EXECUTIVE SUMMARY for the Public (English)

PAKIL PUMPED-STORAGE HYDROELECTRIC POWER PROJECT

Executive Summary

PROJECT FACT SHEET

Project Name	1400MW Pakil Pumped-Storage Hydroelectric Power Project, "Project"				
Project Location	Brgys. Bano, Burgos, Rizal, Taft, Pakil, Laguna				
Project Area	Lower basin: Surface area 106, 963 m^2 Upper basin: Surface area (at FSL) 1,376,386 m^2				
Authority over Project Site	HSC 2021-07-892 effective 20 December 2019 DOE Certificate of Registration No. HSC 2021-07-892-A dated 22 November 2021 DOE Certificate of Confirmation of Commerciality HSC 2021-07-258 dated 22 November 2021 Option Agreement or Lease Agreement signed by the Landowners DOE letter dated 05 May 2021 re: merging of the four (4) 350MW HSCs with a combined capacity of 1400MW and assignment of the HSC from JBD Water Power Inc to Ahunan Power Inc. DOE letter dated August 31, 2021 re: approval of the Merging and assignment of the HSCs and execution of new HSC under HIC 2021-07-892 NCIP issued Certificate of Non-Overlap dated 03 May 2022 LLDA granted a Conditional Surface Water Permit (SWP-2022-02-001) Pakil LGU trhu the Office Sangguniang Bayan issued Resolution No. 088, series of 2021 dated 14 September 2021 Sangguniang Barangay Taft issued Kapasyahan Blg. 17-T-2021 dated 21 May 2021 Sangguniang Barangay Rizal issued Kapasyahan Blg. 10-T-2021 dated 21 May 2021 Sangguniang Barangay Burgos issued Kapasyahan Blg. 14-T-2021 dated 22 May 2021 Sangguniang Barangay Baño issued Kapasyahan Blg. 05-T-2021 dated 10 May 2021				
Project Type	Hydropower Facilities				
Project Nature	Pumped-Storage with Laguna Lake as the Lower Basin				
Gross-Installed Capacity	1400MW (1200MW_{net})				
Main Project Components	**Components**	**Capacity**		**Phase 1**	**Phase 2**
	Upper Basin	Crest elevation:	434.0 mAsl (eastern side) 435.0 mAsl (western side)	✓	✓
		Crest width:	8 m		
		Crest length:	4,107 m		
		Full supply level (FSL):	432 mASL		
		Minimum operation level:	398.50 m asl		
		Active reservoir storage:	13.7 million m3		
		Surface area (at FSL):	564,927 sqm		
		Reservoir length (crest to crest, N-S):	~1170 m		
		Reservoir length (crest to crest, E-W):	~970 m		
	Access Road	Approximate length:	~6.9 km	✓	
		Type:	Asphalt, 2-way truck traffic		
	Emergency Spillway	Width:	200 m	✓	
	Upper Inlet/Outlet Structure (2 units)	Length:	~43 m	✓	✓
		Diameter:	Variable		
		Submerged conventional			
	Headrace Tunnels (2 units)	Concrete lined		✓	✓
		U/S HT: Length: Diameter:	~35m 8.8m		
		D/S HT: Length: Diameter:	~153 m 8.8m		
	Powerhouse (2 units)	Installed capacity: Phase 1:	677 MW	✓	✓
		Phase 2:	723 MW	✓	✓
	Pressure Shaft (2 units)	Transformer Cavern (L x W x H):	113.00 m x 19.40 m x 13.75 m	✓	✓
	Tunnel (2 units)	Concrete lined;		✓	✓
		Length:	~327m		
		Diameter:	7.20m		
	Surge Tank (2 units)	Steel/concrete lined		✓	✓

	Take-off Yard	Concrete lined		✓	
		Inner diameter	7.2 m		
		Depth	109 m		
	Lower Inlet/Outlet Structures (2 units)	Conventional horizontal intake		✓	✓
	Site Installation Area	Land Area:	84,072 sqm.	✓	
	Laguna Channel	Land Area:	85,590 sqm.	✓	
Project Cost	Phase 1: 31,105 Million PhP	Phase 2: 24,595 Million PhP			
Construction Period	Phase 1: 1st Qtr. 2023 to 2nd Qtr. 2026	Phase 2:1st Qtr. 2023 to 2nd Qtr. 2027			
Commercial Operation Date	Phase 1: 1st Qtr. 2027	Phase 2: 4th Qtr. 2027			
Proponent Name	Ahunan Power, Inc.				
Proponent Address and Contact Details	16/F, Three E-Com Center, Bayshore Drive cor. Ocean Drive, Mall of Asia Complex, Pasay City, Philippines Telephone No.: (02) 8396-5320 Email Address: rbuenojr@primemetropower.com				
Proponent Authorized Representative	Mr. Rafael C. Bueno Jr. President and CEO				
EIA Preparer	Aperçu Consultants, Inc.				
Preparer Contact Person	Lilli Beth S. Yazon				
Preparer Address and Contact Details	Unit 307 Philippine Social Science Center Commonwealth Avenue, Diliman, Quezon City Telephone No.: (02) 8929-2778 E-mail Address.: bethyazon@apercu.biz				

PROJECT PROPONENT

Ahunan Power, Inc. (”Ahunan”) was formed thru the partnership of JBD and Prime Metro Power Holdings Corporation (“PMPHC”). Ahunan is in the business of the development, construction, operation, maintenance of hydropower plants and other allied businesses, with a 1,400MW hydropower project in Pakil, Laguna (“Pakil Project”).

PROJECT DESCRIPTION SUMMARY

This Environmental Impact Study (EIS) for the Proposed 1400MW Pakil Pumped-Storage Hydroelectric Power Project is prepared for obtaining an Environmental Compliance Certificate (ECC). The project will have a total installed capacity of 1,400 MW which will be realized in two (2) separate project phases. Phase 1 of the project will have an installed capacity of 677 MW whereas the installed capacity of Phase 2 is 723 MW.

The proposed hydroelectric plant is considered as an Energy Project of National Significance (EPNS), which is aligned with the thrusts and goals of the Philippine Energy Plan (PEP) 2020-2040, which presented two (2) scenarios: the Reference Scenario (REF), which intends to achieve a 35% Renewable Energy (RE) share in the power generation mix by the year 2040 and the Clean Energy Scenario (CES) which also aims to achieve 35% RE but aims to achieve this by the year 2030 and increase it by 50% by the year 2040. Thus, the pumped-storage project will contribute to the REF with its operation by the end of 2027.

Ultimately, the proposed hydroelectric plant aims to provide benefits such as: improvement of the power grid and energy security for the Luzon grid. Additionally, the project will increase tax collections for the LGU, provide additional income for the LGU, and promote the establishment of new businesses and industries in the four (4) direct impact barangays and three (3) indirect impact barangays the municipality of Pakil. With the Project’s long operating lifespan, there will be a continuing job generation during construction up to operating phase, and the access road improvements can provide continuing progress to the community.

PROJECT COMPONENTS

The project will be built across about 300 hectares of land. The proposed project is designed to be executable in two phases with symmetrical underground power waterways and cavern powerhouses connecting an artificial

Upper Basin and Laguna de Bay as the lower basin. Phase 1 will have an installed capacity of 677MW, while Phase 2 will have an installed capacity of 723MW. The layout of the scheme is to a larger extent chosen by fitting into the existing terrain while also satisfying land acquisition aspects and other constraints such as municipal borders and the impact of the towers for the 500kV transmission line.

The project comprises the following main components:

- Access Road
- Upper Basin
  - Emergency Spillway
- Symmetrical Power Waterway, whereby each phase has the following arrangement:
  - Upper Inlet/Outlet Structure
  - Headrace Tunnel
  - Tailrace Tunnel
  - Surge Tunnel
  - Separate Cavern Powerhouse for each phase
  - Main Access Tunnel (MAT)
  - Lower Inlet/Outlet Structure
  - Laguna Lake Channel
- Power Transmission Grid System and Interconnection Switchyard
- Lower Basin (Laguna Lake)

Figure ES-1 presents the general layout of the facilities and delineation of surface and underground components.

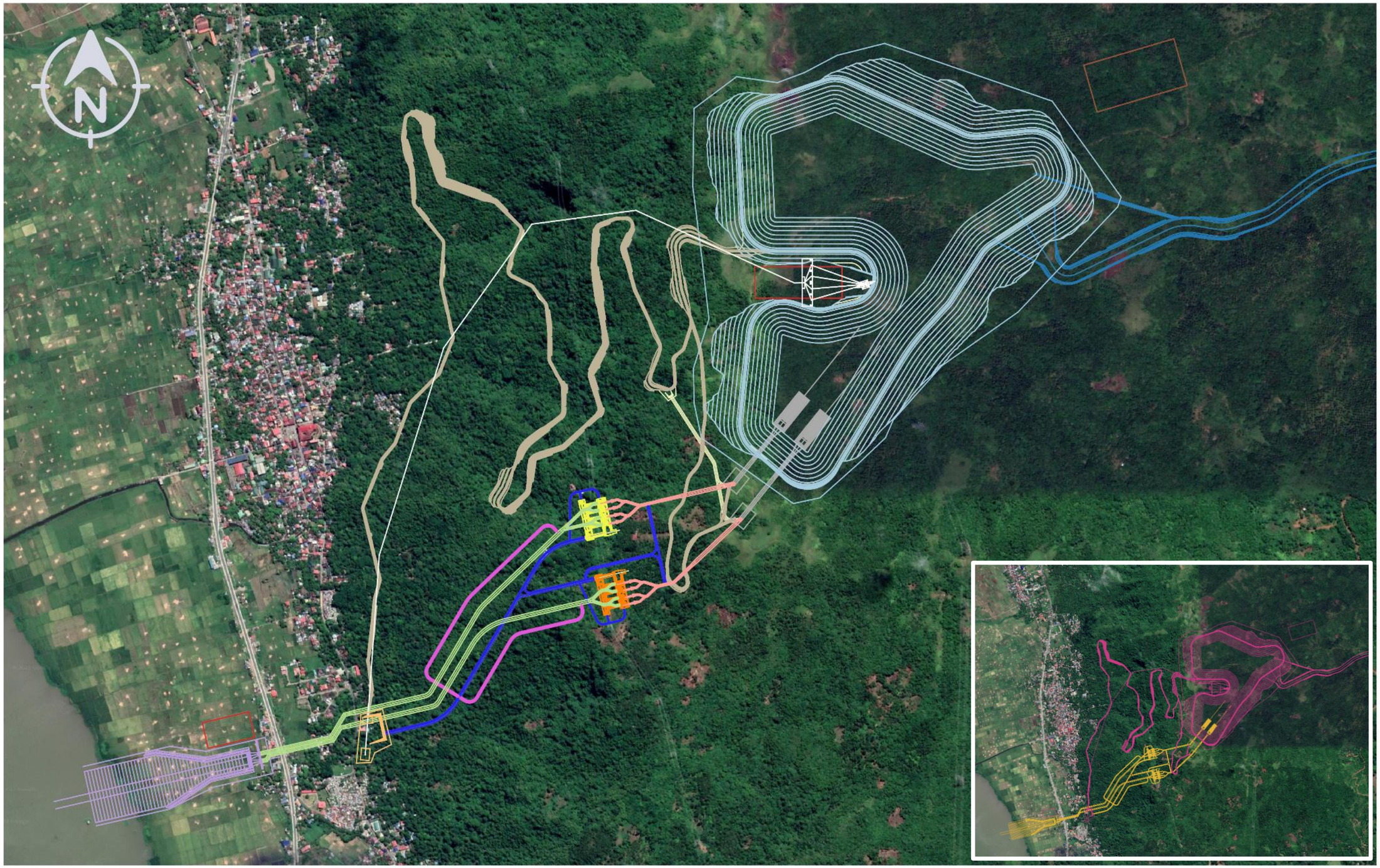

Figure ES-1. General Layout of Facilities

ENVIRONMENTAL IMPACT STATEMENT – Executive Summary
1400MW Pakil Pumped-Storage Hydroelectric Power Project

DATA INFORMATION/SOURCE:

Project Components: Ahunan Power, Inc. (2021)
Base Map: Google Earth (2022)
Created by: Apercu Consultants, Inc. (2022)

AhunanPower

apercu CONSULTANTS INC.

Scale: 1:10,000

PROCESS AND TECHNOLOGY DESCRIPTION

In a reversible pumped-storage system, water will be pumped from the lower reservoir (Laguna de Bay) to the upper reservoir where energy will be stored in the form of gravitational potential energy. Power will be generated by releasing the stored water from the upper basin through the cavern powerhouses in the same manner as a conventional hydropower station. By varying the load, the project can compensate for both variability and changes in output from RE projects from morning to evening hours. The upper reservoir will then be recharged by surplus capacity from the grid to pump the water back to the upper reservoir. The MotorGenerators of the project are connected via a system consisting of switchgear, transformers, high voltage cables, and transmission lines to the project's substation which either takes electricity from or feeds it into the 500kV transmission line of the National Grid Corporation of the Philippines (NGCP), who will be in charge of distributing electricity to electric power distribution company. **Figure ES-2** shows the process of power generation using the pumped-storage system. The 3-D diagram of the project showing the surface underground components is shown in **Figure ES-3**.

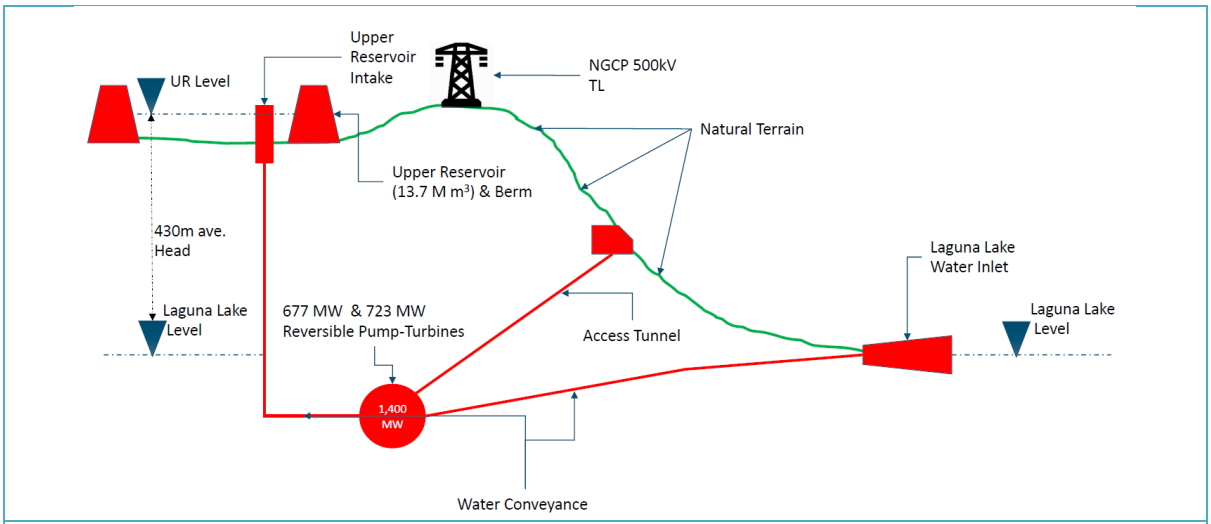

Figure ES-2. Schematic diagram of the intake and discharge of water for energy generation

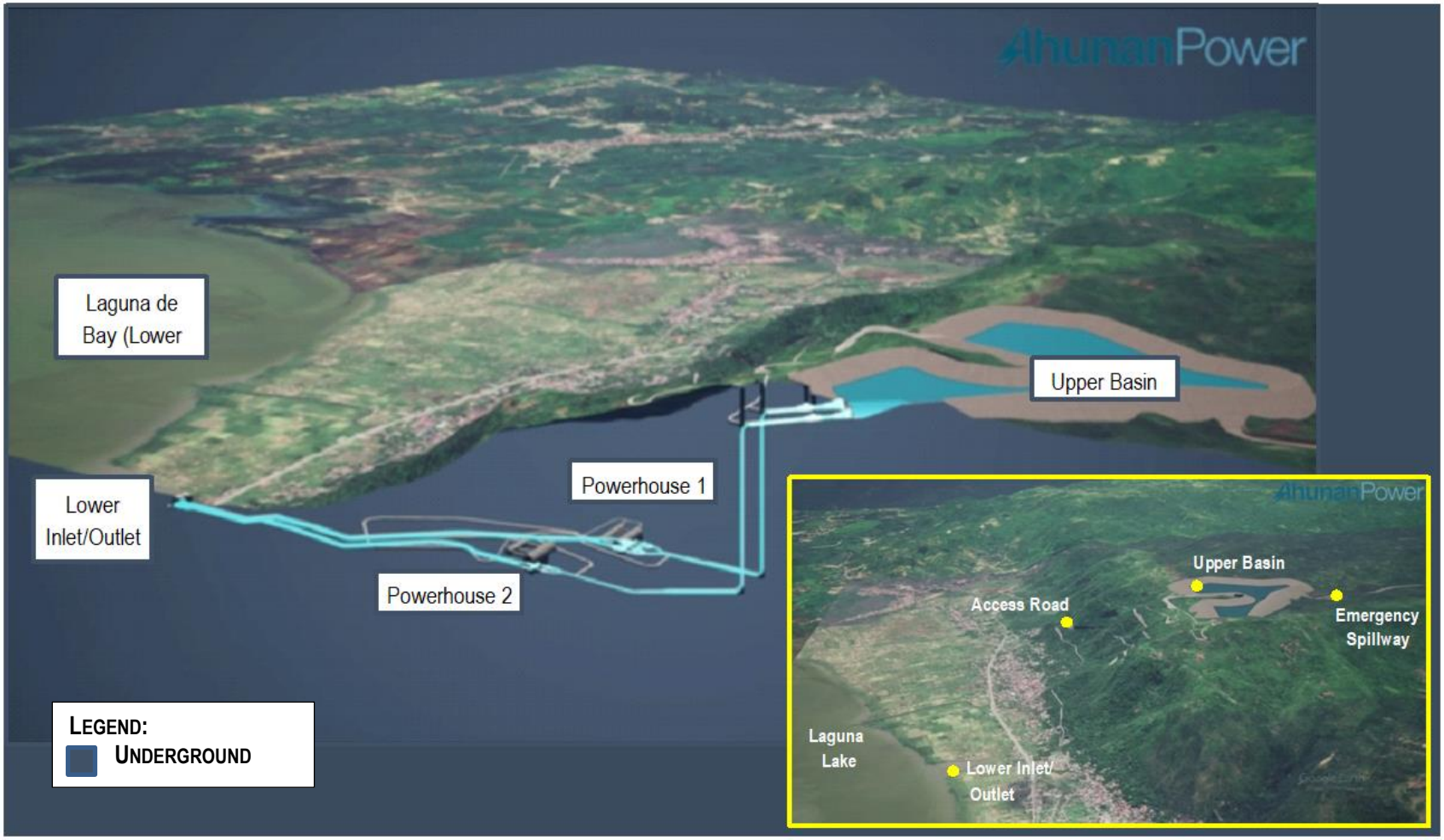

Figure ES-3. 3-D Diagram of the Project

Source: Ahunan Power Inc. (2021)

Summary of the pollution control devices for the proposed project is found in **Table ES-1** and the operations and maintenance of the pumped-storage facility is found in **Table ES-2**.

Table ES-1. Pollution Control Devices

Project Activity	Impacts	Pollution Control Devices with area/capacity	Description
Construction Phase			
Site Development (land cleating, drilling, construction of lower and upper basin, powerhouse, construction of access roads)	Generation of spoils from excavation activity	Designated Spoils Disposal Area	A designated disposal area will be used for temporary storage of spoils. Designated spoils disposal area should be at least 40 meters away from water bodies in the area
	Potential siltation from exposed soil and overburden.	Designated Spoils Disposal Area	A designated disposal area will be used for temporary storage of spoils. Designated spoils disposal area should be at least 40 meters away from water bodies in the area
		Temporary Drainage Structures	Temporary drainage structures will be used to divert runoffs that may cause siltation of waterways.
		Provision of sand and gravel enclosures	Enclosures of sand and gravel will minimize loss of materials during rain events
	Generation of dust	Equipment used for dampening project area during construction (Vehicles, Sprinklers, Hose, Water Buckets, etc.)	Access road surface within the project site will be sprinkled at least three times (3x) a day during dry season to mitigate dust formation in the area
		Equipment for covering loading trucks, excavation materials (e.g., Tarpaulins, plastic covers, canvases etc..)	Covering loading trucks and excavation material would limit exposure of spoils to open air that may cause dust generation.
	Generation of construction wastewater	Settling Ponds	Settling ponds will be used to collect and facilitate the wastewater treatment process
Site Development (Worker's camp)	Generation of domestic waste	Material Recovery Facility (MRF)	Provision of Materials Recovery Facility (MRF); Provision of waste bins and proper impletion of solid waste segregation
		Solid Waste Management Plan	Proper documentation of the SWMP to ensure proper segregation of wastes with proper labelling, and wastes materials manifest indicating the volume of waste and date of collection. Collection will be done by local accredited haulers.
	Generation of hazardous wastes	Designated Temporary Hazardous Waste Storage Facility	Provision of storage facility/area and collected by hazardous wastes DENR accredited third party hauler and treater
		Hazardous Materials Management Plan	Appoint a licensed waste contractor for the transfer of any hazardous waste from the construction site.
			Proper documentation and regular check-ins / maintenance will ensure proper hazard waste management consistent with DENR Standards
	Generation of domestic wastewater	On-site Toilets (Septic Tanks / portable toilets)	Provision of proper and sanitary restroom areas to limit generation of wastewater from construction workers
Site Development (Construction equipment and vehicles)	Noise Pollution	Earpieces, Headphones, Mufflers	Provision of Personal Protected Equipment (PPE) for personnel involved in blasting activity Conducting of blasting activity during daytime only to minimize noise of the project
	Degradation of air quality due to SO_X and NO_x emissions.	Well maintained engines of construction vehicles.	Perform regular check-ins and other preventive maintenance to monitor emissions levels during operational phase.
	Oils and grease leakage from construction equipment and vehicles	Well maintained engines of construction vehicles.	Regular check-ins and maintenance of construction vehicles to avoid leakages of oils and grease
			In case of oil spillage, collect leakage and dispose properly to hazardous waste storage facility

Project Activity	Impacts	Pollution Control Devices with area/capacity	Description
Blasting (construction of underground structures, access roads, foundation)	Noise Pollution	Earpieces, Headphones, Mufflers	Provision of Personal Protected Equipment (PPE) for personnel involved in blasting activity Conducting of blasting activity during daytime only to minimize noise of the project
Operational Phase			
Daily Operations and Maintenance	Generation of domestic wastes (Food Wastes)	Material Recovery Facility (MRF)	Provision of Materials Recovery Facility (MRF); Provision of waste bins and proper impletion of solid waste segregation
		Solid Waste Management Plan (SWMP)	Proper documentation of the SWMP to ensure proper segregation of wastes with proper labelling, and wastes materials manifest indicating the volume of waste and date of collection. Collection will be done by local accredited haulers.
	Generation of hazardous wastes (Office Wastes, Kitchen Oils / Grease)	Designated Temporary Hazardous Waste Storage Facility	Provision of storage facility/area and collected by hazardous wastes DENR accredited third party hauler and treater
			Appoint a licensed waste contractor for the transfer of any hazardous waste from the construction site.
		Hazardous Materials Management Plan	Proper documentation and regular check-ins / maintenance will ensure proper hazard waste management consistent with DENR Standards
	Generation of domestic wastewater	On-site Washrooms / Restrooms	Provision of proper and sanitary restroom areas that are consistent with health and safety standards for employees of daily operations
Potential Risks / Hazards	Potential Flooding	Built-in Flood Protection System	A built-in sensor to monitor water leakages and the corresponding maximum pressure measurement will trigger dewatering system automatically
	Accidental Dam Break	Emergency Spillway	The emergency spillway will allow the passing of the full over-pumping discharge while maintaining an acceptable freeboard on the reservoir
		Built-in Monitoring Device (Pressure and Ultrasonic probe)	Sensors will help closely monitor and control water spills and possible structural failure in case of possible dam break

Table ES-2. Operation Phase Activities and Maintenance

Activity	Details
Operation of the Pakil Pumped-Storage Hydroelectric Project	Pumping of water from Laguna de Bay will be done during off-peak hours to store water at FSL in the upper basin. To generate electricity, the water will be released and will run through the cavern turbines. This process of intake and release of water will take approximately 24hours. The generated power will be transmitted to the Luzon grid. Instrumentation for monitoring is required for the Upper Basin and its appurtenant structures. Adequate monitoring will be essential for the following reasons: • The need to be able to compare observed behavior of the basin and appurtenant structures with predictions and expectations • Detection of abnormal behavior and identification of potential problematic areas at an early stage • Diagnosis of problems as and when they occur and decisions on remedial measures. The instrumentation has to be available to enable measurements to be taken during construction, impounding and long-term operation, with emphasis being given to measurement of deformation and seepage flows through the reservoir and its foundation. The instruments equipped with automatic measuring devices are connected to the central monitoring station, where all data are collected and stored. The central monitoring station (equipment comprise of a workstation with internet access) is placed in the control building at the Upper Basin. Data required for the operation of the Project (e.g. reservoir water level) is sent directly to the control system in the control building at the MAT portal. The monitoring system foreseen to be installed at the Upper Basin includes the following instrumentation: • Monitoring of Reservoir Level - An automatic reservoir level gauging system will be installed close to the intake/ outfall structure. • Monitoring of Settlements - Horizontal and vertical movements (settlements) at the surface of the reservoir embankment are measured by the use of surface monuments (benchmarks) and with settlement tubes and inclinometers within the reservoir body.

Activity	Details
	• Monitoring of Water Pressure and Water Levels - Pore pressure cells are used to measure the interstitial hydrostatic pressure at the foundation, and standpipe piezometers measure the water level within the reservoir and foundation. • Seepage Monitoring - Seepage through the geomembrane liner is collected via the drainage system. A total of three (3) drainpipes collecting systems collect the seepage discharges and lead it from the basin bottom to the outfall south-east of the basin. Seepage water is drained by several reservoir toe drains at the lowest points of the topography. • Earthquake monitoring - A strong motion instrumentation system will be installed to measure earthquake acceleration and structural response from local earthquakes. • Weather Station - A meteorological station will be installed at the platform near the reservoir crest in the south of the ring reservoir to observe the meteorological conditions on site, including temperature, precipitation, humidity, atmospheric pressure, wind speed, wind direction and sunshine duration. The meteorological conditions on site are needed for the evaluation of the seepage discharges and for the assessment of the condition of the geomembrane liner. Trash rack panels are provided for the upper inlet/outlet to prevent debris from entering the hydraulic system. The screens can withstand higher velocities and partial blockage of the screen. Trash rack panels are provided to prevent debris from entering the waterway. Due to the daily reverse operation of the scheme, trash clogging has not been deemed a problem needing attention. Nonetheless, a trash rack cleaning machine is provided.
Preventive Planned and unplanned maintenance	• Inspection and maintenance of the facility, specifically the power waterway and the upper basin will be done monthly to ensure efficient generation. • Trash racks cleaning. • As needed, additional maintenance activities will be conducted as well. • Detailed and proper operation and maintenance procedures will be established and included in the detailed design of the project and required from the EPC Contractor. • Well-planned inventory of spare parts and materials will be maintained to ensure uninterrupted operation such as spare transformer, etc. For Upper and Lower Inlet/Outlet • The hydro-mechanical equipment for the upper and lower inlet/outlet consists of trash racks panels at the intakes, one fixed-wheel gate as service gate and one maintenance gate (stoplogs) for inspection and maintenance purposes. Further, for installation and maintenance purposes an overhead crane is provided at the gate chamber of the upper and lower inlet/outlet. The lower inlet/outlet is also equipped with a trash rack cleaning machine. For Upper Basin Bottom Outlet • The bottom outlet consists of a vertical intake equipped with trash racks, a steel pipe with diameter of 1.2 m embedded in conventional concrete in a trench passing through the reservoir foundation and a 0.8-m diameter control valve (Globe valve). A 0.8 m diameter butterfly valve will act as the emergency (guard) device of the main valve for maintenance purposes.
Operation of permanent staff offices and camp	• Staff offices within the vicinity of the project will be fully operational. • Establish a work health and safety management plans • Establish an environmental management plan (EMP) • Align OM procedures with EMP, such as by using biodegradable hydraulic oil only

RESOURCE UTILIZATION

Water Rights permits will be secured from the National Water Resources Board (NWRB) for any water uses during the construction phase of the project. The water availability study indicates that there is an abundant supply of water in the area. The Malaking Ilog river has a dependable flow of 73.7 lps and may be available for surface water diversion. Groundwater recharge at the Malaking Ilog river basin is about 1000 mm which feeds into the underlying aquifers where springs, artesian wells, and deep wells are tapped for water source.

The estimated water demand for the construction is 122.04 m^3/day. Water supply for construction and in the camps will likely be tapped from the local water distributor, Pakil Water District. During the operations, water demand is estimated to 12 m^3/day. The operations will solely use waters from Laguna Lake. A Conditional Water Permit was secured from the Laguna Lake Development Authority (LLDA).

Power requirements for the project will utilize energy from FLECO, the local energy distributor in the area.

EIA STUDY AREA

The proposed Pakil Pumped-Storage Hydroelectric Power Project will be located on the east bank of Laguna de Bay in Pakil, Laguna Province, Region 4A (CALABARZON). It is estimated to cover approximately 300 hectares

of land, most of which is sparsely populated and covered by a mix of medium-sized trees and tall shrubs. The project area covers four (4) barangays in the municipality of Pakil: Baño, Burgos, Rizal and Taft. The project impact areas, including the upper basin area and areas for temporary facilities are shown in **Table ES-3**.

Table ES-3. Identified direct impact areas (DIAs) of the proposed project

Municipality	DIA (Barangay)	Project Component	Area Covered (sq. m)
Pakil	Rizal	Upper Basin	1,110,997
		Upper Inlet/Outlet Structure	132,937
		Headrace Tunnels	
		Powerhouse	63,614
		Emergency Spillway	441,321
		Pressure Shaft	7,088
		Surge Tank	
		Tunnel	7,125
		Access Road	379,359
		Substation	253,694
	Baño	Powerhouse	43,303
		Tunnel	17,087
		Access Road	16,254
	Taft	Upper Basin	321
		Laguna Channel	1,386
		Lower Inlet/Outlet Structures	11,296
		Take-off Yard	16,107
		Access Road	29,331
		Tunnel	179,341
		Lower Inlet/Outlet Structures	11,296
	Burgos	Laguna Channel	84,203
		Lower Inlet/Outlet Structures	10,078
		Site Installation Area	84,072
Paete	Sitio Bangco (Upland)	Emergency Spillway	53,964
No Barangay Identified		Emergency Spillway	13,324
TOTAL			**2,956,201**

The current vicinity map of the proposed project is shown in **Figure ES-4**.

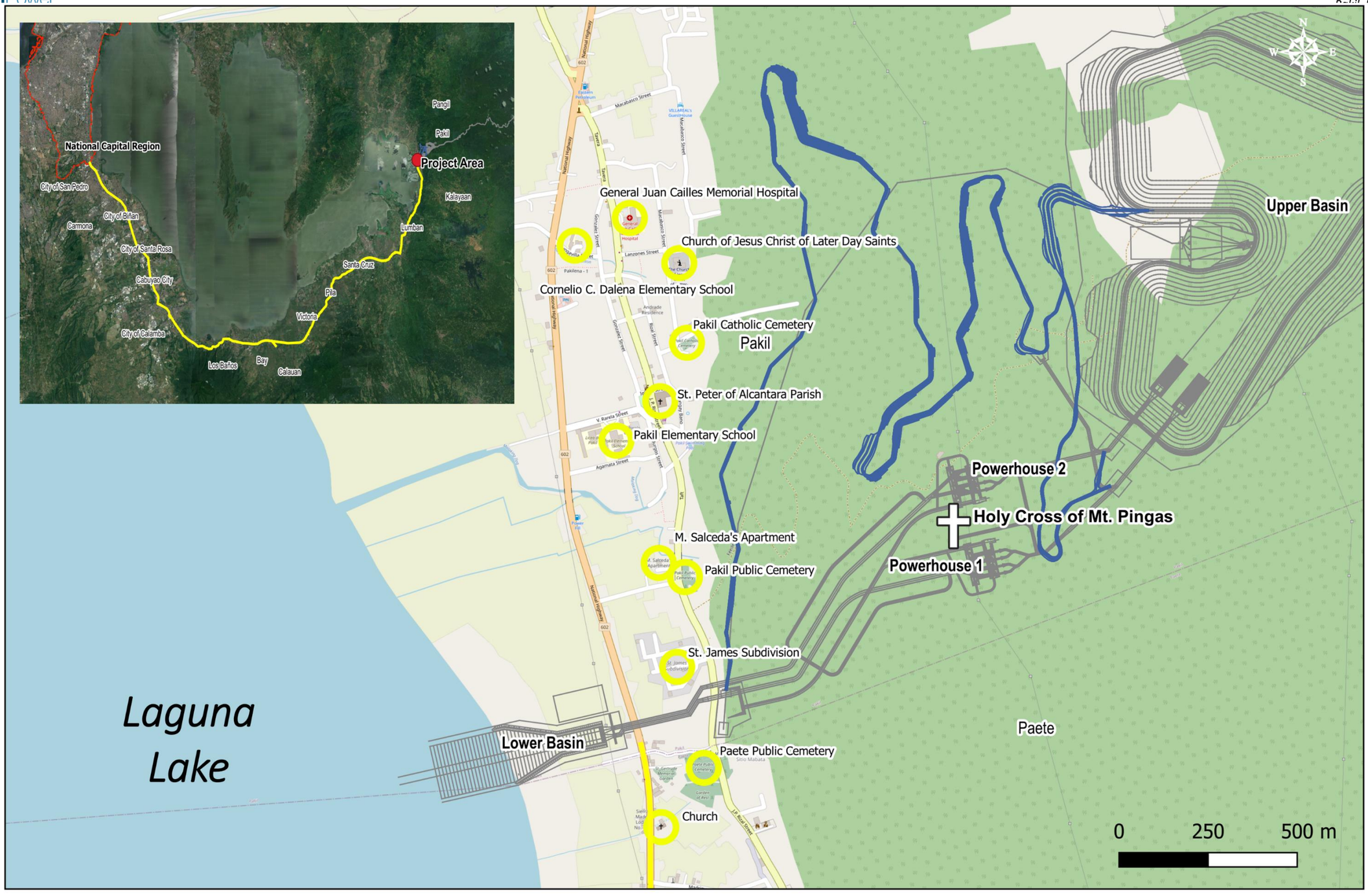

Figure ES-4. Project Vicinity and Accessibility Map

Legend

- Landmarks
- Main Access Road
- National Capital Region
- Proposed Access Road
- Project Layout
- Project Area

DATA INFORMATION/SOURCE:

Project Components: Ahunan Power, Inc. (2021)
Base Map: OpenStreetMap (2022)
Created by: Apercu Consultants, Inc. (2022)

SUMMARY OF ALTERNATIVES

Table ES-4 shows the alternatives considered for the project.

Table ES-4. Summary of Project Alternatives

Aspect	Alternatives
Siting	Identification of potential RE areas and resources by DOE led JBD Water Power, Inc. in 2019 and assigned to Ahunan Power, Inc. to further asses the hydropower potential of the project site. The upper basin is considered an appropriate area for the pumped-storage project considering its elevation from Laguna Lake where the water supply will be sourced, and its terrestrial characteristics are an ideal area for the reservoir. The topographic conditions are quite favorable and that essentially any reasonable size of an upper basin may be allocated to the area. The project site has a distance of about 8 kilometers from the nearby long-existing and efficiently operating Kalayaan Pumped-Storage Power Plant. The geographical locations, weather conditions, and risks impact are relatively the same. The operation of Kalayaan PSPP brings better yield to fisheries and aquatic resources due to the constant movement of water in the lake area and they provide better support for the rehabilitation and management of the watershed area resulting in no incidents of landslides and other detrimental impacts to the environment. Three possible reservoir sites for the Upper Basin were studied and the major consideration of the selected location is the ideal elevation and gross head to meet the required active storage of the reservoir. The topographic conditions are quite favorable and that essentially any reasonable size of an Upper Basin may be allocated in area of Pakil or Paete. The Concept Design location only shows less possibilities for an increase in storage capacity.
Technology/ Design	The proposed location for the upper basin also has potential for a Wind Project; both technologies can co-exist in the Upper Basin Area. Solar technology can be further developed in a certain area of the reservoir to optimize the potential of additional capacity injection to the power grid. The following alternatives were studied during the selection of conceptual design. · Upper Basin: Different location for the upper basin were studied, taking into consideration transmission line towers, design discharge, reservoir design and power waterway. Different dam and reservoir types were also compared. · Powerhouse type: An underground and a shaft powerhouse were compared. Due to the high excavation volumes of the Upper Basin as well as to maximize the use of excavated material for embankment purposes, a Geomembrane Faced Earthfill Reservoir has been considered. This reservoir type is furthermore commonly applied as an economic solution for upper basins of pumped storage projects where the difference in operating water levels can be kept small. Due to the rapid fluctuations in the reservoir level (drawdown of 24.5 m within 10 hours) only surface liners were being considered as this is also favorable for reservoir stability reasons. The dimensions of the power waterways have been selected such as to achieve the same cycle efficiency for all arrangements studied under the consideration of the design discharge. The project's Lower Basin, Laguna de Bay, can be considered of almost infinite capacity. An Upper Basin location combined with an underground waterway and powerhouse had been found to be the most suitable arrangement for the Pakil Pumped Storage Hydroelectric Power Plant of the alternatives studied. The main advantages of this arrangement are: · Lower construction costs · Less geological risks · Suitability for a region of high seismic activity. The proposed project will utilize a reversible pumped-storage system to generate energy. This technology is the least expensive source of electricity. It will also be able to shift loads to provide electricity during peak hours and will also be able to restore network interconnections if blackouts will occur via "black start". Pumped-storage hydro plant has a better ramp rate than other power plants and the agility is one of its most important advantages as it can increase the flexibility of the power grid due to its capability on frequency regulation. This technology is becoming increasingly important and valuable also for storing energy and supporting power generation from other renewables, such as wind and solar power. Water will be pumped from the Laguna Lake (lower reservoir) which is located at lower elevation to the upper reservoir where energy will be stored. The stored water will then be released through turbines to produce electricity. Further assessment of the project determined that the underground waterway system will be more advantageous and has a minimal social and environmental impact over the above-ground structures or shaft design concept of the pumped storage facilities. The purpose of the project as an energy storage/ grid regulating device with short reaction and loading times can otherwise be fulfilled with the use of a 13000MWh Battery Energy Storage System (BESS), a Combustion Engine Power Station, or a Gas Turbine Power

Aspect	Alternatives
	Station. BESS technology is not economically competitive at this scale while the other alternative technologies would have a higher environmental impact. Run-of-river (ROR) or Diversion, utilizes river or stream flows. ROR is subject to seasonal flows and has no capacity to store energy in contrast to the pumped-storage technology. Other technologies like wind and solar are planned to be developed by other project proponents in the nearby area which energy output are comparatively far lower than the API project. These technologies are feasible to co-exist in the area to optimize the energy output to the grid. Solar technology can later on be developed above the reservoir to optimize utilization of the area.
Resources	The proposed project will adopt proven hydropower technology which will make use of available natural resources (i.e., water, geology, and topography) to store energy and generate electricity. Another main resource for the project will either be RE or surplus capacity of the grid which can be stored and released back to the grid at an efficiency of 77%. The Project will utilize water from Laguna Lake, a renewable water source. It will not affect other water supplies as it will not be dependent on the natural inflow of water to fill in the reservoir. The proposed project will produce significantly lower GHG emissions to the environment since there will be no emissions or air pollutants during operations.
Environmental Conditions	The project is located in a region characterized by moderate to high seismicity. The project location has moderate to high susceptibility to hazards such as, ground shaking, liquefaction, landslides and rockfall, which can be mitigated by appropriate design of the facility. The project is not dependent on natural inflow and is not susceptible to flooding from nearby rivers. However, larger typhoons may cause flooding in the floodplains along Laguna de Bay. Seiches are also likely to occur due to the project site's proximity to Laguna de Bay.

NO PROJECT OPTION

The "no-go" alternative is the option of not proceeding with the proposed Pakil Pumped-Storage Hydroelectric Power Project. As a potential source of renewable energy, the capacity of the Luzon gird will remain the same and will continue to depend on electricity from gas or coal-fired power plants. Also, the aim to lessen the country's dependence on fossil fuel to lessen GHG emissions will not be achieved. Likewise, the foreseeable benefits of the project to the host municipality and barangays, including the additional income for the LGU and potential employment and business opportunities in the community, will be impeded.

SUMMARY OF BASELINE CHARACTERIZATION

The existing environment of the project site from the baseline surveys conducted is shown in **Table ES-5**.

Table ES-5. Baseline Characterization Summary

Module	Baseline Characteristics
LAND MODULE	
Land Use	The Municipality of Pakil has a total land area of 1,300 hectares. It consists of 13 barangays. A total of 64.32% of the municipality is occupied by agricultural areas, while 4.42% by built-up areas. The Proposed Project is located within the Province of Laguna, Municipality of Pakil, in Barangays Rizal, Bano, Taft, and Burgos. There are four (4) Certificates of Ancestral Domain Title (CADT), found in Region IV-A or CALABARZON.
Geology and Geomorphology	The Luzon Island is part of the Philippine Mobile Belt and is surrounded by major geologic structures which affect the seismicity of the region. The Municipality of Pakil belongs to the Stratigraphic Grouping (SG) 6 or Southern Sierra Madre – Mainland, specifically the Laguna Formation. On the other hand, Laguna Lake is included in the Macolod Volcanic Complex, specifically under the Southern Luzon Upland. Laguna Lake is known as the largest lake in the Philippines, having a total land area of 871.2 km^2 and an average depth of 2.8 m. The northern and eastern parts of the lake are characterized by a series of rolling hills with high to moderate relief. On the other hand, the southern side is characterized by the presence of volcanic cores with several smaller cinder cones and crater lakes, while the western side is bounded by a flat undulating narrow strip of land that belongs to Metro Manila. Geologic hazards of the project area are discussed below: • The PGA values that will apply to the project site will be 0.22g for the upper reservoir area, powerhouse sites, underground tunnel, and access roads while PGA value of about 0.70g will apply for the lakeshore area where the lower reservoir and intake pipes will be located. • The nearest active fault is located about 17.7km northeast of the proposed upper reservoir. No active or potentially

Module	Baseline Characteristics
	active faults are crossing the project area. • The lower reservoir and intake pipes have a high probability of occurrence of liquefaction and differential settlement. • Tsunami is not present on site since it is entirely located inland. • High possibility of occurrence of seiche. • The area is highly susceptible to earthquake-related landslides and rockfall. • The possibility of subsidence in the project site is low. • The possibility of lateral spreading in the project site is low to steeply sloping. • The nearest active volcano to the project site is Mount Banahaw, which is about 34.5 km. • The lakeshore area of Pakil has high susceptibility to flooding
Pedology	All the parameters were within the Canadian Soil Quality Guidelines for agricultural and industrial areas, except for pH values which were all below 6.0.
Terrestrial Flora	The proposed project site is comprised of a mosaic of different vegetations from grassland to secondary growth forests. The upper basin is dominated by a grassland agroecosystem composed of large plantations of fruit trees and crops. The proposed access road is a large track of forest patch classified as a young secondary growth forest with intermediate and climax species. Based on the initial assessment, a total of 102 morpho-species belonging to 81 genera and 47 families were record through the nested quadrat sampling method and opportunistic survey. The genera with the highest species representation were from *Ficus* (8), *Macaranga* (4), *Syzgium* (4), and *Litsea* (3). Families with the greatest number of species observed are from *Moroceae* (13), *Euphorbiaceae* (8), and *Fabaceae* (6). A total of 47 morpho-species belonging to 37 genera and 21 families were recorded with an equivalent to a density of about 1200 trees for every one-hectare track of land. Across the quadrats surveyed, the most abundant species are mahogany, lanzones, santol, rambutan, and agosip. These species are associated with highly disturbed vegetation where human interventions are very apparent. The computed values revealed that the study area has a very high diversity (H'=3.88). When exotic species are excluded, H' index will increase to 3.9 Exotic species does not have a huge impact on the overall diversity value of the study site. Threatened species in the area based on the IUCN Red List or the Philippines Red List are: magabuyo, hairy leaf apitaong, kamagong, anang, takip asin, tanglin, narra, salaguisog, mahogany, is-is, makaasim, kape, rambutan, haikan, and tagbak.
Terrestrial Fauna	A total of 77 species of vertebrate fauna were recorded during the two surveys conducted. Sixty-four (64) percent of the recorded vertebrate fauna were endemic. Twenty-five (25) species are resident species in Pakil. The common short-nosed fruit bat recorded the high number of individuals, followed by the introduced cane toad. The Philippine bulbul is most commonly encountered bird species The area records a high level of species diversity (H'=3.35).
WATER MODULE	
Hydrology	The Proposed Project will be located along the eastern portion of the Laguna Lake Basin which drains to Laguna Lake and partly within the Mauban-San Antonio Basin that drains to Lamon Bay. The groundwater permits are all located within the Malaking Ilog river basin registered under the Pakil Water District. Two (2) surface water permits are located at the midstream and downstream portion of Tibag River registered under the Sierra Madre Water Corporation.
Aquatic Ecology	Sampling stations share consistent characteristics, with the creek sampling sites mostly slow-flowing and clear. Lake water sites are primarily murky, with various aquatic vegetation. A total of twenty-eight (28) taxa representing four (4) groups of phytoplankton were observed. The phytoplankton communities in the creek sites were dominated by *Pinnularia sp.* and *Arthrospira sp.* during wet season, and by *Diatom asp.* and *Chroococcus sp.* during the dry season. The lake sites were dominated by *Arthrospira sp., Melosira sp.* and *Pediastrum sp.* during the wet season and by *Arthrospira sp., Melosira sp.* and *Aulacoseira sp.* during the dry season. *Euglypha sp.* was the most abundant zooplankton in in the creek sites, while amoeboids, and Tintinnid and *Keratella sp.* were notable in the lake sites during the wet and dry season, respectively. Macroinvertebrates are more abundant in the creek sites compared to lake sites. Larvae of non-biting midges and atyid shrimps are dominant at both creek sites, while *Macrobrachiuim sp.* is the dominant benthic macroinvertebrate in the lake sites. These species are pollution and siltation tolerant species. Fish are one of the major vertebrate groups within the local ecosystem, however, these were not present in the creek sites. The fish diversity in Laguna Lake noted three (3) native species, one of which is the Silver Perch, an endemic species and vulnerable based on the IUCN Red List. Majority of the recorded species are the Nila Tilapia, the Mossambique Tilapia, and the Pangaius Catfish.
Water Quality	Exceedances in the surface water stations occurred in some stations for the TSS, Iron, and Ammonia. All of the stations exceeded for Phosphates and Fecal Coliform, with one exemption during the dry season for Fecal Coliform. The rest of the parameters were compliant with the Class C standards for freshwater sources.

<table>
<tr><th>Module</th><th>Baseline Characteristics</th></tr>
<tr><td></td><td>For the ground water stations, acidic values were measured in some of the stations; one station did not meet the standard for the BOD parameter; another station also exceeded the limit for Iron. All stations exceed the standard Ammonia level during the dry season; while Fecal Coliform exceedances were noted for most stations in the wet seasons but decreased during the dry season.</td></tr>
<tr><td colspan="2">AMBIENT AIR AND NOISE MODULE</td></tr>
<tr><td>Ambient Air</td><td>There are no large stationary sources of air emissions within the model domain.</td></tr>
<tr><td>Noise</td><td>The calculated low sound level exceeded the Classes 1, 2, and 3 limits by two, seven, and 17 decibels respectively. Despite these exceedances, noise impact on the populated receptors is not expected because most of the components will be constructed underground. In addition, the Upper Basin is located far from populated areas.</td></tr>
<tr><td>Meteorology</td><td>The project area falls under Type III climate which is characterized by no pronounced maximum rain period with a short dry season lasting one to 3 months.

Surface temperatures at the Project site appeared to be similar to the regional trend but with lower values. On the other hand, the relative humidity at the site has higher values compared to the regional data but have a similar trend.

The project site is a high typhoon risk area with a cyclone frequency of three every two years. PAGASA has recorded 32 tropical cyclones crossing the province of Laguna from 1948 to 2020, although neither a Severe Tropical Storm nor a Super Typhoon has been recorded crossing the province.

The estimated annual GHG emissions of the project operating for 12 hours may range from about 25 to 110 gigagrams

The Pasquill-Gifford stabilities derived from the Monin-Obukhov length of the AERMOD surface file showed that Stable (~51%) and Unstable (45%) atmospheres dominate the Project area.</td></tr>
<tr><td colspan="2">PEOPLE MODULE</td></tr>
<tr><td>Socioeconomics</td><td>Socioeconomic data of Laguna Province:
Laguna is located in the central part of the Calabarzon Region. The province has a total land area of 175,973 hectares and is subdivided into 24 municipalities, six component cities, seven congressional districts and 681 barangays.
The province has nine district hospitals operated by the provincial government. Additionally, there are five Level I city governments and one university health service managed by UPLB. A total of 35 private hospitals are located in strategic areas of the province.
Electricity in most parts of the province is supplied by MERALCO while the First Laguna Electric Cooperative (FLECO) supplies power to most municipalities of the fourth district.
The Provincial Development Plan of Laguna mentions three operating power plants in the province.
Socioeconomic data of the Municipality of Pakil:
The main economic activities in Pakil are farming (55%), fishing (25%), business (10%), livestock raising (3%) and other activities (7%).
The municipality of Pakil reported a poverty incidence of 18.5% in 2016.
Water supply is provided by the Pakil Water District (Pakwad) that serves Barangays Gonzales, Tavera, Rizal and parts of Taft and Burgos.
Pakil is known for the wood statue and oil painting of Our Lady of Sorrows of Turumba.
Socioeconomic data of impact barangays:
<table>
<tr><th>Barangay</th><th>Urban/Rural</th><th>Occupations</th><th>Population (2020)</th></tr>
<tr><td>Baño</td><td>Urban</td><td>construction workers, private and government employees, ambulant vendors and farmers</td><td>593</td></tr>
<tr><td>Burgos</td><td>Urban</td><td>farmers, sari-sari store and junkshop workers</td><td>2203</td></tr>
<tr><td>Rizal</td><td>Urban</td><td>construction workers, ambulant vendors, farmers, and a few are fishermen</td><td>3130</td></tr>
<tr><td>Taft</td><td>Urban</td><td>fish vendors, contractual workers, wood carvers, papier mache makers, ambulant vendors, online sellers</td><td>1300</td></tr>
<tr><td>Gonzales</td><td>Urban</td><td>farmers, fishermen, overseas workers, carpenters, sari-sari store owners</td><td>2614</td></tr>
<tr><td>Tavera</td><td>Urban</td><td>online sellers, farmers, retailers</td><td>1810</td></tr>
<tr><td>Saray</td><td>Rural</td><td>copra farming, banana and root crop planting</td><td>405</td></tr>
</table>
Primary concerns/issues/suggestions raised during the public participation activities primarily revolve around the following topics: the environmental risks that the project may cause; methodologies of the study, and compensation.</td></tr>
<tr><td>Traffic</td><td>The area is characterized by light to mild traffic. Motorcycles had the highest overall volume throughout the duration of the traffic survey, followed by cars.</td></tr>
</table>

Module	Baseline Characteristics
ERA	The reservoir safety analysis assumes a malfunction that causes over pumping and filling of the upper basin up to Full Supply Level (FSL) leading to the use of the ungated overflow emergency spillway. To empty the reservoir due to technical defects of the turbines or other parts in the power waterway, a gated bottom outlet is located at the eastern side of the basin.

MAIN IMPACTS AND MITIGATING MEASURES

Tables ES-6 provides the Impact Management Plan (IMP).

Table ES-6. Impact Management Plan

Environmental Aspect	Project Activities	Potential Impacts	Prevention or Mitigation or Enhancement	Target Efficiency
I. PRE-CONSTRUCTION PHASE (The pre-construction phase includes activities such as planning, conducting of the feasibility study, detailed engineering, ocular survey, and permit procurement).				
II. CONSTRUCTION PHASE				
Land	• Construction of upper basin and access road	Change/ Inconsistency in Land Use	• Keep vegetation clearing to a minimum • Prepare a Rehabilitation and Revegetation Plan • Compensate landowners for loss of land • Proper implementation of decommissioning and rehabilitation of temporary construction facilities	100% compliance to mitigating measures and regularly monitored and reported by the Proponent
		Encroachment in environmentally critical areas (ECAs)	• Implementing buffer zones to exclude the ECAs from direct impacts of the project, as much as possible • Implementing measures to stabilize steep slopes in the area • Identification of priority sites for conservation, protection, and restoration of species in the area • Placing signages where wildlife encounters are common	100% compliance to mitigating measures and regularly monitored and reported by the Proponent
		Impact on visual aesthetics	• Designation of a specific spoils disposal site to prevent the occurrence of several stockpile areas that will be potential eyesores • Ensuring maximum utilization of spoils/debris and muck for construction purposes to decrease the amount that needs to be stockpiled • Proper disposal of rock from both surface and underground excavation works • Creation of greenery and further development of exposed areas in line with the landscape	100% compliance to mitigating measures and regularly monitored and reported by the Proponent
	• Construction of upper basin, access road, and other surface components	Change in surface landform/ geomorphology/ topography/terrain/ slope	• Road construction following national and international guidelines on road construction • Conduct of a detailed slope stability assessment • Slope protection through the construction of ditches, mesh, catch fences, warning fences, rock sheds, and tunnels • Monitoring of water levels to prevent uncontrolled flow in and out of the designed drainages • Revegetation of cleared out areas to visually assimilate the old terrain and maintain slope stability • Grouting in sections where seepage can occur	100% compliance to mitigating measures and regularly monitored and reported by the Proponent
		Vegetation removal and loss of habitat for terrestrial species	• Limit tree cutting to maintain sufficient vegetation cover and availability of water • Limit habitat modification to a small area as much as possible • Maintenance of vegetation connecting habitat patches to provide avenue to move from one area to another • Relocate animals that are unable to move to adjacent forests	100% compliance to mitigating measures and regularly monitored and reported by the Proponent
		Threat to terrestrial species	• Conduct IECs to address human-wildlife conflicts • Placing signages where there are possibilities of wildlife encounters • No shining of night light outside of the working area • If emergency work proceeds at night, noisy activities will be minimized. • Proper waste disposal system for solid and chemical wastes • Relocate animals that are unable to move to adjacent areas	100% compliance to mitigating measures and regularly monitored and reported by the Proponent
		Hindrance to wildlife access	• Establishment of pathways for wildlife • Maintenance of vegetation connecting habitat patches	100% compliance to mitigating measures and regularly monitored and

Environmental Aspect	Project Activities	Potential Impacts	Prevention or Mitigation or Enhancement	Target Efficiency
			• Signages to prevent hunting in the area	reported by the Proponent
	• Construction of tunnels, cavern powerhouses, and other underground components	Change in subsurface geology/ underground conditions	• Identification of stockpile and/or final disposal site for excavated materials • Use of lining, grouting, or any other method to prevent leakage of water into open fractures, whenever appropriate • Anchorage of tunnels and chambers or reinforcements through lining with concrete or steel • Rock bolts, steel support and lining to prevent collapse of any subsurface tunnel or chamber	100% compliance to mitigating measures and regularly monitored and reported by the Proponent
	• Construction of all project components	Change in rate of erosion and sedimentation	• Reforestation and other watershed management activities	100% compliance to mitigating measures and regularly monitored and reported by the Proponent
		Inducement of subsidence, liquefaction, landslides, mud/debris flow	• Replacement of the susceptible soil with appropriate amount of gravel • Appropriate foundation design of project facilities located in the liquefiable zone • Improving the strength, density and/or drainage characteristics of the soil using a variety of soil improvement techniques	100% compliance to mitigating measures and regularly monitored and reported by the Proponent
		Soil erosion/loss of topsoil/overburden	• Planting of grass, shrubs or other suitable soil erosion control vegetation • Using erosion control blankets made of mulch and other biodegradable material, which when completely degraded can be taken over by natural vegetation growing on the slopes • Building terraces made of wood or concrete blocks to help slow down erosion • Topsoil should be stored separately and used in a nursery for growing planting materials that can be used for reforestation and tree planting activities to support the watershed management program of the project • Creation of diversion channels such as open ditches, drains, pipes or gutters to drain excess surface runoff • Removal of loose rocks/blocks and stabilizing the slopes to mitigate the possibility of rockfall from excess overburden materials	100% compliance to mitigating measures and regularly monitored and reported by the Proponent
		Change in soil quality/fertility	• Set-up compost pits in designated areas for replenishment of soil nutrient in areas susceptible to surface runoff • Fence off and establish an exclusion zone around all areas with contaminated materials • Practice proper storage management of solid and liquid wastes, including hazardous wastes and electronic wastes, in the construction sites and construction camps • Excavation, transportation, and disposal of contaminated soil should be remediated offsite using appropriate treatment options and carried out in accordance with local regulations	100% compliance to mitigating measures and regularly monitored and reported by the Proponent
		Devaluation of land value due to improper waste management	• Development of a Solid Waste Management Plan (SWMP) at work areas and workers' camps that includes practices to manage, reduce, and reuse waste • Strict implementation of rules on proper solid waste management by all personnel engaged or associated with the project • Appointing a licensed waste contractor for transfer of any hazardous waste from the construction site • Use of bund walls for construction material stockpiles to prevent the materials from being washed away by rains or streamflow	100% compliance to mitigating measures and regularly monitored and reported by the Proponent
Water	• Construction of all project components	Change in drainage morphology	• Provision of sediment/silt traps to avoid river sedimentation • Design for an efficient drainage with diversion, proper grading and dewatering system	100% compliance to mitigating measures and regularly monitored and reported by the Proponent
		Change in lake water depth	• Sediment/silt traps will be provided • Drilled/excavated sediments will be properly hauled, conveyed, and used as construction materials	100% compliance to mitigating measures and regularly monitored and reported by the Proponent
		Occurrence or aggravation of flooding in nearby areas	• Proper drainage system and use of sediment/silt traps • Provision of proper river crossings along waterways	100% compliance to mitigating measures and regularly monitored and reported by the Proponent

Environmental Aspect	Project Activities	Potential Impacts	Prevention or Mitigation or Enhancement	Target Efficiency
			• Drilled/excavated sediments will be properly hauled, conveyed, and may be used as construction materials	
	• Presence of significant number of construction workers and their daily requirements in workers' camps • Significant water usage for drilling	Depletion of water resources/ competition in groundwater use	• Use of bottled water and/or refilling stations • Connection to Pakil Water District	100% compliance to mitigating measures and regularly monitored and reported by the Proponent
		Degradation of surface water and groundwater quality	• Ensure proper collection and disposal of solid wastes, for strict compliance • Regular check-ups and preventive maintenance machineries, equipment, and vehicles are to undergo • Allot a secured and industry-standard spoils disposal areas and collect spoils regularly or as needed • Proper storage, disposal, and collection of hazardous wastes, including used oils and grease, medical-related wastes, and construction spoils • Prepare a work-around plan for construction zones for areas near vital water sources	100% compliance to mitigating measures and regularly monitored and reported by the Proponent
	• Construction of lower inlet/outlet and other components near Laguna Lake	Threat to aquatic species	• Implement proper waste management practices • Limit noise and disturbances to conservative levels and to a small area as much as possible • Restore disturbed areas	100% compliance to mitigating measures and regularly monitored and reported by the Proponent
Air	• Construction of all project components • Drilling, blasting, and excavation of materials in the ara • Transport of materials to and from project site	Degradation of air quality due to heavy equipment emissions and fugitive dust pollution	• Regular water application at active construction sites, staging areas, and access roads • Replace vegetation in non-structure areas • Regular maintenance of heavy equipment and motor vehicles • Compacting of exposed soil • Require contractors to provide tarpaulin cover on trucks loaded with construction materials • Impose speed limits to vehicles (15-20 kph)	100% compliance to mitigating measures and regularly monitored and reported by the Proponent
People	• Right of way acquisition prior to construction activities	Displacement of settlers Displacement/ disturbance of properties Change/ conflict in land ownership Change /conflict right of way Impact on public access	• Prepare and Land Acquisition and Resettlement Action Plan • Acquisition of affected properties using fair market values • Proper and timely compensation for land and improvements	100% compliance to mitigating measures and regularly monitored and reported by the Proponent
	• Construction of access roads	Delivery of basic services/ resource competition	• Consultation with the DPWH District Engineering Office and the host LGU to avoid duplication of planned infrastructure projects like road construction projects for Barangay Saray	100% compliance to mitigating measures and regularly monitored and reported by the Proponent
	• Construction of all project components • Drilling and blasting	In-migration	• Coordination with host LGU and barangays and provision of a list of required skills during the construction	100% compliance to mitigating measures and regularly monitored and reported by the Proponent
		Cultural/lifestyle change	• Employ proper mitigating measures for groundwater resources. (See Table EW-## and Table EW-##). • Preserve the trail leading to and the Mt. Ping-as Cross and chapel.	100% compliance to mitigating measures and regularly monitored and reported by the Proponent
		Impacts on physical cultural resources	• Employ proper mitigating measures for groundwater resources. (See Table EW-## and Table EW-##)	100% compliance to mitigating measures and regularly monitored and reported by the Proponent
		Occupational health and safety	• Contractor will implement **HSE Management Plan** to mitigate for all relevant occupational health and safety risks • Provide healthcare for workers in accordance with Philippine OSH Standard Rule 1963.02	100% compliance to mitigating measures and regularly monitored and reported by the Proponent
		Project benefits	• Support to LGU's **Development Plan**. Proper coordination with the LGU to enhance local benefits	100% compliance to mitigating measures and regularly monitored and

Environmental Aspect	Project Activities	Potential Impacts	Prevention or Mitigation or Enhancement	Target Efficiency
			• Coordination with host LGU and barangays and provision of a list of required skills during the construction	reported by the Proponent
	• Construction of all project components • Transport of materials to and from the project site	Threat to public health and safety	• Water down bare areas during the dry season • Use low-noise earth moving equipment and mufflers on noisy construction equipment • Limit noisy activities during daytime; no construction at night so as not to disturb the host communities • Implement Covid-19 screening during hiring and observe proper protocols during construction	100% compliance to mitigating measures and regularly monitored and reported by the Proponent
		Traffic congestion	• Install traffic warning signs near schools, institutions and population centers. • Traffic aides will be assigned to manage traffic if necessary. • Information on construction schedule will be posted in public bulletin boards and announced in local radio stations and LGU website/Facebook page	100% compliance to mitigating measures and regularly monitored and reported by the Proponent
III. OPERATION PHASE				
Land	• Operation of the Pakil Pumped-Storage Hydroelectric Power Plant and permanent staff offices and camp	Impact on visual aesthetics	• Re-vegetation of exposed areas using indigenous species as part of the Catchment Area Treatment Plan (CATP) • Proper waste management to ensure that the areas remain free of solid wastes and other unsightly materials	100% compliance to mitigating measures and regularly monitored and reported by the Proponent
	• Operation of the Pakil Pumped-Storage Hydroelectric Power Plant	Change in surface landform/geomorphology/ topography/terrain/slope	• Long-term watershed management to reduce erosion and sediment inflow into the reservoir	100% compliance to mitigating measures and regularly monitored and reported by the Proponent
Water	• Operation of the Pakil Pumped-Storage Hydroelectric Power Plant	Occurrence or aggravation of flooding in nearby areas	• Proper design of project components to allow the soundly conveyance of water thru tunnels • Provide serviceability access in case of clogging or malfunctioning • Proper design and use of emergency spillway	100% compliance to mitigating measures and regularly monitored and reported by the Proponent
	• Operation of the Pakil Pumped-Storage Hydroelectric Power Plant and permanent staff offices and camp • Planned and unplanned maintenance	Depletion of lake water	• Use of bottled water and/or refilling stations • Connection to PAKWAD • Proper use of bottom outlet or spillway may revert the original or intended flow of water to Tibag River Basin	100% compliance to mitigating measures and regularly monitored and reported by the Proponent
		Degradation of surface water and groundwater quality	• Regular check-ups and preventive maintenance of machineries, equipment, and vehicles • Proper storage, disposal, and collection of hazardous wastes, including used oils and grease, medical-related wastes, and construction spoils	100% compliance to mitigating measures and regularly monitored and reported by the Proponent
		Threat to species in the lake	• Use of trash racks to prevent lake species from entering the intake structures during pumping of water • Restoring disturbed habitats of aquatic species in the lake closest to the project	100% compliance to mitigating measures and regularly monitored and reported by the Proponent
Air	• Operation of the Pakil Pumped-Storage Hydroelectric Power Plant and permanent staff offices and camp • Planned and unplanned maintenance	Contribution in terms of greenhouse gas emissions (or GHG mitigation potential	• Formulate and implement a carbon sink program • Proper operation of the pumped-storage power facility	100% compliance to mitigating measures and regularly monitored and reported by the Proponent
	• Operation of the Pakil Pumped-Storage Hydroelectric Power Plant and permanent staff offices and camp	Degradation of air quality	• Regular compacting and providing vegetation buffers along unpaved access roads • Continuous water suppression and speed restriction	100% compliance to mitigating measures and regularly monitored and reported by the Proponent
	• Operation of the Pakil Pumped-	Increased noise levels from	• Install noise attenuation measures for mechanical equipment.	100% compliance to mitigating

Environmental Aspect	Project Activities	Potential Impacts	Prevention or Mitigation or Enhancement	Target Efficiency
	Storage Hydroelectric Power Plant • Planned and unplanned maintenance	operation of the mechanical equipment, such as turbines and generators; and routine and unplanned maintenance of plant and equipment	• Operate and service of equipment in accordance with the manufacturer's guidelines	measures and regularly monitored and reported by the Proponent
People	• Operation of the Pakil Pumped-Storage Hydroelectric Power Plant and permanent staff offices and camp • Planned and unplanned maintenance	Occupational Health and Safety	• Identity and mitigate occupational health and safety in the **HSE Management Plan** for the operation phase. • Provide healthcare for workers in accordance with Philippine OSH Standard Rule 1963.02	100% compliance to mitigating measures and regularly monitored and reported by the Proponent
	• Operation of the Pakil Pumped-Storage Hydroelectric Power Plant	Project Benefits	• Coordination with LGU for the computation of local taxes which will be paid in a timely manner • Remit government share of the national wealth tax in a timely manner • Conduct orientation seminar for host LGU and barangays on preparation of project proposals for ER 1-94 funding • Conduct regular consultation with host LGU and barangays to determine projects and programs that can be supported under the CSR programs of the company	100% compliance to mitigating measures and regularly monitored and reported by the Proponent

SUMMARY OF MAIN IMPACTS AND RESIDUAL EFFECTS

The main impacts of the project to the project area are the following:

- Change of land use to industrial use
- Permanent change in the visual and aesthetic character of the area
- Change in surface landform, specifically changes in slopes of the area
- Decrease of vegetation in the area and effects to animals in the area
- Displacement of project affected persons and in-migration

Residual effects of these impacts are minimal, including 1) classification of area as industrial, 2) changes in the appearance of slopes, and 3) displacement of PAPs and in-migration of people to the project area for the duration of the project.

RISKS AND UNCERTAINTIES RELATING TO THE FINDINGS

Based on the findings of the EIA team, the following risks and mitigating measures were identified.

Table ES-7. Summary of Risks and Mitigating Measures

Hazard	Assessment
Environmental Risks	
Liquefaction	The probability of liquefaction in the proposed location of the lower reservoir and intake pipes is high due to alluvial nature of the underlying materials. Appropriate support measures must be foreseen for the invert and the side walls of the concrete structure in the geotechnically critical foundation material. As verified from laboratory tests, the reservoir foundation and embankment soils are not susceptible to liquefaction. From laboratory tests on core samples, it may be stated that all tested samples plot in the "Not Susceptible" area, as their Plasticity Index is eighter well above 20 or it is 19 and the Liquid Limit (LL) is well above 59 with a water content above 41%. Hence from technical point of view it may be stated that the reservoir base soils are not susceptible to liquefaction, nor to cyclic mobility.
Earthquake-related landslides and rockfall	Due to moderate to steep slopes on the hills and mountains where the access road, powerhouses, and the upper reservoir will be located, there is a high likelihood for landslides and rockfall to occur. Typical mitigation measures for the design of hydropower projects in such regions include, (a) preference for reservoir types suitable for high seismic loading; (b) preference for underground waterways compared to surface penstocks due to both seismic loading and natural hazards (landslides and rock fall); and (c)Preference for underground powerhouses compared to surface powerhouses. Arrange access roads and installation areas where safe from landslides. Design all permanent / critical slopes with support and drainage measures. Permanent rock support and final lining to be designed and instructed based on actual geological conditions. Strict imposition, monitoring and implementation of HSE requirements and management plans in line with national standards or international best practices. Periodic inspections of tunnels to be included in Operational and Maintenance Procedures.
Landslides	Given the local topography, mapped risk of landslides is high. A geological mapping of the site has been carried out and the findings have been incorporated in the design.
Flooding	The project will not rely on natural inflow to either of its basins and is not susceptible to flooding from nearby rivers. However, the lakeshore area of Pakil is highly susceptible to flooding up to about 1-2m depth, and the national road is moderately susceptible with depths ranging from 0.5 to 1m. Possibility of flooding is due to larger typhoons that may cross the project site. If adverse weather conditions, such as typhoons, are common in the project area, then suitable measures will be taken. Estimation of hydrology and floodwater levels of Laguna de Bay has been performed. Project structures will be designed to be safe against such flood events. API will arrange access roads and areas for temporary works in flood safe areas. Other structures located in the proximity to water must also withstand the flooding issues. The powerhouse is designed to be flood-safe from flooding up to a certain design flood water level.
Seiche	The possibility of occurrence of seiche or standing wave in an enclosed body of water is high. The reservoir crest has a width of 8m. A concrete parapet wall is foreseen at the reservoir crest to increase the freeboard and to prevent overtopping by wave run-up in severe storm events (typhoon events) or over-pumping. The surface of the parapet wall at the western side of the upper basin is also lined with a geomembrane. Thus, this part of the parapet wall can be considered as a watertight element and provides additional freeboard to required safety freeboard of 0.5m during a strong storm event. Freeboard is calculated for design winds according to the National Structural Code of the Philippines (NSCP 2010).

Hazard	Assessment
Construction Risks	
Blasting	Drill and blast (D&B) method will be used with relatively short round lengths (not more than 2.5m) due to the expected geological conditions for the construction of underground components of the facility. Rock support will be installed after each round of blasting. International and national best practices will be implemented and followed.
Operational Risks	
Overflow of Upper Basin	Overflow in the upper basin may occur due to over-pumping from the Laguna Lake from operational or instrument malfunction. Activation of the emergency spillway will prevent overtopping and flooding in the areas near the upper basin. Proper maintenance of the facilities, including the underground facilities will be conducted to ensure that the risk will be minimized.

IDENTIFIED STAKEHOLDERS FOR THE PROJECT

Table ES-8 outlines the identified stakeholders for the proposed project.

Table ES-8. Identified Stakeholders for the Proposed Project

Potential Impact Areas	Basis for Selection	Sectors/Sub-Sectors Identified	Specific Organizations/Entities Likely to be Invited
A. Direct and Indirect Impact Areas			
Brgy. Rizal	Political Jurisdiction – Direct Impact Area (DIA)	Brgy. LGU	Chairman – Hon. Eduardo V. Cruz
		Brgy. Health Workers	Ms. Reynalyn R. Lacao Ms. Melinda A. Cortez Ms. Janeth R. Lacao
		Sangguniang Kabataan	Chairman – Ace P. Ocampo
		Senior Citizens	Mr. Antonio F. Rayosa
		Mini-Pastoral Council	Ms. Antipas Patana
		Women's Club	Ms. Lorenza Esteba
		TODA	Mr. Elmer Laderas
		Elementary School	Teacher - Ms. Nimrose R. Magahis
Brgy. Burgos	Political Jurisdiction – Direct Impact Area (DIA)	Brgy. LGU	Chairman – Hon. Manuel Luis Laciste
		Sangguniang Kabataan	Chairman – Carville Auditor
		Senior Citizens	Ms. Rebecca Duran
		Lay Minister of the Holy Eucharist	President – Mr. Avelino Mendoza
		Women's Club	Ms. Rosita Ulit
		Farmers Sector	President – Mr. Danilo Frankie
		Fishermen Sector	Mr. Ruben Salvado
		TODA	Mr. Arnlod Daksil
		Pakil Central ES	Principal – Mr. Arnel Macabasco
Brgy. Baño	Political Jurisdiction – Direct Impact Area (DIA)	Brgy. LGU	Chairman – Hon. Robert A. Valero
		Brgy. Health Worker	Ms. Ava Galleros
		Sangguniang Kabataan	Chairman - Mr. JR Titik
		Matikero	Mr. Paul Vincent Macapanpan
		Senior Citizens	President - Ms. Anita Bois
		Church Sector	Pastora – Ms. Lucila Atienza
		Women's Club	STK – Winnie Dimaranan
		Streetlight	Ms. Ellen Aguado
		Farmers Sector	Mr. Victor Eulatic
		Magdaragat Sector	Mr. Bay Titik
		Magbubukid Sector	Mr. Orlando Baysa
		Magkakaingin Sector	Mr. Jay Ferrer
		TODA	Mr. Feliciano Vallero Jr.
		Environmental Council	Ms. Teresa Saldania Sanches
		Turumba Swimming Club	President – Mr. Ulpiano Roxas Jr.
Brgy. Taft	Political Jurisdiction – Direct Impact Area (DIA)	Brgy. LGU	Chairman – Hon. Reynaldo T. Alad
		Brgy. Health Worker	Ms. Marita Lopez
		Sangguniang Kabataan	Chairman – Mr. Jake Mar Peras
		Senior Citizens	Ms. Emilia Torente
		Women's Club	Ms. Estelita Doria

		TODA	Mr. Romel Avelaneda
Brgy. Gonzales	Political Jurisdiction –Indirect Impact Area (IIA)	Brgy. LGU	Chairman – Hon. Cesar C. Martizano
		Brgy. Health Worker	Ms. Mary Ann Aguirre
		Sangguniang Kabataan	Kagawad – Mr. Zeus Clifford Adsawan
		Mini-Pastoral Council	Mr. Juan Valero
		Women's Club	President – Ms. Marita Musa
		Farmers Sector	President – Mr. Christopher Cajimat
		Fishermen Sector	Mr. Antonio Pagaraga
		TODA	Mr. Manulito Estrella
		CCDES	Principal – Ms. Ma. Feliza Ambrocio
		Kabulusan Extension HS	Teacher III – Mr. Peter Laurence Evangelista
Brgy. Tavera	Political Jurisdiction –Indirect Impact Area (IIA)	Brgy. LGU	Chairman – Hon. Lauro S. De Roma
		Brgy. Health Worker	Ms. Annie Palatino
		Sangguniang Kabataan	Kagawad – Mr. Ryan Acula
		Senior Citizens	Kgd. Ricardo Ramido
		Women's Club	Ms. Leah Carizo
		Fishermen Sector	Mr. Aurelio Siballe
		TODA	Mr. Jesus De Celis
Brgy. Saray	Political Jurisdiction –Indirect Impact Area (IIA)	Brgy. LGU	Chairman – Hon. Jayson P. Abuel
		Brgy. Health Worker	Ms. Evelyn Gemina Ms. Marilou Lumbao Ms. Joan Dela Trinidad
		Senior Citizens	Head – Ms. Herma Estoy
		Women's Club	Head – Ms. Marilyn O. Cadag
		Sangguniang Kabataan	Head – Mr. Alvin A. Almaida
		Farmers Sector (UFABS)	Head – Mr. Avelino Consuelo
		Saray Elementary School	Head Teacher – Ms. Edelisa Latag
B. Concerned Stakeholders			
Pakil, Laguna	Concerned Stakeholders	Opposing Party	Mamamayang Nagmamahal sa Pakil – Ms. Teresa S. Sanchez
Pakil, Laguna	Concerned Stakeholders	Opposing Party	Concerned Residents of Pakil, Laguna: • Family of Former Judge Diosdado and Loreto Echavaria-Dalena – Atty. Anna Maria Dalena Abad • Family of Gregoria Ybardaloza Asinas – Mr. German Asinas, Jr. Ms. Maria Olivia Asinas Gutierrez Mr. Armando M. Dizon • De Ofonte Family – Ms. Katherene Joanette De Ofonte • Gimenez Family – Mr. Rodelio Gimenez • Family of Rolando Regalado – Ms. Therese Marie Regalado • Saldaña Family – Ms. Virginia Saldaña Ms. Priscilla Saldaña Saldago
C. LGUs with political jurisdiction over the project area			
Municipality of Pakil	Political Jurisdiction	Municipal LGU	Mayor – Hon. Vincent L. Soriano Vice Mayor – Hon. Vipops Charles D. Martinez SB –Hon. Aileen S. Cailles SB – Hon. Vlacheslav Vaarniv D. Martinez SB – Hon. Alfredo D. Maray Jr. SB – Hon. Jeffrey B. Cotoner SB – Hon. Ariel V. Fornoles SB – Hon. Hilario R. Cortez SB – Hon. Kevin M. Reyes SB – Hon. Eugenio A. Pacheco
		Municipal Environment and Natural Resources Office (MENRO)	Head – Mr. Arnel A. Iglesia
		Municipal Planning and Development Coordinator Office(MPDCO)	OIC – Engr. Deo Vito
		Municipal Tourism Office	Head – Ms. Lara Galleros

		Municipal Assesor's Office	Head – Ms. Cenona Casin
		Business Permits and LicensingOfficer	Head – Mr. Don Kelly A. Fernandez
		Municipal Agriculture Office	Head – Ms. Theresita K. Payumo
		Municipal Treasurer's Office	Head – Ms. Cecilia R. Garcia
		Municipal Social Welfare and Development Office	Head – Ms. Eloisa M. Javier
		Pakil Water District	General Manager – Engr. Alfred Allan V. Dorado
		St. Peter of Alcantara Parish Church	Parish Priest – Rev. Jerry Oblepias
Province of Laguna	Political Jurisdiction	Provincial LGU	Governor – Hon. Ramil L. Hernandez Vice Governor – Hon. Karen Agapay Administrator – Atty. Dulce Rebanal
		Provincial Environment and National Resources Office (PENRO)	Head – Mr. Eriberto Saño
		CENRO Sta. Cruz	OIC – Mr. Venerando U. Garcia
		Provincial Planning and Development Coordinator Office (PPDCO)	Head – Mr. Pablo V. Del Mundo, Jr.
		Laguna Lake Development Authority (LLDA)	General Manager – Hon. Jaime C. Medina

PROPONENT STATEMENT OF COMMITMENT

API ensures their commitment and capability to implement the measures discussed above to prevent the possible adverse negative impacts of the project. The signed Statement of Accountability of the proponent is shown in **Figure ES-5** .

EIS ACCESSIBILITY

The copy of the complete Environmental Impact Statement for the Pakil Pumped-Storage Hydroelectric Power Project can be accessed in the DENR-EMB Website.

SWORN STATEMENT OF ACCOUNTABILITY OF THE PROPONENT

This is to certify that all the information and commitments in this Environmental Impact Statement REPORT for Proposed 1400MW Pakil Pumped Storage Hydroelectric Power Plant Project are accurate and complete to the best of our knowledge, and an objective and thorough assessment of the project was undertaken in accordance with the dictates of professional and reasonable judgement. Should we learn of any information which would make this Environmental Impact Statement inaccurate, we shall immediately bring the said information to the attention of DENR-EMB.

I hereby certify that no DENR-EMB personnel were directly involved in the preparation of this Environmental Impact Statement REPORT other than to provide procedural and technical advice consistent with theguidelines in the DAO 03- 30 Revised Procedural Manual.

I hereby bind myself to answer any penalty that may be imposed arising from anymisrepresentation or failure to state material information in this Environmental Impact Statement.

In witness whereof, I hereby set my hand this _____ day of JUN 14 2022at Pasay City _____.

RAFAEL C. BUENO JR.
President
AHUNAN POWER INC

SUBSCRIBED AND SWORN TO before me this JUN 14 2022 day of _____, affiant exhibiting his/her Passport Number P4448614B issued at DFA NCR South on the 20th of January 2020.

Doc No. 190
Page No. 25
Book No. I
Series of 2022

ANDREI LAURENCE V. AQUINO
Notary Public
Commission No. 21-09 valid until December 31, 2022
16F Three E-Com Center, Bayshore cor.
Ocean Drive, Block 21, Mall of Asia Complex,
Pasay City, 1300 Metro Manila
Roll No. 66337
PTR No. 7724404 / Pasay City
IBP Lifetime No. 015049; 1 Feb 2020; Makati City
MCLE Compliance No. VII-0006784 /22 November 2021

Figure ES-5. Signed Statement of Accountability of the Proponent