

III. UNDERTAKING OF GOP

In accordance with the Note Verbale exchanged between GOJ and GOP, GOP shall accord privileges, immunities and other benefits to the Japanese study team and, through the authorities concerned, take necessary measures to facilitate smooth conduct of the Study.

1. GOP shall be responsible for dealing with claims which may be brought by the third parties against the members of the JICA study team and shall hold them harmless in respect of claims or liabilities arising in the course of or otherwise connected with the discharge of their duties in the implementation of the Study, except when such claims or liabilities arise from the gross negligence or willful misconduct of the above-mentioned members.

2. The NPC shall, at its own expense, provide the Japanese study team with the following, if necessary, in cooperation with other agencies concerned:
   (1) Available data information and materials related to the Study.
   (2) Counterpart personnel consisting of engineers.
   (3) Administrative and technical support staff.
   (4) Suitable office space at Manila and project site with adequate floor space and necessary office equipment.
   (5) Suitable necessary lodging accommodation with pieces of furniture for daily life at the project site.
   (6) Credentials or identification cards to the members of the Study team.

3. The NPC shall make necessary arrangements with the governmental and non-governmental organizations concerned for the following:
   (1) To secure the safety of the Study team.
   (2) To exempt the Japanese study team members for taxes, duties, fees and other charges on equipment, machinery and other charges on equipment, machinery and other material brought into the Philippines, and out of the Philippines, for the conduct of the Study.

(3) To exempt from any taxes, duties, surcharges and the likes to be imposed on the equipment imported to the Philippines for the Study and on the JICA experts for their personal belongings carried to or sent to the Philippines, and, income tax, sales tax and any taxes to be imposed to JICA experts including the remittance from abroad.

(4) To arrange customs clearance handling and storage at the port/airport and inland transportation (to and from the Project site) and custody of equipment, machines, instruments, tools and other articles to be brought into the Philippines, for the performance of the Study.

(5) To arrange/coordinate meetings with authorities/agencies concerned.

(6) To obtain official permission for the members of the study team to enter into, stay and work in, and depart from the Philippines.

(7) To secure permission for entry into private properties or restricted areas for the conduct of the Study.

(8) To use appropriate laboratories with qualified technicians for chemical analysis.

(9) To avail medical facilities as needed and the expenses will be chargeable on the members of the study team.

(10) To hire laborers as needed, and wages will be chargeable to JICA funds.

(11) To secure permission to take all data, materials and documents related to the Study out of the Philippines.

IV. UNDERTAKING OF GOJ

In accordance with the Note Verbale exchanged between GOJ and GOP, GOJ, through JICA, will take necessary measures for the implementation of the Study.

(1) To dispatch, at its own expense study team to the Republic of the Philippines.

(2) To pursue technology transfer to the Philippine counterpart personnel in the course of the Study.

V. CONSULTATION

JICA and NPC will consult with each other in respect of any matter that may arise in the interpretation or implementation of the present arrangement.

(APPENDIX I)

SCOPE OF WORK
FOR
THE RE-STUDY
OF
THE SAN ROQUE MULTI-PURPOSE PROJECT

I. OBJECTIVES OF THE STUDY

The objectives of the Study are:

1. To assess the reservoir water quality
2. To assess the irrigation water quality
3. To review the hydrological analysis

II. SCOPE OF THE STUDY

1. Reservoir Water Quality
   a. Conduct studies to forecast the short and long term quality of water stored in the reservoir.

2. Irrigation Water Quality
   a. Assess the effects of the physical, chemical and mineral properties of the mine tailings on the irrigation water, soils and plants in the project area.
   b. Monitor the behavior of crop production in relation to the use of irrigation water water from the Agno River.
   c. Assess the future quality of the irrigation water if mine tailings are stored in the proposed San Roque reservoir.

3. Water Resources
   Review the hydrological analysis to confirm the availability and dependability of water resources for the project.

III. STUDY SCHEDULE

The Study will be executed in accordance with the tentative schedule (APPENDIX II).

IV. REPORTS

JICA will prepare and submit the following reports in English to the GOP.

1. Inception Report
   - o Twenty (20) copies
   - o Within one (1) month after the start of the Study
   - o Covering the program of the Study with its detailed schedule.

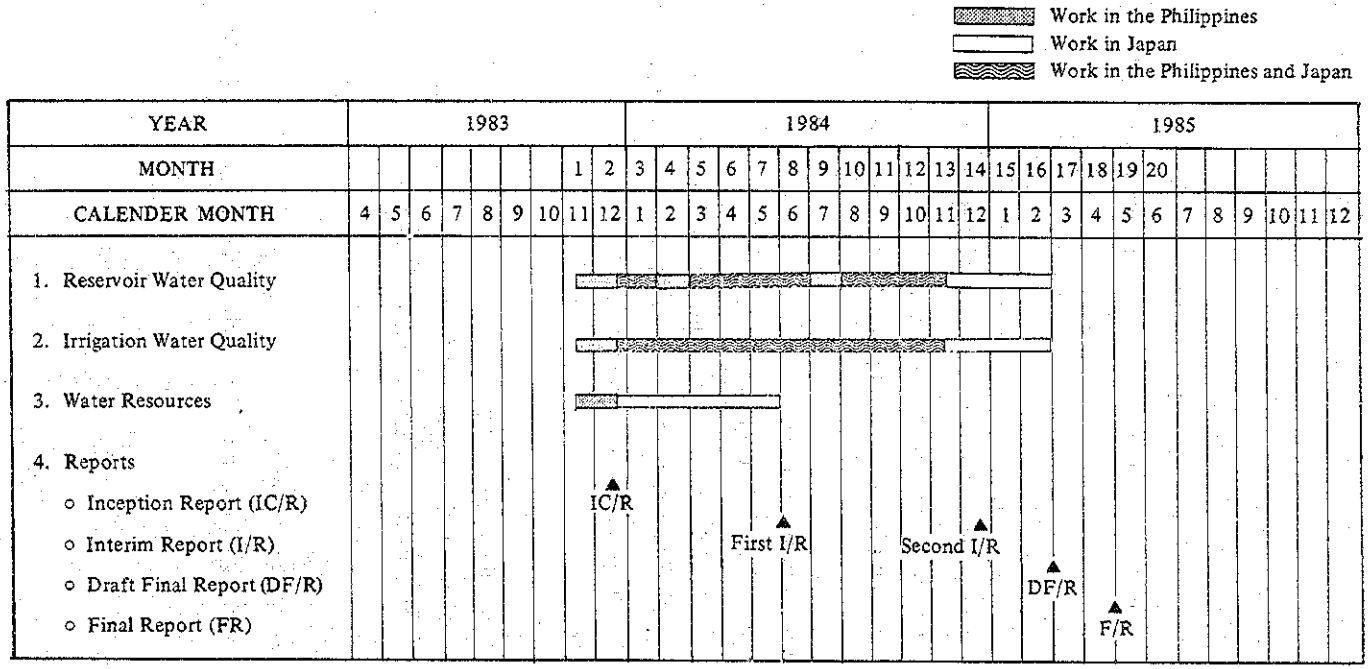
2. First Interim Report
   - o Twenty (20) copies
   - o Seven (7) months after the start of the Study
   - o Covering the result of the hydrological analysis and its evaluation and all the observation data carried out in the dry season.

3. Second Interim Report
   - o Twenty (20) copies
   - o Fourteen (14) months after the start of the Study
   - o Covering the primary result of reservoir water quality except irrigation water quality, and all the observation data.

4. Draft Final Report
   - o Twenty (20) copies
   - o Sixteen (16) months after the start of the Study
   - o Covering all the Study and analysis

5. Final Report
   - o Fifty (50) copies
   - o Within eighteen (18) months after the start of the study.

Tentative Time Schedule



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