2018

BELISAMA PUMPED-STORAGE HYDROPOWER PROJECT

PROJECT DESCRIPTION FOR SCOPING

BELISAMA
HYDROPOWER CORPORATION

Table of Contents

BASIC PROJECT INFORMATION

A. PROJECT INFORMATION

NAME OF PROJECT	BELISAMA PUMPED-STORAGE HYDROPOWER PROJECT
LOCATION	The Project shall be located within the Municipality of Pangil (Barangays Dambo and Mabato-Asufre) and Municipality of Pakil (Barangays Banilan, Dorado, and Kabulusan), both in the Province of Laguna
NATURE OF PROJECT	Pumped-Storage Hydropower Plant Category A - Environmentally Critical Project under 3.2.2 Hydropower facilities with 800 MW capacity per DENR-EMB Memorandum Circular 005
SERVICE CONTRACT	Hydropower Service Contract (Large) HSC No. 2016-07-673 dated 22 November 2016 was executed between Belisama Hydropower Corporation and the Republic of the Philippines, through the Department of Energy, granting Belisama the exclusive right to explore, develop and utilize hydropower resources within the Contract Area located along the Laguna de Bay in the Municipality of Pangil, Province of Laguna.

B. PROPONENT PROFILE

PROPONENT NAME	BELISAMA HYDROPOWER CORPORATION ("**BELISAMA**") *A member of the Gregorio Araneta Group of Companies, incorporated as a subsidiary of Gregorio Araneta, Inc. through its holding company Gregorio Araneta Energy Holdings, Inc.*
ADDRESS	Mezzanine Floor, Adamson Centre, 121 L.P. Leviste Street, Salcedo Village, Brgy. Bel-Air, Makati City, Philippines, 1227
AUTHORIZED REPRESENTATIVES	Gregorio Araneta III *President* Telephone No.: +63 2 848 1501 Email: gaIII@info.com.ph Anthony M. Aquino *General Manager* Telephone No.: +63 2 848 1494 Email: anthony.aquino@gmail.com

Copies of **BELISAMA**'s latest Articles of Incorporation and General Information Sheet filed with the Securities and Exchange Commission are attached hereto as ANNEX 1 and ANNEX 2, respectively. **BELISAMA** has also been issued a Certificate of Registration by the Department of Energy as Renewable Energy Developer in respect of the **BELISAMA** HYDROPOWER PROJECT, a copy of which is attached as ANNEX 3.

PROJECT DESCRIPTION

A. PROJECT LOCATION

BELISAMA's proposed Project involves the development of an 800MW Pumped-Storage Hydropower Plant within the Municipalities of Pangil and Pakil, Province of Laguna. The Project will utilize the Laguna Lake as lower reservoir through an intake structure located in Barangay Dambo, Municipality of Pangil, and an upper dam shall be constructed in an area straddling the Barangays of Kabulusan, Banilan, and Dorado in the Municipality of Pakil, and Barangay Mabato-Asufre in the Municipality of Pangil. The major components of the Project are as follows:

PROJECT COMPONENT	PROPOSED LOCATION
Lower Reservoir	Laguna Lake at Barangay Dambo, Municipality of Pangil
Powerhouse Complex	Underground cavern at Barangay Dambo, Municipality of Pangil
Power Waterways	Underground penstock to traverse Barangays Dambo and Mabato-Asufre, Municipality of Pangil, and Barangay Banilan, Municipality of Pakil
Upper Dam	Dam straddling Barangays Kabulusan, Banilan, and Dorado in the Municipality of Pakil, and Barangay Mabato-Asufre, Municipality of Pangil
Access Road	The project area can be accessed via the Pakil-Pangil-Mabitac National Highway. New access roads from the National Highway to the main structures of the project need to be constructed, i.e. to the tailrace tunnel and power cavern, upper dam and reservoir. An access road to the main access tunnel and power cavern will branch off the National Highway near the tailrace channel. A direct route from the powerhouse to the upper dam traversing Barangay Mabato-Asufre, Municipality of Pangil, is being considered.

The location map and impact areas of the Project are provided in **FIGURE A-1** and **FIGURE A-2**. The proposed layout of the proposed project site is further provided in ANNEX A-1 with the geographic coordinates reflected in Table A-1 below. Aerial photos of the proposed project site are also provided in ANNEX A-2.

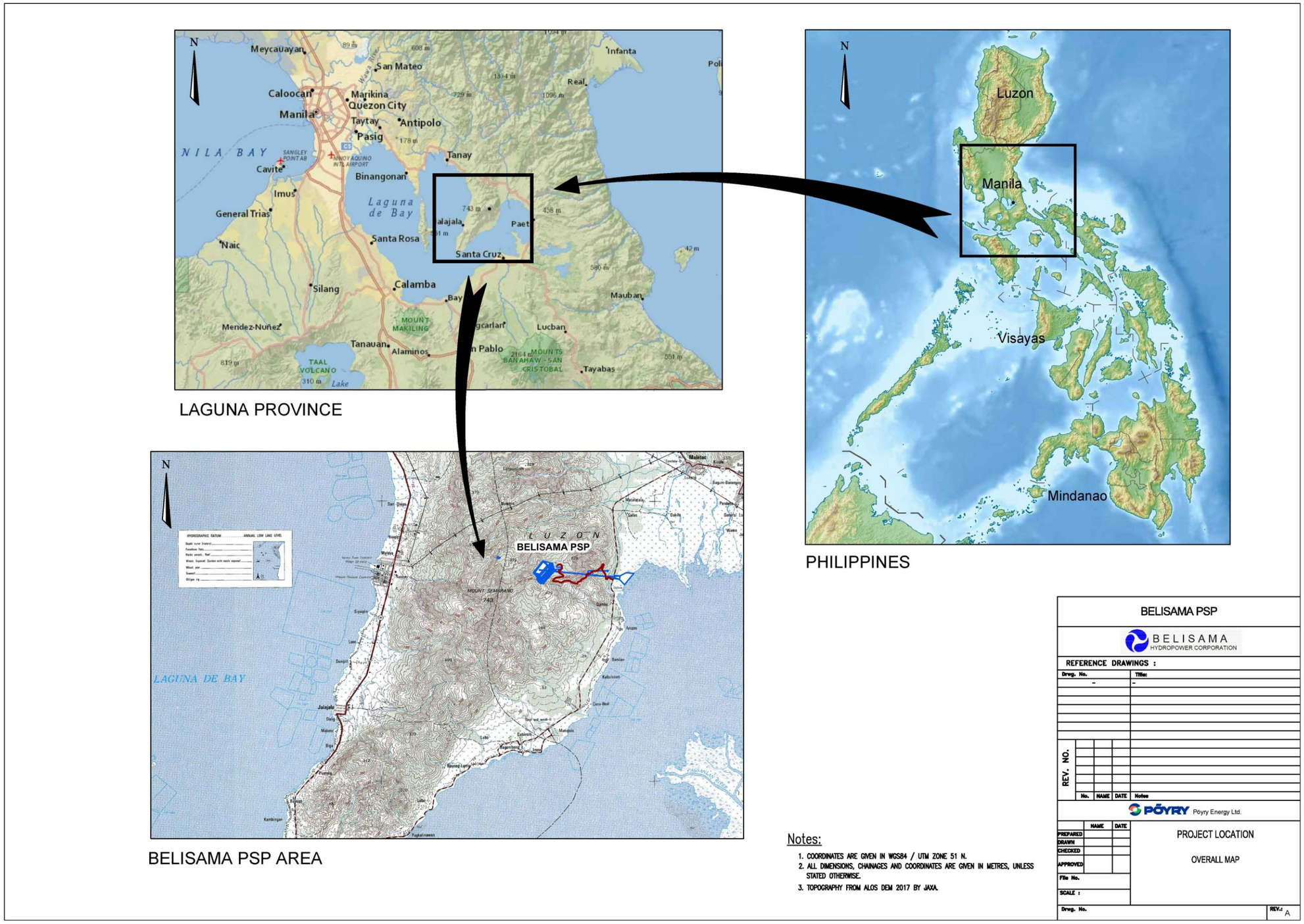
Annex 2-2 of the Revised Procedural Manual (RPM) of DAO 2003-30 defined the Direct Impact Area (DIA) at the pre-EIA stage as the area where all "project facilities are proposed to be constructed/situated and where all operations are proposed to be undertaken". The DIA in the pre-EIA stage is shown in red polygon that covers a portion of the Laguna Lake which is most likely to

be affected in terms of change in lake water circulation and change in water temperature during operation but still subject for further study. Areas outside of each project component or facility but inside in the DIA (red polygon) are those likely to be affected during construction phase, such as dust generation and lake water sedimentation. The Indirect Impact Areas (IIA) is initially delineated to be those within a 2-kilometer radius (in yellow circle) of the proposed project and may possibly be changed after the EIA baseline studies.

TABLE A-1. GEOGRAPHIC COORDINATES OF THE PROPOSED PROJECT COMPONENTS

KEY PROJECT COMPONENTS	LATITUDE	LONGITUDE
Powerhouse Cavern	14°23'35.6528"N	121°23'50.8018"E
Powerhouse Access Portal	14°23'39.661"N	121°24'11.464"E
Lower Intake	14°23'33.9829"N	121°24'18.8333"E
	14°23'32.391"N	121°24'18.6998"E
	14°23'34.5051"N	121°24'25.2633"E
	14°23'30.7951"N	121°24'24.6071"E
Upper Dam	14°23'41.9912"N	121°23'3.0308"E
	14°23'41.6968"N	121°23'11.5094"E
	14°23'30.2795"N	121°23'1.2047"E
	14°23'37.2033"N	121°22'53.9477"E
Access Road to Upper Dam	14°23'30.9921"N	121°24'17.1884"E
	14°23'45.2613"N	121°23'18.5057"E

FIGURE A-1. LOCATION MAP



Notes:

1. COORDINATES ARE GIVEN IN WGS84 / UTM ZONE 51 N.
2. ALL DIMENSIONS, CHAINAGES AND COORDINATES ARE GIVEN IN METRES, UNLESS STATED OTHERWISE.
3. TOPOGRAPHY FROM ALOS DEM 2017 BY JAXA.

BELISAMA PSP

BELISAMA HYDROPOWER CORPORATION

REFERENCE DRAWINGS :

Drwg. No.	Title:
-	-

REV. NO.	No.	NAME	DATE	Notes

PÖYRY Pöyry Energy Ltd.

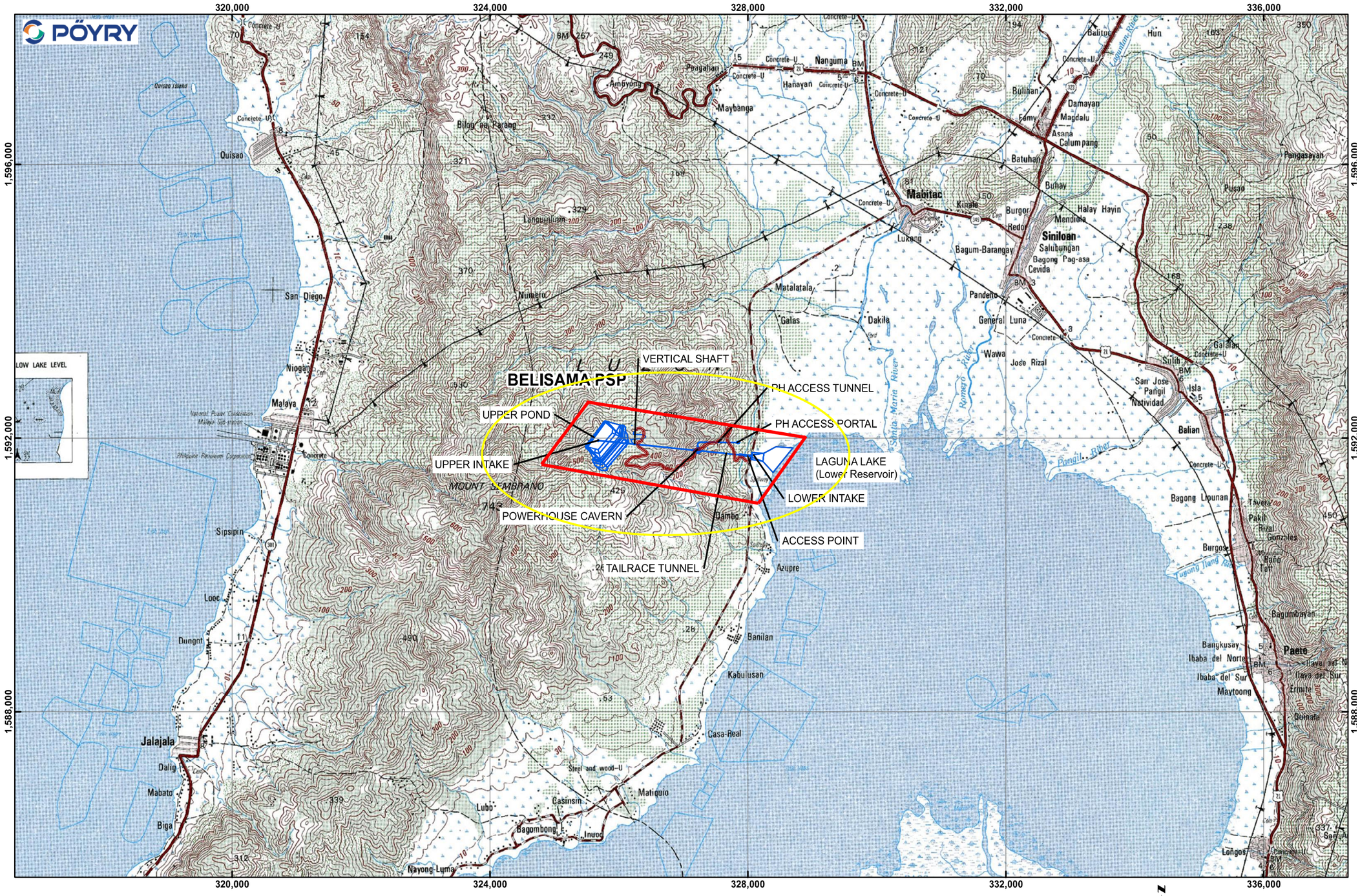
	NAME	DATE
PREPARED		
DRAWN		
CHECKED		
APPROVED		
File No.		
SCALE :		

PROJECT LOCATION

OVERALL MAP

Drwg. No. REV.: A

FIGURE A-2. PROJECT IMPACT AREAS



BELISAMA PUMPED STORAGE HYDROPOWER PROJECT

1:50,296

NOTE:
1. NAMRIAPhilippines1:50,000 Topographical MapPAETE ,SHEET 7271 I
2.Coordinate System: WGS 1984 UTM ZONE 51 North

B. PROJECT RATIONALE

The Philippine Development Plan 2017-2022 identifies implementation of strategic infrastructure programs and projects as among the key strategies to support the country's socio-economic development. These include pursuing developments in the renewable energy sector to improve power generation and encourage competition to drive down electricity costs.

Under the Power Development Plan 2016-2040 issued by the Department of Energy ("**DOE**"), peak demand for electricity is expected to increase by about four times from 12,213MW in 2015 to 49,287MW in 2040 under the high GDP growth scenario with an annual average growth rate of 6% from 2016-2040. To meet the projected electricity demand, the DOE estimates that the Philippines will need 43,765MW capacity addition by 2040.

Notably, the recent *Rules and Guidelines Governing the Establishment of the Renewable Portfolio Standards for On-Grid Areas* issued by the DOE further sets an aspirational target of 35% share of electricity coming from renewable energy resources in the generation mix by 2030.

The Project is envisioned to augment power supply and contribute to energy security in the country as a clean renewable energy resource consistent with the strategy directions under the Philippine Development Plan and the Power Development Plan.

C. PROJECT ALTERNATIVES

1. SITE LOCATION

(a) Lower Reservoir

The Laguna Lake, a natural lake with a surface area of approximately 900 km^2 and having water levels just a few meters above sea level, will serve as the lower reservoir. Due to its size, the pumped-storage operation will hardly lead to fluctuations in the water level (less than 1 cm). The main criteria for the selection of the location of the lower intake at the Laguna Lake was to minimize the number of impacted households along the tailrace channel.

(b) Upper Dam Site

Two possible locations for the upper dam have been studied: (i) a dam located at a depression about 450 meters above the Laguna Lake and (ii) a ring dam on the top of a hill. The comparative study showed clear cost advantages for the first alternative, which is further developed.

A suitable location for the upper dam has been identified in the mountainous region covering Barangays Banilan, Kabulusan, and Dorado, Municipality of Pakil, and Barangay Mabato-Asufre, Municipality of Pangil, allowing the development of an average head of approximately 450 meters.

The location of the upper dam is only a few kilometers away from the shore line of Laguna Lake, which results in rather short water tunnels, leading to reduced overall costs.

(c) Powerhouse and Power Waterways

The location of the powerhouse was selected due to favorable geological conditions at the site in relation to the requirements of the Project. The location of the power waterways, which connect the upper dam with the lower reservoir, is driven mainly by the selection of the upper dam site.

(d) Access Road

The project area can be accessed via the National Highway (Pakil-Pangil-Mabitac Road). Short access roads to the powerhouse cavern (via the main access tunnel) and Laguna Lake lower intake will branch off from the National Highway in Barangay Dambo, Municipality of Pangil.

For the upper dam and reservoir, a new access road traversing Barangay Mabato-Asufre, Municipality of Pangil, is being considered which will provide a direct route from the powerhouse to the upper dam.

2. TECHNOLOGY SELECTION

Pumped-storage plants are the only available and well proven technology to store electricity in large scale. Like storage hydropower plants, pumped-storage plants usually generate electricity during peaking hours, when the demand is high. In liberalized markets, the electricity prices are higher during peaking hours, which make pumped-storage operation economically viable.

Due to its ability to respond to sudden demand changes in the grid within seconds, pumped-storage schemes can help control transmission system frequency and provide ancillary services and reserve capacities, such as capacity reserve, reactive power, black start capability, and spinning reserve. New variable speed technology allows provision of frequency and voltage regulation services in both the generation and pumping mode. Especially in electricity grids with a high share of non-dispatchable and intermittent renewable energy sources the generation mix lead to new challenges for the grid stability. Fast available regulating capabilities together with large storage capacities are essential to ensure a stable system in grids with a high share of wind and photovoltaics.

A pumped-storage plant is considered a closed cycle process, wherein the water will only be used to store energy (non-consumptive) and only water losses from evaporation or leakage will need to be compensated. The water is not in contact with any harmful substances, and no additives are used in the process.

(a) Pump-Turbine Technology

For the given head of approximately 450 meters, reversible pump-turbines are the most economical solution. Reversible pump-turbine units comprise of the pump-turbine and the motor-

generator on the same shaft. By changing the direction of rotation, the pump will operate as a turbine. Reversible pump-turbines are usually operated at a fixed speed. While the output in generation mode can vary between 40% and 100% of the rated capacity (similar to Francis units), pumping at part-load is not possible. In pumping mode, only the full capacity can be switched on and off.

With the use of an asynchronous motor-generator or a frequency converter with a synchronous motor-generator, the rotational speed of the pump-turbine can be varied. Thus, the capacity in pumping mode can be adjusted, which allows for frequency control and grid stabilization services in pumping mode. The usual operation range in pumping mode is between 70% and 100%.

Alternatively, ternary units would be available, which comprise of three main parts: a motor-generator, a turbine (often a Pelton turbine), and a pump (can be a single stage or multi-stage pump). The turbine and the pump are connected to the motor-generator on the same shaft by a coupling. Due to the two separated hydraulic machines, the direction of the motor-generator is the same for both operation modes: generation and pumping.

Reversible pump-turbine are more cost effective than ternary units, and allow for a compact design of the powerhouse. Reversible pump-turbines have been installed for heads from 50 m to 800 m.

The use of variable speed units would have advantages when providing ancillary services (storage and reserve capacities required for the stability of the electricity grid). The use of reversible speed units will be studied and decided in a later stage. A possible solution could be to equip 50% of the units with variable speed technology, providing additional flexibility and limiting the investment costs (variable speed units are approximately 25% more expensive compared to fixed speed units).

(b) Powerhouse

A comparative study of an underground powerhouse and a shaft powerhouse have been carried out. The underground powerhouse shows clear advantages in costs and a reduced risk profile (compared to the shaft powerhouse option).

The underground powerhouse is comprised of the main power cavern with the generating/pumping equipment, the transformer cavern hosting the main transformers and the gas insulated (GIS) switchgear, and the main access tunnel (MAT). The MAT will serve as main access during construction (mucking, material transport, ventilation). For operation phase, the MAT will be divided by concrete walls into three sections, (i) the main access tunnel, (ii) a section hosting the power cables and the exhausted air, and (iii) the emergency exit and fresh air section.

(c) Power Waterways

The power waterways connect the upper reservoir with the lower reservoir. An intake/outfall structure will be the terminal structure at each reservoir. From the upper intake, the waterways are all constructed underground, and comprise of a headrace tunnel, a vertical pressure shaft, and a high-pressure shaft conveying the water towards the underground powerhouse. From a

structural perspective, the power waterways will be fully lined with concrete, while the high-pressure tunnel will be partly lined with steel.

The powerhouse is connected to the Laguna Lake through the tailrace tunnel and the tailrace channel. The hydraulic system has been designed and dimensioned in a way that no surge facilities are required at the headrace or the tailrace system

(d) Upper Dam Type

A dam type study has compared a hardfill dam and a geo-membrane faced rockfill dam solution. Both options are technically feasible and are similar in construction costs. However, as the foundation requirements for the rockfill dam are less stringent and do not require transport of bulk cement to site (lower environmental and social impact during construction), a rockfill dam is being considered as the preferred dam type.

3. PROJECT COMPONENTS

The Project involves the pumping of water from the Laguna Lake to an upper dam and subsequently releasing the water back to the Laguna Lake for the generation of electricity during periods of high electricity demand. The major components of the Project are shown in TABLE C-3.

TABLE C-3. MAJOR PROJECT COMPONENTS

PROJECT COMPONENT	DESCRIPTION
Lower Reservoir	Natural lake with approximately 900 square kilometers, intake to be located in the north-eastern part of the lake
Powerhouse Complex	Underground powerhouse is comprised of the main power cavern hosting the main generation/ pumping equipment, the transformer cavern with the transformers and GIS switchgear, the main access tunnel (hosting air/ventilation, emergency exit, power cables, and main access to the underground powerhouse). The area of the powerhouse complex is approximately 20,000 m^2.
Power Waterways	Comprised of the vertical shaft, high pressure penstock (tailrace tunnel and channel), and powerhouse complex (main powerhouse, transformer cavern, main access tunnel), these will be underground and will not be visible at the surface. The overall length of the power waterways will be approximately 2.26 km.
Upper Dam	Artificial dam to be located in a depressed area, comprised of a geo-membrane faced rockfill dam (and liner in the reservoir area). The surface area of upper reservoir will be approximately 312,500 m^2.

Project Component	Description
Access Roads	The project area can be accessed via the National Highway (Pakil-Pangil-Mabitac Road). New access roads from the National Highway leading to the following main structures of the Project need to be constructed: (a) access portal for the powerhouse main access tunnel and (b) upper dam. The access road will branch off the National Highway near the tailrace channel, and will provide access along the tailrace channel to the main access tunnel and the underground power cavern. A direct route from the powerhouse to the upper dam traversing Barangay Mabato-Asufre, Municipality of Pangil, with an overall length of approximately 4 km, is being considered.

4. Resource Utilization

Initial impoundment of the upper dam will be undertaken and will require an estimated total of 7.2 million cubic meters of water sourced from Laguna de Bay and rainfall. The water requirement during electricity generation is estimated at 199 m^3/s or equivalent to 7.2 million cubic meters. At off-peak hours, the same volume of water discharged to generate electricity will be pumped back to the upper reservoir from the Laguna de Bay.

The electricity required for pumping is about 3,500 GWh and will be sourced from the Luzon Grid.

D. Project Phases

The Project involves three (3) major phases from pre-development to commercial operations. The activities and processes involved under the project phases and key environmental impacts thereof are provided in Table D-1 below.

1. Pre-Development

The pre-development phase of the Project involves the conduct of the feasibility study ("**FS**"), acquisition of applicable pre-construction permits, and completion of the detailed engineering design for the Project.

The FS will cover the geotechnical study, investigation and analysis, hydrologic investigation and analysis, conduct of geodetic survey works and engineering design, and economic and financial study.

The pre-construction permits to be obtained for the project include the Certification Precondition from the National Commission on Indigenous Peoples, clearances and permits from the Laguna Lake Development Authority, Environmental Compliance Certificate from the

Department of Environment and Natural Resources, and endorsements from the local government units affected by the Project.

The pre-development phase is limited to five (5) years under BELISAMA's Hydropower Service Contract reckoned from the date of its execution on 22 November 2016 and shall be in accordance with the 5-Year Work Program for Pre-Development Activities approved by the Department of Energy, as may be amended.

2. CONSTRUCTION AND DEVELOPMENT

The construction and development phase of the Project is estimated at four (4) years, which will cover the construction and installation of the upper dam, penstock, powerhouse, water intake facilities, access roads and interconnection facilities, including initial impoundment and commissioning of the pumped-storage plant.

Prior to the start of the main construction works, site and office facilities will be installed and access roads to the main construction sites have to be constructed.

The main activities for the upper dam will be excavation works and placement of dam fill material. The main equipment to be used will be drill rigs, excavators, dumpers, compactors, etc. The power waterways and the power station will be underground, using drill and blast method for the construction.

The tailrace channel will be constructed using conventional excavators. Dredging will be carried out at the outfall area at the Laguna Lake in order to avoid erosion of fines during operation (entrance of fines into the power waterways during pumping operation).

The site installation foresee that the concrete is mixed on site, the aggregates will be sourced from suitable quarries in the vicinity of the project site. The bulk material required for construction will be transported on road, and will be mainly reinforcement steel, cement, steel for construction and the generation equipment.

The construction and development phase will end with the completion of the commissioning and trial operation phase.

3. OPERATION AND MAINTENANCE

During the operation of the hydropower plant, water will be discharged from the upper dam through the penstock and captured in the powerhouse to generate approximately 800MW of electricity before the water is discharged to Laguna Lake, which will serve as lower reservoir for the Project. The water requirement during electricity generation is estimated at 199m^3/s or equivalent to 7.2 million cubic meters. At off-peak hours, the same volume of water discharged to generate electricity will be pumped back to the upper dam from the Laguna Lake.

In order to avoid erosion in the Laguna Lake (entrance of fine particles into the waterways) and to minimize the impact during pumping in the intake area, the outfall structure at the Laguna Lake will be designed based on an average velocity of 0.15 m/s (for different operation modes of the Belisama Pumped-Storage Hydropower Project).

The major benefit of utilizing a pumped-storage facility is that only a minimal amount of water is required for the actual operation of the Project. Any additional water requirement caused by evaporation, leakage or seepage will be managed by the dam's capture of rainfall or additional pumped water from Laguna de Bay.

During the operation of the project the pumped-storage facility will utilize the water in a closed cycle. There will be no significant change in the water flow and only approximately 0.5% of the water from Laguna Lake will be required for operation, which will be pumped to the upper dam and released back to the Laguna Lake during power generation throughout the day. Only losses due to evaporation or leakages need to be compensated with additional volume.

Regular operation and maintenance activities are planned throughout the lifetime of the plant. A pumped-storage plant is – like regular hydropower schemes – a sustainable technology. Pollution of the environment will be avoided (water, air, soil). The maintenance works are comprised of day-to-day maintenance work during normal operation of the scheme, check-ups (every 5 to 10 years for inspection of main components and replacement of minor parts) and partial overhaul (10 to 20 years for replacement of critical components).

TABLE D-1. KEY ENVIRONMENTAL IMPACT OF ACTIVITIES AND PROCESSES

ACTIVITY	DESCRIPTION	POTENTIAL ENVIRONMENTAL IMPACT	MITIGATION MEASURES
PRE-DEVELOPMENT PHASE			
Conduct of the feasibility study ("**FS**"), acquisition of applicable pre-construction permits, and completion of the detailed engineering design for the Project.	The FS will cover the geotechnical study, investigation and analysis, hydrologic investigation and analysis, conduct of geodetic survey works and engineering design, and economic and financial study. The pre-construction permits to be obtained for the project include the Certification Precondition from the National Commission on Indigenous Peoples, clearances and permits from the Laguna Lake Development Authority, Environmental Compliance Certificate from the Department of Environment and Natural Resources, and endorsements from the local government units affected by the Project.	No perceived impact	
CONSTRUCTION AND DEVELOPMENT PHASE			
Site preparation	Site clearing, earthworks and access road construction	Removal of vegetation	- Conduct of tree inventory and securing of Tree Cutting Permit - Phase-wise tree cutting - Replacement of corresponding number of endemic species of seedlings and conduct of tree planting inside the designated project area

ACTIVITY	DESCRIPTION	POTENTIAL ENVIRONMENTAL IMPACT	MITIGATION MEASURES
		Dust emissions due to road layouting, removal and transport of earth materials by hauling trucks	- Regular spraying of water on exposed soil surfaces of the project access road - Restrict speed of hauling trucks and other project vehicles - Provision of dust mask to construction workers - Installing warning signage at strategic points of the construction areas
		Additional traffic and workers on site	- Deployment of Traffic Enforcers at the affected traffic route particular to the national highway and entry point of the project access road - Implementation of standard construction management protocols to include proper hygiene practices at the temporary facilities
Running the site facilities	Construction materials staging and domestic activities of workers	Generation of solid waste and domestic waste water	- Provision of temporary sanitation facilities - Formulate and implement a solid waste management system
Upper dam construction	Excavation and earth works and use of heavy construction equipment	Removal of vegetation	- Conduct of tree inventory and securing of Tree Cutting Permit - Phase-wise tree cutting - Replacement of corresponding number of endemic species of seedlings and conduct of tree planting inside the designated project area
		Dust emission due to excavation and movements of hauling trucks	- Regular spraying of water on exposed soil surfaces of the project access road - Restrict speed of hauling trucks and other project vehicles - Provision of dust mask to construction workers

ACTIVITY	DESCRIPTION	POTENTIAL ENVIRONMENTAL IMPACT	MITIGATION MEASURES
			- Installing warning signage at strategic points of the construction areas
		Noise emission from the operation of heavy equipment during excavation	- Provision of earplug to the workers
		Additional traffic	- Deployment of Traffic Enforcers at the affected traffic route particular to the national highway and entry point of the project access road - Formulation and implementation of Traffic Management Plan to include installation of warning signage
Power waterways construction	Underground excavation and use of heavy equipment	Removal of vegetation	- Conduct of tree inventory and securing of Tree Cutting Permit - Phase-wise tree cutting - Replacement of corresponding number of endemic species of seedlings and conduct of tree planting inside the designated project area
		Dust emission due to excavation and movements of hauling trucks	- Regular spraying of water on exposed soil surfaces of the project access road - Restrict speed of hauling trucks and other project vehicles - Provision of dust mask to construction workers - Installing warning signage at strategic points of the construction areas
		Noise emission from the operation of heavy equipment during excavation	- Provision of earplug to the workers
		Additional traffic	- Deployment of Traffic Enforcers at the affected traffic route particular to the

ACTIVITY	DESCRIPTION	POTENTIAL ENVIRONMENTAL IMPACT	MITIGATION MEASURES
			national highway and entry point of the project access road - Formulation and implementation of Traffic Management Plan to include installation of warning signage
		Health and Safety	- Provision of PPEs to construction workers - Formulate and implement a solid waste management system - Formulate and implement standards construction management protocols - Installing warning signage at strategic points of the construction areas
	Concrete works	Dust emission from the movements of delivery and hauling trucks	- Regular spraying of water on exposed soil surfaces of the project access road - Restrict speed of hauling trucks and other project vehicles - Provision of dust mask to construction workers - Installing warning signage at strategic points of the construction areas
		Additional traffic (cement, reinforcement steel)	- Deployment of Traffic Enforcers at the affected traffic route particular to the national highway and entry point of the project access road - Formulation and implementation of Traffic Management Plan to include installation of warning signage
		Generation of solid waste and construction spoil materials	- Formulate and implement a solid waste management system
Underground cavern construction	Underground excavation and use of heavy equipment	Removal of vegetation	- Conduct of tree inventory and securing of Tree Cutting Permit - Phase-wise tree cutting

ACTIVITY	DESCRIPTION	POTENTIAL ENVIRONMENTAL IMPACT	MITIGATION MEASURES
			- Replacement of corresponding number of endemic species of seedlings and conduct of tree planting inside the designated project area
		Dust emission due to excavation and movements of hauling trucks	- Regular spraying of water on exposed soil surfaces of the project access road - Restrict speed of hauling trucks and other project vehicles - Provision of dust mask to construction workers - Installing warning signage at strategic points of the construction areas
		Noise emission from the operation of heavy equipment during excavation	- Provision of earplug to the workers
		Additional traffic	- Deployment of Traffic Enforcers at the affected traffic route particular to the national highway and entry point of the exaction and dredging areas - Formulation and implementation of Traffic Management Plan to include installation of warning signage
		Health and Safety	- Provision of PPEs to construction workers - Formulate and implement a solid waste management system - Formulate and implement standards construction management protocols - Installing warning signage at strategic points of the construction areas
	Concrete works	Dust emission from the movements of delivery and hauling trucks	- Regular spraying of water on exposed soil surfaces of the project access road

ACTIVITY	DESCRIPTION	POTENTIAL ENVIRONMENTAL IMPACT	MITIGATION MEASURES
			- Restrict speed of hauling trucks and other project vehicles - Provision of dust mask to construction workers - Installing warning signage at strategic points of the construction areas
		Additional traffic (cement, reinforcement steel)	- Deployment of Traffic Enforcers at the affected traffic route particular to the national highway and entry point of the project access road - Formulation and implementation of Traffic Management Plan
		Generation of solid waste and construction spoil materials	- Formulate and implement a solid waste management system
	Installation of equipment	Transport of heavy parts as additional traffic	- Deployment of Traffic Enforcers at the affected traffic route particular to the national highway and entry point of the project access road - Formulation and implementation of Traffic Management Plan
Construction of Tailrace channel	Excavation	Generation of solid waste and domestic waste water	- Provision of temporary sanitation facilities - Formulate and implement a solid waste management system
		Dust emissions	- Regular spraying of water on exposed soil surfaces - Restrict speed of hauling trucks and other project vehicles - Provision of dust mask to construction workers - Installing warning signage at strategic points of the construction areas

ACTIVITY	DESCRIPTION	POTENTIAL ENVIRONMENTAL IMPACT	MITIGATION MEASURES
		Transport and impact to traffic	- Deployment of Traffic Enforcers at the affected traffic route particular to the national highway and entry point of the project access road - Formulation and implementation of Traffic Management Plan
		Water Sedimentation and Contamination	- Provision of silt traps to prevent its dispersion outside the excavation area - Regular maintenance of heavy equipment to avoid oil and grease spillages and leakages
Lower intake structure construction and outfall area preparation	Excavation of intake structure area	Dust emissions from the movements of hauling trucks	- Regular spraying of water on exposed soil surfaces of the project access road - Restrict speed of hauling trucks and other project vehicles - Provision of dust mask to construction workers - Installing warning signage at strategic points of the construction areas
		Noise emission	- Provision of earplug to the workers
	Excavation of intake structure area	Localized ponding causing flooding due to lake overflowing during rainy days	- During rainy days, immediate pumping of water towards barangay drainage line - Priority completion of the site elevation design to counter overflows - If possible, completion of excavation works during summer months
		Health and safety	- Temporary enclosure of the excavation area to confine dust emission - Installing warning signage at strategic points of the excavation areas - Proper staging of excavated materials and immediate disposal

ACTIVITY	DESCRIPTION	POTENTIAL ENVIRONMENTAL IMPACT	MITIGATION MEASURES
			- Restricted speed of hauling trucks and covering of tarpaulin during hauling of earth materials to minimize dust generation and dispersion
		Transport and impact to traffic	- Deployment of Traffic Enforcers at the affected traffic route particular to the national highway and entry point of the project access road - Formulation and implementation of Traffic Management Plan
	Dredging of outfall area (portion of Laguna Lake) to avoid erosion of fine sediments.	Improved water quality due to removal of sediments/siltation	- Proper staging of sediment materials and immediate disposal at designated area
		Accumulation of sediments at lake water	- Provision of silt traps to prevent its dispersion outside the dredging area - Removal of dredge materials, proper staging and immediate disposal
		Oil and grease contamination of the lake water from heavy equipment	- Regular maintenance of heavy equipment to avoid oil and grease spillages and leakages - Immediate removal of floating oil and grease
		Removal of aquatic plants and displacement of fishes and other aquatic organisms	- Aquatic surveys (flora and fauna including fishes), determination of important local species and provide recommendations - Securing of corresponding LLDA permit and compliances to its guidelines
Initial filling of the system	Filing of the waterway system and upper reservoir with water from Laguna Lake	Possible suction of small fishes and other aquatic organisms	- A trash rack will be installed at the intake structure to prevent bigger fishes from entering the power waterways.

Activity	Description	Potential Environmental Impact	Mitigation measures
		Potential flooding during rainy season due to overflow of the upper dam	- Pre-development studies as input in the detailed engineering design to ensure no landslide and flooding scenarios at the upper dam and its vicinities
		Safety	- Installing warning signage at strategic points of at the lower intake and outfall areas and upper dam
Operation and Maintenance Phase			
Generation of electricity	Discharge of water from upper dam-penstock-powerhouse and operation of turbines	Indoor noise and heat generation for personnel health	- Standard design for underground cavern structures - Sustained maintenance works for cooling and ventilation systems - Provision of PPEs
	Discharge of water to Laguna Lake	Change in water temperature to affect fish growth and population	- Designed acceptable velocity of water discharge to the lake - Quarterly water quality monitoring
		Change in water circulation to affect fish growth and population	- Designed acceptable velocity of water discharge to the lake
		Safety	- Installing warning signage at strategic points of at the lower intake and outfall areas, powerhouse cavern, power waterways and upper dam
	Pumping of water from lower reservoir to upper reservoir	Possible suction of small fishes and other aquatic organisms	- A trash rack will be installed at the intake structure to prevent bigger fishes from entering the power waterways. - Use of appropriate screening mechanism at the lower intake structure -
Administration	Daily activities of the plant personnel	Generation of domestic solid waste and waste water	- Implementation of solid waste segregation, re-use and immediate disposal - Regular maintenance works for the Sewage Treatment Plant (STP)

ACTIVITY	DESCRIPTION	POTENTIAL ENVIRONMENTAL IMPACT	MITIGATION MEASURES
Maintenance	Impact due to maintenance works outside the regular O&M activities	Traffic contribution	- Deployment of Traffic Enforcers at the affected traffic route particular to the national highway and entry point of the project access road - Formulation and implementation of Traffic Management Plan - Installation of traffic warning signage at strategic points
		Dust emissions from movements of project vehicles	- Restrict speed of project vehicles in expose access road surface

E. PROJECT COST AND DURATION

The indicative project cost of the Dambo Hydro Project is at PhP50 Billion with an estimated economic life of 50 years.

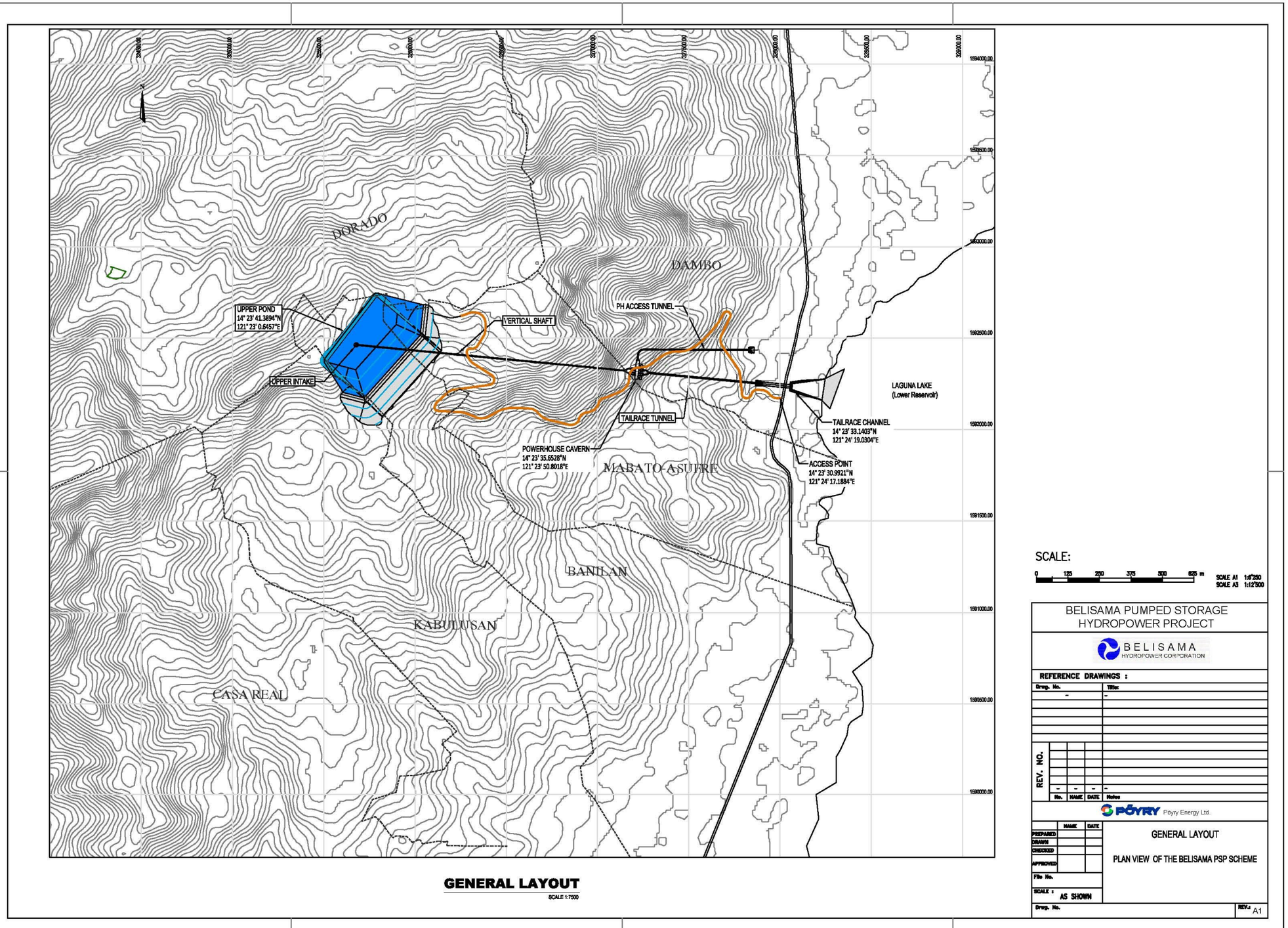
The pre-development phase under BELISAMA's Hydropower Service Contract is five (5) years. The construction period of the Project is estimated at four (4) years.

ANNEXES

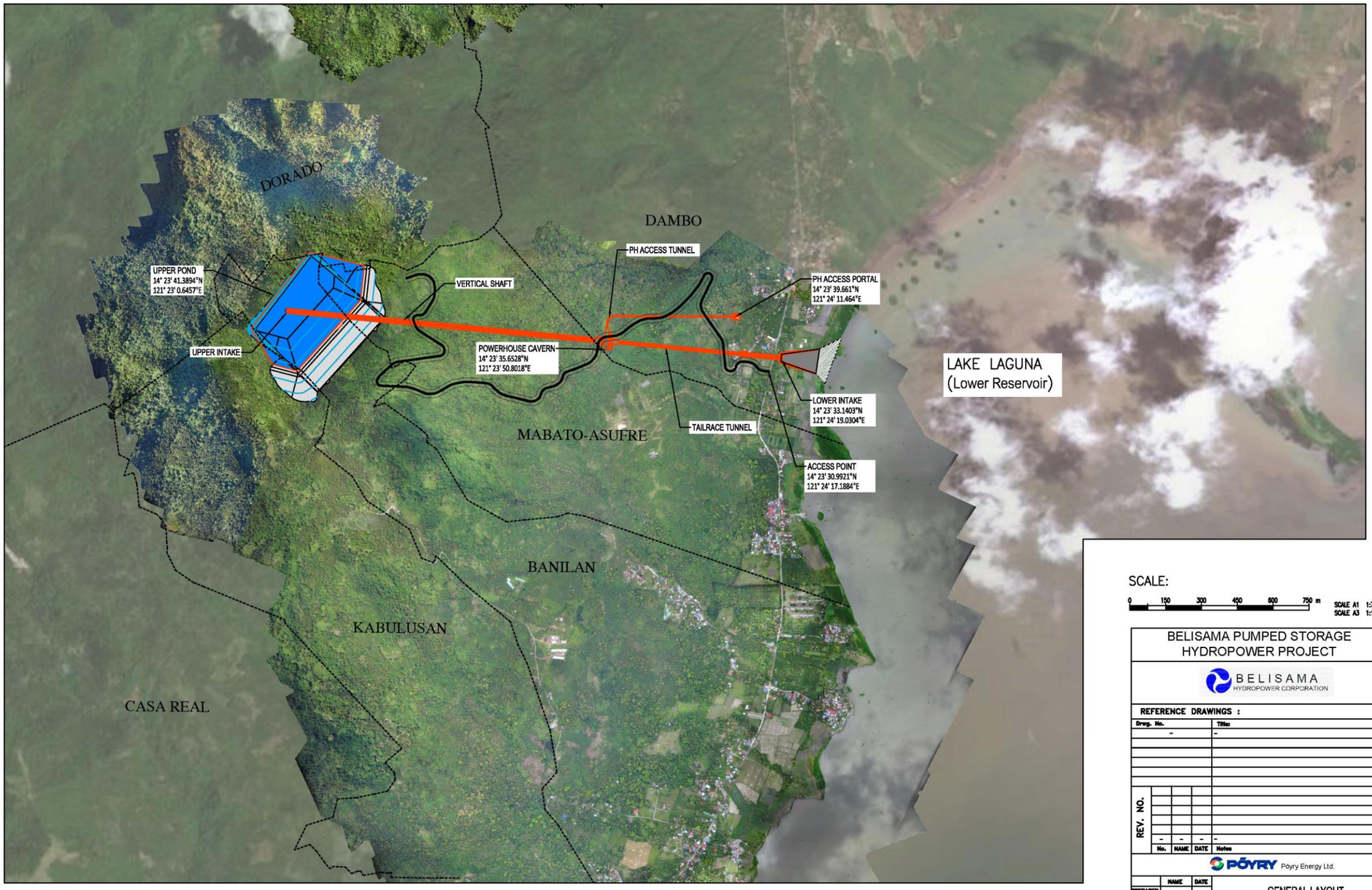
ANNEX 2 Latest General Information Sheet

ANNEX 3 Certificate of Registration as RE Developer

ANNEX C-1 Layout of Proposed Project Site



ANNEX C-2 Aerial Photos of Proposed Project Site



GENERAL LAYOUT
SCALE 1:7500

SCALE:
0 150 300 450 600 750 m
SCALE A1 1:7'500
SCALE A3 1:15'000

BELISAMA PUMPED STORAGE HYDROPOWER PROJECT

BELISAMA HYDROPOWER CORPORATION

REFERENCE DRAWINGS :

Drwg. No.	Title:
-	-

REV. NO.	No.	NAME	DATE	Notes
	-	-	-	-

PÖYRY Pöyry Energy Ltd.

	NAME	DATE
PREPARED		
DRAWN		
CHECKED		
APPROVED		

GENERAL LAYOUT

PLAN VIEW OF THE BELISAMA PSP SCHEME

File No.

SCALE : AS SHOWN

Drwg. No. REV.: A1

UPPER POND

POWERHOUSE AND PENSTOCK