REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF ENERGY
NATIONAL IRRIGATION ADMINISTRATION

REPUBLIC OF THE PHILIPPINES
PREPARATORY SURVEY FOR MINI-HYDROPOWER DEVELOPMENT IN THE PHILIPPINES (MICRO/MINI HYDROPOWER PROJECT IN THE PROVINCE OF ISABELA (IRRIGATION CANAL))

FINAL REPORT

MARCH, 2013

JAPAN INTERNATIONAL COOPERATION AGENCY

TOKYO ELECTRIC POWER SERVICES CO.,LTD

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Preface

Japan International Cooperation Agency (JICA) decided to conduct the preparatory survey and entrust the survey to Tokyo Electric Power Services Co., LTD.

The survey team held a series of discussion with the officials concerned of the Government of the Philippines, and conducted field investigations. As a result of further studies in Japan, the present report was finalized.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of the Philippines for their close cooperation extended to the survey team.

March, 2013

Hidetoshi IRIGAKI
Director General
Industrial Development and Public Policy Department
Japan International Cooperation Agency

Summary

1. Country Profile

1-1 National Land and Natural Conditions

Located on the ocean route that links Japan to Southeast Asia, the Middle East and Europe, the Philippines is composed of 7,109 islands of various sizes. Its national land area is approximately 0.8 times the size of Japan, and its population of roughly 87 million is the second largest in the ASEAN region.

All of the Philippines belongs to the tropical rain forest zone, and temperatures nationwide reach a peak in May and hit a low in January. The rainy season and dry season differ according to each area: in Isabela Province in the north of Luzon Island where the Project site is located, the dry season lasts from March to May and the rainy season is from August to October, however, annual rainfall around the Project site is around 2,100 millimeters.

The Isabela Province is 2nd biggest province in the Philippines, and receives the benefit of the water from a Cagayan mountain range. The Isabela Province was the 1st rank as for the corn quantity of production, and the 2nd rank as for quantity of production of rice in the country in 2011.

The amount of water of Magat Integrated Irrigation System (MARIIS) which is the target of the project is supplied from Magat River. The circumference of the project site is low-flat rice field.

1-2 Socioeconomic Conditions

Private consumption in the Philippines, supported by healthy remittances by overseas workers, is growing, and in 2010 the Philippines recorded an economic growth rate of 7.6% (IMF, World Economic Outlook Database) and GDP of US$199.6 billion (ditto). In 2011, due to the impact of the European credit crisis and so forth, economic growth slowed to 3.7% (ditto) and the GDP was US$213.1 billion (ditto), however, growth of 4.2% (ditto) is predicted for 2012, indicating that the country is enjoying firm economic growth. Per capita GDP in 2011 was US$2,223 (ditto).

Looking at the GDP share of each industry, primary industry accounts for 13% (Philippine National Statistical Coordination Board, 28 November 2012), secondary industry for 32% (ditto), and tertiary industry for 56% (ditto), and tertiary industry has been growing rapidly in recent years.

In terms of diplomacy, the basic policies are security, economic diplomacy and protection of overseas workers, and emphasis is placed on relations with Japan, the United States and China. Moreover, the Government of the Philippines lays emphasis on the following policies geared to realizing even more sustainable economic growth based on promoting overseas direct investment via improvement of the business and investment environment: ① enhancement of industrial competitiveness, ② infrastructure development, and ③ promotion of employment. In order to address these policy issues, the government is striving to make improvements based on various policy, system and administration improvement items.

Under these circumstances, there is a lot of external direct investment from Japan to the Philippines, especially in the manufacturing sector.

In recent years, relations between the Philippines and Japan have deepened a lot, and the Japan-Philippines joint statement on the comprehensive promotion of the "strategic partnership" was announced on the occasion of President Aquino's visit to Japan, thereby further strengthening ties between the two countries.

2. Background to the Project

2-1 Overall Goals

Having meager fossil fuel resources, the Philippines is promoting the diversification of energy sources, however, it still relies on imported fossil fuels to generate half of its generated electrical energy, and it is desirable to switch to further domestic and renewable energies from the viewpoints of energy security and reduction of greenhouse gas emissions. Hydropower accounts for 21% of all power supply in the Philippines and ranks with geothermal energy as a renewable energy and important source of power supply, and its further utilization is anticipated.

In October 2008, the Government of the Philippines enforced the Renewable Energy Act of 2008, R.A. 9315 (hereinafter referred to as the "RE Act") - the first comprehensive legislation on renewable energy in Southeast Asia. This Act has the objectives of improving the self-sufficiency of energy supply, strengthening the capacity of central and local governments via development of renewable energy, and balancing economic growth with environmental protection. Furthermore, the Government of the Philippines in June 2011 announced the National Renewable Energy Program with the goal of increasing the amount of power generated from renewable energy by three times (to approximately 16,200 MW) over the 2010 level by 2030. The Philippines depends approximately 40% of electricity source on imported fossil fuel. For the purpose of energy security as well as reduction of greenhouse effect gas, domestic renewable energy is expected to substitute imported fossil fuel.

The Project, therefore, will encourage realizing the goals of RE Act as well as National Renewable Energy Program.

2-2 Current Conditions and Problems in the Sector

In the Philippines, although there has been active mini-hydropower development following enactment of the RE Act, because development has conventionally focused on large-scale hydropower development, appropriate technologies concerning mini hydropower development have failed to take root. As a result, the average operating rate of exiting flow-in type mini hydropower plants (10 MW or less) is 38%, which is far lower than the corresponding rate of 76% in Japanese mini hydropower plants of the same scale. In future, it will be necessary to conduct appropriate development upon giving full consideration to the rooting of mini-hydropower technologies, mitigation of environmental impacts on local communities and ecosystems, flood control based on units of rivers and securing of water supply for irrigation purposes and so on.

Meanwhile, the Philippines is an agricultural country and so far it has constructed approximately 23,000 kilometers of irrigation channels to supply water to 3 million hectares of farmland. However, the funds constructing these facilities are dependent on the national budget and ODA funds, while autonomous funding is limited to minor irrigation charges levied from farmers.

Under these conditions of threadbare state finances, the major challenge that faces the National Irrigation Administration (NIA) from now on will be how to maintain these irrigation channels in a stable and continuous manner, and an important theme will be how to secure new autonomous sources of funds. Moreover, since electricity charges in the Philippines are some of the most expensive in Southeast Asia, another important theme for improving the balance will be to reduce expenditure on electricity needed to pump water from irrigation channels to paddies and upland fields.

In recent years in the Philippines, attention has come to be directed towards mini hydropower development utilizing head works, which are frequently attached to irrigation facilities, and unused head of diversion weirs. Hydropower development utilizing existing irrigation equipment makes it possible to secure stable funds to manage irrigation equipment as well as provide a source of power for pumping water. Moreover, since such development doesn't require a lot of new civil engineering facilities installation, it is more advantageous than regular hydropower development in terms of both environment and funding. In particular, in the case of low-head mini hydropower development that utilizes water channels, as there are numerous potential sites in irrigated areas, it is anticipated that current issues of the irrigation systems in the Philippines can be mitigated and resolved by utilizing multiple potential sites in a certain region, even

though each power capacity is not large. This scheme is expected to contribute to the sustainable development of agricultural activities.

In line with the above, the Government of the Philippines requested to the Government of Japan for the Grand Aid on small-scale hydropower development utilizing irrigation facilities in Isabela Province.

3. Outline of the Study Findings and Contents of the Project

Through constructing a mini hydropower plant in an irrigation district in a rural area of the Philippines, the Project intends to promote utilization of domestic renewable energy, thereby contributing to the diversification of energy sources and reduction of greenhouse gas emissions, as well as aiding the dissemination of power in the area concerned.

The Project components are described below.

The Project will construct small-scale hydropower plant in irrigation area in rural area in the Philippines aiming at:

- Promoting renewable energy,
- Diversity of energy source,
- Reduction of greenhouse gas, and
- Contribution to the electricity supply in the region

3-1 Civil Structures and Power Equipment

(1) Civil Structures

Table 1 gives an outline of the civil engineering facilities in the Project.

Table 1 Feature of Civil Structures

Category	Facility	Contents	Remarks
Power generating particulars	Type of generation	Run of River type	Type dependent on irrigation water
	Peak water usage	3.0m^3/s	Single unit 1.5m^3/s
	Effective head	3.0m	
	Maximum output	45kW	Single unit output 22.5kW
Civil structures	Inlet	H 1.75m, W 1.75m, L 4.53m	Reinforcement of existing irrigation weir
	Headrace	H 1.75m, W 1.75m, L 3.80m	Box culvert
	Head works	Drop 3.0m, W 1.75m	Vertical drop method
	Discharge channel	H 1.5~4.8m, W 1.75m, L 5.73m	Open channel
	Outlet	H 1.5m, W 1.75m, L 1.65m	Open channel

(2) Generator, Transformation and Distribution Equipment

Table 2 and 3 shows the outline specifications of the generator, transformation and distribution equipment.

Table 2 Outline Specifications of Generator

Equipment	Outline Specifications	Remarks
Water turbine	Vertical axial flow turbine x 2 Effective head: 3.0m Maximum water usage: 1.5m^3/s	Procure from Japanese small or medium enterprise
Generator	3 phase induction generator x 2 22.5kW	Ditto
Control system	Turbine and generator control system Protective relay Independent operation detection unit	Ditto
Main transformer	Single phase 25 kVA x 3 Voltage 440/13.2kV	National Electrification Administration standard
Switchgear	3 phase load switchgear with fuse Voltage: 24 kV	Ditto
Distribution line (inter-connection line)	3 phase 4 line, 13.2 kVA New installation: 2.2 km	Ditto
Distribution pole	Steel poles	Ditto
Power meter, etc.	Instrument transformer Instrument current transformer Watt-hour meter	Ditto
Gate, screen	Gate: W1600, H1500 Screen: W1750,H1750	It is necessary to confirm local manufacturing capability in the detailed design.

Table 3 Length of Distribution Line Work Sections

Section	Length (m)	Remarks
Lateral-B power plant ～ No.9982 pole	2,200	New installation
Total	2,200	

4. Project Works Period and Outline of Project Cost

4-1 Project Works Period

Table 4 shows the works period that will be required to implement the Project.

Table 4 Project Works Period

Implementation Contents	Implementation Period	Implementation Months
Detailed design	April ~ June, 2013	3 months
Tender work	June ~ September, 2013	4 months
Facilities construction and equipment procurement period	October 2013 ~ November 2014	14 months

4-2 Outline of Project Cost

Table 5 shows the outline of project cost.

Table 5 Outline of Project Cost

Total Project Cost	Non-disclosed up to Approval of the Execution and procurement Contractor Agreements
Burden of Japan	Ditto
Burden on the host country side	0.06 billion yen

(Note) 1.0Php＝￥2.03

5. Project Evaluation

5-1 Relevance

The Interim Development Plan (2011~2016) of the Philippines that was approved in March 2011 aims to promote the development and utilization of domestic sources of renewable energy including hydropower. Furthermore, the National Renewable Energy Program, which was announced in June that year, has the goal of increasing the amount of power generated from renewable energy by three times over the 2010 level by 2030; in particular, it states that hydropower development projects including mini hydropower should be rapidly developed as a means of securing power supply sources.

Against this background where the field of mini hydropower generation is regarded as a high priority field in the Philippines, implementing pilot activities utilizing Japanese technology for mini hydropower development utilizing currently unused head is significant in diplomatic terms too.

5-2 Effectiveness

The anticipated outputs of Project implementation are as follows.

(1) Quantitative effects

Table 6 Quantitative Effect Indicators

Indicator	Reference Value (as of 2012)	Target Value (as of 2018) [3 years after Project completion]
Generated electrical energy at the generating end (MWh/year)	0	151
Contribution to CO_2 emissions reduction (tCO_2/year) (generating end)	0	74

(2) Qualitative Effects

None.

Preparatory Survey Report

for

Preparatory Survey for Mini-Hydropower Development Project

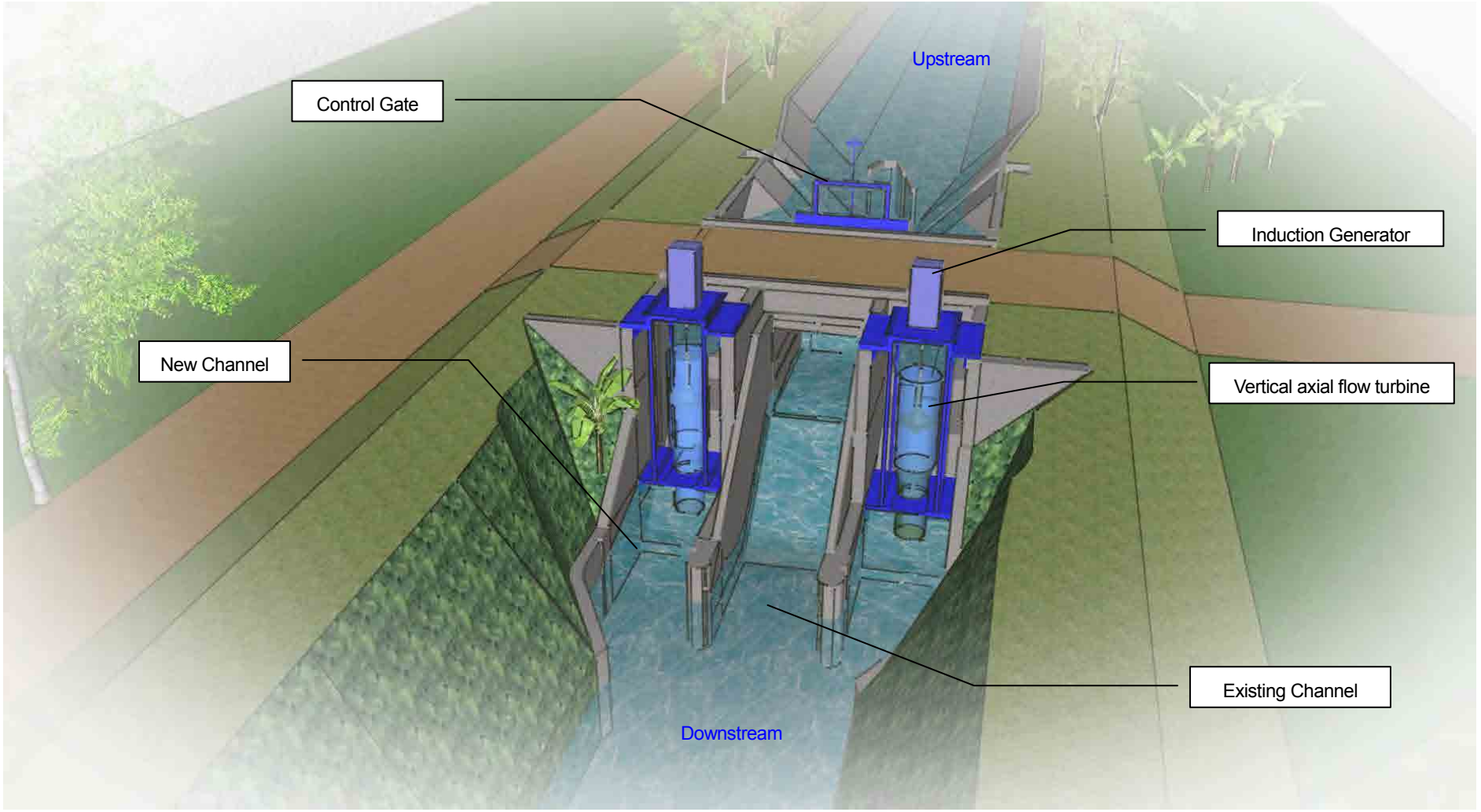
in the Philippines

(Micro/Mini Hydropower Project in the Province of Isabela (Irrigation Canal)

Final Report

Contents

Location Map



Perspective

Pictures of the Project Site

Photo-1: The Project site is located in flat rice-producing area where the existing irrigation system supply water.

Photo-2: The water flow of the canal is controlled by the existing irrigation system and is constant except the time of water stoppage scheduled for approximately 1 month.

Photo-3: Approximately 3m-high water head at downstream of the existing drop work is currently untapped. On both sides of the drop work, the Project will install simple turbines.

Photo-4: Former approximately 30-year-old hydropower project planed at the existing irrigation gate near the Site was canceled due to mismatch of the site condition and procured turbines which still remain at the project site.

Photo-5: The project will utilize the existing 13.2kV distribution line near the Site which connects hydro power stations and 69kV substation in the vicinity.

Photo-6: MARIIS own and operate Barigatan Hydropower Plant. The supervisor and operators have sufficient experience in plant operation.

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Abbreviations

AMHPP	Ambangal Mini-Hydro Power Plant
B/C ratio	Benefit / Cost ratio
BBL	Barrel
BRTTF	Banaue Rice Terrace Task Force
CADC	Certificate of Ancestral Domain Claim
CALC	Certificate of Ancestral Land Claims
CAR	Cordillera Autonomous Region
CDM	Clean Development Mechanism
CIS	Communal Irrigation System
CNC	Certificate of Non-Coverage
CO2	Carbon Dioxide
COA	Commission of Audit
COC	Certificate of Compliance
D/L	Distribution Line
DBO	Department of Budget Office
DBO-CAR	Department of Budget Office-Cordillera Autonomous Region
DBP	Development Bank of the Philippines
D-CNC	Category D-Certificate of Non-Coverage
DENR	Department of Environmental and Natural Resources
DILG	Department of Interior and Local Government
DOE	Department of Energy
DPWH	Department of Public Work and Highway
e8	An international NPO which is composed of 10 of the world's leading electricity companies from G8 countries
EC	Electric Cooperative
ECC	Environmental Compliance Certificate
EDP	Environmental Development Project
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
EMB	Environmental Management Bureau
EPIRA	Electric Power Industry Reform Act
ERC	Energy Regulatory Commission
ESA	Energy Sales Agreement
FIRR	Financial Internal Rate of Return
FIT	Feed-In-Tariff
FPIC	Free Prior Informed Consent
GDP	Gross Domestic Product
HRMO	Human Resources Management Office
ICC	Indigenous Cultural Community
ICHO	Ifugao Cultural Heritage Office
ICOMOS	International Council of Monuments and Sites
IEE	Initial Environmental Examination
IFELCO	Ifugao Electric Cooperative
IKGS	International Keeping Good Sannna
IPRA	Indigenous Peoples Right Act
IRA	Internal Revenue Allotment
IRR	Implementing Rules and Regulations
IRTCHO	Ifugao Rice Terraces Cultural Heritage Office
ITC	Ifugao Terraces Commission
IUCN	International Union for the Conservation of Nature
JBIC	Japan Bank for International Cooperation
JICA	Japan International Cooperation Agency
kW	Kilo Watt
kWh	Kilo Watt Hour
LGU	Local Government Unit
LLCR	Loan Life Coverage Ratio
LMHPP	Likud Mini-Hydropower Plant
LTL	Long Term Loan
MEG	Monitoring and Evaluation Group

MHh	Mega Watt hour
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MPDO	Municipal Planning and Development Office
NAPOCOR	National Power Corporation
NCCA	National Commission on Culture and Arts
NCIP	National Commission on Indigenous People
NGCP	National Grid Corporation of the Philippines
NGO	Non Governmental Organization
NPC	National Power Corporation
NPV	Net Present Value
NSO	National Statistics Office
NUVELCO	Nueva Vizcaya Electric Cooperation
NWRB	National Water Resource Board
O&M	Operation and Maintenance
P/S	Power Station
PACCO	Provincial Accounting Office
PAENRO	Provincial Agriculture Environment Natural Resources Office
PBP	Pay Back Period
PD	Presidential Decree
PEO	Provincial Engineering Office
PGI	Provincial Government of Ifugao
PGO	Provincial Governor's Office
PHP	Peso
PLO	Provincial Legal Office
PPDO	Provincial Planning and Development Office
Pre-FS	Pre-Feasibility Study
PTO	Provincial Treasury Office
PV	Present Value
PVC	Polyvinyl Chloride
RA	Republic Act
RE	Renewable Energy
REMB	Renewable Energy Management Bureau
ROE	Return of Equity
ROI	Return on Investment
RPS	Renewable Portfolio Standard
S/S	Sub-Station
SB	Sanggunian Bayan
SITMO	Save the Ifugao Terraces Movement
SP	Sanggunian Panlalawigan
STL	Short Term Loan
T/L	Transmission Line
TEPCO	Tokyo Electric Power Company
TOR	Terms of Reference
TP	Tapping Point
TRANSCO	National Transmission Corporation
UNESCO	United Nations Educational, Scientific and Cultural Organization
WTI	West Texas Intermediate

Chapter 1 Background of the Project

1-1 Background and Outline of the Grant Project

1-1-1 Background

The Philippines has meager fossil fuel resources, however, the country depends approximately 65% of electricity source on fossil fuel (as of 2010, gross electricity capacity: 16,539MW, coal: 27%, oil: 20%, natural gas: 18%, hydropower: 21%, geothermal: 13%). In terms of energy security as well as reduction of greenhouse effect gas, domestic renewable energy is expected to substitute imported fossil fuel.

Currently total potential hydropower is estimated to be approximately 13,097MW. However, large-scale hydropower development requires vast initial investment as well as long-range collection period and this causes difficulties in funding and socio-environmental consideration especially in the Philippines where private initiative lead the deregulated power market sector. As a result, only approximately 25% (3,400MW) of total potential hydropower is utilized so far. Meanwhile, small-scale hydropower development have less impact on the country's whole energy balance, at the same time it causes fewer difficulties in such aspects. In addition, the country has rich small-scale (capacity less than or equal to 10MW) hydropower potential of approximately 1,900MW. Therefore, it is expected that the country aggressively develop small-scale hydropower.

In line with above, "Medium Term Philippines Development Plan (2011-2016)", approved in March, 2011, aims to develop/promote domestic renewable energy in the country. "National Renewable Energy Program", issued in June 2011, also aims to triple electricity production by renewable energy from 2010.

Meanwhile, in 2008, Global Environment Centre Foundation conducted potential study on mini-hydropower development in the Philippines and confirmed the possibility of mini hydropower development utilizing irrigation facilities in Isabela Province.

In line with the above, the Government of the Republic of the Philippines requested the Government of Japan to conduct a Preparatory Survey for Micro/Mini Hydropower Development Project on Irrigation Canal in Isabela Province.

The Project will be conducted in accordance with the "Green Growth" policy by Government of Japan, which emphasizes on utilization of elaborated products, such as hydro turbines, fabricated by Japanese small, medium scale enterprise.

1-1-2 Contents of Request

Items originally requested by the Philippines side are shown in Table 1-1. Based on discussion, requested components in the Project are confirmed as follows.

Table 1-1 Original Request and the Project Component

Original Request	Project Component
a. Inventory Study for Hydropower Potential utilizing with National Irrigation System（NIS）	a. Out of Scope
b. Construction of Mini/Micro-Hydro in NIS	b. Ditto
c. Construction of Distribution Line（13.8kV）	c. Ditto
d. Overseas Study Tour and Training	d. Training in the Philippines

1-1-3 Selection of Project Site

During the 1st survey term, the Project site was selected according to the following criteria on the condition that no negative impact would be caused by the Project over normal function of irrigation canal system.

a. Effective head : should be 2m or more
b. Installed capacity: should be 100kW or more
c. Power discharge: should be stable through the year
d. Distance from power grid: should be within 10km from major load center
e. Access: should be easy for heavy load transport
f. Land acquisition: should be none or easy (no compensation is preferable)

According to the criteria, Magat-C was initially selected as the Project site.

However, as summarized in Table 1-2, taking into account issues of the Philippines during the 2nd survey term, Lateral-B was finally selected as the Project site and the Philippines side and the Mission Team agreed it.

Potential sites in the target area are shown in Table 1-2.

Table 1-2 Description of Site Selection

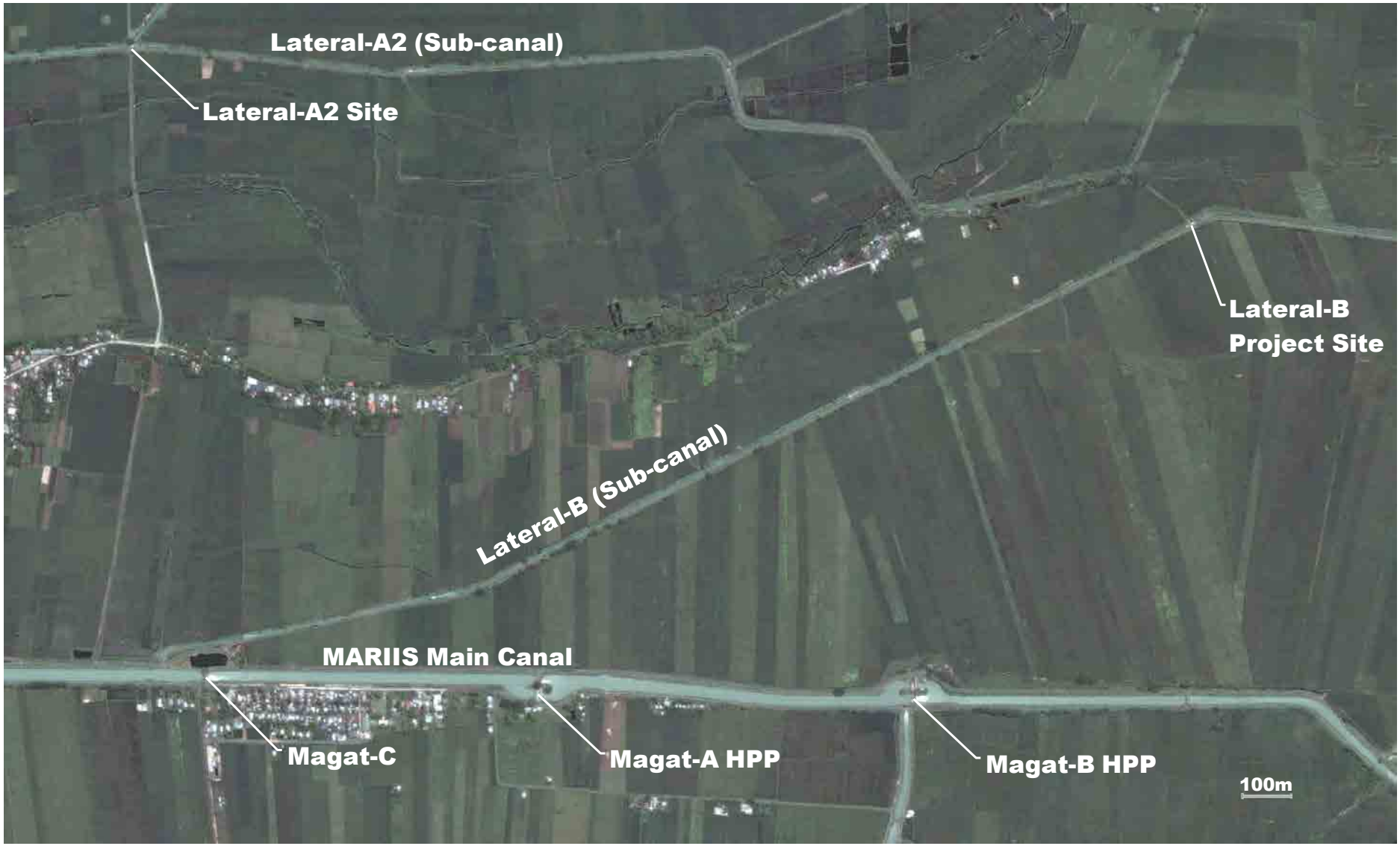
Time	Description
Minutes of Discussion (M/D) (August, 2012)	NIA proposed candidate project sites. Among them, considering few issue on land acquisition and others, Magat-C site was selected as the project site. DOE, NIA and JICA agreed on the selection of Magat-C.
End of 1st survey mission (September, 2012)	Mission Team found an additional potential site Lateral-A2 near Magat-C. JICA decided to have additional survey on Lateral-A2 in the 2nd survey mission.
During 2nd survey mission (October, 2012)	Mission Team found an additional potential site Lateral-B near Magat-C.
Stakeholders' Meeting during 2nd site survey mission (October 12, 2012)	ISELCO-I insisted that: (1) ISELCO-I and NIA had a contract dated November 9, 1983 on construction of Magat-C mini-hydro. (2) ISELCO-I has signed contract dated October 8, 2012 with an energy developer on the development of Magat-C.
End of 2nd survey mission (November 11, 2012)	JICA decided to designate both Magat-C and Lateral-B as the project site. Since installation period of Lateral-A2 will be required more than one month, the Lateral A2 Project was not accepted as the project site. JICA requested DOE and NIA to settle above matter raised by ISELCO-I.
Coordination Meeting (DOE, NIA and JICA) (November 21, 2012)	DOE stated that the settlement of above matter would take long. JICA concluded to give up the development of Magat-C and concentrate on the development of Lateral-B

Table 1-3 Candidate Site for Small-scale Hydro Development on Irrigation Canal

Potential Sites for JICA Study on Mini-Hydro Power in Irrigation Systems

State	Name of Potential Site	Name of Irrigation System	Head (m)	Plant Discharge (m^3/s)	Capacity (kW)	Access to Site	Distance to Distribution Line (km)	Efficiency	Rank	Remarks
LUZON Region										
Pangasinan	San Fabian Dam Right	San Fabian RIS	6.90	9.00	300	Good / NG	3.00	asm. 0.60	D	Free
	Dumuloc Dam	Dumuloc RIS	4.00	4.00	200	Good / NG	4.00	asm. 0.60	D	Free
	Cabatuan Dam	Dumuloc RIS	5.30	-	250.00	Good / NG	5.000	asm. 0.60	D	The dam is non-operational due to damaged structures
Isabela	Baligatan II	MARIIS		30.00	3,000	Good / NG	1.000			Free
	Magat C	MARIIS	3.18	56.00	1,500	Good / NG	0.50			Free
	North Diversion Canal (NDC)-MC	MARIIS	7.20	10.94	500	Good / NG	0.050	0.648	A	Free
Nueva Ecija	Macanae Dam	UPRIIS Div-I	20.00	4.00	600	Good / NG	3.000	0.765	B	Free
	TRIS Chute-Main Canal	UPRIIS Div-I	15.00	6.00	1,000	Good / NG	1.000	0.850	C	Free
	RG3 of DC1	UPRIIS Div-I	3.00	28.00	800	Good / NG	0.200	0.765	B	Free
	RG4 of DC1	UPRIIS Div-I	3.00	25.00	700	Good / NG				Free
	RG5 of DC1	UPRIIS Div-I	3.00	20.00	500	Good / NG	0.200	0.680	A	Free
	Headworks of SDA Supply	UPRIIS Div-I	6.00	16.00	900	Good / NG	0.100	0.680	A	Free
	PRIS MC Canal	UPRIIS Div-II	6.00	25.00	1,500	Good / NG	0.200			Free
	RG 1 of DC1	UPRIIS Div-II	3.00	50.00	1,500	Good / NG	0.100			Free
	RG 2 of DC1	UPRIIS Div-II	3.00	40.00	1,200	Good / NG	0.200			Free
	Lateral E-SDC	UPRIIS Div-5	4.70	17.70	600	Good / NG	1.000	0.736	B	Free
Camarines Sur	Lower Lalo MLCCnal	Lower Lalo RIS	7.00	5.00	300	Good / NG	2.000	0.875	C	Free
	Upper Lalo Main Canal	RIDA RIS	6.00	6.85	300	Good / NG	1.000	0.745	B	Free
Visayas Region										
Eastern Samar	Borongan	Borongan CIP	4.00	10.00	250	Good / NG	0.200	0.638	A	The irrigation systems are under construction
	Sulat	Sulat CIP	4.00	12.00	300	Good / NG (30 km from Borongan City)	1.000	0.638	A	

Source : 'NIA Potential Sites for Mini-Hydro Power Development (as of 20 June 2012)'
Updated following the meeting of 23 July 2012 of NIA-DOE-JICA Phil



Source: ©Yahoo JAPAN

Fig. 1-1 Potential Site in the Target Area

1-2 Natural Conditions

(1) Land and Nature

Located on the ocean route that links Japan to Southeast Asia, the Middle East and Europe, the Philippines is composed of 7,109 islands of various sizes. Its national land area is approximately 0.8 times the size of Japan, and its population of roughly 87 million is the second largest in the ASEAN region

All of the Philippines belongs to the tropical rain forest zone, climate. The entire country belongs to tropical rainforest climate. The climate of the country is characterized by four major types, and the western region of Isabela Province, where the Project site is located, belongs to Type III. In Type III, seasons are not very pronounced but the weather is relatively dry from November to April and wet from May to October.

Temperature and precipitation of Isabela Province respectively are shown in Table 1-4 and Table 1-5.

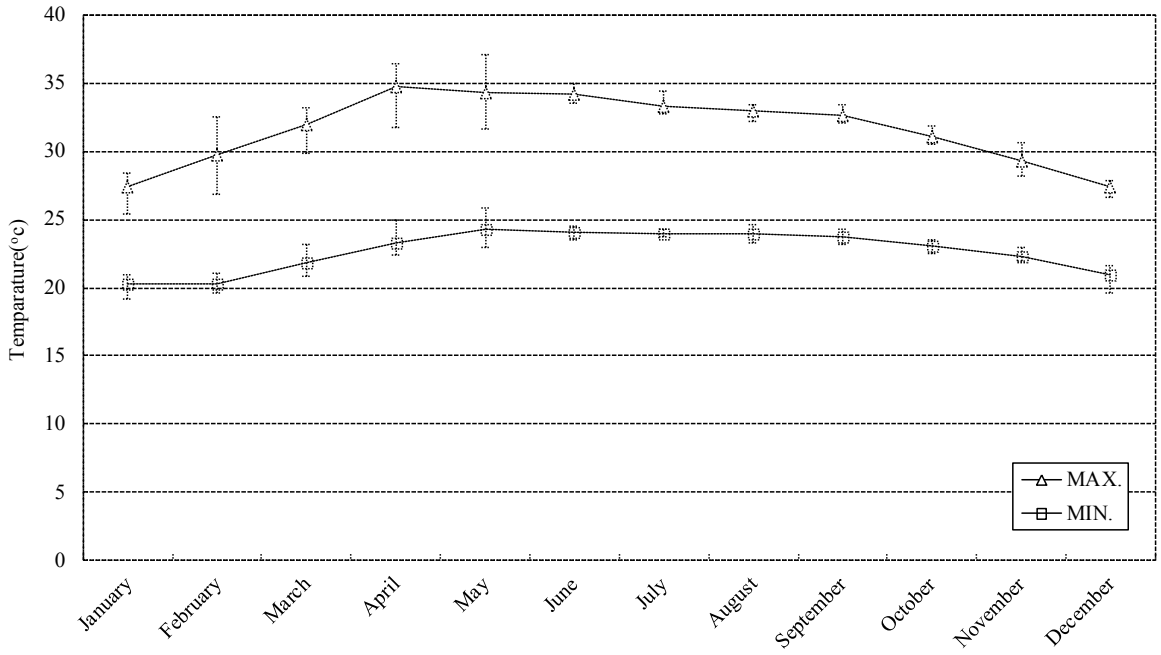
Temperature reaches the maximum in April and May and the minimum in December and January. Annual average precipitation is around 2,100 mm with more rainfall during May to November and less rainfall from December to April.

The Project area is low-lying area with elevation not higher than 100 m and slope of 3% or less. Magat River, the tributary of Cagayan River, flows from western mountainous area in Ifugao Province and travels in the west part of the site. Isabela Province is known as the second largest province in the country and has benefited from sufficient river water, and its production of corn and rice were ranked first and second respectively in 2011.

Table 1-4 Temperature of the Isabela Province

Unit: °C

Month	2006		2007		2008		2009		2010		Average	
	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.
January	28.4	21.0	27.3	20.7	27.8	20.7	25.4	19.2	28.2	19.6	27.4	20.2
February	30.2	20.8	29.6	19.9	26.9	20.1	29.6	21.1	32.5	19.6	29.8	20.3
March	33.0	23.2	32.3	21.5	29.9	21.3	31.7	22.3	33.2	20.8	32.0	21.8
April	35.8	25.0	35.2	23.6	34.4	22.4	31.8	22.7	36.4	22.7	34.7	23.3
May	35.1	25.9	34.8	24.1	33.0	23.8	31.6	23.0	37.1	24.8	34.3	24.3
June	34.6	24.4	34.1	24.1	33.7	23.5	33.6	24.1	35.0	24.5	34.2	24.1
July	33.1	24.2	34.4	24.3	32.8	23.9	32.9	23.9	33.4	23.7	33.3	24.0
August	33.3	24.2	32.7	23.7	32.2	23.3	33.4	24.6	33.2	23.9	33.0	23.9
September	33.0	23.6	32.5	24.0	33.4	23.6	32.1	24.3	32.5	23.2	32.7	23.7
October	30.6	23.0	30.5	23.1	31.9	23.5	30.7	22.5	31.7	23.4	31.1	23.1
November	30.6	22.2	28.2	22.1	28.8	22.3	29.8	22.0	29.2	23.0	29.3	22.3
December	27.0	21.6	27.9	21.2	26.6	20.9	27.9	19.6	27.8	21.4	27.4	20.9
Average	32.1	23.3	31.6	22.7	31.0	22.4	30.9	22.4	32.5	22.5	31.6	22.7



Source: Isabela Provincial Development and Physical Framework Plan, 2010-2016

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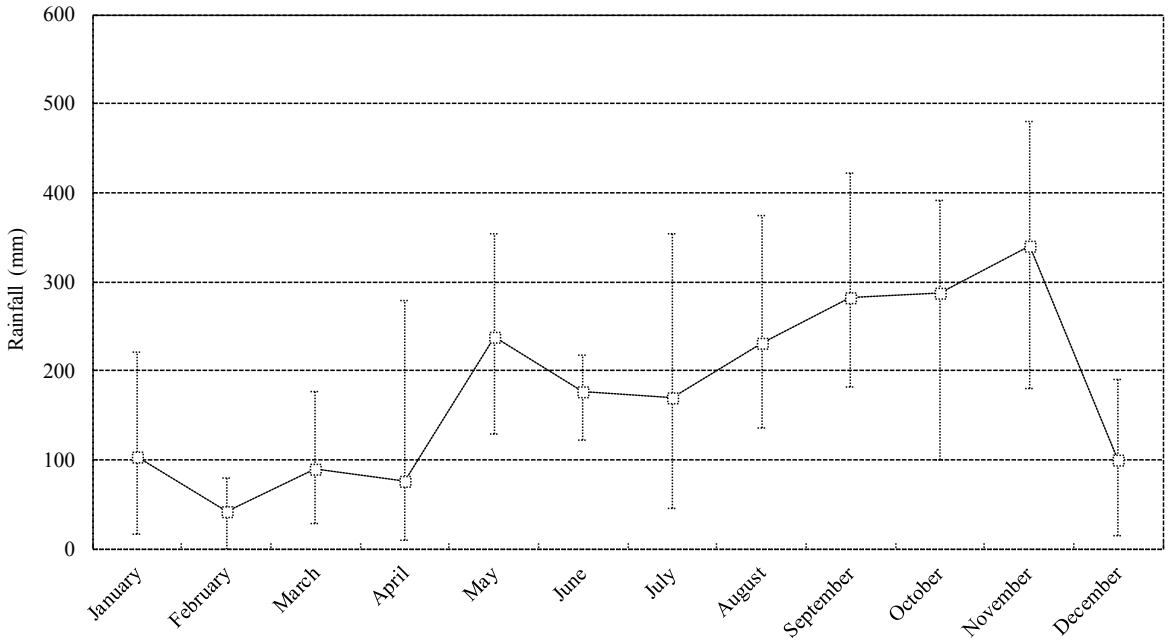
Table 1-5 Precipitation of the Isabela Province

Unit: mm

Month	2006	2007	2008	2009	2010	average
January	220.5	95.9	138.1	48	16.1	103.7
February	72.5	9.1	53.4	79.3	0	42.9
March	176.1	39.8	51.7	152.5	28.5	89.7
April	12.2	9.8	28.8	279.7	52.4	76.6
May	129.5	252	278.8	354.2	176.9	238.3
June	151.4	187.6	204.8	121.8	217.3	176.6
July	201	45.7	71.5	353.7	177.4	169.9
August	232.6	374.3	178.7	232.6	136	230.8
September	421.9	349.2	184.9	277.2	182.6	283.2
October	367.6	231	99.9	346.9	391	287.3
November	179.5	479.7	367.3	256.9	420.9	340.9
December	191.1	135.6	113	14.1	44.6	99.7
Total	2366.9	2209	1770.9	2516.9	1843.6	2141.5

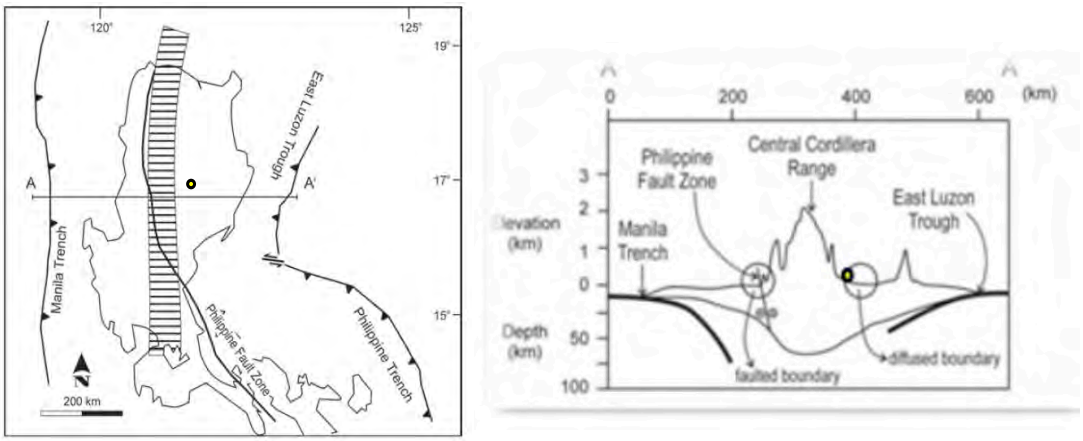


Source: Isabela Provincial Development and Physical Framework Plan, 2010-2016

(2) Topography and Geology

The Philippines belongs to the mountain-forming zone called the circum -Pacific orogenic zone, the same as Japan and has the complicated topography and geology because it is sandwiched in between Pacific plate and Eurasian plate and is compressed by them. Fig. 1-2 schematically shows earth's crust of Luzon where the project is located. The Project Site is at the yellow colored point in the Fig. which is in central Coldirella mountain range.

Geologic quadrangles (scale 1:50,000) such as Cabatuan, Cordon and Aritao are generally issued surrounding the project site, and the site is shown by a red circle in Fig. 1-3.



Source: C.B.Dimalanta and G.P.Yumul,Jr., 2004

Fig. 1-2 Tectonics of the Luzon and schematic profile of W-E direction

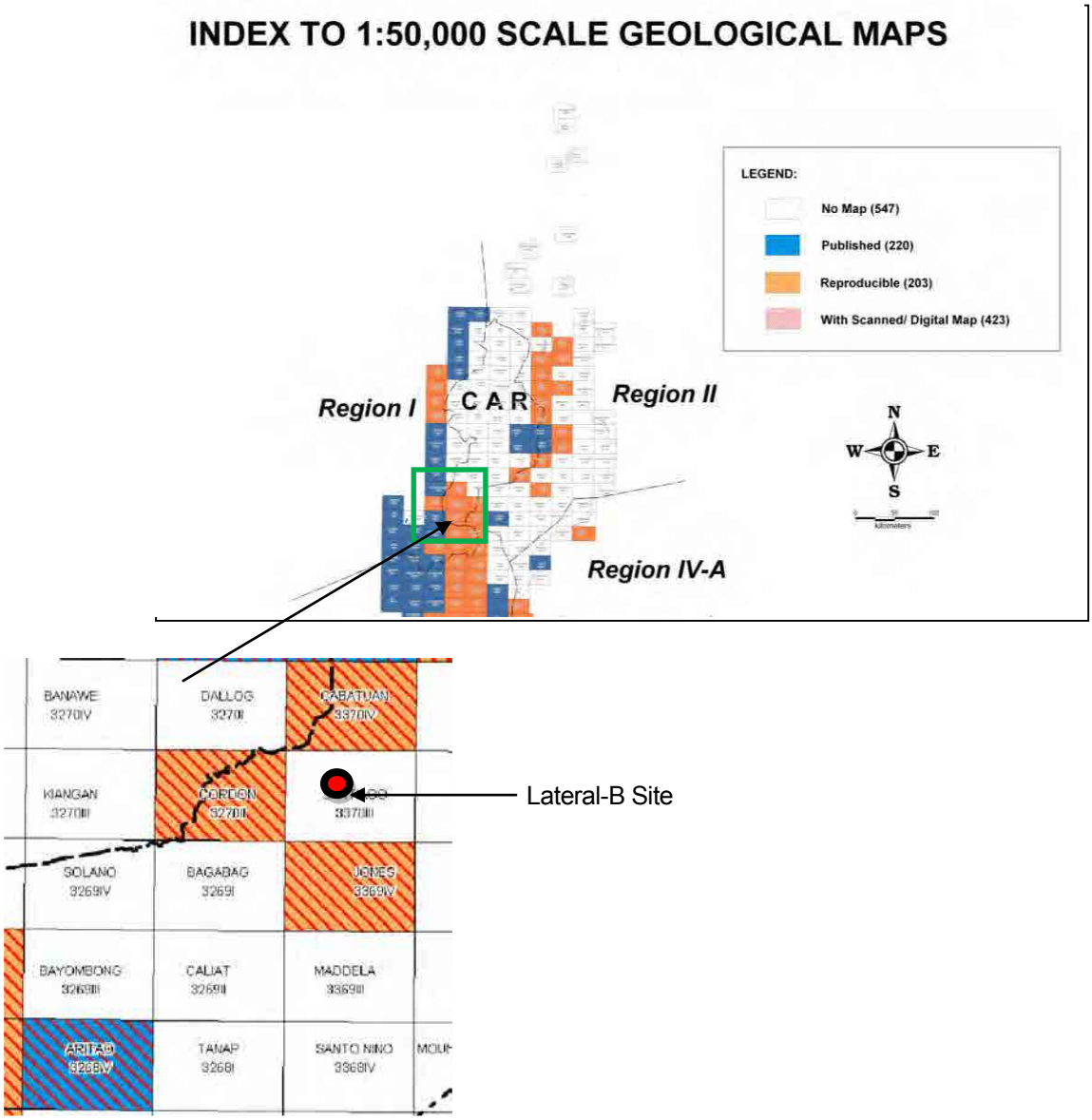


Fig. 1-3 Generally published geologic quadrangles and the position of the Project site

Bedrock surrounding the Lateral-B scheme is sedimentary rock belonging to Ilagan group of Miocene epoch in Neogene of Cenozoic era. Rocks of the group consist of alternation of shale and sandstone formed in the deep sea and neritic to terrestrial course sandstone and conglomerate. However the rocks are overlain by quaternary soil called Bago sandy clay loam (referred from Soil Texture Map issued by Isabela Province).

Since August, when the team carried out investigation, was the wet season and the water level of Magat River was high, only a few rock outcrops were observed along the river , however, conglomerate exposure was discovered just downstream of the MARIIS dam on the left bank of Magat River coincidentally.

The strata dip to downstream and the bedding plane's strike and dip is N10E/42SE (Fig.-4). Hydrothermal alteration and clay minerals were observed at some parts of the rock .

The water qualities surrounding the canal are shown in Table 1-1. The pH value near the Lateral-B site varies from 5.8 to 6.4 which is slightly acidic, whereas the Magat River water which is downstream of MARIIS dam is 6.8 as near-neutral. On the other hand, EC (Electrical Conductivity) values are almost 20 m^S/m, and there are few differences by the place. The quality of the water in itself does not adversely affect concrete structures.

Table 1-6 Measured Result of the natural Water Surrounding the Lateral-B Scheme

place	No.	pH	EC (mS/m)	Temp (℃)	date
Magat-A P/S	Magat-C-1	6.4	21.0	27.0	14 Aug. '12
downstream of MARIIS dam	Magat-C-2	6.8	21.0	25.6	16 Aug. '12
pond of Magat-C	Magat-C-3	5.8	18.1	29.3	
Lateral-A	Magat-C-4	5.8	24.1	27.1	03 Oct. '12

The canal branches off from the water gate just upstream of Magat-C with very low gradient to the site on the terrace, but down sharply about 3m at the Lateral-B site. There are no such steep cliffs surrounding the rice field but there is a small gap of more than 1 m at the site, and this might be recognized as a so-called terrace cliff.

Generally, in cases where the terrace cliff is formed, the land on the eroded side is more dense and consists of sand and gravel layers in many cases. Though the detail investigation should be carried out, the canal bottom for the basement for the structure seems to be a gravelly layer.

Downstream view of MARIIS dam in the wet season. Riverbed outcrops are invisible because the river water fully covers the riverbed.

Outcrop of conglomerate exposed at downstream of MARIIS dam. the bedding plane's strike and dip is N10E/42SE.

Conglomerate has been hydrothermal altered and some sulfide minerals were deposited and some part of them were soften and changed to clay

Lowered water level in harvest time（2012/10/04）
A part of the paddy field is eroded, and the cohesive cultivation soil is exposed.

An embankment is exposed, and collapse is seen here and there to lower the waterway in the harvest time. However, the concrete structure of the weir is not damaged.

(3) Natural Environment

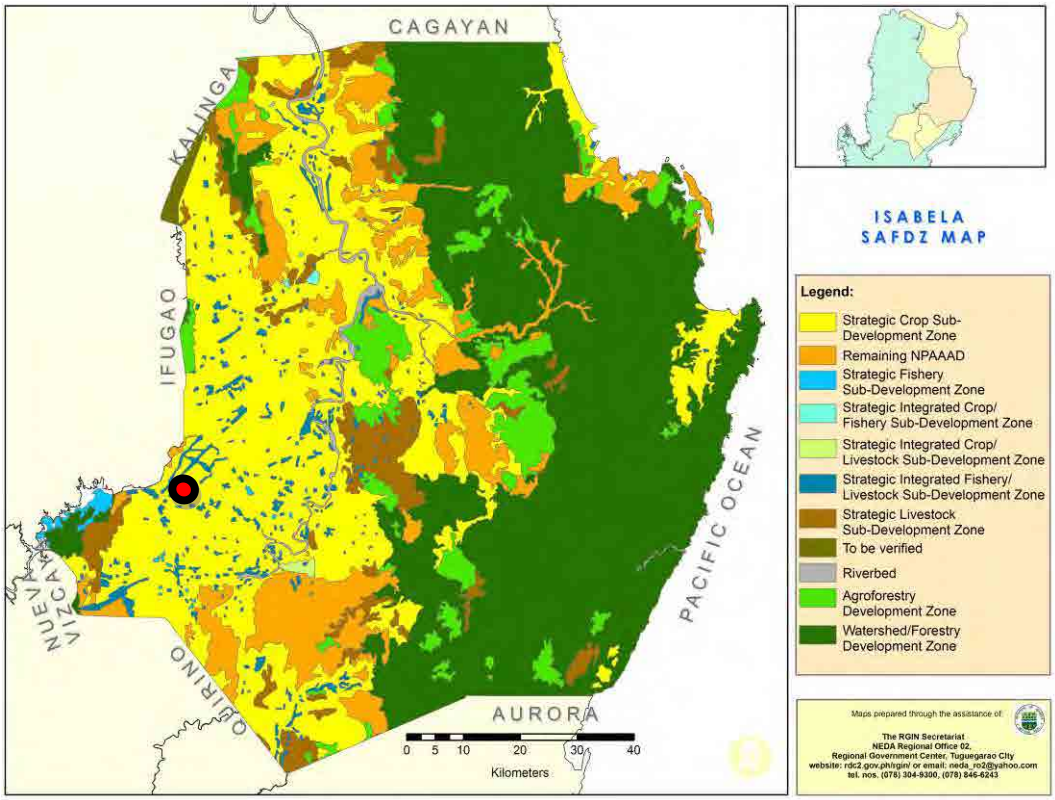
According to the SAFDZ map, the Project site is in the strategic crop sub-development zone and the strategic integrated fishery/ livestock sub-development zones are scattered in the zone (refer to Fig. 1-4). Over most of the area, rice fields take part in the cultivated land, and only some mango trees are seen in some rice fields. In addition, the cash crops such as bitter gourds are cultivated in the small portion of the rice field zone in a higher terrace.

The irrigation canal beginning in the MARIIS dam reaches Alicia through San Mateo via Ramon in Isabela Province. The scheme is in the middle of the canal, and is 4.7km from the intake in MARIIS dam.

Through natural environments investigation downstream of the MARIIS dam, some species of small fish were confirmed coincidentally in the casting net of a local fisherman They are genus of *Gobiidae* and a kind of percoid fish . There is some dealing of aquatic products which are caught by local people in the MARIIS dam site of Magat River.

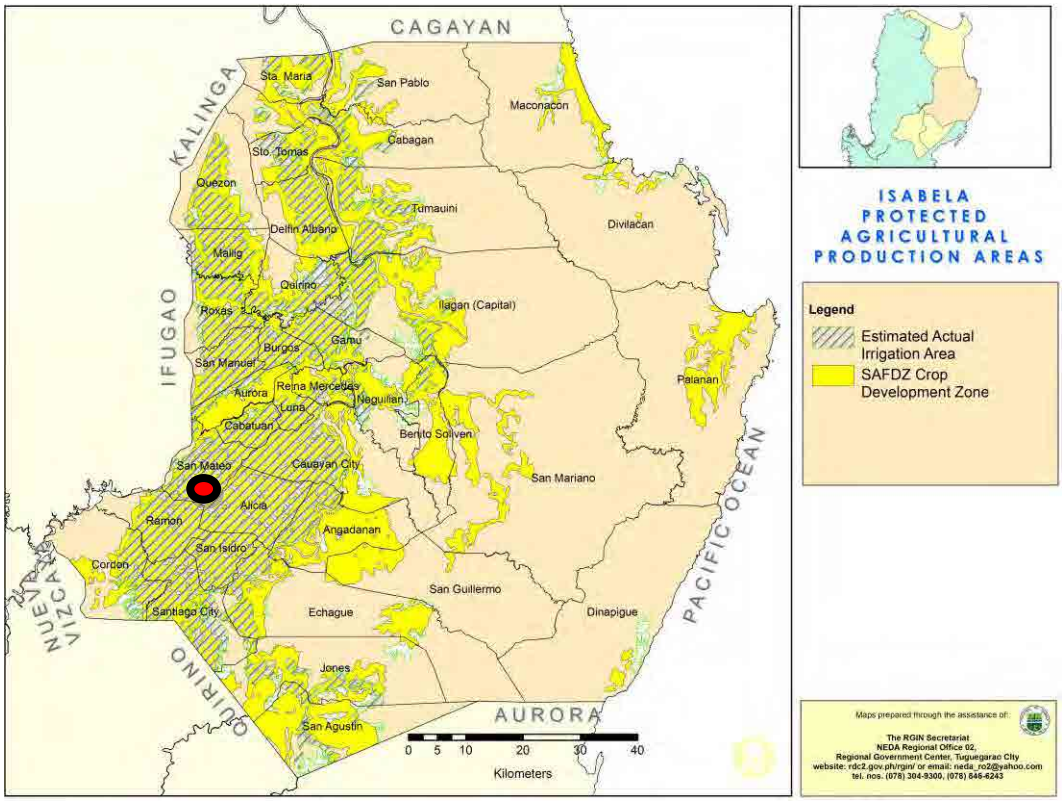
genus of *Gobiidae* and a kind of percoid fish caught by casting net at downstream of MARIIS dam in Magat river

Local people dealing fish and shellfish caught at surrounding MARIIS dam in Magat river



Source: Isabela Provincial Development and Physical Framework Plan, 2010-2016

Fig. 1-4 SAFDZ map surrounding the Lateral-B scheme



Source: Isabela Provincial Development and Physical Framework Plan, 2010-2016

Fig. 1-5 Protected agricultural Protected area surrounding the Lateral-B scheme

(4) Irrigation Water

Fig. 1-6 shows design discharge of MARIIS. In the irrigation system, irrigation water is diverted at MARIIS Dam located just downstream of Magat Dam and flows along MARIIS Main Canal (MMC) and its sub-canals until it runs through the entire irrigation service area. Lateral-B is one of the sub-canals originating just upstream of Magat-C gates.

Discharge from MARIIS Dam to Magat-C is summarized as Table 1-7. Since there is consistency between design flow (56.00 m^3/s) and maximum measured flow (59.40 m^3/s) at Magat-C , it is thought that the irrigation system is operated as planned.

Table 1-7 Discharge of MMC

Location	$Q_{M1}(m^3/s)$	$Q_{M2}(m^3/s)$	$Q_D(m^3/s)$	
MARIIS Dam	121.50		-40.00	Lateral -A
CP#1	81.00	81.50	-17.50	South Low Canal
CP#2	63.50	64.00	-4.50	Lateral -B
			-0.10	C Extra
CP#3 (Magat-C)	56.00	59.40		

CP: Control Point

Q_{M1}: Design Max. Main Canal Discharge

Q_{M2}: Theoretical Max. Main Canal Discharge

Q_D: Design Max. Diverted Discharge

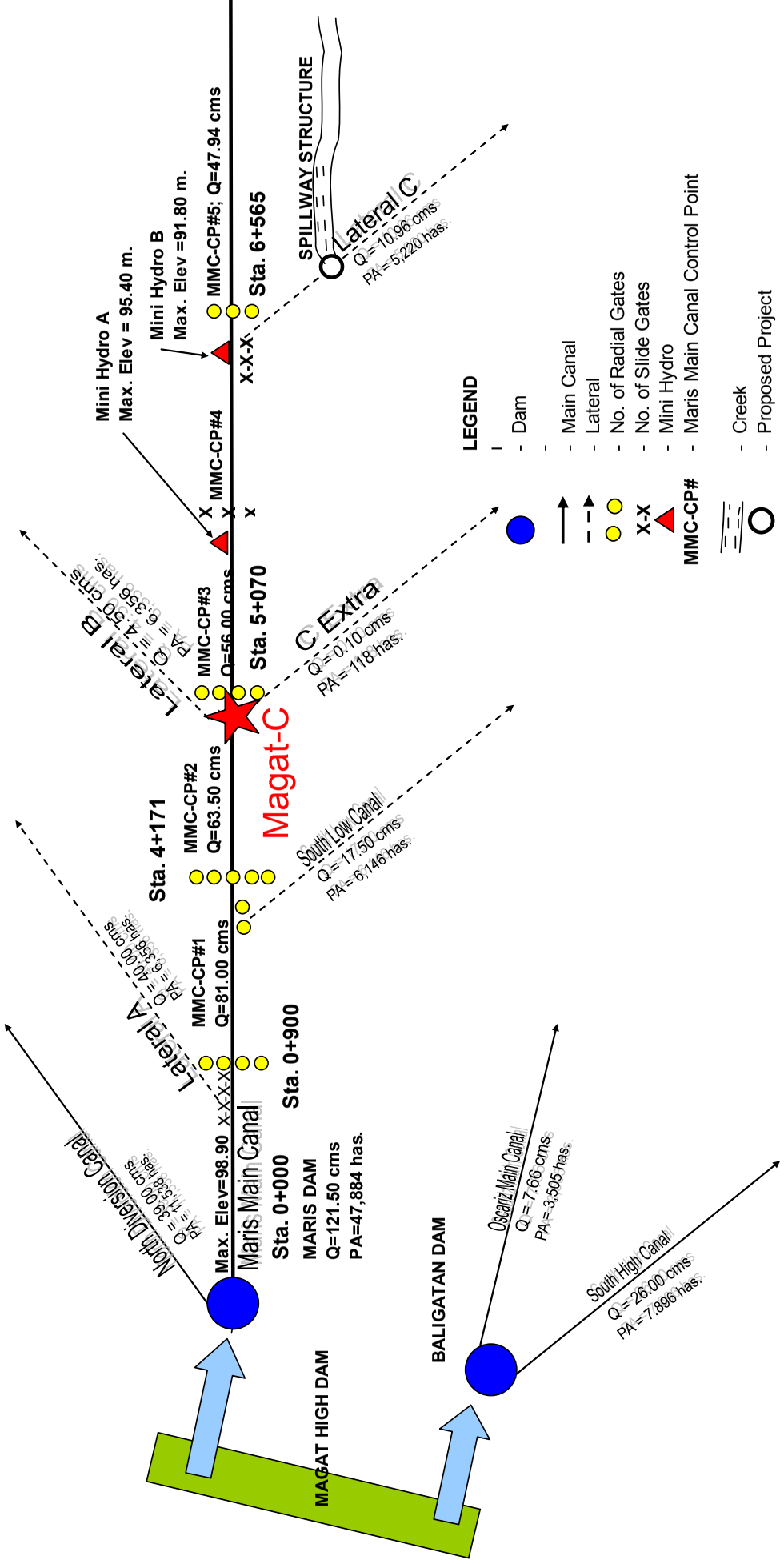


Fig. 1-6 Design Discharge of MARIIS

MARIIS is operated according to three major patterns, namely dry season, wet season and maintenance period, as shown in Fig. 1-7.

Dry Season	Nov.～Jan.	Constant Discharge of Design Flow
(Transitional Period)	Feb.~ Mar.	Gradually Decrease
Maintenance Period	Ari.~ May	Zero
(Transitional Period)	Jun.	Rapidly increase to Design Flow
Wet Season	Jul.~ Aug.	Depends on Requirement of Irrigator's Associations

Based on monthly averaged discharge record provided by NIA-MARIIS, discharge of Magat-C is analyzed and indicated in Table 1-9.

- While having some variations year by year, the trend of monthly discharge is consistent with the operation patterns. The flow data is reliable enough for further design.
- It is possible to secure discharge of 20 m^3/s or more at Magat-C except during the maintenance period in April and May and transition period in October.

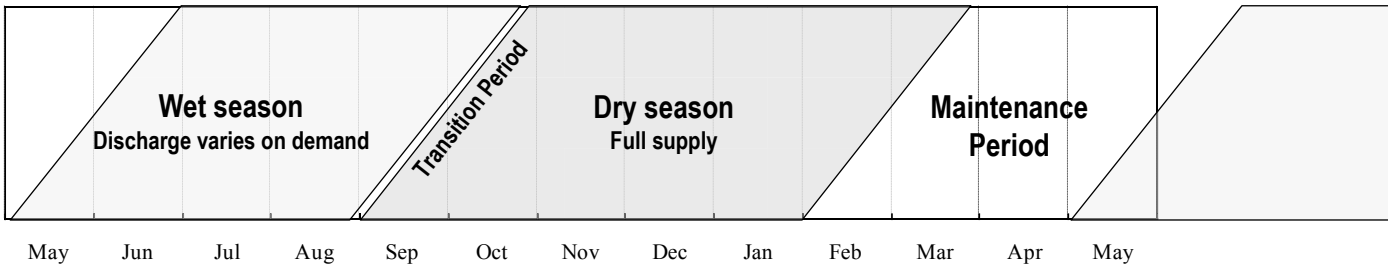


Fig. 1-7 Annual Operation of MARIIS

Table 1-8 Monthly Mean Irrigation Release for MARIS Main Canal (MMC)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
2000	97.61	98.91	79.61	12.61	0.00	69.71	107.41	109.62	85.16	39.28	68.60	98.87	72.28
2001	101.83	101.09	68.19	36.78	81.65	108.28	98.25	77.84	60.65	26.40	101.61	100.82	80.28
2002	97.47	93.34	68.99	3.12	0.00	44.56	90.81	90.60	82.75	67.24	86.18	110.74	69.65
2003	85.88	72.01	55.31	3.62	0.00	94.99	89.56	109.94	68.26	54.20	94.61	93.44	68.49
2004	77.83	81.58	59.55	0.00	36.53	87.19	93.38	94.95	66.76	63.00	91.60	81.65	69.50
2005	125.66	101.28	43.73	10.36	0.00	89.22	114.47	101.61	51.35	39.83	82.43	66.19	68.84
2006	76.80	92.09	82.09	59.40	88.83	92.21	81.26	66.46	56.12	53.96	111.15	96.16	79.71
2007	103.65	109.05	72.92	18.02	41.34	117.35	112.58	84.41	64.24	24.29	82.57	107.99	78.20
2008	98.83	105.19	52.42	39.45	86.25	114.46	111.66	95.41	71.84	43.76	90.79	103.31	84.45
2009	96.04	107.18	70.18	9.15	24.21	106.24	106.22	109.27	65.05	12.26	94.91	107.68	75.70
2010	66.31	72.68	38.25	0.00	17.82	57.98	117.84	107.63	99.59	34.48	62.11	112.58	65.61
Mean	93.45	94.04	62.84	17.50	34.24	89.29	102.13	95.25	70.16	41.70	87.87	98.13	73.88
Max.	125.66	109.05	82.09	59.40	88.83	117.35	117.84	109.94	99.59	67.24	111.15	112.58	84.45
Min.	66.31	72.01	38.25	0.00	0.00	44.56	81.26	66.46	51.35	12.26	62.11	66.19	65.61

(unit: m^3/sec)

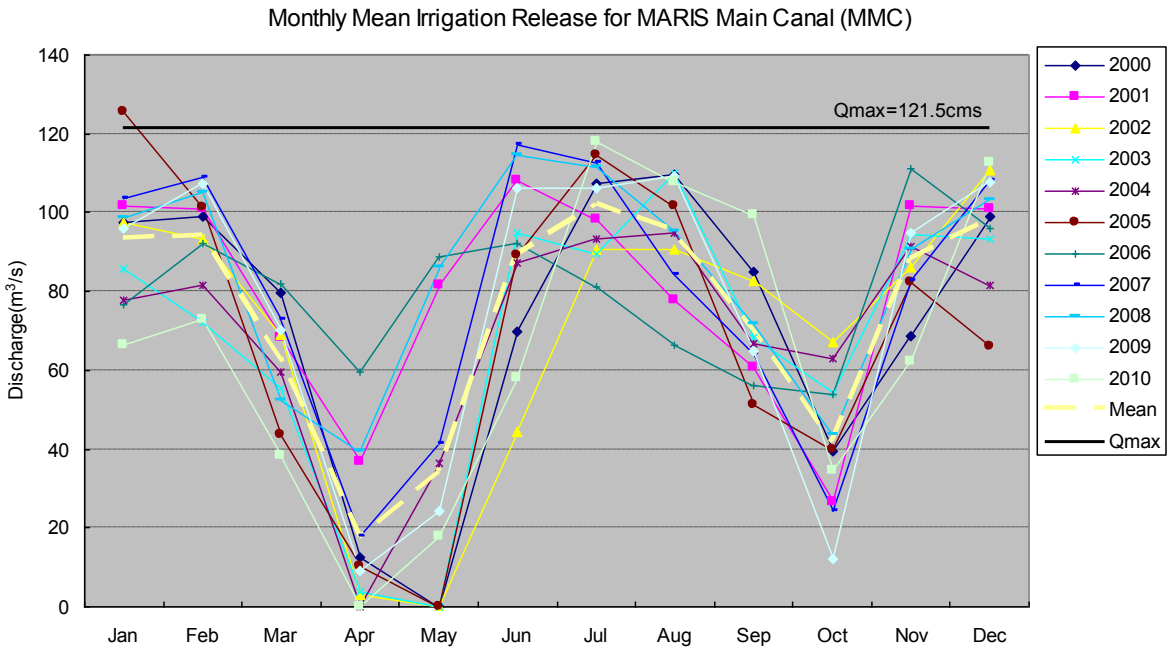
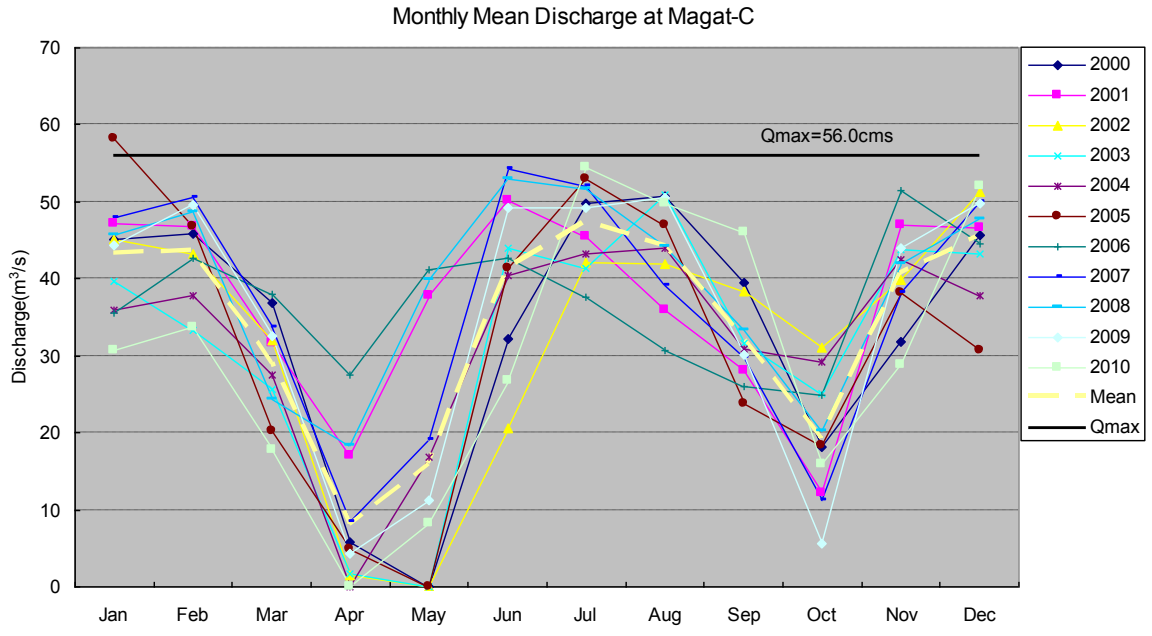


Table 1-9 Monthly Mean Discharge at Magat-C

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
2000	45.17	45.78	36.84	5.84	0.00	32.26	49.71	50.73	39.41	18.18	31.75	45.76	33.45
2001	47.13	46.79	31.56	17.02	37.79	50.11	45.47	36.03	28.07	12.22	47.03	46.66	37.16
2002	45.11	43.20	31.93	1.44	0.00	20.62	42.03	41.93	38.30	31.12	39.88	51.25	32.23
2003	39.75	33.33	25.60	1.68	0.00	43.96	41.45	50.88	31.59	25.08	43.79	43.24	31.70
2004	36.02	37.76	27.56	0.00	16.91	40.35	43.22	43.95	30.90	29.16	42.39	37.79	32.17
2005	58.16	46.87	20.24	4.79	0.00	41.29	52.98	47.03	23.77	18.43	38.15	30.64	31.86
2006	35.55	42.62	37.99	27.49	41.11	42.68	37.61	30.76	25.97	24.97	51.44	44.50	36.89
2007	47.97	50.47	33.75	8.34	19.13	54.31	52.10	39.07	29.73	11.24	38.21	49.98	36.19
2008	45.74	48.68	24.26	18.26	39.92	52.98	51.68	44.16	33.25	20.25	42.02	47.81	39.08
2009	44.45	49.61	32.48	4.23	11.21	49.17	49.16	50.57	30.11	5.67	43.92	49.84	35.03
2010	30.69	33.64	17.70	0.00	8.25	26.83	54.54	49.81	46.09	15.96	28.75	52.10	30.36
Mean	43.25	43.52	29.08	8.10	15.85	41.32	47.27	44.08	32.47	19.30	40.67	45.42	34.19
Max.	58.16	50.47	37.99	27.49	41.11	54.31	54.54	50.88	46.09	31.12	51.44	52.10	39.08
Min.	30.69	33.33	17.70	0.00	0.00	20.62	37.61	30.76	23.77	5.67	28.75	30.64	30.36

(unit: m^3/sec)



(4) Possible Water Head

Based on the measurement at the site during 2nd site survey, the difference between upstream and downstream water surface elevation was determined as roughly 3.0 m.

1-3 Environmental and Social Considerations

The Project is classified as "Category C" according to "JICA's Guidelines for Environmental and Social Consideration" because the Project is likely to have minimal or little adverse impact on the environment and society for the following reasons.

- Proposed facilities are very small in size and are installed within the existing premise of the irrigation canal.
- Proposed mini hydropower plant utilizes untapped water drop and produces no additional recession area so as to cause very little impact on upstream/downstream flow, water quality and ecosystem.
- No involuntary resettlement is required by the Project.

In line with the above, this part describes the contents of environmental and social consideration to be conducted by the Philippine side as well as the items required for obtaining legal authorization in the Philippines and their progress confirmed during the Preparatory Survey.

(1) Land acquisition

The Lateral-B MHPP will be installed within the premise of the existing irrigation sub-channel owned by NIA-MARIIS. The area affected by the Project is estimated to be approximately 200 m^2 (20m x 10m) and is considered to be very small. Therefore, no additional land acquisition is required.

(2) Compliance with the Indigenous Peoples Protection Law

The Project site is the MARIIS irrigation channel and surrounding area, and it has been confirmed with San Mateo Municipal Office and Isabela Province NCIP office that no indigenous people inhabit the area. However, since Project officials believe it necessary to conduct procedure to prove the NCIP claims that the area contains no indigenous people or their land, MARIIS is currently looking into the subject. This report will be used in making the said application.

(3) Meeting of Stakeholders

In this preparatory survey, a meeting of stakeholders comprising the following members has been staged. In the course of this, outline explanation of the Project has been given and the basic understanding of the participants has been obtained.

Table 1-10 Members of the Meeting of Stakeholders

Members	Role in the Project
Department of Energy (DOE) Hydropower and Ocean Energy Management Department (HOEMD)	Supervisory implementing agencies
National Irrigation Administration, Central Office (NIA-CO)	Implementing agency
MARIIS	Project operation and maintenance agency
ISELCO-I	Local power distribution company
San Mateo Municipal Office	Host municipality of the Project site
Isabela Provincial Government	Host province of the Project site

(4) Environmental clearance in the Philippines

Concerning hydropower development in the Philippines, the contents of the environmental impact assessment report required by the Department of Environment and Natural Resources (DENR) differ according to the scale of development and amount of river flow used. According to the environmental impact assessment manual (DAO 02-30) compiled by DENR-EMB, as is indicated in the contents of environmental assessment reports according to project type as shown in Table 1-11 and Table 1-12, projects entailing a Run-of -River type hydropower development with output no higher than 1 MW are classified as Category D and do not require an EIA or IEE. The project implementing agency only needs to submit an outline description of the project and obtain a Certificate of Non-Coverage.

The Project targets an existing irrigation channel rather than a natural river, but it is still classified as a flow-in type project on a river.

Table 1-11 Project Categories

Category A	Environmentally Critical Projects (ECPs) with significant potential to cause negative environmental impacts.	Require to secure Environmental Compliance Certificate (E**CC)** Submit Environmental Impact Statement (**EIS)** report
Category B	Projects that are not environmentally critical in nature, but which may cause negative environmental impacts because they are located in Environmentally Critical Areas (ECAs)	Require to secure **ECC**, however in cases where the **IEE** Report fails to address all environmental issues, the application may be upgraded to an **EIS** Report.
Category C	Projects intended to directly enhance environmental quality or address existing environmental problems.	Require to submit Project Description for issuance of Certificate of Non-Coverage (**CNC**).
Category D	Projects not falling under other categories OR unlikely to cause adverse environmental impacts.	Outside the purview of the Philippine **EIS** System, and shall be issued Certificate of Non-Coverage (**CNC**) upon request by the proponent. However additional environmental safeguards as it may deem necessary.

Table 1-12 Contents of Environmental Assessment Report according to Project Type

Group II – Non-ECPs in Environmentally Critical Areas (ECAs) First Set of Group II Projects under similar Project Types as declared in Presidential Proclamation No. 2146					
Project Type			Project Size Parameter	EIA Report Type for Corresponding Project Size/Threshold/ Decision Document	
				Initial Environment Examination [3] (IEE Report: IEER or IEE Checklist: IEEC) / ECC	Project Description Report [4] / CNC
63.	B.3.g.1	• With physical or mechanical processing	annual processing (inputs)	> 200.0 MT annually but < 70,000 MT	≤ 200.0 MT annually AND ≤ 1.0 MT daily
64.	B.3.g.2	• With chemical processing	annual processing (inputs)	< 70,000 MT	
65.	B.3.h.	Non-commercial Geothermal Exploration Projects		Regardless of area or number of wells	
66.	B.3.i.	Non-commercial mineral and fossil mining projects: core drilling/sampling, exploration (drilling and testing), feasibility studies, geo-scientific, physical surveys; gravity survey, piloting; reconnaissance; research and development activities; seismic survey, and similar activities with no significant earth moving activities etc.			regardless of capacity or area
67.	B.3.j.	Non-metallic mineral processing plants like cement, other cement products, clinker, limestone, sulfur	annual production rate	> 200 MT but < 50,000 MT	≤ 200.0 MT annually AND ≤ 1.0 MT daily
68.	B.3.k.	Non-metallic mineral processing projects like ceramic industries, manufacture of glass and glass products, manufacture and processing of calcium	annual production rate	> 200 MT but < 70,000 MT	≤ 200.0 MT annually AND ≤ 1.0 MT daily
	C.	**INFRASTRUCTURE PROJECTS**			
69.	C.1	**MINOR DAMS**	Reservoir flooded area AND water storage capacity	≥ 25 hectares AND < 20 million m^3	
	C.2	**MINOR POWER PLANTS (Proc No. 2146 declared types: fossil-fueled, nuclear fueled, hydroelectric or geothermal)**			
70.	C.2.a.	Small power plants	total power production capacity		≤ 1 MW unless specified below
71.	C.2.b.	Fuel Cell	total power production capacity	≥ 5 MW but < 100 MW	< 5 MW
72.	C.2.c.	Gas-fired thermal power plants	total power production capacity	≥ 10.0 MW but < 50.0 MW	< 10.0 MW
73.	C.2.d.	Geothermal facilities	total power production capacity	> 1.0 MW but < 50.0 MW	≤ 1 MW
74.	C.2.e.	Hydropower facilities		< 20 million cubic meters water impounding capacity	Run-of-river system

Chapter 2 Contents of the Project

2-1 Basic Concept of the Project

(1) Overall Goal

In October 2008, the Government of the Philippines enforced the Renewable Energy Act of 2008, R.A. 9513 (hereinafter referred to as the "RE Act") - the first comprehensive legislation on renewable energy in Southeast Asia. This Act has the objectives of, ① improving the self-sufficiency of energy supply, ② strengthening the capacity of central and local governments via development of renewable energy, and ③ balancing economic growth with environmental protection. Furthermore, the Government of the Philippines in June 2011 announced the National Renewable Energy Program with the goal of increasing the amount of power generated from renewable energy by three times (to approximately 16,200 MW) over the 2010 level by 2030. Because the Philippines relies on imported fossil fuels to cover 40% of its power generation requirement, implementation of the Project can be expected to promote the utilization of renewable energy based on domestic water resources, and thereby contribute to energy security and reduction of greenhouse gas emissions.

The Project will contribute to achieving the goals of the RE Act and the National Renewable Energy Program and it will contribute to the stable and ongoing maintenance of irrigation facilities based on mini hydropower development.

(2) Project Purpose

Through constructing a mini hydropower plant in an irrigation district in a rural area of the Philippines, the Project intends to promote utilization of domestic renewable energy, thereby contributing to the diversification of energy sources and reduction of greenhouse gas emissions, as well as aiding the dissemination of power in the area concerned. In addition, the Project aims to become a pilot undertaking for disseminating mini hydropower development utilizing the idle head of irrigation channels in the Philippines.

2-2 Outline Design of the Japanese Assistance

2-2-1 Design Policy

Considering said objectives of the Project and results of discussion between the Philippine side and JICA Team, the Project is planned based on the following design policy.

(1) Technical Standard and Cost Estimate Standard in the Project

The technical standards and cost estimate standards that are required in implementing the Project will basically be adopted from the standards used by the host local government, but Japanese and international standards will be referred to in situations where the local standards are insufficient or unclear. Concerning design of civil engineering and electrical and mechanical equipment, the Hydropower Development Guide Manual (March 2011) prepared by JICA will be referred to. As for power transformation and transmission equipment, it has been decided to conduct the design based on standards prescribed by the National Electrification Administration of the Philippines.

Table 2-1shows the main technical and cost estimate standards that need to be prepared in the Survey for the Project.

Table 2-1 Technical Standard and Cost Estimate Standard Used in the Project

Name		issue	Remark
Philippines	Guide on Mini-Hydropower Development in the Philippines	DOE	Regulation on development scale, procedure, etc based on "Mini-Hydroelectric Power Incentives Act" (Act. No. 7156)
	Manual for Design, Implementation and Management for Micro-Hydropower Development ;June 2009	DOE -EUMB	Technical manual prepared on JICA technical cooperation project "Rural Electrification Project" covering lower than 1MW scale
	Philippine Grid Code Jan,2001	ERC	Criteria for transmission
	Distribution Code Jan,2001	ERC	Criteria for distribution
	Philippine Electric Code (PEC)	ERC	Electrical standard in the Philippines
	NEA Regulation	NEA	Regulation by NIA
Japan	Technical Standard for Hydropower Facilities	METI	
	Technical Standard for Electrical Facilities	METI	
	Technical Criteria for River Works	MILT	
	Standard Specification of Concrete Structures	JSCE	
	Technical Standard for Gate & Penstock	JHGPA	
	Criteria for Transmission/Substation	JESC	
	Technical Requirement Guideline for Interconnection	METI	
	Technical Guideline for Interconnection by Distributed Generation	JEA	
	Technical Guideline for Design of Steel Structures, Mini-hydropower Edition	MAFF	
	The Institute of Electrical Engineers of Japan	JEC	
	Standard Criteria of JEMA	JEMA	
	Electric Technology Research Association	ETRA	
	Standard for Cost Estimation on Civil Works	MILT	
	Estimation Table for Machinery Ownership Rate	MILT	
	Standard Yardstick for Construction	CRI	
Reference	Guideline and Manual for Hydropower Development Vol.2 Small Scale Hydropower	JICA	Technical manual for rural electrification on mini-hydropower under 500kW

(2) Consideration of the Existing Irrigation Facilities

The Project is designed considering water operation in the existing irrigation facilities to avoid adverse impact on water supply to surrounding crop fields.

(3) Selection of Equipments

As an agricultural country, the Philippines has large-scale irrigation systems such as MARIIS and also many smaller communal irrigation systems (CIS). Many of these irrigation systems possess untapped head that can be used in hydropower generation. As is indicated in Fig. 2-2, the Project area has two potential sites around Magat-C site alone.

In recent years in Japan, simple small-scale water turbines catering to installation on head works of small-scale irrigation channels have been developed. Since these turbines have simple structure, even though they have low generating efficiency, they can be manufactured and maintained by small factories and major cost reductions can be anticipated even in developing countries such as the Philippines, provided that appropriate technology transfer is carried out. It is anticipated that the utilization of such simple water turbines can help lead to the dissemination of mini hydropower utilizing small irrigation channels in developing countries. Moreover, Japanese manufacturers appear keen to transfer such technology to developing countries.

In this project, according to the policy by Government of Japan, Turbine, Generator and Control System are designed on the assumption to utilize the elaborated products fabricated by Japanese small, medium scale enterprise. On that basis, Outline design was conducted with following basic policy.

(4) Minimization of reform of existing structures

The simple small-scale water turbine was developed on the premise of minimizing reform of existing civil structures, and consideration has been taken in the Project too to ensure that reform of the existing channel structure in line with the installation of hydropower facilities is kept to a minimum.

(5) Utilization of Local Resources

It is easy for construction machinery to enter the Project site, and a construction firm that possesses all types of construction machinery (excavators, dump trucks, trucks, compaction machines, large trailers and mixer trucks, etc.) is located nearby. Moreover, the civil engineer of this company also worked on the Magat-C works in the 1980s and was employed by a Japanese firm in the Middle East for two years, so he is well-versed in the local conditions and has experience of working with Japanese companies. Accordingly, it will be easy to locally secure construction machinery and human resources for the Project. In the basic design, the generating equipment was designed on the assumption that local equipment, materials and human resources will be utilized to the full.

(6) Substation and Distribution Line

The design of substations and distribution lines basically conforms to relevant standards of the Philippines. The Project will connect Lateral-B Hydro Plant to the existing distribution line owned by ISELCO-I and supply electricity.

Procurement of materials is done considering easiness of repair and replacement of supplies. Equipment of substation and distribution line is available in the country. The following specifications are adopted for the relevant equipment.

- Engineering Bulletin
- Philippine Grid Code
- Philippine Distribution Code
- Specifications and Drawings for 7.62/13.2kV line construction

(7) Quantitative Effectiveness Index

The following items are computed in order to evaluate quantitative effectiveness of the Project.

a. Gross power generation
b. Greenhouse effect gas reduction

1) Gross Power Generation

It is important to understand that power generation in the Project depends on water flow in the existing irrigation canal which is influenced by climate as well as artificial conditions such as cultivation period and maintenance of irrigation facilities.

As seen in Table 1-9, discharge at Magat-C varies year by year and fluctuation band is approximately $10m^3/s$ (equivalent to 20% of maximum discharge).

Expecting such fluctuation, water flow for power generation is reduced to 80% of average flow data and used to estimate gross power generation.

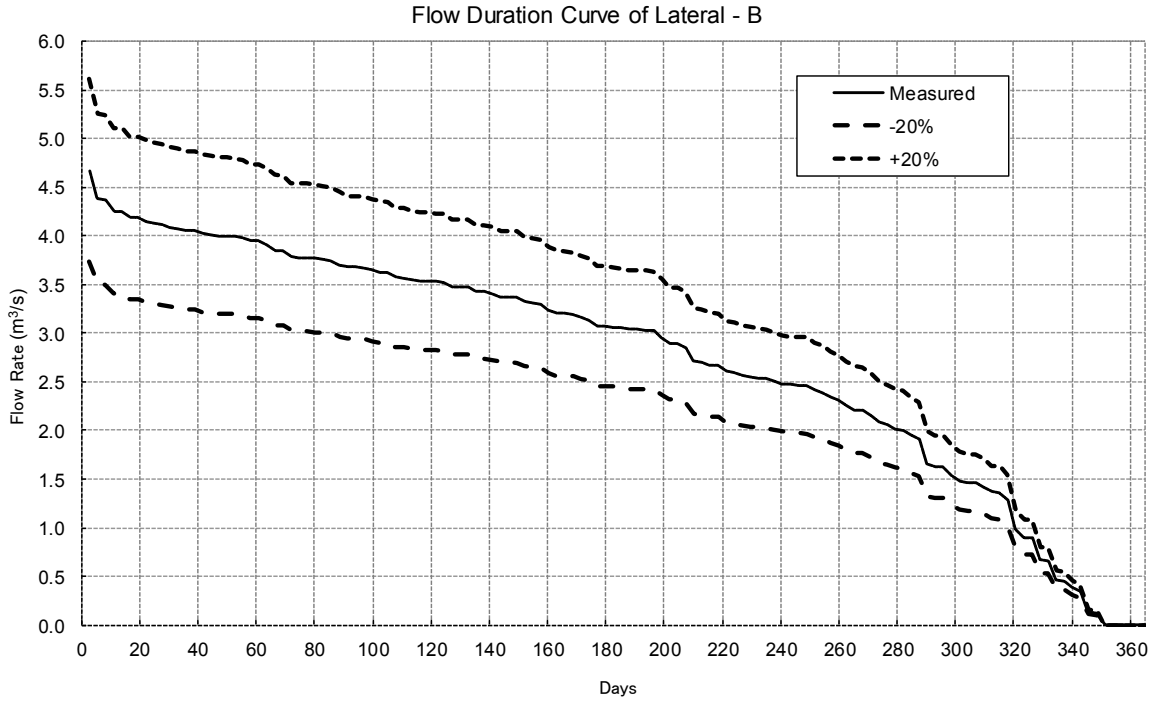


Fig. 2-1 Duration Curve of Lateral-B for Estimation of Power Generation

2) Greenhouse Gas Reduction

This is expressed as the difference between baseline emissions and Project activity emissions.

$ER_y = BE_y - PE_y$ ·

ER_y: Annual emissions reduction (tCO2/year)

BE_y: Baseline annual emissions (tCO2/year)

$BE_y = EG_y \times EF_{elec}$ (case of power generating project)

EG_y: Annual generated electricity (MWh/year)

EF_{elec}: Emission coefficient at all power sources (tCO2/MWh)

In the case of the Philippines, this is 0.487tCO2/MWh at the generating end and 0.520tCO2/MWh at the sending end.

PE_y: Annual emissions in the project activity (tCO2/year)

This isn't considered in the case of renewable energy (small-scale flow-in hydropower project).

2-2-2 Basic Plan

2-2-2-1 Power Plan

As was mentioned above, since the Project is intended to be a pilot project for disseminating mini hydropower utilizing irrigation facilities in the Philippines, sites have been selected by placing emphasis on pilot features in view of the following points.

- Effective head should be low (since a low head entails technical difficulty, the pilot characteristics are enhanced).
- Flow rate should be stable all year round.
- Distance to the power grid should be short (less than 10 km is assumed)
- It should be easy to transport heavy objects.
- There should be no need to acquire land.

Meanwhile, in the case of flow-in mini hydropower generation, the scale of development is automatically determined by the site selection. Therefore, a generating plan that enables hydropower potential to be amply utilized was compiled within the specific constraints of the site.

(1) Useful head

Based on the measurements conducted in the second field survey, the difference between the upstream and downstream water level at Lateral-B was 3.0 m.

(2) Useful flow rate

Since flow observation is not conducted at Lateral-B, the useful flow rate was estimated based on flow data from the aforementioned Magat-C.

In conducting estimation, it was assumed that the flow ratio of Magat-C and Lateral-B is constant at all times. Accordingly, the flow rate data at Lateral-B was compiled using the following formula:

(Lateral-B flow rate) = (Magat-C flow rate data)
x (Lateral-B design flow rate 4.5 m^3/s) / (Magat-C peak flow rate 56.0 m^3/s)

Fig.2-2 shows the discharge-duration curve at Lateral-B obtained from these results.

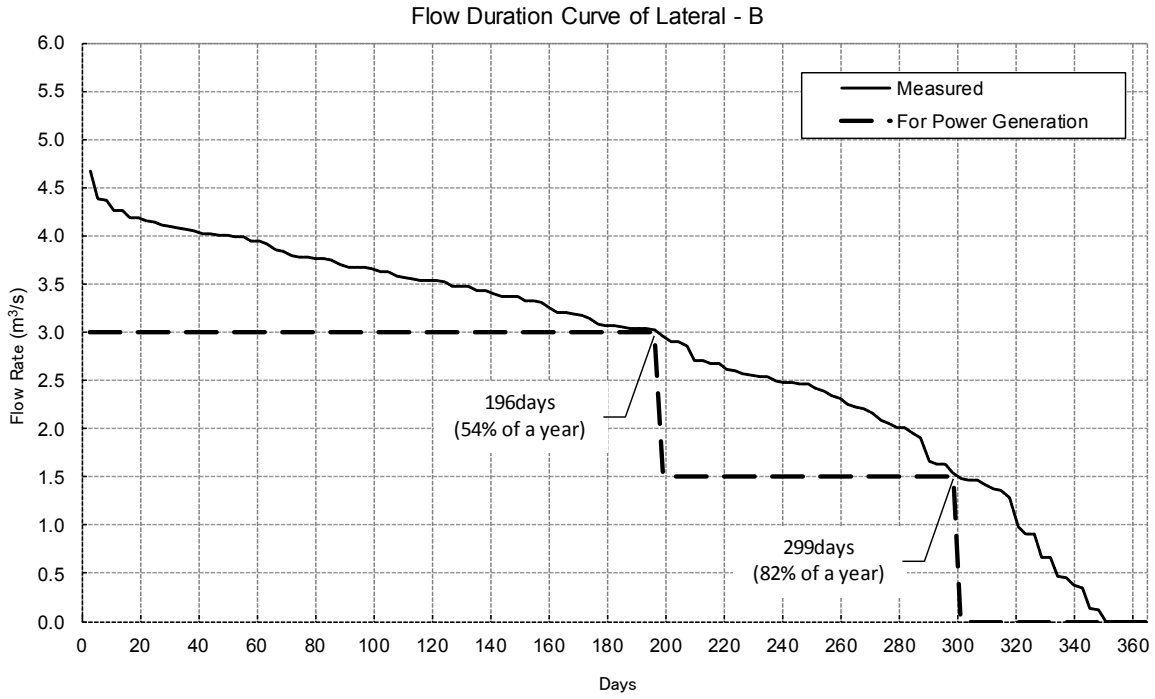


Fig. 2-2 Lateral-B Discharge Duration Curve

(3) Maximum output

The maximum output was sought upon taking into account the useful head, useful flow rate and applicable scope of the procurable mini hydropower turbine at Lateral-B.

- As the loss head and turbine efficiency are unknown at the present time, the mitigation factor was set at 0.5 upon assuming the loss head to be 10% of the total head and the turbine efficiency to be 0.6.
- The number of units was set at two upon considering the available space for installation on the site.
- The type of turbine that cannot adjust the flow rate was selected.
- In the case of two units, it was made possible to switch between single unit operation and operation of two units according to the flow conditions.
- Assuming the used flow per unit to be the parameter, the case where the generated electric power becomes the maximum was adopted.

Fig.2-3 shows the results of the parametric study. From these results, it is clear that the peak generated electric power occurs when the used flow per unit is 1.5m^3/s.

According to hearings with Japanese makers, this head and flow rate constitute the applicable scope for adoption of mini hydropower turbine on an irrigation channel.

Therefore, the peak output is evaluated to be 45.0 kW.

Maximum output = (Gravitational acceleration m/s^2) x (Head m) x (Flow rate m^3/s)
x (Loss head-efficiency) x (Number of units)
= 9.8 x 3.0 x 1.5 x 0.5 x 2 ≒ 45.0 (kW)

In this case, the annual generated electric power is predicted as follows (according to Fig. 2-2):

Days with 2 units operating = 196 days
Days with 1 unit operating = 299 – 196 = 103 days
Annual generated electricity = (Output kW) x (Operating days) x (24 hours)
= (45.0 x 196 x 24) + (22.5 x 103 x 24) =267 (MWh)

Moreover, since the annual maximum generated electricity in respect to the equipment capacity is 394 MWh (=45.0 x 365 x 24) and the predicted annual generated electricity is 267 MWh, the equipment utilization rate is 68% (=267÷394) and a relatively high operating rate can be anticipated.

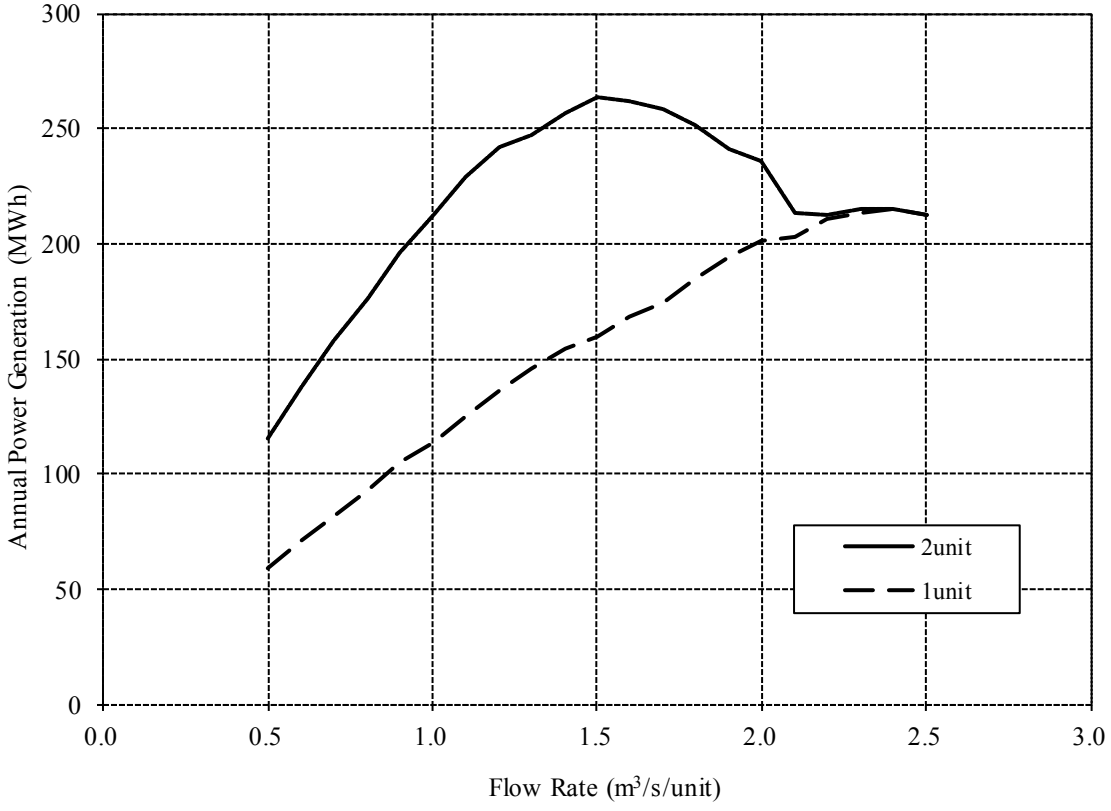


Fig. 2-3 Relation of Flow Rate and Annual Power Generation at Lateral-B site

2-2-2-2 Civil Structure Plan

This site is located in San Mateo Municipality, Isabela Province. The site has a diversion system by which water is diverted from the Lateral-B channel to a tributary, and the Lateral-B channel width becomes narrower at this point. In the Project, in order to install inside the MARIIS site, by-pass channels will be newly installed on both sides of this tapered section and head works of approximately 3.0 m in height will be established inside the new channels. Simple small-scale water turbines (vertical shaft axial flow turbines) will be installed on each head works (two turbines in total). Fig. 2-4 shows the basic layout.

The main civil engineering facility will be the diversion channels having width of roughly 1.8 meters installed on both sides of the existing channel. This Project site also has a dry season of roughly one month, however, the structures are small, there are few schedule constraints and the period for installing equipment, etc. may coincide with the period when water is flowing through the main channel. Therefore, stop-logs will be installed on the upstream and downstream sides of the diversion channels in order to prevent water from flowing in from the main channel.

Also, a manually operated slide gate will be installed on the main channel to ensure that water level on the upstream side is kept at a constant level.

Table 2-2 Feature of Generation System and Civil Structures

Category	Facility	Contents	Remarks
Power generating particulars	Type of generation	Run of River type	Type dependent on irrigation water
	Peak water usage	3.0m^3/s	Single unit 1.5m^3/s
	Effective head	3.0m	
	Maximum output	45kW	Single unit output 22.5kW
Civil structures	Inlet	H 1.75m, W 1.75m, L 4.53m	Reinforcement of existing irrigation weir
	Headrace	H 1.75m, W 1.75m, L 3.80m	Box culvert
	Head works	Drop 3.0m, W 1.75m	Vertical drop method
	Discharge channel	H 1.5~4.8m, W 1.75m, L 5.73m	Open channel
	Outlet	H 1.5m, W 1.75m, L 1.65m	Open channel

It is noted that NIA-MARIIS requested the following during the 3rd Site Survey.

- A fence enclosing power facilities is required for security of the Project site.
- Instead of outdoor type control box, indoor type control box is desired also for security reasons.

Necessity and facility plan for the request shall be determined in the detailed design.

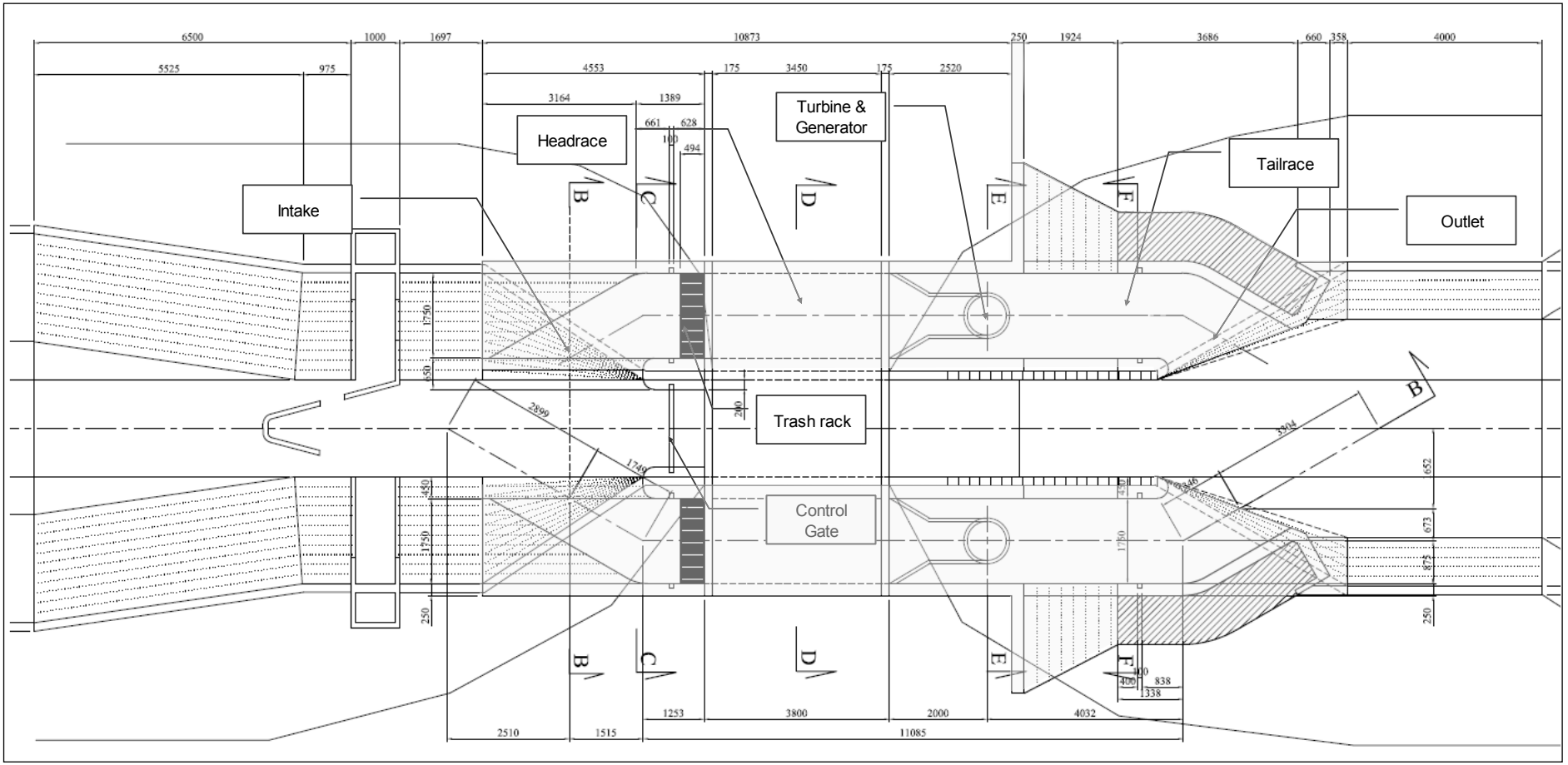


Fig. 2-4 General Plan of Lateral-B Hydropower Development

2-2-2-3 Power Equipment Plan

(1) Generation System

① Turbine

a. Turbine type

A turbine that is compatible with the 2 m head of the Project cannot be selected from general selection charts, however, upon investigating maker catalogs, the horizontal shaft propeller turbine and vertical shaft axial flow turbine are deemed to be potential choices.

In the Project, the vertical shaft axial flow turbine will be adopted at Lateral-B.

b. Generating output

The power plant output will be as follows.

Table 2-3 Feature of Generation System

Item	Contents	Remarks
Turbine type	Vertical shaft axial flow turbine	
Effective head (m)	3.0	
Flow rate (m^3/s)	1.5	
Turbine generator combined efficiency (%)	51	
Generator output (kW)	22.5	
Quantity (units)	2	
Power plant output (kW)	45	

c. Quantity of main units

According to the selected type of turbine, since there is a limit to the flow that can be used with the designated effective head, 2 units x 1.5 m^3/s have been set for Lateral-B.

② Generator

Since generator output is small compared to the existing grid capacity, the inexpensive induced generator will be adopted at both power plants.

③ Control device

All operation controls for the turbine and generator such as starting, stopping and emergency stopping, etc. will be carried out manually. In the event where a protective relay is activated, an alarm will be sounded and the gate will be closed manually.

Concerning routine operation, operators will operate the gate to maintain the necessary water level while monitoring the water level from the detector fitted to the head tank.

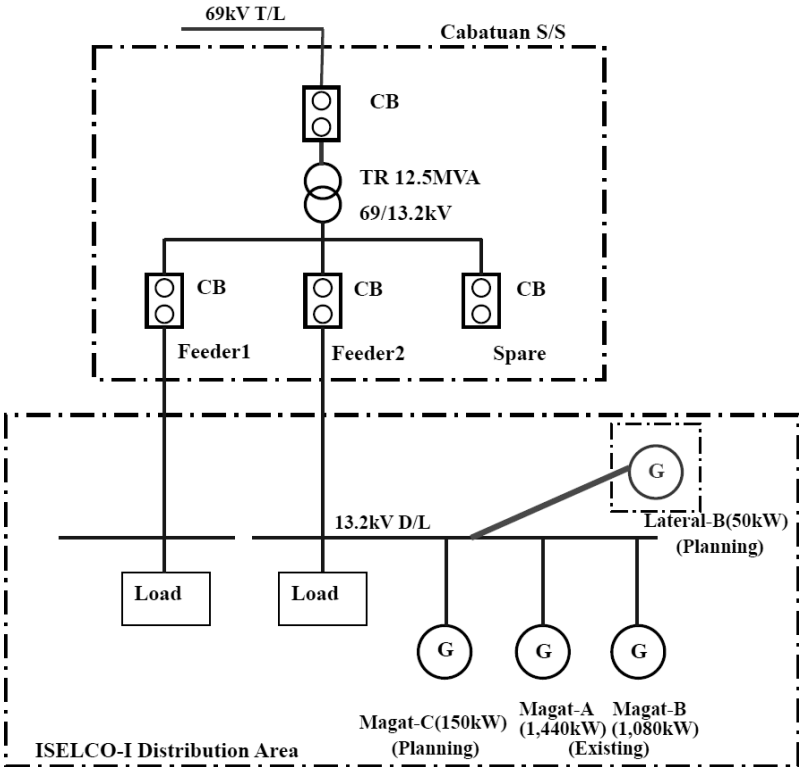
Since the Project turbines have no guide vanes for performing flow regulation, the number of operating units will be adjusted in order to respond to periods of low incoming flow.

Since the power plant has no responsibility to operate independently, the generators will be stopped by means of independent operation detector in the event where the grid is suspended. Resumption of operation will be confirmed by telephone communication from the substation.

(2) Transformation and distribution equipment

① Outline

The transformation equipment for the power plant will be installed outdoors on the plant premises. The transformation equipment will comprise a 24 kV load switcher (with PF), 13.2 kV/400V main transformer, business energy meter and arrester, etc. and will be installed inside an area enclosed by fence, etc.



Source : JICA Study Team

Fig. 2-5 Outline of Transformation and Distribution

② Frequency and voltage of use

Equipment will be planned assuming the frequency of use in the Philippines of 60 Hz and the distribution line voltage of 13.2 kV of the distribution company (ISELCO-1).

③ Supply system

Lateral-B power plant will be connected and supply power to the local distribution company (ISELCO-1) grid (overhead distribution line) via a 3 phase 4 line connection.

④ Distribution line route

Considering maintenance following distribution line construction, economy will also be taken into account when deciding the route. Table 2-4 shows the distance of the works section.

Table 2-4 Distance of Distribution Line Works Section

Section	Length (m)	Remarks
Lateral-B power plant ~ No.9982 pole	2,200	New installation
Total	2,200	

⑤ Transformation and distribution equipment specifications

a. Transformation equipment

i) Transformer

In order to connect to the existing distribution system (13.2 kV), a step-up transformer having the following specifications will be installed close to the power plant.

Type: Single phase x 3 units

Voltage: 440 V / 13.2 kV

Capacity: 25 kVA x 3 units

ii) Switchgear

Switchgear will be assembled on the transformation equipment pole located at the power plant exit, which can act as a demarcation point between the power plant and distribution line and can be cut off in the event of accidents.

Type: 3 phase load switchgear with fuse (LBS)

Voltage: 24 kV

iii) Lightning conductor

A lightning conductor will be assembled on the transformation equipment pole to prevent lightning surges damaging the generating equipment.

Type: Insulator lightning rod

Voltage: 20 kV

iv) Instrumentation

In order to gauge the quantity of power supplied to the distribution line, an instrument transformer will be installed on the transformation equipment pole, and an energy meter will also be installed.

- Instrument transformer (PT) 3 phase Voltage: 14kV / 200V
- Instrument current transformer (CT) 3 phase Current: 50 A/5 A
- Integrating electricity meter: 3 phase Type: GEKV2C x 2

b. Distribution equipment

i) Power line

The local distribution company (ISELCO-1) uses ACSR, which has high tensile strength, and the same type of wire will be used throughout in the interests of maintenance.

Also, line size that entails no problems in terms of transmission capacity will be selected.

- Power line specifications: 1/0 ACSR (approximately 53.5mm^2)

ii) Supports (poles)

Steel hollow poles, which are easily available in the Philippines, will be adopted. The pole length will be decided upon considering the local environment, but 35 feet will be adopted in consideration of the load during transportation and so on.

iii) Pole-mounted transformers

Transformers will not be newly installed in the project.

iv) Mounting hardware/branch lines

The pole mounting method is standardized in the NEA standard (Specifications and Drawings for 7.62/13.2kV Line Construction), and the method here will be selected upon considering horizontal and vertical angles in accordance with this.

Mounting method (3 phase): C type

Table 2-5 Outline of the Equipment

Equipment	Outline Specifications	Remarks
Water turbine	Vertical axial flow turbine x 2 Effective head: 3.0m Maximum water usage: 1.5m^3/s	Procure from Japanese small or medium enterprise
Generator	3 phase induction generator x 2 22.5kW	Ditto
Control system	Turbine and generator control system Protective relay Independent operation detection unit	Ditto
Main transformer	Single phase 25 kVA x 3 Voltage 440/13.2kV	National Electrification Administration standard
Switchgear	3 phase load switchgear with fuse Voltage: 24 kV	Ditto
Distribution line (inter-connection line)	3 phase 4 line, 13.2 kVA New installation: 2.2 km	Ditto
Distribution pole	Steel poles	Ditto
Power meter, etc.	Instrument transformer Instrument current transformer Watt-hour meter	Ditto
Gate, screen	Gate: W1600, H1500 Screen: W1750,H1750	It is necessary to confirm local manufacturing capability in the detailed design.

2-2-3 Outline Design Drawing

No-1 : General Layout and Profile

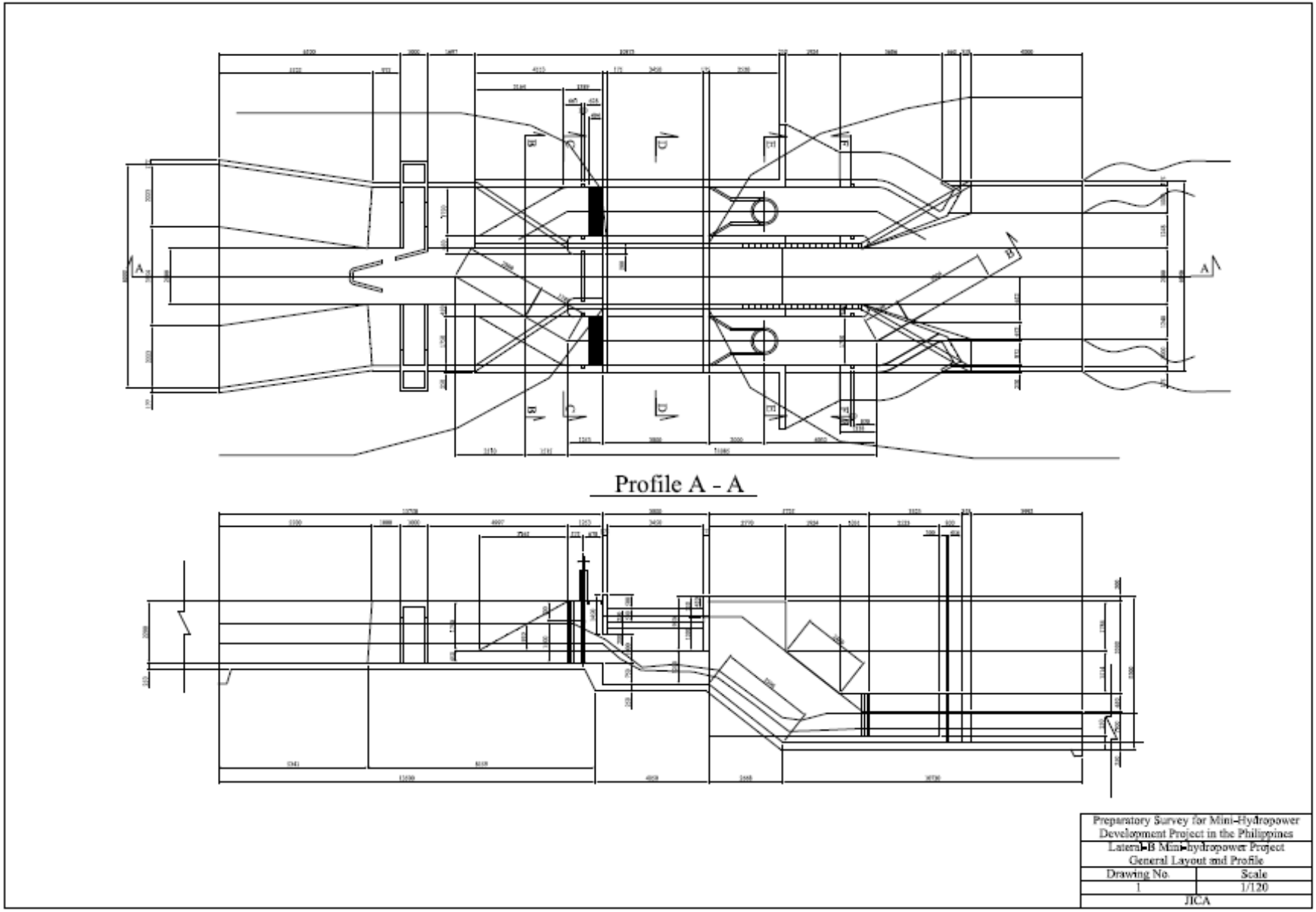
No-2 : Section View

No-3 : Single Diagram

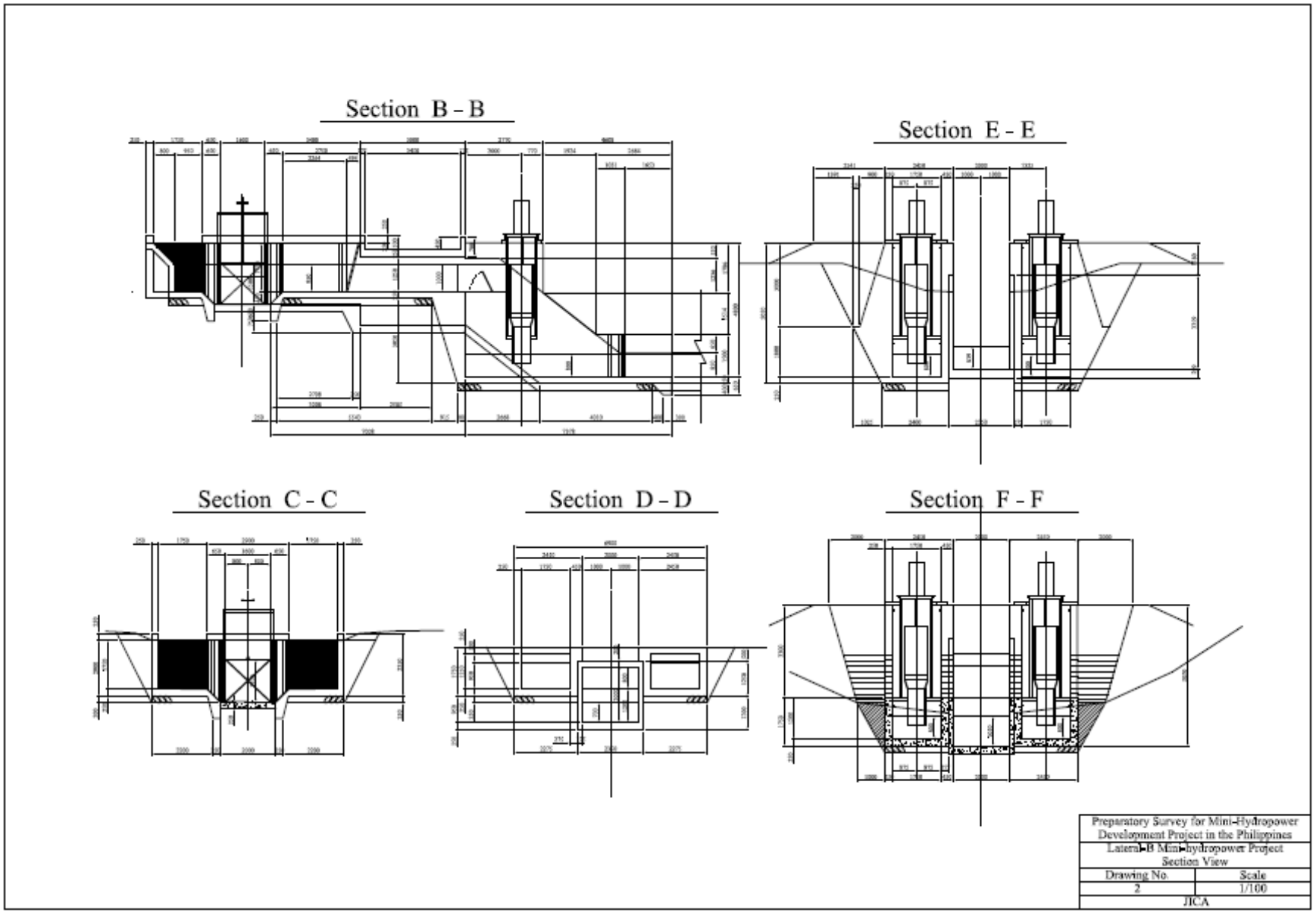
No-4 : Sub-Station Layout and Plan

No-5 : Distribution line Route

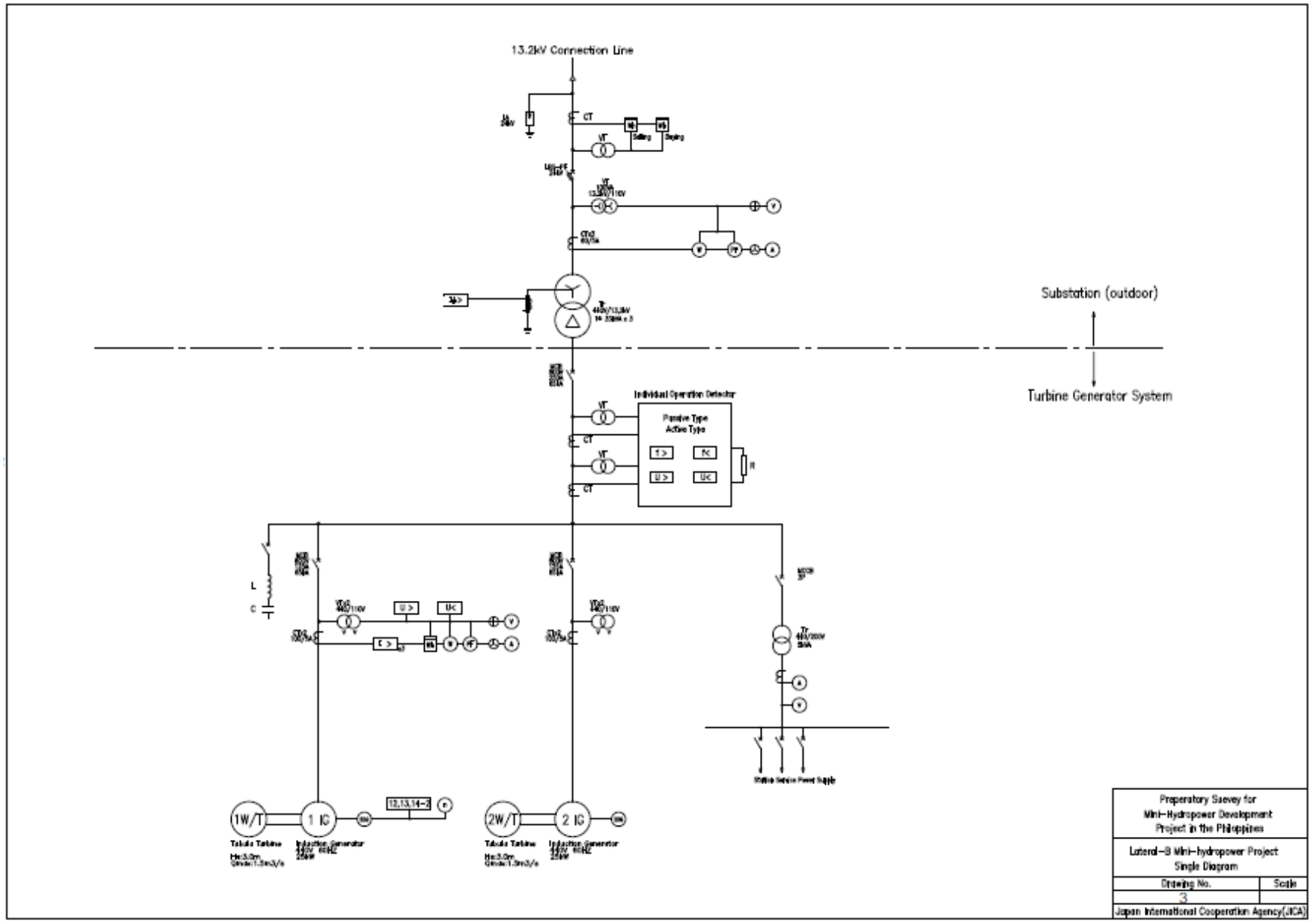
No-1 : General Layout and Profile



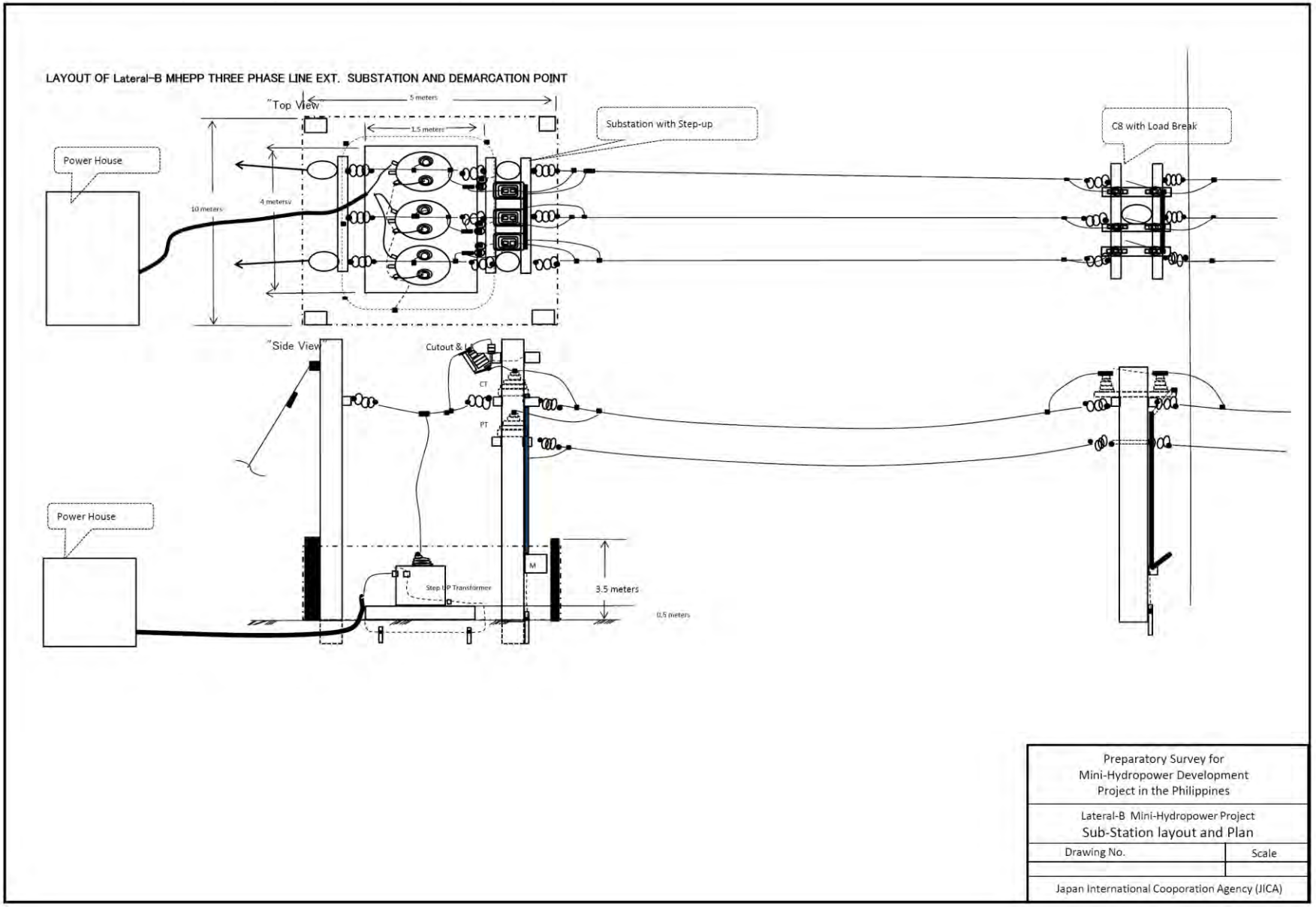
No-2 : Section View



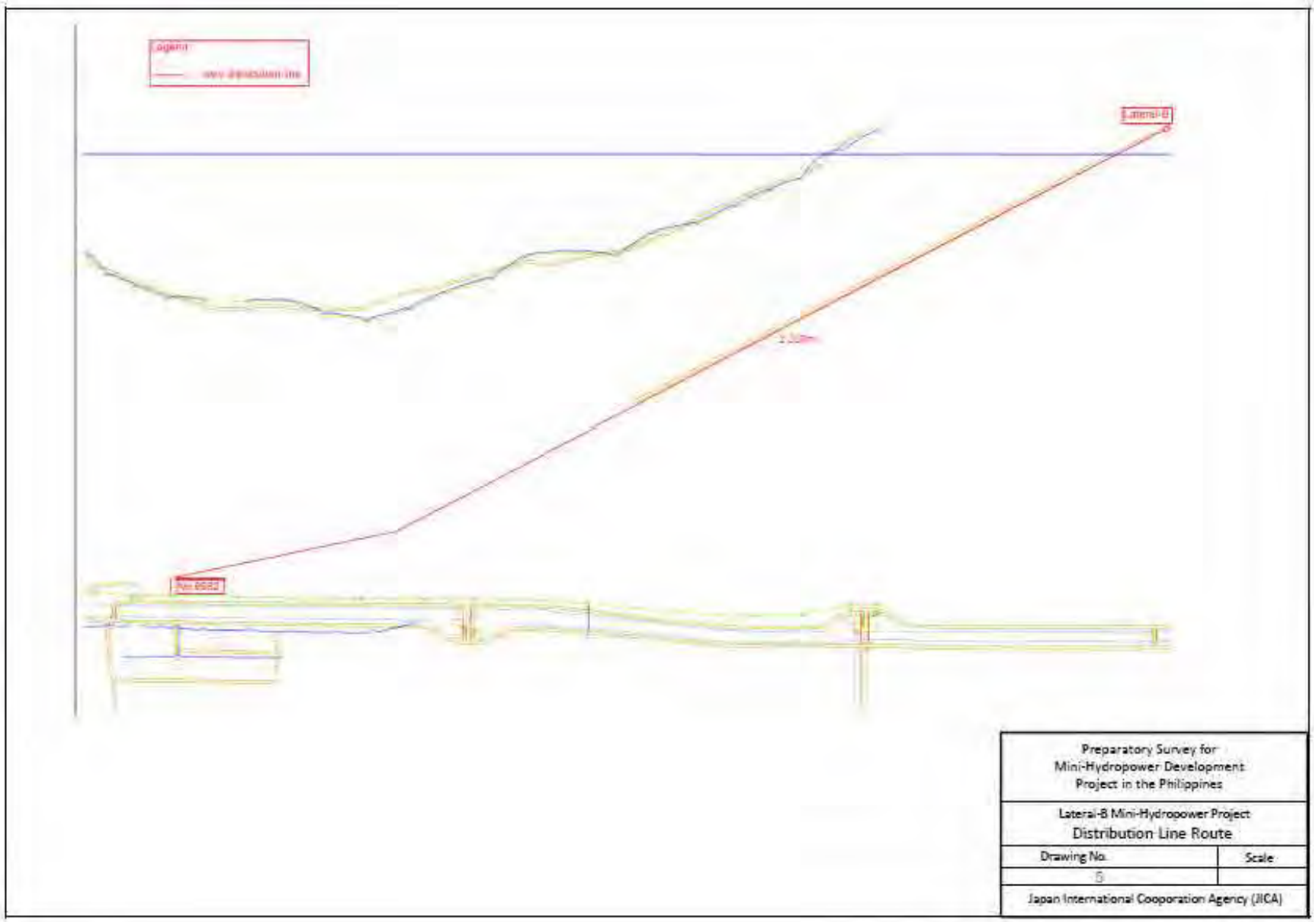
No-3 : Single Diagram



No-4 : Sub-Station Layout and Plan



No-5 : Distribution line Route



2-2-4 Implementation Plan

2-2-4-1 Implementation Policy

(1) Limitation of the scope of works

The Project construction sites will be restricted to the premise of sub-canal of MARIIS (Lateral-B).

(2) Utilization of local construction firms, etc.

In the survey, the capacity of local construction firms was investigated, although information was collected on just one construction company in the area around the construction site. This company is located 30 minutes from the construction sites along a main road and it is a compound company that operates rice milling plants and gasoline stations, etc. It owns all types of construction machinery (excavators, dump trucks, trucks, compaction machines, large trailers and mixer trucks, etc.) and maintains them in good condition. Moreover, the civil engineer of this company also worked on the Magat-C works and was employed by a Japanese firm in the Middle East for two years. In view of the company size, ownership of heavy machinery, location in relation to the project sites and the fact that it has an employee with experience of the Magat-C works, this company is deemed to possess ample technical capacity for implementing the Project.

Moreover, concerning distribution line and transformation substation works in the Project, it will be possible to utilize the local power distribution company (ISELCO-I).

The implementation plan is based on the premise that local construction firms will be utilized.

However, since it will be necessary to complete the Project in a short time and the dry season will only last for around one month, it will be necessary to conduct guidance and management by Japanese engineers in the civil engineering, electrical and machine fields.

2-2-4-2 Implementation Conditions

(1) Accessibility to the Project Site

The Project site is located in San Mateo Municipality, Isabela Province in the north of Luzon Island. Since a paved national highway runs from Manila to Isabela Province, there is no problem regarding transportation

of large-size freight. The distance from Manila to the Project site is approximately 400 kilometers and the journey takes ordinary vehicles about nine hours. Meanwhile, equipment and materials that are transported overseas will be landed at Manila Port, where it is possible to import general freight. Located in Manila Bay to the west of Metro Manila, Manila Port is one of the leading international ports in Southeast Asia and poses no problems regarding the landing of equipment and materials.

A national highway and municipal road (partially unpaved) lead from the center of San Mateo Municipality to the Project site and can be used by large vehicles.

In consideration of the above points, conditions of access to the Project site are extremely good.

(3) Procurement of Construction Machinery

On the Project site, both the civil engineering works and equipment installation works can be executed by machines and construction machinery can be easily procured around the Project site.

(4) MARIIS irrigation water operation

In the Project, it will be necessary to take steps to ensure that irrigation water supply by existing irrigation facilities is not affected. According to the water management by MARIIS, there is a dry season of around a month between March and May, and it will be necessary to execute the mini hydropower plant construction works while water is flowing through the existing channel. In the Project, it will be necessary to compile the schedule in consideration of these water operating conditions of MARIIS.

(5) Power supply and water supply for works

Out of the Project sites, Magat-C already has a distribution line (13.2 kV) and the works power supply can be easily secured. At Lateral-B, there is no need for a large capacity power supply and a portable generator will be sufficient.

There should be no problem regarding water supply because the Project sites are located close to the existing irrigation channel.

2-2-4-3 Scope of Works

The works targeted by Japan's grant aid are as indicated in Table 2-6. There are no works that need to be borne by the Philippine side.

Table 2-6 Works Targeted by Japan's Grant Aid

Items			Contents	Remarks
Power generation Plan	Type of generation		Run of River utilizing Irrigation Channel	
	Type of Power Plant		Conduit type	
	Maximum Design Discharge		3.0m^3/s （1.5m^3/s/Unit）	
	Effective Head		3.0m	
	Maximum Output		45kW （22.5kW x 2）	
	Annual Power Generation		256,000 kWh	
	Effective Power Generation		230,000 kWh	Stop-Operation Ratio 10%
Name of Stuructures		Type	Dimension	Remarks
Civil Structures	Intake	Side Intake	W1.75m、L4.533m、H1.75m	Each one of Both Side
	Headrace	Box Colbert	W1.75m、L3.80m、H1.75m	
	Drop Structure	Vertical	W1.75m、H3.0m	
	Tailrace	Open Channel	W1.75m、L5.725m、H4.8～1.5m	
	Outlet	Open Type	W1.75m、L1.653m、H1.5m	
	Control Gate	Slide Gate	W1.6m、H1.5m	
Generation System	Turbine	Vertical axial flow turbine	Output 28kW/Unit	Made in Japan
	Generator	Induction type	22.5kW/Unit	
	Control System		Manual Operation	
Distribution and Sub-Station	Transformer	Step up	440V/13.2kV、25kVAx3	Procurements from Local
	Switch	3Phase	24kV	
	Line	3Phase 4Line	13.2kV、Length：2.2km	

2-2-4-4 Construction Method

The construction method according to each type of equipment is as follows.

(1) Intake channel (including intake) and discharge channel (including outfall)

The intake channel and discharge channel will be constructed while water flow is suspended in the irrigation channel (around one month between March and May). The work procedure is as follows:

① After water flow is cut off, manually remove lining concrete from the intake and discharge channels on both the upstream and downstream sides.

② Start excavating from the upstream and downstream sides. Basically conduct manual excavation close to the existing structures and remove the soil by loading onto a back hoe ($0.6m^3$). Temporarily leave the excavated sediment nearby and use it later for backfilling.

③ Following excavation, give priority to placing concrete around the intake and discharge parts, and following curing, set flush boards on both the upstream and downstream sides.

④ Place concrete in the intake and discharge channels.

⑤ In tandem with the above work, install a control gate in the existing channel. Following installation, fully open the gate in readiness for stoppage of the water suspension.

(2) Headrace channel (including head works)

Implement the headrace works after the above-mentioned intake channel works, etc. The work procedure is as follows.

① Conduct excavation from the existing road on the opposite side of the irrigation channel. Basically conduct manual excavation close to the existing structures and remove the soil by loading onto a back hoe ($0.6m^3$). Temporarily leave the excavated sediment nearby and use it later for backfilling.

② Following completion of excavation, place the concrete in the channel and retaining wall, conduct curing and then backfill the soil.

(3) Installation of turbine and other equipment

Conduct the installation of equipment with a 15-ton truck crane. Concerning the two turbines, first install the one on the left bank (Unit 1), and then install the one on the right bank (Unit 2).

(4) Substation works

The substation site is the MARIIS land on the right bank. Implement the substation work at the same time as the abovementioned turbine installation.

(5) Distribution line works

The distribution line works will be consigned to the local distribution company, and it will be necessary for these works to be finished before the equipment installation.

2-2-4-5 Construction Supervision

Following conclusion of the consultant agreement, the Japanese team comprising the works chief, civil design engineer (hydropower civil works), electric/mechanical engineer, distribution engineer and tender manager will implement the detailed design, preparation of tender documents, tender, and checking and approval of plant drawings for the penstock, gate, screen, generator equipment and power distribution equipment. Site work for the detailed design will comprise the pre-design field confirmation survey, approval of tender documents and tender evaluation to be implemented by the works chief, civil design engineer and tender manager. The other work will basically be implemented in Japan.

Execution supervision during the construction period, comprising checking and approval of execution drawings, environmental conservation and yield checking, will be implemented by the works chief, permanent supervisor (general civil engineering), civil engineer (hydropower civil works: channel and power plant), electrical engineer, mechanical engineer and power distribution engineer. All members apart from the permanent works supervisor will only be dispatched for limited periods according to the local works schedule.

Table 2-7 shows the work to be managed by the Consultant's supervisory staff (Japanese personnel).

Table 2-7 Members for Construction Supervision

Category	Number	Local Dispatch Period	Reason for Appointment/Contents of Work
Consultant leader	1	1.0	Starting arrangements and completion inspection
Supervising engineer (general civil engineering)	1	8.0	Approval of works drawings, yield check, checking of quality test results, etc.
Civil engineer	1	0.5	Concerning the hydropower plant, since connections and adjustment with civil engineering facilities, electrical and mechanical equipment are important, an engineer who has general experience in hydropower plant construction will be assigned prior to the electrical and mechanical works in order to conduct final checks on these civil engineering works and implement guidance on gate operations, etc.
Mechanical engineer	1	1.0	Checking and approval of turbine-related shop drawings, supervision of site tests both with and without water passage, and witnessing of receiving inspections
Electrical engineer	1	1.0	Checking and approval of generator and control device-related shop drawings, supervision of site tests both with and without water passage, and witnessing of receiving inspections

2-2-4-6 Quality Control Plan

(1) Civil engineering structures

Considering below conditions, no concrete test will be conducted in the Project.

- Small quantity of total concrete used; approximately 70m^3
- Time constraints; short construction period during non-operation of irrigation

(2) Turbines, generators and controllers

Mechanical/electrical engineer will check/approve shop drawings and inspect the products during shop assembly and at the time of shipping.

2-2-4-7 Procurement Plan

Table 2-8 shows the procurement sources of equipment and materials necessary for the Project.

The construction equipment and materials are locally available and will basically be procured in San Mateo district, where the Project site is located. The turbines, generator, control equipment and gates, which aren't locally available, will be procured in Japan, while other items will be procured locally. Turbine, Generator and Control System will be procured fabricated by Japanese small, medium scale enterprise according to the policy by the Government of Japan.

Table 2-8 Procurement Plan

Item	Rough Specifications	Philippines	Japan	Reason
Turbine and generator	Vertical shaft axial flow turbine x 2 3 phase induction generator x 2 24 kW		○	Assuming procurement from a Japanese small enterprise
Control device	Protective relay Independent operation detector		○	Ditto
Main transformer	Single phase 25 kVA x 3 Voltage 440/13.2kV	○		Standard of the Philippine National Electrification Agency
Switchgear	3 phase load isolating switch with Voltage 24 kV	○		Ditto
Distribution line (grid connection line)	3 phase 4 line, 13.2kVA New 2.9 km Repaired 9.3 km	○		Ditto
Distribution pole	Steel pole	○		Ditto
Electricity meter, etc.	Instrumentation transformer Instrumentation current transformer Integrating electricity meter	○		Ditto
Gate		○		

2) Spare Parts

The spare parts and maintenance and repair tools that are required to ensure the sustained effect of the Project will be supplied. Spare parts are basically divided into expendable parts and replacement parts. In the Project, expendable parts (enough for one replacement) necessary for operation such as lamps and fuses, etc. will be supplied together with the following replacement parts.

Table 2-9 List of Spare Parts

Parts	Quantity
Ceramic Bearing	For 2 units
Seal, O-ring	For 2 units
Pillow Block	For 2 units
Push Button, Lump	1 Set

3) Defect Liability

All the equipment and materials procured in the Project will require defect warranty. Moreover, the period of defect warranty will be one year.

2-2-4-8 Operation Guidance Plan

1) Guidance method

An operation and maintenance manual will be prepared and guidance will be conducted for operators at the times of installation adjustment, testing and trial operation.

2) Contents

Guidance will be conducted on equipment adjustment methods when installing the equipment and when conducting overhauls.

Guidance will be conducted on start-up method, operating method, output setting method, stopping method and method for restoring operation after simple troubles and so on. Guidance will be offered on operating records and patrol methods (check items). Guidance will be offered on items to be notified to makers when breakdowns occur.

3) Implementation plan

Around two weeks each will be spent on initial operational guidance at the times of installation adjustment, testing and trial operation.

Table 2-10 Implementation Plan of Initial Control Guidance and Operation Guidance

	Aug. 2014	Sep. 2014	Oct .2014	Remark
Installation of Equipment	▬▬	▬▬		
Commissioning Test		▬▬	▬▬	

Out of the items in the equipment plan, Table 2-11 shows the equipment that needs to be installed and adjusted.

The installation works will mainly comprise fixing into place, electrical and piping works, etc., and the equipment procurement operator will bear the installation costs. Also, maker engineers will conduct initial operation guidance and operation control guidance.

Table 2-11 Equipment requiring Installation and Adjustment

Equipment	Quantity
① Equipment necessary for hydropower generating equipment ・ Turbine ・ Generator ・ Power factor improvement capacitor	2 units
② Equipment required for the distribution panel switchgear ・ Generator panel ・ Transformer panel ・ Power supply panel ・ Power transmission panel	1 set
③ Equipment required for the outdoor transformation equipment ・ Transformer ・ Lightning conductor ・ Load disconnecting switch ・ Instrumentation transformer ・ Instrumentation current transformer ・ Energy meter	1 set
④ Equipment required for distribution ・ Distribution poles ・ Power line ・ Mounting hardware ・ Branch line	1 set

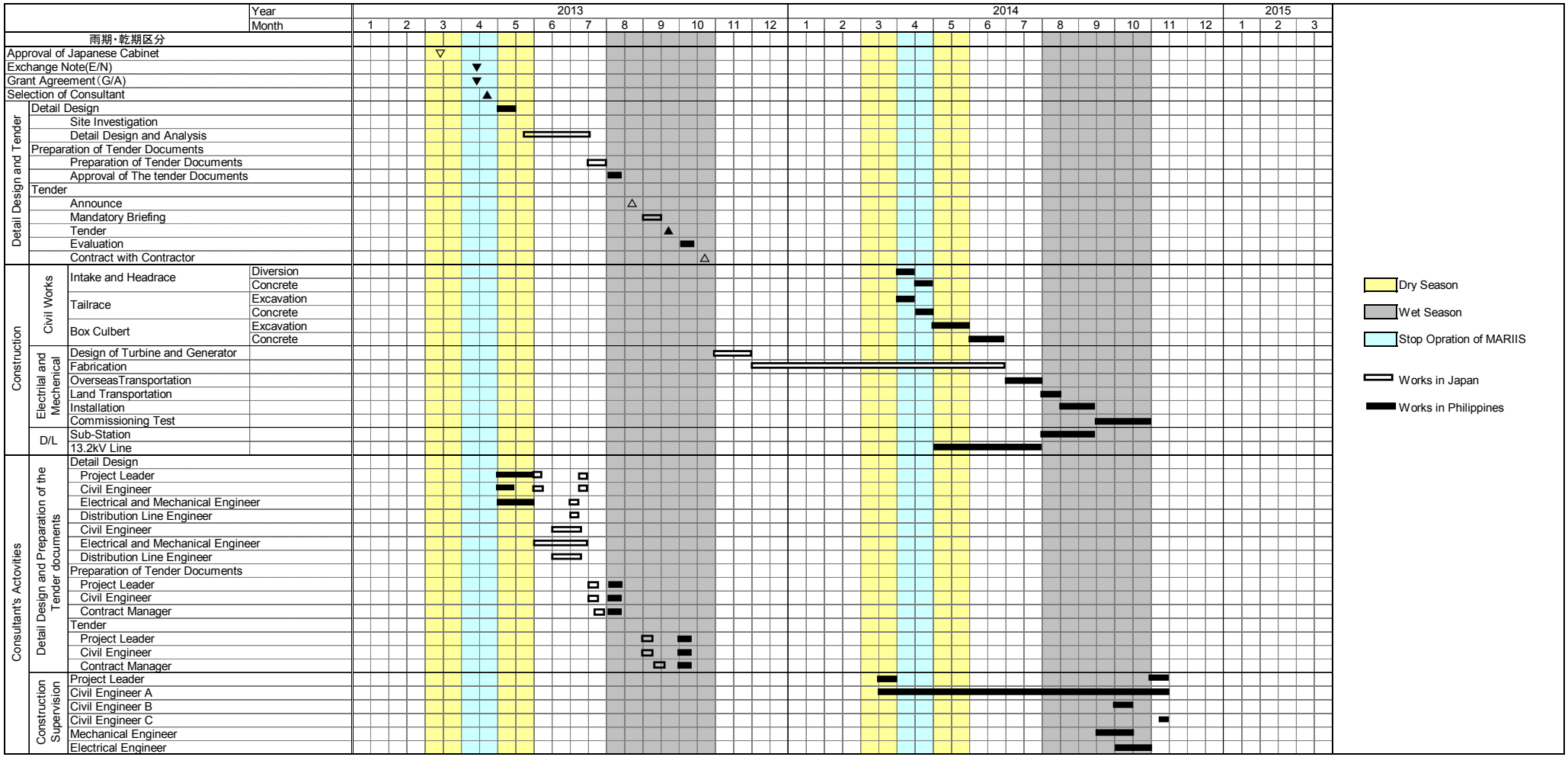
2-2-4-9 Soft Component (Technical Assistance) Plan

No soft component or technical assistance program will be applied to the Project..

2-2-4-10 Implementation Schedule

The Project will be implemented over three fiscal years as shown in Table 2-12.

Table 2-12 Work Implementation Schedule



2-3 Obligation of Recipient Country

In the Project, the following tasks will be the scope of works on the Philippine side.

(1) Signing of MOA

The JICA grant aid implementing agency is the Department of Energy (DOE), which will be responsible for implementation from survey through to construction. NIA-MARIIS will conduct operation and maintenance of the hydropower plant after handover. As attached in Appendix-5, Memorandum of Agreement between the DOE and the NIA was concluded on December 11, 2012. The MOA describes outline of the Project and agreed duties and responsibilities of DOE and NIA as summarized below.

(2) Authorization procedure concerning the hydropower development

In accordance with the Renewable Energy Act of the Philippines, various authorization procedures necessary for the hydropower development will be conducted as shown in Table 2-13.

Table 2-13 Authorization Procedures Needed for the Hydropower Development

Application/Authorization (Clearance Agencies)	Contents of Authorization	Responsible Implementing Agency	Necessary Period	Items to Consider in the Study
1. LGU Endorsement (PLGU,MLGU,Brangay)	Approval by municipality, barangay and provincial assemblies	MARIIS	1 week at shortest	Give timely reports on the survey progress and reach a basic consensus.
2. Right of Way (Land Owners)	Land acquisition/compensation	MARIIS	Around 3 months	Stage public explanation meetings according to the survey progress and reach a basic consensus.
3. NCIP Certification FPIC (NCIP)	Approval of indigenous people's organizations	MARIIS	55 days	Ditto, and reporting on the survey progress to the National Commission on Indigenous People
4. Environment Compliance Certificate (DENR)	Demonstration of environmental compliance	MARIIS	Around 20 days	In the case of flow-in type, a Certificate of Non-Coverage (CNC) is issued in a short time.
5. Water Rights Permit (NWRB)	Water rights	MARIIS	Around 1 month	Permission is conditional on the CNC already being acquired.
6. Energy Sales Agreement (ERC)	Power sale contract	MARIIS & ISELCO-1	Around 2 months	Coordinate and attain a basic consensus with the distribution cooperative and transmission company during the study period. Finally, the contract is confirmed on provision of the ERC authorization stated below.
7. Renewable Energy Service / Operating Contract (DOE)	Power plant operating permission	MARIIS	43 days	FS report and items 1, 3, 4, 5 and 6 above are required as the attached documents.
8. Certificate of Compliance	Power sale price	MARIIS	60 days	FS report and items 1, 3, 4,

(ERC)	approval			5, 6 and 7 above are required as the attached documents.

(3) Construction of the operation and maintenance setup (by MARIIS)

The operation and maintenance setup for the mini hydropower plant will be constructed within the National Irrigation Administration Magat General Irrigation System Office (NIA-MARIIS) and staffed with personnel who possess the necessary skills.

During the construction period, as the Japanese side will conduct technical training on operation and maintenance methods, NIA-MARIIS will need to secure the required number of supervisors and operators through subscribing both inside and outside of the organization.

(4) Budgeting of operation and maintenance costs (by MARIIS)

The necessary budget for operating and maintaining the mini hydropower plant will be planned every year. Moreover, the necessary funds for conducting replacement and repair of major electrical and mechanical equipment in the long term will be secured.

(5) Administration of funds from power generation (by MARIIS)

The revenue gained from selling power generated by the hydropower plant will be used for repairing and rehabilitating the irrigation system (channels, gates, pumps, etc.).

(6) Tariff exemption procedure (by DOE)

When the Project is implemented, VAT budget measures will be taken. Also, during construction, procedure will be taken to exempt tariffs imposed on products imported to the Philippines.

Concerning VAT on grant aid projects conducted after July 2000 in the Philippines, the governments of both countries have agreed that, “VAT will not be exempted but will be borne by the implementing agency in the Philippines (in this case, the DOE).”
In the Project, the DOE and Survey Team held a number of discussions and the DOE promised to secure the necessary budget.

(7) Procedure for issue of a banking agreement and authority to pay (by DOE)

When the Project is implemented, a banking agreement and authorization to pay will be issued.

(8) Other points

- Exemption of taxes on overseas nationals including Japanese nationals involved with the Project (by DOE)
- Bearing of all items not covered by Japan's grant aid during implementation of the Project (by DOE)
- Adjustment, application and approval with various related agencies (by DOE & MARIIS)

2-4 Project Operation Plan

2-4-1 Organization of Project Operation

Fig. 2-6 shows the organization chart of MARIIS. This shows the Administrative & Finance Division, Engineering & Operation Division, Dam & Reservoir Division and four field office divisions organized under the MARIIS Office of the Operation Manager. The Magat-C and Lateral-B sites are under the jurisdiction of Field Office Division II.

Source : NIA-MARIIS

Fig. 2-6 MARIIS Organization Chart

The Engineering & Operation Division and Dam & Reservoir Division are responsible for managing the power plant in the Project. (see Fig. 2-7)

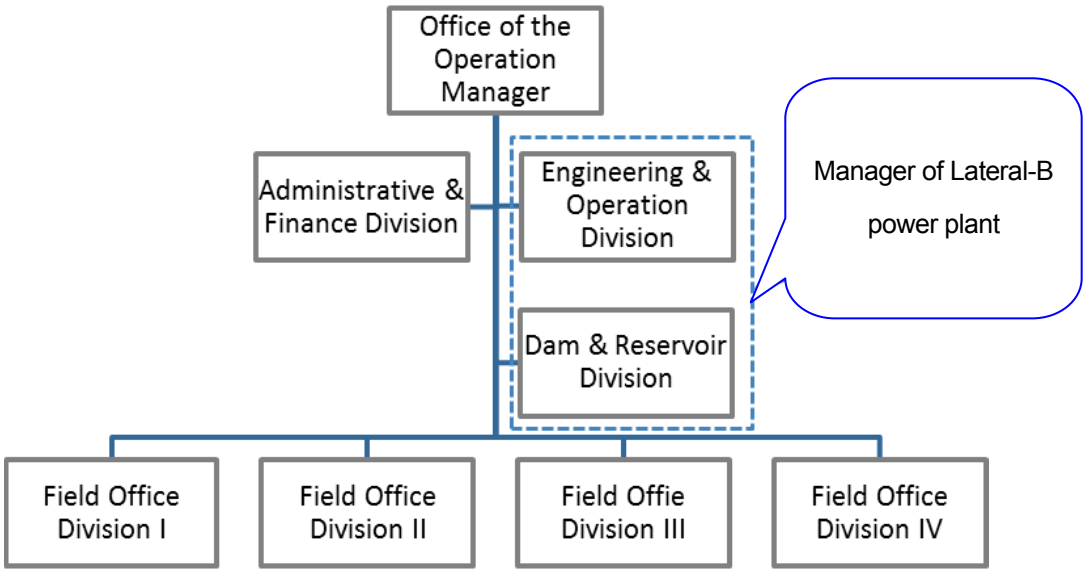


Fig. 2-7 Mini Hydropower Plant Operation and Maintenance by MARIIS

2-4-2 Organization of Power Plant Operation

In discussions with the DOE, NIA and MARIIS during the preparatory survey, the operation and maintenance setup of the power plant was confirmed as shown in Fig. 2-8. Table 2-14 indicates the roles of each staff member.

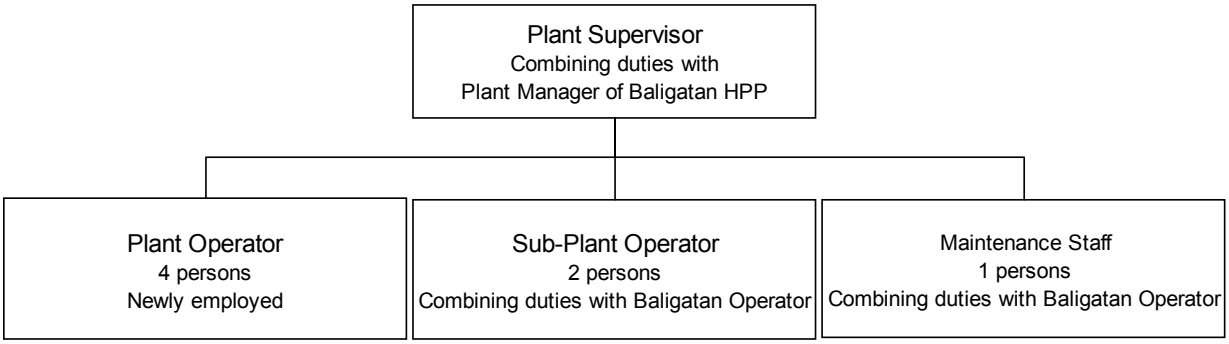


Fig. 2-8 Lateral-B MHPP Operation and Maintenance Setup

Table 2-14 Hydropower Plant Operation and Maintenance Personnel

Position	Role
Plant Supervisor	Person responsible for operation and maintenance of the hydropower plant Combining duties as the existing manager of Baligatan power plant
Plant operators (4 members)	Operation and maintenance of the hydropower plant Patrolling, maintenance and repair of generating equipment and recording of generated electrical energy 8-hour shifts by 1 member at a time
Emergency plant operators	2 members: combining existing duties at Baligatan power plant
Maintenance staff	Combining existing duties at Baligatan power plant

2-5 Project Cost Estimation

2-5-1 Initial Cost Estimation

In the case where the Project is implemented under the grant aid scheme, the portion of costs that will need to be borne on the Philippine side will be as follows. However, this amount does not represent the grant limit stated in the E/N.

(1) Cost burden on Japan side

This cannot be disclosed until the construction and procurement contracts are certified.

(2) Cost burden on the Philippine side

Table 2-15 Cost Burden of the Host Country

Cost Item/Contents	Amount		Remarks
	(1000 Php)	(Approx. 1000 yen)	
Commission based on the bank agreement (A/P commission fee, B/A commission fee)	77	156.31	DOE
VAT on locally procured materials	538	1,092.14	Ditto
Subtotal	615	1248.45	
Authorization fees	1,700	3,451.00	NIA-MARIIS
Initial year operating expenses (personnel expenses, repair cost, etc.)	817	1,658.51	Ditto
Subtotal	2,517	5,109.51	
Total	3,132	6,357.96	

(3) Estimation conditions

① Estimation point: October 2012

② Exchange rate: 1.0 Php = 2.03 JPY (mean rate for the past 6 months at the estimation point)

③ Price fluctuation factor

The price fluctuation factor from the estimation point to the tender month was calculated as follows based on the IMF inflation average consumer prices for 2011 and 2012. As a result, the price fluctuation factor came to 1.033.

④ Construction and procurement period

Table 2-15 shows the detailed design and the construction schedule.

⑤ Others

Estimation was implemented based on the Government of Japan's Grant Aid scheme.

Table 2-16 Setting of Exchange Rate (JPY/Php) and Price Fluctuation Factor

Month	2012 April	May	June	July	August	September	Mean
JPY/Php	2.07	2.02	2.01	2.04	2.03	2.03	2.03

According to Mitsubishi UFJ Research and Consulting Co., Ltd. "Customer Foreign Exchange Rates Published by Mitsubishi Tokyo UFJ Bank" and "Local Reference Foreign Exchange Rates"

2-5-2 Operation and Maintenance Cost

Since NIA-MARIIS has operated Baligatan power plant for many years and its plant supervisors and operators have plentiful experience in plant operation, there will be no problem regarding the maintenance setup.

Moreover, it is estimated that the total revenue from power sales from the Project mini hydropower plant will be around 892,000 Php. As is shown in Table 2-17, the annual cost of operation and maintenance will be around 817,000 Php, and it will be necessary to cover some of this out of the revenue from power sales.

Table 2-17 Operation and Maintenance Cost at Lateral-B Mini Hydropower Plant

Item	Contents			Annual Cost (1,000 Php)
Operation and maintenance personnel expenses	Operators	4	12,000 Php/person/month	576
Repair cost				241
Total				817

Chapter 3 Project Evaluation

3-1 Preconditions

The necessary permits and approval must be obtained from the following relevant agencies before the mini hydropower plant can go into operation. In the Project, NIA-MARIIS will need to advance the procedures for permits and approvals without delay in accordance with the Project progress. The time required for permit and approval procedures and the items that need to be considered in the Project are as indicated in Chapter 2 Table 2-13.

(1) Local Government Units Endorsement: LGUs
(2) Certificate of NCIP/FPIC: National Commission on Indigenous People (NCIP)
(3) Environmental Compliance Certificate :Environmental Management Bureau (EMB-DENR)
(4) Water Right Permit: National Water Resources Board (NWRB)
(5) Energy Sales Agreement: Energy Regulatory Commission (ERC)
(6) Renewable Energy Service / Operation Contract: Department of Energy (DOE)
(7) Certificate of Compliance: Energy Regulatory Commission (ERC)

The following paragraphs give an outline of permit and approval applications and the current situation regarding procedures for Lateral-B mini hydropower project.

(1) LGUs: LGU Endorsement

All administrative bodies at the provincial, municipal and barangay levels must be approached by the project implementing body to provide support, approval and relevant resolutions in writing. It will be necessary for the project implementing body to explain the planned contents of the project to the assembly of each LGU and/or communities (through community consultation meetings). The said body must submit documents, including a survey report, location map of the project site and planned contents of the project, with a view to obtaining approval. The said body must also obtain various permits, including a business permit, power plant operation permit and building permit, during the implementation of the project.

DOE, NIA-CO and Survey Team gave outline explanations of the Project to municipal and provincial agencies during the preparatory survey phase and obtained basic understanding.

(2) NCIP: NCIP Certification

The Indigenous People's Rights Act (IPRA Law; Act No. 8371) demands that any development in areas inhabited by indigenous people must obtain FPIC (free and prior informed consent) certification by means of disclosing the project contents and any other relevant information to stake holding communities of indigenous people. When the general consent of such communities is obtained based on the FPIC certification mechanism, the NCIP issues a Certification Precondition (CP) to the project implementing body.

Since there is no need to acquire additional land for the Project and the Project area is small (approximately 200 m^2), the FPIC should not be a hindrance to the Project, however, NIA-MARIIS will need to follow the application procedure according to the IPRA Law.

(3) EMB-DENR: Environment Compliance Certificate

The EMB is responsible for the issue of an environment compliance certificate in response to an application lodged by a project implementing body. There is an agreement between the DOE and DENR that the Certificate of Non-Coverage (CNC) arrangement is applicable to power generation projects of which the scale of development is 1.0 MW or lower. An application for a CNC must be accompanied by a project description report. According to the Procedural Manual for Environmental Impact Statement System (DAO 03-30), the CNC process is applicable to all run-of-river type hydropower generation projects regardless of the development scale for which the submission of a project description report is required.

Concerning the Project, NIA-MARIIS is due to make the application for issue of CNC.

(4) NWRB: Water Rights Permit

The NWRB issues a water rights permit to authorize a hydropower generating project which is classified under a special category of river water use to take a certain amount of water from the river concerned for the purpose of power generation. The CNC mentioned in c) above is required to obtain this water rights permit. After obtaining a permit, the project implementation body must pay an annual fee for its water use.

Concerning the Project, it will be necessary to conduct procedure for partially revising the purpose of water use. Application will be made following the official decision to implement the Project (E/N and G/A) and issue of CNC.

(5) DOE: Renewable Energy Service/ Operating contract

The Renewable Energy Act (Act No. 9513) makes the DOE responsible for the supervision of all renewable

energy development projects in the Philippines. The DOE issues permits concerning pre-development contracts for an investigation and service/operating contracts for a project implementation. Based on the same Act No. 9513, the DOE also provides some incentives, including special tax exemption, for developers to facilitate the development of renewable energy.

In the case of the Project, the DOE is the Project responsible agency and there is no need for a pre-development contract, however, it is necessary for NIA-MARIIS to obtain permission for the operating contract by the end of construction.

（6）Energy Sales Agreement（ESA）

In the Project, it is anticipated that power will basically be sold at FIT prices, however, the procedure up to FIT approval is unclear and it may be possible to bind a relative contract with the power distribution company (ISELCO). Whether the contract is the FIT type or relative type, the DOE will provide contract assistance.

(7) ERC: Certificate of Compliance (Approval of Unit Energy Sales Cost)

In accordance with the Electric Power Industry Reform Act (Act No. 9136), the ERC examines whether or not the wholesale unit price of electricity is appropriate and issues a certificate of compliance. A project implementation body must obtain this COC prior to the start of operation.

In the Project, ERC approval must be obtained by the end of construction. NIA-MARIIS (the Project operator) is the applying party, and the DOE plans on supporting the application procedure and providing additional explanations to the ERC.

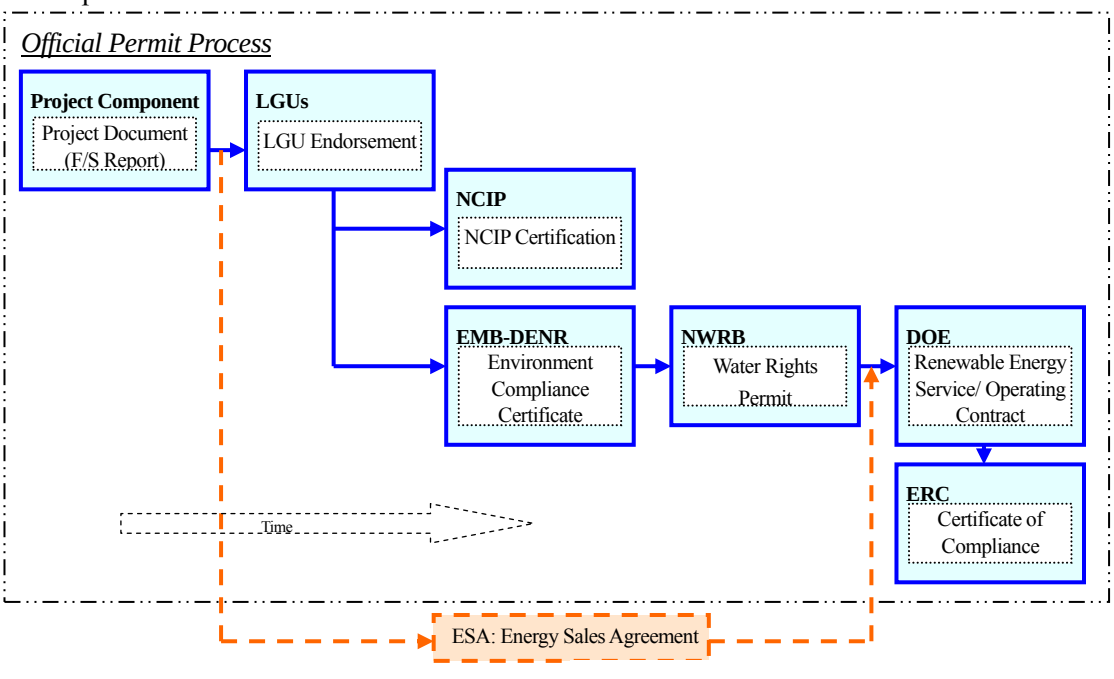


Table 3-1 Mini-hydro Permit Process Flow

3-2 Necessary Inputs by Recipient Country

The items that need to be implemented by the Philippine side in order to achieve the overall Project plan are separately described below according to the DOE (the responsible agency) and NIA-MARIIS (the implementing agency).

3-2-1 Inputs of DOE

(1) Cooperation with JICA concerning the Project implementation
(2) Support for legal procedures by NIA-MARIIS
(3) Verification of the validity of Project contents
(4) Support for consensus building activities by NIA-MARIIS
(5) Support for training of operators, etc.
(6) Ownership of the power generating facilities (completion of construction ~ handover to NIA-MARIIS)
(7) Support for power plant operation and maintenance conducted by NIA-MARIIS
(8) Bearing of VAT and handling of import tariff exemptions, etc. (see Chapter 3 Section 3-3)
(9) Opening of bank account and bearing of commission fees, etc. based on the banking agreement (see Chapter 3 Section 3-3)

3-2-1 Inputs of NIA-MARIIS

(1) Legal procedures
(2) Support for training of operators, etc.
(3) Bearing of costs linked to power plant maintenance (see Chapter 3 Section 3-3)

3-3 Important Assumptions

The Project is a pilot undertaking aimed at disseminating mini hydropower development utilizing idle drop in an irrigation area, and the external condition that will impact achievement of this objective is fluctuation in the irrigation flow.

Since the Project entails hydropower development dependent on irrigation water, the amount of power generated will depend on the size of irrigation flow, and this will be affected by rainfall and other weather conditions and the demand for water in the supply area. As is shown in Table 1-9, flow is subject to large

fluctuations.

Operation is schedule to commence in November 2014, however, it is difficult to accurately predict how the irrigation flow will vary beyond that, and the Project effect will be influenced by the irrigation flow.

3-4 Project Evaluation

3-4-1 Relevance

For the Philippines, which relies on imported fossil fuels to provide half of its power requirement, implementation of the Project is expected to promote the utilization of water resources-based renewable energy, contribute to improving energy security and help mitigate greenhouse gas emissions. Moreover, since this mini hydropower activity geared to promoting utilization of renewable energy is also compatible with the energy policy of the Philippines, the Project is deemed to be relevant.

At the same time, through adding to the experience of Japanese mini hydropower equipment makers, which possess technical capability but are having difficulty making overseas advances, the Project will be effective for demonstrating mini hydropower equipment and it will contribute to a new growth strategy that is based on the promotion of technical dissemination and overseas extension of makers.

3-4-2 Effectiveness

The anticipated outputs of Project implementation are as follows.

(1) Quantitative Evaluation

According to the policy that was described in Chapter 2 Section 2-2-1(7), the quantitative effect indicators for evaluating the Project effect have been set as shown in Table 3-1.

Table 3-2 Quantitative Effect Indicators

Indicator	Reference Value (2012)	Target Value (2018) [3 years after Project completion]
Generated electrical energy at the generating end (MWh/year)	0	151
Greenhouse gas emissions reduction (tCO_2/year)	0	74

(2) Qualitative Evaluation

None.

Appendices

1. Member of List of the Study Team
2. Study Schedule
3. List of Parties Concerned in the Recipient Country
4. Minutes of Discussions
5. MOA between DOE and NIA-CO

1. Member of List of the Study Team

Name	Task	Company
Kazunari Oshima	Project Leader	JICA
Naoto Furukawa	Project Management	JICA
Mitsuru Shimizu	Consultant Study Team Leader/Supervision/ Operation and Maintenance Plan/ Construction Plan	TEPSCO
Yukio Miyamoto	Hydropower Design A	TEPSCO
Hiroshi Kobayashi	Hydropower Design B	TEPSCO
Yukio Adachi	Electrical and Mechanical Facilities/Protection and Control	TEPSCO
Tomio Ichikawa	Transmission and Substation Facilities	TEPSCO
Kenichi Yoshida	Procurement Plan / Cost Estimation	JEM
Nobuki Hayashi	Environmental and Social Consideration	TEPSCO
Takashi Yanase	Economical and Financial Analysis	TEPSCO
Kiminori Nakamata	Natural Condition and Examination	TCEC

2. Study Schedule

(1) The 1st Mission Schedule

Date			JICA						Consultant				
			Planning Management	Leader	Consultant Leader	Hydropower-A	Environment	Hydropower-B	Procurement	Natural Condition	Economist	Electrical	Distribution
			N.FURUKAWA	K.OSHIMA	M.SHIMIZU	Y.MIYAMOTO	N.HAYASHI	H.KOBAYASHI	K.YOSHIDA	K.NAKAMATA	T.YANASE	Y.ADACHI	T.ICHIKAWA
1	29-Jul	San	Move to Manila										
2	30-Jul	Mon	Courtesy Call & Presentation of I/R for DOE-REMB,EOJ,JICA-Manila Pre-Meeting on Isabela Site with DOE-REMB										
3	31-Jul	Tue	Kickoff Meeting with DOE-REMB and NIA (Presentation about Japanese Grant Aid and the Projects)										
4	1-Aug	Wed	Discussion with DOE (Project Proponent, Project Site in Isabela, Schedule of Site Survey)										
5	2-Aug	Thu	Discussion of MD			Data Collection (DENR, NIA)							
6	3-Aug	Fri	Signing of MD			Data Collection (DENR, NIA)							
7	4-Aug	Sat	Back to Tokyo	Team Internal Meeting					Move to Manila				
8	5-Aug	Sun		Move to Ifugao									
9	6-Aug	Mon		Courtesy Call for Government of Ifugao (Presentation about Japanese Grant Aid and the Likud Project)									
10	7-Aug	Tue		Stakeholder Meeting				Site Study of Ambangal MHP					
11	8-Aug	Wed		Barangay Consultation/ Move to Isabela									
12	9-Aug	Thu		Courtesy Call for Government of Isabela (Presentation about Japanese Grant Aid and the Project)									
13	10-Aug	Fri		Site Reconnaissance/Stakeholder Meeting (if necessary)					Preparation of Local Contract				
14	11-Aug	Sat		Back to Tokyo	Team Internal Meeting								
15	12-Aug	Sun			Data Arrangement								
16	13-Aug	Mon			Site Reconnaissance		Meeting w Proponent	Survey on Electric Demand and Supply Local Materials	Procurement Survey	Site Reconnaissance			
17	14-Aug	Tue			Contract w Local	Site Reconnaissance	Contact w Local						
18	15-Aug	Wed			Move to Ifugao								
19	16-Aug	Thu			Survey on Condition of Construction	Survey on Structures	Survey on Regal Procedure						
20	17-Aug	Fri						Move to Ifugao					
21	18-Aug	Sat			Team Internal Meeting								
22	19-Aug	Sun			Data Arrangement								
23	20-Aug	Mon			Survey on Condition of Construction Grid Connection	Survey on Electric Demand and Supply Local Materials	Survey on Regal Procedure Project Organization Environment	Survey on Electric Demand and Supply Local Materials	Procurement Survey	Geological Survey			
24	21-Aug	Tue											
25	22-Aug	Wed											
26	23-Aug	Thu											
27	24-Aug	Fri											
28	25-Aug	Sat			Team Internal Meeting								
29	26-Aug	Sun			Data Arrangement								
30	27-Aug	Mon			Survey on Condition of Construction	Survey on Electric Demand and Supply	Survey on Regal Procedure Project Organization	Survey on Electric Demand and Supply Local Materials	Procurement Survey	Geological Survey			
31	28-Aug	Tue											
32	29-Aug	Wed			Stakeholder Meeting (Result of 1st Survey)								
33	30-Aug	Thu			Move to Isabela			Move to Manila	Move to Isabela	Move to Manila			
34	31-Aug	Fri			Stakeholder Meeting (Result of 1st Survey)			Back to Tokyo	Data Collection	Back to Tokyo			
35	1-Sep	Sat			Move to Manila				Move to Manila				
36	2-Sep	Sun			Data Arrangement				Data Arrangement				
37	3-Sep	Mon			Additional Data Collection				Data Collection				
38	4-Sep	Tue											
39	5-Sep	Wed			Preparation of 1st Site Survey Report (Draft)				Preparation of 1st Site Survey Report (Draft)				
40	6-Sep	Thu											
41	7-Sep	Fri											
42	8-Sep	Sat											
43	9-Sep	Sun											
44	10-Sep	Mon			Report to DOE-REMB,NIA,JICA-Manila,EOJ				Report				
45	11-Sep	Tue			Back to Tokyo				Back to Tokyo				
					45	45	45	34	39	28	0	0	0

(2) The 2nd Mission Schedule

Date			Consultant								
			Consultant Leader	Hydropower-A	Environment	Hydropower-B	Natural Condition	Procurement	Distribution	Economist	Electrical
			M.SHIMIZU	Y.MIYAMOTO	N.HAYASHI	H.KOBAYASHI	K.NAKAMATA	K.YOSHIDA	T.ICHIKAWA	T.YANASE	T.ICHIKAWA
1	30-Sep	San	Move to Manila								
2	1-Oct	Mon	Meeting with DOE-REMB			Move to Manila					
3	2-Oct	Tue	Move to Isabela			Move to Isabela					
4	3-Oct	Wed	Stakeholder Meeting			Stakeholder Meeting				Move to Manila	
5	4-Oct	Thu	Additional Survey			Additional Survey				Meeting w/DOE&NIA	
6	5-Oct	Fri	Move to Ifugao			Move to Ifugao				NEDA	
7	6-Oct	Sat	Internal Meeting		Move to Manila	Internal Meeting		Move to Manila		Data Arrangement	
8	7-Oct	Sun	Data Arrangement		Move to Ifugao	Data Arrangement		Move to Ifugao			
9	8-Oct	Mon	Stakeholder Meeting				Additional Survey in Ifugao				
10	9-Oct	Tue	Barangay Consultation				Additional Survey in Ifugao				
11	10-Oct	Wed	Additional Survey in Ifgao			Move to Isabela	Addditional Survey	Move to Isabela			
12	11-Oct	Thu	Additional Survey in Ifgao			Additional Survey	Addditional Survey	Additional Survey			
13	12-Oct	Fri	Additional Survey in Ifgao			Additional Survey	Addditional Survey	Additional Survey			
14	13-Oct	Sat	Move to Manila								
15	14-Oct	Sun	Data Arrangement				Back to Tokyo				
16	15-Oct	Mon	Seminor on Hydropower Development utilizing Irrigation Canal								
17	16-Oct	Tue	Additional Survey in Manila								
18	17-Oct	Wed	Preparation of Site Report								
19	18-Oct	Thu	Preparation of Site Report								
20	19-Oct	Fri	Explanation of Results of Survey (DOE,JICA,EOJ)								
21	20-Oct	Sat	Back to Tokyo								
Total			21	21	15	20	14	9	9	12	0

(3) The 3rd Mission Schedule

Date (Tentative)			JICA		Consultant								
			Planning Management	Leader	Consultant Leader	Hydropower-B	Environment	Hydropower-A	Natural Condition	Procurement	Distribution	Economist	Electrical
			N.FURUKAWA	K.OSHIMA	M.SHIMIZU	H.KOBAYASHI	N.HAYASHI	Y.MIYAMOTO	K.NAKAMATA	K.YOSHIDA	T.ICHIKAWA	T.YANASE	T.ICHIKAWA
1	2-Dec	San			Move to Manila								
2	3-Dec	Mon			Meeting with DOE-REMB								
3	4-Dec	Tue			Meeting with NIA-CO								
4	5-Dec	Wed			Move to Isabela								
5	6-Dec	Thu			Additional Survey for Lateral-B								
6	7-Dec	Fri			Meeting with MARIIS								
7	8-Dec	Sat			Move to Ifugao		Move to Manila						
8	9-Dec	Sun			Data Arrangement		Move to Ifugao						
9	10-Dec	Mon			Stakeholder meeting in Ifugao								
10	11-Dec	Tue			Additional Survey and data collection								
11	12-Dec	Wed			Additional Survey and data collection								
12	13-Dec	Thu			Barangay Consultation in Ifugao								
13	14-Dec	Fri			Move to Manila								
14	15-Dec	Sat			Data Arrangement								
15	16-Dec	Sun	Move to Manila		Data Arrangement								
16	17-Dec	Mon	DOE-REMB, NIA-CO		Meeting with DOE-REMB & NIA-CO								
17	18-Dec	Tue	NIA-CO		Additional Survey in Manila								
18	19-Dec	Wed	NIA-CO		Preparation of Site Report								
19	20-Dec	Thu	MD Signning DOE-REMB, NIA-CO		Preparation of Site Report								
20	21-Dec	Fri	Back to Tokyo		Explanation of Results of Survey (DOE,JICA,EOJ)								
21	22-Dec	Sat			Back to Tokyo								
Total			7	7	21	21	15						

3. List of Parties Concerned in the Recipient Country

Name of Organization	Division	Name
NATIONAL		
Department of Energy (DOE)	Undersecretary	Atty. Jose M. Layug, Jr.
DOE	Director of Renewable Energy Management Bureau (REMB)	Mr. Mario C. Marasigan
DOE	Division chief of Hydropower & Ocean Energy Management Division (HOEMD)	Mr. Ronnie N. Sargento
DOE	HOEMD	Mr. Epifanio E. Gacusan Jr.
DOE	HOEMD	Mr. Rey Salvania
DOE	HOEMD	Mr. Jowil Rodrigues
National Irrigation Administration (NIA)	Administrator	Mr. Antonio S. Nangel
NIA	NIA-CO Engineering & Operation Sector, Operations Department, Irrigation Engineering Center	Mr. B.S. Labiano
NIA	NIA-CO	Ms. Eden P. Bulatao
NIA	NIA-CO	Mr. Roneo F. Solis
EOJ	Trade and Commercial Attache	Mr. Kenichiro Koreeda
JICA Philippines Office	Senior Representative	Mr. Susumu Ito
JICA Philippines Office	Representative	Mr. Katsumasa Hamaguchi
JICA Philippines Office	Representative	Mr. Hiroyuki Matsuda
JICA Philippines Office	Program Manager	Mr. Floro O. Adviento
JICA Philippines Office	Program Officer	Mr Juan Paulo M. Fajardo
ISABELA		
Magat River Integrated Irrigation System (NIA-MARIIS)	Acting Operations Manager	Mr. Helsy S. Bermudez
NIA-MARIIS	Manger, Engineering & Operation Division	Mr. Wilfredo C. Gloria
NIA-MARIIS	Principal Engineer C, Engineering & Operation Division	Mr. Josue A. Sabio

NIA-MARIIS	Manager, Dam & Reservoir Division	Mr. Florentino C. Baniqued, Jr.
NIA-MARIIS	Manager, Admin & Finance Division	Ms. Erlinda B. Dizon
NIA-MARIIS	Manager, Division II	Mr. Dalawampu
Isabela Electric Cooperative I (ISELCO I)	General Manager	Engr. Virgilio L. Montano
ISELCO I	OIC, Technical Services Dep.	Engr. Roman L. Flores
ISELCO I	Area Engr.	Engr. Abraham C. Balingue
Province of Ilagan, Isabela	Provincial Planning & Development Coordinator	Mr. Nestor O. Salvador
DENR-EMB Provincial, Isabela	Provincial Environmental Management Office, Isabela	Mr. Prowle C. Castanela
NCIP, Isabela	NCIP provincial officer	Ms. Barbara G. Garcia
Municipal of San Mateyo Environmental Office (MENRO)	Environmental Management Specialist I	Mr. Henry B. Magno
Municipality of San Mateyo	Mayor	Ms. Crispina R. Agcaoili
Municipality of San Mateyo	Vice-Mayor	Mr. Roberto C. Agcaoili
Municipality of San Mateyo	OIC, Municipal Engineer	Mr. Edgar G. Tagueban
Municipality of San Mateyo	OIC Mun. Plannin & Dev. Coordinator	Engr. Augustus C. Cruz

4. Minutes of Discussions

Minutes of Discussions
on the Preparatory Survey
for Mini-Hydropower Development Project
in the Philippines
(for Micro/Mini Hydropower Development Project on Irrigation Canal)

In response to the request from the Government of the Republic of the Philippines, the Japan International Cooperation Agency (hereinafter referred to as "JICA"), in consultation with the Government of Japan, decided to conduct a Preparatory Survey (hereinafter referred to as "the Survey") for two project ("Mini-Hydropower Project in the Province of Ifugao", and "Micro/Mini Hydropower Development Project on Irrigation Canal"). This minutes of Discussions is agreed for the Micro/Mini Hydropower Development Project on Irrigation Canal (hereinafter referred to as "the Project").

JICA sent to the Republic of the Philippines the Preparatory Survey Team (hereinafter referred to as "the Team"), headed by Mr. Kazunari OSHIMA, In-house consultant of Electric Power Division, Natural Resources and Energy Group, Industrial Development and Public Policy Department, JICA. The Team is scheduled to stay in the country for 1st mission from July 29 to September 11th, 2012.

Both sides agreed that the final terms and agreements necessary to implement the Project shall be subject to full government authorization and consent of appropriate government signatories. Finally, upon obtaining requisite final authorities therefor, both sides agree that they shall cooperate fully and do all such further acts and things and execute and deliver any further documents that may be necessary to give effect to the transactions contemplated under the Project.

The Team held discussions with the officials of concerned authorities in the Philippines (hereinafter referred to as "the Philippines side"). In the course of the discussions, both sides have confirmed the main items described in the sheets attached hereto.

Makati, August 3rd, 2012

Mr. Susumu Ito
Senior Representative
Japan International Cooperation Agency

Atty. Jose M. Layug, Jr.
Undersecretary
Department of Energy

Mr. Antonio S. Nangel
Administrator
National Irrigation Administration

Mr. Naoto Furukawa
Deputy Assistant Director
Japan International Cooperation Agency

Mr. Mario C. Marasigan
Director
Department of Energy – Renewable Energy Management Bureau

ATTACHMENT

The Team explained that the Project will be conducted under the Japanese Grant Aid Program aiming at promoting "Green Growth", which the Government of Japan puts stress on, by introducing mini-hydropower plant with elaborated technologies of Japan.

1. Objective of the Project

The objectives the Project is to contribute to energy diversity, to CO_2 reduction, and to enhance electrification with mini-hydro power generation in irrigation area.

2. Selection of Locations of Project

The Team explained that candidate of the project site was selected according to the following criteria on the condition that no negative impact would be caused by the project over normal function of irrigation canal system.

- Effective head : should be 2m or more
- Installed capacity : should be 100kW or more
- Power discharge : should be stable through the year
- Distance from power grid : should be within 10km from major load center
- Access : should be easy for heavy load transport
- Land acquisition : should be none or easy (no compensation is preferable)

According to the criteria, MAGAT-C was selected as the project site. The Philippines side and the Team (hereinafter referred to as "Both side") agreed it.

The project site is located in Isabera province as shown in Annex-1.

3. Responsible and Implementing Organizations

(1) The responsible organization is Department of Energy (DoE).
(2) The implementing organization is National Irrigation Administration (NIA).

The Organization Structures of DoE, and NIA is shown in Annex-2 , and Annex-3.

As for the other organizations such as owner of mini-hydropower plant, and operation and maintenance, the Philippines side shall be responsible for the preparation and execution of the MoA among these organizations. The Team requested the Philippines side that the MoA shall be given to the Team by September 10th, 2012.

4. Component of the Project

(1) Items originally requested by the Philippines Side are as follows.
   a) Conducting hydropower potential study along National Irrigation System
   b) Construction and installation of mini-hydropower pilot plant utilizing National Irrigation System
   c) Connecting power system to 13.8kV distribution lines
   d) Overseas study tour and training
(2) Based on discussion, Both side confirmed requested components as follows.
   a) Construction and installation of mini-hydropower pilot plant utilizing National Irrigation System
   b) Connecting power system to 13.8kV distribution lines
   c) Training in Philippines

The Team explained that the requested components are considered as candidate components to be implemented. However, the items of the components might be adjusted due to the budget frameworks of the Japanese side and result of the survey.

5. Japan's Grant Aid Scheme

(1) JICA confirmed that the Philippines side understood Japan's Grant Aid Scheme explained by the Team as described in Annex-4 and 5.

(2) The Philippines side will take the necessary measures, as described in Annex-6, for smooth implementation of the Project as prerequisites for the Japan's Grant Aid to be implemented.

6. Schedule of the Survey

The Team will continue the Survey in Philippines until September 11th, 2012.

7. Environmental and Social Considerations

(1) The Philippines side agreed to comply with the JICA Guidelines for Environmental and Social Considerations (April 2010) (hereinafter referred to as "JICA Guidelines") as well as laws and regulations in the Philippines.

(2) The Philippines side agreed to make necessary arrangements with concerned governmental organizations in order to secure funding for and execution of the above environmental matters in a schedule as required for smooth execution of the Project if necessary.

8. Other Relevant Issues

(1) Status of the Survey

The Team explained that the purpose of the Survey is to collect information and data necessary for the outline design and cost estimation of the Project components which are confirmed through the Survey and the analysis in Japan.

(2) Progress of preparatory works for the Project

The Philippines side agreed to undertake preparatory works necessary for the Project including land acquisition if necessary. The preparatory works shall be completed no later than six months from the conclusion of Grant Agreement (G/A).

(3) Budget for operation and maintenance

The Team emphasized that it is essential for the Philippines side to secure the necessary budget for operation and maintenance based on periodical overhaul and preventive maintenance program including major overhauls of equipment to be procured under the Project in order to ensure long-term stable power supply. The Philippines side has fully understood and committed to secure budget allocation especially until the plant operation starts.

(4) Enhancement of structure for operation and maintenance

The Team emphasized that the establishment of an operation and maintenance structure with the allocation of enough number of qualified engineers and skilled technicians who will be in charge of operating and maintaining the new facilities is a crucial factor for implementation of the Project. The Philippines side understood its importance.

(5) Counterpart personnel

The Team requested the Philippines side that the necessary number of counterpart personnel shall be assigned to the Team and necessary arrangements with related organizations shall be made during the Survey in Philippines. The Philippines side agreed to support the Team based on the request.

(6) Questionnaires

The Team requested the Philippines side that the answers to the questionnaires which the

Team had already submitted to the Philippines side shall be given to the Team by September 10th, 2012.

(7) Customs and tax exemption

The Philippines side understands that it shall be fully responsible on exemption of taxes, custom duties and any other levies imposed in the Republic of Philippines, in case the Project is implemented.

(8) Skill enhancement for the Project

The Philippines side considered the Project as a pilot project. Through implementing the Project, the Philippines side intends to enhance the skill of survey and design for irrigation power generation, prioritization and evaluation of potential sites. The Team understands that, and the Team suggested the training in the Philippines under the grant aid scheme. The Philippines side agreed it.

(End)

Annex-1	Project Site
Annex-2	Organization Chart of DoE
Annex-3	Organization Chart of NIA
Annex-4	Japan's Grant Aid
Annex-5	Flow Chart of Japan's Grant Aid Procedures
Annex-6	Major Undertakings to be taken by Each Government

Minutes of Discussions
on the Preparatory Survey
for Mini-Hydropower Development Project
in the Philippines
(for Micro/Mini Hydropower Development Project on Irrigation Canal)
(Explanation on Draft Final Report)

In response to the request from the Government of the Republic of the Philippines, the Japan International Cooperation Agency (hereinafter referred to as "JICA"), in consultation with the Government of Japan, decided to conduct a Preparatory Survey (hereinafter referred to as "the Survey") for two projects ("Mini-Hydropower Project in the Province of Ifugao", and "Micro/Mini Hydropower Development Project on Irrigation Canal"). This minutes of Discussions is agreed for the Micro/Mini Hydropower Development Project on Irrigation Canal (hereinafter referred to as "the Project").

JICA conducted a first field survey from July 29 to September 11, 2012. Second field survey was conducted from September 30 to October 20, 2012. Through discussions, field surveys and with the result of technical examination in Japan, JICA prepared a Draft Final Report of the Survey.

In order to explain and to consult with the officials of concerned authorities in the Philippines (hereinafter referred to as "the Philippines side") on the contents of the Draft Final Report, JICA dispatched to the Philippines the Preparatory Survey Team for Draft Final Report Explanation (hereinafter referred to as "the Team"), which is headed by Mr. Kazunari OSHIMA, In-house consultant of Energy and Mining Division I, Natural Resources and Energy Group, Industrial Development and Public Policy Department, JICA. The Team is scheduled to stay in the Philippines from December 2 to 22, 2012.

Both sides agreed that the final terms and agreements necessary to implement the Project shall be subject to full government authorization and consent of appropriate signatories. Finally, upon obtaining requisite final authorities therefor, both sides agree that they shall cooperate fully and do all such further acts and things and execute and deliver any further documents that may be necessary to give effect to the transactions contemplated under the Project.

The Team held discussions with the officials of concerned authorities in the Philippines side. In the course of the discussions, both sides have confirmed the main items described in the sheets attached hereto.

Makati, December 21, 2012

Mr. Susumu Ito
Senior Representative
Japan International Cooperation Agency

Mr. Ramon Allan V. Oca
Undersecretary
Department of Energy

Mr. Antonio S. Nangel
Administrator
National Irrigation Administration

Mr. Naoto Furukawa
Deputy Assistant Director
Japan International Cooperation Agency

Mr. Mario C. Marasigan
Director
Department of Energy – Renewable Energy Management Bureau

ATTACHMENT

The Philippines side has recognized, as the Embassy of Japan in the Philippines explained, that the Project will be conducted in accordance with the "Green Growth" policy by the Government of Japan, which emphasizes on utilization of the elaborated products, such as hydro turbines, fabricated by Japanese small, medium scale enterprise.

1. Objectives of the Project

The objectives of the Projects are to contribute to energy diversity, to CO_2 reduction, and to enhance electrification with micro-hydro power generation in irrigation area.

2. Selection of Locations of Project

Initially MAGAT-C had been selected as the project site. But according to the letter from DoE on the 22 November, 2012, Lateral-B is finally selected as the project site. The Philippines side and the Team (hereinafter referred to as "Both side") agreed it.

The project site is located in Isabera province as shown in Annex-1.

3. Contents of the Draft Final Report

The Philippines side agreed and accepted in principle the contents of the Draft Final Report and the Draft Technical Specifications for the Project explained by the Team.

4. Responsible and Implementing Organizations

(1) The responsible organization is Department of Energy (DoE).
(2) The implementing organization is National Irrigation Administration (NIA).

The Organization Structures of DoE, and NIA are shown in Annex-2 , and Annex-3. Actual implementing organization is NIA-MARIIS (Magat River Integrated Irrigation System), under NIA-Central Office (CO). NIA-CO has the responsible to supervise NIA-MARIIS.

As for the other arrangement such as ownership of micro/mini hydropower plant, and for operation and maintenance, the Philippines side has the responsibility for undertaking MoA (Memorandum of Agreement) with organizations in charge. The Team requested the Philippines side that the signed MoA shall be given to the Team by December 21, 2012.

5. Components of the Project

The following are selected as the Project Components.

(1) Construction and installation of micro/mini hydropower pilot plant utilizing National Irrigation System (2x22.5kW)
(2) Connecting power system to 13.8kV distribution lines

6. Confidentiality of the Project

(1) Project Cost

The Team explained the estimated cost of the Project as described in Annex-4. The Philippines side also agreed that the cost for the Project contains procurement cost of equipment, construction cost of facility, transportation cost up to the Project site, installation cost and the Consultant fees.

The Philippines side agreed that the cost for the Project should not exceed the amount agreed in the Exchange of Notes (E/N) to be signed between the governments. The Philippines side understood that the estimated cost for the Project attached as Annex-4 is not the final and is subject to change as a result of the detailed design to be implemented after the E/N.

(2) Detailed specifications of the Facilities and Equipment

Both sides agreed that all information related to the Project including estimated cost,

detailed drawings and specifications of the facilities and equipment, and other technical information shall not be disclosed to any outside parties (i.e. outside of JICA and the Philippines side) before the conclusion of all contract(s) for the Project.

7. Possibility of Change in Scope, Schedule and Cost of the Project

The Team stressed that scope, schedule, and cost for the Project are tentative and subject to change due to the domestic circumstances in Japan and in the Philippines. The Philippines side understood it.

8. Japan's Grant Aid Scheme

(1) JICA confirmed that the Philippines side understood Japan's Grant Aid Scheme explained by the Team as described in Annex-5 and 6.

(2) The Philippines side will take the necessary measures, as described in Annex-6, for smooth implementation of the Project as prerequisites for the Japan's Grant Aid to be implemented.

9. Environmental and Social Considerations

(1) The Philippines side agreed to comply with JICA Guidelines for Environmental and Social Considerations (April 2010) (hereinafter referred to as "JICA Guidelines") as well as laws and regulations in the Philippines.

(2) The Philippines side agreed to make necessary arrangements with concerned governmental organizations in order to secure funding for and execution of the above environmental matters in a schedule as required for smooth execution of the Project if necessary.

10. Other Relevant Issues

(1) Progress of preparatory works for the Project

The Philippines side agreed to undertake preparatory works necessary for the Project including any authorization procedure. The preparatory works shall be completed no later than six months from the conclusion of Grant Agreement (G/A).

(2) Budget for operation and maintenance

The Team explained estimated cost of operation and maintenance for micro/mini hydropower pilot plant, which is written in Draft Final Report. In addition, the Team emphasized that it is essential for the Philippines side to secure the necessary budget for operation and maintenance based on periodical inspection and preventive maintenance program including major overhauls of equipment to be procured under the Project in order to ensure long-term stable power supply. The Philippines side has fully understood and committed to secure budget allocation including necessary cost until the plant operation starts.

(3) Enhancement of structure for operation and maintenance

Through the Survey, both side (DoE, NIA-CO, NIA-MARIIS and JICA) agreed power plant operation and maintenance setup as written in Draft Final Report. The Team emphasized that the establishment of an operation and maintenance structure with the allocation of enough number of qualified engineers and skilled technicians who will be in charge of operating and maintaining the new facilities is a crucial factor for implementation of the Project. The Philippines side understood its importance.

(4) Counterpart personnel

The Team requested the Philippines side that the necessary number of counterpart personnel shall be assigned to the Team and the necessary arrangements with related organizations be made during implementing stage in the Philippines. The Philippines side

has agreed to accept the request.

(5) Customs and tax exemption

The Philippines side understands that it shall be fully responsible on exemption of taxes, custom duties and any other levies imposed in the Republic of Philippines, in case the Project is implemented.

(6) Future dissemination of micro/mini hydropower on irrigation canal

The project is considered as a pilot project for future dissemination of micro/mini hydropower on irrigation canal. To promote the dissemination, initial scrutiny of potential micro/mini hydropower sites utilizing irrigation canal by NIA and DoE is important. NIA and DoE fully understood it.

(End)

Annex-1	Project Site
Annex-2	Organization Chart of DoE
Annex-3	Organization Chart of NIA
Annex-4	Estimated Project Cost (Confidential)
Annex-5	Japan's Grant Aid
Annex-6	Flow Chart of Japan's Grant Aid Procedures
Annex-7	Major Undertakings to be taken by Each Government

5. MOA between DOE and NIA-CO

NATIONAL IRRIGATION ADMINISTRATION

BOARD OF DIRECTORS RESOLUTION

SUBJECT: Memorandum of Agreement Between the Department of Energy (DOE), as implementing agency and the National Irrigation Administration (NIA) as the Cooperating Agency of the Japan International Cooperation Agency (JICA) Grant Aid Project on the Micro-Hydropower Development at a Drop in Canal Profile of Lateral "B" of Magat River Integrated Irrigation System (MARIIS).

RESOLUTION NO. 7820-12
SERIES OF 2012

RESOLVED, as it is hereby resolved, on motion duly seconded, to approve the Memorandum of Agreement (MOA) between the Department of Energy (DOE), as implementing agency and the National Irrigation Administration (NIA) as the cooperating agency of the Japan International Cooperation Agency (JICA) Grant Aid Project on the Micro-Hydropower Development at a Drop in Canal Profile of Lateral "B" of Magat River Integrated Irrigation System (MARIIS).

Date Adopted: December 11, 2012	I, the undersigned, hereby certify that the foregoing is a true copy of the resolution adopted by the Board of Directors of the National Irrigation Administration and spread in the minutes of a duly constituted meeting of said Board held on December 11, 2012
884th Regular Board Meeting	**JOSEPHINE E. ABEJON** Corporate Board Secretary

MEMORANDUM OF AGREEMENT

KNOW ALL MEN BY THESE PRESENTS:

This Memorandum of Agreement, hereinafter referred to as the "Agreement," made and entered into by and between:

> The **DEPARTMENT OF ENERGY**, an agency of the Republic of the Philippines created under Republic Act No. 7638 with principal office address at Energy Center, Merritt Road, Fort Bonifacio, Taguig City, Metro Manila, represented herein by its Secretary, **Hon. CARLOS JERICHO L. PETILLA**, hereinafter referred to as "**DOE**";
>
> and
>
> The **NATIONAL IRRIGATION ADMINISTRATION**, a government-owned and controlled corporation of the Republic of the Philippines created under Republic Act No. 3601, as amended, with principal office address at EDSA, Diliman, 1100 Quezon City, Metro Manila, represented by its Administrator, **Hon. ANTONIO S. NANGEL**, through Board Resolution No. 7820-12 series of 2012, hereinafter referred to as "**NIA**";
>
> The **DOE** and **NIA** collectively hereinafter referred to as "**Parties**" and individually as "**Party**".

WITNESSETH: That

WHEREAS, DOE is tasked to formulate policies and programs for the accelerated development of renewable energy systems, and the promotion and commercialization of the applications of such systems;

WHEREAS, to fulfil the abovementioned tasks, DOE implements / observes / enforces Republic Act No. 9513 or the Renewable Energy Act of 2008 relative to the development of renewable energy systems;

WHEREAS, DOE submitted a project proposal on Mini-Hydropower Development in Irrigation Systems the Philippines for Grant-Aid support under the Japan International Cooperation Agency (JICA);

WHEREAS, responding to the aforementioned proposal, the Government of Japan through JICA dispatched to the Philippines a Preparatory Survey Mission for the Development of Micro- and Mini-Hydropower Plants;

WHEREAS, JICA focused at a drop in canal profile of Lateral "B" of the NIA-managed Magat River Integrated Irrigation System (MARIIS), hereinafter referred to as the "site", located in San Mateo, Isabela;

WHEREAS, the Micro-Hydropower Project in Lateral "B"(hereinafter referred to as the "Project") shall consist of the construction of diversion canal and power house, and installation of a mini-hydropower plant inclusive of a substation and transmission facilities;

WHEREAS, this Project shall serve to augment the electricity requirement and ease the electricity deficit during peak-need periods in the municipality of San Mateo in particular and province of Isabela in general;

WHEREAS, NIA, being the owner and operator of MARIIS, agreed to act as "cooperating agency" to JICA and DOE on the Preparatory Survey and Feasibility Study for and in the development of the Project;

WHEREAS, the above-mentioned NIA's cooperation with JICA and DOE is consistent with the NIA's thrust of developing micro- and mini-hydroelectric power plants in NIA-managed irrigation systems relative to energy security goal;

WHEREAS, NIA agreed to accept in gratuitous manner from DOE as "implementing agency" the ownership of the completed Project including its substation and transmission facilities upon project completion, and

WHEREAS, NIA, as the owner/operator of the Project, shall use the revenue derived there from for the following purposes: (i) operations, maintenance and repair (OMR) of the Project and MARIIS, and (ii) for any other purpose relative thereof.

NOW, THEREFORE, in view of the foregoing premises, DOE and NIA hereby stipulate and agree as follows:

1. **Project Purposes**

The Project, to be funded and developed by JICA in cooperation with DOE and NIA, aims to contribute in augmenting energy supply and minimizing gas emissions by utilizing domestic renewable energy. By tapping the hydropower generation potential of irrigation facilities, it also aims to serve as a demonstration facility for low-head hydropower technology that can improve quality of life of the local people.

2. **Project Scope**

JICA, in cooperation with DOE and NIA, will provide financial and technical assistance in the construction / installation of a grid-connected micro-hydropower generation facility in Lateral "B" in San Mateo, Isabela. JICA will also help set up an operations scheme for the Project facility, with NIA, under the technical guidance of DOE, taking full responsibility for the OMR of the facility after the transfer of the Project from DOE.

3. **Project Organization**

To ensure the smooth flow / execution of activities for executing the Preliminary Survey and Feasibility Study of the Project, DOE and NIA shall dispatch counterpart staff to JICA Missions to assist in data collection. NIA and DOE shall each designate a central level and a field level Project

Focal Person responsible in carrying out coordination works, attending coordination meetings, and securing of licenses / permits.

4. Rights and Responsibilities of DOE

a. As the project "implementing agency", spearhead the implementation / development of the Lateral "B" Micro-Hydropower Project in partnership with JICA and NIA;
b. Assist NIA in the preparation of documents and acquisition / negotiation for permits and licenses for the implementation of the Project;
c. Review the detailed feasibility study, engineering design plans and drawings, plan of operations, etc. for the Project in coordination with JICA and NIA;
d. Shoulder import duties (or facilitate tax exemption) of imported equipment / materials, and Value-Added Tax (VAT) of locally procured equipment / materials for the Project;
e. Extend any assistance in implementing the Project, including securing of public consent among the residents and local communities of the site;
f. Receive the Project from the contractor / JICA at the end of construction period and transfer same to NIA or its assigns at the end of the cooperation period;
g. Issue a Certificate of Acceptance to the contractor / JICA upon completion / turnover of the Project, and monitor and extend technical assistance in the O&M and utilization of the facility;
h. Extend technical assistance to NIA in the operations and maintenance (O&M) of the facility, including training of concerned NIA staff and negotiations with cooperatives;
i. Act as counterpart agency to JICA and as coordinating body in relation with other concerned public and private institutions for the smooth implementation of the Project; and
j. Provide counterpart personnel to JICA Missions and necessary funds in the execution of the Preliminary Survey and Feasibility Study for the Project.

5 Rights and Responsibilities of NIA

a. As the project "cooperating agency", assist DOE and JICA in the formulation of the Project, including participation in coordination and consultation works for the smooth implementation and success of the Project;
b. Provide counterpart personnel to JICA Missions and funds to cover the expenses for the application of hydropower service contract with DOE, permits, licenses and certifications for the Project;
c. Prepare documentations and secure / negotiate necessary permits / licenses for the construction / installation of the Project, and pay needed lands, rights of way and other real properties ;
d. Issue a Certificate of Acceptance to DOE in connection to the turnover by DOE to NIA of the Project right after completion of facility construction / installation;
e. Assume ownership, supervision and control of the Project, upon turnover by DOE, and carryout O&M and commercial operations thereof;

f. Provide appropriate salaries / wages for the Project's O&M personnel and manage collection of fees / tariff for the utilization of the electricity generated by the Project;
g. Use Project revenues for the OMR of Project and MARIIS facilities and for other purposes NIA sees critical, and make annual reports for the first five years of operations to JICA and DOE on revenue utilization;
h. Procure a suitable place for the Project and warrant that construction and operations thereof at such place has minimum impact to the environment; and
i. Sell electricity generated by the Project to the Isabela 1 Electric Cooperative, Inc. (ISELCO 1) and/or any other customer to be covered by a mutual energy sales agreement.

6. **Development Costs**

"Development Costs" for the Project shall include any and all costs and expenses incurred by or on behalf of the Parties for the fulfilment of their respective responsibilities under Sections 4 and 5 herein. Such costs and expenses are attributable to the Parties' respective internal employees, representatives, advisors or agents, including travel cost, with each Party shouldering its own development costs.

7. **Transfer of Title and Risk Loss**

Title and risk loss shall pass from JICA to DOE upon the construction of the Lateral "B" Micro-Hydropower Project facilities and the DOE agrees to assume full liability for the facility after DOE's acceptance of the facility. DOE shall assume that full liability on and after the date when the JICA sends a notice of completion of construction, and for the duration of the lifespan of the facility, or until its transfer to the ultimate owner, NIA;

8. **Quality Assurance and Satisfaction**

Duties and responsibilities to be undertaken by any **Party** shall be executed and completed in a reasonable manner that is acceptable and satisfactory to the **Parties**.

9. **Force Majeure**

Neither **Party** shall be liable for any delay or failure in the performance of its obligations under this Agreement if and to the extent such delay or failure in performance arises from any cause or causes beyond the reasonable control of the **Party** affected hereinafter referred to as "Force Majeure", which shall include, but not limited to, the following:

a. Acts of God, including cyclone, earthquake, drought, flood or any other such operation of the forces of nature like scouring, erosion and sedimentation that the **Party** affected could not reasonably foresee or provide against; and
b. War (declared or undeclared), hostilities, invasion, act of any foreign enemy, threat of or preparation of war, riot, insurrection, civil commotion, rebellion, revolution, usurped power, civil war, and labor troubles or others like strikes, embargoes, blockades, and sabotage.

10. **Liability**

Neither **Party** shall be held liable for any loss or damage sustained by the other **Party** as a result of act or omission by Third Parties, arising out of or in connection with the implementation of this Agreement, and a **Party** to this Agreement shall not make any claims against the other **Party** for any liability it has incurred as a result of any damage sustained by Third Parties from any causes whatsoever.

No **Party** shall be liable to the other **Party** for any indirect, consequential, punitive or any damage other than the actual, direct and foreseeable costs, losses and damages incurred by such **Party** as a result of a breach of this Agreement.

11. **Confidentiality**

11.1 Any data, document, plan, design or drawing, or information received by the other **Party** in connection with the Project shall not be disclosed to a third party or used other than for the purpose of this Project, without prior written consent of the disclosing **Party**.

Any data, document, plan, design or drawing, or information collected, developed or formulated during the course of implementing the Project, which may be mutually determined by the **Parties** as classified shall not be disclosed to a third party, unless with the other **Party's** prior written consent.

Notwithstanding the stipulation written above, a receiving **Party** may disclose the information to consultants or advisors who need to know such information for the purpose of the implementation of this Agreement and who are legally bound to maintain confidentiality of the information.

The confidentiality obligations set forth in this Agreement shall terminate five (5) years or on the earlier date by mutual written agreement hereto.

11.2 The foregoing restriction shall not apply to:

a. Information which at time of disclosure is generally available to the public;
b. Information which after disclosure becomes generally available to the public through no fault of the receiving **Party**;
c. Information which the receiving **Party** can show was in its possession prior to the disclosure and which was not acquired directly or indirectly from the other **Party**;
d. Information which the receiving **Party** can show was received by it after the time of disclosure from the third party without any obligation of confidentiality and which was not acquired directly or indirectly from the other **Party**; and
e. Information which is required to be disclosed pursuant to any applicable law, regulation, judicial or administrative order or decree, or request by regulatory organizations having authority pursuant to the law.

Notwithstanding the foregoing, the **Parties** hereto shall not request from each other any fee, cost or consideration with regard to the disclosure of information.

12. **Publication of Results**

For the public interest and the mutual benefits of the **Parties**, without prejudice to Section 10 of this Agreement, the **Parties** agree to promote and give full credits to each **Party's** contributions for the Project and all outcomes resulting from the activities under this Agreement in any type of communication, written and oral, such as company report, conferences, papers or news media.

13. **Intellectual Property Rights**

The **Parties** understood and agreed that:

a. Notwithstanding the foregoing, any intellectual property right, including copyright, trademark, patent or industrial design rights, resulting solely from joint activities under this Agreement shall be jointly owned by the **Parties** and each of the **Parties** shall be allowed to use such property for their own purposes with mutual agreement prior to its use; and
b. Any intellectual property right contributed by one of the **Parties** shall remain the property of that **Party**.

Termination of this Agreement for any reason shall not affect the rights and obligations of any **Party** under this Article.

14. **Applicable Law**

This Agreement shall be governed by and construed in accordance with the laws of the Republic of the Philippines.

15. **Consultation and Settlement of Disputes**

a. The **Parties** shall endeavour to resolve any difficulties or misunderstandings resulting from or relating to the Project in the spirit of cooperation and mutual trust.
b. Any question arising in connection with the interpretation or implementation of the provisions hereof or anything unspecified herein shall be promptly resolved or specified through discussion.
c. Detailed schedules and procedures shall be determined by both **Parties** before the commencement of the Project.

If no such mutual and amicable agreement is attainable, the matter shall be subject to exclusive jurisdiction of the Court of Justice of the Philippines.

16. **Withdrawal and Modification**

Any **Party** can withdraw from this Agreement without any liability and cost by providing written notice to the other **Party** at least sixty (60) days without prejudice. For the purpose of clarification, any **Party** who withdraws from this Agreement pursuant to this Article shall be liable for any cost and liability incurred by the Project before such withdrawal and shall not be liable after such

withdrawal. The **Parties** agree that the terms of this Agreement may be modified upon mutual agreement. Such modification shall be contained in an addendum, which shall form an integral part of this Agreement. Any variation or modification shall only be valid if produced in writing and signed by the **Party** hereto.

17. **Working Language**

The working language of the Project is English. If translation into English of any language is necessary (verbal or written), each party will bear its own costs. In event of a difference in meaning, English shall prevail.

18. **Terms of Cooperation**

This Agreement shall become effective on the date and signing by the **Parties** and shall be effective through and to the end of the Lateral "B" Micro-Hydropower Project, which is planned for January 31, 2015, or an earlier date by mutual written agreement hereto (Attached: Appendix "A": Schedule of Activities). However, Sections 9, 10, 12, 13 and 14 shall survive expiration or termination of this Agreement.

In case a **Party** breaches or defaults the performance of any provision of this Agreement, and such breach or default is not cured within sixty (60) days after the breaching **Party** receives notification by the non-breaching **Party**, the non-breaching Party shall have the right to terminate this Agreement.

19. **Miscellaneous**

a. No **Party** may assign or otherwise transfer any of its rights or obligations under this Agreement without prior written consent of the other **Party**.
b. Nothing hereto contained in this Agreement shall be construed to create between the **Parties** partnership, joint venture, agency relationship or other business entity.
c. The **Parties** hereby agree that, to the extent that their or any of their property may have acquired (or may be attributed, whether or not claimed) any right of immunity (including, but not limited to sovereign immunity) from suit, court jurisdiction, execution, attachment prior to judgement, attachment in aid of execution of judgment, set-off or other legal process, that they hereby irrevocably waive and agree not to claim, to the fullest extent permitted by law, such right of immunity (other than immunity from bankruptcy and insolvency laws to which they are otherwise entitled) with respect to (a) their obligations under this Agreement, (b) any legal proceedings to enforce such obligations, and (c) any legal proceedings to enforce any judgment rendered in any proceedings to enforce such obligations.
d. This Agreement constitutes the entire agreement among the **Parties** and supersedes any prior written or oral agreement among the **Parties**.
e. In the event that a section of the present document was declared illegal or invalid, the other sections of the present document will be considered valid and will be in force.

20. **Final Provisions**

Notwithstanding to the contrary herein, any provision of this Agreement shall not be construed as a guarantee for certain level of power production, timing of the completion of the Project or any other level of performances or services for the DOE and NIA.

21. **Notice**

All notices or communication required or permitted to be given under this Agreement shall be written in English and shall be given to the address and persons shown below. Each **Party** may change the designated person at anytime by giving written notice to the other **Party**.

To DOE:

Hon. CARLOS JERICHO L. PETILLA
Secretary
Department of Energy
Energy Center, Merritt Road, Fort Bonifacio
Taguig City, Metro Manila, Philippines

To NIA:

Hon. ANTONIO S. NANGEL
Administrator
National Irrigation Administration
NIA Complex, EDSA, Diliman
Quezon City, Metro Manila, Philippines

IN WITNESS WHEREOF, the Parties set their hands this __ day of JAN 2 9 2013 2012 at _____, Philippines.

Department of Energy (DOE)
By:

Republic of the Philippines
DEPARTMENT OF ENERGY
IN REPLYING PLS CITE:
SOE-JLP-13000398

CARLOS JERICHO L. PETILLA
Secretary

National Irrigation Administration (NIA)
By:

ANTONIO S. NANGEL
Administrator

Witnessed by:

MARIO C. MARASIGAN
Director
Renewable Energy Management Bureau

Witness by:

ROBERT C. SUGUITAN
Deputy Administrator
Engineering & Operations, NIA

ACKNOWLEDGEMENT

REPUBLIC OF THE PHILIPPINES)
Manila CITY, METRO MANILA)S.S.

I, Isidro V. Almanfero, a Notary Public duly authorized in the city named above to take acknowledgements, certify that on this FEB 0 1 2013 personally appeared:

Name	Passport No.	Date / Place of Issuance
HON. CARLOS JERICHO L. PETILLA	EB48102050	27 Feb. 2012 / DFA Tacloban City
HON. ANTONIO S. NANGEL	XX3962699	15 June 2009 / DFA Pampanga

known to be the same persons described in the foregoing instrument, who acknowledged before me that their signatures on the instrument was voluntarily affixed by them for the purposes stated therein, and who declared to me that they executed the instrument as their free and voluntary act and deed as well as the free and voluntary act and deed of the government agency herein represented.

This instrument which consists of 9 pages including this page and Annex "1" on which the acknowledgement is written, is signed on each and every page thereof by the **Parties** and their instrumental witnesses, and sealed with my notarial seal, refers to a Memorandum of Agreement between DOE and NIA.

WITNESS MY HAND AND SEAL on FEB 0 1 2013 at Manila.

ATTY. ISIDRO V. ALMANFERO
Notary Public
Until December 31, 2013
IBP No. [illegible]/MLA/Oct 19, 2012
Commission Valid for 2013 and 2014
PTR No. [illegible]/2/2/MLA/2012-28-2012
MCLE Compliance No. IV-0016394
Attorney's Roll No. 34272
NOTARY PUBLIC

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Book No. 100;
Series of 2013.