



# Initial Environmental Examination (IEE) Solar Development Solar Power Plant

**Project Name :** Solar Development Solar Power Plant  
**Project Site :** Sa Long Ruea Sub-District, Huai Krachao District  
Kanchanaburi  
**Project Owner :** Solar Development Co.,Ltd.  
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TLT Consultants Co.,Ltd.

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## EXECUTIVE SUMMARY

### 1. INTRODUCTION

Solar Development Co., Ltd. (The Project Developer) is a subsidiary of Gulf Energy Development Public Company Limited (GED) has planned to develop the Solar Development Solar Power Plant Project. This project aims to generate electric power from solar energy using photovoltaic technology or solar cells installed on the ground with an Battery Energy Storage Systems (BESS) installed capacity of 162.129 MWp with an average annual energy output of 264.377 GWh/year. All generated electricity is expected to sell to EGAT under 25 year-agreement.

The Project is covering an area of 1,301,614.00 sq.m (130.16 ha), located on 19 land title deeds in Sa Long Ruea Sub district, Huai Krachao District, Kanchanaburi Province, about 180 km west of Bangkok which purchased land since July 2022. The transmission line is 115 kV will laid within the right-of-way (ROW) of public roads, from front of the Project to Bo Phloi substation and U-Thong substation, a distance of approximately 22.5 km. The Provincial Electricity Authority (PEA) is responsible for the construction of this transmission line as well as obtaining the appropriate permissions from relevant agencies such as the Department of Highways and the Department of Rural Roads.

### 2. LEGISLATIVE REQUIREMENT

According to the Regulations of the Energy Regulatory Commission on the Criteria for Preparing a Code of Practice Report and a Report of Compliance with the Code of Practice for the Operation of Electricity Generation B.E. 2565 (2022), the development of the Project is required to conduct the Code of Practice (CoP) Report for non-fuel Power Plants. According to the ADB Safeguard Policy Statement (2019), Equator Principle 4 and IFC, the development of the Project falls under category B to C from an environmental and social point of view respectively.

The Project Developer has appointed TLT Consultants Co., Ltd. for preparing the CoP report which was submitted to and was approved from the Energy Regulatory Commission (ERC) on 12 December 2023, and Initial Environmental Examination Report (IEE Report) and the Social Compliant Audit (SCA Report) in line with applicable ADB's Safeguard Policy Statement (SPS), International Finance Corporation Performance Standard (IFC-PS), Equator Principles (EP), Asian Infrastructure Investment Bank (AIIB) and other related parties to support financial arrangement with Lender and key stakeholder for further step of project implementation.

### 3. DESCRIPTION OF THE PROJECT

The Project is covering an area of 1,301,614.00 sq.m (130.16 ha). Approximately 68.76% of the total area is the power generation and 27.09% is empty space, road, walkways, or parking area, while the rest is the supporting facilities such as warehouse, waste storage, admin office, green area, switchyard or substation.



The Project is a non-combustion power plant that generates electric power from solar energy using Photovoltaic (PV) technology or solar cells installed on the ground with an energy storage system. Main equipment installed in the Project area includes PV modules, inverters, transformers and Battery Energy Storage Systems (BESS). Main equipment installed in the Project area includes PV modules, inverters transformers and BESS system. Details are as following;

Photovoltaic Module

- Number (PV modules) : 267,982
- Peak power generation capacity (Wp) : 605
- Dimensions (W x H x D) (mm) : 2,465×1,134×30
- Installation angle (degree): 11

Mounting Structure

- Material : Aluminum fixed with poles

Inverter

- Number (inverters) 386
- Output (kVA) 300
- Dimensions (W x H x D) (mm) 1,048×732×395
- Weight (with mounting plate) (kg) ≤ 112

Transformer

- Number of 70 MVA transformer 1
- Number of 3.437 MVA transformer 39

Battery Energy Storage System (BESS)

- Number of BESS 34
- Capacity (kWh) 2,752
- Dimensions (W x H x D) (mm) : 9,340×1,730×2,600

Transmission Line

- Distance of approximately 22.5 km.
- Power lines Aluminum conductor (AAC) with a size of 400 sq.mm.
- Transmission circuit Single circuit, double conductor
- Utility poles 22 m. height  
Pre-stressed concrete poles with a base size not exceeding 0.9×2.2×3.0 m.

## 4. ASSESSMENT OF ENVIRONMENTAL AND SOCIAL IMPACT& RISKS

### 4.1 Air Quality

Construction Phase

The construction activities during this phase that might cause dust dispersion and affected to the ambient air quality include; land clearance and site preparation for building and supporting facilities related to power generation activities. The box model has been adopted to predict the TSP concentration at the Huai Luek Samakkhitham Temple, the nearest sensitive receptor. The predicted TSP-24 hrs is 173.45 µg/m<sup>3</sup>, combined with the maximum concentration from field measurement 79µg/m<sup>3</sup>, the total

concentration is  $252.45 \mu\text{g}/\text{m}^3$  equivalent to 76.50 % of the standard value. The resulting 24-hour average Total Suspended Particulate (TSP) is within the air quality standards specified by the national standards (not exceeding  $330 \mu\text{g}/\text{m}^3$ )

Moreover, the Project has determined prevention and correction measures to minimize the impact on ambient air quality such as spraying water at the area with topsoil stripping, material stacking, and entrance of the construction site, and keeping construction materials tidily. Therefore, the impact will be low.

#### Operation Phase

The project activities during this phase involves electricity generation from solar cells. There will be no equipment or machines that generate particulate matters or pollutants. Therefore, there will be no impact of ambient air quality.

## **4.2 Noise Level**

#### Construction Phase

The construction activities during this phase that might cause noise impact to the construction worker and surrounding communities include; land clearance and site preparation for building and supporting facilities related to power generation activities. The noise level from the construction equipment and machines has been collected from the Update of Noise Database for Prediction of Noise on Construction and Open Sites, UK Government Department (2005) and adopted the equation from the FHWA Highway Construction Noise Handbook (FHWA, 2006) to predict the Leq 1 and 24 hrs at 3 sensitive receptors surrounding the project area (Approximately 8-140 m. away).

The predicted Leq-24 hrs from the construction activities ranged from 38.3-50.7 dB(A), and combined with the maximum Leq-24 hrs from monitoring will result in the total noise ranged from 49.7-60.5 dB(A), not exceeding the standard of ambient noise which is determined at not more than 70 dB(A), When comparing noise level results with IFC guidelines, Increasing of Leq 1 hr in all sensitive areas during daytime more than 3 dB(A) (increasing 0.5-15.5 dB(A)). Therefore, installation of a noise barrier at the construction sites near house east of the project, house west of the project and pig farm west of the project is required to reduce the noise level. After installation the noise barrier, the total Leq 24 hrs and increasing of Leq 1 hr during daytime will reduced and became less than 3 dB(A) in accordance with IFC guidelines (increasing 0.0-2.0). The impact will be moderate.

#### Operation Phase

The project activities during this phase involves electricity generation from solar cells. There will be no loudly equipment or machines. Therefore, there will be no noise level impact.

## **4.3 Reflection and Heat**

#### Construction Phase

The Project is designed to use PV panels that are coated with an anti-reflection coating with the lowest light reflection coefficient. Additionally, the project specifies that the solar panels will be installed at an angle of approximately 10 degrees to the ground,

which prevents light reflection towards the surrounding area. Therefore, it is anticipated that there will be no significant impact from light reflection and heat generated by the solar panels.

#### Operation Phase

Current solar panel manufacturing technologies have improved significantly, with external coatings that reduce light reflection. According to the report "PV Systems: Low Levels of Glare and Reflectance vs. Surrounding Environment" by Mark Shields in 2010, which studied light reflection when impacting various materials, it was found that the light reflection coefficient of solar glass is lower than that of other materials. When an Anti-Reflection coating is applied, the light reflection coefficient is further reduced. Therefore, there will be no impact on the community.

### **4.4 Biodiversity**

#### Construction Phase

Most of the surrounding areas of the Project are also farmlands. The forest area in the study area of the project is approximately 2,356 rai (8.56% of the study area) located in the northeast of the project area and the southeastern side of the project by about 1 kilometer. This forest area is a community forest area that is not registered as a forest resource conservation area by law. Therefore, the construction activities will be limited to the project area, so there will be no impact on forest resources. The project site is located in farmlands which purchased land since July 2022, and the construction activities is limited within its premises. Therefore, there is no impact on forest resources.

Most wild animals found in this area are birds and reptiles commonly living in farming areas. These animals can move quickly and adapt to the environment well. Construction activities of this Project is limited within its premises. Therefore, the construction activities of this Project would not cause any impact on wildlife.

#### Operation Phase

The project activities during this phase involves electricity generation from solar cells. There will be no impact on forest resources biodiversity.

### **4.5 Aquatic Ecology**

#### Construction Phases

In the construction area and the surrounding areas, there is no source of surface water. The source of surface water closest to the construction area is Khlong Pla Soi, 1.4 km west of the Project area. Wastewater will be generated from 2 major sources;

(1) Wastewater from construction activities (cleaning equipment and tools) will be collected at a retention pond to separate oil from water before being collected and disposed of by an agency authorized by government agencies.

(2) Wastewater from consumption of workers amounts 72.63 m<sup>3</sup>/day, which will be treated with a septic tank prepared by the contractor. Treated wastewater and sewage will be collected and disposed of by a local agency according to the principles outlined in the Public Health Act B.E. 2535 (1992) and the Ministerial Regulations on Hygienic Sewage Management B.E. 2561 (2018). The wastewater will not be drained off outside the Project area. Therefore, the construction of the Project will not have any impact on aquatic ecology.

### Operation Phase

Wastewater from employee's consumption (peak consumption at PV cleaning period) will be treated by a septic tank and not discharged to the surrounding environment. Wastewater from PV cell cleaning activity, which is not contaminated with impurities such as oils but only contains dust will be directly discharged onto the ground. For the runoff that may be contaminated with oil from the transformer area where the engine oil is used, it will be sent to an oil sump to separate oil and treated further, The project doesn't discharge wastewater to the environment; thus, it has no impact on aquatic quality.

## 4.6 Socio-economics

### Construction Phase

- **Potential Positive Impacts**

- *Employment of Local People:* The Project has a policy to give first priority to be hired local people which qualified to work non-skill and skill labors. However, these employment is temporary only 12 months during the construction phase, so the positive impact will be low.

- *Local Economic Promotion:* the construction workers will buy a consumer product from the local shop/stores nearby the construction site and workers' camp. It will increase the cash flow and improve the local economy. However, it will be temporary only 12 months during the construction phase, the positive impact will be low.

- **Potential Negative Impacts**

- *Disturbance and annoyance to the community from construction activities:* The construction activities, especially the transportation activities may increase the traffic volume and accidents on National Highway No. 3443 and National Highway No. 3472 temporarily at certain times of each day, and caused noise impact to communities along the road. However, the Project has determined the prevention and correction measures to minimized impact during this phase. Therefore, the impact level will be low.

### Operation Phase

- **Potential Positive Impacts**

- *Local Development and Improvement of Quality of Life for Local People:* The local administrative organizations will collect taxes from the Project, such as local maintenance tax, building and land tax, and a share of value-added tax. This revenue can be used for local development. In addition, the Project has several community relations campaigns to establish positive relationships and pay back to the community. The Project will also support local activities throughout the operation phase. Therefore, the positive impact will be moderate.

- *Employment of Local People:* The Project given the first priority to hire the local people who qualified to the work requirements. The employment during this phase comprised 5 permanent employees and approximately 20 part-time employees throughout 25 years of the project operation phase. Therefore, the positive impact will be moderate.

- *Activities Promoting Community Relations:* The Project has public relations campaigns about its operations regularly to establish an accurate understanding and minimize concerns among people living near the Project. The purpose is to establish a good relationship between the Project and the local communities. All activities will be implemented throughout the operation phase. Therefore, the positive impacts will be moderate.



- **Potential Negative Impacts**

- *Concerns over the Project Operation:* The communities around the Project area may have concerns about the Project operations. Therefore, the Project has several plans to establish an accurate understanding and assure confidence in the Project development. There are channels to receive complaints and resolve the impacts from the Project development and hear suggestions from relevant parties. Therefore, the impact will be low.

#### **4.7 Gender Assessment**

##### Construction and Operation Phases

The first priority for labor of construction will be given to local people for the both skilled and non-skilled workers. However, a substantial number of workers will come from outside. As such, GBVH risks and issues may arise most specifically from labor influx. To prevent and mitigate GBVH risk, the Project mandates the prevention measures, so the impact will be low.

The Project has implemented a Non-Discrimination and Harassment policy and Diversity policy for all employees. The Project also encourages its business partners, suppliers, contractors, and other counterparties to apply such commitments in their own activities and operations. Therefore, the impact will be low.

#### **4.8 Influx Management**

##### Construction Phase

- **Impacts within the Construction Area and Construction Workers' Camp Workers**

- *Sanitation within the Construction Workers' Camp:* There are 1,297 construction workers (Maximum) during construction phase. The contractor will provide the workers' camp with proper welfare and utilities include; accommodation, bathrooms and toilets, electricity, tap water, drinking water, wastewater management, and solid waste management comply with the Notification of the Labor Welfare Committee on Standards of Residence as Labor Welfare for Employees in the Type of Construction Business B.E. 2559 (2016) and relevant laws or international standards, including recommendations and suggestions from ADB, as well as the Project developer's own experiences. Therefore, the health impacts on the construction workers will be low.

- *Medical Welfare Provision:* The Contractors strictly comply with the Notification of the Labor Welfare Committee regarding standards for residential welfare for construction labor, B.E. 2559 (2016), and provide first aid equipment and medical supplies within the construction area, including a medical shuttle, according to the Ministry of Labor Regulations on the provision of welfare in business establishments B.E. 2548 (2005). Therefore, the health impacts on the construction workers will be low.

- **Impact to the Surrounding Communities**

- *Wastewater Management* :If the contractor discharges treated waste or sewage outside into natural water sources or private areas, the contractor must obtain permission from relevant government agencies or landowner to ensuring that the discharged sewage will not have adverse environmental impacts in the future. In addition, the contractor shall provide a retention pond at workers' camp and conduct water quality monitoring once a month to ascertain the water quality before discharging.

- *Noise*: Noise impact from the workers' camp may disturb the communities at nighttime because of high number of workers. This could cause conflict with local people. The Project and the contractors shall strictly implement preventive and mitigative measures to control and monitor the workers so that they do not create problems to surrounding communities at nighttime.

- *Transportation*: The results showed that the project's transportation activities during the construction phase do not significantly impact the service level of Highway no. 3472. The road's level of service remains the same (Level A), allowing vehicles to move freely at free-flow speed. However, the Project has mitigation measures for the construction phase to construct impact on the surrounding communities related to the pollution and environmental impacts from the construction activities will be low.

- *Impact on public health services and public infrastructure*: With a large number of construction workers, if there is a contagious disease or epidemic occurs in the workers' camp, there is a chance that the disease may spread to the surrounding communities. Communicable diseases such as sexually transmitted diseases, hepatitis, pneumonia, diarrhea, and diseases that are carried by insects, such as dengue fever could be areas of concern. Common cold and flu caused by probably new strains are very well possible, as well as respiratory tract diseases. If illness occurs, it will increase the service burden on the local primary health care unit, namely Ta Lung Nuea Sub-district Health Promoting Hospital. It is necessary that the Project and the contractors strictly comply with the relevant laws and regulations.

- *Conflict with the local people*: The project has established preventive and mitigative measures to control and monitor these workers so that they do not create problems for surrounding communities. In order to ensure the efficient operation of the project without causing social and environmental impacts or annoyance and conflict problems between the project and surrounding communities, the project has established procedures for handling complaints. When the complaint is corrected are completed, the project will urgently notify the complainant of the results and actions of the project.

- *Economic impact from influx of workers*: Population influx as well as the presence of sizeable outsider workforce can disturb social dynamics, for example with the increased demand or pressure on services and resources such as housing, education, health services. Differences in social norms as well as income levels can create social jealousy. Artificial inflation of prices locally can also create potential tension.

Due to a signification influx of workers from external sources, there is a heightened risk of several impacts emerging as aforementioned, particularly associated with labor migration. To minimize risks, the Project has implemented preventive measures, so the impact is low.

### Operation Phase

There are only 5 permanent employees and 20 part-time employees during cleaning solar panels. This will not significantly increase to cause influx situation. Therefore, the impacts will be low and negligible.

## **4.9 Occupational Health Impact Assessment**

### Construction Phase

The construction activities may cause occupational diseases and occupational health risk such as fall of objects, hit on head, electric shock, traffic accident, etc. Therefore, the project determined the prevention and correction measures and adequate training program in occupational health and safety to minimize the occupational health impact. Moreover, the contractor provide first aid equipment and medical supplies within the construction area, including a medical shuttle, according to the Ministry of Labor Regulations on the provision of welfare in business establishments B.E. 2548 (2005). Therefore, the occupational health impacts on the construction workers will be low.

Dust (Particulate Matter) and noise from the construction activities could be caused adverse health impact to the construction workers. However, the project spraying water at the area with topsoil stripping, material stacking, and entrance of the construction site, and keeping construction materials tidily to minimizes the dust dispersion and provide personal protective equipment (PPE), consisting of safety helmets, safety shoes, goggles, and task-specific personal safety equipment appropriate to working conditions and risks that may arise from work. Therefore, the occupational health impacts on the construction workers will be low.

### Operation Phase

The project determined the prevention and correction measures and adequate training program in occupational health and safety associated with the Project's operations include field inspections, safety maintenance, and cleaning of the solar panels. Regularly inspection and safety shall be carried out in accordance with the criteria prescribed by relevant law and guideline to minimize the occupational health impact. Therefore, the occupational health impacts on the project staff will be low.

## **4.10 Health Impact Assessment**

### Construction phase

The Qualitative Risk Assessment approach has adopted to evaluate the health impact assessment with a Health Risk Matrix. Considering the interaction between project activities, environmental and health baseline condition, the identified health risk impact are air pollution (dust from land clearing, operations of machinery, and pollutants from transportation), noise (loudly noise, disturbance noise, and vibration from construction activities, stress and panic about noise and vibration), solid waste (waste accumulation may attract disease carriers), transportation (accidents from transporting construction workers, and machines, obstruction to traffic), occupational health and safety (accidents caused by unsafe working environment, accidents caused by unsafe act, safety concerns), and sharing public health services (sharing public health services caused by illnesses or accidents of workers, communicable diseases that come with migrant workers). Therefore, the prevention and correction measures on these issues shall be determined to minimize the impact.

### Operation Phase

The identified health risk impact during this phase are solid waste (waste accumulation may attract disease carriers), transportation (accidents from transporting staff, and obstruction to traffic), occupational health and safety (accidents caused by unsafe working environment, accidents caused by unsafe act, safety concerns). Therefore, the prevention and correction measures on these issues shall be determined to minimize the impact.

## **4.11 Land Use**

### Construction Phase and Operation Phase

The project site is located in Zone 3.2 (Land use for the category of rural and agricultural area (Green Color)) as stipulated in the Ministerial Regulations to Enforce the Kanchanaburi Provincial Comprehensive Plan B.E. 2560 (2017), which can be used for agriculture or agriculture-related activities, residence, commercial purposes, educational institutions, religious places, government agencies, infrastructure, and utilities. The development of the solar power plant not prohibit under this regulation. Therefore, there is no impact on land use.

## **4.12 Land Transportation**

### Construction Phase

The transportation of construction materials, machinery, and workers could be increased the traffic volume and accident on the road. The total traffic volume will be about 21 vehicles/day. The assessment of traffic impact on land transportation in term of vehicle to the road capacity (V/C ratio) found that the V/C ratio on National Highway No. 3443 (km.7+700) and National Highway No. 3472 (km.9+000) were slightly increasing from the existing condition and level of service is still free-flow condition with unimpeded maneuverability. Therefore, the impact level will be low.

### Operation Phase

The project activities during this phase involves electricity generation from solar cells. Few of transportation activities for 5 permanent employees and 20 part-time employees during solar PV cleaning will not affected to the road capacity, and the V/C ratio on National Highway No. 3443 (km.7+700) and National Highway No. 3472 (km.9+000) were slightly increasing from the existing condition and level of service is still free-flow condition with unimpeded maneuverability. Therefore, the impact level will be low.

## **4.13 Solid Waste Management**

### Construction Phase

The construction waste such as scraps of plastic, wood, and steels, is estimated at 54.53 ton/year, will be collect and sorted them. Recyclable waste, and sell it to recycle waste buyers, while non-recyclable waste and hazardous waste will be collected in suitable containers before coordinated with the agency authorized by the Department of Industrial to collect and disposal properly.



The worker consumption waste is estimates at 1,102.45 kg/day (Maximum).The Project will prepare an adequate trash bin at several point that Sa Long Rueva Municipality can collect it for disposal properly outside of the Project area. Therefore, the impact level is low.

#### Operation Phase

The staff consumption waste is estimated at 21.25 kg/day (Maximum).The Project will prepare an adequate trash bin at several point that Sa Long Rueva Municipality can collect it for disposal properly outside of the Project area.

Waste from scheduled maintenance, damaged or deterioration solar panels, and rainwater contaminated will be collected and storage in the designated area prior contact an agency authorized by the Department of Industrial Works for disposal outside the Project area. Therefore, the impact level is low.

### **4.14 Wastewater Management**

#### Construction Phase

All wastewater generated during this phase include; wastewater from construction equipment and tools cleaning of about 10.00 m<sup>3</sup>/d. and wastewater from consumption of construction workers of about 72.63 m<sup>3</sup>/d (maximum) The project will treat wastewater from workers consumption using a septic tank and contact local agencies for proper disposal. Also, effluent from construction machinery and equipment washing will be collected at the clarifier to separate water and grease before sending it to be disposed of outside the Project by agencies authorized by government agencies. Therefore, the impact on wastewater management during the construction phase will be low.

#### Operation Phase

The wastewater generated during this is quite less, include; wastewater from staff consumption of about 0.28 m<sup>3</sup>/d and wastewater from solar panel cleaners of about 1.12 m<sup>3</sup>/d. The wastewater from staff consumption will be treated by septic tank with anaerobic filters and removed by an authorized agency for appropriate treatment. In addition, effluent from solar module washing will be left to be evaporate or seep into the ground naturally without affecting the quality of surface water. As a result, the impact on wastewater management in the operation phase will be low.

### **4.15 Water Drainage**

#### Construction Phase

The land area of 6,735.00 sq.m or 0.52 % within the project site will transformed from soil cover area to pavement area such as asphalt, concrete and roof. These will be quite increasing run-off water from the existing condition. Moreover, the Project will prepare a temporary drain in those areas to collect and drain water to a retention pond in the project area and control the discharging rate not exceeded the existing condition. Therefore, the impact level will be low.

#### Operation Phase

As mention in the construction phase, only 0.52% of the total area which transformed to pavement area and quite increasing run-off water from the existing condition. The Project will prepare a retention pond with a capacity of 700 m<sup>3</sup> to collect run-off water which can be holding at least three hours, and control the discharging rate not exceeded the existing condition. Therefore, the impact level will be low.

## 4.16 Major Hazard

### Construction and Operation Phases

Risk and Hazard Assessment has adopted the regulations of Department of Industrial Works: Criteria of Hazard Indication, Risk assessment and Risk Management Plan, B.E. 2543 (2000). The results from risk and hazard assessment found that the short circuit and fire in the equipment caused by personnel/equipment being in wet conditions contacts with electrical equipment (Human Error) is a high risk level and prevention and correction measures are required. The Project determined to arrange appropriate solar panels washing plan and encourage the staff to strictly follow the prescribed procedures, PPE (e.g., helmets, safety gloves, safety shoes, etc.), must always be used in the operation and must always be kept in ready to use condition, and establish clear operational procedure for panels washing to ensure that the electricity is turned off before panel washing.

## 4.17 Climate Change Risk Assessment (CCRA)

### Construction and Operation Phases

The implementation of the Project is categorized as “Category B” (Projects with potential limited adverse environmental and social risks and/or impacts that are few in number, generally site-specific, largely reversible and readily addressed through prevention and correction measures), a CCRA required under EP4 Principle. The results of CCRA can be summarized as following;

- **GHG Emissions from Project Implementation:** Net annual GHG emissions during construction and operation phases are summarized in Table 4.8-8, the highest GHG emitted is estimated at 2,816.63 tonne CO<sub>2</sub>-eq/year during construction phase, while the avoided GHG is estimated at -66,163.26 tonne CO<sub>2</sub>-eq/year throughout the operation phase. Therefore, the project caused the positive impact to climate change and the “Transition Risks” is no need to consider.

- **Results of Physical Risk Assessment**

- *Storm and Heavy Rain:* Climate change expected to enhance the cyclone, and possible to increasing wind speed and rainfall or precipitation intensity. Moreover, the extreme rainfall events are likely to more frequent. However, the typhoons reaching Thailand in between 2013-2043 are expected to be increased, but the number of monsoon storms are projected to stay relatively stable. Moreover, the structure of PV Solar structure is design in accordance with DPT. 1311-50 standard, and could be tolerate for wind speed at 30 m/s or 108 km/hr. (the wind speed of storm is range from 89-102 km/hr.). Therefore, the impact will be low.

- *Flood:* Under lower emissions pathways coherent with the Paris Climate Agreement almost all Asian countries face an increase in the frequency of extreme river flows. What would historically have been a 1 in 100-year flow, could become a 1 in 50-year or 1 in 25-year event in most of South, Southeast, and East Asia. (Paltan et al. (2018)). However, the Project area locate in low flooding risk area (Less than 3 time in 10 year period) and the solar panel level designed to be set at least 0.50 m higher than the ground elevation as recommended in the Flood Risk Assessment for the Project. Therefore, the impact will be low.

## 4.18 Human Right Risk Assessment

### Construction and Operation Phases

Result of Human Rights Risk and Impact Assessment found that the impact on the occupational health and safety, discrimination, working hours, and community safety & standard of living is medium to high. Prevention and correction measures are required. Therefore, the Project determined the prevention and correction measures such as arranged occupational safety management in a systematical and efficient manner in conformity with the requirements of occupational safety, health and environment law relating to construction, and GBVH, so the impact is low.

## 5. ENVIRONMENTAL & SOCIAL MANAGEMENT PLAN AND SYSTEM

### 5.1 Environmental and Social Management Plan

Based on the environmental and social impact assessment, the project development has some impacts during construction and operation phases. Solar Development Co.,Ltd. will be responsible for implementation of corresponding mitigation measures and monitoring programs in order to ensure that the project development during both phases will have impacts within an acceptable level. The implementation will be under the responsibility of the EPC (Engineering Procurement and Construction) Contractor and the Project owner, Solar Development Company Limited.

Measures	Construction Phase	Operation Phase
Prevention and Mitigation	<ul style="list-style-type: none"> <li>- Air Quality</li> <li>- Noise</li> <li>- Water quality and drainage</li> <li>- Reflection and heat</li> <li>- Biodiversity</li> <li>- Socio-economics and public participation</li> <li>- Gender-based violence and harassment</li> <li>- Public health and safety</li> <li>- Occupational health and safety</li> <li>- Transportation</li> <li>- Solid waste management</li> <li>- Major hazard</li> <li>- Land maintenance</li> </ul>	<ul style="list-style-type: none"> <li>- Water quality</li> <li>- Socio-economics and public participation</li> <li>- Occupational health and safety</li> <li>- Transportation</li> <li>- Solid waste management</li> <li>- Green area and aesthetics</li> <li>- Land access</li> </ul>
Monitoring	<ul style="list-style-type: none"> <li>- Air Quality</li> <li>- Noise</li> <li>- Water use and effluent quality</li> <li>- Socio-economics and public participation</li> <li>- Occupational health and safety</li> <li>- Transportation</li> <li>- Solid waste management</li> </ul>	<ul style="list-style-type: none"> <li>- Water use and effluent quality</li> <li>- Socio-economics and public participation</li> <li>- Occupational health and safety</li> <li>- Solid waste management</li> </ul>

## 5.2 Emergency Preparedness and Response Plan

Emergency Preparedness and Response Plan (ERP) is to be prepared by EPC Contractor for construction phase and submit to the project proponent for concurrence, while ERP for operation phase is to be prepared by the Project. ERP shall cover emergency incidents that may occur in the construction sites during the construction of the Project components and in the project area during operation phase. The emergency incidents could have adverse impacts on the environment, and on health and safety of construction workers, project staff, nearby factories, and nearby communities.

## 6. STAKEHOLDER ENGAGEMENT

Pre-engagement meeting was conducted to gather the information from the public and stakeholders regarding the preparation of an environmental report. This was initiated at the early stage of Project development with the aim of presenting preliminary Project details to gather feedback, concerns, and suggestions from stakeholders regarding the Project. From the pre-engagement activity, no concerns or complaints were raised regarding the land acquisition for the Project. The individual meeting of the target group was held 22-23 May 2023 and 6 June 2023. The target group consists of:

- Provincial Offices for Natural Resources and Environment Kanchanaburi
- Provincial Energy Office Kanchanaburi Province
- Provincial Industry Office Kanchanaburi Province
- Mayor of Sa Long Ruea Subdistrict
- President of Wang Phai Subdistrict Administrative Organization
- Sa Long Ruea Subdistrict Headman
- Village Headman, Village No. 6, Sa Long Ruea Subdistrict
- Village Headman, Village No. 12, Sa Long Ruea Subdistrict
- Nong Pradu Subdistrict Headman
- Village headman, Village No. 3, Nong Pradu Subdistrict
- Village headman, Village No. 4, Nong Pradu Subdistrict
- Village Headman, Village No. 9, Nong Pradu Subdistrict

Public consultation were conducted on June 23, 2023 (9:00 - 11:30 p.m), at Ban Pong Mai School, Nong Pradu Subdistrict, Lao Khwan District, Kanchanaburi Province. There are 296 people participated in this public consultation (Excluding officials of project owners and environmental consulting firms and counting the number of attendees individually), consisting of representatives of people in the study area, community leaders, representatives of provincial government agencies, representatives of district government agencies, representatives of sub district government agencies, infirmaries, educational institutions.

The opinion, concerns, and suggestion were raised during the public consultations regards to project details, impact from the project on environmental and social aspects, occupational health and safety, socio-economics and public consultation.



**IEE OF SOLAR DEVELOPMENT SOLAR POWER PLANT  
SOLAR DEVELOPMENT CO., LTD.**

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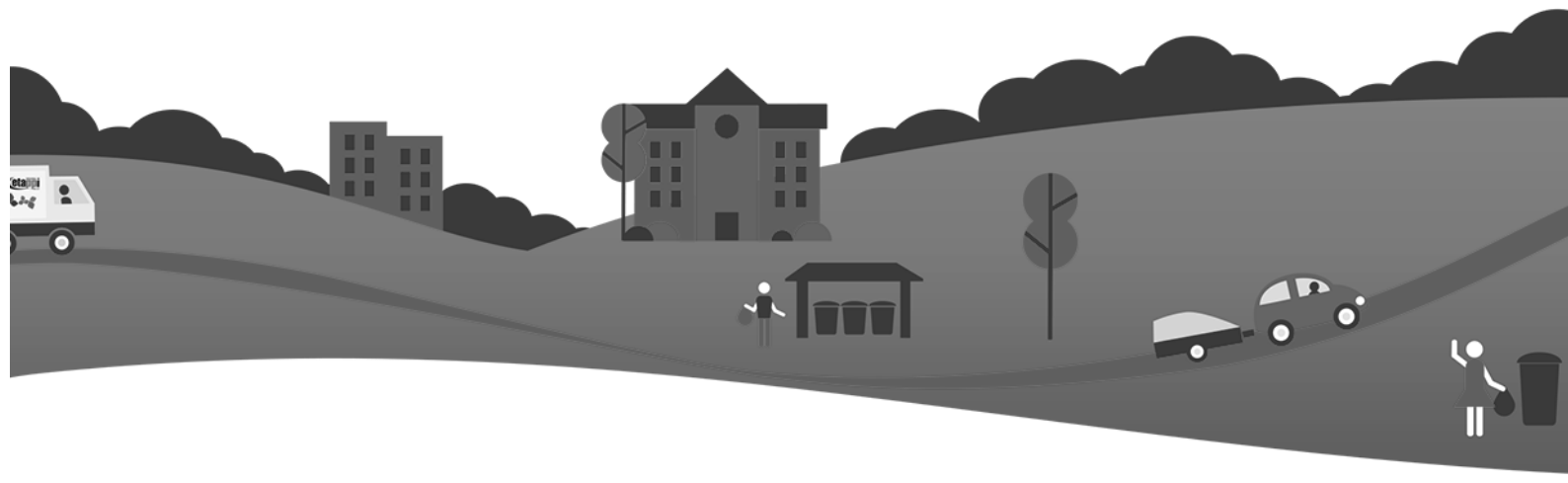
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# CHAPTER 1

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## PROJECT BACKGROUND, LEGAL COMPLIANCE, IMPACT SIGNIFICANCE, AND CATEGORIZATION



## CHAPTER 1

### PROJECT BACKGROUND, LEGAL COMPLIANCE, IMPACT SIGNIFICANCE, AND CATEGORIZATION

#### 1.1 PROJECT BACKGROUND

##### 1.1.1 Project Development Status

Solar Development Co., Ltd. has plan to develop the Solar Development Solar Power Plant Project. This Project aims to generate electric power from solar energy using photovoltaic technology or solar cells installed on the ground with an installed capacity of 162.129 MWp to supply electric power to the government under the government policy to support renewable energy or clean energy. The Project is located on land with a valid title deed in Sa Long Ruea Subdistrict, Huai Krachao District, Kanchanaburi Province. The total area is 1,301,614 square meters (130.16 ha). The Project is required to prepare the Code of Practice (CoP) Report for non-fuel power plants according to the Regulations of the Energy Regulatory Commission on the criteria for preparing a Code of Practice report and a report of compliance with the Code of Practice for the operation of electricity generation B.E. 2565 (2022). The CoP report were submitted to the ERC and were officially approved on 12 December 2023.

At present stage financial arrangement for implementation of the Project is being discussed with Financial Institutions (Lenders). IEE Report is then required during this process. This IEE report is the document that addresses the Environmental and Social Risks and Impact associate with any project activities during the project lifecycle which could pose any direct, indirect or reputational risks to project developer and subsequently to the financial institutions and other key stakeholders as part of project implementation. Solar Development Co.,Ltd. have engaged TLT Consultants Co., Ltd. to prepare this IEE Report for the Solar Development Solar Power Plant Project in line with applicable ADB's Safeguard Policy Statement (SPS), International Finance Corporation Performance Standard (IFC-PS), Equator Principles (EP) and other related parties. This IEE report will be used to support financial arrangement with Lender and key stakeholder for further step of project implementation.

##### 1.1.2 Project Developers

Solar Development Co., Ltd, the developers of the Solar Development Solar Power Plant is a subsidiary of Gulf Energy Development Public Company Limited (GED) that invests in conventional and renewable power generation and distribution businesses, as well as natural gas supply and distribution, infrastructure development projects, and digital business. Solar Development Co., Ltd. operates renewable power generation business and its headquarter is at 87 M. Thai Tower 26<sup>th</sup> Floor, All Seasons Place, Wireless Road, Lumpini, Pathumwan Bangkok 10330.

### 1.1.3 Project Location, Area of Influence and Key Sensitive Receptors

#### (1) Project Location

The Solar Development Solar Power Plant Project is located on the 1,301,614.00 square meter land in Sa Long Ruea Subdistrict, Huai Krachao District, Kanchanaburi Province (as shown in **Figure 1.1-1**), about 180 km west of Bangkok.

#### (2) Area of Influence (AoI) and Key Sensitive Receptors

Based on definition of AoI by IFC-PS1, the following AoIs of the Project were identified:

- Communities located within 3-kilometer radius from the Project site may be affected by the Project's construction activities, such as noise from building construction; and materials, equipment, and worker transportation to the construction site about 64 trips/day. Hence, the study area for environmental impacts has been determined as shown in **Figure 1.1-1**.

- The project will connect to and transmit generated electricity into the Provincial Electricity Authority (PEA) national grid. The PEA will construct a 22.5 km long 115 kV high-voltage transmission line, linking the project to Bo Phloi substation and U Thong substation (as shown in **Figure 1.1-2**). It is noted that the TL will be constructed, owned and operated by the PEA. The transmission line for the project will be laid within the Right of Way (RoW) of public roads. AoI of the Project's transmission line for the study, in particular associated with the construction and operation EHS impacts is set at 200 meters corridor ( 100m from each side of the line route) covering 7 villages in Sa Long Rues Sub-district (Moo 12 Ban Krok Ta Pho, Moo 6 Ban Huai Luek, Moo 9 Ban Dong Rang, Moo 1 Ban Sa Long Ruea, Moo 2 Ban Phai Si and Nong Pradu Sub-district (Moo 9 Ban Hiang Ngam and Moo 3 Ban Ta Lung Nuea).

#### (3) Key Sensitive Receptors

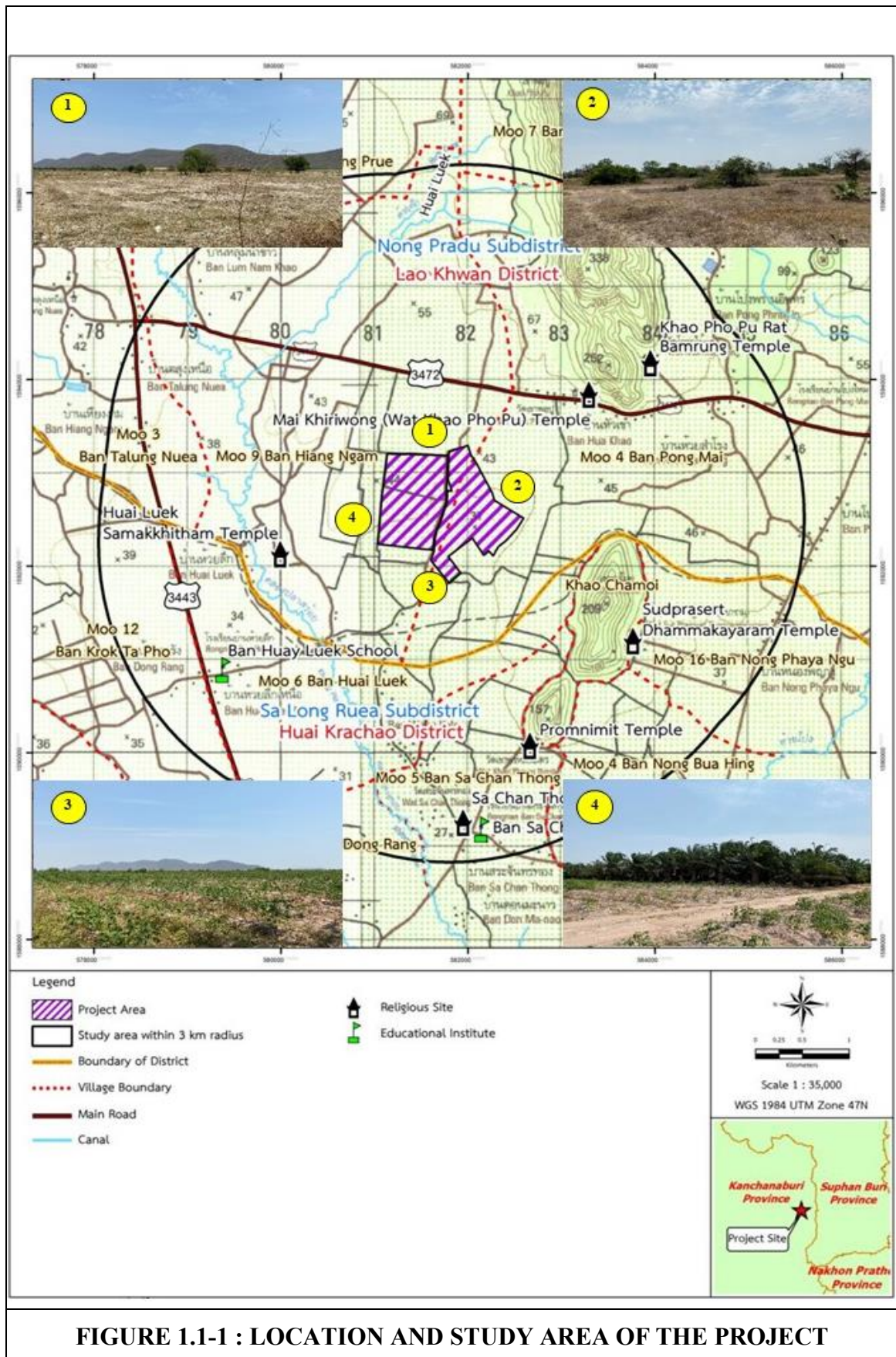
The key sensitive receptors include, but are not limited to,

- Communities in the AoI.
- Public facilities in the affected communities such as health centers.

**Table 1.1-1** details the list of important sensitive receptors.

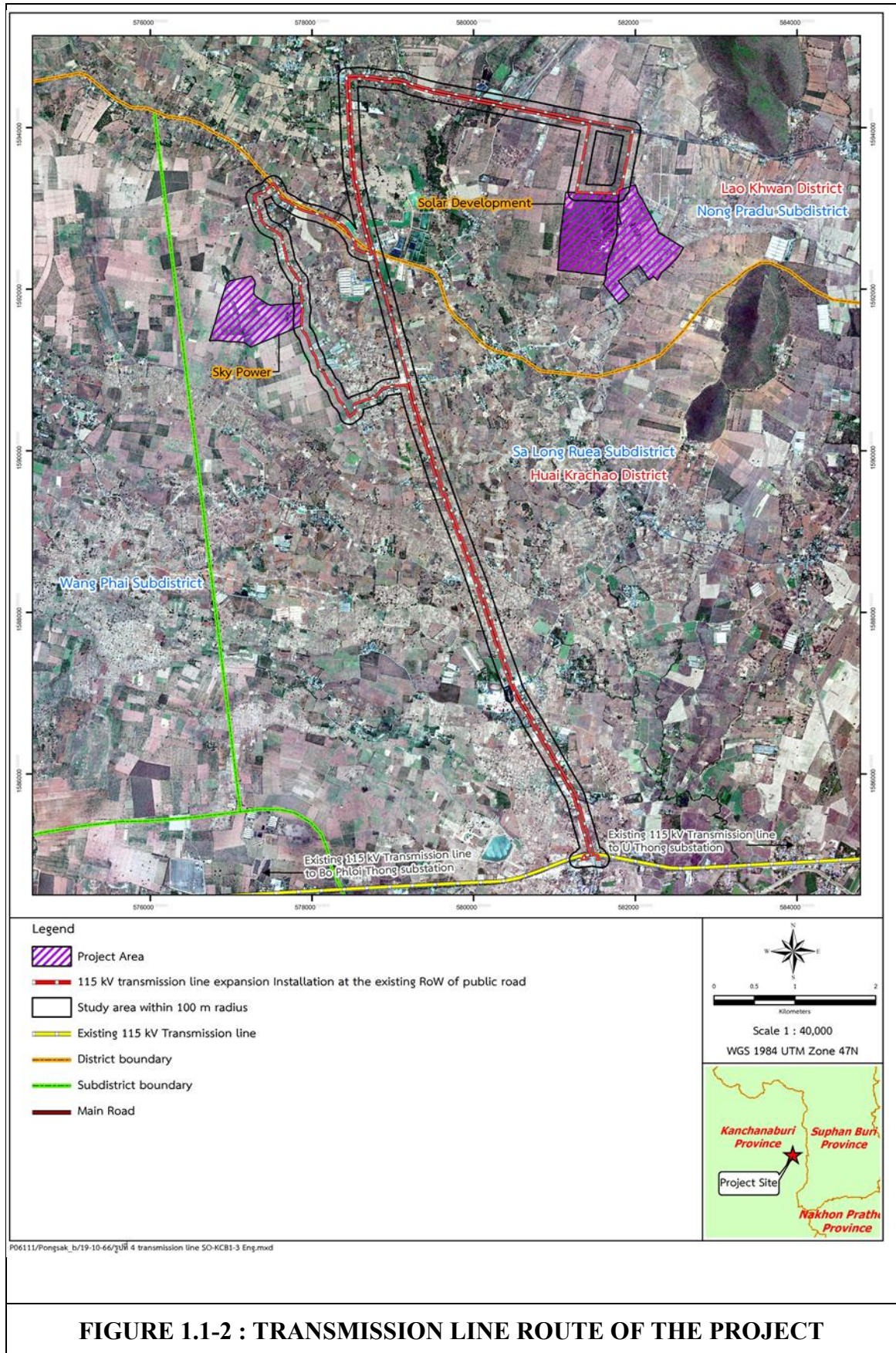
**TABLE 1.1-1**  
**KEY SENSITIVE RECEPTORS WITHIN AREA OF INFLUENCE**

Province	District	Sub-district	Key Sensitive Receptors
Kanchanaburi	Lao Khwan	Nong Pradu	Moo 3 Ban Talung Nuea
			Moo 4 Ban Pong Mai
			Moo 5 Ban Nong Prue
			Moo 7 Ban Nong Kai Leung
			Moo 9 Ban Hiang Ngam
			Huai Luek Samakkhitham Temple
			Mai Khiriwong (Wat Khao Pho Pu) Temple
			Khao Pho Pu Rat Bamrung Temple
	Huai Krachao	Sa Long Ruea	Moo 4 Ban Nong Bua Hing
			Moo 5 Ban Sa Chan Thong
			Moo 6 Ban Huai Luek
			Moo 9 Ban Dong Rang
			Moo 12 Ban Krok Ta Pho
			Ban Huai Luek School
			Ban Sa Chan Thong School
			Sa Chan Thong Temple
			Promnimit Temple
Supraser Dhammakayaram Temple			



**FIGURE 1.1-1 : LOCATION AND STUDY AREA OF THE PROJECT**





**FIGURE 1.1-2 : TRANSMISSION LINE ROUTE OF THE PROJECT**

#### 1.1.4 Data Sources

During the course of project preparation, several studies were conducted and be used as references for this study as listed below:

- Code of Practice report of Solar Development Solar Power Plant Project prepared by TLT Consultants Co., Ltd. approved on 12 December 2023
- Environmental Safety Assessment report prepared by TLT Consultants Co., Ltd., submitted to the Department of Industrial Works in August 2023.

References that are collected from other related sources include;

- Asian Development Bank (ADB)
  - ADB Environmental Assessment Guidelines (December 2003).
  - Safeguard Policy Statement (June 2009).
- International Finance Corporation (IFC)
  - Environmental, Health, and Safety General Guidelines (April 2007).
  - Stakeholder Engagement: A Good Practice Handbook for Companies, Doing Business in Emerging Markets (2007).
  - Guide to Human Rights Impact Assessment and Management (HRIAM) (September 2011).
  - Performance Standards on Environmental and Social Sustainability (2012).
- Equator Principles (EP)
  - EP4 (July 2020).
  - The Equator Principles Implementation Note, Equator Principles Association (September 2020).
  - Guidance Note on Implementation of Human Rights Assessments under the Equator Principles (September 2020).
  - Guidance Note to Support Effective Consistent Application of the Equator Principles (July 2022).
  - Guidance Note on Climate Change Risk Assessment (May 2023).



## 1.2 OBJECTIVE OF THE STUDY

The objectives of the study and preparation of the IEE Report for Solar Development Solar Power Plant Project are as follows:

(1) To investigate the Project details, such as location, construction plan, construction activities, and environmental management process, to be used in assessing the environmental and social impacts that may occur from the Project development to be comprehensive and appropriate as much as possible.

(2) To investigate the existing environmental condition of the Project area and the surrounding area within a radius of 3 kilometers from the Project fence line; as well as of the transmission line within a 100-meter radius from the centerline to be used as basic information for environmental and social impact assessment, using primary data from field surveys and secondary data from relevant agencies.

(3) To assess the environmental and social impact from Project development both in the construction phase and operation phase

(4) To determine mitigation measures and monitoring measures for environmental impacts that may arise from project operations.

(5) To prepare the IEE report for approval from Financial Institutions (Lenders).

## 1.3 COMPLIANCE WITH NATIONAL LAW, REGULATION AND PERMITS

### 1.3.1 Applicable Laws and Regulations

Thai laws and regulations which are applicable to the Project preparation, construction and operation stages are summarized below

Applicable Law and Regulation	Legal Requirement for Project Compliance	Responsible Authorities
<b>Code of Practice (CoP) Report and Environmental Safety Assessment (ESA) Report Preparation</b>		
Regulations of Energy Regulatory Commission re: the Criteria for Preparing a Code of Practice Report and Monitoring Report for Electricity Generation Business B.E. 2565 (2022)	The Regulations prescribes that the applicant for a license or the licensee of thermal with a capacity lower than 10 MW and non-combustion power plants must submit the following reports: 1) Preliminary Code of Practice (CoP) report, 2) Final CoP report, and 3) CoP compliance monitoring report. There are specific guidelines for preparing those reports for each type of power plants. The CoP reports must be submitted to the Energy Regulatory Commission (ERC) to review before issuing licenses or approving changes to existing licenses, and to review and make comments on the CoP compliance monitoring report which will be provided to licensees at least once a year to monitor their energy company operations.	Office of Energy Regulatory Commission

Applicable Law and Regulation	Legal Requirement for Project Compliance	Responsible Authorities
<b>Code of Practice (CoP) Report and Environmental Safety Assessment (ESA) Report Preparation (Cont'd)</b>		
<ul style="list-style-type: none"> <li>– Notification of the Ministry of Industry on Preparation of a Report on Environmental Safety Assessment B.E.2552 (2009)</li> <li>– Notification of the Ministry of Industry on Preparation of a Report on Environmental Safety Assessment (No.2) B.E.2559 (2016)</li> </ul>	<p>The notification prescribes that anyone wishing to apply for a factory business license or a license to expand a factory based on the types or categories of factories listed in this announcement must submit a report on environmental safety assessment (ESA) in one copy, along with the application for a factory business license or a license to expand a factory, as applicable. Production of electricity from solar energy with capacity over 1,000 kW is required to prepare ESA.</p>	Ministry of Industry
<b>Construction and Operation Stages</b>		
Provincial Electricity Authority Act (Version 4) B.E.2542 (1999)	<p>The act prescribes the main provision as follows.</p> <ol style="list-style-type: none"> <li>1. Establishment of the provincial electricity authority (PEA), capital, and reserves</li> <li>2. Supervision, control, and management</li> <li>3. Construction and maintenance of the electric energy transmission system</li> <li>4. PEA's Relations with the government</li> <li>5. Petition and aids for the officials of PEA</li> <li>6. Accounting, auditing, and examining</li> </ol>	Provincial Electricity Authority
Labor Protection Act, B.E. 2541 (1998)	<p>The Labor Protection Act of 1998 has principles and regulations covering matters such as wages, holidays, leave, promotions, termination, wearing clothing. Danger prevention Creation of a labor council and the establishment of labor courts The Labor Protection Act of 1998 has been amended several times, most recently in 2017, which increased the minimum wage rate. Increasing sick leave days Granting rights to maternity leave to fathers and increasing compensation in the case of termination of employment</p>	Ministry of Labour
Ministerial Regulation on the Prescribing of standard for Conducting Health Check-Up of Employees Working with Risk Factors B.E. 2563 (2020)	<p>The Ministerial Regulation states that the employer shall provide health check-up for the employees who work with risk factors, by completing the first health check-up for employees within thirty days from the first day the employee is employed; and subsequent health check-ups shall be conducted at least once a year.</p>	Ministry of Labour

Applicable Law and Regulation	Legal Requirement for Project Compliance	Responsible Authorities
<b>Construction and Operation Stages (Cont'd)</b>		
Ministerial Regulation concerning Labour Welfare Provision in an Establishment B.E. 2548 (2005)	The Ministerial Regulation prescribes that an employer shall provide necessary welfare to employees such as clean drinking water not less than one station for not exceeding forty employees, bathrooms and toilets with the layout and number as prescribed in the Building Control Law and other related laws, maintenance of cleanliness and hygiene, and provision of necessary kits for first aid and medical service in an adequate quantity for employees in the workplace.	Ministry of Labour
Ministerial Regulation on the Prescribing of Standard for Administration and Management of Occupational Safety, Health and Environment Regarding Fire Prevention and Suppression B.E. 2555 (2012)	The Ministerial Regulation stipulates that there shall be fire prevention and suppression system in workplace and the fire prevention and suppression system must be kept ready for efficient and safe use. The Ministerial Regulation sets forth the safety requirements related to buildings and fire exits; prevention of fire from sources of heat dissipation, flammable materials, and explosives; disposal of combustible waste; lightning protection; and operations related to fire safety and reporting of the results of firefighting and evacuation drills.	Ministry of Labour
Prescribing of Standard for Administration and Management of Occupational Safety, Health and Environment Regarding Fire Prevention and Suppression 2 <sup>nd</sup> revision B.E. 2561 (2018)	The Ministerial Regulation is a regulation implemented in Thailand to ensure the safety, health, and environmental standards relating to fire protection and prevention in workplaces. This regulation aims to establish guidelines for employers to effectively manage fire risks and prevent accidents in the workplace. It sets standards for fire prevention measures, emergency preparedness, evacuation plans, firefighting equipment maintenance, training programs, and personal safety protection.	Ministry of Labour
Ministerial Regulation on the Prescribing of Standard for Administration and Management of Occupational Safety, Health and Environment in Relation to Heat, Light and Noise B.E. 2559 (2016)	The Ministerial Regulation requires that the employer shall control and maintain the levels of heat, light and noise within the workplace where employees are working not to exceed the defined standard. In case the levels exceed the prescribed standard, personal protective equipment shall be provided as appropriate throughout working hours. Measurement and analysis of working conditions shall be conducted, and health checkups shall be arranged for employees who work in the working conditions that may be harmful by heat, light or noise.	Ministry of Labour

Applicable Law and Regulation	Legal Requirement for Project Compliance	Responsible Authorities
Notification of the Ministry of Industry on Management of Waste and Unused Materials B.E. 2566 (2023)	The Notification stipulates waste codes and types of waste or unusable materials from factory operations. The waste exempt from being in compliance with this Notification shall be: (1) waste that consists of feces or urine that occurs within the factory premises (2) non-hazardous wastes from offices, housing and canteen located in a factory area, and consumption within a factory area; (3) wastewater conveyed via pipe for off-site treatment; (4) unused materials, such as gas pressure containers that can be reused or refilled; and In addition, the Notification sets forth prescriptions and guidelines for waste generators, prescriptions and guidelines for hazardous waste collection and transportation, and prescriptions and guidelines for waste processors.	Ministry of Industry
Notification of the Department of Labour Protection and Welfare Prescribing Personal Protective Equipment Standards B.E.2554 (2011)	The Notification requires that an employer shall provide the employees with and require them to wear personal protective equipment in accordance with the standards specified by the Director-General. The standards shall be appropriate for the type or category of work performed by employees.	Department of Labour Protection and Welfare, Ministry of Labour
Notification of the Department of Labour Protection and Welfare on Rules, Procedures and Conditions of Training for Executives, Supervisors and Employees Regarding Occupational Safety, Health and Environment of the Workplace B.E. 2555 (2012)	The Notification of the Department of Labour Protection and Welfare requires that an employer shall provide occupational safety, health and environment training to be attended by executives, supervisors and every employee in order to safely administer, manage and execute the occupational safety, health and environment. In the case where an employer hires employees to work, changes the employee's work, workplace or machinery or equipment, which may harm the life, physique, mentality and health of the employees, the employer shall provide training for every employee prior to commencement of work.  In the event that an employer is unable to provide training for an employee, the employer shall arrange for such employee to attend training at the Occupational Safety, Health and Environment Promotion Institute or an agency specified or recognized by the Department of Labour Protection and Welfare.	Department of Labour Protection and Welfare, Ministry of Labour

### **1.3.2 Project Developer Policy Statement on Environment and Social Management, Biodiversity, and Human Rights Aspects**

As **Gulf Energy Development PCL. (GED)** environmental and social management (E&S) policy applies to all members of Gulf Group of Companies, Solar Development Co., Ltd., a subsidiary of GED, is required to apply the E&S policy which have been posted on GED's website. They are detailed below.

#### **1.3.2.1 Environmental and Social Management Policy**

Gulf Energy Development Public Company Limited recognizes the importance of conducting business with environmental and social responsibility while working to reduce negative impacts along the value chain, from project planning and development to operations and maintenance to decommissioning, and including related business and support activities such as supplier selection and procurement, distribution and logistics, mergers and acquisitions, and managerial and administrative activities. The Company shall strive to do so with a focus on the following areas.

##### **i. General Provisions**

a. The Company shall implement and maintain an environmental and social management system (ESMS) covering key issues as outlined in the Company's Sustainability Framework as well as context-specific issues where required, and will work to continuously improve its environmental and social management performance throughout the organization.

b. The ESMS shall cover all businesses under the Company, including any sites under the Company's management, and shall apply to all key business activities including: due diligence and feasibility studies, mergers and acquisitions, project implementation, operations, logistics and transmission/distribution, and decommissioning, as well as goods and services provided to the Company.

c. The Company shall comply with relevant national laws at a minimum, and shall strive to comply with other applicable national and international environmental and social safeguard requirements or other relevant regulations related to environmental and social management.

d. The Company shall collaborate with, and communicate its commitments and expectations to, key counterparties, including contractors, suppliers and business partners, as well as other stakeholders throughout the Company's value chain, to encourage increased awareness of environmental issues, develop greater understanding of the Company's environmental and social management policy, and improve environmental and social management performance within the Company and among its stakeholders.

e. The Company shall ensure appropriate and sufficient training related to environmental and social management for its employees on a regular basis, and collaborate with key counterparties and stakeholders to ensure contractors, suppliers or other individuals under the Company's responsibility receive appropriate and sufficient training on relevant issues.

f. The Company shall incorporate environmental and social issues, including occupational health and safety issues, into its risk management process, and shall strive to develop appropriate risk prevention and mitigation measures including establishing emergency and business continuity plans.

g. The Company shall establish a procedure to investigate any major incidents related to environmental, social or safety issues in order to determine the cause, identify impacts, develop remediation plans, develop prevention and mitigation plans, and communicate lessons learned throughout the organization for future improvement. The Company's Executive Committee shall have the authority to designate the investigation team, consider the findings of the investigation, and, in the event of wrongdoing, determine the appropriate punishment and/or remediation as required.

h. The Company shall monitor and review its environmental and social management performance on a regular basis, and report on the performance to the Company's management and Board of Directors at least quarterly, as well as disclose information about the Company's environmental and social management performance to key stakeholders and/or publicly, where appropriate.

## **ii. Environmental Management**

a. The Company shall comply with applicable local, national and/or international environmental laws at a minimum, and shall strive to operate in accordance with internationally-accepted standards and regulations for environmental management.

b. The Company shall establish clear processes and procedures for environmental management to be implemented within the organization and within its projects, and shall regularly review and revise such processes and procedures at least annually and whenever a major change or event occurs.

c. The Company may set environmental performance targets for specific issues or areas of operation, such as waste and/or emissions reduction targets, and shall regularly monitor its environmental performance with the aim of continuous improvement in environmental management.

d. The Company shall consider key issues such as biodiversity, waste management, greenhouse gas emissions, air emissions, water management, resource management, and impacts to local communities and/or ecosystems as part of its environmental management.

e. The Company shall establish an environmental monitoring committee or shall designate an environmental team to monitor environmental performance and identify any potential environmental issues for the Company or its projects that need to be managed.

f. The results of the environmental performance monitoring shall be reported to the Company's management and the Board of Directors on a regular basis, and reported to relevant management or Board committees and external entities as required. The Company's environmental performance may also be disclosed through public channels where appropriate.

### iii. Social Management

a. The Company shall consider key issues such as human rights, diversity and non-discrimination, labor rights, occupational health and safety, and community relations as part of its social management.

b. The Company shall comply with applicable local, national and/or international laws related to occupational health and safety, labor rights, and other social issues at a minimum, and shall strive to operate in accordance with internationally-accepted standards and regulations for occupational health and safety management, human rights, and labor rights.

c. The Company shall establish clear processes and procedures for occupational health and safety management to be implemented within the organization and within its projects, and shall regularly review and revise such processes and procedures at least annually and whenever a major change or event occurs.

d. The Company may set social performance targets for specific issues or areas of operation, including a zero accident target in relation to occupational health and safety, and shall regularly monitor its performance with the aim of continuous improvement in social and occupational health and safety management.

e. The Company shall establish an occupational health and safety committee or shall designate a safety team to monitor occupational health and safety performance and identify any potential safety issues that need to be managed for the Company, its projects, its employees, or other individuals under the Company's responsibility. Prioritization of issues, along with management and action plans, shall be developed in consultation with the Company's employees, contractors, workers, and/or their representatives to ensure key issues are addressed.

f. The Company shall provide appropriate and sufficient training and capacity-building related to social and occupational health and safety issues for its employees, contractors, and other individuals under the Company's responsibility.

g. The results of the social and occupational health and safety performance monitoring shall be reported to the Company's management and the Board of Directors on a regular basis, and reported to relevant management or Board committees and external entities as required. The Company's social performance may also be disclosed through public channels where appropriate.

### 1.3.2.2 Biodiversity Policy

GED will:

- i. Ensure governance of biodiversity at the executive and Board levels.
- ii. Provide a framework for the management of biodiversity based on the mitigation hierarchy (avoid, minimize, remediate, offset), taking into account both direct and indirect drivers that result in biodiversity or ecosystem change, covering:
  - a. Objectives and strategy
  - b. Study and research
  - c. Risk assessment
  - d. Action plans
  - e. Monitoring and assessment.
- iii. Comply with laws and regulations governing biodiversity conservation areas<sup>1</sup>, avoiding operational activities in areas with high biodiversity importance where possible and appropriate, and apply the precautionary principle in its decision-making process as appropriate.
- iv. Integrate biodiversity management in the Company's environmental and social management system, including ensuring that issues related to biodiversity are monitored and managed throughout the lifespan of projects, from conception to retirement.
- v. Undertake and/or support actions, such as reforestation, to preserve biodiversity with no net loss and no net deforestation, where necessary, appropriate and feasible.
- vi. Engage with external parties and relevant stakeholders, including the Ministry of Natural Resources and Environment, to develop appropriate biodiversity action plans for the Company's operations where required
- vii. Support education and advocacy related to environmental responsibility:
  - a. Among all departments and at all levels within the Company.
  - b. Among external stakeholders including business partners, suppliers, contractors, and the communities in which the Company operates.

### 1.3.2.3 Human Rights Policy

Gulf Energy Development Public Company Limited is aware of the importance of respecting and upholding the human rights of its stakeholders and the general society, and shall strive to do so with a focus on the following areas.

- i. General provisions
  - a. The Company shall support a human rights due diligence process to engage with its stakeholders to identify, assess, manage, and, where applicable, prevent or mitigate human rights risks and related issues in key areas including within the Company, in its projects, and within the local communities where the Company operates.
  - b. The Company shall ensure fair and equal treatment of stakeholders, respecting the diverse nature of people, and placing emphasis on avoiding discrimination based on sex, gender, age, race, ethnicity, religion, nationality, and any other non-merit-based attributes.
  - c. The Company shall communicate its commitments and expectations regarding human rights to its stakeholders through the appropriate and relevant channels.



d. The Company shall provide appropriate reporting and whistleblowing channels as well as a clear grievance mechanism to manage any such reports, including managing fair and equitable remediation where necessary and appropriate.

ii. Within the Company and its projects

a. The Company respects labor rights and complies with labor laws, including complying with regulations regarding appropriate working hours and conditions, relevant freedoms and collective rights as appropriate, as well as supporting appropriate welfare benefits and compensation for employees beyond the legal minimum wage.

b. The Company shall support gender equality and women's rights, including supporting equal pay for equal work based on a non-discriminatory, merit-based performance evaluation process.

c. The Company shall provide and maintain a safe and healthy workplace for employees with consideration for all aspects of employee well-being (including physical, mental, emotional, social well-being), and comply with applicable safety and health laws and regulations.

d. The Company shall maintain a ZERO TOLERANCE POLICY regarding child labor, slave labor, forced labor, or any form of human trafficking.

iii. Stakeholders and the general society

a. The Company shall support human rights throughout its value chain through monitoring and advocacy, including educating and/or advocating for human rights both within the Company and among external stakeholders including business partners, suppliers, contractors, and the communities in which the Company operates.

b. The Company shall support corporate social responsibility programs and initiatives that promote human rights, with a focus on education, health, work and environmental protection, for children, local communities and the general society. These commitments shall be undertaken within the framework of sustainability and good corporate social responsibility to ensure that the Company continues to create a positive impact in all spheres where it operates.

These commitments shall be undertaken within the framework of sustainability and good corporate social responsibility to ensure that the Company continues to create a positive impact in all spheres where it operates.

## 1.4 SCREENING AND SCOPING OF ENVIRONMENTAL AND SOCIAL IMPACT

(1) **Approach for screening and scoping** includes the following steps.

- Identifying the distinct project activities that could potentially produce an interaction with the physical, biological, or social environment during each phase of the project;

- Identifying the probable receptor types existing in the project area. Receptors for the physical, biological, and social environments.

- The creation of a matrix that lists the project activities against the likely affected receptor types;

- The supporting explanation for ‘no interactions’ that were scoped out from further assessment is provided in this Chapter; and
- An assessment of potential impacts interactions is provided in Chapter 4.

## (2) Result of Screening and Scoping

The project life cycle is separated into two major phases: pre-construction and construction and operation. There are major actions that may affect specific E&S components during various phases. Each E&S component's expected impact was assessed. **Table 1.4-1** shows the outcome of the project's screening and scoping E&S impact. There were E&S components identified as having no interaction or being unaffected by Project operations. The following are the supporting explanations for the lack of interaction.

### 2.1) Construction Phase

- Geology/seismology: the construction of the Project will be conducted above ground, which will not impact the geology. In addition, the Project site is not situated near the active fault; hence, the project will not be affected by the earthquake.
- Hydrology: there will be minor site adjustment to consolidate installation of ground-mounted solar modules and minor land use for building construction. The water drainage condition during construction phase will remain the same as the existing condition.
- Topography: the Project was designed to have minor modification to the land slope and condition, such as grading and leveling.
- Indigenous people: there is no indigenous people in the subdistricts where the Project is situated in.
- Physical and cultural heritage: there is no physical and cultural heritage nearby the Project area.
- Water Use / Electricity and Energy Use: during the construction phase will rely on the supply of water and electricity from Provincial Water Authorities and Provincial Electricity Authorities respectively with sufficient capacity. The impact on the water and electricity use of the surrounding communities can be negligible.

### 2.2) Operation Phase

- Geology/seismology: the project's operations will take place above ground, with no impact on the geology. Furthermore, the project site is not located near an active fault, thus it will be unaffected by the earthquake.
- Air quality/noise: there will be no sources which will cause the potential air quality and noise impacts.
- Topography: the Project was designed to have minor modification to the land slope and condition, such as grading and leveling.
- Indigenous people: there is no indigenous people in the subdistricts where the Project is situated in.
- Physical and cultural heritage: there is no physical and cultural heritage nearby the Project area.

**TABLE 1.4-1  
SCREENING AND SCOPING RESULT OF ENVIRONMENTAL AND SOCIAL  
COMPONENTS FOR THE SOLAR DEVELOPMENT SOLAR POWER PLANT  
PROJECT**

Project activities	E&S components affected by Project activities
<p><b>Construction phase</b></p> <ul style="list-style-type: none"> <li>- Land acquisition</li> <li>- Site preparation</li> <li>- Transport and stockpiling of construction materials and equipment</li> <li>- Construction of building</li> <li>- Installation of supporting structures, invertors, solar modules, substation, and transformer</li> </ul>	<ul style="list-style-type: none"> <li>- Soil</li> <li>- Climate change risk</li> <li>- Air quality</li> <li>- Noise</li> <li>- Surface water quality</li> <li>- Terrestrial ecology</li> <li>- Aquatic biological resources</li> <li>- Socio-economic</li> <li>- Public health</li> <li>- Human rights risk</li> <li>- Occupational health and safety</li> <li>- Land use</li> <li>- Land transportation</li> <li>- Solid waste management</li> <li>- Wastewater management</li> </ul>
<p><b>Operation phase</b></p> <ul style="list-style-type: none"> <li>- Electricity production</li> </ul>	<ul style="list-style-type: none"> <li>- Climate change risk</li> <li>- Surface water quality</li> <li>- Flood risk</li> <li>- Electromagnetic field</li> <li>- Terrestrial ecology (Wildlife)</li> <li>- Aquatic biological resources</li> <li>- Socio-economic</li> <li>- Public health</li> <li>- Human rights risk</li> <li>- Occupational health and safety</li> <li>- Land transportation</li> <li>- Solid waste management</li> <li>- Wastewater management</li> <li>- Water drainage</li> <li>- Major hazard</li> </ul>

- Land Use: Even the operation of solar power plant was converted from agricultural area, the surrounding areas still remain primarily agricultural. In such a scenario, the overall land use will be limited to the converted area itself.

- Water Use / Electricity and Energy Use: during the operation phase, water and electricity will be supplied by Provincial Water Authorities and Provincial Electricity Authorities respectively with sufficient supply capacity. The impact on the water and electricity use of the surrounding communities can be negligible.

## 1.5 PROJECT CATEGORIZATION

According to the ADB's SPS, Equator Principle 4 and IFC, the definition for project categories is defined as following.

**Category A** – Projects with potential significant adverse environmental and social risks and/or impacts that are diverse, irreversible or unprecedented. These impacts may affect an area larger than the sites or facilities subject to physical works. An environmental impact assessment is required;

**Category B** – Projects with potential limited adverse environmental and social risks and/or impacts that are few in number, generally site-specific, largely reversible and readily addressed through mitigation measures. An initial environmental examination is required; and

**Category C** – Projects with minimal or no adverse environmental and social risks and/or impacts. No environmental assessment is required although environmental implications need to be reviewed.

Based on the preliminary assessment of impact significance of each environmental aspects for the Project in **Table 1.4-1**, the determination of project category is as follows:

**Environment:** The Project has the potential to have an impact on some environmental and social issues, particularly during the construction phase. Its effects will typically be caused by constructing activity, worker consumption, and worker influx, all of which will last about a year and can be readily addressed by mitigation measures. Following that, the operations phase will focus on producing electricity from solar power. The primary impact such as solid waste and wastewater will come from staff consumption. Their management is governed by laws and regulations, and they can be minimized by appropriate measures. As a result, the project is categorized as **Category B**.

**Involuntary Resettlement:** Involuntary Resettlement: the Project is situated on land owned by Solar Development Co., Ltd., which was acquired through a willing-seller-willing-buyer scheme. The price was negotiated until the landowners agreed to sell. The transaction included payment and the official transfer of land ownership in the presence of Land Office authorities. In addition, consultants interviewed the landowners about the land sale process. Project officials approached landowners [*This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.*] to discuss the purchase of the land for the installation of a solar power plant. The land was sold [*This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.*] after successful price negotiations. Prior to the sale, the land was used to grow cassava. Following the sale, all landowners are not affected because they already have other occupations, such as employees or government officials. As a result, there will be no physical and economic displacement.

The transmission line for the project will be built within the right-of-way (RoW) of public roadways, which will be overseen by the Provincial Electricity Authority (PEA). The encroaching structures and agricultural areas within the RoW will be managed by PEA. If the constructing method for the transmission line is necessary to clear encroaching structures inside the right-of-way or causes concerns for nearby communities, PEA will change the design of the construction approach. Furthermore, PEA has a policy that allows farmers to harvest crops in areas where power transmission poles will be constructed as

soon as feasible, according to the constructing schedule. This causes no physical and economical displacement.

As a result, the Project can be classified as **Category C** regarding involuntary resettlement.

**Indigenous People:** There are other sources indicating that "Thai Song Dam or Lao Song is the name of Tai Dam ethnic group who originally settled alongside the Black and the Red rivers of Northern Vietnam in Sipsong Chu Thai area called Muang Thang or present-day Dien Bien Phu. Throughout the Thon Buri and early Rattanakosin periods, several groups of Lao Song had migrated via LAO PDR, from where the word "Lao" in "Lao Song" derived, to Thailand and lived there for more than 200 years. Thai Song Dam's unique tradition includes wearing mostly black clothes and their expertise in hand-weaving exquisite "Suea" (a shirt or blouse) and "Pah Sinh" (a traditional wraparound skirt), the costume clearly reflecting this ethnic group's identity. Most of Thai Song Dam people in Thailand live in Phetchaburi Province where their traditions, rites, and ceremonies are still maintained strictly."

In the area of Sa Long Ruea subdistrict, there is an ethnic group, Thai Song Dam, who lives in harmony in the communities with the locals, mostly can speak and understand Thai language, and has equal rights to the locals. This is to say, Thai Song Dam is not indigenous people, so the project can be categorized as **Category C** regarding indigenous people.

# CHAPTER 2

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## PROJECT DESCRIPTION



## CHAPTER 2 PROJECT DESCRIPTION

### 2.1 PROJECT LAYOUT AND UTILIZATION

The Solar Development Solar Power Plant Project has a total area of 1,301,614.0 square meter, which is located on land with 19 title deeds in Sa Long Ruea Subdistrict, Huai Krachao District, Kanchanaburi Province (**Appendix 2A**). The project has already purchased land *[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]*, as shown in **Figure 2.1-1**. Most of the area is for power generation, accounting for 895,116.30 square meter or 68.76 percent, power generation control building 288.00 square meter or 0.02 percent, spare parts, material, equipment, waste storage area, and maintenance area 124.00 sq.m. or 0.01 percent, green area 1,726.00 square meter or 0.13 percent, buffer area 37,822.70 square meter or 2.91 percent, switchyard or substation 1,527.00 square meter or 0.12 percent, empty space or road, walkways, or parking space 352,571.65 square meter or 27.09 percent, power generation supporting area and power-generating related area 4,800.00 square meter or 0.37 percent, and other areas (ponds and existing drains) 7,638.30 square meter or 0.59 percent. More details are shown in **Table 2.1-1**. The diagram of land use is shown in **Figure 2.1-2**.

**TABLE 2.1-1  
LAND USE IN THE AREA OF THE SOLAR DEVELOPMENT  
POWER PLANT PROJECT**

Items	Land use of the Project	
	Area (square meter)	Percentage (%)
1. Power generation area	895,116.30	68.76
2. Power generation control building	288.00	0.02
3. Admin & Warehouse Maintenance & Waste Storage Area		
3.1 Warehouse Maintenance area	20.00	0.002
3.2 Waste Storage area	20.00	0.002
3.3 Admin office	80.00	0.006
4. Green area	1,726.00	0.13
5. Buffer area	37,822.70	2.91
6. Switchyard or substation	1,527.00	0.12
7. Empty space or roads, walkways, or parking space	352,571.70	27.09
8. Power generation supporting area and power-generating related area	4,800.00	0.37
9. Others (ponds, existing drains)	7,638.30	0.59
<b>Total</b>	<b>1,301,614.00</b>	<b>100.00</b>

**Source:** Solar Development Co., Ltd., 2023



**FIGURE 2.1-1 : TITLE DEED AREA OF THE SOLAR DEVELOPMENT SOLAR POWER PLANT PROJECT**



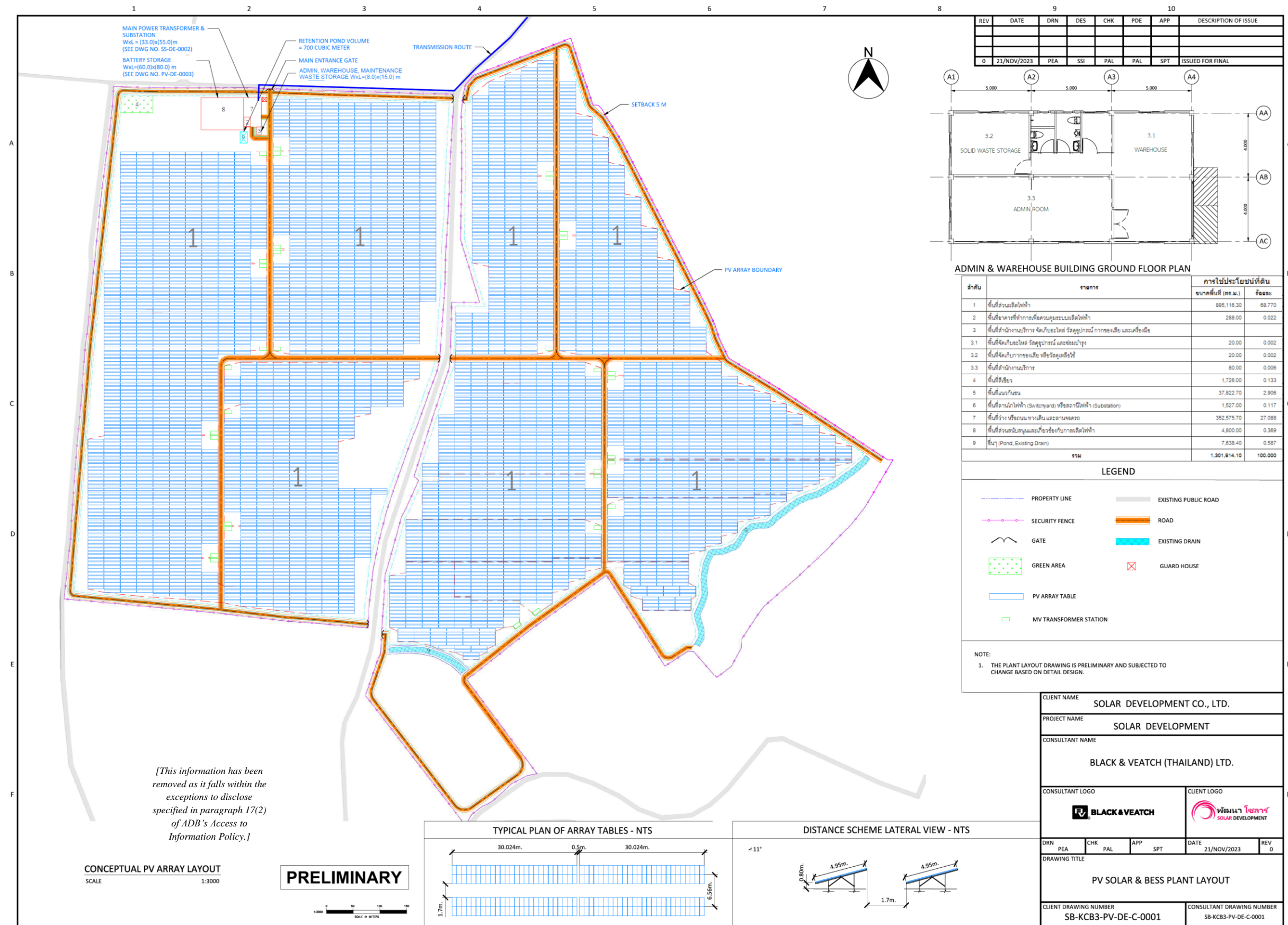


FIGURE 2.1-2 : LAYOUT OF LAND USE OF THE SOLAR DEVELOPMENT SOLAR POWER PLANT PROJECT.

## 2.2 PROJECT COMPONENTS

The Solar Development Solar Power Plant Project is a non-combustion power plant that generates electric power from solar energy using photovoltaic technology or solar cells installed on the ground with an energy storage system. Main equipment installed in the Project area includes PV modules, inverters, transformers and Battery Energy Storage Systems (BESS). The details of main technology and equipment can be summarized below and the land acquisition for those components are presented in **Table 2.2-1**.

### 2.2.1 Power Generation Area

#### 2.2.1.1 Photovoltaic Modules (PV Modules)

The Project will use monocrystalline silicon PV modules that have been tested and certified with the IEC61215, IEC61730, ISO9001:2015, ISO14001:2015, ISO 45001:2018, or equivalent standards to ensure that its safety complies with the Thai Industrial Standards Institute (TIS) or equivalent to international standards. In total, there will be 267,982 PV modules. Each PV module has a peak power generation capacity (Peak Power Watts: Pmax) of 605 watts (Wp), with a total installed capacity of 162.129 megawatts (MWp). A PV module is 2,465 mm in width, 1,134 mm in height, 30 mm in thickness, and 34.6 kg in weight. Monocrystalline PV modules do not cause light reflection. In addition, the installation angle is 11 degrees horizontally. So, it does not affect the visibility of people living near the Project area. (**Appendix 2B**)

#### 2.2.1.2 Mounting structure

The PV module mounting structure is made of aluminum fixed with poles. The beams are made of rustproof galvanized steel. This structure can withstand the force of the wind speed not less than 30 meters per second. (**Appendix 2C**)

#### 2.2.1.3 Inverters

Inverters convert the electric power generated from PV modules by turning direct current to alternating current. The Project will use inverters that comply with the regulations or requirements of the Provincial Electricity Authority and have passed the standards of IEC62109, IEC61727, IEC62116, or equivalent standards. There will be 386 inverters, with a capacity of 300.00 kVA each or equivalent. Total installed capacity of 115.800 megawatts (MWp). The inverters are 1,048 mm in width, 732 mm in height, 395 mm in thickness, and 122 kg in weight. (**Appendix 2D**)

#### 2.2.1.4 Transformers

Transformers convert electric power into high-voltage electricity to increase the voltage enough to supply electricity. The Project will install one transformer of 70 megavolt-amperes (MVA) and 39 transformers of 3.437 megavolt-amperes (MVA). (**Appendix 2E**)

#### 2.2.1.5 Switch Gears

12 units of indoor 22 kV switch gear consisting of disconnecting switches, fuse, or circuit breakers are employed. Switch gear controls and protect equipment in case of abnormality or equipment malfunction occurs in the electricity generation process. They are designed to meet IEC 62271-200 and Provincial Electricity Authority Regulations on Power Network System Interconnection Code B.E. 2559 (2016).

**TABLE 2.2-1  
LAND ACQUISITION FOR PROJECT COMPONENTS**

<b>Project Component</b>	<b>Location*</b>	<b>Area Requirement</b>	<b>% Total Project Area</b>	<b>Mode of Land Acquisition</b>	<b>Status of Land Acquisition</b>
1. Power generation area	Situated at the center of the project site	895,116.30	68.77	Willing-buyer-willing seller scheme	Purchased by Solar Development Co.,Ltd. in <i>[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]</i>
2. Power generation control building	Situated at the eastern of the project site	288.00	0.02		
3. Storage and maintenance area	Situated at the eastern of the project site	120.00	0.01		
4. Green Area	Situated at the eastern of the project site	1,726.00	0.13		
5. Buffer area (setback area from the project fence)	Next to the fence around the project site	37,822.70	2.90		
6. Switchyard/substation	Situated in the southern part of the project site	1,527.00	0.12		
7. Internal roads, walkways, parking space or empty space	Internal roads surround the project site and pass through the center of the project site	352,575.70	27.09		
8. Other areas (ponds and existing drains)	Ponds is situated in the southern part of the project site	4,800.00	0.37		
9. Transmission Line (TL)	Start from front of the project to Bo Phloi substation and U-Thong Substation	1,732.50**	Not included in the project area	Within RoW of public roads	The lands within RoW were acquired by concern authorities.
<b>Total</b>		<b>1,301,614.00</b>	<b>100.00</b>		

**Remark:** \* See the project components in **Figure 2.1-2.**

\*\* The area requirement for transmission line is estimated from the area require for each utility pole's foundation 0.9x2.2 sq.m. and 875 utility poles in total. This area is within RoW of public roads, so it is not included in the project area.

### 2.2.1.6 Battery Energy Storage System

Battery Energy Storage System (BESS) The Project will install 34 BESS with a capacity of 2,752 kWh each. A BESS is 9,340 mm in width, 2,600 mm in height, 1,730 mm in width, and 26,400 kg in weight. BESS collects excess electric power. The Project will use BESS that has passed the tests and is certified with the standards of CE, IEC62477-1, IEC61000-6-2, IEC61000-6-4, IEC62619, or equivalent standards to ensure that its safety complies with the standard of the Thai Industrial Standards Institute (TIS) or equivalent to international standards. **(Appendix 2F)**

### 2.2.1.7 Power Conversion System (PCS)

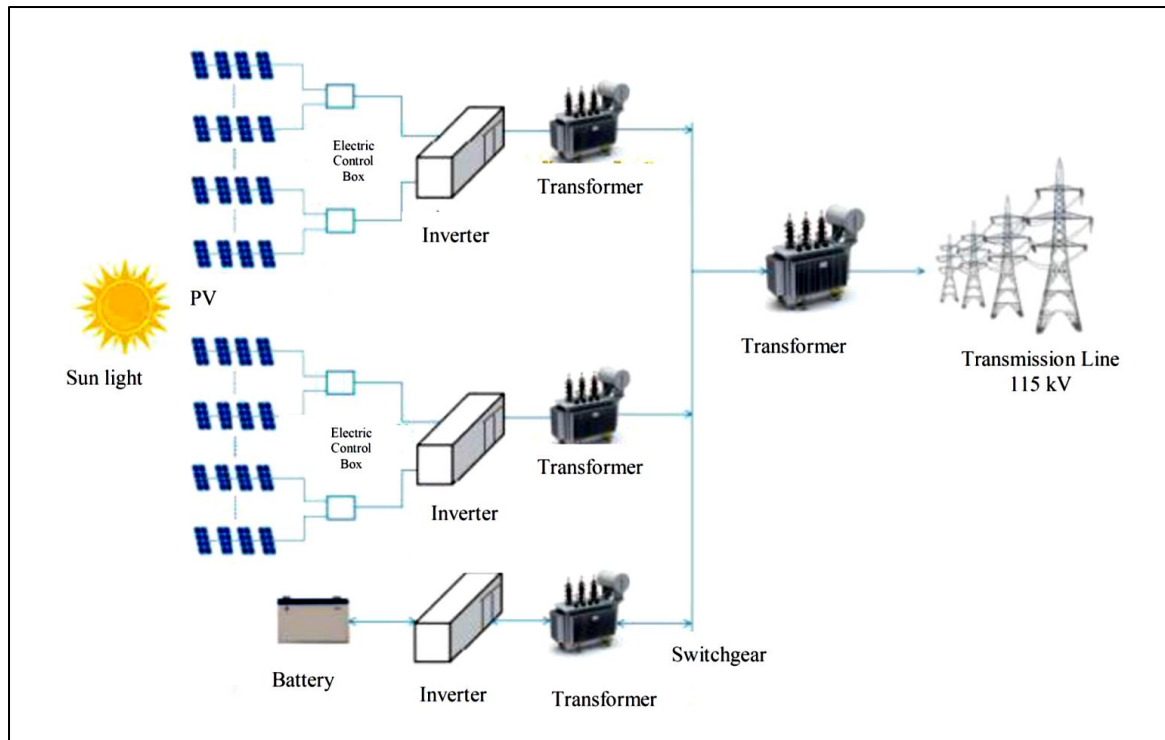
Power Conversion System (PCS) is the system to control and regulate energy storage system is designated to comply with SC2500UD standards.

### 2.2.1.8 Electrical Substation

The electricity generation process starts when sunlight, which is an electromagnetic wave, comes in contact with PV modules, which are semiconductor. The contact will cause positive and negative charged particles to move in opposite directions.

The movement of such positive and negative charged particles generates direct current power. Such DC power will be supplied to a device called "inverter" to convert direct current into alternating current, then sent to the transformer to convert to high voltage. Some portion of the electric power will be supplied to the supply system to distribute electric power to the Electricity Generating Authority of Thailand (EGAT). The excess electricity generated will be supplied to the 22 kV Switchgear, then adjust the voltage with a transformer from 22 kV to 900 V, control the supply of electrical energy with the Power Conditioning System (PCS) to store the power in the battery energy storage system (BESS).

During periods when electricity generation is low, or electricity generation from solar energy is not possible, such as at nighttime, the electric energy stored in the BESS is returned to the 22 kV switchgear. After that, the power from the 22 kV switchgear will be supplied through the 22 kV transmission line to the main transformer and to the 115 kV transmission line in order to supply power to EGAT **(Figure 2.2-2)**. The total length of the transmission line is 22.5 kilometers, from a substation in the Project area connecting to the existing 115 kV transmission system at the intersection of Highway 3443. However, the transmission line considered as Associated Facility. The single line diagrams of PV modules are shown in **Figure 2.2-2**. **(Appendix 2G)**



**FIGURE 2.2-2: ELECTRIC POWER GENERATION FROM SOLAR ENERGY**

### 2.2.1.9 Cabling

The connection of the solar energy production system with the power distribution system of the Provincial Electricity Authority (PEA) is designed with inverters, which are devices used to convert direct current electricity from the production system into alternating current electricity for supply to the distribution network. In this regard, the connection with the PEA distribution network will adhere to the electrical installation standards for Thailand, established by the Engineering Institute of Thailand under the Royal Patronage (Standard TIS 022001-22). The installation will be supervised by licensed Control System Engineers specializing in electrical power, as stipulated by the Professional Engineers Act of 2542 B.E.

### 2.2.1.10 Communications

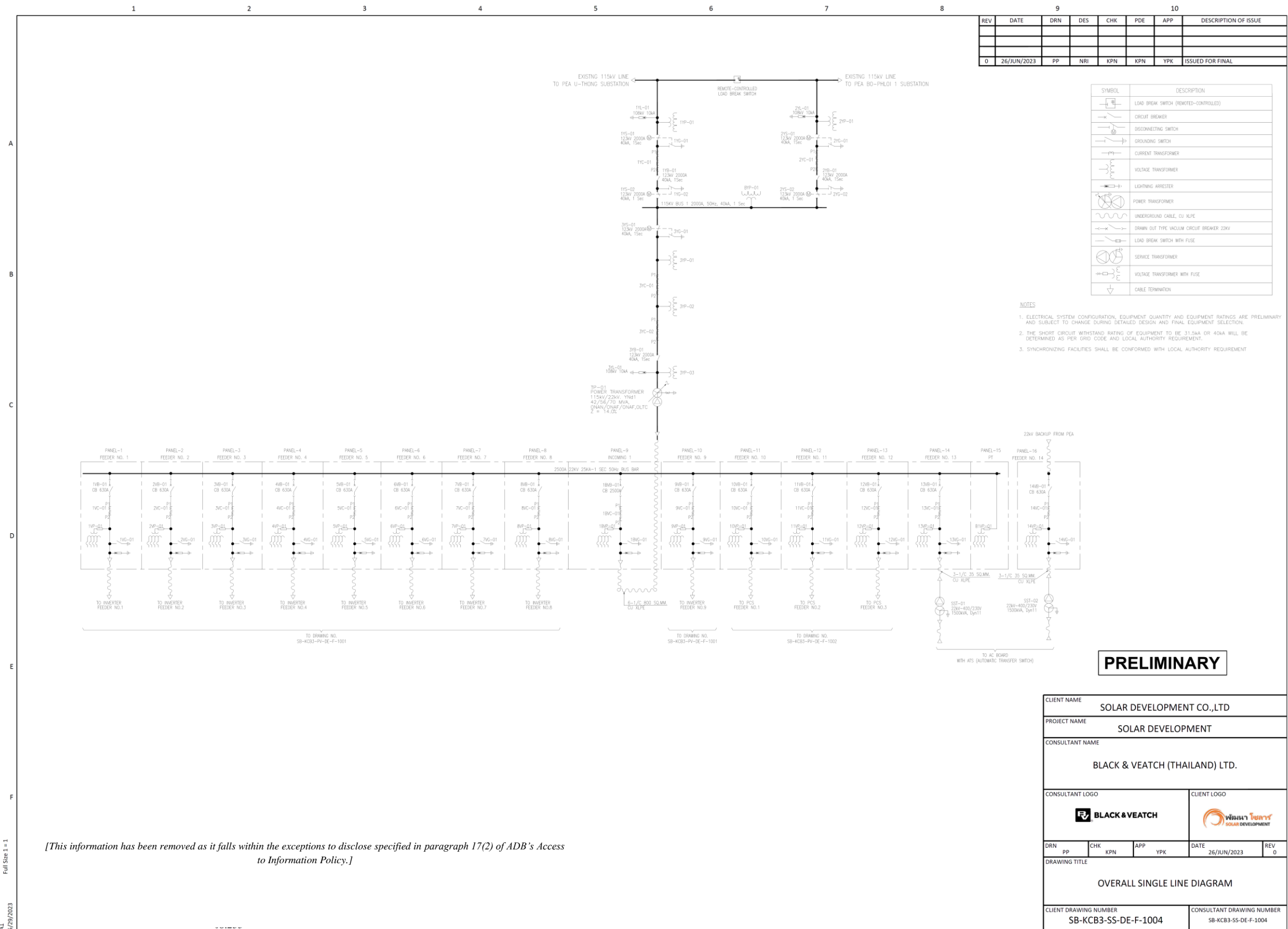
The project will coordinate with telephone and internet service providers to obtain fixed line services and high speed internet or Broad Band Internet, including mobile phones for communication within the organization with external agencies and the general public. In addition, the project has provided an emergency communication system in the project's fire prevention and suppression plan.

#### **2.2.1.11 Site Security and Fencing**

The project area will be enclosed by transparent fencing, and clear signs stating the area limits will be placed. In addition, fences will be placed to separate the public road located in the project area (as shown in **Figure 2.1-2**), so the access to the public road will not be restricted or limited. Furthermore, security officers will be stationed at a security guard house located at the main entrance gate.

#### **2.2.1.12 Access Road**

Transportation routes into the project area include National Highway No. 3443 (Talad Mai-Talung Nuea) and National Highway No. 3472 (U Thong-Talung Nuea). The road is approximately 12 meters wide with two return traffic lanes of 3.50 meters (separating directions) and The shoulder width is approximately 2.50 meters on each side, so there is no need for road expansion.



**FIGURE 2.2-3: SINGLE LINE DIAGRAM FOR PV MODULES OF THE PROJECT**

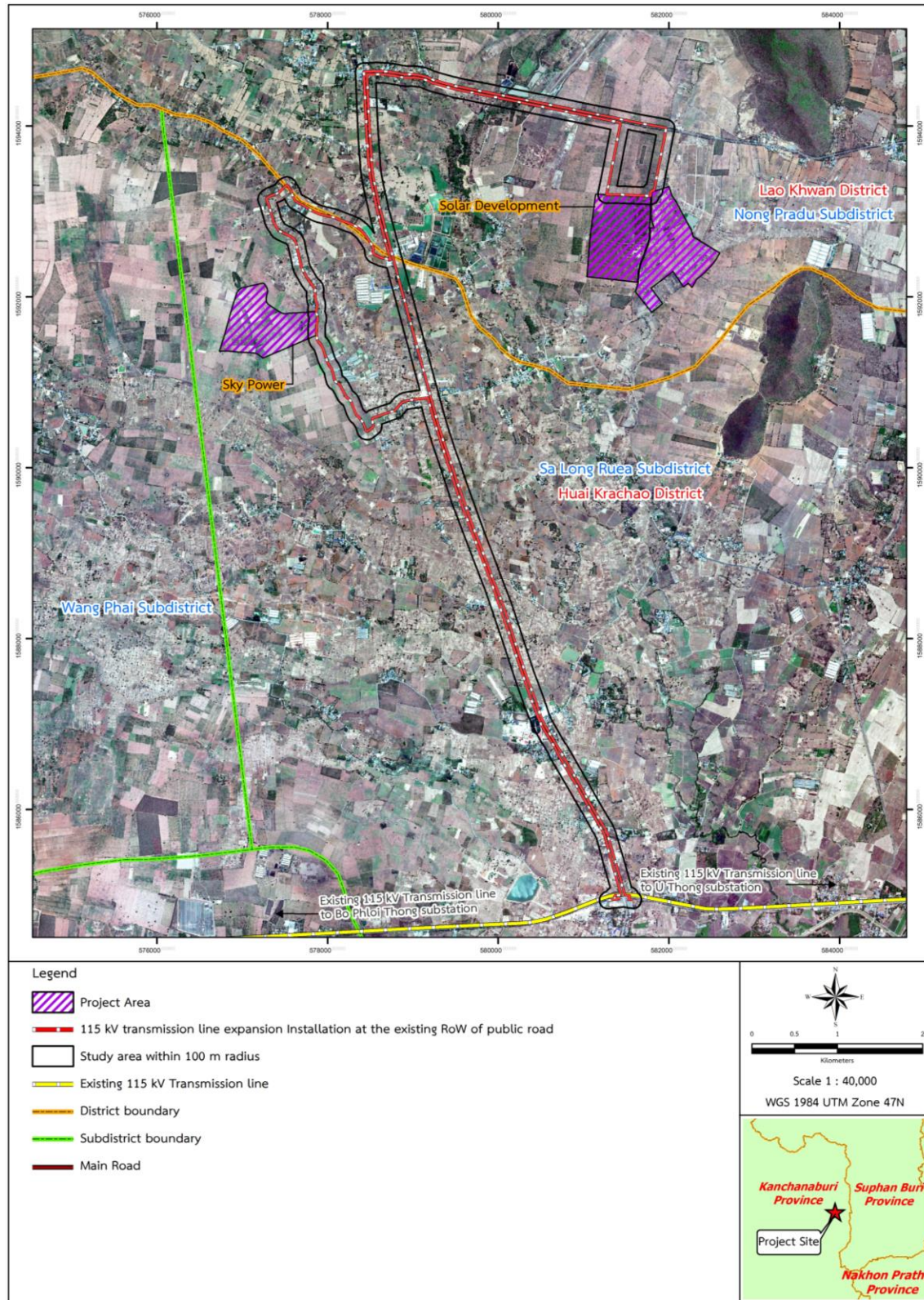
## 2.2.2 Transmission Line

The project will transport electricity to the Bo Phloi substation and U Thong substation through 115 kV power lines the power lines will run from Solar Development Solar Power Plant along the right-of-way (RoW) of the public road until they reach the existing 115 kV transmission line (TL) between the Bo Phloi substation and the U Thong substation, a distance of approximately 22.5 kilometers (as indicated in **Figure 2.2-3**) The TL will be constructed, owned and operated by PEA. It is noted that the TL will not be financed under the financing arrangements with the Lenders and will therefore be considered as Associated Facility. The **Table 2.2-2** presents a comprehensive summary of transmission line.

**TABLE 2.2-2**  
**OVERALL PROJECT’S DESCRIPTION AND ASSOCIATED FACILITY**

Detail	Transmission Line
Owner	Provincial Electricity Authority (PEA)
Location	Right of Way (RoW) along the public roads is required for the construction of a 115-kV transmission line. The transmission line spans a total length of 22.5 kilometers, starting from the project’s substation to the Bo Phloi substation and the U Thong substation.
Components	<ol style="list-style-type: none"> <li>1. Transmission Line: 400 square millimeters All Aluminum Conductor (AAC).</li> <li>2. Transmission Circuit: Single circuit, Double conductor.</li> <li>3. Electricity Poles: Reinforced concrete poles with a height of 22 meters, and about 0.9 x 2.2 x 3.0 meters (width x length x depth) of foundation dimensions.</li> </ol>
Study area and affected villages	<p>100-m. from the transmission line route, covering 5 villages Sa Long Ruea Subdistrict, Huai Krachaov District and 2 village in Nong Pradu Subdistrict, Lao Kkwan District, Kanchanaburi Province.</p> <p><b>Sa Long Ruea Subdistrict Administration Organization (SAO)</b></p> <ul style="list-style-type: none"> <li>- Village no. 12 Ban Krok Ta Pho - Village no. 1 Ban Sa Long Ruea</li> <li>- Village no. 6 Ban Huai Luek - Village no. 2 Ban Phai Si</li> <li>- Village no. 9 Ban Dong Rang</li> </ul> <p><b>Nong Pradu Subdistrict Administration Organization (SAO)</b></p> <ul style="list-style-type: none"> <li>- Village no. 9 Ban Hieng Ngam - Village no. 3 Ban Ta Lung Nuea</li> </ul>





P06111/Pongsak\_h/19-10-66/รูปที่ 4 transmission line SO-KCB1-3 Eng.mxd

**FIGURE 2.2-4 : TRANSMISSION LINE ROUTE OF THE PROJECT**

### 2.2.2.1 Approach of Transmission Line Construction

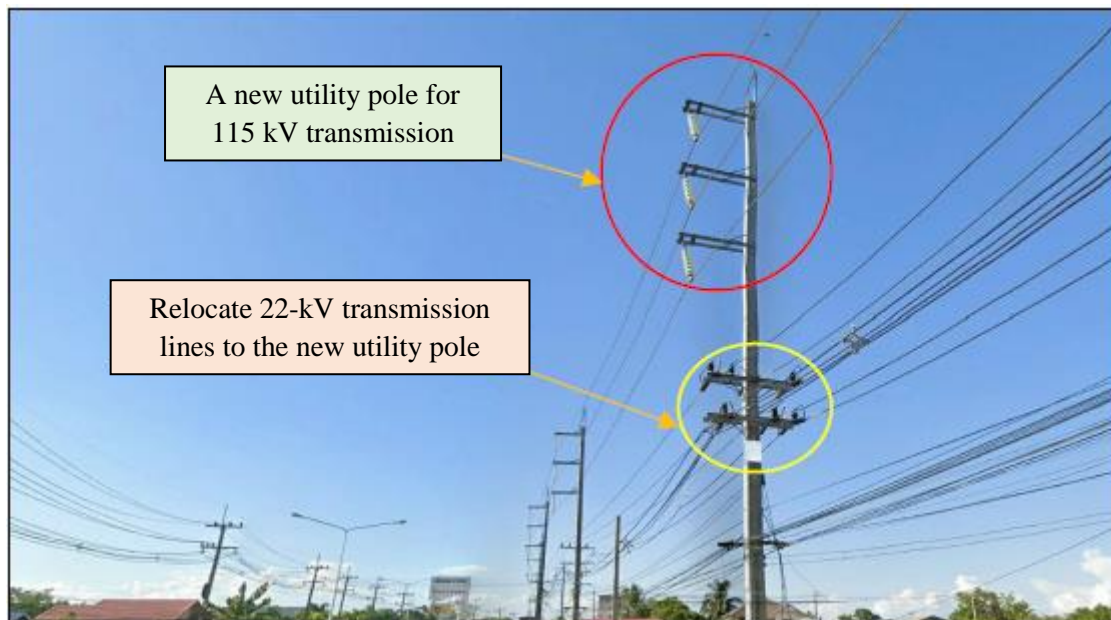
The power transmission lines will be constructed within the right-of-way of the public roads with 2 following approaches:

1. Construction within the area where PEA's power lines exist will be done using two approaches:

- Construction of new utility poles for the 115 kV power transmission lines, which will replace the existing utility poles for the PEA's 22 kV power transmission lines. The original 22 kV electricity transmission lines will be relocated to the new utility poles (as shown in **Figure 2.2-5**).

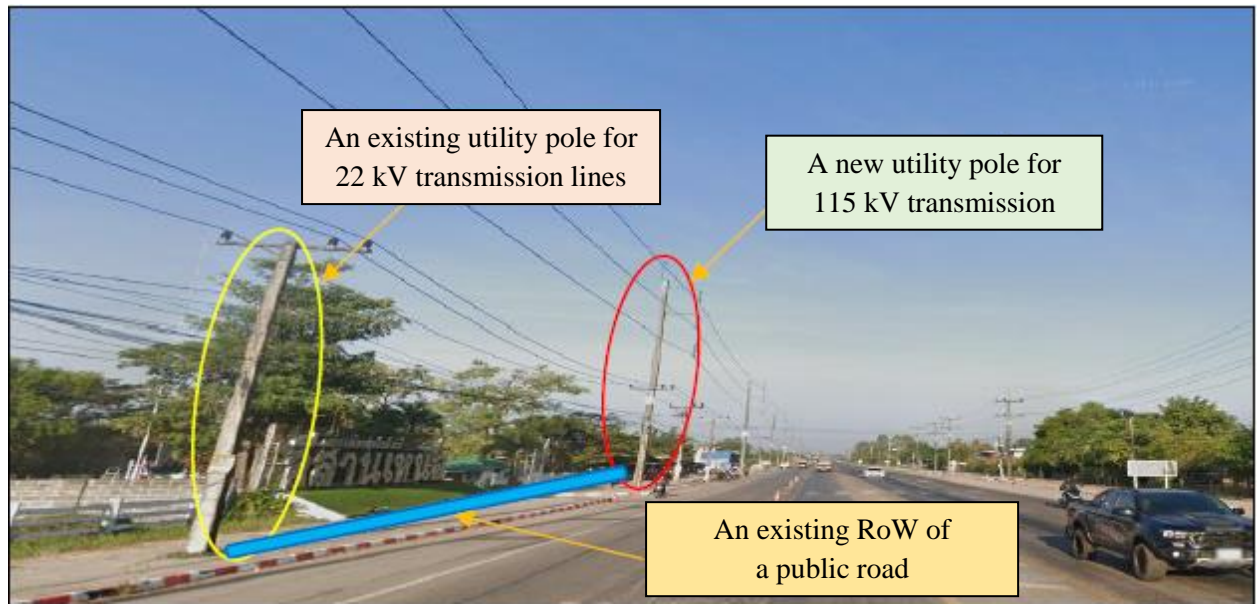
- Construction of new utility poles for the 115 kV power transmission lines along the same alignment as the existing utility poles for the PEA's 22 kV power transmission lines, without displacing the old PEA power transmission lines (as indicated in **Figure 2.2-6**).

2. In areas where there are no existing power transmission lines within the right-of-way, new utility poles and power transmission lines will be constructed along the right-of-way, as shown in the example of the utility pole alignment in **Figure 2.2-7**.

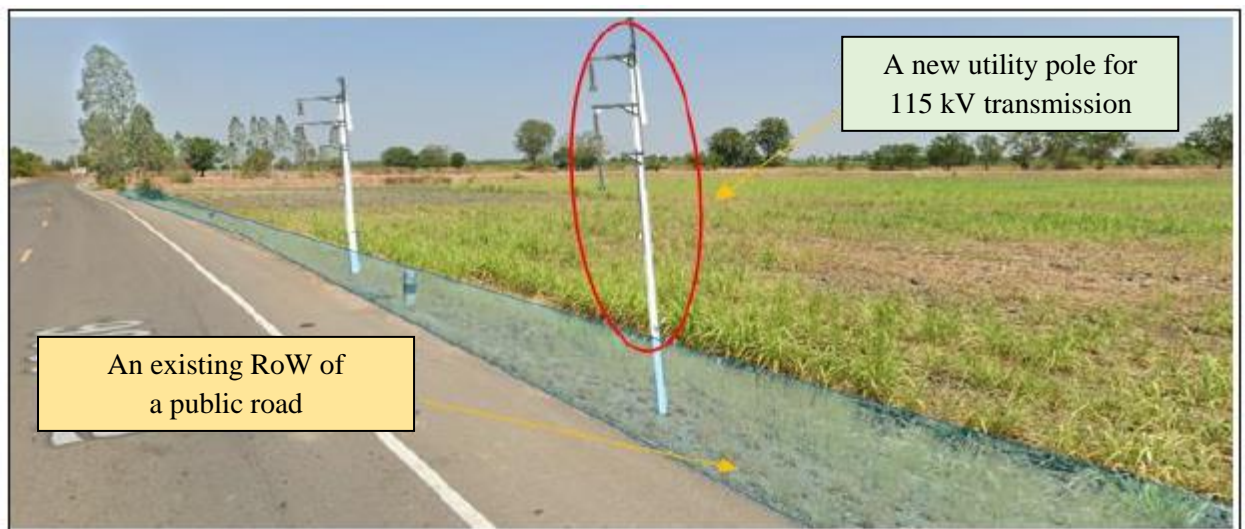


**FIGURE 2.2-5: AN EXAMPLE OF THE CONSTRUCTION OF UTILITY POLES FOR 115 KV TRANSMISSION LINES TO REPLACE THE EXISTING PEA UTILITY POLES.**





**FIGURE 2.2-6: AN EXAMPLE OF THE CONSTRUCTION OF UTILITY POLES FOR 115 KV TRANSMISSION LINES IN THE SAME ALIGNMENT AS THE EXISTING PEA UTILITY POLES.**



**FIGURE 2.2-7: AN EXAMPLE OF THE CONSTRUCTION OF UTILITY POLES FOR 115 KV TRANSMISSION LINES IN AREAS WHERE THERE ARE NO EXISTING UTILITY POLES.**

### 2.2.2.2 Procedure of Transmission Line Construction

The construction of the Project's transmission line falls under the purview of the PEA and will occur within the restricted right-of-way of public roads, which is under the jurisdiction of the Department of Highways or the Department of Rural Roads or local administrative organizations. The PEA is responsible for obtaining the appropriate permissions from those agencies. The following are the procedures to be followed when designing and constructing power transmission lines in accordance with regulations of the Provincial Electricity Authority for the Establishment of Electrical Systems in B.E. 2559 (2016):

1. Supplement the physical site survey with data and maps obtained from the Geographic Information System (GIS) of the electrical system.
2. Conduct an examination and assessment of the tangible site conditions in order to utilize the information in the design and creation of plans. The plans ought to align with the existing conditions of the site.
3. For design purposes, coordinate with pertinent government and private sector agencies to obtain information regarding right-of-way areas.
4. Assess site conditions with respect to diverse impediments, including communication lines, fiber optic cables, and water drainage pipelines, in order to precisely delineate the electrical system configuration.
5. Obtain permission or consent from the respective landowners or agencies prior to constructing the electrical system or cutting down trees, branches, or roots in government agency areas traversed by construction projects. Such restricted areas consist of national highways, railway tracks, irrigation zones, forest preserves and more.

*[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]*

### 2.2.2.3 Stakeholder Engagement for Transmission Line

Engagement regards to the transmission line will be conducted by PEA as PEA as developer and owner of the TL. Hence, the engagement will be conducted by PEA as follow.

- Typically, PEA notifies those living along the planned transmission line route in proper time before construction begins.
- PEA will seek permission from authorities responsible for managing Right-of-Way (RoW) areas for use of land for construction and for cutting trees or roots within the RoW.

#### 2.2.2.4 Compensation for Damages Caused by PEA's Operations

PEA indicated that in the event that the construction of the TL requires clearance or removal of encroaching structures, plants, trees within the RoW right-of-way or generates disputes with neighboring residents, PEA will try to alter the design to avoid such clearance. In the event that the removal of the encroachment is unavoidable, PEA will request that the RoW agencies, such as the Department of Highways to negotiate with the land user to remove their structures. *[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]*

For damages caused to properties and assets within local land ownership (outside of RoW), compensations can be claimed from PEA in accordance with the Provincial Electricity Authority Act (Version 4) B.E. 2542 (1999), stating: if there is any damage to the owner or possessor of an immovable property or a holder of other right as a result of the act officials from construction and maintenance of the electric energy transmission system, such person may claim compensation from PEA.

The compensation will be paid in accordance with the Provincial Electricity Authority's Regulations Concerning the Practice of Compensating for Damages or Providing Humanitarian Assistance to External Parties, B.E. 2564 (2021), state that in cases where damage is caused by a tortious act of PEA or arises from the performance of duties by its employees or workers, the following procedures should be undertaken:

- 1) In the event that an external party's property is damaged, consideration should be given to deducting depreciation according to the condition of the property or using the market price at the time of the incident as part of the assessment before proposing to the authorized person to approve the payment of damages.

- 2) In cases where an external party is deceased and the heirs make a claim for damages from PEA, the authorized person should provisionally approve an initial payment of damages to the heirs of the deceased not exceeding 50,000 baht. Subsequently, a fact-finding committee shall consider determining the damages, taking into account the status and actual damages incurred by the individual concerned.

- 3) In cases where an external party sustains injuries or disabilities, or loses their capacity, a fact-finding committee shall consider determining the damages by comparing guidelines for considering compensation payments as specified in the annex of these regulations. However, this does not include medical expenses and other damages such as loss of earnings or loss of support.

### 2.2.2.5 PEA's Complaint Receiving Channel

Complaints about impacts from PEA's operations can be made through the following channels:

- Hotline 1129
- Complaints via electricity billing officers or local electricity offices
- The website of the Provincial Electricity Authority

When the PEA receives a complaint, they will respond within 30 days, and the complainant can track the progress of the complaint resolution on the PEA's website.

## 2.3 PROJECT ALTERNATIVES

### 2.3.1 Site Selection

The project developer has acquired the lands for Solar Development Solar Power Plant Project through willing-buyer-willing-seller scheme *[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]* The criteria for site selection was in compliance to the Regulations of the Energy Regulatory Commission Regarding the supply of electricity from renewable energy in the form of Feed-in Tariff (FiT) for the year 2022-2030 for the group without fuel costs, B.E. 2565 and according to the regulations of the Energy Regulatory Commission Regarding the criteria for the preparation of the Code of Practice Report and report the results of compliance with the Code of Practice For the operation of electricity generation, B.E. 2565, stipulates that the project area must not violate any laws about the location that is currently in effect, such as

- 1) The project must not violate the law on town planning
- 2) The project must not the law on the promotion and conservation of national environmental quality.
- 3) The project must not violate the law on ancient monuments and antiques.
- 4) The project must not be contrary to the resolution of the Cabinet
- 5) In case the project is located in an industrial estate or other areas that look like industrial estates must not contradict the law on the Industrial Estate Authority of Thailand

Furthermore, the project location must not cause any impact on the reflection of light in the vicinity of the airport or be in a vulnerable area or have safety standard requirements. Before purchasing the land, the project owner ensured that it met the aforementioned standards. The inspection provided the following results:

#### 2.3.1.1 Compliance of Land Use

##### (1) Kanchanaburi Comprehensive Town Plan

Relevant laws have been reviewed to consider choosing the Project location. It was found that the Project is located in the administrative area of Kanchanaburi Province. Currently, the Department of Public Works and Town & Country Planning and the Office of Public Works and Town Planning, Kanchanaburi Province, have set a comprehensive town plan in the area of Kanchanaburi Province to be a framework for the development of all 4 areas as summarized in **Table 2.3-1**.

**TABLE 2.3-1  
TOWN PLANS BEING IN EFFECT IN KANCHANABURI**

Type or name of town plans	Announced in the Royal Gazette
1. Ministerial Regulations on the Enforcement of the Town Plan of the Tha Muang Community, Kanchanaburi Province B.E. 2562 (2019)	Volume 136, Section 125 A 22 November 2019
2. Notification of the Ministry of Interior on the prescribing of prohibited areas for construction, modification, or change of use of certain or certain types of buildings in some areas in Kaeng Sian Subdistrict and Ban Kao Subdistrict, Mueang Kanchanaburi District, Kanchanaburi Province	Volume 135, Special Section 290 D 16 November 2018
3. Ministerial Regulations on the Enforcement of the Kanchanaburi Provincial Comprehensive Plan B.E. 2560 (2017)	Volume 134, Section 23 A 24 February 2017
4. Ministerial Regulations on the Enforcement of the Tha Ruea Phra Thaen Comprehensive Town Plan, Kanchanaburi Province, B.E. 2559 (2016)	Volume 133, Section 108 A 21 December 2016

**Source:** The Office of Public Works and Town Planning, Kanchanaburi Province, April 2023

By inspecting the land use of the Project with the Bureau of National and Regional Planning, the Department of Public Works and Town & Country Planning (**Appendix 2H**), the Project is located in the Kanchanaburi provincial town plan area under the Ministerial Regulations on the Enforcement of the Kanchanaburi Provincial Comprehensive Plan B.E. 2560 (2017) around the number 3.2 (**Figure 2.3-1**). Land use was determined for rural and agricultural areas (Green), which means the land shall be used for agriculture or related use, habitation, commercial activities, educational institutions, religious places, government offices, utilities, and public facilities. The list that determines the type, kind, and category of prohibited plants attached to Kanchanaburi Comprehensive Town Plan B.E. 2560 (2017) does not state to prohibit plant number 88 (1) solar power generating plants. Therefore, the Project is entitled to operate and is not against the ministerial regulation.

**(2) Other Relevant Laws**

The Project has been certified that the Project site does not violate laws Enhancement and Conservation of National Environmental Quality Act, and is not located within or near a 1-kilometer radius of wildlife conservation areas, wildlife sanctuary areas, national parks, ancient sites the compliance of project location to the law on city planning and the law on the enhancement and conservation of national environmental quality in accordance to the Regulation of the Energy Regulatory Commission with the criteria for preparing a Code of Practice report and monitoring report for Electricity Generation Business B.E. 2565 (2022).







### 2.3.1.2 Reflective effects on the airport

The location of a solar power plant project must not cause any reflective effects on the airport vicinity areas. Based on the examination, the Solar Development Solar Power Plant Project is far from Kamphaeng Saen Airport, Nakhon Pathom Province, 36 kilometers southeast. Therefore, the Project does not cause reflective effects on the airport. In addition, there was no safety standard requirement in the Project area and surrounding areas.

### 2.3.2 Solar PV Technology

#### (1) Monocrystalline Solar Panels

Monocrystalline solar panels are a type of photovoltaic technology that is made from a single crystal structure, usually silicon. The advantages of this technology include:

- High energy conversion efficiency compared to other types of solar panels. It can generate more electricity from the same intensity of sunlight.
- Have a lifespan of 25 years or more.

However, the cost of monocrystalline panels is more expensive in comparison with other PV technologies.


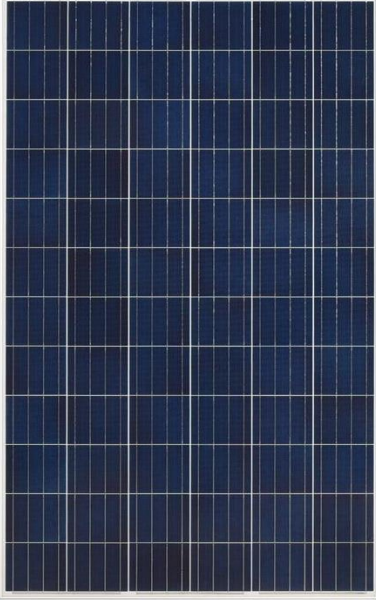
#### (2) Polycrystalline Solar Panels

Polycrystalline solar panels are a type of photovoltaic technology made from multiple crystal structures of silicon. Its advantages include; more cost-effective and more tolerate to high temperature in comparison with monocrystalline panels. However, Polycrystalline solar panels typically have lower energy conversion efficiency compared to monocrystalline panels, therefore they generate less electricity from the same intensity of sunlight.

Comparison between Monocrystalline Silicon and Polycrystalline Silicon as shown in **Table 2.3-2**. According to the advantages and disadvantages of solar PV technology (monocrystalline and polycrystalline), the project chose monocrystalline silicon because it produces more electricity than polycrystalline.

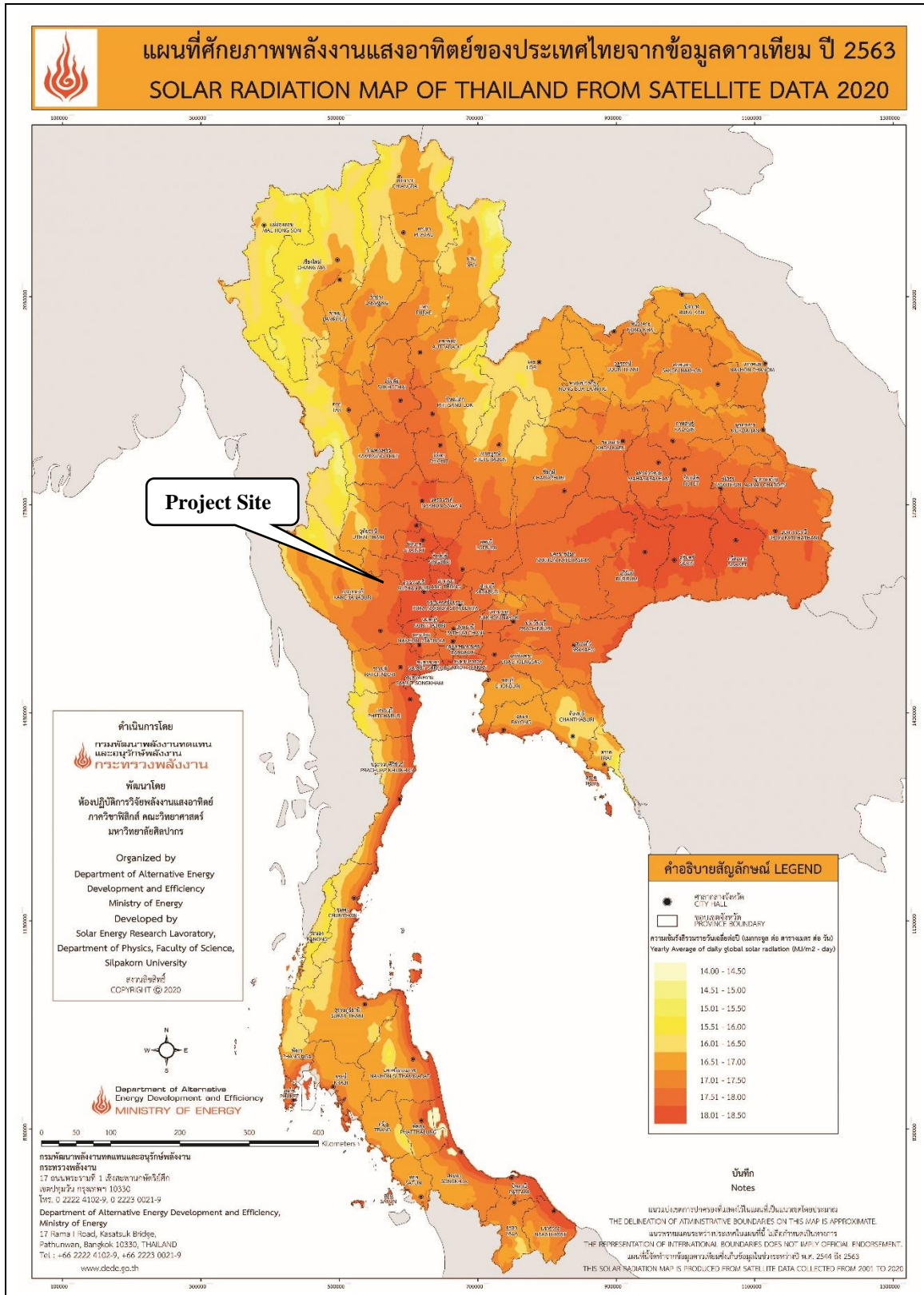
### 2.3.3 Solar Resource and Supply

Solar energy is an important factor in the solar power generation system. The project has studied the potential of solar power generation in the project site from the solar energy potential map of Thailand based on satellite data as shown in **Figure 2.3-2**. From the report of renewable energy in Thailand between 2019-2021 of the Department of Alternative Energy Development and Efficiency, it was found that the annual average light intensity in Sa Long Ruea subdistrict, Hai Krachao district, Kanchanaburi province is about 18.0 MJ/square meter-day. Therefore, the areas that have the potential to generate electricity from solar energy.

	
<p><b><u>Monocrystalline Silicon</u></b></p> <ul style="list-style-type: none"> <li>- Best electricity generation</li> <li>- Takes up little space</li> <li>- Life span more than 25 years</li> <li>- Shadows affect electricity generation</li> </ul>	<p><b><u>Polycrystalline Silicon</u></b></p> <ul style="list-style-type: none"> <li>- Produces less electricity than Monocrystalline</li> <li>- Takes up a lot of space</li> <li>- Life span more than 25 years</li> <li>- Shadows affect electricity generation</li> </ul>

Source: Solar Development Co., Ltd., 2023

**TABLE 2.3-2 COMPARISON BETWEEN MONOCRYSTALLINE SILICON AND POLYCRYSTALLINE SILICON**



Source: Thailand Alternative Energy Situation, 2021

**FIGURE 2.3-2 : THE SOLAR RADIATION MAP OF THAILAND FROM SATELLITE DATA**

## 2.4 PROJECT IMPLEMENTATION PHASING AND ACTIVITIES

### 2.4.1 Construction Phase

#### 2.4.1.1 Project Area

The construction phase will take about 12 months, with a maximum of 1,297 workers on site at a given time. The contractor will procure all workers and provide a worker camp with the proper welfare and environment as mentioned above. Construction activities will include the following:

##### (1) Site Preparation

The preparation of the Project area and equipment installation takes place within the Project's designated boundaries. Perimeter fences are constructed to prevent intrusion and facilitate security management. Additionally, the site preparation is done by land clearing, cut and fill method only within the designated boundaries. The construction equipment used for site preparation is as follow:

- Tracked excavator
- Dozor
- Compactor
- Dump truck

##### (2) Mounting Structure Construction

Mounting structure will be constructed to support the solar panels concurrently with the construction of the building and civil works. The work will start with the foundations for installing the support columns and bases for the solar panel arrays. Subsequently, the solar panels and other equipment will be installed on these structures in sequential order. The construction equipment utilized for this activity is as follow:

- Excavator pile driver
- Generator (4.5 kW)

##### (3) PV Module Installation

Once the mounting structured are completed, PV modules will be installed and secured in place facing South with a 11-degree tilting angle. Each row is 1.7 meter apart. The solar panels will be installed at a height of approximately 0.8 meters above ground level, facing south and tilted at an angle of 11 degrees in a north-south direction.

##### (4) Construction of Other Components

After site preparation, the Project shall commence the construction of buildings and civil works, including the construction of a control building for managing the electricity production system, the construction of the electrical switchyard or substation area, BESS and related support areas. During the construction activities for the building foundation work will involve, excavation and piling activities; hence, the equipment used for the construction is as follow:

- Hydraulic hammer rig
- Concrete mixer truck
- Tracked excavator
- Cranes
- Dump truck

## (5) Commissioning

After complete installation and inspection of PV system, electricity from production system will be transferred to the grid. At this period, the contractor will hand over the system to the Project owner.

### 2.4.1.2 Camp Site

During the pre-construction phase, the labor camp will be established to house labors imported by contractors from outside of the local areas. The project labor camp will be located outside of the project's boundaries. Currently, the labor camp location has not been determined because the project developer has yet to select the Engineering, Procurement, and Construction (EPC) contractor who will provide input and advice on rental area for the labor camp. However, the Project provides general guidelines for selecting a site for the labor camp as follows:

**(1) Physical Suitability and Constraints:** The land must be suitable for development, taking into account any limitations such as flooding risk, and sensitive area from the work site or other sources.

**(2) Environmental Impact:** The development should have the least possible impact on major natural features and environmental assets. Considerations include biodiversity, local ecosystems, and potential contamination.

**(3) Community and Cultural Values:** Protecting key community or cultural values is critical for maintaining positive relationships with local residents.

**(4) Access to Infrastructure and Services:** Worker accommodation must be supported by physical infrastructure (such as roads, water supply, and power) and community services (such as healthcare and shopping). This guarantees that workers have a decent standard of living and that the development does not overburden local services.

Furthermore, the project developer has established welfare criteria for worker camp construction, which were developed by referencing and/or adapting relevant laws or international standards, including recommendations and suggestions from ADB, as well as the project developer's own experiences, as follow:

#### (1) Surrounding Environment

- Clearly display signs indicating residential areas.
- Equip sturdy and secure fences around the residential areas.
- Ensure sufficient lighting along roads or general areas for safety in residential areas.
- Provide adequate parking spaces for the number of residents.
- Implement security systems and closed-circuit television.
- Appoint a supervisor to oversee the accommodation area.
- Establish a routine for keeping the area clean and hygienic, involving daily cleaning by the staff and regular check-ups by company personnel.
- Conduct training in regulations, health, and infectious disease prevention.

#### (2) Accommodation

- Room size should be at least 3 square meters per person, with a minimum width of 2.5 meters and a minimum height of 2.4 meters.
- Rooms must have doors, windows, or ventilation openings that connect to the outside to allow natural airflow. This collective open space

should be no less than 10% of the room area, excluding door areas, window areas, and ventilation areas that connect to other rooms or internal building pathways.

- If accommodations are built in a continuous or combined manner and have a total length of 45 meters, there must be a gap between rows of at least 2.5 meters.
- The foundation and structure of the accommodation rooms must be safe and sturdy.
- Rooms or buildings should be able to prevent insects and reptiles, such as installing wire mesh or constructing buildings at least 50 centimeters above the ground.

### **(3) Bathrooms and Toilets**

- Bathrooms and toilets must adhere to sanitary standards, providing clean water for washing, cleaning, and equipped with cleaning facilities.
- Bathrooms and toilets can be separate or combined in the same room, but must be segregated by gender
- Size for Bathrooms and toilets:
  - In the case of separate rooms, the size must be no less than 1 square meter, with an internal width of at least 1 meter.
  - In the case of combined rooms, the size must be no less than 1.5 square meters, with an internal width of at least 1 meter.
- Bathrooms and toilets must have ventilation openings equal to at least 10% of the room area or have sufficient natural airflow or exhaust fans.
- The distance from the bathroom floor or toilet floor to the lowest part of the wall must be at least 2 meters.
- The bathroom and toilet area must have a slope not less than 1 in 100, with drainage points at the lowest part of the sloped floor.
- The number of toilets (for defecation), bathrooms, and handwashing basins must comply with the proportions specified in Ministerial Regulation No. 63 (B.E. 2551 (2008)) under the Building Control Act B.E. 2522 (1979).
  - For male workers ranging from 41 to 80 people, there must be 3 toilets, 3 bathrooms, and 1 handwashing basin, with an additional increase of 1 for every 50 additional residents.
  - For female workers ranging from 41 to 80 people, there must be 3 toilets, 3 bathrooms, and 1 handwashing basin, with an additional increase of 1 for every 50 additional residents.
- Adequate and appropriate space for changing clothes.

### **(4) Electrical System and Equipment**

- Electrical equipment must be in a safe and undamaged condition, equipped with safety devices to prevent electrical leakage, including grounding for transformers, electrical panels, etc.
- Ensure the presence of circuit breakers to control electrical usage.

- In cases where electrical wiring is on ground or underground, use secure and safe conduits for the electrical cables.

**(5) Water Use**

- Provide clean and sufficient water for worker consumption.

**(6) Drinking Water**

- Drinking water for workers must be clean.
  - If bottled water are provided, the manufacturing company must meet the quality standards for drinking water as required by the law or international standards.
  - If water filtration systems are installed, the quality of the drinking water must meet the standards set by the Ministry of Public Health, and regular inspections must be conducted every three months.
- There must be at least one drinking water station provided for every 40 workers, and additional stations should be provided in proportion to the number of workers, with one station for every additional 40 workers.
- Containers for storing drinking water must be tightly sealed and regular cleaning must be carried out consistently.

**(7) Wastewater Treatment System**

- Septic tanks must be located at least 30 meters away from rivers or public water sources.
- Gas venting lines must have a diameter of no less than 2.5 centimeters, at the height level that not cause disturbance by odor.
- The wastewater treatment system must sufficient for the volume of wastewater generated in the residential area.
- In the case of discharge into natural water sources, must obtain permission from relevant government agencies or landowner to ensure that the discharged sewage will not have adverse environmental impact in the future. In the case of discharge into private areas, consent must be obtained in writing from the landowner.
- The wastewater treatment system should be capable of treating wastewater to meet the quality standards according to the announcement of the Ministry of Natural Resources and Environment regarding the standards for controlling the discharge of wastewater from certain types and sizes of buildings, B.E. 2548 (2005). Before discharging into surrounding environment.

**(8) Solid Waste Management**

- Waste bins must be categorized, such as organic waste, general waste, recyclable waste, and hazardous waste.
- Waste bins must have tightly sealed lids and be sufficient in size for the amount of waste.

- Disposal of waste must comply with public health regulations, by being disposed of by government agencies or with permission from the government only.

#### **(9) Rainwater Drainage**

- Rainwater drainage channels must surround the worker accommodation area to prevent overflow into surrounding areas.
- Rainwater drainage channels must be able to accommodate the volume of rainwater falling in the area.
- The direction of the rainwater drainage channels must flow towards a rainwater storage pit before being discharged into public water sources and should not flow into adjacent areas.

#### **(10) Health Management**

- Provide essential household remedy in sufficient quantities and maintain a list as per the Ministry of Public Health regulations regarding employee welfare in the workplace, B.E. 2548.
- In cases where there are more than 200 residents, there must be at least one bed in the first aid room. In cases where there are more than 1,000 residents, there must be at least two beds in the first aid room.
- Ensure clear contact information for the medical facility is available in easily visible areas.
- Provide transportation with readiness at all times for transporting workers to the medical facility.

#### **(11) Fire Prevention**

- Establish criteria or areas for cooking, such as prohibiting open-fire or gas cooking. Designate cooking areas and/or dining rooms, especially for centralized food warming (Canteen).
- Provide fire extinguishers in accordance with government regulations and standards for managing occupational health, safety, and environmental conditions related to fire prevention and control, as per the Occupational Safety, Health, and Environment Management in the Workplace to Prevent and Control Hazardous Incidents Act, B.E. 2555 (2012).
- Implement an alarm system capable of signaling emergencies to cover the entire area.
- Develop a fire prevention and suppression plan, including inspection, training, awareness campaigns, firefighting, evacuation, and relief measures.
- Conduct regular drills for fire evacuation and firefighting plans within 6 months of occupancy and annually thereafter following the initial drill.



## 2.4.2 Operation Phase

The installed equipment will generate electricity for 25 years according to their useful lifetime. The operation will require 5 persons to administer the electric power generation from solar energy and security guards. Their regularly duties are as the following.

(1) Monitoring the plant operation real-time from the control room. The control system has been designed so that remote monitoring of the plant productivity, weather information, factors related to electricity production such as light intensity, temperature, etc. can be monitored remotely.

(2) Onsite schedule inspection and report the status of the equipment and the plant to ensure the plant working efficiently.

(3) Security control by patrolling the site to ensure safety of the plant, staff, and visitors in addition to monitoring using CCTV system.

In addition, the solar panels selected for the Project are expected to have a lifespan of approximately 25-30 years. The efficiency of electricity production will be regularly monitored, both from the control room and through field inspections. In case of any deterioration or damage, the solar panels will be replaced.

Furthermore, since the solar panel structures have safety glass covers on top to protect the panels, any dust or debris on the surface can reduce their efficiency by blocking sunlight. Therefore, the Project plans to employ 20 workers from outsource to clean the solar panels an average of twice a year or as needed. Cleaning will be done manually by using water spraying methods. The Project shall source water for cleaning from the regional water supply, Provincial Waterworks Authority (PWA), Lao Khwan Branch. However, Solar module cleaners do not work permanently at the Project site since the Project will clean the panels two times a year, taking about 60 days each time. Therefore, in the operation phase, there will be a maximum of 25 workers on some days.

**Table 2.4-1** presented the project timeline of the key activities of the project.

## 2.5 UTILITY SYSTEMS

### 2.5.1 Water Use

#### (1) Construction Phase

In the construction phase, the Project will obtain water by purchasing from Provincial Water Authority, Lao Khwan Branch (**Appendix 2I**) to serve the needs of the Project, which uses water for the following construction activities.

- Spraying the area and cleaning tires consume about 40.00 m<sup>3</sup>/day.
- Cleaning equipment and tools consume about 10.00 m<sup>3</sup>/day.
- Consumption of construction workers requires about 90.79 m<sup>3</sup>/day.

This is calculated based on the maximum number of workers (1,297 persons), where one person consumes 70 liters a day (Kriengsak Udomsinrot, 1996).

Therefore, the estimated maximum amount of water consumption is 140.79 m<sup>3</sup>/day. The water balance chart is summarized in **Figure 2.5-1**, and the details of water consumption are in **Table 2.5-1**.

## (2) Operation Phase

In the operation phase, the Project will obtain water by purchasing from Provincial Water Authority, Lao Khwan Branch to serve the needs of the Project operation, which uses water for the following activities.

1. The water for consumption has the maximum volume of 1.75 m<sup>3</sup>/day. The details are explained below.

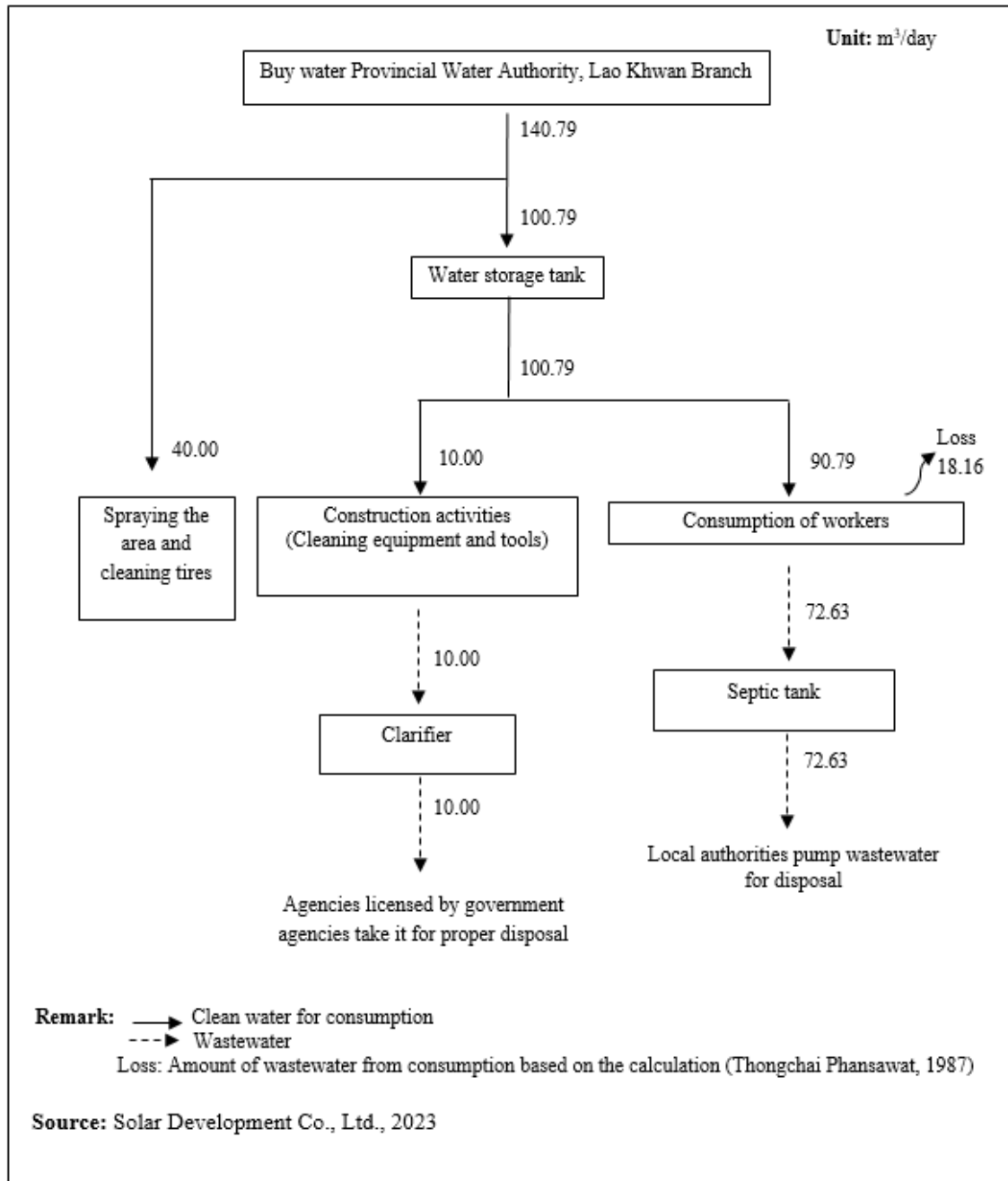
- Employees administering the electric power generation from solar energy and the battery energy storage system and security guards (5 persons) will consume a maximum of 0.35 m<sup>3</sup>/day. (This is based on the assumption that one person consumes 70 liters a day (Kriengsak Udomsinrot, 1996)).

- PV module cleaners (20 persons) will consume a maximum of 1.40 m<sup>3</sup>/day. (This is based on the assumption that one person consumes 70 liters a day (Kriengsak Udomsinrot, 1996)).

**TABLE 2.4-1  
ACTION PLAN OF THE SOLAR DEVELOPMENT POWER PLANT PROJECT**

Activities	Duration (month)	Month																							
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21			
1. Design Work	2	←→																							
2. Preparation of the CoP and ESA Report	7		←→																						
3. Obtaining permission from relevant authorities	3						←→																		
4. Construction works	12									←→															
4.1 Detail Engineering design	2									←→															
4.2 Equipment transportation	5									←→															
4.3 Building construction and civil engineering	5										←→														
4.4 Installation of PV modules	4										←→														
4.5 Installation of inverters, solar panels, and batteries	7											←→													
4.6 Installation of power plant equipment and transformers	4																←→								
4.7 Installation of utilities (fire prevention, lighting, and water)	2																			←→					
5. System testing and commissioning	2																					←→			
6. Connecting to power grid	-																						★		

Source: Solar Development Co., Ltd., 2023

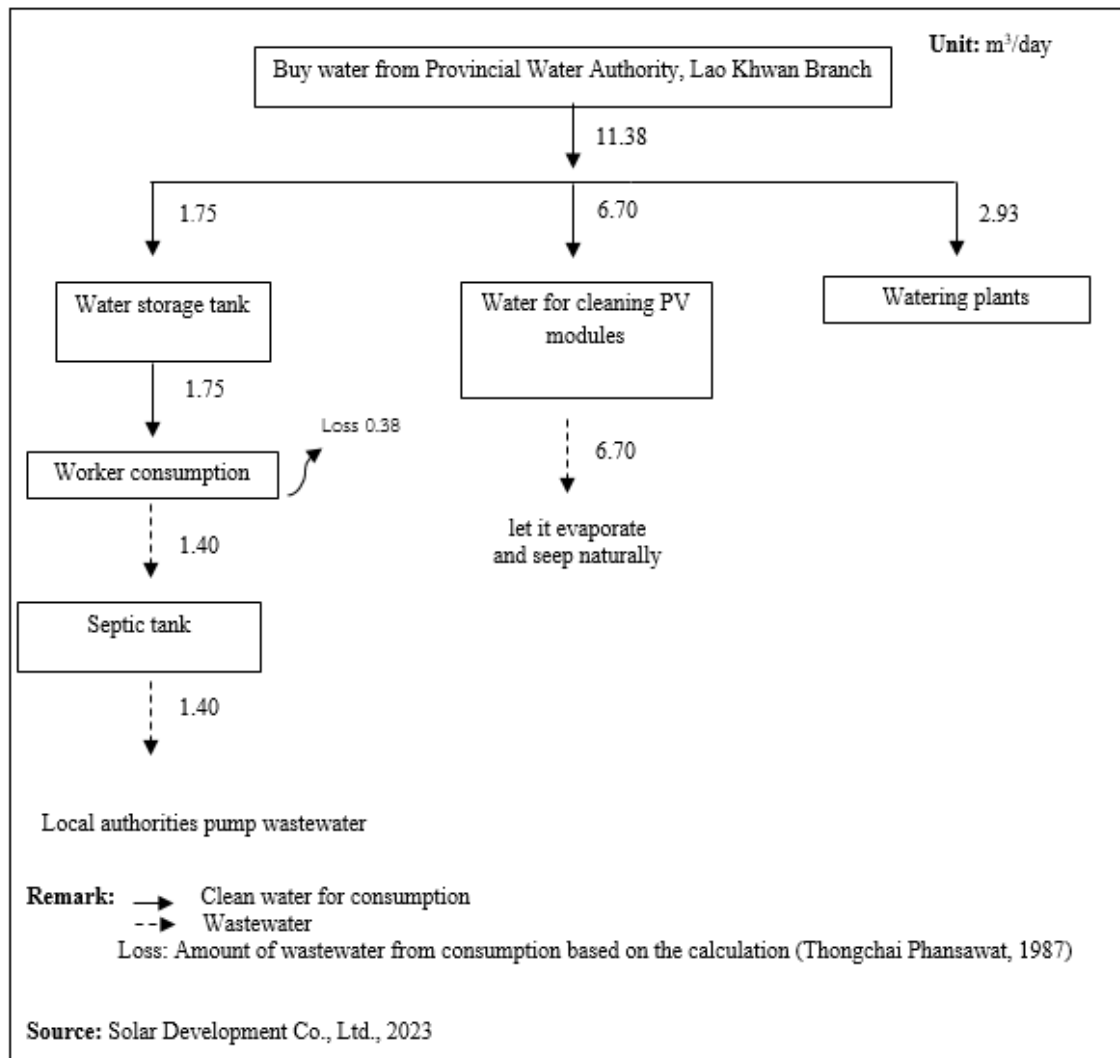


**FIGURE 2.5-1 : WATER BALANCE CHART IN THE CONSTRUCTION PHASE OF THE SOLAR DEVELOPMENT SOLAR POWER PLANT PROJECT**

2. Water for cleaning PV modules: The Project will have 267,982 PV modules, with a cleaning plan of two times a year (no cleaning in the rainy season). Each cleaning time takes 60 days, using the rate of 1.5 liters/panel/time. Therefore, the required amount of water is 6.70 m<sup>3</sup>/day.

3. Water for watering plants in the green area covering 1.07 rai (1,726 sq.m.) This activity will require water of about 2.93 m<sup>3</sup>/day (based on the rate of 1.70 liters/sq.m.- day (Mansin Tanthulawet, 2542)).

Therefore, it is estimated that the maximum water demand is about 11.38 m<sup>3</sup>/day. The water balance chart is summarized in **Figure 2.5-2**, and the details of water consumption are in **Table 2.5-1**.



**FIGURE 2.5-2 : WATER BALANCE CHART IN THE OPERATION PHASE OF THE SOLAR DEVELOPMENT POWER PLANT PROJECT**

**TABLE 2.5-1  
THE AMOUNT OF WATER USED IN THE PROJECT IN THE  
CONSTRUCTION AND OPERATION PHASES**

Details of water use	Amount (m <sup>3</sup> /day)
<b>Construction Phase</b>	
1. Water for construction activities	
1.1 Spraying the area and cleaning tires	40.00
1.2 Cleaning equipment and tools	10.00
2. Consumption of workers (1,297 people)	90.79
<b>Total in the construction phase</b>	<b>140.79</b>
<b>Operation Phase</b>	
1. Water for consumption	
1.1 Employees administering the power generating system (5 people)	0.35
1.2 PV module cleaners (20 people)	1.40
2. Water for cleaning PV modules (2 times/year, using 1.5 liters/panel/ time The number of PV modules: 267,982)	6.70
3. Watering plants	2.93
<b>Total in the operation phase</b>	<b>11.38</b>

Source: Solar Development Co., Ltd., 2023

## 2.5.2 Electricity Use

### (1) Construction Phase

In the construction activities of the Project, some equipment or machines will use electricity from the Provincial Electricity Authority, Lao Khwan District Branch, Kanchanaburi. The power demand during the construction phase is not high. The Provincial Electricity Authority, Lao Khwan District Branch, Kanchanaburi, has the capacity to adequately supply the power.

### (2) Operation Phase

Internal use of electricity i.e. office building and lighting systems will be sourced from the district's electrical supply, Provincial Electricity Authority.

### 2.5.3 Water Drainage System and Flood Prevention System

#### (1) Construction Phase

The Project construction takes about 12 months. Most of the Project areas are for power generation where PV modules are installed, including empty space, roads, walkways, and parking areas. These areas are kept to the same condition in terms of water drainage as before initiating the Project. The Project will modify only 6,735.0 sq.m. or 0.52% of the entire Project area, particularly the power generation control building, storage areas of spare parts, tools, materials, waste, and maintenance, the switchyard or substation, and supporting area related to power generation. Land modification may change the water drainage of the area. Therefore, the Project will provide temporary drains in such areas to collect and drain water to the clarifier in the Project area.

#### (2) Operation Phase

##### (2.1) Non-contaminated rainwater

The Project will modify land only at the power generation control building, storage areas of spare parts, tools, materials, waste, and maintenance, the switchyard or substation, and supporting area related to power generation, which covers only 6,735.0 sq.m. or 0.52% of the entire Project area. This may change the water drainage capacity in such areas from before the Project development. That is, the amount of non-contaminated rainwater will increase after developing within three hours by 568.85 m<sup>3</sup>.

Therefore, the Project has designed a clarifier pond with a capacity of 700.00 m<sup>3</sup> to collect rainfall in the Project area for 3 hours and will control the rainfall drainage rate from the Project area not to exceed the current drainage rate. The calculations of the size of the Project's clarifier are shown in **Appendix 2J**

##### (2.2) Contaminated rainfall

Contaminated rainfall in the Project area is caused by the rainfall around the 70-MVA transformers. One transformer requires an installation area of 36.98 m<sup>2</sup>. It is important to collect rainfall in that area to prevent contaminating outside areas. The amount of oil-contaminated rainfall that may occur at the transformers can be calculated using the rational method described below.

$$Q = 0.278 CIA$$

- Where
- Q = Rainfall flow rate (m<sup>3</sup>/sec)
  - C = Coefficient of rainfall flow rate (C = 0.9)
  - I = Average rainfall intensity in the 25-year period = 114.4 m/hr.  
(Source: Frequency Analysis of Maximum Rainfall for Each Period at K.27 C. Kanchanaburi (1970-1988), titled "The relationship between rain intensity-period-rain frequency and the percentage of distribution of the maximum rainfall in the 24-hour period in the western region", Royal Irrigation Department, Ministry of Agriculture and Cooperatives, 2001)
  - A = Area of the transformers

Contaminated rainfall around a 70 MVA transformer with an installation area of 36.98 sq.m.

$$\begin{aligned} Q &= 0.278 \times 0.9 \times 114.4 \times 0.00003698 \\ &= 0.001058 \text{ m}^3/\text{sec} \end{aligned}$$

The period of rainfall contaminated with oil is in the first 30 minutes. Therefore, the amount of rainfall contaminated with oil can be calculated as follows.

$$\begin{aligned} \text{Oil contaminated rainfall} &= 0.001058 \times 60 \times 30 \\ &= 1.90 \text{ m}^3/30 \text{ minutes} \end{aligned}$$

Therefore, the rainfall at a 70-MVA transformer will contain oil-contaminated rainfall of 1.90 m<sup>3</sup>/30 minutes. The Project shall contain contaminated rainfall in the dike near the transformers, with a capacity not less than the amount of rainfall, before sending to the soil sump to separate oil from the water. After that, the Project will contact an authorized agency for proper disposal.

## 2.5.4 Transportation

### (1) Construction Phase

In the construction phase of the Project, construction materials, machines, equipment, and workers will be transported to the Project area. The materials may temporarily and materials may temporarily increase the traffic on Highway No. 3472, which is transportation of labors and materials Project area, during certain periods of time.

The increase in traffic will be caused by:

1) 18-wheel trailer trucks for transporting PV modules, inverters, and transformers (10 trips a day) However, the project has stipulated that transportation will only occur during daylight hours for a total of 8 hours per day, avoiding peak hours from 07.00 am-08.00 am and 04.00 pm-06.00 pm.

2) 6-wheel trucks for transporting construction materials (8 trips a day) However, the project has stipulated that transportation will only occur during daylight hours for a total of 8 hours per day, avoiding peak hours from 07.00 am-08.00 am and 04.00 pm-06.00 pm.

3) 6-wheel trucks transporting sewage (4 trips a week)

4) 6-wheel trucks transporting construction workers (88 trips a day) during 07.00 am-08.00 am and 04.00 pm-06.00 pm.

5) 7-passenger car (2 trips a day)

6) Water trucks containing 18,000 liters of water (16 trips a day)

### (2) Operation Phase

Regarding traffic control in the Project area, the Project will manage one-way traffic. The area will be restricted, with vehicles being allowed to enter and exit only the authorized areas, such as employee vehicles, visitor vehicles, garbage trucks, sewage trucks, and water trucks. They will enter the Project area only as necessary. The transportation estimate is explained below.



1) Employees administering power-generating systems will use about 5 vehicles a day (10 trips a day).

2) Transportation of PV module cleaners will use one medium-sized bus per day (2 trips per week) will run round trips for staff involved in maintenance and inspection during peak hours (dry season) (07.00 am-08.00 am and 04.00 pm-06.00 pm).

3) Transportation of solid waste for disposal will use one 6-wheel truck per month (2 trips per month). The project will collect and store waste in designated areas within the office building and material storage for subsequent disposal by authorized agencies, along with deteriorated solar panels. The latter vehicles will only 1 vehicle (2 trips every 3 months).

In summary, during the operational phase, there will be a maximum of 6 vehicles (12 trips per day) during peak hours (07.00 am-08.00 am and 04.00 pm-06.00 pm), and during normal hours, there will be a maximum of 5 vehicles (10 trips per day).

## **2.6 ENVIRONMENTAL MANAGEMENT**

### **2.6.1 Air Quality**

#### **(1) Construction Phase**

Activities during the construction phase that contribute to air pollution include preparing the area for solar panel installation, constructing buildings, and various public utility systems, as well as transportation for construction equipment and personnel transportation. These activities can generate dust and particulate matter dispersion. Thus, the project will conduct water spraying on the construction area to prevent the dispersion of dust and particulate matter and minimize the impact on nearby residential areas.

#### **(2) Operation Phase**

During the operation phase of solar power plant, it does not cause any air and noise pollution.

### **2.6.2 Noise**

#### **(1) Construction Phase**

Activities in the construction phase that might cause noise are land clearing for the power generation control building, spare parts, material, waste storage area and maintenance area, the switchyard area or substation, and power generation supporting area and related areas, the construction of structures and buildings, which will take place for a short time. Installation of PV modules on the ground will cause low noise during the installation because the Project will use screw piles, which generate low noise compared to typical piles. Construction activities or the use of machinery and equipment that generate loud noises are prohibited between 08:00 am and 07:00 pm. Furthermore, the project has prepared personal protective equipment (PPE) such as earplugs and earmuffs to protect workers from potential hazards and excessive noise exposure.

#### **(2) Operation Phase**

The power generation process of the Project is to generate electric power from PV modules or solar cells, which does not generate noise impact on the communities and sensitive receptors.

### 2.6.3 Water Quality

#### (1) Construction Phase

Wastewater from construction activities occurs at a maximum of approximately 82.63 m<sup>3</sup>/ day as presented in **Table 2.6-1**. The details are as follows:

1. Effluent from cleaning equipment and tools, approximately 10.00 m<sup>3</sup>/ day will be collected at the clarifier to separate water and grease before sending it to be disposed of outside the Project by agencies authorized by government agencies.

2. Wastewater from the consumption of workers occurs at a maximum of 72.63 m<sup>3</sup>/ day. This is calculated from the maximum number of workers at 1,297 people (assuming that wastewater is 80% of consumption water at 90.79 m<sup>3</sup>/ day (Thongchai Phansawat, 1978)). The Project will treat wastewater using a septic tank provided by the contractor. Regarding treated wastewater and sewage, the contractor will contact local agencies for proper disposal according to the guidelines specified in the Public Health Act B.E. 2535 (1991) and the Ministerial Regulations on Sewage Management Hygiene B.E. 2561 (2018).

#### (2) Operation Phase

The effluent generated during the operation period comes from water consumption activities as shown in **Table 2.6-1**, including:

1. Wastewater from consumption (calculated from 80% wastewater generation rate of the amount of water used (Thongchai Phansawat, 1987)).

– Employees in charge of the Project's solar power generation system and the Project's security staff (5 people) generate 0.28 m<sup>3</sup> of wastewater per day. This is based on the amount of water used 0.35 m<sup>3</sup> per day.

– PV module cleaners (20 people) generate 1.12 m<sup>3</sup> of wastewater per day. This is based on the amount of water used 1.40 m<sup>3</sup> per day.

Therefore, in the operation phase, there will be a maximum staff of the Project of 25 people per day, including the Project staff and PV module cleaners. They will generate wastewater from water consumption of 1.40 m<sup>3</sup> per day from the consumption of 1.75 m<sup>3</sup> per day. Such wastewater will be collected in the septic tank. Treated wastewater and sewage will be pumped out and disposed of by local agencies, according to the guidelines specified in the Public Health Act B.E. 2535 (1991) and the Ministerial Regulations on Sewage Management Hygiene B.E. 2561 (2018).

2. Wastewater from cleaning PV module is about 6.70 m<sup>3</sup> per day (panel cleaning two times a year). This proportion of wastewater is chemical-free, but contaminated with dust particles. It will be left to evaporate or seep into the ground naturally without affecting the quality of surface water.

**TABLE 2.6-1  
WASTEWATER MANAGEMENT IN THE CONSTRUCTION  
AND OPERATION PHASES**

Source	Amount (m <sup>3</sup> /day)	Wastewater Management
<b>Construction Phase</b>		
1. Effluent from cleaning equipment and tools	10.00	Collect wastewater into a settling tank for sedimentation before further utilization.
2. Wastewater from the consumption of workers	72.63	Coordinate for authorized waste collection vehicles from local authorities to enter and conduct waste collection and disposal activities.
<b>Total in the construction phase</b>	<b>82.63</b>	
<b>Operation Phase</b>		
1. Wastewater from consumption	1.40	Coordinate for authorized waste collection vehicles from local authorities to enter and conduct waste collection and disposal activities.
2. Wastewater from cleaning PV module	6.70	Left to evaporate or seep into the ground naturally
<b>Total in the operation phase</b>	<b>8.10</b>	

Source: Solar Development Co., Ltd., 2023

## 2.6.4 Solid Waste

### (1) Construction Phase

Solid waste generated during construction mainly consists of the following:

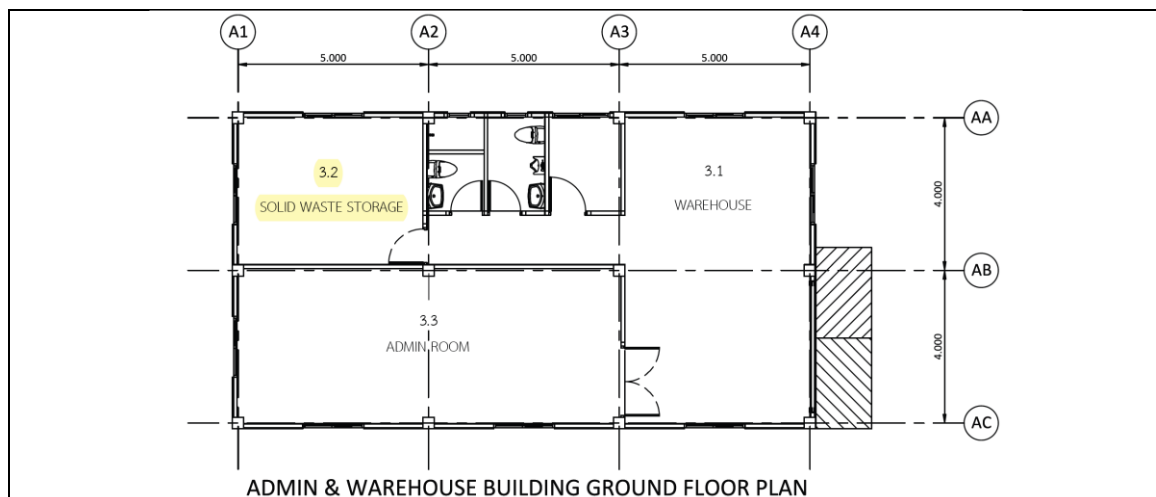
- Solid waste from consumption of construction workers, such as food scraps, plastic bags, and paper waste, is estimated to amount 1,102.45 kilograms per day from the maximum of 1,297 workers per day (the rate of waste generation is 0.85 kg per person per day (Kriengsak Udomsinrot, 1994)). The Project will provide sufficient garbage bins at various points for Sa Long Ruea Subdistrict Municipality's garbage truck to pick it up for disposal outside the Project area.

- Construction waste, such as plastic scraps, scrap wood and scrap metal, is expected to be approximately 54.53 tons per year. The contractor will collect recyclable waste and resell it to a scrap dealer. Non-recyclable or hazardous waste will be collected in suitable containers, and the contractor will contact the waste disposal agency authorized by the Department of Industrial Works for proper disposal.

## (2) Operation Phase

Solid waste generated during the operation phase mainly consists of the following:

- Solid waste from consumption of the Project staff and PV module cleaners, such as food scraps, plastic bags, and paper waste, is estimated to amount 21.25 kilograms per day from the maximum of 25 people per day (the rate of waste generation is 0.85 kg per person per day (Kriengsak Udomsinrot, 1994)). The Project will provide sufficient garbage bins at various points for Sa Long Ruea Subdistrict Municipality’s garbage truck to pick it up for disposal outside the Project area.
- Waste from power generating systems and scheduled maintenance, such as used lubricant, is expected to amount 559 kg a month or 6.7 tons a year. This type of waste will be collected in a tightly closed container kept in an area of about 20 sq.m. in the office and storage area (**Figure 2.6-1**). Waste disposers holding a license from the Department of Industrial Works will be contacted for disposal outside the Project area.
- PV modules used in this Project have a lifespan of 25 years. In case of damage or deterioration, the Project will send the damaged parts for disposal outside the Project area by disposers holding a license from the Department of Industrial Works.
- Rainwater contaminated with oil at the transformer: Rainwater contaminated with oil in the first 30 minutes will be collected in the dike and sent to the oil sump to separate the oil from the water. An agency licensed by the Department of Industrial Works will be contacted for proper disposal.



Source: Solar Development Co., Ltd., 2023

**FIGURE 2.6-1 : WASTE STORAGE AREA WITHIN OFFICE BUILDING AND MATERIAL STORAGE**

## 2.7 OCCUPATIONAL HEALTH AND SAFETY

The Project provides Occupational Health, Safety, and Environment policy for as follows;

(1) The safety management system shall be put in place in compliance with the law and occupational health requirements as well as related international standards.

(2) Recognition and maintenance shall be ensured for occupational health principle to control and prevent hazards from business operation, which may impact the welfare and asset of the Company and its personnel.

(3) Resources shall be allocated to ensure continuous development of the occupational health management system.

(4) The following occupational health guidelines are established.

- Occupational health is the first priority of all personnel of the Company.
- The Company shall support the improvement of the workplace environment to ensure safety and minimize accident risk exposure as well as support and encourage safety activities to build awareness and attitude for occupational health so as to maintain the occupational health standard, aiming for zero accident.
- Supervisors of all levels shall lead, oversee, and support personnel of the Company to ensure undisrupted occupational health.
- Personnel of the Company shall consider about the safety of themselves, colleagues, and the Company's assets throughout the operating period.
- Personnel of the Company shall cooperate in occupational health projects and propose ideas for further safety and operations improvement.

(5) The Company shall comply with relevant safety laws and regulations throughout the life cycle of its projects.

(6) The Company shall take into consideration as part of its decision-making and risk assessment processes potential environmental and social impacts, including issues related to the health and safety of employees, local communities and other relevant stakeholders.

### (1) Construction Phase

The Project will comply with requirements, regulations, and obligations throughout the construction phase. Occupational health, safety and environment programs will be implemented in the preparation of occupational health and safety requirements as a standard for the contractor. The contractor must agree to perform the work in accordance with the Company's policy and relevant regulations, laws, and rules. There are guidelines for the contractor as follows.

(1) The Project determines working conditions in the agreement with the construction contractor and the team working within the Project and enforces occupational safety, health, and working environment measures both in the design, construction, and operation to comply with laws, standards, and regulations on occupational health and safety.

(2) The contractor must prepare workplace safety plan for the construction and propose it before starting construction activities.

(3) The contractor of the Project must establish an occupational safety and health working environment committee in accordance with the guidelines set forth in the relevant Ministerial Regulations. The occupational safety, health and working environment manager will report directly to the top management of the Project and hold a meeting of the said Committee at least once a month to evaluate the results and suggest solutions to the problems.

(4) The contractor shall provide basic personal protective equipment (PPE), including safety helmets, safety boots, and safety goggles, to all construction workers and specific PPE for working conditions and risks that may arise due to the nature of work, at the quantity which complies with the legal requirement. The quality of PPE shall comply with the standard set forth in the Notification of the Department of Labor Protection and Welfare on Standards for Personal Safety Protection Equipment B.E. 2554 (2011).

(5) The contractor shall put on warning signs in the construction areas, dangerous areas, and areas that require entrants to wear PPE.

(6) The contractor shall establish a permit system to grant permission to perform certain types of work as required by law.

(7) The contractor shall prepare a coordination plan with the local firefighting unit in preparation for emergency response.

(8) The contractor shall prepare first-aid kits, basic medicines, and emergency vehicles according to the Ministerial Regulations on the provision of welfare in the workplace B.E. 2548 (2005)

(9) The contractor shall provide adequate utilities for construction workers according to the sanitation principles, such as clean drinking water and restrooms.

(10) In case the contractor provides a worker camp, the contractor must comply with the Notification of the Labor Welfare Committee on Standards of Residence as Labor Welfare for Employees in the Type of Construction Business B.E. 2559 (2016)

## **(2) Operation Phase**

The Project establishes occupational safety and health in the operation phase. The occupational safety, health, and working environment policy was determined to comply the guidelines set forth in the Occupational Safety, Health, and Environment Act B.E. 2554 (2011) and the Labor Protection Act B.E. 2541 (1998). The safety action plans are established as follows:

(1) The health plan on industrial hygiene consists of a survey on industrial hygiene, preparation of an annual audit plan for industrial hygiene, analyzing the audit results and follow-up on corrections, and summarizing the performance of occupational health.

(2) The health examination, evaluation, and monitoring plan includes physical examinations based on the risks specified in the ministerial regulation on the prescribing of the standard for physical examinations of employees performing risky tasks B.E. 2563 (2020) for all employees in order to prepare an industrial hygiene plan.

(3) A preventive plan for the working environment includes safety measures for noise and hazard risks to prevent harm to operators. This also complies with relevant legal requirements, such as the Notification of the Ministry of Industry on Safety Protection Measures in Factory Operations Regarding Working Environment B.E. 2546 (2003).

(4) Fire prevention and suppression plan: The Project must prepare an action plan in accordance with the guidelines specified in the Ministerial Regulations prescribing standards for the management and implementation of occupational safety, health, and working environment related to fire prevention and suppression B.E. 2555 (2012) and the Notification of the Ministry of Industry on Fire Prevention and Suppression in Factories B.E. 2552 (2009). Some measures are, for example, the installation of fire prevention and suppression equipment that is sufficient and in compliance with international standards, as well as the annual fire drill.

Additionally, the project will coordinate with relevant agencies in the area to provide support in case of severe emergencies that cannot be controlled. This support may include additional equipment and personnel to assist in suppressing the incident. The project will ensure that all fire extinguishing equipment, including portable fire extinguishers, is regularly inspected and maintained to ensure its immediate usability during an emergency. The installation of this equipment will be done in various areas within the project area, such as office buildings, building control systems, electricity production areas, and electrical transformers. The design of the equipment will meet the standards set by the Engineering Institute of Thailand under His Majesty the King's Patronage (EIT) and the National Fire Protection Association (NFPA).

## 2.8 COMMUNITY RELATIONS

Project implementation may cause both direct and indirect impacts on the environment and well-being of surrounding communities. With the aims for sustainable development and fostering understanding with the communities, the project has established an action plan to enhance knowledge and understanding about the project. This will strengthen confidence in the development of the project, as well as enable community benefit or activities support for local communities starting from the pre-construction phase to the operation phase. The project has prepared guidelines for the implementation in each aspect as follows.

(1) Environmental conservation programs e.g., school in power plants project, environmental site visit project or supporting environmental activities of the community, etc.

(2) Programs relevant to society, child and youth e.g., supporting the activities of educational institutions in the area and supporting sports activities, etc.

(3) Health programs e.g., the Village Health Volunteer Potential Development project (VHVs), etc.

(4) Cultural and tradition programs e.g., supporting the Kathin ceremony, supporting Songkran traditions, etc.

Example of Future CSR Plan is shown in **Table 2.8-1**

**TABLE 2.8-1  
EXAMPLE OF FUTURE CSR PLAN**

Activities	Implementation	Target Group	Objectives	Budget	Responsible Parties
<b>1. Environment</b> - Open-house events for project visits and project learning	Organize educational field trips to visit and provide knowledge about the Solar project.	1. Communities within a 3-kilometer from the project boundary 2. Educational Institutions 3. Relevant Agencies	1. To provide the community with knowledge and understanding of the project's operations, including the project's environmental management. 2. To disseminate project information.	To be determined	CSR Department
- Education Zone within the power plant	Conduct activities to provide knowledge and visit the production processes of the project, as well as energy-saving methods.	Educational Institutions within a 3-kilometers from the project boundary	1. To provide the community with knowledge and understanding of the project's operations, including the project's environmental management. 2. Promote campaigns on energy conservation.	To be determined	CSR Department and the Project
- Supporting community environmental activities	Conduct activities to provide knowledge and visit the production processes of the project, as well as energy-saving methods.	Educational Institutions within a 3-kilometers from the project boundary	1. To provide the community with knowledge and understanding of the project's operations, including the project's environmental management. 2. Promote campaigns on energy conservation.	To be determined	CSR Department and the Project
<b>2. Social, Child, Youth</b> - Supporting educational institution activities	Support teaching and learning materials and activities for educational institutions.	Educational Institutions within a 3-kilometers from the project boundary	To support teaching materials	To be determined	CSR Department



**TABLE 2.8-1  
FUTURE CSR PLAN (CONT'D)**

Activities	Implementation	Target Group	Objectives	Budget	Responsible Parties
- Supporting sports activities	Support sports equipment and school sports budget.	Communities within a 3-kilometer from the project boundary	To promote physical exercise.	To be determined	CSR Department
- Supporting National Children's Day activities	Support budget and gifts for National Children's Day activities.	Communities within a 3-kilometer from the project boundary	To build good relationships with the community.	To be determined	CSR Department
<b>3. Health</b>					
- Village Health Volunteer (VHV) Development Project	Support training sessions and provide support for basic health examination equipment.	Health Promoting Hospital and VHV within a 3-kilometers from the project boundary	1. Promoting health awareness among the community members. 2. Encouraging comprehensive health check-ups for the community.	To be determined	CSR Department
<b>4. Cultural and Tradition</b>					
- Supporting budget for local community cultural and traditional events	Provide budget support for local community cultural and traditional events as appropriate and opportunities.	Communities within a 3-kilometer from the project boundary	To collaborate in preserving and perpetuating local traditions.	To be determined	CSR Department
- Supporting budget for merit-making events	Support budget and participate in merit-making events at the temple in the area of operation and within a 3-kilometer study radius.	Communities within a 3-kilometer from the project boundary	To collaborate in preserving and perpetuating local traditions.	To be determined	CSR Department
- Supporting budget for Songkran Festival events	Participate in community activities and support drinking water for public service points.	Communities within a 3-kilometer from the project boundary	1. To collaborate in preserving and perpetuating local traditions. 2. To be part of creating road safety during festivals.	To be determined	CSR Department

## 2.9 ENVIRONMENTAL AUDIT COMMITTEE

The project will establish an environmental audit committee to enhance confidence and disseminate clear and continuous project information. In addition, the project recognizes the importance of the environment and well-being of the communities, therefore the community is encouraged to be a part in the environmental impact monitoring both during the construction phase and the operation phase. The establishment of the committee will be completed at least 1 month before construction to be a center for communication, monitoring, inspection, control and concerns reduction. This will enable clear understanding and ensure that the communities and the project co-exist in harmony. The objectives of the establishment of the Environmental Audit Committee, including the structure and authority of the committee are as follows.

### (1) Objectives

a) To publicize, enhance understanding and good relations related to operations related to the environment of the project to the surrounding communities through the Environmental Audit Committee.

b) To be a communication channel between the communities and the project for complaints and opinions receiving on the project implementation.

c) To have a central organization representing surrounding communities and related government agencies with an authority to inspect and consider the complaints of surrounding communities regarding the project environmental impacts.

### (2) Structure of the committee

The Environmental Audit Committee consists of members from different sectors, including representatives of the public, representatives of government agencies, a qualified expert, and the Company's representative. Representatives of the public shall account for at least half of all the Committee members. The total number of Committee is 26 members. The details are as follows:

a) Public sector representative committees are nominated from each sub-district or municipality in a radius of 3 kilometers from the Project boundaries in Huai Krachao District and Lao Khwan District, Kanchanaburi Province. The members include:

- 7 public sector from public representatives from Sa Long Ruea Subdistrict, Huai Krachao District, Kanchanaburi Province
- 6 public sector from public representatives from Nong Pradu, Lao Khwan District, Kanchanaburi Province

b) State representative committees are as follows.

- 1 representative from Huai Krachao District, as the Project location
- 1 representative from local administrations in the Project area and a radius of 3 km from the Project boundaries (a member for each agency)

- A representative from Sa Long Ruea Subdistrict Municipality, Huai Krachao District, Kanchanaburi Province

- A representative from Nong Pradu Subdistrict Administrative Organization, Lao Khwan District, Kanchanaburi Province

- A director of the Subdistrict Health Promoting Hospital (SHPH) of the project area

- 1 representative from educational institutions in the project area
- 4 additional state representatives, 1 representative per organization

- A representative from Kanchanaburi Provincial Office of Industry
  - A representative from Kanchanaburi Provincial Office of Natural Resources and Environment
  - A representative from Kanchanaburi Provincial Office of Energy
  - A representative from the Office of the Energy Regulatory Commission Area 9, Kanchanaburi
- c) 1 honorary committee
  - d) 1 company representative committee

(3) **The committee nomination process** is described as follows.

a) **Public sector representative committee**

The nomination of representatives from the public sector shall be in accordance with the requirements or methods or practices of each sub-district or municipality, which might be election or nomination.

b) **Committee qualifications**

- **Public sector representative committees** must be qualified as follows.
  - Minimum age is 25 years old on the date of nomination or election and must not be disqualified as follows.

- Having inappropriate behavior, being malfeasant, being sentenced to bankruptcy or being sentenced to imprisonment by a final judgment except for a petty offense or an offense committed through negligence.

- Being a person of unsound mind or having mental insanity or was ordered by the court to be an incompetent or equivalent to incompetent person.

- Being listed in the household registration in that sub-district area at least one year prior to the nomination date.

- **State representative committees**

The committees are nominated from the government agencies and local administrative organizations within the project area and the area within a radius of 3 kilometers from the project boundary.

- **Honorary committee**

There will be 1 honorary committee collaboratively nominated by the public sector representatives committee and company (Solar Development Co., Ltd.) representative committee.

**Qualifications of honorary committee**

- Minimum age is 30 years old on the date of nomination.
- Processing knowledge and capability to monitor environmental impacts or any aspect related to the operation or having appropriate behavior or being approved or respected by the public.

- Must not be disqualified as follows.
  - Being malfeasant, being sentenced to bankruptcy or being sentenced to imprisonment by a final judgment except for a petty offense or an offense committed through negligence.

▪ Being a person of unsound mind or having mental insanity or was ordered by the court to be an incompetent or equivalent to incompetent person.

• **Company representative committee**

The company representative committee is nominated by Solar Development Co., Ltd.

**(4) Terms of Committee**

a) The term of office of the committees is 4 years from the date of appointment with a limitation to 2 consecutive terms.

b) At the end of the term, if the nomination of new committee appointment has not been proposed, the committee who retired by rotation shall remain in office for continuous duties until the nominated or newly appointed committee members undertake their duties. The temporary duties must not exceed ninety days from retirement by rotation date.

c) In the case of termination before the end of the term, the nomination and appointment of a committee of the same category shall be carried out within forty-five days from the termination date. The nominated or appointed committee shall hold the position in place for the remaining term of the replaced committee.

d) In the case of termination before the end of the term where the remaining term is less than ninety days, nomination or appointment of the new committee may not be executed. The board of committee will consist of the remaining committee members.

e) Addition to the retirement by rotation, the committee be terminated when:

- Death
- Retirement
- Having inappropriate behavior while holding the committee position e.g., not attending the meeting for 3 consecutive times without reasonable cause. or malfeasant or having lower competency to perform committee duties and being dismissed by majority of the board of committee.

- Being sentenced to bankruptcy or being sentenced to imprisonment by a final judgment except for a petty offense or an offense committed through negligence.

- Being a person of unsound mind or having mental insanity or was ordered by the court to be an incompetent or equivalent to incompetent person.

f) For meeting frequency, the committee meeting must be attended by not less than half of the total number of the board of committee for constitution of a quorum. The meeting will be held every six months. In case of urgency, the meeting can be held before the general schedule if half of the board of committees resolve to summon the meeting.

g) The decision of the meeting shall be made by a majority of votes. One committee can cast one vote. If the votes are equal, the chairman of the meeting shall cast an additional vote as a casting vote.

**(5) Power and duties** are as follows:

- a) Establish guidelines and procedures for monitoring the environmental impact of the project.
- b) Gather complaints, consider and make a decision on the complaints and suggestions of the public sector regarding the environmental impacts from the construction and operation of the project.
- c) Give an opinion or proposal for the project improvement or modification to be in line with the requirements set out in the project's Code of Conduct (CoP) report.
- d) Make recommendations to government agencies for the project improvement or modification to be in line with the requirements set out in the project's Code of Conduct (CoP) report.
- e) Appoint assistants as appropriate.
- f) Establish a good understanding between the community and the project and coordinate with relevant agencies.
- g) Assess environmental quality according to the environmental preventive and corrective measures and the environmental monitoring measures of the project.
- h) Conduct site visit to inspect the construction and various operations of the project.
- i) Publicize accurate project information to the public.
- j) Set guidelines for complaints receiving, appealing, making decision on the complaints from public sector, or other guidelines necessary for the operation.
- k) Post the public complaints and announce the decision of the working group at the offices of government agencies in the area in at least 3 public locations.
- l) Jointly consider the case that requires damage compensation if it can be proved that damages are caused by the project operation.

# CHAPTER 3

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## EXISTING ENVIRONMENTAL CONDITIONS



## CHAPTER 3

### EXISTING ENVIRONMENTAL CONDITIONS

The current environmental conditions comprehensively include physical condition, natural resources, social economic condition and human use value will relate to the project. The scope of the Project's study area extends within a 3-kilometer radius from the project's location. This comprehensive study encompasses all four aspects: Physical Resource, Biological Resource, Human Use Value, and Quality of Life Value.

The study area also includes sensitive areas in two districts and three subdistricts within the Kanchanaburi province. Specifically, it encompasses:

- 1) Hai Krachao District, Sa Long Ruea Subdistrict.
- 2) Lao Khwan District, consisting of Nong Pradu Subdistrict

### 3.1 PHYSICAL CONDITIONS

#### 3.1.1 Geology And Soil

##### (1) Geology

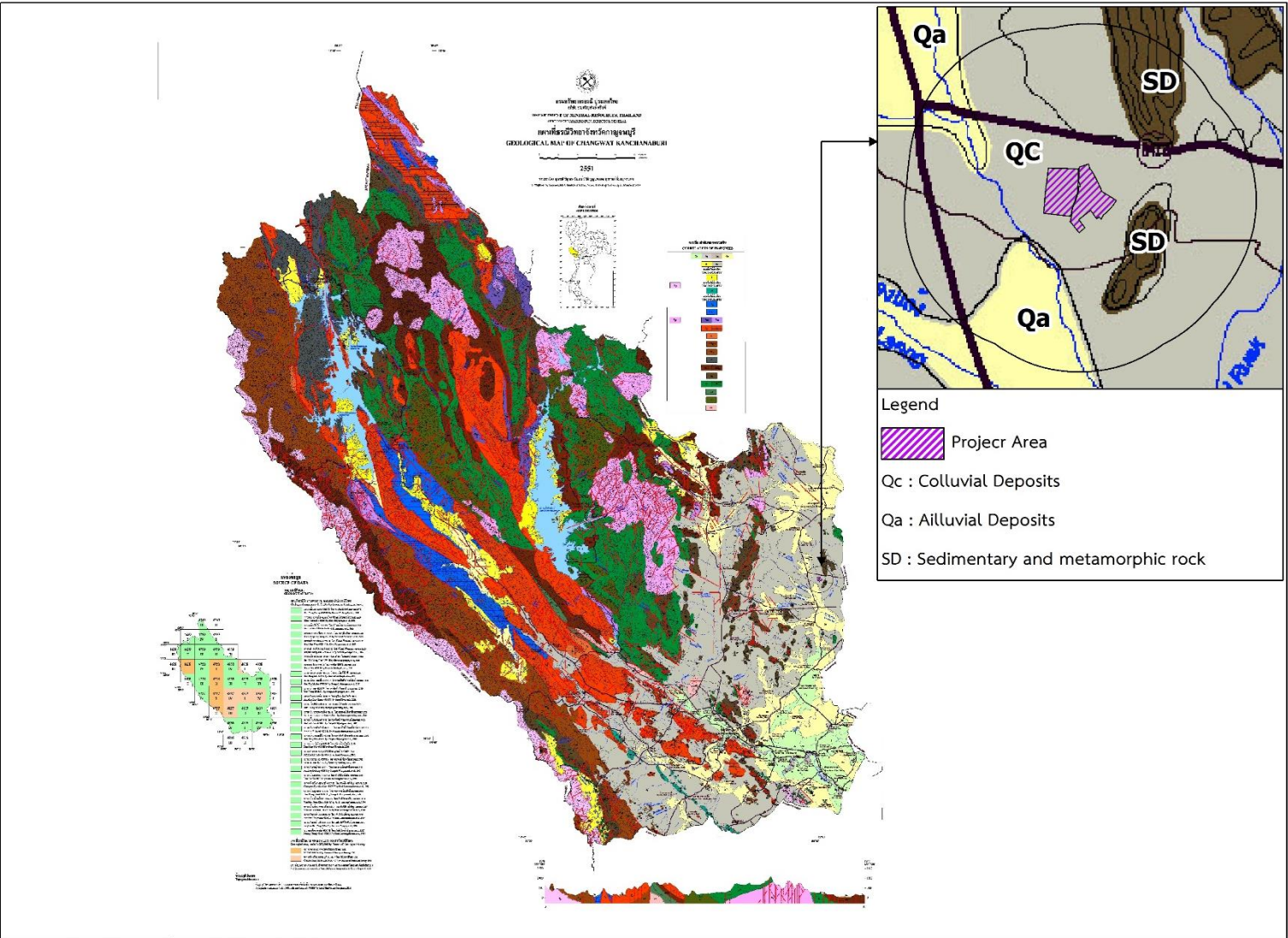
The geological data collected from the Kanchanaburi geological maps (2008) of the Geological Bureau, Department of Mineral Resources, show that the study area has two types of geological conditions, as depicted in **Figure 3.1-1**, along with the following details:

**(A) Colluvial deposits (Qc):** These are sub-sediments of the Quaternary (Q) sediments that are found over most of the study area, shaped by the decay of the original rock that has been eroded and blown away, not far from the source. The slope of the land helps in carrying large sediments, which are distributed around the mountains and nearby foothills. This type of deposit exhibits a plateau-like morphology, composed of rock fragments such as quartzite, sandstone, siltstone, granite, sand, silt, laterite, and terra rossa soils of various sizes. These fragments range from small pebbles to large rocks and have a loose texture due to weathering and poor sorting.

**(B) Alluvial deposits (Qa):** These are sub-sediments of Quaternary sediments (Q) shaped by the evacuation of surface water. The slope of the land somewhat influences their accumulation on plains located a significant distance from the source. The terrain is characterized by flatness and minimal slope, often featuring small rivers or waterways. As a result of these conditions, various types of sediments, such as gravel, sand, silt, and clay, are mixed together. This mixture occurs due to the rapid changes in sediment and the limited sorting process. Notably, a significant presence of steel and cement grains can be observed within these deposits.

**(C) Silurian-Devonian rocks (SD):** This belongs to the Silurian-Devonian period and falls within the Bo Phlul Formation. It consists of altered volcanic rocks, including quartzitic sandstone, argillaceous sandstone, brown, gray, and reddish mudstone. The texture ranges from fine to coarse with semi-rounded grains and good size sorting. Intercalations of mudstone and sandy mudstone also occur. Some locations have been altered to quartzite, phyllite, and chert. Fossil remains of early Devonian age trilobites have been found.

The study area is situated within a Colluvial deposits environment.



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FIGURE 3.1-1: KANCHANABURI GEOLOGICAL CONDITIONS



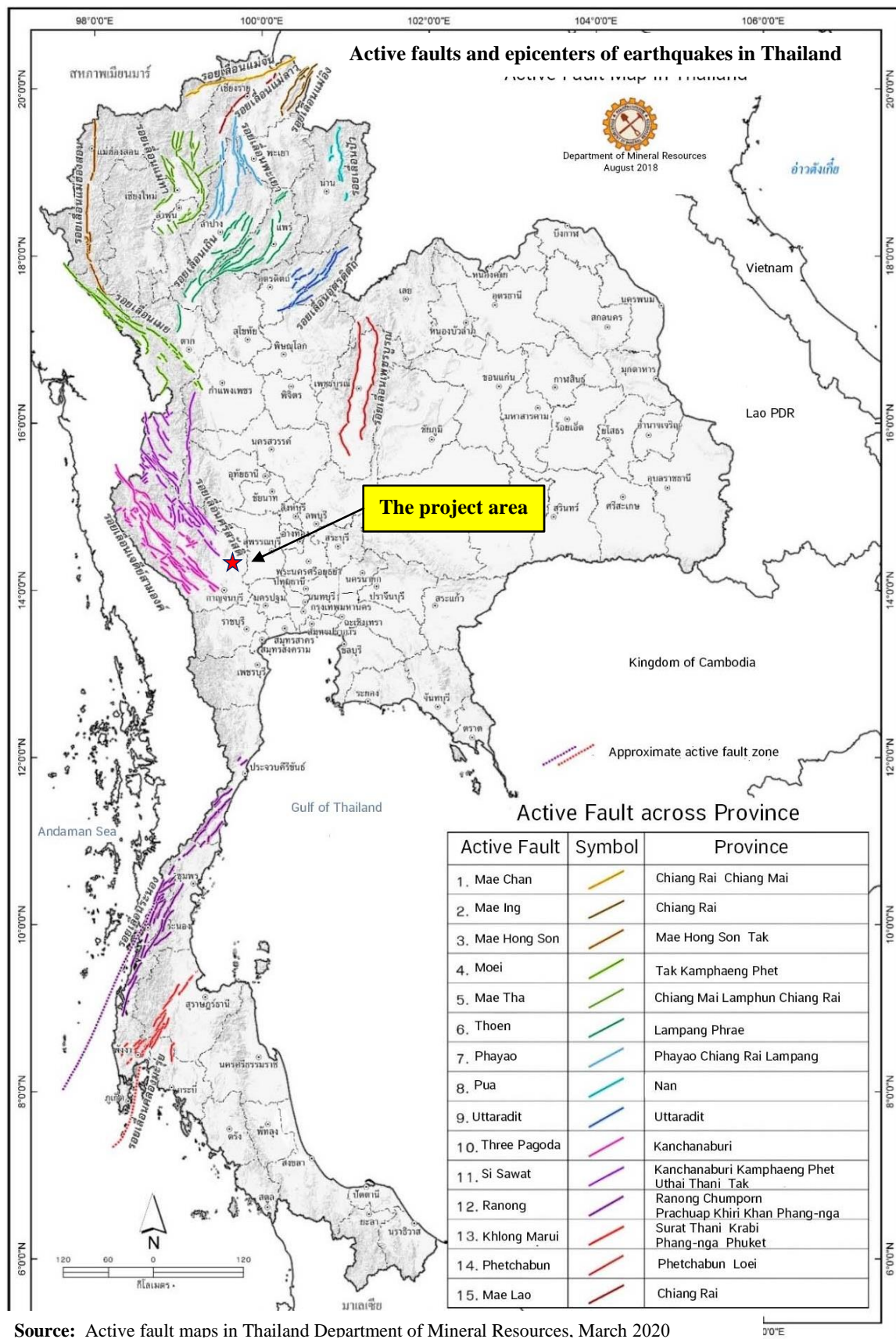
## (2) Seismicity

The seismicity data has been collected from related agencies and reports, including earthquake statistics from earthquake statistics of the Earthquake Observation division, Thai Meteorological Department 2018-2023 and risk area information from a map showing active fault lines in Thailand of the Department of Mineral Resources 2020 and earthquake maps from the Atlas book of Active Faults in Thailand 2018.

The project is situated in Kanchanaburi Province. According to the earthquake statistics collected by the Earthquake Observation Division, Thai Meteorological Department for the years 2018-2023 (**Appendix 3A**), it has been determined that Kanchanaburi Province serves as the epicenter for 2 earthquakes. This finding aligns with the risk area information derived from the map illustrating active faults in Thailand, as provided by the Department of Mineral Resources in 2020. This information is presented in **Figure 3.1-2**, indicating that Kanchanaburi Province encompasses two types of active fault lines: the Si Sawat Fault and the Three Pagodas Fault.

In regard to both the study area and the project area, there are no available statistics regarding earthquake epicenters or the impacts caused by earthquakes. Regarding the distance between the power fault line and the project area, it is evident that the project is situated at distances of 24.3 and 47.8 kilometers from the Si Sawat Fault and the Three Pagodas Fault, respectively.

The Thai earthquake map of October 2016 revision (2018 Thailand Active Fault Atlas Book) (**Figure 3.1-3**) shows the intensity of earthquakes. The intensity measurement of an earthquake refers to the phenomena that occur during and after the earthquake, such as people's feelings, shaking or damage of objects and buildings, changes in the physical nature of the ground, etc., using the 12-rank Modified Mercalli Scale (MM Scale) from least to most severe earthquakes as shown in **Table 3.1-1**. It shows that in the project area and the study area if an earthquake occurs, there will be an earthquake of magnitude 5 Mercarily, which is a relatively strong level. Almost everyone can feel it. Many people are shocked. Objects are unstable and overturned. Pillars and trees are swaying.

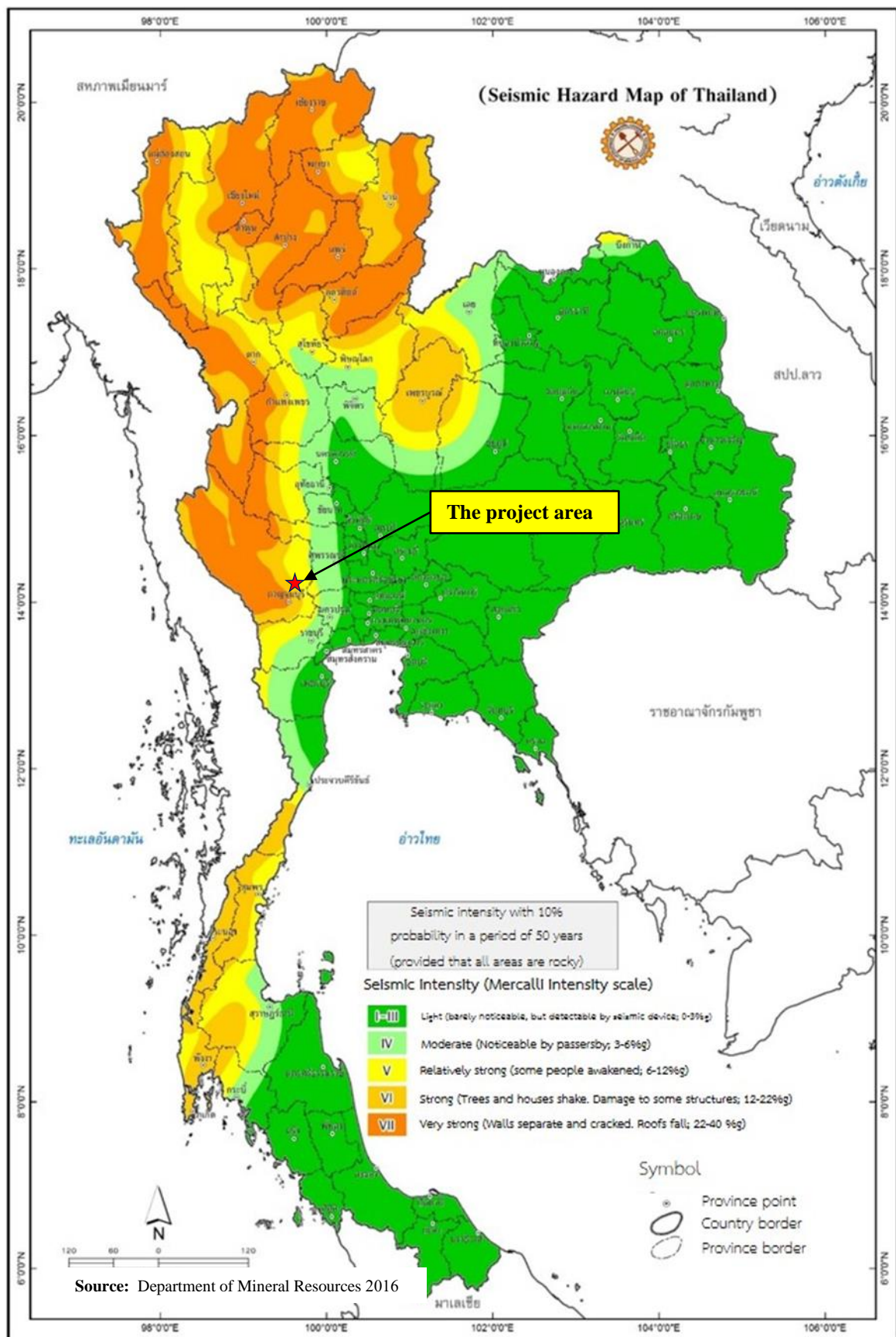


**FIGURE 3.1-2 : ACTIVE FAULTS AND EPICENTERS OF EARTHQUAKES IN THAILAND**

**TABLE 3.1-1**  
**LEVELS OF EARTHQUAKE INTENSITY BASED ON THE MODIFIED**  
**MERCURI SCALE (MM)**

Level	Ground conditions
I	Not felt except by very few under especially favorable conditions.
II	Felt only by a few people at rest, especially on upper floors of buildings. Delicately suspended objects may swing.
III	Felt quite noticeably by people indoors, especially on upper floors of buildings: Many people do not recognize it as an earthquake. Standing vehicles may rock slightly. Vibrations are similar to the passing of a truck, with duration estimated.
IV	Felt indoors by many, outdoors by few during the day: At night, some are awakened. Dishes, windows, and doors are disturbed; walls make cracking sounds. Sensations are like a heavy truck striking a building. Standing vehicles are rocked noticeably.
V	Felt by nearly everyone; many awakened: Some dishes and windows are broken. Unstable objects are overturned. Pendulum clocks may stop.
VI	Felt by all. Some heavy furniture is moved; some chimneys are broken. Damage is slight
VII	Damage is negligible in buildings of good design and construction; but slight to moderate in well-built ordinary structures; damage is considerable in poorly built or badly designed structures; some chimneys are broken. Noticed by motorists.

**Source:** The Earthquake Observation division, Thai Meteorological Department 2023 ([www.seismology.tmd.go.th](http://www.seismology.tmd.go.th))



**FIGURE 3.1-3: SEISMIC HAZARD MAP OF THAILAND**

### (3) Soil Resources

Soil resource data has been collected from various relevant agencies and reports. This data includes a map of the Lao Khwan district soil series in Huai Krachao district, Kanchanaburi, which was conducted by the Kanchanaburi Land Development Station Office, Region 10, Department of Land Development, in 2019. Additionally, data pertaining to the characteristics and properties of soil series has been obtained from the Land Development Department's website ([http://oss101.ldd.go.th/thaisoils\\_museum/62\\_soilgroup/main\\_62soilgroup.htm](http://oss101.ldd.go.th/thaisoils_museum/62_soilgroup/main_62soilgroup.htm)).

From examining the soil maps of Lao Khwan District and Huai Krachao District in Kanchanaburi Province, a total of 6 soil series have been identified within the study area. These are as follows: Bo Phloi soil series (Bop), Khao Phlong soil series (Kpg), Tha Yang soil series (Ty), Wang Saphung soil series (Ws), Lat Ya soil series (Ly), and Slope Complex (SC). The characteristics of the soil series data within the study area of the project are presented in **Table 3.1-2 and Figure 3.1-4**. The project area is situated on the Khao Phlong soil series (Kpg), which is the most predominant soil series.

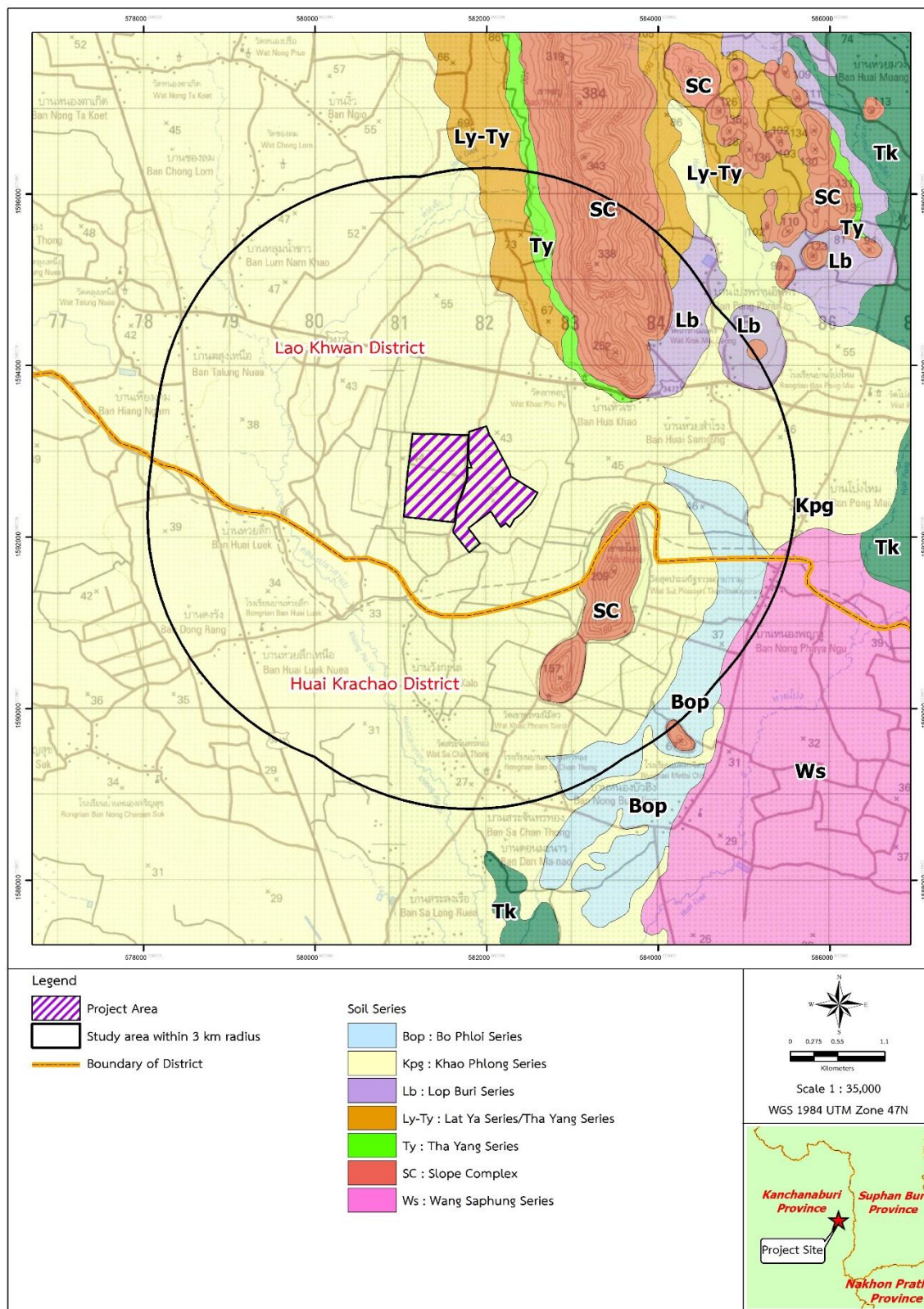
**Khao Phlong Series (Kpg)** has its origin as waterborne sediments. The area is relatively smooth, good drainage, moderate to fast water permeability, slow to moderate surface runoff. The top soil is sandy loam soil. The soil reaction is slightly acidic (pH 5.5-6.5) throughout the soil layer. This soil series is covering an area of 42.08 square kilometers or representing 87.07% of the total study area (including Project location).

**TABLE 3.1-2**  
**CHARACTERISTICS OF THE SOIL SERIES IN THE STUDY AREA**

Group of Soil series	Soil series	Name of Soil series	Drainage	Soil Permeability	Slope (%)	Soil texture		pH value		Fertility
						Top soil	Subsoil	Top soil	Sub soil	
36	Bop	Bo Phloi	good	medium	2-12	sandy loam	sandy loam to sandy clay	5.5-6.5	6.5-8.0	low
40	Kpg	Khao Plong	good	medium to fast	1-12	sandy loam or loamy sand	sandy loam to sandy clay	6.5-5.5 throughout the whole layers		low
48	Ty	Tha Yang	good	medium to fast	2-20	loamy soil mixed with gravel or loamy soil mixed with sandy gravel.	loamy soil mixed with sand and gravel particles	5.0-6.0	4.5-5.0	medium
55	Ws	Wang Saphung	good	medium	2-12	loamy soil, loamy soil mixed with clay, or clayey soil mixed with sandy loam	clay	6.0-7.0	4.5-6.5	medium
56	Ly	Lat Ya	good	medium	2-20	loamy soil or sandy loam soil	loamy soil mixed with clay	5.0-6.0	4.5-5.0	medium
62	SC	Slope Complex	uncertain	uncertain	>35	uncertain				

**Source:** Soil Resources Survey and Research Division, Land Development Department, retrieved on 27 April 2023 from [www.idd.go.th](http://www.idd.go.th)





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**FIGURE 3.1-4: THE SOILS SERIES MAP OF THE PROJECT AREA.**

### 3.1.2 Climate And Meteorology

Climatic and meteorological data for the 17-year period (2006-2022) has been collected from U-Thong Meteorological Station, Agricultural Meteorological Station (station code 425301/48427), located at Chorakhe Sam Phan Subdistrict, U Thong District, Suphan Buri Province. It is the closest meteorological station to the project area. It is located at latitude 14° 18' 18.30" North and longitude 99° 51' 40.50" East, about 18 kilometers southwest of the project site (SE).

#### (A) Climate conditions

The project is located in Kanchanaburi province, influenced by 2 types of monsoons, namely the northeast monsoon, which blows from the northeast during the winter causing Kanchanaburi to encounter cold and dry conditions, and the southwest monsoon, which prevails during the rainy season, causing rain and moist air in Kanchanaburi, there are 3 seasons as follows.

- **Winter** - Starts from mid-October to mid-February which is the northeast monsoon season. A high-pressure area from China with coldness and dryness will spread to cover Thailand during this period. However, since Kanchanaburi is located in the central region, the influence of the high-pressure area from China that spreads over the area in the winter will be slower than in the northern and northeastern regions causing cold weather later than those two regions. Cold weather will start around mid-November onwards.

- **Summer** - Starts when the northeast monsoon ends, around mid-February to mid-May. During this period, a low-pressure area from heat covers upper Thailand causing hot and sweltering weather in general. The weather is extremely hot in April.

- **Rainy** - Starts from mid-May to mid-October. It is during the southwest monsoon that prevails over Thailand. The monsoon trough across the southern region of Thailand will move up and straddles the central and northern regions, respectively. It causes much more rain from mid-May onwards. September is the wettest period of the year. The humidity is high.

**(B) Meteorological conditions** - Based on the collection of meteorological data from U-Thong Meteorological Station, Agricultural Meteorological Station for the 17-years (2006-2022) (station code 425301/48427), which is the closest meteorological station to the project study area as shown in **Table 3.1-3**, it can be summarized as follows.

- **Atmospheric pressure**- The mean atmospheric pressure in the whole year is 1,009.04 hectopascals. The highest mean atmospheric pressure is in January and December, with 1,012.4 hectopascals. The lowest mean atmospheric pressure is in July, with 1,006.3 hectopascals.

- **Temperature** - The mean temperature in the whole year is 28.1 °C. The highest mean temperature is in April at 30.4 °C. The lowest mean temperature is in January at 25.0 °C.

- **Relative humidity** - The mean relative humidity in the entire year is 74.6 percent. The highest monthly mean relative humidity is in October, with 82.0 percent. The lowest monthly mean of relative humidity is in April, with 69.0 percent.

- **Wind speed and wind direction** - The mean wind speed is in the range of 0.4-1 knots. The lowest monthly mean wind speed is in October. The highest monthly mean wind speed is in July and December. The wind direction blows from the southwest (SW) from May to September, Northeast (NE) from October to February and the southeast (SE) from March to April (**Figure 3.1-5**).

- **Rainfall** - The annual rainfall is 970.9 mm. The highest rainfall is in September, with 211.6 mm. The lowest rainfall is in January, with 7.8 mm. The total number of rainy days for the year is 104.6 days.



**TABLE 3.1-3  
METEOROLOGICAL STATISTICS FROM U-THONG METEOROLOGICAL  
STATION FOR 17-YEAR PERIODS (2006-2022)**

Station : U THONG AGROMET. Elevation of station above MSL : 6 Meters  
 Index Station : 48427 Height of barometer above MSL : 6.68 Meters  
 Latitude : 14° 18' "18.30N Height of Thermometer above ground : 1.5 Meters  
 Longitude : 99° 51' 40.50 "E Height of wind vane above ground : 11 Meters  
 Height of rain gauge : 1 Meters

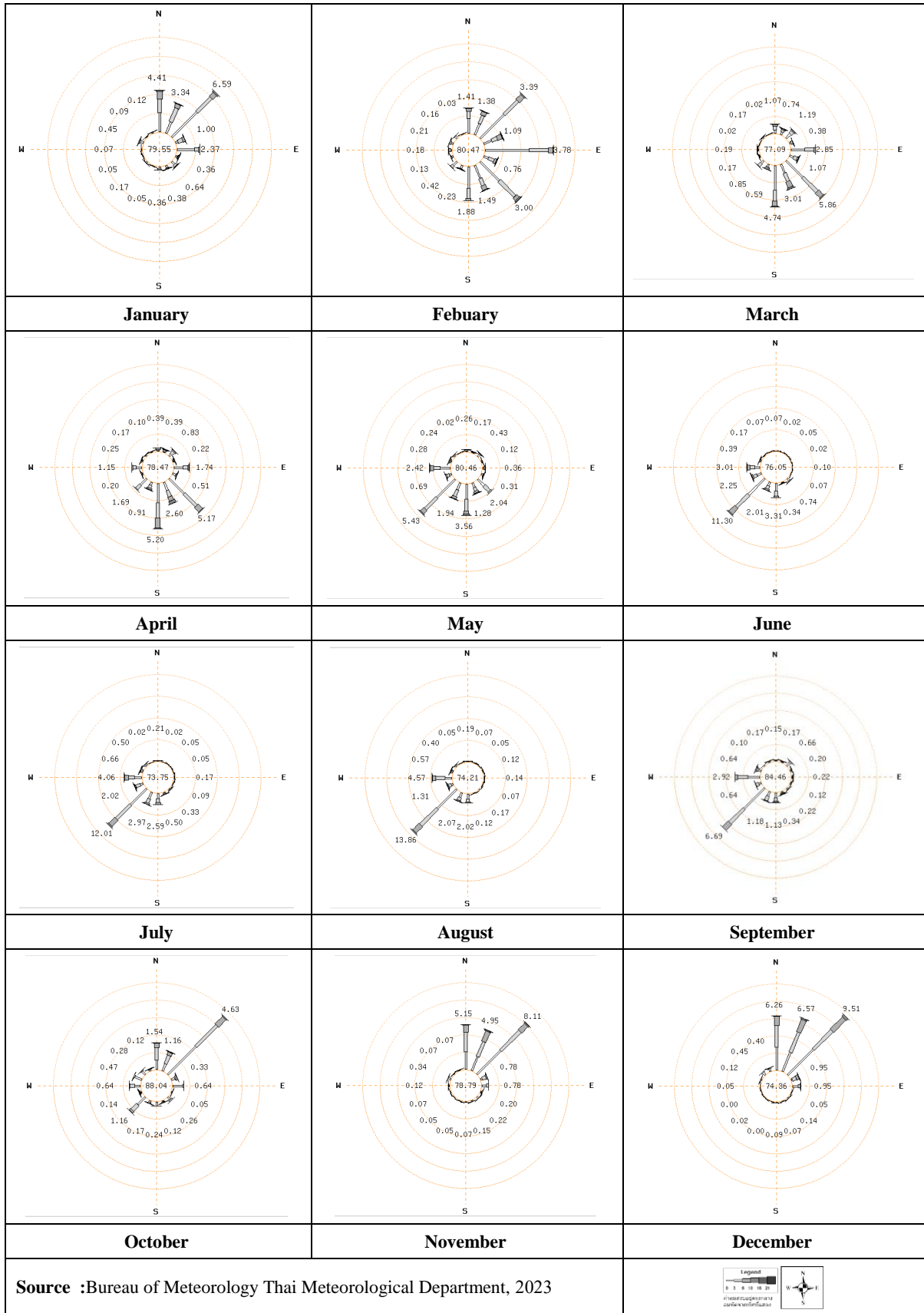
Elements	N-Years	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Annual
<b>Pressure (hPa)</b>														
Mean	17	1012.4	1011.2	1009.6	1008.5	1007	1006.4	1006.3	1006.5	1007.6	1009.6	1011.0	1012.4	1009.04
Mean Daily Range	17	4.9	5.2	5.5	5.4	4.9	4.1	3.9	4.2	4.6	4.7	4.6	4.7	4.73
Ext .Max.	17	1023.74	1022.29	1019.78	1018.89	1016.18	1013.10	1012.38	1012.68	1015.73	1020.11	1019.45	1023.52	1023.74
Ext .Min.	16	1001.33	1002.58	1000.79	1000.63	999.54	997.48	999.15	993.56	999.18	1001.32	1002.94	1000.85	993.56
<b>Temperature (Celsius)</b>														
Mean Max.	17	31.5	33.8	36	37	35.8	34.8	34	34	33.6	32.6	32	30.9	33.8
Ext .Max.	17	37.2	37.8	41.8	42.0	41.7	40.1	38.5	38.7	37.3	36.3	35.7	35.1	42.0
Mean Min.	17	19.1	21.1	23.5	24.8	25.2	24.8	24.4	24.4	24.1	23.6	22.4	19.8	23.1
Ext .Min.	17	8.5	10.2	16.4	17.0	20.2	21.4	20.1	19.5	19.9	0	12.6	8.5	0
Mean	17	25.0	27.2	29.3	30.4	30.0	29.4	28.8	28.6	28.2	27.7	26.9	25.1	28.1
<b>Dew Point Temp.(C°)</b>														
Mean	17	19.4	21.2	22.6	23.3	24.1	23.9	23.6	23.7	24.2	24.1	22.1	19.4	22.6
<b>Relative Humidity (%)</b>														
Mean	17	73	72	71	69	73	74	75	76	80	82	77	73	74.6
Mean Max.	17	92	93	93	90	90	90	90	91	94	95	92	90	91.7
Mean Min.	17	51	48	44	44	52	55	57	57	61	64	57	52	53.4
Ext .Min.	17	16	23	13	20	25	35	34	30	44	40	29	32	13
<b>Visibility (Km.)</b>														
Mean	17	7.5	7.3	7.4	7.9	8.0	8.1	8.0	8.1	8.0	7.8	8.0	7.8	7.8
07.00LST	16	7.0	6.7	7.2	7.8	8.1	8.1	8.1	8.0	8.0	7.8	7.8	7.6	7.7
<b>Cloud Amount (1-10)</b>														
Mean	17	4.5	4.7	5.4	6.2	7.6	7.8	8.2	8.4	8.5	7.5	5.6	4.6	6.6
<b>Wind (Knots)</b>														
Prev .Wind	17	NE	NE	SE	SE	SW	SW	SW	SW	SW	NE	NE	NE	-
Mean	17	0.7	0.6	0.8	0.8	0.7	0.8	1.0	0.9	0.5	0.4	0.8	1.0	0.8
Max.	17	29	22	25	25	29	25	30	25	23	26	22	32	32
<b>Pan Evaporation (mm.)</b>														
Total	17	128.1	136.5	180.6	197.5	185.3	165.6	158.1	154.2	134	122.4	119.8	125.4	1807.5
<b>Rainfall (mm)</b>														
Total	30	7.8	12.6	28.7	55.2	110.6	93	96.2	107.7	211.6	195.4	43.2	8.9	970.9
Num .of Days	30	1.2	1.6	3.3	5.1	11.9	13.5	15.1	15.4	18.0	13.8	4.3	1.4	104.6
Daily Max.	30	54	57.1	86.6	115.6	132.2	92.2	60.8	107.1	161.9	122.5	94.9	39.1	161.9
<b>Sunshine Duration (hr.)</b>														
Mean	17	242.3	224.9	231.8	244.8	213.3	126.3	111.9	133.4	163.1	192.8	213.4	241.2	2339.2

**TABLE 3.1-3  
METEOROLOGICAL STATISTICS FROM U-THONG METEOROLOGICAL  
STATION FOR 17-YEAR PERIODS (2006-2022) (CONT' D)**

Station : U THONG AGROMET. Elevation of station above MSL : 6 Meters  
 Index Station : 48427 Height of barometer above MSL : 6.68 Meters  
 Latitude : 14° 18' "18.30N Height of Thermometer above ground : 1.5 Meters  
 Longitude : 99° 51' 40.50 "E Height of wind vane above ground : 11 Meters  
 Height of rain gauge : 1 Meters

Elements	N-Years	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Annual
<b>Phenomena (Days)</b>														
Fog	17	1.9	2.6	0.6	0.1	0.1	0.1	0.2	0.1	0	0.1	0.1	0.2	6.1
Haze	17	23.4	23.3	25.9	23.1	15.9	13.2	13.8	11.4	6.2	6.7	12.2	18.2	193.3
Hail	17	0	0	0	0	0	0	0	0.1	0.1	0	0	0	0.2
Thunder Storm	17	0.1	0.2	0.7	1.5	2.5	1.9	1.4	1.4	3.2	1.6	0.6	0.2	15.3
Squall	17	0	0	0.1	0	0	0	0	0	0	0	0	0	0.1

Source :Thai Meteorological Department, 2023



**FIGURE 3.1-5 : WIND ROSE DIAGRAM OF U-THONG METEOROLOGICAL STATION IN THE 17-YEAR PERIOD (2006-2022)**

### 3.1.3 Air Quality

Air quality monitoring was conducted in the project vicinity that may be affected by the project. It was conducted 2 times during dry season and rainy season, at two stations, are as follows:

A1 : Mai Khiri Wong Temple (Wat Khao Pho Pu) is about 1,443 meters NE from the project area,

A2 : Huai Luek Samakkhitham Temple is about 1,008 meters SW from the project area,

Which, focusing on the location from the data of wind and topographical conditions of the study area as shown in **Figure 3.1-6**.

The measured parameters included Total Suspended Particles (TSP), and Particulate Matter with a diameter of less than 10 micrometers (PM-10). During wet season, ambient air quality measurements were conducted in the study area between 25-30 May 2023.

For the dry season, ambient air quality measures were conducted between 2-7 November 2023. The measure parameters included Total Suspended Particles (TSP), Particulate Matter with a diameter of less than 10 micrometers (PM-10), and Particulate Matter with a diameter of less than 2.5 micrometers (PM-2.5)

The sampling and analysis methods follow the Royal Gazette or other systems approved by the Pollution Control Department, as shown in **Table 3.1-4**. The sample collection was carried out by a private analytical laboratory registered by the Department of Industrial Works, with accurately calibrated measuring and analytical instruments. The relevant documents are in **Appendix 3B**.

The results of ambient air quality monitoring in dry season and rainy season at Wat Mai Khiri Wong (Wat Khao Pho Pu) (A1) and Wat Huai Luek Samakkhitham (A2) show that the concentration of 24-hour average TSP and 24-hour average PM-10 comply with ambient air quality standard, as shown in **Table 3.1-5 and Figure 3.1-8 and Appendix 3C**. It is summarized as follows.

#### (1) Total suspended particulate (TSP), 24-hour average

*During rainy season*, the average 24-hour TSP concentration at Mai Khiri Wong Temple (Wat Khao Pho Pu) (A1) and Huai Luek Samakkhitham Temple (A2) are in the range of 48.00-93.00 and 40.00-78.00 micrograms per cubic meter, respectively. *During dry season*, the average 24-hour TSP concentration at Mai Khiri Wong Temple (Wat Khao Pho Pu) (A1) and Huai Luek Samakkhitham Temple (A2) are in the range of 31.00-74.00 and 33.00-79.00 micrograms per cubic meter, respectively. There are within the ambient air quality standard value that determines 24-hour average TSP not exceeding 330 micrograms per cubic meter, The measured values are, therefore, in accordance with the National Environmental Board, No. 24 (2004).

#### (2) PM-10, 24-hour average

*During rainy season*, the average 24-hour PM-10 concentration at Mai Khiri Wong Temple (Wat Khao Pho Pu) (A1) and Huai Luek Samakkhitham Temple (A2) are in the range of 26.00-53.00 and 18.00-42.00 micrograms per cubic meter, respectively. *During dry season*, at Mai Khiri Wong Temple (Wat Khao Pho Pu) (A1) and Huai Luek Samakkhitham Temple (A2) are in the range of 16.00-42.00 and 19.00-43.00 micrograms per cubic meter, respectively. There are within the ambient air quality standard value that determines 24-hour average PM-10 not exceeding 120 micrograms per cubic meter, The measured values are, therefore, in accordance with both the National Environmental Board, No. 24 (2004) and General EHS Guidelines, IFC (2007).

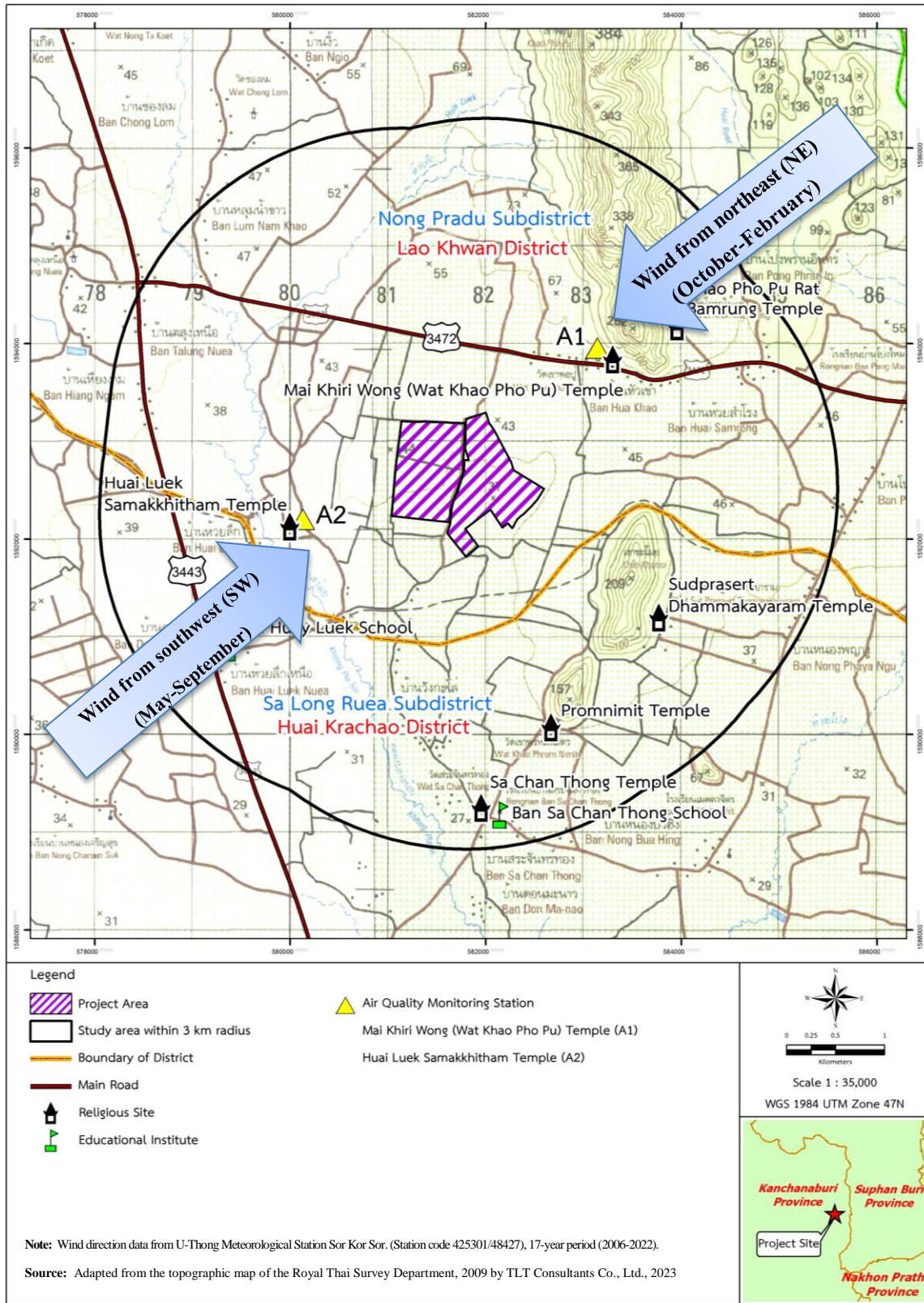
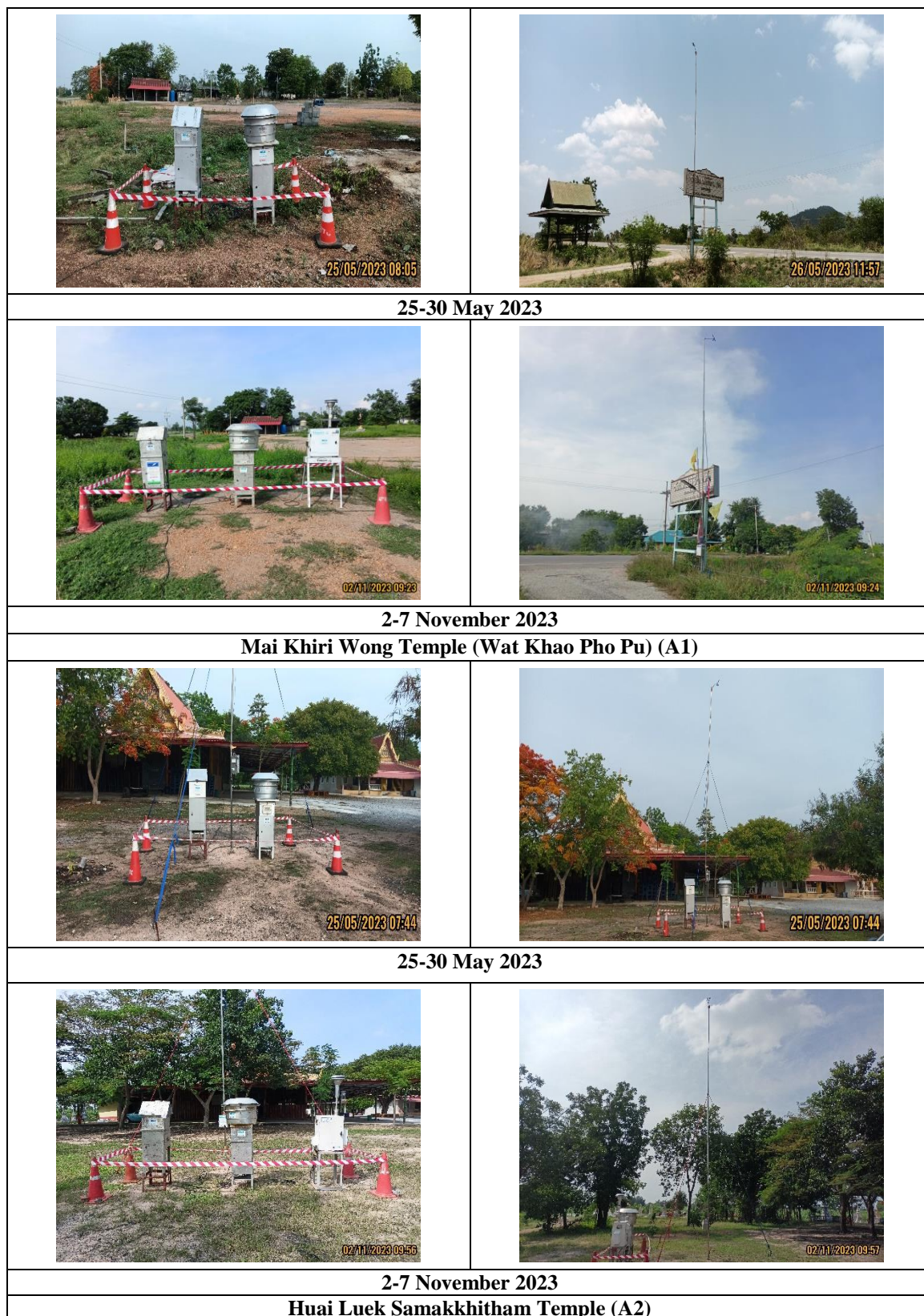


FIGURE 3.1-6 : AIR QUALITY MONITORING STATION





**FIGURE 3.1-7 : AMBIENT AIR QUALITY MONITORING ACTIVITIES AT THE PROJECT AREA BETWEEN 25-30 MAY 2023 AND 2-7 NOVEMBER 2023**

**TABLE 3.1-4**  
**AIR QUALITY INDEX, SAMPLING AND AIR QUALITY ANALYSIS**  
**METHODS**

Variables	Sampling methods	Analysis methods	Reference
1. Total Suspended Particulates; TSP	High Volume Air Sampler	Gravimetric Method	1/, 2/
2. Particulate matter with a diameter of less than 10 microns (PM-10)	PM10- Size Selective, High-Volume Air Sampler	Gravimetric Method	1/, 2/
3. Particulate matter with a diameter of less than 2.5 microns (PM-2.5)	PM-2.5 Size Selective, Low-Volume Air Sampler	Gravimetric Method	3/
4. Wind Speed and Wind Direction	Wind Vane and Cup Anemometer	EPA Method (WRPLOT Utility Program)	-

**Note:** 1/ Notification of the National Environment Board, No. 10 (B.E. 2538) on ambient air quality standards  
2/ Notification of the National Environment Board, No. 10 (B.E. 2538) on ambient air quality standards  
3/ Notification of the National Environment Board (B.E. 2565) on PM-2.5 ambient air quality standards

**TABLE 3.1-5  
RESULTS OF AMBIENT AIR QUALITY MONITORING IN THE PROJECT  
AREA BETWEEN 25-30 MAY 2023 AND 2-7 NOVEMBER 2023**

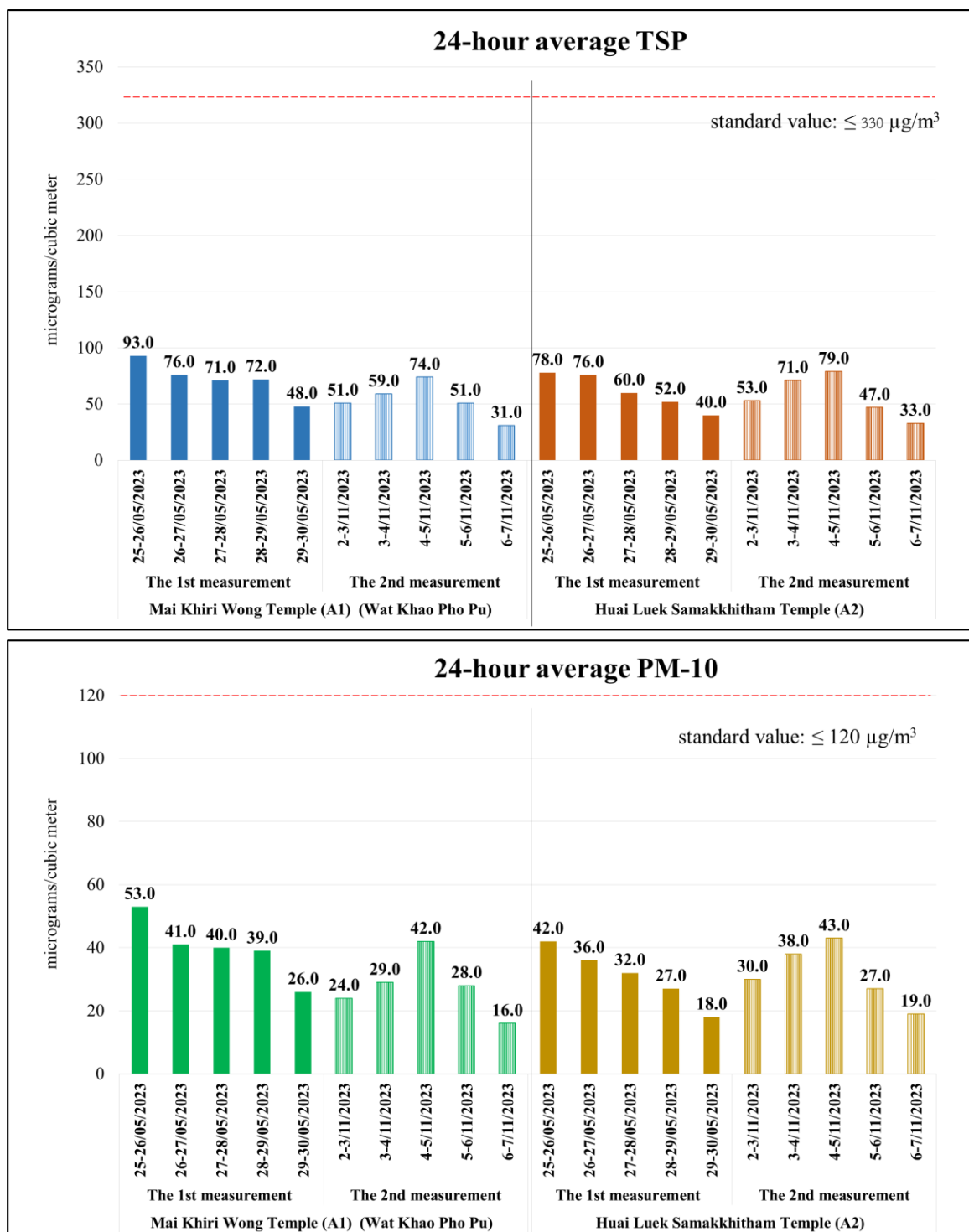
Monitoring station	Monitoring date	Concentration (micrograms/cubic meter)		
		TSP (24-hour average)	PM-10 (24-hour average)	PM-2.5 (24-hour average)
Mai Khiri Wong Temple (A1) (Wat Khao Pho Pu) (47P 0583263 E, 1593776 N)	25-26/05/2023	93.00	53.00	-
	26-27/05/2023	76.00	41.00	
	27-28/05/2023	71.00	40.00	
	28-29/05/2023	72.00	39.00	
	29-30/05/2023	48.00	26.00	
	<b>Min-Max</b>	<b>48.00-93.00</b>	<b>26.00-53.00</b>	
	<b>percentage of standard values<sup>1/, 2/</sup></b>	<b>14.55-28.18</b>	<b>21.67-44.17</b>	
	2-3/11/2023	51.00	24.00	
	3-4/11/2023	59.00	29.00	
	4-5/11/2023	74.00	42.00	
	5-6/11/2023	51.00	28.00	
	6-7/11/2023	31.00	16.00	
	<b>Min-Max</b>	<b>31.00-74.00</b>	<b>16.00-42.00</b>	
	<b>percentage of standard values<sup>1/, 2/</sup></b>	<b>9.39-22.42</b>	<b>13.33-35.00</b>	
Huai Luek Samakkhitham Temple (A2) (47P 0580042 E, 1592069 N)	25-26/05/2023	78.00	42.00	-
	26-27/05/2023	76.00	36.00	
	27-28/05/2023	60.00	32.00	
	28-29/05/2023	52.00	27.00	
	29-30/05/2023	40.00	18.00	
	<b>Min-Max</b>	<b>40.00-78.00</b>	<b>18.00-42.00</b>	
	<b>percentage of standard values<sup>1/, 2/</sup></b>	<b>12.12-23.64</b>	<b>15.00-35.00</b>	
	2-3/11/2023	53.00	30.00	
	3-4/11/2023	71.00	38.00	
	4-5/11/2023	79.00	43.00	
	5-6/11/2023	47.00	27.00	
	6-7/11/2023	33.00	19.00	
	<b>Min-Max</b>	<b>33.00-79.00</b>	<b>19.00-43.00</b>	
	<b>percentage of standard values<sup>1/, 2/</sup></b>	<b>10.00-23.94</b>	<b>15.83-35.83</b>	
<b>Thai Standard values</b>	<b>330<sup>1/</sup></b>	<b>120<sup>1/</sup></b>	<b>37.5<sup>2/</sup></b>	
<b>WHO Guidelines values</b>	<b>-</b>	<b>50<sup>3/,4/</sup></b>	<b>25<sup>3/,4/</sup></b>	

**Note :**

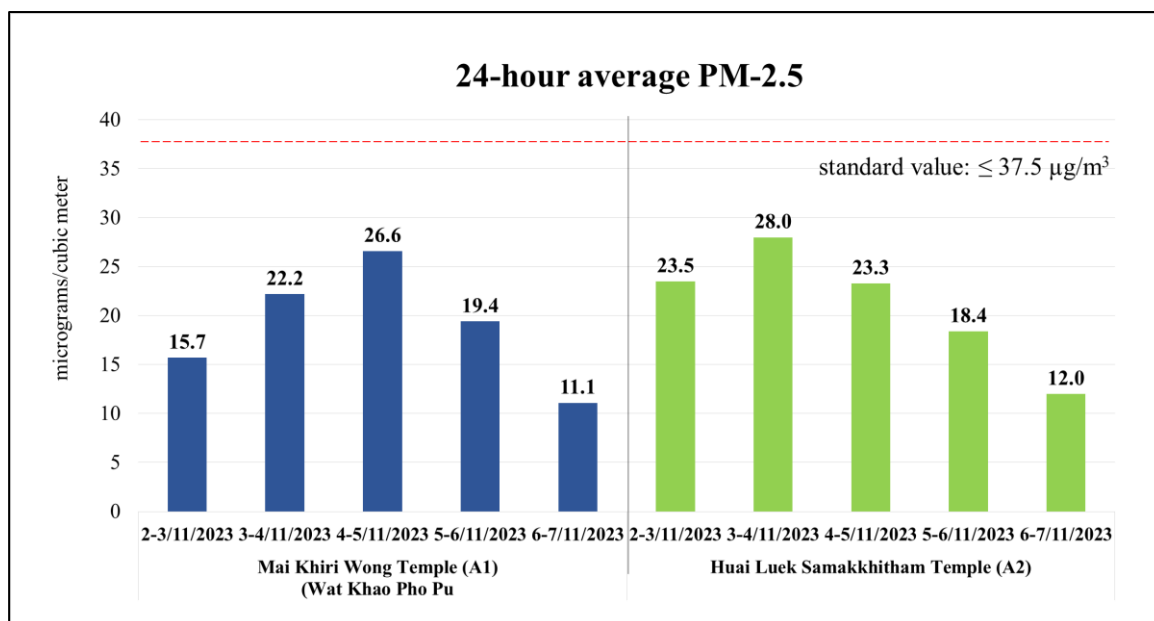
- 1/ Notification of the National Environment Board, No. 24 (B.E. 2538) on ambient air quality standards
- 2/ Notification of the National Environment Board (B.E. 2565) on PM-2.5 ambient air quality standards
- 3/ WHO Ambient Air Quality Guidelines, Air Quality Guidelines Global Update, 2005.
- 4/ Environmental, Health and Safety Guideline, General EHS Guideline : Environmental Air Emissions and Ambient Air Quality, IFC (2007)

**Source :** Environment Research & Technology Co., Ltd, 2023





**FIGURE 3.1-8 : GRAPH SHOWING THE MONITORING RESULTS OF AMBIENT AIR QUALITY**



**FIGURE 3.1-8 : GRAPH SHOWING THE MONITORING RESULTS OF AMBIENT AIR QUALITY (CONT'D)**

**(3) PM-2.5, 24-hour average**

During dry season, at Mai Khiri Wong Temple (Wat Khao Pho Pu) (A1) and Huai Luek Samakkhitham Temple (A2) are in the range of 11.10-26.60 and 12.00-28.00 micrograms per cubic meter, respectively. There are within the ambient air quality standard value that determines 24-hour average PM-2.5 not exceeding 37.5 micrograms per cubic meter, representing 29.60-70.93 and 32.00-74.67 percent of standard values, respectively.

**(4) Wind Speed and Wind Direction**

Wind speed and wind direction measurements were conducted in the study area same period with ambient air quality sampling, at 2 stations: Mai Khiri Wong Temple (Wat Khao Pho Pu) (A1) and Huai Luek Samakkhitham Temple (A2)

(A1) : Mai Khiri Wong Temple (Wat Khao Pho Pu) : during rainy season, the wind speed range of less than 0.4 to 4.9 meters per second. Most of the winds are from the northwest (NW), accounting for 30.83% of all wind direction monitoring. Calm winds are 1.67% of all wind direction monitoring. During dry season the wind speed range of less than 0.4 to 3.1 meters per second. Most of the winds are from the north (N), accounting for 21.67% of all wind direction monitoring. Calm winds are 6.67% of all wind direction monitoring. as shown in **Table 3.1-6 and Figure 3.1-9.**

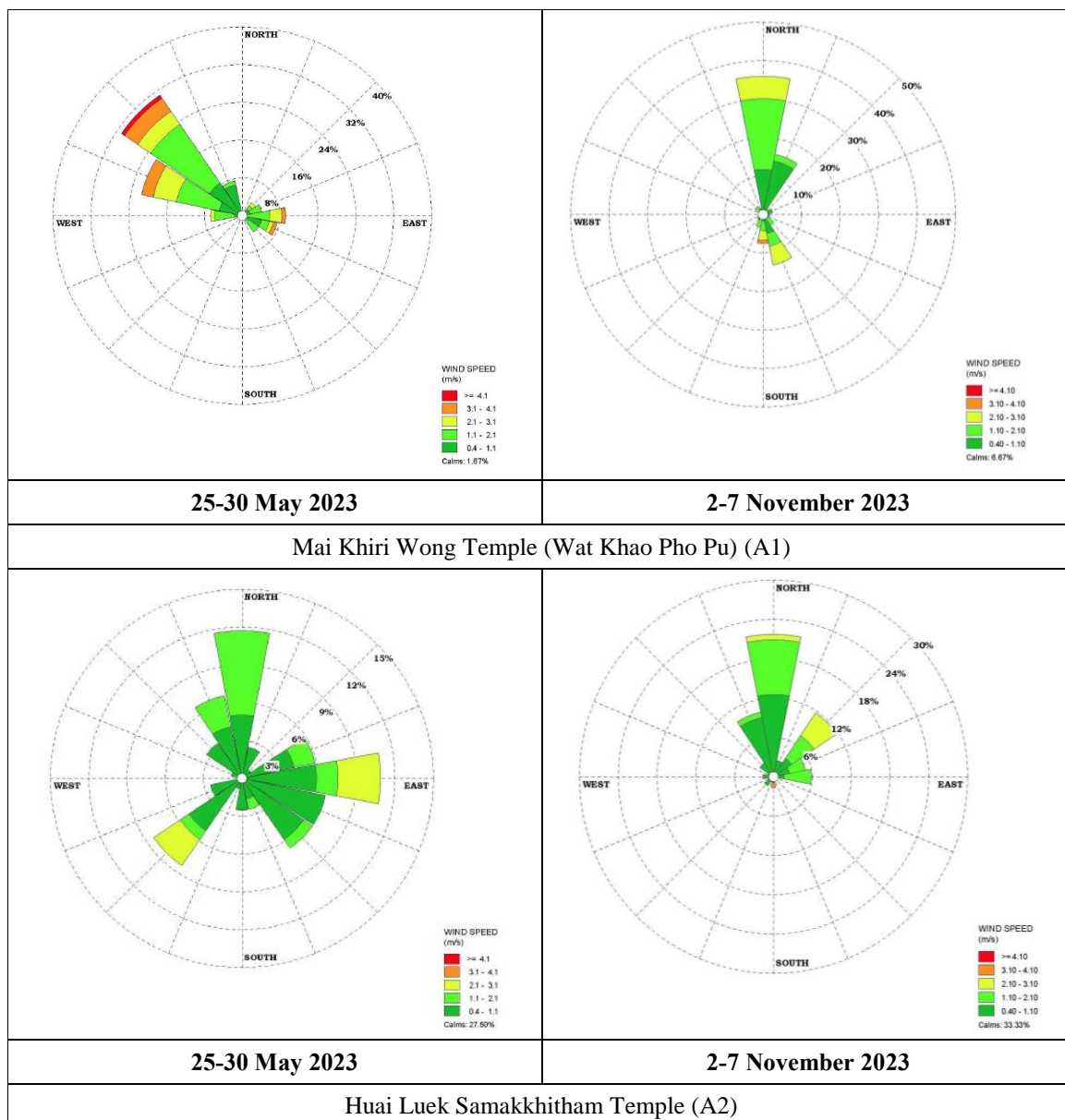
(A2) : Huai Luek Samakkhitham Temple : during rainy season, the wind speed range is less than 0.4 to 2.2 meters per second. Most winds are winds from the north (N), accounting for 11.67% of all wind direction monitoring. Calm winds are 27.50% of the total wind direction monitoring. During dry season the wind speed range is less than 0.4 to 3.1 meters per second. Most winds are winds from the north (N), accounting for 21.67% of all wind direction monitoring. Calm winds are 33.33% of the total wind direction monitoring, as shown in **Table 3.1-6 and Figure 3.1-9**

**TABLE 3.1-6**  
**THE MONITORING RESULTS OF WIND DIRECTION IN THE PROJECT**  
**AREA BETWEEN 25-30 MAY 2023 AND 2-7 NOVEMBER 2023**

Direction	Percentage of wind direction At Mai Khiri Wong Temple (Wat Khao Pho Pu) (A1)		Percentage of wind direction At Huai Luek Samakkhitham Temple (A2)	
	25-30 May 2023	2-7 November 2023	25-30 May 2023	2-7 November 2023
N	0.83	35.83	11.67	21.67
NNE	0.83	15.83	2.50	2.50
NE	3.33	1.67	0.83	11.67
ENE	4.17	2.50	5.83	5.00
E	9.17	1.67	10.83	5.83
ESE	7.50	1.67	6.67	0.00
SE	4.17	3.33	6.67	0.00
SSE	0.00	13.33	2.50	0.00
S	0.83	7.50	2.50	1.67
SSW	0.00	3.33	0.83	0.83
SW	0.00	1.67	8.33	1.67
WSW	0.83	0.00	2.50	0.83
W	6.67	0.00	0.00	1.67
WNW	21.67	0.83	0.83	0.83
NW	30.83	2.50	3.33	2.50
NNW	7.50	1.67	6.67	10.00
Calm wind	1.67	6.67	27.50	33.33

**Note:** ■ refers to the most frequent wind direction

**Source:** Environment Research & Technology Co., Ltd, 2023



**FIGURE 3.1-9 : WIND DIRECTION AND SPEED IN THE PROJECT AREA BETWEEN 25-30 MAY 2023 AND 2-7 NOVEMBER 2023**

### 3.1.4 Noise

The project conducts sound level measurements in the community closest to the project site that may be affected by the project operation. The measurement was conducted two times in 2 stations as shown in **Figure 3.1-10**, are as follows:

- N1 : the eastern house of the project area is about 140 meters from the project area,
- N2 : the western house of the project area is about 74 meters from the project area,

The measurements were performed for 5 consecutive days, including working days and holidays between 25-30 May 2023 (rainy season), and 7 consecutive days, including working days and holidays between 2-9 November 2023 (dry season) as shown in **Figure 3.1-11**. The parameters are 24-hour equivalent sound level ( $L_{eq}$  24 hr), sound level at the 90<sup>th</sup> percentile ( $L_{90}$ ), day-night average sound level ( $L_{dn}$ ) and the maximum sound level ( $L_{max}$ )

The measurement uses an integrating sound level meter according to the standard IEC 651 or IEC 804 of the International Electrotechnical Commission, IEC. The sound level calculation method is according to the International Organization for Standardization, ISO, as shown in **Table 3.1-7**. Also, sample collection was conducted by a private analytical laboratory registered by the Department of Industrial Works with measuring and analytical equipment that has been accurately calibrated. The relevant documents are in **Appendix 3B**.

The results of sound level measurements between 25-30 May 2023 and 2-9 November 2023, in the area of the houses in the eastern area of the project area (N1) and the western area of the project area (N2) show that the sound level is within standard value, as shown in **Table 3.1-8** and **Figure 3.1-12** and **Appendix 3C**. Details are as follows.

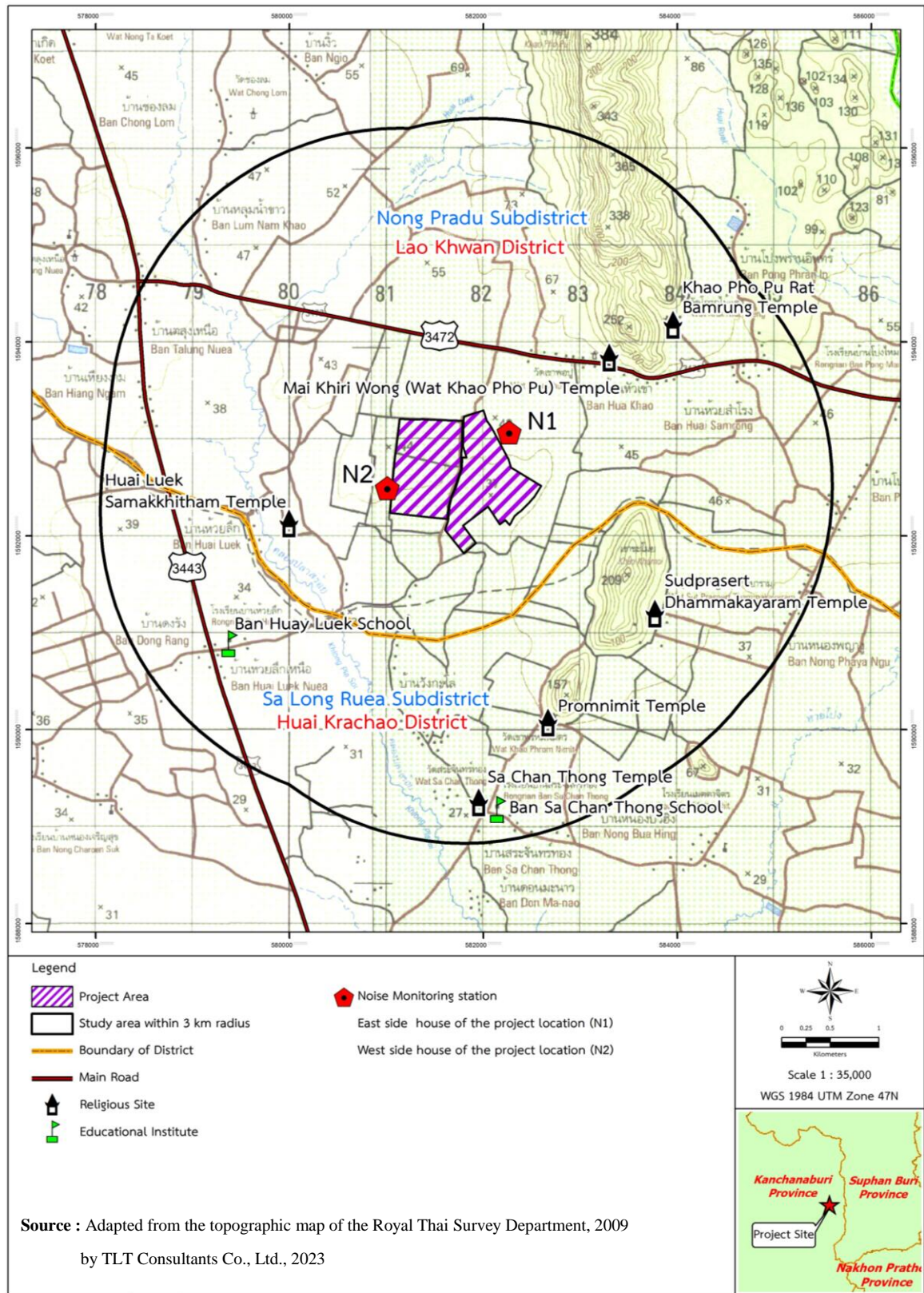
(1) **24-hour equivalent sound level ( $L_{eq}$  24 hr)** *During rainy season*, the equivalent 24-hour noise level at the houses on the eastern area of the project area (N1) and the western area of the project area (N2) are between 44.1-48.8 and 48.5-49.9 dB(A), representing 63.0-69.7% and 69.3-71.3% of the standard value, respectively, *during dry season*, the houses on the eastern area of the project area (N1) and the western area of the project area (N2) are between 45.6-49.4 and 56.3-60.0 dB(A), representing 65.14-70.57% and 80.43-85.71% of the standard value, respectively, which is within the general noise level standard criteria according to the Notification of the National Environment Board, No. 15 (B.E. 2540) that sets the value not more than 70 dB(A).

(2) **Maximum sound levels ( $L_{max}$ )** *During rainy season*, the maximum noise level at the houses on the eastern area of the project area (N1) and the western area of the project area (N2) are between 84.5-99.0 and 87.6-95.8 dB(A), representing 73.5-86.1% and 76.2-83.3% of the standard value, respectively, *during dry season*, the maximum noise level at the houses on the eastern area of the project area (N1) and the western area of the project area (N2) are between 78.5-85.2 and 84.5-94.2 dB(A), representing 68.26-74.09% and 73.48-81.91% of the standard value, respectively, There are within the general noise level standards according to the Notification of the National Environment Board No. 15 (B.E. 2540) that set the value not less than 115 dB(A).

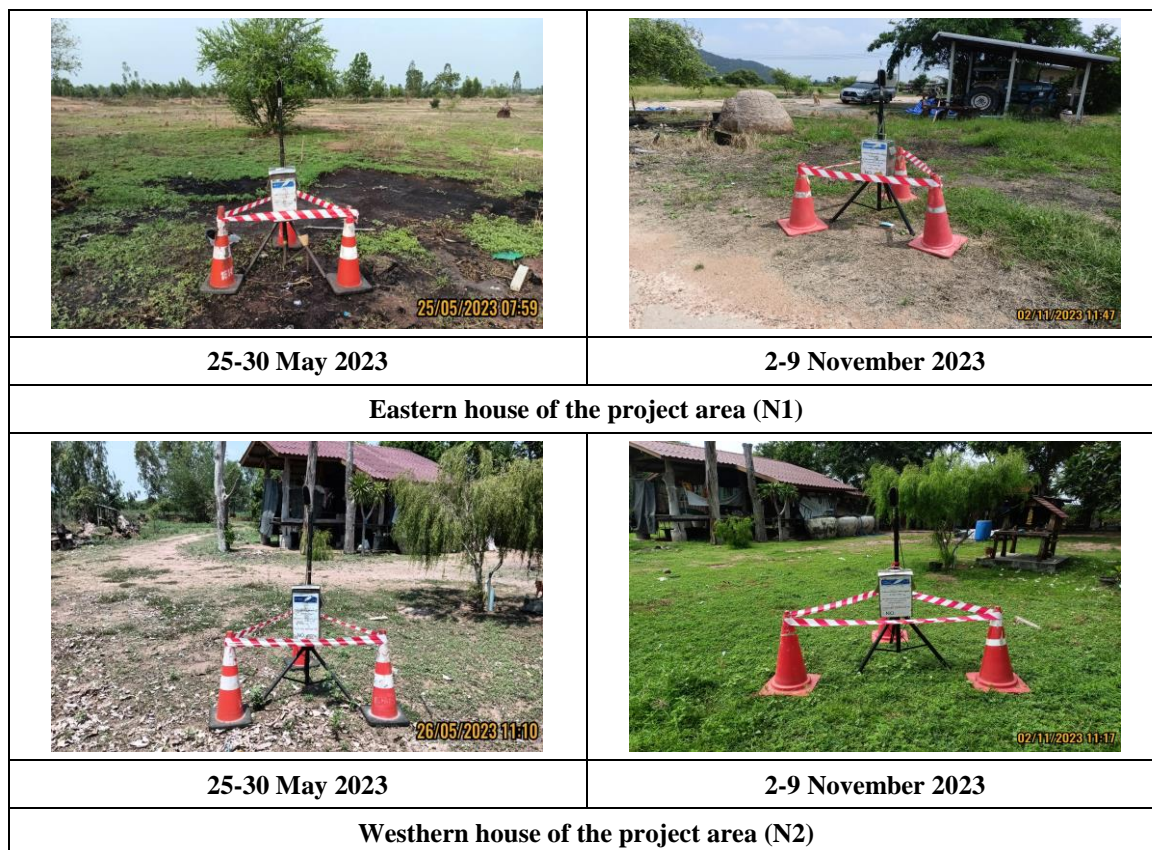
(3) **Day-night average sound levels ( $L_{dn}$ )** *during dry season*, the average daytime and nighttime noise level at the houses on the eastern area of the project area (N1) and the western area of the project area (N2) are between 50.5-54.9 and 56.0-58.1 dB(A), respectively. *during dry season*, they are between 51.1-56.2 and 63.9-68.0 dB(A), respectively.

(4) **Sound level at the 90<sup>th</sup> percentile ( $L_{90}$ ) (Background Noise Level)** *During dry season*, the background noise level at of the houses on the eastern area of the project area (N1) and the western area of the project area (N2) are between 37.2-42.5 and 43.8-44.9 dB(A), respectively. *during dry season*, they are between 41.1-44.3 and 53.8-57.8 dB(A), respectively.





**FIGURE 3.1-10 : SOUND LEVEL MEASUREMENT STATION**



**FIGURE 3.1-11 : SOUND LEVEL MEASUREMENT IN THE PROJECT AREA BETWEEN 25-30 MAY 2023 AND 2-9 NOVEMBER 2023**

**TABLE 3.1-7  
INDEX OF SOUND ANALYSIS, SAMPLING METHOD AND ANALYSIS METHOD**

<b>Index</b>	<b>Sampling</b>	<b>Analysis method</b>	<b>Reference</b>
$L_{eq}$ 24 hr	Integrating Sound Level Meter	International Organization for Standardization	1/
$L_{90}$			
$L_{dn}$			
$L_{max}$			

**Note :** <sup>1/</sup> Notification of the National Environment Board, No. 15, 1997 on General Noise Level Standards

**TABLE 3.1-8**  
**RESULTS OF SOUND LEVEL MEASUREMENT IN THE PROJECT AREA**  
**BETWEEN 25-30 MAY 2023 AND 2-9 NOVEMBER 2023**

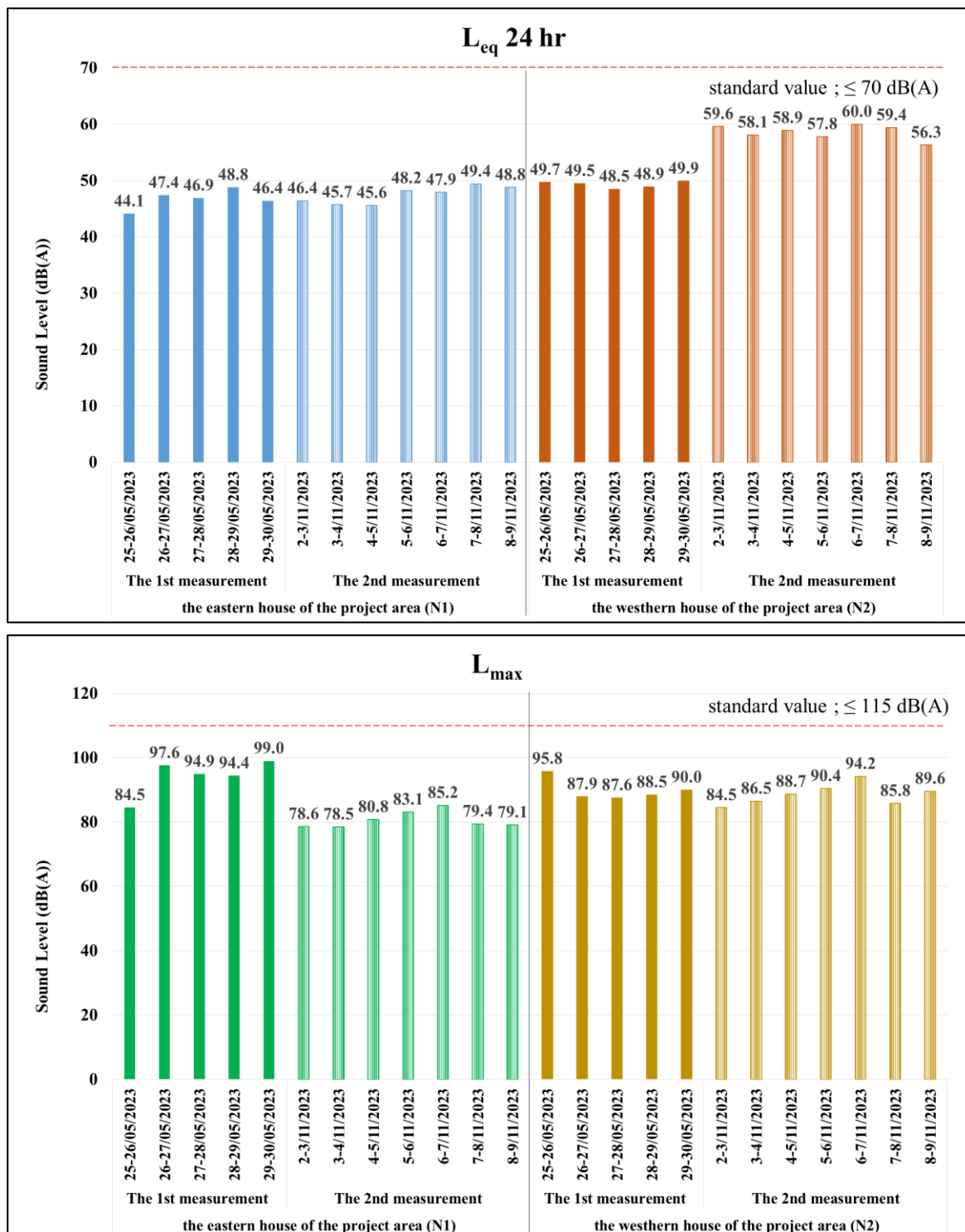
Station	Date/Month/Year	Sound level (decibel(A))			
		L <sub>eq</sub> 24hr	L <sub>max</sub>	L <sub>dn</sub>	L <sub>90</sub>
the eastern house of the project area (N1) (47P 0582266 E, 1593064 N)	25-26/05/2023	44.1	84.5	50.5	37.2
	26-27/05/2023	47.4	97.6	53.7	41.0
	27-28/05/2023	46.9	94.9	52.7	40.7
	28-29/05/2023	48.8	94.4	54.9	42.5
	29-30/05/2023	46.4	99.0	52.6	40.7
	<b>Min-Max</b>	<b>44.1-48.8</b>	<b>84.5-99.0</b>	<b>50.5-54.9</b>	<b>37.2-42.5</b>
	<b>percentage of standard values<sup>1/</sup></b>	<b>63.0-69.7</b>	<b>73.5-86.1</b>	-	-
	2-3/11/2023	46.4	78.6	51.7	41.8
	3-4/11/2023	45.7	78.5	51.4	41.6
	4-5/11/2023	45.6	80.8	51.1	41.1
	5-6/11/2023	48.2	83.1	52.3	43.2
	6-7/11/2023	47.9	85.2	54.5	42.9
	7-8/11/2023	49.4	79.4	56.2	44.3
	8-9/11/2023	48.8	79.1	56	44.0
	<b>Min-Max</b>	<b>45.6-49.4</b>	<b>78.5-85.2</b>	<b>51.1-56.2</b>	<b>41.1-44.3</b>
<b>percentage of standard values<sup>1/</sup></b>	<b>65.14-70.57</b>	<b>68.26-74.09</b>			
the western house of the project area (N2) (47P 0581010 E, 1592490 N)	25-26/05/2023	49.7	95.8	58.1	44.9
	26-27/05/2023	49.5	87.9	57.8	43.8
	27-28/05/2023	48.5	87.6	56.0	44.4
	28-29/05/2023	48.9	88.5	56.9	44.2
	29-30/05/2023	49.9	90.0	57.8	44.8
	<b>Min-Max</b>	<b>48.5-49.9</b>	<b>87.6-95.8</b>	<b>56.0-58.1</b>	<b>43.8-44.9</b>
	<b>percentage of standard values<sup>1/</sup></b>	<b>69.3-71.3</b>	<b>76.2-83.3</b>	-	-
	2-3/11/2023	59.6	84.5	66.5	57.4
	3-4/11/2023	58.1	86.5	66.2	55.4
	4-5/11/2023	58.9	88.7	66.6	56.3
	5-6/11/2023	57.8	90.4	66.0	54.4
	6-7/11/2023	60.0	94.2	65.7	57.8
	7-8/11/2023	59.4	85.8	68.0	56.8
	8-9/11/2023	56.3	89.6	63.9	53.8
	<b>Min-Max</b>	<b>56.3-60.0</b>	<b>84.5-94.2</b>	<b>63.9-68.0</b>	<b>53.8-57.8</b>
<b>percentage of standard values<sup>1/</sup></b>	<b>80.43-85.71</b>	<b>73.48-81.91</b>			
<b>Thai Standard values</b>	<b>70<sup>1/</sup></b>	<b>115<sup>1/</sup></b>	-	-	
<b>WHO Guidelines values</b>	<b>70<sup>2/</sup></b>	<b>110<sup>2/</sup></b>	-	-	

**Note :** 1/ Notification of the National Environment Board, No. 15, 1997 on General Noise Level Standards

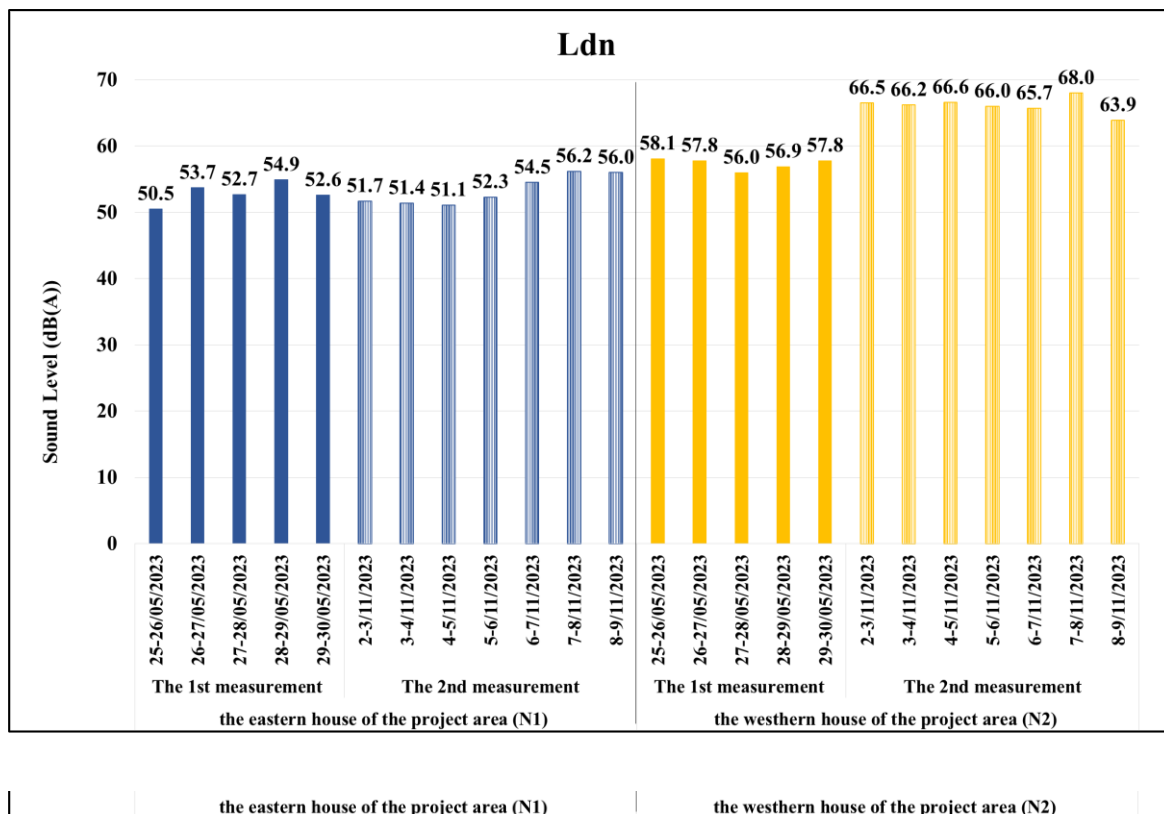
2/ WHO Guidelines for community noise, 1999

**Source :** Analysis by Environment Research & Technology Co., Ltd, 2023





**FIGURE 3.1-12 : GRAPH SHOWING THE RESULTS OF SOUND LEVEL MEASUREMENT**



**FIGURE 3.1-12 : GRAPH SHOWING THE RESULTS OF SOUND LEVEL MEASUREMENT (CONT'D)**

**Comparison of Sound level Results and International Standard**

Existing noise level measurement result during 25-30 May 2023 and 2-9 November 2023 compared with the WHO standard and IFC standard is as shown in **Table 3.1-9**. However, some results daytime and nighttime of Leq 1 hr were exceeded the standard value.

**TABLE 3.1-9**  
**RESULT OF SOUND LEVEL MEASUREMENT BETWEEN**  
**25-30 MAY 2023 AND 2-9 NOVEMBER 2023**

Station	Date	Leq 1 hr	
		Daytime (07.00-22.00)	Nighttime (22.00-07.00)
1. the eastern house of the project area (N1) (47P 0582266 E, 1593064 N)	25-26/05/2023	34.4-50.3	39.9-49.7
	26-27/05/2023	43.1-51.0	38.3-52.0
	27-28/05/2023	42.2-50.2	42.4-50.9
	28-29/05/2023	40.3-51.6	40.5-55.1
	29-30/05/2023	41.9-50.1	37.6-49.5
	<b>Min-Max</b>	<b>34.4-51.6</b>	<b>37.6-55.1</b>
	<b>percentage of standard values</b>	<b>62.5-93.8</b>	<b>83.6-122.4</b>
	2-3/11/2023	39.0-49.9	57.7-78.6
	3-4/11/2023	42.0-49.6	41.3-47.3
	4-5/11/2023	40.9-50.7	40.9-47.3
	5-6/11/2023	45.2-55.7	42.0-46.8
	6-7/11/2023	41.2-50.9	41.5-52.2
	7-8/11/2023	44.1-55.0	42.2-58.1
	8-9/11/2023	40.2-50.7	44.8-54.5
	<b>Min-Max</b>	<b>39.0-55.7</b>	<b>40.9-58.1</b>
	<b>percentage of standard values</b>	<b>70.91-101.27</b>	<b>90.89-129.11</b>
2. the western house of the project area (N2) (47P 0581010 E, 1592490 N)	25-26/05/2023	43.3-50.2	47.4-57.8
	26-27/05/2023	41.6-51.6	46.6-58.8
	27-28/05/2023	42.6-50.2	47.6-54.3
	28-29/05/2023	42.9-49.6	47.5-56.4
	29-30/05/2023	43.2-52.0	45.1-56.5
	<b>Min-Max</b>	<b>41.6-52.0</b>	<b>45.1-58.8</b>
	<b>percentage of standard values</b>	<b>75.6-94.5</b>	<b>100.2-130.7</b>
	2-3/11/2023	41.3-65.7	52.8-65.1
	3-4/11/2023	42.6-63.1	50.8-61.8
	4-5/11/2023	40.9-64.9	50.5-63.1
	5-6/11/2023	43.3-61.9	52.1-63.1
	6-7/11/2023	40.1-67.3	50.9-64.5
	7-8/11/2023	40.8-63.4	55.2-65.0
	8-9/11/2023	40.2-61.0	51.4-61.2
	<b>Min-Max</b>	<b>40.1-67.3</b>	<b>50.5-65.1</b>
	<b>percentage of standard values</b>	<b>72.91-122.36</b>	<b>112.22-144.67</b>
Noise Level Guideline <sup>1/</sup>	<b>Residential; institutional; education</b>	<b>55</b>	<b>45</b>
	<b>Industrial; commercial</b>	<b>70</b>	<b>70</b>

Source: <sup>1/</sup> Guidelines for Community Noise, World Health Organization (WHO), 1999.

### 3.1.5 Hydrology and Water Quality

#### (1) Hydrology

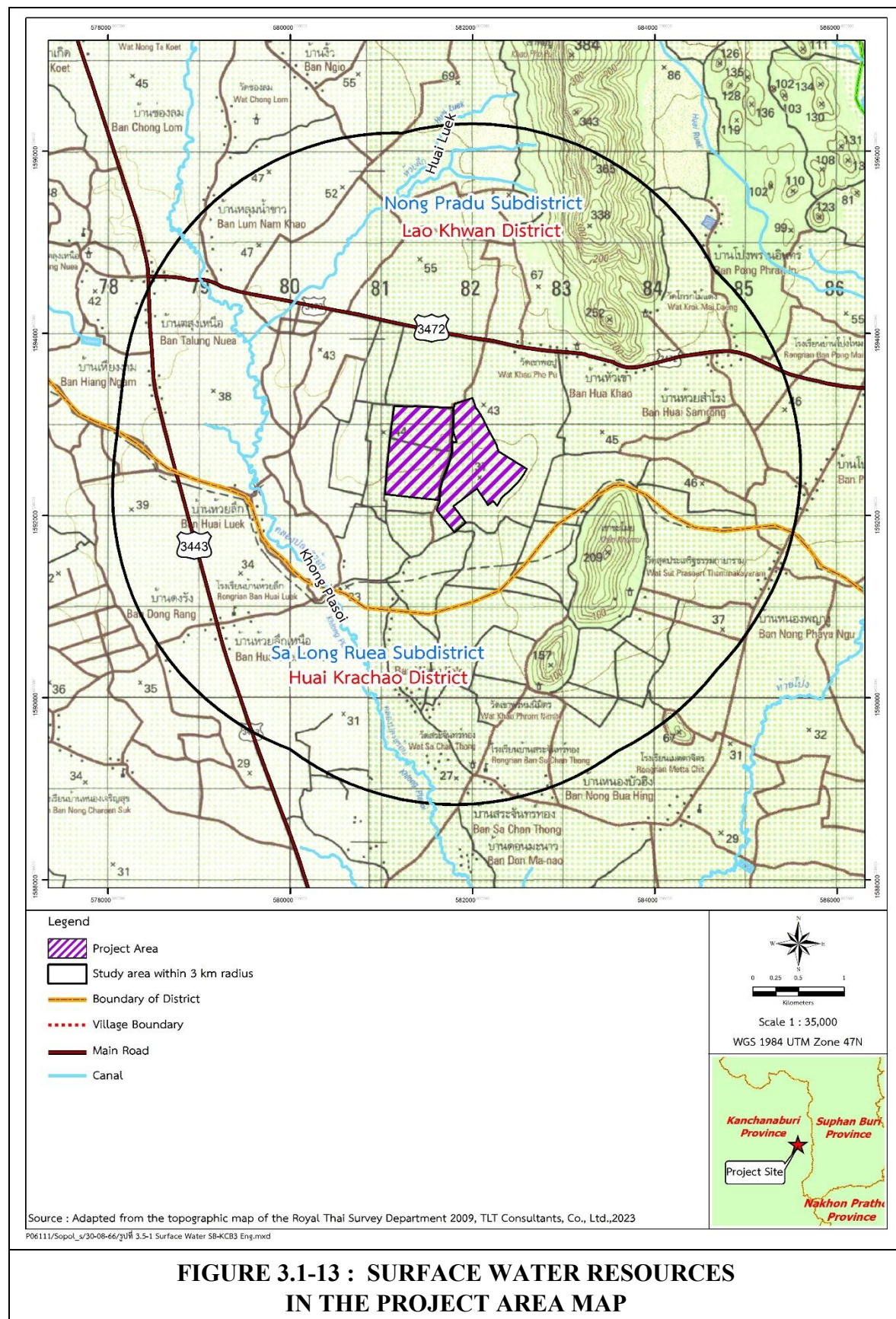
The hydrology data has been collected from related reports and documents. i.e., information about canals, rivers and related water resources in the project area conducted by related agencies such as 1: 50,000 topographical map of the Royal Thai Survey Department and the Royal Irrigation Department, etc.

There are important natural water sources in Kanchanaburi, i.e., the Kwai Noi River, Khwae Yai River and the Mae Klong River and 3 dams to store water for electricity generation, i.e., Vajiralongkorn Dam of Thong Pha Phum District, Srinakarin Dam of Si Sawat District and Tha Thung Na Dam of Mueang Kanchanaburi District. In addition, the Royal Irrigation Department has built another irrigation dam for agriculture, i.e., Mae Klong Dam of Tha Muang District.

In the project, there are 2 natural water resources (as shown in **Figure 3.1-13** and **figure 3.1-14**)

1) **Huai Luek** - During the dry season, the amount of water in the canal is lower and dry in some areas. The color of the water is light yellow with a slight smell. The water flows slowly. The elevation from the bank is about 4-5 meters, and the direction of the water flows from the north to the south. It is a source of water for agriculture.

2) **Khlong Pla Soi** - During the dry season, the amount of water in the canal is lower and dry in some areas. The color of the water is light yellow with a slight smell. The water flows slowly and sometimes is still. The elevation from the bank is about 5 meters. The direction of water flow is from north to south. It is a source of water for agriculture and receiving water from the community.







**FIGURE 3.1-14: SURFACE WATER RESOURCES IN THE PROJECT AREA.**

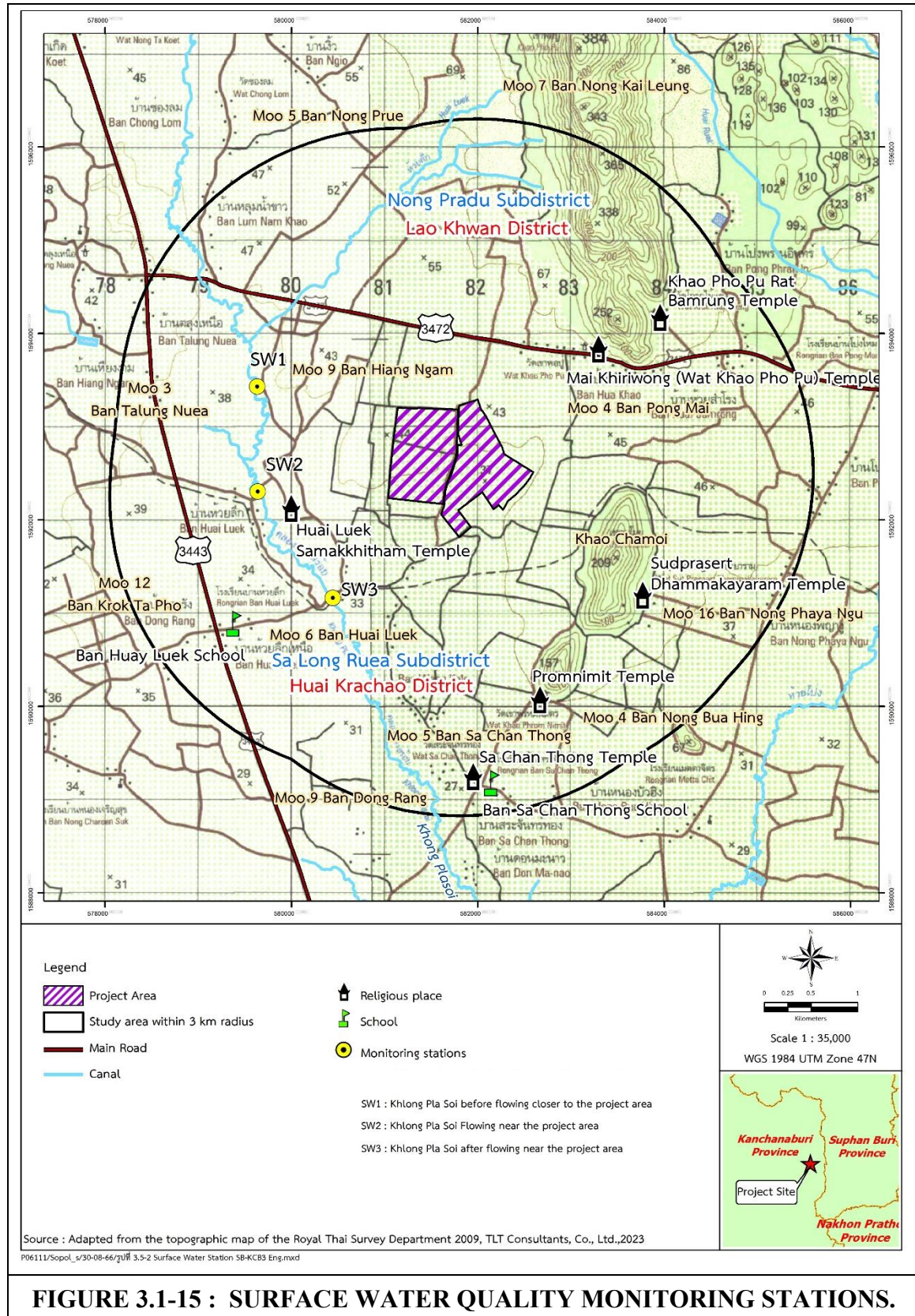
**(2) Surface water quality**

Water quality samples were collected in the project vicinity at 3 stations, i.e., Klong Pla Soi before flowing closer to the project area (SW1), Klong Pla Soi flowing near the project area (SW2), and Klong Pla Soi after flowing near the project area (SW3), as in **Figure 3.1-15**. Sampling was taken on 30 May 2023, as shown in **Figure 3.1-16**. The parameters were current velocity, temperature, color, transparency, depth, pH, electrical conductivity, salinity, dissolved oxygen (DO), BOD, COD, suspended solids, total coliform bacteria (TCB) and fecal coliform bacteria (FCB).

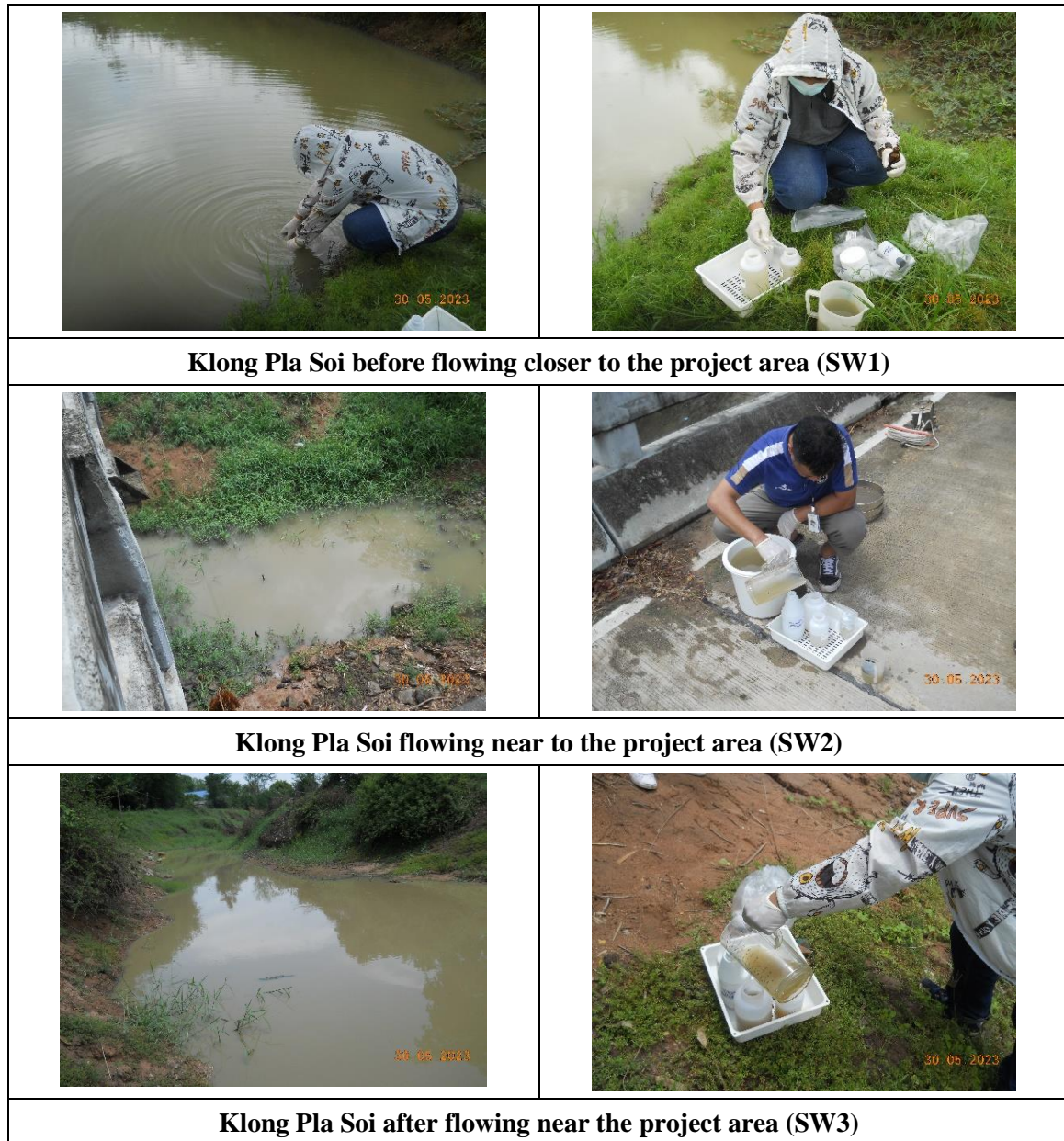
The result of the surface water quality analysis in Klong Pla Sang (**Appendix 3C**) when comparing Klong Pla Soi with the water quality standards in surface water sources according to the Notification of the National Environment Board, No. 8 (1994) shows that it is in type 3, a water source that receives wastewater from some activities which can be used for (1) consumption but disinfection and the general water quality improvement process are required (2) agriculture as the details (**Table 3.1-10**)

(A) **Klong Pla Soi before flowing closer to the project area (SW1)** is a shallow water resource for agriculture and receiving water from the community.

- **Physical quality of water** is still water with a temperature of 30.2 degrees Celsius, light yellow, 0.15-m transparency and 0.5 m depth.
- **Chemical water quality** has pH of 7.5, electrical conductivity of 411.0 micro/cm., salinity of 0.2 PPT, dissolved oxygen (DO) of 5.2 mg/l, BOD of 12 ml/l, COD of 70 ml/l, suspended solid of 107.3 ml/l and total dissolved solids of 206.0 mg/l.







**FIGURE 3.1-16 : SAMPLING OF WATER QUALITY IN KLONG PLA SOI.**



**TABLE 3.1-10**  
**RESULTS OF WATER QUALITY MONITORING IN KLONG PLA SOI**

Monitoring index	Unit	Monitoring stations			Standard value <sup>1/</sup>	
		SW1	SW2	SW3	Type 3	Type 4
<b>Physical</b>						
Current Velocity	m/sec	*	*	*	-	
Temperature	°C	30.2	31.7	35.6	Less than natural water for 3°C	
Color	-	Light yellow	Light yellow	Light yellow		
Transparency	m	0.15	0.15	0.03	-	-
Depth	m	0.5	0.2	0.3	-	-
<b>Chemical</b>						
pH	-	7.5	7.5	8.7	5.0 – 9.0	5.0 – 9.0
Electrical conductivity	µS /cm.	411.0	468.1	1,004.0	-	-
Salinity	PPT	0.2	0.2	0.5	-	-
Dissolved oxygen (DO)	mg/l	5.2	5.1	7.0	>4.0	>2.0
BOD	mg/l	12.0	8.6	21.0	less than 2.0	less than 4.0
COD	mg/l	70.0	67.0	187.0	-	-
Suspended Solids	mg/l	107.3	134.1	71.0	-	-
Total Dissolved Solids	mg/l	206.0	228.0	488.4	-	-
<b>Biological</b>						
Total Coliform Bacteria (TCB)	MPN/100ml.	7,900	7,900	7,900	20,000	-
Fecal Coliform Bacteria (FCB)	MPN/100ml.	2,200	4,900	3,300	4,000	-

**Note:** 1/ The Notification of the National Environment Board No. 8 (B.E. 2537) issued under the Enhancement and Conservation of National Environmental Quality Act 2535 (1992) regarding the prescribing of water quality standards in surface water sources.

\* Still water

**Source:** Environment Research & Technology Co., Ltd., 2023

- **Biological water quality** has total coliform bacteria (TCB) of 7,900 MPN/100 ml and fecal coliform bacteria (FCB) of 2,200 MPN/100 ml.

The results of surface water quality monitoring in Khlong Pla Soi before flowing closer to the project area shows that most monitoring indices are within the standard value of surface water quality sources according to the Notification of the National Environment Board, No. 8 (B.E. 2537), type 3 - water sources receiving wastewater from some activities and can be used for (1) Consumption but disinfection and general water quality improvement processes are required. (2) Agriculture, except the BOD that exceeds the standard type 3 but is still within the surface water quality standard in type 4 - water sources receiving wastewater from some activities and can be used for (1) Consumption, but disinfection and general water quality are required (2) Industry. Due to the general conditions in the sampling area which show that the land is an agricultural area, living space and establishments, wastewater from agricultural areas, communities and the establishment may be one of the factors for the high BOD value (BOD).

**(B) Khlong Pla Soi flowing near the project area (SW2)** is still water for agriculture and receiving water from the community.

- **Physical water quality** is still water with a temperature of 31.7degrees Celsius, light yellow, 0.15-m transparency and 0.2 m dept.

- **Chemical water quality** has pH of 7, electrical conductivity of 468.1 micro/cm, salinity of 0.2 PPT, dissolved oxygen (DO) of 5.1 mg/l, BOD of 8.6 mg/l, COD of 67.0 mg/l, suspended solid of 134.1 mg/l and total dissolved solids of 228.0 mg/l.

- **Biological water quality** has total coliform bacteria (TCB) of 7,900 MPN/100 ml and fecal coliform bacteria (FCB) of 4,900 MPN/100 ml.

The results of surface water quality monitoring in Khlong Pla Soi flowing near the project area show that most monitoring indices are within the standard value of surface water quality sources according to the Notification of the National Environment Board, No. 8 (B.E. 2537), type 3 - water sources receiving wastewater from some activities and can be used for (1) Consumption but disinfection and general water quality improvement processes are required. (2) Agriculture, except the BOD that exceeds the standard type 3 but is still within the surface water quality standard in type 4 - water sources receiving wastewater from some activities and can be used for (1) Consumption, but disinfection and general water quality are required (2) Industry. Due to the general conditions in the sampling area which show that the land is an agricultural area, living space and establishments, wastewater from agricultural areas, communities and the establishment may be one of the factors for the high BOD value (BOD).

**(C) Khlong Pla Soi after flowing near the project area (SW3)** is a shallow water resource for agriculture and receiving water from the community.

- **Physical quality of water** is still water with a temperature of 35.6 degrees Celsius, light yellow, 0.03-m transparency and 0.3 m depth.

- **Chemical water quality** has pH of 8.7, electrical conductivity of 1,004.0 micro/cm, salinity of 0.5 PPT, dissolved oxygen (DO) of 7.0 mg/l, BOD of 21.0 mg/l, COD of 187.0 mg/l, suspended solid of 71.0 mg/l and total dissolved solids of 488.4 mg/l.

- **Biological water quality** has total coliform bacteria (TCB) of 7,900 MPN/100 ml and fecal coliform bacteria (FCB) of 3,300 MPN/100ml.

The results of surface water quality monitoring in Khlong Pla Soi after flowing near to the project area show that most monitoring indices are within the standard value of surface water quality sources according to the Notification of the National Environment Board, No. 8 (B.E. 2537), type 3 - water sources receiving wastewater from some activities and can be used for (1) Consumption but disinfection and general water quality improvement processes are required. (2) Agriculture, except the BOD that exceeds the standard type 3 but is still within the surface water quality standard in type 4 - water sources receiving wastewater from some activities and can be used for (1) Consumption, but disinfection and general water quality are required (2) Industry. Due to the general conditions in the sampling area which show that the land is an agricultural area, living space and establishments which wastewater from agricultural areas, communities and the establishment may be one of the factors for the high BOD value (BOD).

### **3.1.6 Topography**

Secondary data on topography were collected from various sources, including work-related study reports and a topographic map from the Royal Thai Survey Department with a scale of 1:50,000. Additionally, a study of satellite imagery was conducted to assess the current land use of the area, its topographical features, and the distinctive characteristics of both the project site and its surrounding area.

The topography of Kanchanaburi Province consists of mountains, hills, and lowland river valleys. In the northern and western directions of the province, the terrain gradually transforms from mountains to hills and then descends to the south and east. It can be divided into three major zones; (1) Mountainous and Highland Zone: This area is situated in the northern part of the province and is characterized by continuous mountain ranges. Starting from the northern part of the province, there is a continuous mountain range known as Thongchai Range, which extends westward to become the Tanaosri Range. This range serves as a natural border between Thailand and Myanmar. In the southern part of this zone, important rivers originate, serving as significant sources of water for the province. (2) Plateau and Foothill Zone: This area is located in the eastern direction and the northern part of the province. It features a combination of plateau-like and hilly terrains. It spans across districts like Loei Khwan, Bo Phloi, and some parts of Phanom Thuan District. (3) Lowland River Valley Zone: This zone is situated in the southern part of the province. The landscape is characterized by fertile lowlands with rich soils. It covers areas in districts such as Tha Maka, Tha Muang, some parts of Phanom Thuan District, and the city of Kanchanaburi.

The project area is located in the Nong Pradu Subdistrict of Lao Khwan District and the Sa Long Ruea Subdistrict of Huai Krachao District, Kanchanaburi Province with the elevation of 28.56-40.48 meters MSL. The predominant topography surrounding the project area belongs to the Plateau and Foothill Zone, characterized by a blend of plateau-like and hilly terrains.

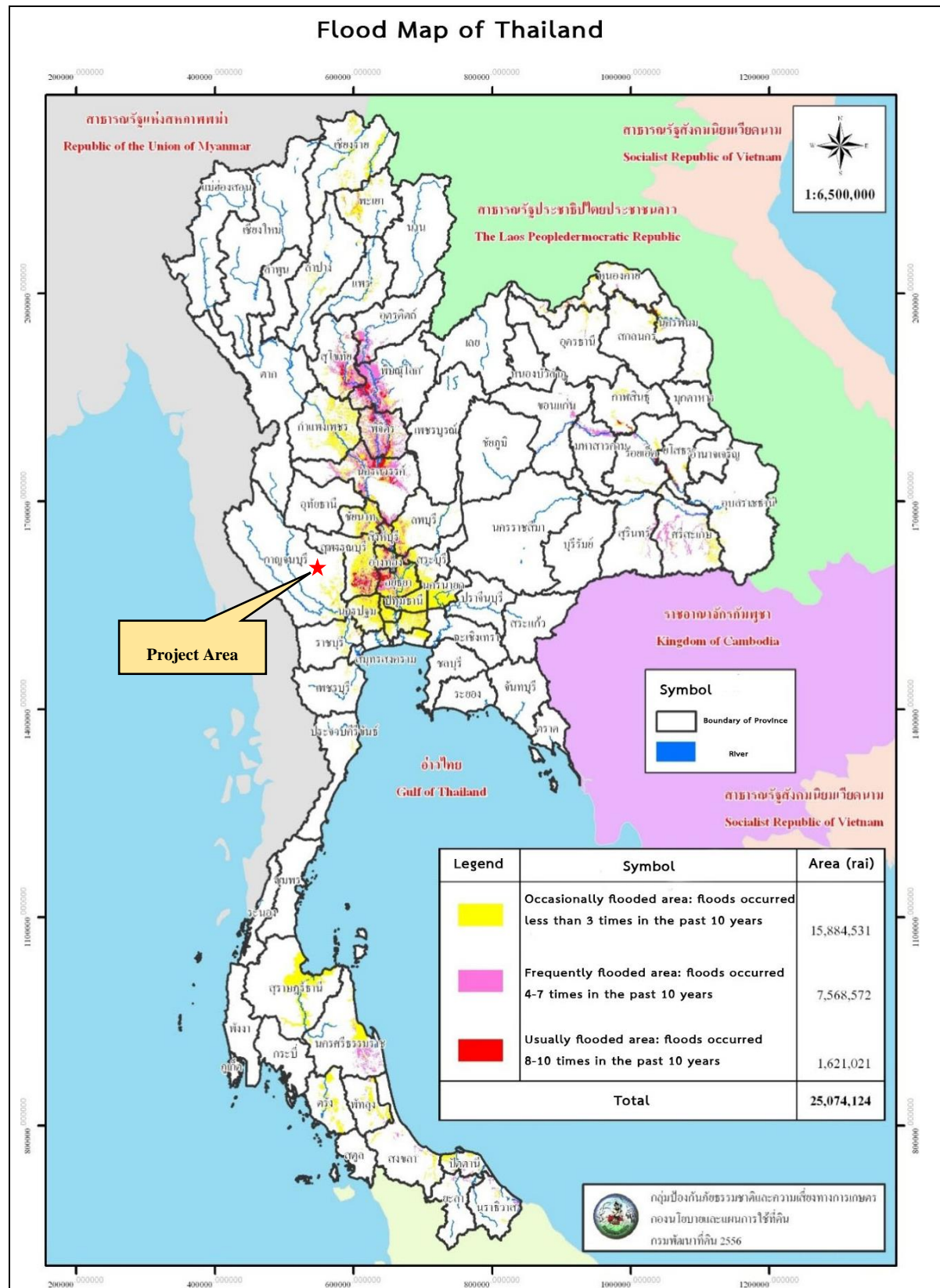
### 3.1.7 Flood Risk

The secondary data collection from the Natural Disaster Prevention and Agricultural Risk Group, Land Use Policy and Planning Division, Department of Land Development (2013) shows that the project area has no risk of repeated flooding, as shown in **Figure 3.1-17**. The flooding statistics in Kanchanaburi Province from the Department of Disaster Prevention and Mitigation of The Ministry of Interior show that during 2012-2018, there were 5 floods in Nong Fai Subdistrict, Lao Khwan District, Kanchanaburi Province. The distance from the project is about 30 kilometers to the northwest (NW).

KCB3 Project is located in the Mae Nam Tha Chin Plain Area Sub-Basin. The project site may be affected by floods caused by stormwater in the catchment area draining downstream to the Khlong Pla Soi. To simulate the flooding situation a mathematical model HEC-RAS was applied. The simulation covers the Khlong Pla Soi catchment area of about 207 km<sup>2</sup>. The model simulated flood maps using the frequency analysis results of maximum rainfall and the Digital Elevation Model (DEM) of catchment area. The Developed model was used to compute water levels in two scenarios of 100-year floods. The simulation results reveal that the average maximum flood depths in the inundated area with the 100-years return periods were estimated to be about 0.19 m. **Figure 3.1-18**.

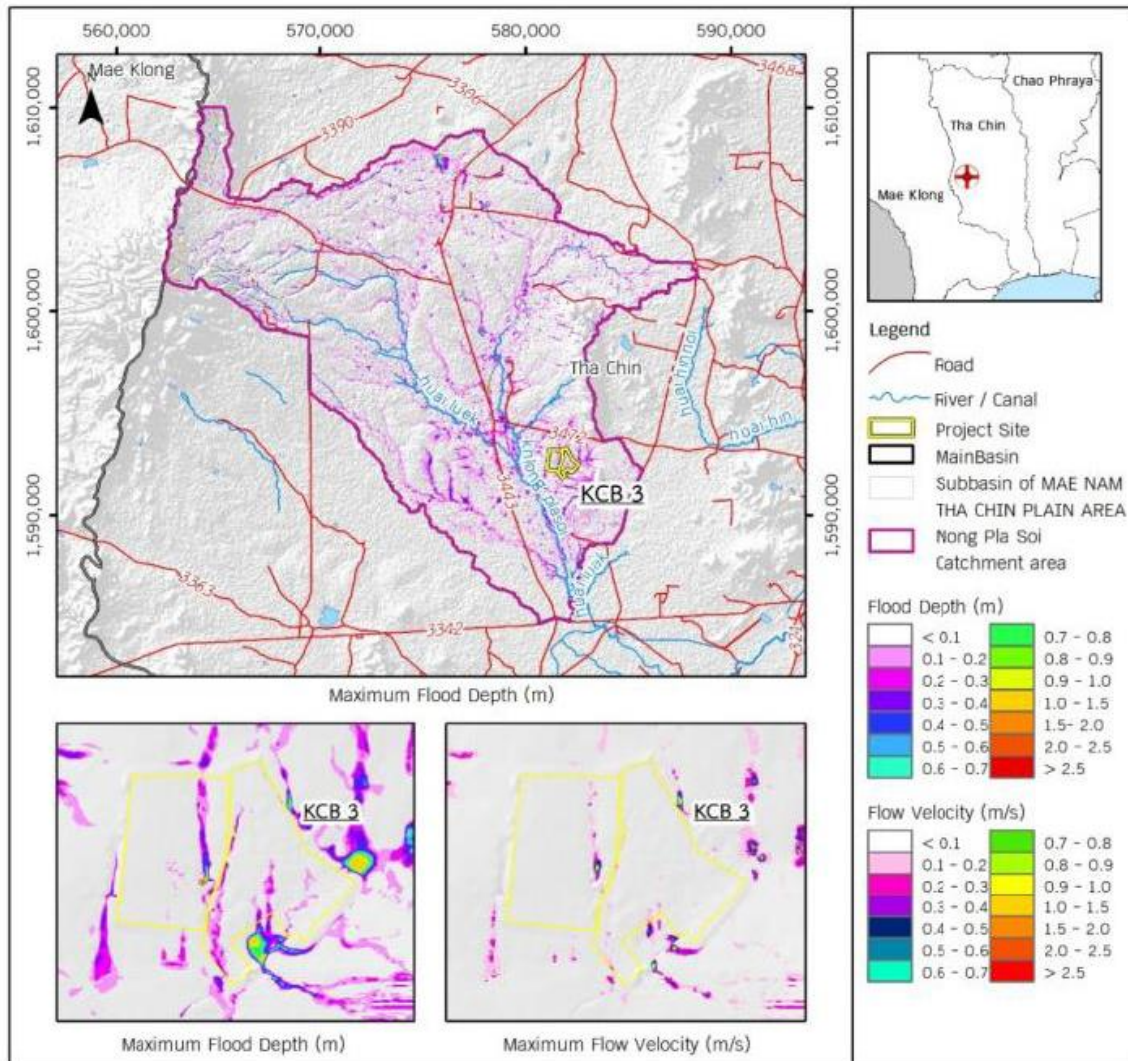
### 3.1.8 Solar Radiation

Solar energy is an important factor in the solar power generation system. The project has studied the potential of solar power generation in the project site from the solar energy potential map of Thailand based on satellite data as shown in **Figure 3.1-19**. From the report of renewable energy in Thailand between 2019-2021 of the Department of Alternative Energy Development and Efficiency, it was found that the annual average light intensity in Sra long ruea sub-district, Haul Kra chao district, Kanchanaburi province is about 18.0 MJ/square meter-day. Therefore, the areas that have the potential to generate electricity from solar energy.



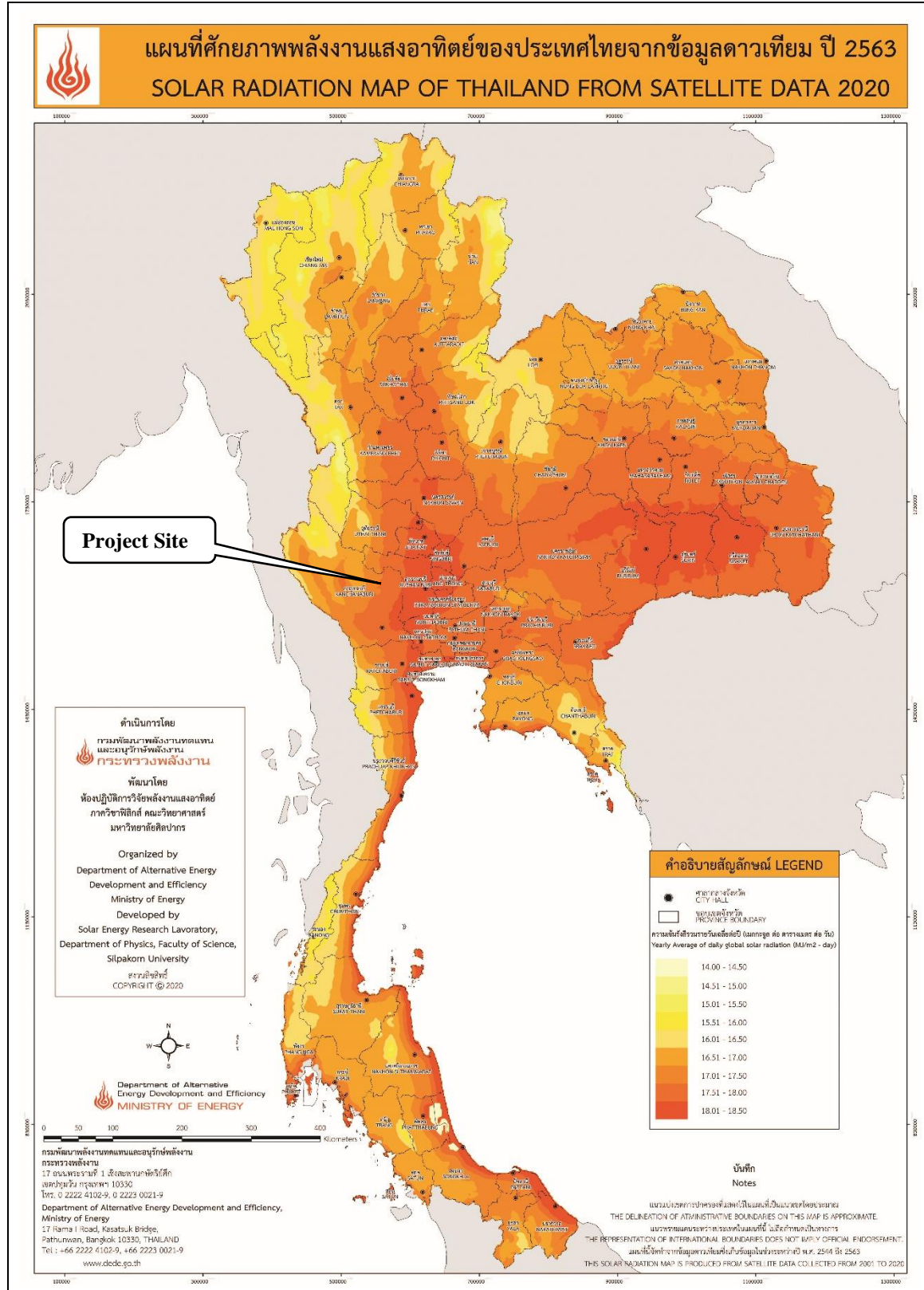
Source: Land Development Department, 2013 Modified by TLT Consultants Co., Ltd., 2023

**FIGURE 3.1-17 : MAP OF THAILAND'S REPEATED FLOODING AREAS IN 2013.**



**FIGURE 3.1-18 : SIMULATED FLOOD DEPTH MAP AT THE 100-YEAR RETURN PERIOD.**





Source: Thailand Alternative Energy Situation, 2021

**FIGURE 3.1-19 : THE SOLAR RADIATION MAP OF THAILAND FROM SATELLITE DATA**

## 3.2 BIOLOGICAL CONDITIONS

### 3.2.1 Terrestrial Ecology

#### 3.2.1.1 Forest Resources

##### (1) Secondary Data Collection

The secondary data on forest resources from the Royal Forest Department Department of National Parks, Wildlife and Plant Conservation shows that Kanchanaburi Province, with an area of approximately 12,176,968 rai or 19,483.15 square kilometers, has total forest resources of approximately 7,445,151 rai or 11,912.24 square kilometers, representing 61.14% of Kanchanaburi Province. The forest resources of Kanchanaburi Province are divided into 15 national reserved forests, 7 national parks, 2 wildlife sanctuaries, 3 non-hunting areas and 1 forest park, as shown in **Table 3.2-1** to **Table 3.2-5**.

However, no national reserved forests, national parks, wildlife sanctuaries, non-hunting areas and forest park are found in the project area, Sa Long Ruea Subdistrict, Huai Krachao District, as shown in **Figure 3.2-1**. For the study area of project found unofficial community forestry area of 2,356 rai (8.56% of study area) at Northeast and Southeast of project location as shown in **Figure 3.4-2** in Land Use Topic.

**TABLE 3.2-1**  
**NATIONAL RESERVED FOREST OF KANCHANABURI PROVINCE**

Order	Name of forest	District	Subdistrict	Area (rai)
1	Wat Phra Thaen Dong Rang	Thamaka	Phra Thaen	1,344
2	Chat Yai and Khao Soong Forest	Dan Makham Tia	Glondo, Dan Makham Tia, Rangali	13,275
3	Salaengphan	Phanom Thuan	Phanom Thuan	1,040
4	Nhongrong	Phanom Thuan	Nong Rong	19,375
5	Eastern Chong Nonsi	Phanom Thuan	Huai Krachao	37,500
6	Don Slap and Lao Khwan	Lao Khwan	Don Sa Laeb and Lao Khwan	337,500
7	Namjod	Thong Pha Phum	Cha Lae	472,706.25
8	Hauikhayeng	Thong Pha Phum / Sai Yok	Tha Khanun, Pilok, Hin Dat, Linthin / Sai Yok	376,320
9	Wangyai Forest and Noi River	Thong Pha Phum /Sai Yok	Linthin/Sai Yok, Lum Sum, Sing, Srimongkol	996,418
10	Khao Chang Phuak	Sangkhla Buri / Thong Pha Phum	Nongloo, Prungphlae/ Pilok, Tha khanun	1,085,977
11	Khao Phra Ruesi and Khao Bo Rae, the first plot	Sai Yok/ Thong Pha Phum / Sangkhla Buri	Sai Yok / Hin Dat, Tha khanun, Pilok, Cha Lae, Linthin/ Prungphlae	542,500
12	Khao Tha La Mao	Si Sawat / Thong Pha Phum	Nong Pet, Tha Kradan, Cha Lae	6,781
13	The paper mill, the sixth plot	Si Sawat	Khao Jod	101,562
14	Nong Ree	Si Sawat/ Bo Phloi	Khao Jod/Nong Ree	272,187
15	Khao Phra Ruesi and Khao Bo Rae, the second plot	Si Sawat/ Bo Phloi	Khao Jon, Na Suan, Nong Pet, Dan Mae Chalab/ Nong Ree	750,000

**Source:** Provincial Office for Natural Resources and Environment Kanchanaburi, 2023



**TABLE 3.2-2  
KANCHANABURI NATIONAL PARKS**

Order	Name	District	Area (rai)
1	Khao Leam	Thong Pha Phum/ Sangkhla Buri	935,584.69
2	Thong Pha Phum	Thong Pha Phum/ Sangkhla Buri	772,214.27
3	Lam Khlong Ngu	Thong Pha Phum	420,374.00
4	Srinagarindra Dam	Sai Yok / Si Sawat / Thong Pha Phum	957,500.00
5	Chaloem Rattanakosin	Si Sawat	36,875.00
6	Erawan	Sai Yok / Si Sawat /Mueang	343,735.00
7	Sai Yok	Sai Yok	595,868.00

Source: Provincial Office for Natural Resources and Environment Kanchanaburi, 2023

**TABLE 3.2-3  
KANCHANABURI WILDLIFE SANCTUARY**

Order	Name	District	Area (rai)
1	Thung Yai Naresuan	Thong Pha Phum / Sangkhla Buri	1,331,062.00
2	Salak Phra	Mueang / Bo Phloi	536,594.00

Source: Provincial Office for Natural Resources and Environment Kanchanaburi, 2023

**TABLE 3.2-4  
KANCHANABURI NON-HUNTING AREA**

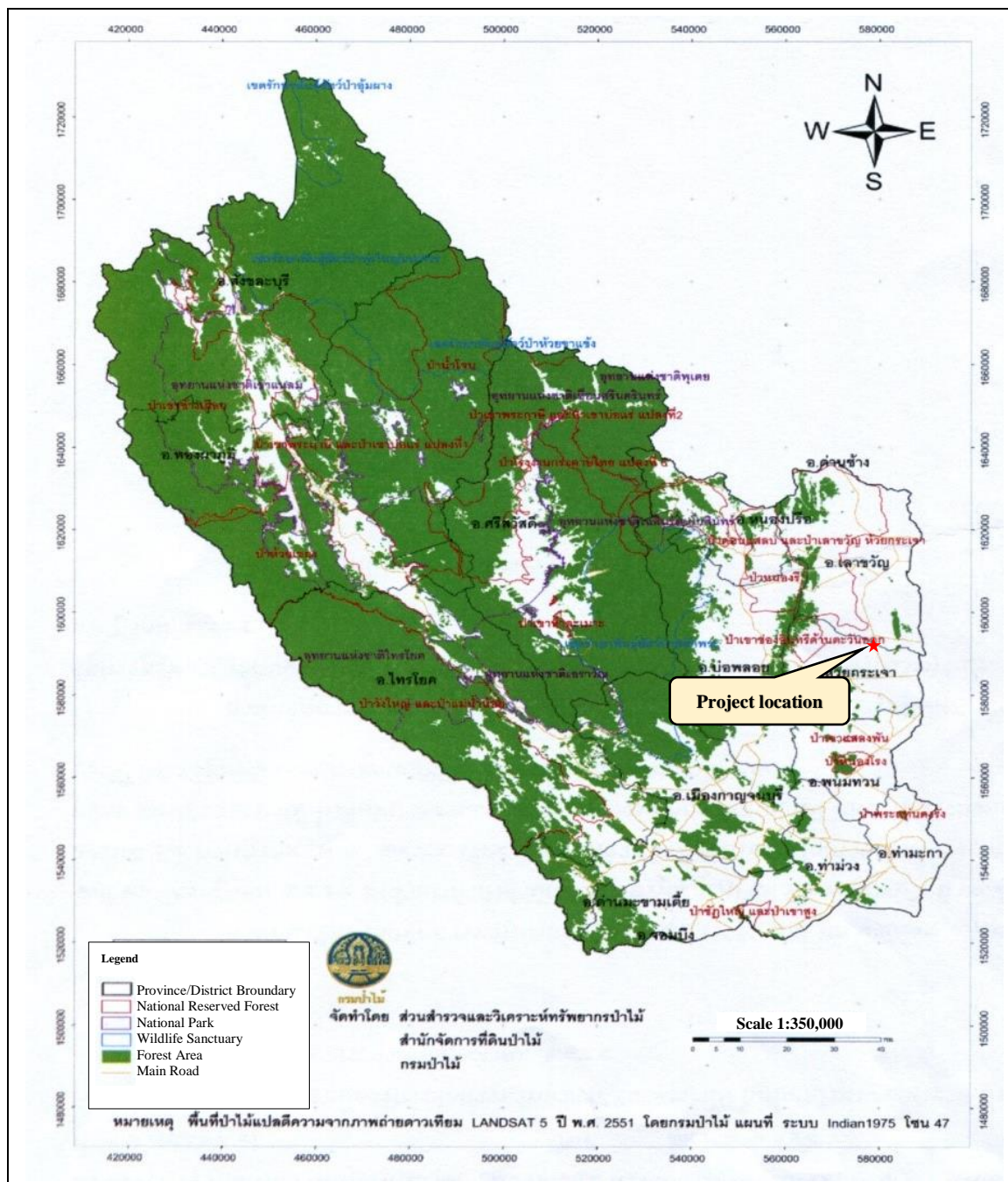
Order	Name	District	Area (rai)
1	The princess Mother Memorial Park	Mueang	56,250.00
2	Lawa-Daowadueng cave	Sai Yok	58,537.00
3	Kroeng Krawia Swamp and Nong Nam Sub	Thong Pha Phum	297.00

Source: Provincial Office for Natural Resources and Environment Kanchanaburi, 2023

**TABLE 3.2-5  
KANCHANABURI FOREST PARKS**

Order	Name	District	Area (rai)
1	Phra Thaen Dong Rang Forest Park	Thamaka	1,471.00

Source: Provincial Office for Natural Resources and Environment Kanchanaburi, 2023



Source : Forest Land Management Office, Royal Forest Department, 2023

**FIGURE 3.2-1: FOREST AREA IN KANCHANABURI**

## (2) Field Survey

The forest resources in the project area and within the radius of 3 kilometers of the project boundary were surveyed in November 2023. The survey focus on the abundance of forest.

### Study Procedure

1) Scope of the study area. The forest resources in the project area and the radius area of 3km. will be surveyed, with emphasis on the abundance of forest.

#### 2) Study techniques

2.1) Collect the land use information in the year 2022. Categorize the land use types by visual translation from the drone and update the information to indicate the study areas of ecology and forest resources.

2.2) Survey the area for topography, plant communities and current characteristics of the land use of the project area. Information from the drone and information system, such as Google Earth, will be employed to plan the field survey and data collection.

2.3) Survey the varieties of plant in the study area. Emphasis is made on the types of trees with the chest-level height of 1.30 m. and diameter of more than 4.5 cm.

2.4) Survey the varieties of plant in the project area. Emphasis is made on the types, quantity, diameter, height and position of trees with the chest-level height of 1.30 m. and diameter of more than 4.5 cm.

#### 3) Data analysis

3.1) Analyze the types of trees, for example, common name, scientific name, family name and habit.

3.2) Analyze the carbon sequestration of the perennial plant in the project area.

3.3.1) Calculate the volume of above ground biomass of the perennial plant with Ogawa et al. (1965)'s Allometric Equation, as follows:

$$W_S = 0.0396(D^2H)^{0.933}$$

$$W_B = 0.00349(D^2H)^{1.027}$$

$$W_L = (28.0/W_S + W_B + 0.025)^{-1}$$

$$W_T = W_S + W_B + W_L$$

when  $W_S$  is the biomass of the trunk (kilogram)

$W_B$  is the biomass of the branch (kilogram)

$W_L$  is the biomass of the leave (kilogram)

$W_T$  is all the above ground biomass (kilogram)

D is the chest-level diameter (centimeter)

H is the height (meter)

3.2.2) Calculate the below ground biomass of the perennial plant. The ratio of the dry weight of the root to the trunk is 27.0 (IPCC, 2006).

3.2.3) Calculate the average of carbon in the plan tissue. The ratio of carbon in the biomass of the perennial plant is 47.0 (IPCC, 2006).

3.2.4) Calculate the carbon sequestration of the perennial plant. Employing all the biomass, carbon in the biomass of the perennial plant and carbon dioxide and carbon, as follows:

the carbon sequestration (kgCO<sub>2</sub>eq) = biomass (kg.) x  
0.47 x (44/12)

3.2.5) Analyze the environmental valuation or analysis of the carbon sequestration. The carbon sequestration is multiplied by the price of current carbon credit trading, according to Thailand Greenhouse Gas Management Organization (2023).

4) Status assessment will assess the trees' status, both the tree legal protection and tree preservation orders, with details as follows:

4.1) Tree legal protection is the tree that is protected by the forest act, B.E. 2562 (2019). It is categorized into 2 types as follows:

– Restricted wood type A. The wood business of this type must be authorized by the authorized person or concession according to the law. The wood is listed in the Restricted Wood declared under the Royal Decree, B.E. 2530 (1987) and the Restricted Wood declared under the Royal Decree, B.E. 2565 (2022).

– Restricted wood type B. This is specially restricted by the government or rare wood. The wood business is prohibited except for the special permit from the Minister of Agriculture and Cooperatives of Thailand. The wood is listed in the Restricted Wood declared under the Royal Decree, B.E. 2530 (1987).

4.2) The Conservation status from Department of National Park, Wildlife and Plant Conservation (2017) will be considered according to the status of threatened plants in Thailand. The status can be categorized into 8 types: (1) Rare: R (rare to find plants), (2) critically endangered animal: CR (plants are critically endangered in the nature), (3) endangered animal: EN (plants are riskily endangered in the nature), (4) vulnerable animal: VU (plants are vulnerably endangered in the nature), (5) near threatened animal: NT (plants are nearly threatened in the nature), (6) least concern animal: LC (plants are generally found and not in the risk endanger), (7) data deficient: DD (data is deficient to be in any status), and (8) not listed. The IUCN Red List of Threatened Species (2022-2) is categorized into 7 types: (1) critically endangered animal: CR (plants are critically endangered in the nature), (2) endangered animal: EN (plants are riskily endangered in the nature), (3) vulnerable animal: VU (plants are vulnerably endangered in the nature), (4) near threatened animal: NT (plants are nearly threatened in the nature), (5) least concern animal: LC (plants are generally found and not in the risk endanger), (6) data deficient: DD (data is deficient to be in any status), and (7) not listed.

5) The impact assessment. The impact assessment of the forest resources will analyze the environment that expected to be directly affected by the project, such as the forest or the area. There are 2 groups of assessment: (1) the plants have positive impact because of the new environment caused by the project contributes to the natural growth and (2) the plants have negative impact because of the change in environment caused by the project. The negative impact can be categorized into 3 types as follows:

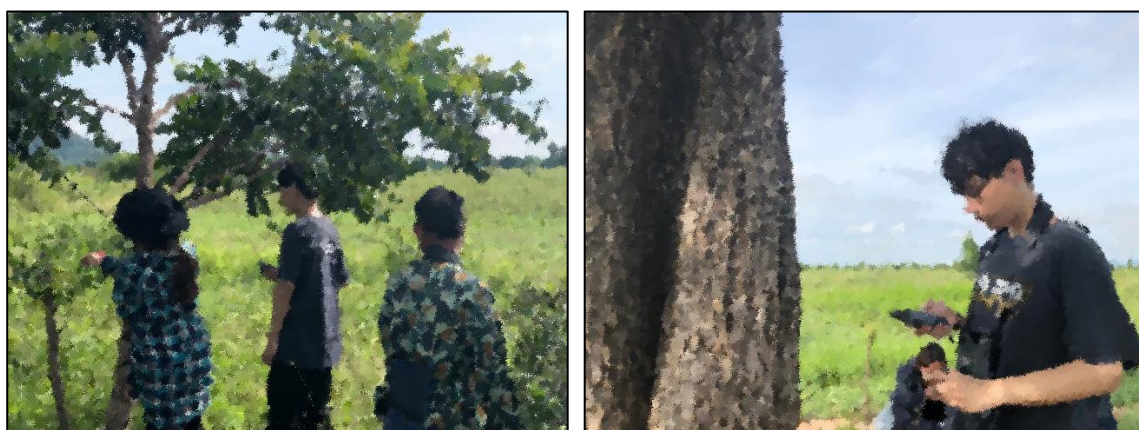
5.1) Minor impact. Most plants are large in numbers, not listed in the restricted wood type A or not in the status for preservation. Plants can adapt themselves to the change during the construction and operation phases of the project.

5.2) Moderate impact. Most plants are moderate or low in numbers, listed in the restricted wood type A or in the status for preservation with low to moderate threat. They can grow and expand in the nearby project area during the construction and the operation phases.

5.3) High impact. Most plants are low in numbers, endemic species, sentimental value and listed in the restricted wood type B. They have the status of critically endanger and cannot grow or expand in the nearby project area during the construction and the operation phases.

### Survey Results

The study results of the forest resources in the project area in November 2023 (Figure 3.2-2) are displayed as follows:



**FIGURE 3.2-2 : THE SURVEY OF THE FOREST RESOURCES IN THE PROJECT AREA**

#### 1) Land use in the study area

From the survey of the topography plant community, and land use characteristics in the project study area, it was found that the study area encompasses the community forest area of Khao Pho Pu Chalom Phra Kiat, Nong Pradu Subdistrict, Lao Khwan District. The topography of the area consists of flat terrain interspersed with hills and slopes. The land use patterns include community areas and agricultural areas, such as tapioca, sugarcane, yucca, rice fields, field crops, and livestock farming, including buffaloes. The surrounding areas of the project site also feature planted ornamental plants in the community, along field edges, roadsides, and forested areas, such as Eucalyptus (*Eucalyptus camaldulensis*) Rain Tree (*Samanea saman*) Golden shower (*Cassia fistula*) Siamese neem tree (*Azadirachta indica*) Copper pod (*Peltophorum dasyrrhachis*) Queen's crape myrtle (*Lagerstroemia speciosa*) Pluang (*Dipterocarpus tuberculatus*) Teng (*Shorea obtusa*) Barking Deer's Mango (*Irvingia malayana*) Ceylon oak (*Schleichera oleosa*) Ma kha num (*Sindora siamensis*) Indian Walnut (*Albizia lebbbeck*) Ironwood (*Xylia xylocarpa*) Burma Padauk (*Pterocarpus macrocarpus*) Chaeng (*Maerua siamensis*) Ivory (*Wrightia arborea*). The project area has an open landscape. Some parts are used for agricultural cultivation, including cassava, and there is livestock farming, specifically involving buffaloes.

#### 2) The Forest Ecosystem in the Project Area

##### 2.1) Plant Diversity

From surveying the project area, it was found that the agriculture area has 8 species of tree, 8 genus, and 8 families. The tree found in the area as listed in Table 3.2-6

**TABLE 3.2-6  
LIST OF TREE IN THE PROJECT AREA**

No.	Common name	Family name	Scientific name	Habit	Status		No. of plants			Total
					DNP (2017)	IUCN (2022-2)	Restricted wood type A	Restricted wood type B	Not listed	
1	Chaeng	CAPPARACEAE	<i>Maerua siamensis</i>	T	-	-	-	-	19	19
2	Malabar Ebony	EBENACEAE	<i>Diospyros malabarica</i>	T		LC	2	-	-	2
3	Thanon chai	ANACARDIACEAE	<i>Buchanania siamensis</i>	T	-	-	8	-	-	8
4	Burma Padauk	FABACEAE	<i>Pterocarpus macrocarpus</i>	T	-	EN	2	-	-	2
5	Tellicherry tree	APOCYNACEAE	<i>Holarrhena pubescens</i>	T	-	LC	2	-	-	2
6	Hairy Keruing	DIPTEROCARPACEAE	<i>Dipterocarpus obtusifolius</i>	T	-	NT	6	-	-	6
7	Eucalyptus	MYRTACEAE	<i>Eucalyptus camaldulensis</i>	ExT	-	NT	-	-	131	131
8	Siamese neem tree	MELIACEAE	<i>Azadirachta indica</i>	T	-	LC	12	-	-	12
<b>Total Number of Trees (unit)</b>							<b>32</b>	<b>-</b>	<b>150</b>	<b>182</b>
<b>Total Number of Plant Species (species)</b>							<b>6</b>	<b>-</b>	<b>2</b>	<b>8</b>

- Remarks:**
- Habit: T = Tree, S/T = Shrub/Tree, ST = Shrubby Tree, ExT = Exotic Tree
  - Status: the restricted wood according to the forest law are categorized into 2 types:
    - 1) Restricted wood type A: the wood business of this type must be authorized by the authorized person or concession according to the law.
    - 2) Restricted wood type B: this is specially restricted by the government or rare wood.
  - DNP (2017) = plants listed in Threatened Plants in Thailand
  - IUCN (2022) = plants listed in IUCN Red List of Threatened Species. Version 2022-2  
 CR = critically endangered                      EN = endangered                      VU = vulnerable  
 NT = near threatened                              LC = least concern                      - = no status

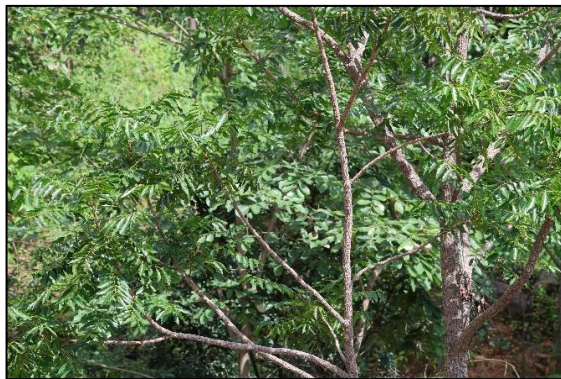




Ma kha num (*Sindora siamensis*)



Burma Padauk (*Pterocarpus macrocarpus*)



Siamese neem tree (*Azadirachta indica*)



Thanon chai (*Buchanania siamensis*)



Eucalyptus (*Eucalyptus camaldulensis*)



Rain Tree (*Samanea saman*)

**FIGURE 3.2-3 : SAMPLES OF PLANTS IN THE STUDY AREA**



## 2.2) The Plant Status

From the survey of forest resources in the project area, there are 8 types of plants. With reference to the protected status by the forest act, B.E. 2562 (2019), there are 6 restricted wood type A (75.0%) and 2 types of plant that are not listed in the restricted wood type B (25.0%). The restricted wood type A are Malabar Ebony (*Diospyros malabarica*) Thanon chai (*Buchanania siamensis*) Burma Padauk (*Pterocarpus macrocarpus*) Tellicherry tree (*Holarrhena pubescens*) Hairy Keruing (*Dipterocarpus obtusifolius*) Siamese neem tree (*Azadirachta indica*) In this regard, the project area does not contain any prohibited plant species under category B (Wild Plants) when assessed for conservation status based on the IUCN (2022-2), which considers the global threat status (IUCN Red List of Threatened Species). Only one plant species was identified as near-threatened (EN), and it is: Burma Padauk (*Pterocarpus macrocarpus*) and plant species near-threatened (NT) include 2 species, namely: Hairy Keruing (*Dipterocarpus obtusifolius*) Eucalyptus (*Eucalyptus camaldulensis*) (as listed in **Table 3.2-6**).

### 3) Carbon Sequestration of Perennial Plants

There are 182 trees in the project area. After the above and below ground biomass analysis with Allometric equations, it is found that the biomass of the trees is 9,847.45 kg. : the biomass of the trunk is 6,412.03 kg., the biomass of the branch is 1,307.64 kg., the biomass of the leaves is 34.22 kg., and the biomass of the roots is 2,093.55 kg. (**Table 3.2-7**).

**TABLE 3.2-7**  
**BIOMASS OF THE TREES IN THE PROJECT AREA**

Plant community	Biomass (kg.)				
	Trunk (W <sub>s</sub> )	Branch (W <sub>B</sub> )	Leaves (W <sub>L</sub> )	Roots (W <sub>R</sub> )	Total
Trees in the project area	6,412.03	1,307.64	34.22	2,093.55	9,847.45

Carbon Sequestration from all the biomass, carbon in the biomass of the Perennial plants and carbon dioxide and carbon indicated that the Carbon Sequestration of the trees in the project area is 16.97 ton carbon dioxide.

### 4) The tree valuation

The environmental valuation is the calculation for carbon sequestration. The analysis is done by the carbon sequestration multiplied by the carbon credit trading of forest project (286.15 Baht/ton carbon dioxide). The Carbon Sequestration of the trees in the project is 16.97 ton carbon dioxide. The environmental valuation of the trees in the project is 4,856.09 Baht. (**Table 3.2-8**).

**TABLE 3.2-8**  
**THE ENVIRONMENTAL VALUATION FROM ASSESSMENT OF CARBON SEQUESTRATION**

<b>Plant community</b>	<b>Carbon Sequestration (ton carbon dioxide)</b>	<b>valuation (Baht)</b>
Trees in the project area	16.97	4,856.09

**Remarks:** Refer to the trading price of carbon credit of the forest area, November 2023.  
Thailand Greenhouse Gas Management Organization, (www.carbonmarket.tgo.or.th)

### 3.2.1.2 Wildlife Resources

#### (1) Secondary Data Collection

The secondary data on wildlife resources from the Department of National Parks, Wildlife and Plant Conservation, 2021, and the Journal of Wildlife in Thailand, Faculty of Forestry, Kasetsart University shows that wildlife resources in Kanchanaburi and the project area is detailed below:

##### 1) Wildlife resources in Kanchanaburi

Thungyai Naresuan Wildlife Sanctuary is a world heritage site of Thailand being in the registration by UNESCO in conjunction with Huai Kha Khaeng Wildlife Sanctuary under the name of Thung Yai-Huai Kha Khaeng Wildlife Sanctuary in 1991. It covers 6 districts of 3 provinces: Ban Rai District, Lan Sak District, Huai Khot District, Uthai Thani Province, Sangkhla Buri District, Thong Pha Phum District Kanchanaburi and Umphang District, Tak Province, with an area of 2,279,500 rai or 3,647 square kilometers. It can be divided as follows.

1. Thungyai Naresuan Wildlife Sanctuary on the east side in the area of Tak Province
2. Thungyai Naresuan Wildlife Sanctuary on the west side in the area of Kanchanaburi Province which the remaining area in this area is 1,331,062 rai

The geographical features of Thungyai Naresuan Wildlife Sanctuary are complex mountains. The average height is approximately 800–1,200 meters above sea level. Khao Yai is the highest peak of Thungyai Naresuan Wildlife Sanctuary, with 1,800 meters above sea level, and it is a habitat for many rare wild animals. Some rare wild species are endangered or endemic animals, such as wild elephants, gaurs, various kinds of tigers, Gray-backed pheasants, hornbills, chamois, hyenas, Thai peacocks and various kinds of wild insects.

The Salakpra Wildlife Sanctuary features 352 species of wildlife. Most of them are birds, with about 191 species, representing 54.26%, mammals, with about 59 species, representing 16.76% and fresh water fish, reptiles and amphibians, representing 13.07, 11.08 and 4.83 %, respectively. Overall, there are 41 species at a very high abundance level, 123 species at an abundance level, 151 species at a low abundance level and rare wildlife with 35 species.

## 2) Wildlife resources in the project area

The project area is located in Sa Long Rueda Subdistrict, Huai Krachao district, Kanchanaburi. The most of study area is agricultural land and housing. It found unofficial community forestry area of 2,356 rai (8.56% of study area) at Northeast and Southeast of project location. Only birds and reptiles are commonly seen in agricultural areas.

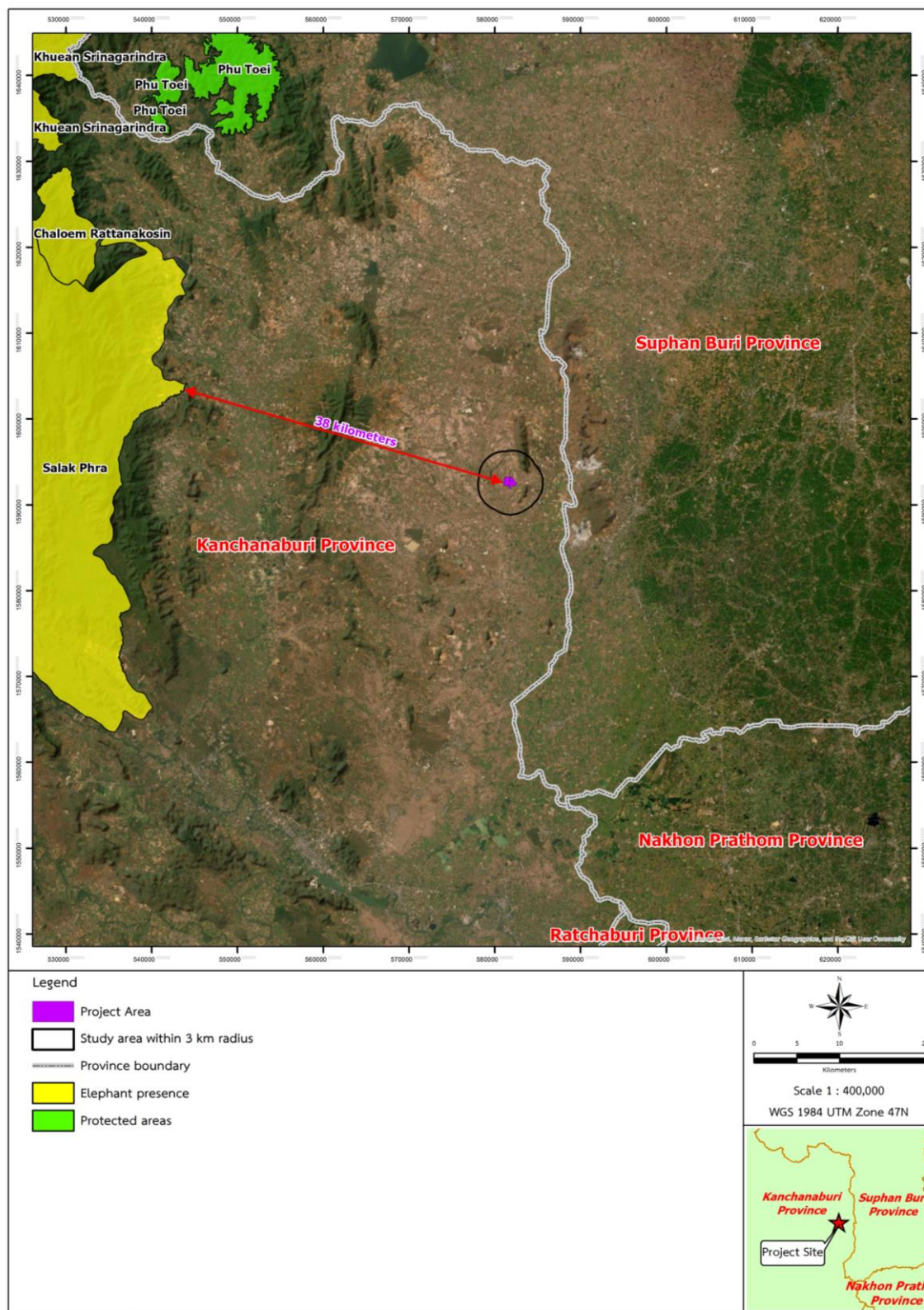
In addition, according to the proximity report generated from IBAT and provided by ADB, there were 5 endangered species within 50 kilometers of the Project site, namely Asian Elephant (*Elephas maximus*), Greater Adjutant (*Leptoptilos dubius*), Green Peafowl (*Pavo muticus*), Southeast Asian Box Turtle (Thailand : *Cuora amboinensis kamaroma*), and Steppe Eagle (*Aquila nipalensis*). From reviewing data on habitats and sightings of these 3 species, they were not found in the project area (57.78 ha) and the 3 km radius study area of the project, which the information shows as follows:

### **Asian Elephant (*Elephas maximus*)**

From the examination of data, the distribution of Asian elephants, according to the IUCN distribution status, does not show habitats and food sources for wild elephants in the study area within a radius of 3 kilometers. This aligns with the information on wild elephants found in the conservation areas of Thailand, as reported by humanelephantvoices.org. Therefore, considering the ecological data, distribution, and movement based on current evidence, including the analysis of the project location and the transmission lines passing through agricultural areas, community activities, and infrastructure systems with intense human activities, it is not a suitable habitat for wild elephants. Additionally, when considering the presence of elephants residing in the protected area of wildlife, if the distance is approximately 38 kilometers from the project study area, it is unlikely that there will be any significant impact on the elephants in the project area (see **Figure 3.2-4**).

### **Greater Adjutant (*Leptoptilos dubius*)**

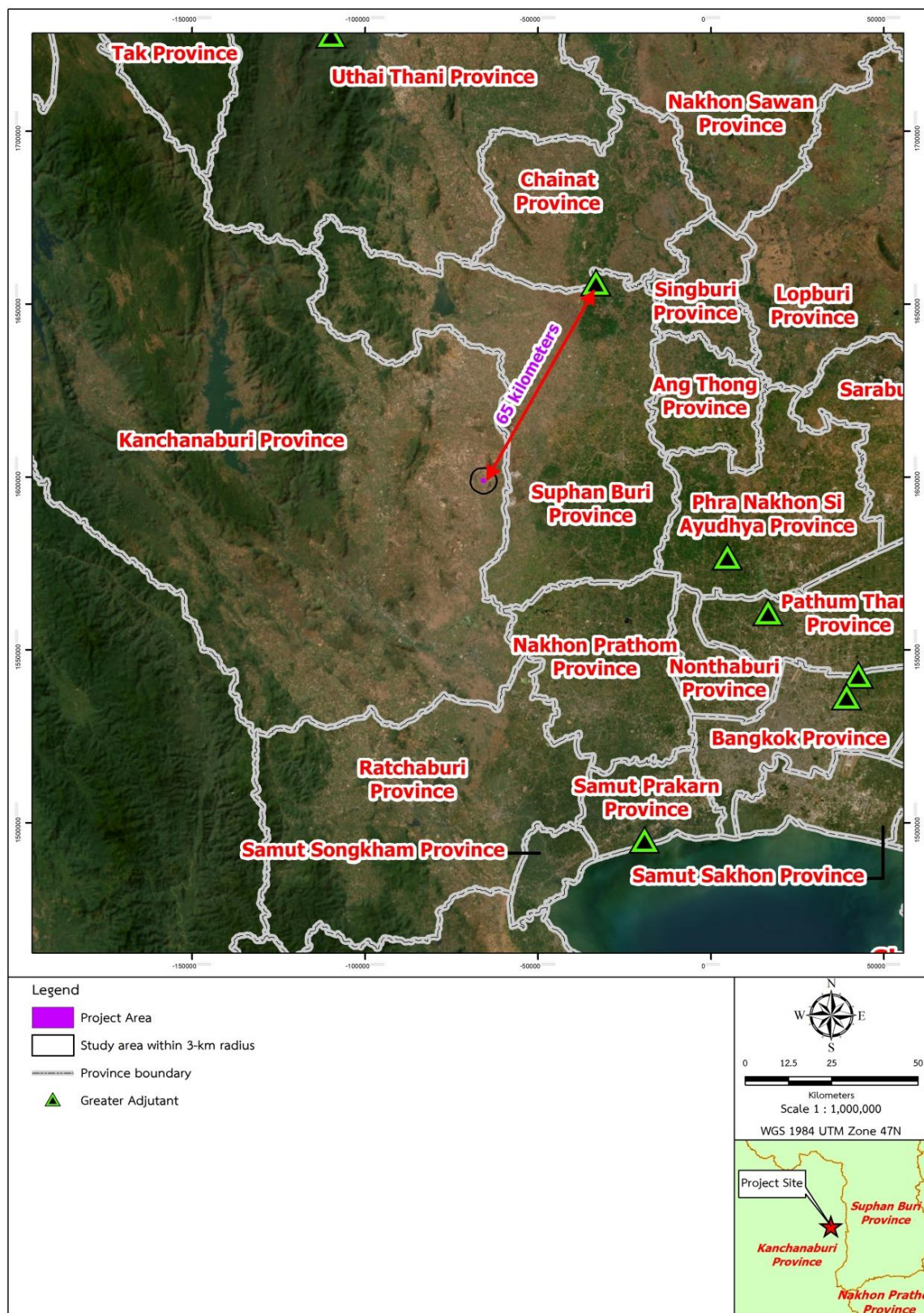
The Greater Adjutant is the rare resident bird and winter migratory bird. There is no report of finding the project area. In the area, the field crops are planted for 70% of the area, for example, corn, sugar cane, and cassava. The rest of the area are the paddy field (10%), water resource (1%) and the communities and area for activities (19%). From the details mentioned above, it is suggested that the area is quite dry and not suitable for the Greater Adjutant which needs the large water resource for its living, food or for migration. Therefore, the Greater Adjutant is not found in the project development area. This is supported by the distribution in the plan, report or document during the past 40 years. However, Thailand is the zone where it is possible to find the Greater Adjutant, according to the distribution plan of IUCN which refer to the old document for the past 40 years and the information is not reviewed. The distance where the Greater Adjutant can be found is 85 kilometers in Tung Bang Ban, Ayutthaya province (the distribution information of the last 21 years). In the present, the report indicated the finding at the distance of 120 kilometers in Klaongsamwa district, Bangkok (see **Figure 3.2-5**).



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**FIGURE 3.2-4 : SHOW THE DISTANCE FROM THE KCB3 PROJECT AREA TO THE NEAREST ENCOUNTER WITH ELEPHANTS, WHICH IS APPROXIMATELY 38 KILOMETERS**





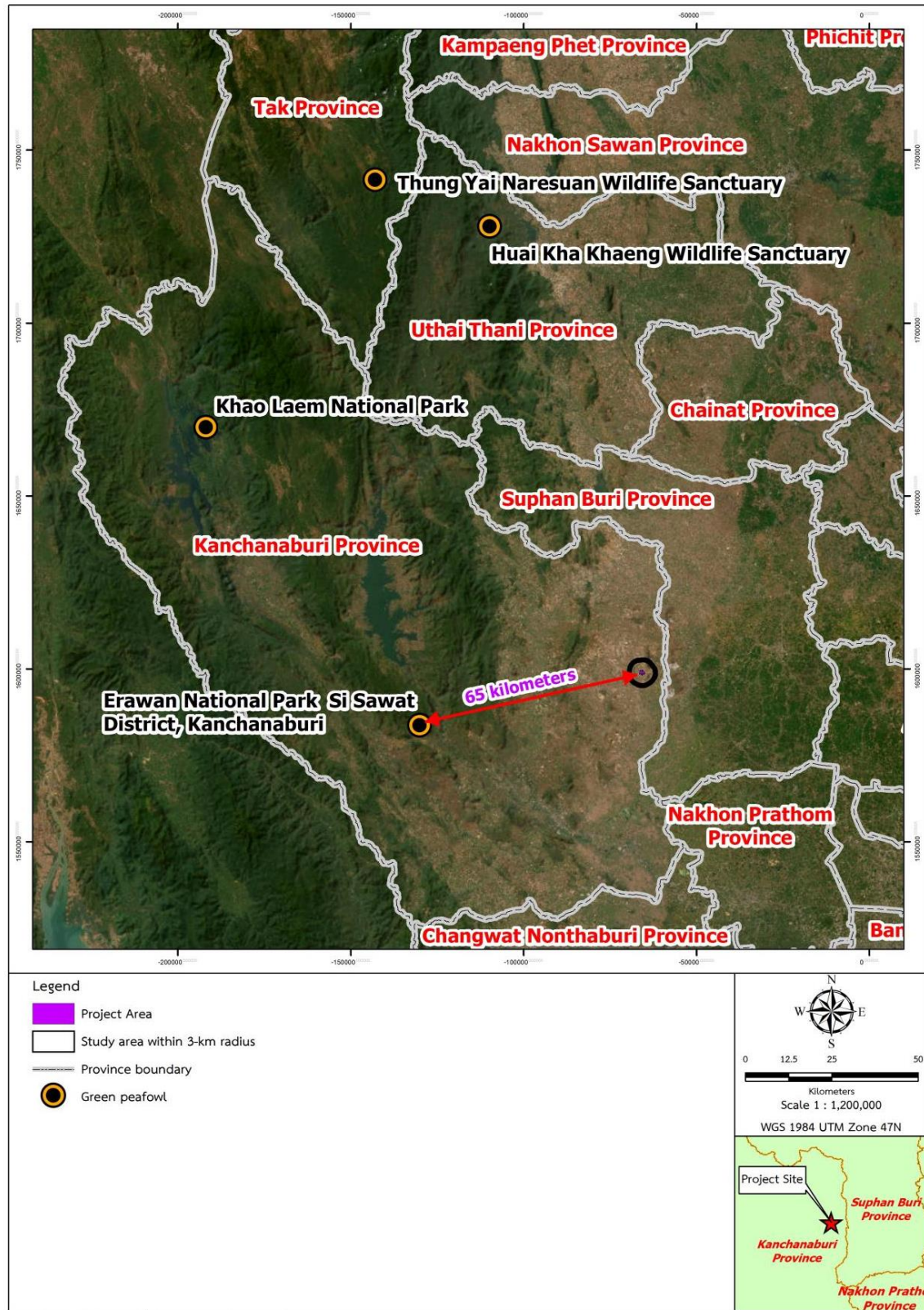
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**FIGURE 3.2-5 : THE DISTANCE FROM THE PROJECT AREA (KCB3). THE GREATER ADJUTANT WAS SEEN AT THE NEAREST DISTANCE OF 65 KILOMETERS.**

### **Green Peafowl (*Pavo muticus*)**

From the examination of data on the current distribution and ecology of Green Peafowl, it is found that conservation areas are only present in the northern and western regions, according to the distribution data from Bird of Thailand (2018), a guide to studying the biodiversity of Thai birds. This aligns with information from Birdlife International (2023), which reports in the IUCN distribution status that there is a possibility of extinction from certain areas. Therefore, considering the Land Use Classification along with the project area and transmission lines, approximately 70% of the area is agricultural, and about 5% is community area. The remaining area is inhabited by communities, characterized by intense human activities. Consequently, the mentioned area is not suitable for the habitat and foraging of hornbills. The closest area where Green Peafowl distribution is likely to be encountered is within the conservation area of Erawan National Park, which is more than 60 kilometers away from the project area and transmission lines. Therefore, it can be concluded that there is no cause for concern regarding the presence of hornbills in the project area and transmission lines (see **Figure 3.2-6**).





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**FIGURE 3.2-6 : SHOW THE DISTANCE FROM THE KCB3 PROJECT AREA TO THE NEAREST ENCOUNTER WITH GREEN PEAFOWL, WHICH IS APPROXIMATELY 65 KILOMETERS.**



## (2) Field Survey

The wildlife resources in the project area and within the radius of 3 kilometers of the project boundary were surveyed in November 2023. Although the survey was not conducted at the transmission line, most of transmission line (about 18 km. out of 22.5 km) is situated inside the 3 km. radius of the project boundary.

### Study Procedure

1) Collect the diversities of wildlife in the study area. The 2 study techniques are described as follows:

1.1) The direct search is the field survey that requires walking survey to cover the ecosystem characteristics in the project area. The 3 survey stations (as shown **Figure 3.2-7**), indicated by the ecosystem of the wildlife, consist of (1) 8 stations of the project area, (2) the 4 border areas of the project and adjacent area, and (3) the 4 outside areas for wildlife searching or traces of wildlife, such as footprints, dung, carcass, hair, marks, hole and burrow, den, trap and noise of wildlife. The searching method of wildlife are as follows:

- Reptiles and mammals. The survey in all conditions of ecosystem is made by looking under the log, stone, and pile of leaves, tree hollow or look up the trees.
- Birds. Binoculars is the tools used to look for the birds in all conditions of ecosystem, especially the area where bird foods, such as ripe fruits, are grown, and water resources. The species of birds are indicated by listening to their sounds.
- Amphibians. The adult and tadpole will be found in the water resources. Tadpole will be easier to be found during the daytime.
- Bats. The survey in all conditions of ecosystem is made by harp trap and net, especially the area where bird foods, such as ripe fruits, are grown, and water resources.

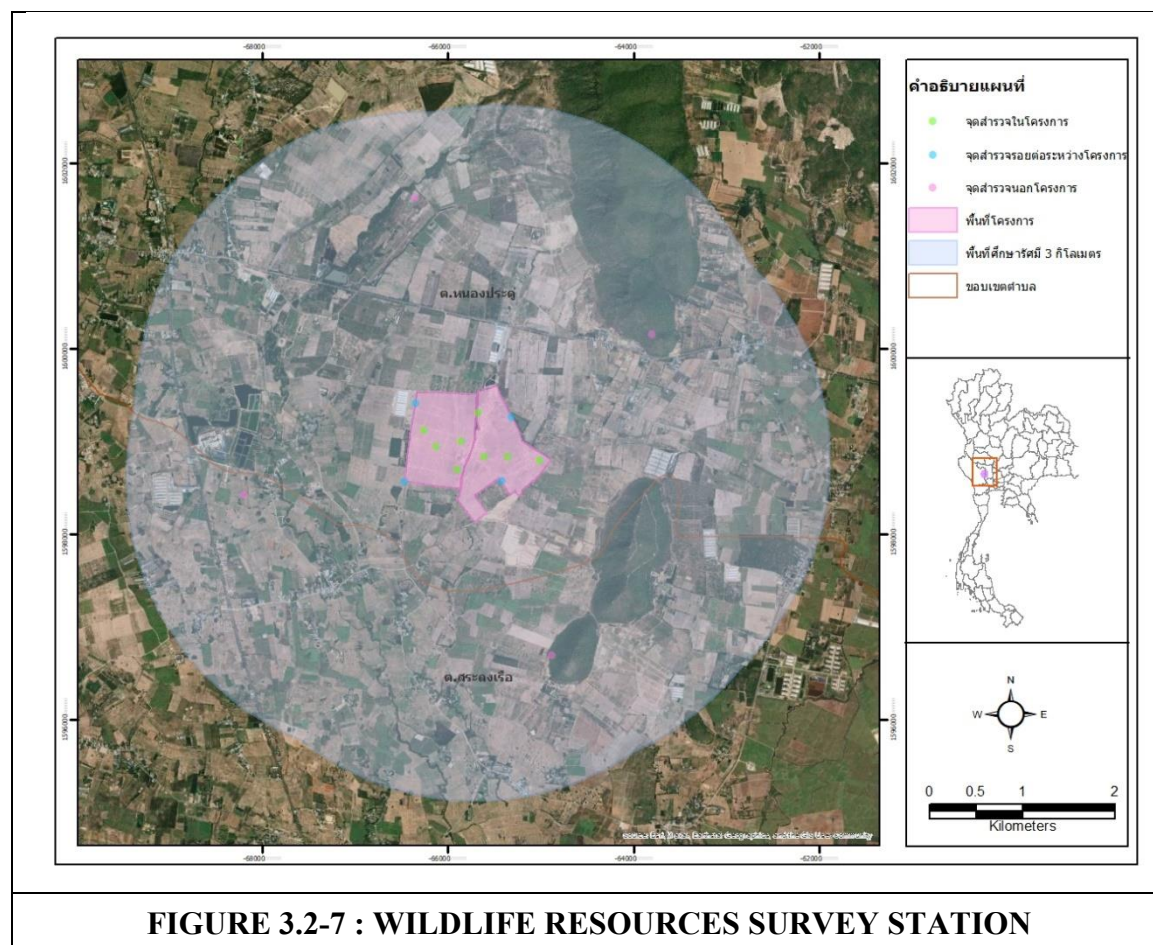
The survey records the diversities of wildlife from the traces in the ecosystem. The photographic rate is also recorded in order to assess the level of relative abundance.

1.2) The indirect inquiry is to collect the information by asking the local residence near the project area. The indirect inquiry is done many times in various areas for the accurate and update results.

2) The ecosystem study of the wildlife will analyze the project area concerning the wildlife habitat and the relation of wildelife species and its purposes of coming into the area. The survey emphasizes the habitat, food supply, food plants, and temporary and permanent water resources

3) The wildlife classification and accuracy check need the reference documents as follows:

- Amphibians refers to the document of Piyawan et al. (2019), Tanya (2003), Weerayuth (2009), Biodiversity-Based Economy Development Office (2016), and Taylor (1962).
- Reptiles refers to the document of Biodiversity-Based Economy Development Office (2016), Weerayuth (2009), Chan-ardet al. (2015), Cox (1991), Cox et al. (1999), Das (2010, 2012), and Taylor (1963, 1965).



**FIGURE 3.2-7 : WILDLIFE RESOURCES SURVEY STATION**

- Birds refers to the document of Treesucon and Limparungpatthanakij (2018), Jarujin et al. (2018), Chaiyan et al. (2008), Prasit (2008), Lekagul and Round (1991), and Robson (2002).
- Bats refers to the document of Prateep (2007), Pipat (2011).
- Mammals refers to the document of Francis (2001, 2008), and Lekagul and McNeely (1977).

4) Diversities of wildlife will be listed in groups of taxonomy. Amphibians and reptiles employs the study of Vitt and Caldwell (2009). The birds employs the study of Treesucon and Limparungpatthanakij (2018). The mammals and bats employs the study of Wilson and Reeder (2005). The list includes the wildlife information in the area, the relative abundance, and status of each type of wildlife.

5) The diversities of wildlife from the direct research and the inquiry will be listed the groups of taxonomy, and relative abundance. The assessment of relative abundance uses the frequency of encountering each wildlife to calculate, employing the study of Pettingill (1970).

$$\text{Percentage of relative abundance} = \frac{\text{times of encounter} \times 100}{\text{Times of survey}}$$

The 3 levels of relative abundance are 1) abundant or common, 2) common, and 3) less common. For criteria of abundant or common, the species of wildlife are quite common, with the relative abundance of 67-100%. For the criteria of common, the species of wildlife are common, with the relative abundance of 34-66%. For criteria of less common, the species of wildlife are not frequently found or the information comes from the inquiry, with the relative abundance of 1-33%.

6) Wildlife status is the assessment of status for legal protection and for reservation, with details as follows:

6.1) Legal protection status. Wildlife is protected by the Wild Animal Reservation and Protection Act, B.E. 2562(2019).

- Reserved wildlife animals are rare wild animal species which have to be reserved. The reserved wild animals are listed in the Wild Animal Reservation and Protection Act, B.E. 2562 (2019) (Thai government gazette, 2562 (2019)).
- Protected wildlife are wild animals that are important to the ecosystem. The decreasing protected animals can affect the ecosystem. They are listed in the Wild Animal Reservation and Protection Act, B.E. 2562 (2019) (Thai government gazette, B.E.2546 (2003)).

Other wildlife are non-protected animals. They are commercially raised, have a large population in the natural condition or they can cause damage to the economic.

6.2) Reservation status by Natural Resources and Environmental Policy and Planning (2020) is considered by the threatened status and IUCN (2022-2) which is the international standard and worldly accepted. The threatened animals are categorized into 7 levels : (1) critically endangered animal: CR (animals are critically endangered in the nature), (2) endangered animal: EN (animals are riskily endangered in the nature), (3) vulnerable animal: VU (animals are vulnerably endangered in the nature), (4) near threatened animal: NT (animals are nearly threatened in the nature), (5) least concern animal: LC (animals are generally found and not in the risk endanger), (6) data deficient: DD (data is deficient to be in any status), and (7) not listed.

7) The impact assessment of the wildlife will analyze the environment that expected to be directly affected by the project. There are 2 groups of assessment: (1) the wildlife has the positive impact because of the new environment caused by the project contributes to the expansion of habitation area and (2) the wildlife has the negative impact because of the change in environment caused by the project. The negative impact can be categorized into 3 types as follows:

7.1) Minor impact. Most wildlife are large in numbers and not listed in the reservation status. Wildlife can adapt themselves to the change. They can live in the project area during the construction and operation phases of the project.

7.2) Moderate impact. Most wildlife are moderate or low in numbers, and listed in the status for reservation with low to moderate threat. However, they can live the project area during the construction and the operation phases.

7.3) High impact. Most animals are low in numbers, or endemic species, and listed in the reserved wild animals or the status with critically endanger. They cannot live in the nearby project area during the construction and the operation phases.

### Study Results

The study results of the wildlife resources in the project area and within the radius of 3 km of the project boundary (**Figure 3.2-8**) are as follows:



**FIGURE 3.2-8 : WILDLIFE SURVEY IN THE PROJECT AREA**

#### 1) Numbers of wildlife species

According to the information of wildlife from the direct encounter and from the inquiry, there are 121 species of wildlife: 60 species in the project area and 114 species in the radius of 3 km. from the project area (**Table 3.2-9**), with details as follows:

- Mammals: 15 species or 12.2% of a total found species
- Birds: 72 species or 58.5 % of a total found species
- Reptiles: 23 species or 18.7 % of a total found species
- Amphibians: 13 species or 10.6 % of a total found species

**TABLE 3.2-9  
SPECIES OF WILDLIFE IN THE PROJECT AREA**

Wildlife	number (species)	Percentage	Number of wildlife in the area	
			Project area	Radius of 3 km.
Mammals	15	12.2	3	15
Birds	72	58.5	38	72
Reptiles	23	18.7	11	23
Amphibians	13	10.6	8	13
<b>Total</b>	<b>123</b>	<b>100.0</b>	<b>60</b>	<b>123</b>

## 2) Diversities of wildlife

The collected details of wildlife (4 groups, 121 species) with diversities of species and ecosystems are as follows:

**2.1) Mammal:** A total of 15 species of mammals were found in the project study area, each species distributed across the project site as listed in **Table 3.2-10**. Among the mammals, one species belongs to the order Primates, namely: Long-tailed Macaque (*Macaca fascicularis*). One species belongs to the order Carnivora, which is: Common Palm Civet (*Paradoxurus hermaphroditus*) Two species belong to the order Chiroptera and are insectivorous bats, namely: Lesser Asiatic yellow house bat (*Scotophilus kuhlii*) Large-footed Bat (*Myotis hasseltii*) The remaining 11 species belong to the orders Rodentia and Scandentia, characterized by sharp front teeth suitable for gnawing food and self-defense. They are mostly small in size, including: Norway rat (*Rattus norvegicus*) Tanezumi rat (*Rattus tanezumi*) Savile's bandicoot rat (*Bandicota savilei*) Greater Bandicoot Rat (*Bandicota indica*) Kleine Pazifikratte (*Rattus exulans*) Cook's mouse (*Mus cookii*) Ricefield rat. (*Rattus argentiventer*) Variable Squirrel (*Callosciurus finlaysonii*) Indochinese ground squirrel (*Menetes berdmorei*) Indomalayan Bamboo Rat (*Rhizomys sumatrensis*) and Common tree shrew (*Tupaia belangeri*)

**TABLE 3.2-10**  
**LIST OF MAMMALS IN THE PROJECT AREA**

Order/Family/Species	Abundance	Status			Area found	
		1	2	3	1	2
<b>Order Plimates</b>						
<b>Family Cercopithecidae</b>						
1. Long-tailed Macaque ( <i>Macaca fascicularis</i> )	Moderate	P	LC	EN	×	✓
<b>Order Carnivora</b>						
<b>Family Viverridae</b>						
2. Common Palm Civet ( <i>Paradoxurus hermaphroditus</i> ) *	Low	-	LC	LC	×	✓
<b>Order Chiroptera</b>						
<b>Family Vespertilionidae</b>						
3. Lesser Asiatic yellow house bat ( <i>Scotophilus kuhlii</i> )	Moderate	P	LC	LC	✓	✓
4. Large-footed Bat ( <i>Myotis hasseltii</i> ) *	Low	P	LC	LC	×	✓
<b>Order Rodentia</b>						
<b>Family Muridae</b>						
5. Norway rat ( <i>Rattus norvegicus</i> )	Moderate	-	LC	LC	×	✓
6. Tanezumi rat ( <i>Rattus tanezumi</i> )	Moderate	-	LC	LC	✓	✓
7. Savile's bandicoot rat ( <i>Bandicota savilei</i> ) *	Low	-	LC	LC	✓	✓
8. Greater Bandicoot Rat ( <i>Bandicota indica</i> ) *	Low	-	LC	LC	×	✓
9. Kleine Pazifikratte ( <i>Rattus exulans</i> ) *	Moderate	-	LC	LC	×	✓
10. Cook's mouse ( <i>Mus cookii</i> ) *	Low	-	LC	LC	×	✓
11. Ricefield rat. ( <i>Rattus argentiventer</i> ) *	Low	-	LC	LC	×	✓
12. Indomalayan Bamboo Rat ( <i>Rhizomys sumatrensis</i> ) *	Low	-	LC	LC	×	✓
<b>Family Sciuridae</b>						
13. Variable Squirrel ( <i>Callosciurus finlaysonii</i> )	High	-	LC	LC	×	✓
14. Indochinese ground squirrel ( <i>Menetes berdmorei</i> )	Low	-	LC	LC	×	✓
<b>Order Scandentia</b>						
<b>Family Tupaiidae</b>						
15. Common tree shrew ( <i>Tupaia glis</i> ) *	Low	-	LC	LC	×	✓

**Remarks:** Areas of occurrence : 1 = project area      2 = a radius of 3 km of the project boundary  
 Status: 1 = the Wild Animal Reservation and Protection Act, B.E.2562 (2019)  
           - = not protected by law      P = protected wildlife      R = reserved wildlife  
           2 = Natural Resources and Environmental Policy and Planning (2020)  
           CR = critically endangered animal      EN = endangered animal  
           VU = vulnerable animal      NT = near threatened animal  
           LC = least concern animal      - = no status  
           3 = IUCN (2022-2)  
           CR = critically endangered animal      EN = endangered animal  
           VU = vulnerable animal      NT = near threatened animal  
           LC = least concern animal      - = no status  
           \* = from inquiry

**2.2) Birds** represent the most numerous and diverse group of wildlife in the study area. Through the survey, a total of 72 species were identified, comprising 50 resident bird species and 20 migratory bird species, as listed in **Table 3.2-11**. The majority of these species are commonly found in agricultural areas, open spaces, community areas, water sources, and forested areas. Resident bird species include, for example, Common myna (*Acridotheres tristis*) Streak-eared bulbul (*Pycnonotus blanfordi*) Malaysian pied fantail (*Rhipidura javanica*) Green-billed malkoha (*Rhopodytes tristis*) Paddyfield pipit (*Anthus rufulus*) Red-wattled lapwing (*Vanellus indicus*) Scaly-breasted munia (*Lonchura punctulata*) Eurasian tree sparrow (*Passer montanus*) Common tailorbird (*Orthotomus sutorius*) Olive-backed Sunbird (*Cinnyris jugularis*) Scarlet-backed flowerpecker (*Dicaeum cruentatum*) Common iora (*Aegithina tiphia*) Red collared dove (*Streptopelia tranquebarica*) Large-billed crow (*Corvus macrorhynchos*) The shikra (*Accipiter badius*). For the group of birds that migrate to Thailand, they are migratory birds during the winter season, coming from the northern hemisphere, such as Russia and China. Additionally, some migratory birds pass through Thailand to reach destinations like Malaysia, Indonesia, Australia, and those that migrate to Thailand to lay eggs. Examples of migratory birds in the study area include, Asian Brown Flycatcher (*Muscicapa dauurica*) Black-naped Oriole (*Oriolus chinensis*) Barn swallow (*Hirundo rustica*) Amur stonechat (*Saxicola stejnegeri*) Brown shrike (*Lanius cristatus*) Yellow Wagtail (*Motacilla flava*) Pied Harrier (*Circus melanoleucos*) Common kestrel (*Falco tinnunculus*).

**TABLE 3.2-11**  
**LIST OF BIRDS IN THE PROJECT AREA**

Order/Family/Species	Abundance	Migration status		Status			Area found	
		resident	migration	1	2	3	1	2
<b>Order Passeriformes</b>								
<b>Family Aegithinidae</b>								
1. Common iora ( <i>Aegithina tiphia</i> )	Moderate	✓	×	P	LC	LC	×	✓
<b>Family Artamidae</b>								
2. Ashy woodswallow ( <i>Artamus fuscus</i> )	Moderate	✓	×	P	LC	LC	✓	✓
<b>Family Alaudidae</b>								
3. Indochinese Bushlark ( <i>Mirafra erythrocephala</i> )	Low	✓	×	P	LC	LC	✓	✓
<b>Family Cisticolidae</b>								
4. Common tailorbird ( <i>Orthotomus sutorius</i> )	Moderate	✓	×	P	LC	LC	×	✓
5. Yellow-bellied Prinia ( <i>Prinia flaviventris</i> )	Low	✓	×	P	LC	LC	✓	✓
6. Plain Prinia ( <i>Prinia inornata</i> )	Low	✓	×	P	LC	LC	✓	✓



**TABLE 3.2-11  
LIST OF BIRDS IN THE PROJECT AREA (CONT'D)**

Order/Family/Species	Abundance	Migration status		Status			Area found	
		resident	migration	1	2	3	1	2
<b>Family Corvidae</b>								
7. Large-billed crow ( <i>Corvus macrorhynchos</i> )	Moderate	✓	×	P	LC	LC	✓	✓
8. rufous treepie ( <i>Dendrocitta vagabunda</i> )	Low	✓	×	P	LC	LC	×	✓
<b>Family Dicaeidae</b>								
9. Scarlet-backed flowerpecker ( <i>Dicaeum cruentatum</i> )	Low	✓	×	P	LC	LC	×	✓
<b>Family Dicruridae</b>								
10. Black drongo ( <i>Dicrurus macrocercus</i> )	High	×	✓	P	LC	LC	✓	✓
<b>Family Estrildidae</b>								
11. Scaly-breasted munia ( <i>Lonchura punctulata</i> )	High	✓	×	P	LC	LC	✓	✓
12. White-rumped munia ( <i>Lonchura striata</i> )	Low	✓	×	P	LC	LC	×	✓
<b>Family Hirundinidae</b>								
13. Barn swallow ( <i>Hirundo rustica</i> )	Moderate	×	✓	P	LC	LC	✓	✓
<b>Family Laniidae</b>								
14. Brown shrike ( <i>Lanius cristatus</i> )	Low	×	✓	P	LC	LC	✓	✓
15. Burmese shrike ( <i>Lanius collurioides</i> )	Low	×	✓	P	LC	LC	✓	✓
<b>Family Motacillidae</b>								
16. Paddyfield pipit ( <i>Anthus rufulus</i> )	Moderate	✓	×	P	LC	LC	✓	✓
17. Eastern Yellow Wagtail ( <i>Motacilla tschutschensis</i> )	Low	×	✓	P	LC	LC	×	✓
<b>Family Muscicapidae</b>								
18. Oriental magpie-robin ( <i>Copsychus saularis</i> )	Low	✓	×	P	LC	LC	×	✓
19. Amur stonechat ( <i>Saxicola stejnegeri</i> )	Low	×	✓	P	LC	LC	×	✓
<b>Family Nectariniidae</b>								
20. Olive-backed Sunbird ( <i>Cinnyris jugularis</i> )	High	✓	×	P	LC	LC	×	✓

**TABLE 3.2-11**  
**LIST OF BIRDS IN THE PROJECT AREA (CONT'D)**

Order/Family/Species	Abundance	Migration status		Status			Area found	
		resident	migration	1	2	3	1	2
<b>Family Oriolidae</b>								
21. Black-naped Oriole ( <i>Oriolus chinensis</i> )	Low	×	✓	-	LC	LC	×	✓
<b>Family Passeridae</b>								
22. Eurasian tree sparrow ( <i>Passer montanus</i> )	High	✓	×	-	LC	LC	×	✓
23. Plain-backed sparrow ( <i>Passer flaveolus</i> )	Moderate	✓	×	P	LC	LC	✓	✓
24. house sparrow ( <i>Passer domesticus</i> )	High	✓	×	P	LC	LC	×	✓
<b>Family Ploceidae</b>								
25. Baya weaver ( <i>Ploceus philippinus</i> )	Moderate	✓	×	P	LC	LC	✓	✓
<b>Family Pycnonotidae</b>								
26. Streak-eared bulbul ( <i>Pycnonotus blanfordi</i> )	Moderate	✓	×	P	LC	LC	✓	✓
27. Yellow-vented bulbul ( <i>Pycnonotus goiavier</i> )	Low	✓	×	P	LC	LC	×	✓
28. Sooty-headed bulbul ( <i>Pycnonotus aurigaster</i> )	Moderate	✓	×	P	LC	LC	✓	✓
<b>Family Rhipiduridae</b>								
29. Sunda pied fantail ( <i>Rhipidura javanica</i> )	High	✓	×	P	LC	LC	✓	✓
<b>Family Sturnidae</b>								
30. Common myna ( <i>Acridotheres tristis</i> )	High	✓	×	P	LC	LC	✓	✓
31. Great myna ( <i>Acridotheres grandis</i> )	High	✓	×	P	LC	LC	✓	✓
32. Thai pied starling ( <i>Gracupica floweri</i> )	Moderate	✓	×	P	LC	LC	×	✓
33. Vinous-breasted myna ( <i>Acridotheres leucocephalus</i> )	Low	✓	×	P	LC	LC	×	✓
<b>Order Columbiformes</b>								
<b>Family Columbidae</b>								
34. Red collared dove ( <i>Streptopelia tranquebarica</i> )	High	✓	×	P	LC	LC	✓	✓
35. Eastern Spotted dove ( <i>Spilopelia chinensis</i> )	High	✓	×	-	LC	LC	✓	✓
36. Zebra dove ( <i>Geopelia striata</i> )	Moderate	✓	×	-	LC	LC	✓	✓
37. Rock pigeon ( <i>Columba livia</i> )	High	✓	×	-	LC	LC	✓	✓

**TABLE 3.2-11**  
**LIST OF BIRDS IN THE PROJECT AREA (CONT'D)**

Order/Family/Species	Abundance	Migration status		Status			Area found	
		resident	migration	1	2	3	1	2
<b>Order Coraciiformes</b>								
<b>Family Coraciidae</b>								
38. Indian roller ( <i>Coracias benghalensis</i> )	Moderate	✓	×	P	LC	LC	✓	✓
<b>Family Meropidae</b>								
39. Asian green bee-eater ( <i>Melops orientalis</i> )	High	✓	×	P	LC	LC	✓	✓
40. Chestnut-headed Bee-eater ( <i>Melops leschenaulti</i> )	Moderate	×	✓	P	LC	LC	×	✓
<b>Family Muscipidea</b>								
41. Asian Brown Flycatcher ( <i>Muscicapa dauurica</i> )	Low	×	✓	P	LC	LC	×	✓
42. Red-throated flycatcher ( <i>Ficedula albicilla</i> )	Low	×	✓	P	LC	LC	×	✓
<b>Order Cuculiformes</b>								
<b>Family Cuculidae</b>								
43. Greater coucal ( <i>Centropus sinensis</i> )	High	✓	×	P	LC	LC	✓	✓
44. Green-billed malkoha ( <i>Phaenicophaeus tristis</i> )	Low	✓	×	P	LC	LC	×	✓
45. Western koel ( <i>Eudynamys scolopaceus</i> )	High	✓	×	P	LC	LC	✓	✓
<b>Order Piciformes</b>								
<b>Family Megalaimidae</b>								
46. Coppersmith barbet ( <i>Psilopogon haemacephala</i> )	Low	✓	×	P	LC	LC	×	✓
47. Lineated Barbet ( <i>Psilopogon lineata</i> )	Low	✓	×	P	LC	LC	×	✓
<b>Order Caprimulgiformes</b>								
<b>Family Apodidae</b>								
48. Asian Palm Swift ( <i>Cypsiurus balasiensis</i> )	Moderate	✓	×	P	LC	LC	✓	✓
<b>Family Caprimulgidae</b>								
49. Indian nightjar ( <i>Caprimulgus asiaticus</i> )	Moderate	✓	×	P	LC	LC	✓	✓

**TABLE 3.2-11  
LIST OF BIRDS IN THE PROJECT AREA (CONT'D)**

Order/Family/Species	Abundance	Migration status		Status			Area found	
		resident	migration	1	2	3	1	2
<b>Order Ciconiiformes</b>								
<b>Family Ciconiidae</b>								
50. Asian openbill ( <i>Anastomus oscitans</i> )	Moderate	✓	×	P	LC	LC	✓	✓
<b>Order Charadriiformes</b>								
<b>Family Charadriidae</b>								
51. Red-wattled lapwing ( <i>Vanellus indicus</i> )	Moderate	✓	×	P	LC	LC	✓	✓
<b>Family Glareolidae</b>								
52. Oriental Pratincole ( <i>Glareola maldivarum</i> )	Low	×	✓	P	LC	LC	✓	✓
<b>Family Jacanidae</b>								
53. Bronze-winged jacana ( <i>Metopidius indicus</i> )	Moderate	✓	×	P	LC	LC	×	✓
<b>Family Turnicidae</b>								
54. Barred buttonquail ( <i>Turnix suscitator</i> )	Low	✓	×	P	LC	LC	✓	✓
<b>Order Gruiformes</b>								
<b>Family Rallidae</b>								
55. White-breasted waterhen ( <i>Amaurornis phoenicurus</i> )	Moderate	×	✓	P	LC	LC	×	✓
<b>Order Coraciiformes</b>								
<b>Family Alcedinidae</b>								
56. White-breasted kingfisher ( <i>Halcyon smyrnensis</i> )	Low	✓	×	P	LC	LC	✓	✓
57. Common kingfisher ( <i>Alcedo atthis</i> )	Low	×	✓	P	LC	LC	×	✓
58. Pied Kingfisher ( <i>Ceryle rudis</i> )	Low	✓	×	P	LC	LC	×	✓
<b>Order Pelecaniformes</b>								
<b>Family Ardeidae</b>								
59. Chinese pond heron ( <i>Ardeola bacchus</i> )	High	✓	×	P	LC	LC	✓	✓
60. Cattle egret ( <i>Bubulcus ibis</i> )	High	✓	×	P	LC	LC	✓	✓
61. Little Egret ( <i>Egretta garzetta</i> )	Moderate	×	✓	P	LC	LC	×	✓
62. Great White Egret ( <i>Ardea alba</i> )	Low	×	✓	P	LC	LC	×	✓
63. Grey heron ( <i>Ardea cinerea</i> )	Low	×	✓	P	LC	LC	✓	✓

**TABLE 3.2-11  
LIST OF BIRDS IN THE PROJECT AREA (CONT'D)**

Order/Family/Species	Abundance	Migration status		Status			Area found	
		resident	migration	1	2	3	1	2
<b>Order Suliformes</b>								
<b>Family Phalacrocoracidae</b>								
64. little cormorant ( <i>Microcarbo niger</i> )	Moderate	✓	×	P	LC	LC	×	✓
<b>Order Strigiformes</b>								
<b>Family Strigidae</b>								
65. Asian barred owlet ( <i>Glaucidium cuculoides</i> )	Low	✓	×	P	LC	LC	×	✓
66. Spotted owlet ( <i>Athene brama</i> )	Low	✓	×	P	LC	LC	×	✓
<b>Order Galliformes</b>								
<b>Family Phasianidae</b>								
67. Red junglefowl ( <i>Gallus gallus</i> )	Low	✓	×	P	LC	LC	×	✓
<b>Order Accipitriformes</b>								
<b>Family Accipitridae</b>								
68. Pied Harrier ( <i>Circus melanoleucos</i> )	Moderate	×	✓	P	LC	LC	✓	✓
69. Shikra ( <i>Accipiter badius</i> )	Low	×	✓	P	LC	LC	×	✓
<b>Family ELanidae</b>								
70. Black-winged Kite ( <i>Elanus caeruleus</i> )	Low	✓	×	P	LC	LC	✓	✓
<b>Order Falconiformes</b>								
<b>Family Falconidae</b>								
71. Common kestrel ( <i>Falco tinnunculus</i> )	Low	×	✓	P	LC	LC	×	✓
72. Steppe Eagle ( <i>Aquila nipalensis</i> )	Low	×	✓	P	LC	EN	×	×

**Remarks:** Areas of occurrence : 1 = project area      2 = a radius of 3 km of the project boundary  
 Status:      1 = the Wild Animal Reservation and Protection Act, B.E.(2019) 2562  
                  - = not protected by law      P = protected wildlife      R = reserved wildlife  
                  2 = Natural Resources and Environmental Policy and Planning (2020)  
                  CR = critically endangered animal      EN = endangered animal  
                  VU = vulnerable animal      NT = near threatened animal  
                  LC = least concern animal      - = no status  
                  3 = IUCN (2022-2)  
                  CR = critically endangered animal      EN = endangered animal  
                  VU = vulnerable animal      NT = near threatened animal  
                  LC = least concern animal      - = no status  
                  \* = from inquiry

**2.3) Reptiles** A total of 23 species were identified in the study area. Each species is distributed in the project study area, as listed in the **Table 3.2-12**. There are 3 species of crawling animals, which are members of the order Testudines, namely, Malayan snail-eating turtle (*Malayemys macrocephala*) Southeast Asian Box Turtle (*Cuora amboinesis*) Asiatic soft-shelled Turtle (*Amyda cartilaginea*) and another 20 species are members of the order Squamata, which includes all reptiles with scales. These species consist of: Oriental garden lizard (*Calotes versicolor*) Indo-Chinese Forest Lizard (*Calotes mystaceus*) Forest garden lizard (*Calotes emma*) Reeves's butterfly lizard (*Leiolepis reevesii*) Golden Tree Snake (*Chrysopelea ornata*) Long-nosed whip snake (*Ahaetulla nasuta*) Red-necked Keelback (*Rhabdophis subminiatus*) Malayan banded wolf snake (*Lycodon subcinctus*) Indo-Chinese Rat Snake (*Ptyas korros*) Banded rat snake (*Ptyas mucosa*) Cantor's kukri snake (*Oligodon dorsolateralis*) Monocellate Cobra (*Naja kaouthia*) Reticulated Python (*Malayopython reticulatus*) Tokay Gecko (*Gekko gekko*) Flat-tailed House Gecko (*Hemidactylus platyurus*) The Common House-Gecko (*Hemidactylus frenatus*) Common Sun Skink (*Eutropis multifasciata*) Gefleckte Mabuye (*Eutropis macularius*) Asian Water Monitor (*Varanus salvator*) and Bengal monitor (*Varanus bengalensis*)

**TABLE 3.2-12**  
**LIST OF REPTILES IN THE PROJECT AREA**

Order/Family/Species	Abundance	Status			Area found	
		1	2	3	1	2
<b>Order Testudines</b>						
<b>Family Geoemydidae</b>						
1. Malayan snail-eating turtle ( <i>Malayemys macrocephala</i> )	Low	P	LC	LC	×	✓
2. Southeast Asian Box Turtle ( <i>Cuora amboinensis</i> )	Low	P	NT	EN	×	×
<b>Family Trionychidae</b>						
3. Asiatic softshell turtle ( <i>Amyda cartilaginea</i> ) *	Low	P	LC	VU	×	✓
<b>Order Squamata</b>						
<b>Family Agamidae</b>						
4. Oriental garden lizard ( <i>Calotes versicolor</i> )	High	P	LC	LC	✓	✓
5. Indo-Chinese Forest Lizard ( <i>Calotes mystaceus</i> )	Moderate	P	LC	LC	×	✓
6. Forest garden lizard ( <i>Calotes emma</i> )	Moderate	P	LC	LC	×	✓
7. Reeves's butterfly lizard ( <i>Leiolepis reevesii</i> )	Moderate	P	NT	LC	✓	✓
<b>Family Colubridae</b>						
8. Golden Tree Snake ( <i>Chrysopelea ornata</i> )	Moderate	-	LC	LC	✓	✓
9. Long-nosed whip snake ( <i>Ahaetulla nasuta</i> )	Moderate	-	LC	LC	×	✓
10. Red-necked Keelback ( <i>Rhabdophis subminiatus</i> )	Moderate	-	LC	LC	✓	✓
11. Malayan banded wolf snake ( <i>Lycodon subcinctus</i> ) *	Low	-	LC	LC	✓	✓
12. Indo-Chinese Rat Snake ( <i>Ptyas korros</i> ) *	Low	P	LC	NT	✓	✓
13. Banded rat snake ( <i>Ptyas mucosa</i> ) *	Low	P	LC	LC	×	✓
14. Cantor's kukri snake ( <i>Oligodon dorsolateralis</i> )	Moderate	-	LC	LC	✓	✓
<b>Family Elapidae</b>						
15. Monocellate Cobra ( <i>Naja kaouthia</i> ) *	Low	-	LC	LC	×	✓
<b>Family Gekkonidae</b>						
16. Tokay Gecko ( <i>Gekko gekko</i> )	High	-	LC	LC	×	✓
17. Flat-tailed House Gecko ( <i>Hemidactylus latyurus</i> )	High	-	LC	LC	✓	✓



**TABLE 3.2-12**  
**LIST OF REPTILES IN THE PROJECT AREA (CONT'D)**

Order/Family/Species	Abundance	Status			Area found	
		1	2	3	1	2
18.The Common House-Gecko ( <i>Hemidactylus frenatus</i> )	Moderate	-	LC	LC	✓	✓
<b>Family Pythonidae</b>						
19.Reticulated Python ( <i>Malayopython reticulatus</i> ) *	Low	P	LC	LC	×	✓
<b>Family Scincidae</b>						
20.Common Sun Skink ( <i>Eutropis multifasciata</i> )	High	-	LC	LC	✓	✓
21.Gefleckte Mabuye ( <i>Eutropis macularius</i> )	High	-	LC	LC	✓	✓
<b>Family Varanidae</b>						
22. Asian Water Monitor ( <i>Varanus salvator</i> ) *	Moderate	P	LC	LC	×	✓
23.Bengal monitor ( <i>Varanus bengalensis</i> ) *	Low	P	LC	NT	×	✓

**Remarks:** Areas of occurrence : 1 = project area      2 = a radius of 3 km of the project boundary  
 Status:    1 = the Wild Animal Reservation and Protection Act, B.E.(2019) 2562  
               - = not protected by law      P = protected wildlife    R = reserved wildlife  
               2 = Natural Resources and Environmental Policy and Planning (2020)  
               CR = critically endangered animal    EN = endangered animal  
               VU = vulnerable animal                NT = near threatened animal  
               LC = least concern animal           - = no status  
               3 = IUCN (2022-2)  
               CR = critically endangered animal    EN = endangered animal  
               VU = vulnerable animal                NT = near threatened animal  
               LC = least concern animal           - = no status  
               \* = from inquiry

**2.4) Amphibain** surveyed in the project area comprise a total of 13 species, each of which is distributed throughout the study area, as listed in the **Table 3.2-13**. The 13 amphibians belong to the order Anura, which includes frogs, toads, and treefrogs. Adult individuals in this group have legs and lack tails. These forest-dwelling species rely on moist skin for gas exchange, requiring consistently moist skin. They inhabit aquatic environments or areas with high humidity, and they forage during the night when temperatures drop, and relative humidity rises. The 13 amphibian species are terrestrial, inhabiting the land or residing in burrows or various water bodies, including flowing water and stagnant water in freshwater ecosystems, as well as rice fields. Seven of these species prefer aquatic habitats or areas near water bodies, having a higher humidity level than on land. These species include: Chinese edible frog (*Hoplobatrachus rugulosus*) Boie's wart frog (*Fejervarya limnocharis*) Dicroglossidae (*Fejervarya triora*) Green puddle frog (*Occidozyga lima*) Round-tongued floating frog (*Occidozyga martensii*) Red-eared Frog (*Hylarana erythraea*) and Three-striped Grass Frog (*Hylarana macrodactyla*). The remaining six species inhabit the land or trees or reside in burrows in areas with high humidity, but they must lay their eggs in water. These species include: Asian common toad (*Duttaphrynus melanostictus*) The Four-lined (*Polypedates leucomystax*) Ornate Pigmy Frog (*Microhyla ornata*) Guangdong rice frog (*Microhyla pulchra*) Asian painted frog (*Kaloula pulchra*) and Blunt-headed Burrowing Frog (*Glyphoglossus molossus*)

**TABLE 3.2-13**  
**LIST OF AMPHIBIANS IN THE PROJECT AREA**

Order/Family/Species	Abundance	Status			Area found	
		1	2	3	1	2
<b>Order Anura</b>						
<b>Family Bufonidae</b>						
1.Asian common toad ( <i>Duttaphrynus melanostictus</i> )	High	-	LC	LC	✓	✓
<b>Family Dicoglossidae</b>						
2.Chinese edible frog ( <i>Hoplobatrachus rugulosus</i> ) *	Low	-	LC	LC	×	✓
3.Boie’s wart frog ( <i>Fejervarya limnocharis</i> )	High	-	LC	LC	×	✓
4.Dicoglossidae ( <i>Fejervarya triora</i> )	Low	-	LC	LC	✓	✓
5.Green puddle frog ( <i>Occidozyga lima</i> )	High	-	LC	LC	✓	✓
6.Round-tongued floating frog ( <i>Occidozyga martensii</i> )	High	-	LC	LC	✓	✓
<b>Family Microhylidae</b>						
7.Ornate Pigmy Frog ( <i>Microhyla fissipes</i> )	Moderate	-	LC	LC	✓	✓
8.Guangdong rice frog ( <i>Microhyla pulchra</i> )	Moderate	-	LC	LC	✓	✓
9.Asian painted frog ( <i>Kaloula pulchra</i> )	Moderate	-	LC	LC	✓	✓
10.Blunt-headed Burrowing Frog ( <i>Glyphoglossus molossus</i> ) *	Low	-	NT	NT	×	✓
<b>Family Ranidaeae</b>						
11.Red-eared Frog ( <i>Hylarana erythraea</i> ) *	Low	-	LC	LC	×	✓
12.Three-striped Grass Frog ( <i>Hylarana macrodactyla</i> ) *	Low	-	LC	LC	×	✓
<b>Family Rhacophoridae</b>						
13.The Four-lined ( <i>Polypedates leucomystax</i> )	Moderate	-	LC	LC	✓	✓

**Remarks:** Areas of occurrence : 1 = project area                      2 = a radius of 3 km of the project boundary  
Status:     1 = the Wild Animal Reservation and Protection Act, B.E.(2019) 2562  
                 - = not protected by law            P = protected wildlife    R = reserved wildlife  
                 2 = Natural Resources and Environmental Policy and Planning (2020)  
                 CR = critically endangered animal    EN = endangered animal  
                 VU = vulnerable animal                    NT = near threatened animal  
                 LC = least concern animal                - = no status  
                 3 = IUCN (2022-2)  
                 CR = critically endangered animal    EN = endangered animal  
                 VU = vulnerable animal                    NT = near threatened animal  
                 LC = least concern animal                - = no status  
\* = from inquiry

### 3) Wildlife abundance

Each species in the study area cannot indicate the numbers per area because of the significant factors: the methods of wildlife assessment or indication are various, and the study period is short. Therefore, the expression of a number of each species of wildlife was assessed by dividing wildlife abundance into 3 levels of relative abundance. **Table 3.2-14** presents wildlife abundance, and the details of wildlife abundance are as follows:

**TABLE 3.2-14**  
**SPECIES OF WILDLIFE AND THEIR ABUNDANCE IN THE STUDY AREA**

Wildlife	Species	Abundance		
		High	Moderate	Low
Mammals	15	1	5	9
Birds	72	16	23	33
Reptiles	23	5	9	9
Amphibians	13	4	4	5
<b>Total</b>	<b>123</b>	<b>26</b>	<b>41</b>	<b>56</b>
<b>Percentage</b>	<b>100.0</b>	<b>21.1</b>	<b>33.3</b>	<b>45.6</b>

**3.1) High abundance level:** These species are easily observed through physical presence, traces, and evidence or by their high-frequency vocalizations. They are often small-bodied species that inhabit areas with desired environmental conditions and can adapt to different ecological needs over a wide range. They have a varied diet, which allows them to reproduce and maintain large populations. They are highly adaptable to disturbances, so they are not very secretive and are frequently encountered. This group consists of 4 wildlife groups, totaling 26 species, or 21.1% of the total number of wildlife species. They are categorized as follows:

- Mammals: 1 species - Variable Squirrel (*Callosciurus finlaysonii*)
- Birds: 16 species - Black drongo (*Dicrurus macrocercus*) Scaly-breasted munia (*Lonchura punctulata*) Olive-backed Sunbird (*Cinnyris jugularis*) Eurasian tree sparrow (*Passer montanus*) house sparrow (*Passer domesticus*) Malaysian pied fantail (*Rhipidura javanica*) Common myna (*Acridotheres tristis*) Great myna (*Acridotheres grandis*) Red collared dove (*Streptopelia tranquebarica*) Spotted dove (*Spilopelia chinensis*) Rock pigeon (*Columba livia*) Asian green bee-eater (*Melops orientalis*) Greater coucal (*Centropus sinensis*) Asian koel (*Eudynamis scolopaceus*) Chinese pond heron (*Ardeola bacchus*) Cattle egret (*Bubulcus ibis*)
- Reptiles: 5 species - Oriental garden lizard (*Calotes versicolor*) Tokay Gecko (*Gekko gecko*) Flat-tailed House Gecko (*Hemidactylus platyurus*) Common Sun Skink (*Eutropis multifasciata*) Gefleckte Mabuye (*Eutropis macularius*)
- Amphibians: 4 species - Asian common toad (*Duttaphrynus melanostictus*) Boie's wart frog (*Fejervarya limnocharis*) Green puddle frog (*Occidozyga lima*) Round-tongued floating frog (*Occidozyga martensii*)

**3.2) Intermediate abundance level:** This includes species frequently encountered, either through direct observation, traces, or by hearing their calls, but with lower frequency compared to highly abundant species. These species can adapt well to different environmental conditions or tolerate changes in the environment caused by human activities, which is why they are relatively common. There are 41 species belonging to 4 wildlife groups in this category, accounting for 33.3% of the total number of wildlife species. They are classified as follows:

- Mammals: There are 5 species of mammals, including Long-tailed Macaque (*Macaca fascicularis*) Lesser Asiatic yellow house bat (*Scotophilus kuhlii*) Norway rat (*Rattus norvegicus*) Tanezumi rat (*Rattus tanezumi*) Kleine Pazifikratte (*Rattus exulans*)

- Birds: There are 23 species of birds, including common iora (*Aegithina tiphia*) ashy woodswallow (*Artamus fuscus*) Common tailorbird (*Orthotomus sutorius*) Large-billed crow (*Corvus macrorhynchos*) Barn swallow (*Hirundo rustica*) Paddyfield pipit (*Anthus rufulus*) Plain-backed sparrow (*Passer flaveolus*) baya weaver (*Ploceus philippinus*) Streak-eared bulbul (*Pycnonotus blanfordi*) Sooty-headed bulbul (*Pycnonotus aurigaster*) Bronze-winged jacana (*Metopidius indicus*) Zebra dove (*Geopelia striata*) Indian roller (*Coracias benghalensis*) Chestnut-headed Bee-eater (*Melops leschenaulti*) Asian Palm Swift (*Cypsiurus balasiensis*) Indian nightjar (*Caprimulgus asiaticus*) Asian openbill (*Anastomus oscitans*) Red-wattled lapwing (*Vanellus indicus*) white-breasted waterhen (*Amaurornis phoenicurus*) Little Egret (*Egretta garzetta*) Little cormorant (*Microcarbo niger*) Pied Harrier (*Circus melanoleucos*)

- Reptiles: There are 9 species of reptiles, including Indo-Chinese Forest Lizard (*Calotes mystaceus*) Forest garden lizard (*Calotes emma*) Reeves's butterfly lizard (*Leiolepis reevesii*) Golden Tree Snake (*Chrysopelea ornata*) Long-nosed whip snake (*Ahaetulla nasuta*) Red-necked Keelback (*Rhabdophis subminiatus*) Cantor's kukri snake (*Oligodon dorsolateralis*) The Common House-Gecko (*Hemidactylus frenatus*) Asian Water Monitor (*Varanus salvator*)

- Amphibians: There are 4 species of amphibians, including Ornate Pigmy Frog (*Microhyla fissipes*) Guangdong rice frog (*Microhyla pulchra*) Asian painted frog (*Kaloula pulchra*) and The Four-lined (*Polypedates leucomystax*)

**3.3) Low abundance level:** This includes species that are rarely encountered, either through direct observation, traces, or by hearing their calls, and each encounter has a small population or is not found through direct search but is based on survey data. There are 56 species belonging to 4 wildlife groups in this category, accounting for 45.6% of the total number of wildlife species. They are classified as follows:

- Mammals: There are 9 species of mammals, including Common Palm Civet (*Paradoxurus hermaphroditus*) Large-footed Bat (*Myotis horsfieldii*) Savile's bandicoot rat (*Bandicota savilei*) Greater Bandicoot Rat (*Bandicota indica*) Cook's mouse (*Mus cookii*) Ricefield rat (*Rattus argentiventer*) Indomalayan Bamboo Rat (*Rhizomys sumatrensis*) Indochinese ground squirrel (*Menetes berdmorei*) Common tree shrew (*Tupaia glis*)

- Birds: There are 33 species of birds, including Indochinese Bushlark (*Mirafra erythrocephala*) Yellow-bellied Prinia (*Prinia flaviventris*) Plain prinia (*Prinia inornata*) scarlet-backed flowerpecker (*Dicaeum cruentatum*) White-rumped munia (*Lonchura striata*) Brown shrike (*Lanius cristatus*) Burmese shrike (*Lanius collurioides*) Eastern Yellow Wagtail (*Motacilla flava*) Oriental magpie-robin (*Copsychus saularis*) Amur stonechat (*Saxicola stejnegeri*) Yellow-vented bulbul (*Pycnonotus goiavier*) Asian Brown Flycatcher (*Muscicapa dauurica*) Red-throated flycatcher (*Ficedula albicilla*) green-billed malkoha (*Rhaenicophaeus tristis*) Stenius Muller (*Megalaima haemacephala*) Lineated Barbet (*Psilopogon lineata*) Oriental Pratincole (*Glareola maldivarum*) Rufous treepie (*Dendrocitta vagabunda*) Black-naped Oriole (*Oriolus chinensis*) Vinous-breasted myna (*Acridotheres leucocephalus*) Grey heron (*Ardea cinerea*) Spotted owl (*Athene brama*) Red junglefowl (*Gallus gallus*) Barred buttonquail (*Turnix suscitator*) White-throated kingfisher (*Halcyon smyrnensis*) Common kingfisher (*Alcedo atthis*) Pied Kingfisher (*Ceryle rudis*) Great white egret (*Ardea alba*) Asian barred owl (*Glaucidium cuculoides*) Shikra (*Accipiter badius*) Black-winged Kite (*Elanus caeruleus*) common kestrel (*Falco tinnunculus*)

- Reptiles: There are 9 species of reptiles, including Malayan snail-eating turtle (*Malayemys macrocephala*) Asiatic softshell turtle (*Amyda cartilaginea*) Malayan banded wolf snake (*Lycodon subcinctus*) Indo-Chinese Rat Snake (*Ptyas korros*) Banded rat snake (*Ptyas mucosa*) Monocellate Cobra (*Naja kaouthia*) Reticulated Python (*Malayopython reticulatus*) Bengal monitor (*Varanus bengalensis*)

- Amphibians: There are 5 species of amphibians, including Chinese edible frog (*Hoplobatrachus rugulosus*) Dicroglossidae (*Fejervarya tritoria*) Blunt-headed Burrowing Frog (*Glyphoglossus molossus*) Red-eared Frog (*Hylarana erythraea*) Three-striped Grass Frog (*Hylarana macrodactyla*)

#### 4) Wildlife Status

Conservation of wildlife requires the designation of the status of wildlife to serve as a basis for protecting species with small populations and species restricted to limited areas to prevent them from disappearing from the site or the world. Thailand has designated the status of wildlife for the abovementioned purpose, and 102 species of wildlife have been surveyed in the project area with their status listed in **Table 3.2-15**.

**TABLE 3.2-15**  
**THE NUMBER OF WILDLIFE SPECIES PROTECTED AND NOT PROTECTED BY WILDLIFE CONSERVATION LAWS**

Wildlife group	Number of Species	The number of species with designated status according to Wild Animal Conservation and Protection Act (2019)		
		Reserved wildlife	Protected wildlife	Non-protected wildlife
Mammals	15	-	3	12
Birds	72	-	67	5
Reptiles	23	-	12	11
Amphibians	13	-	-	13
<b>Total</b>	<b>123</b>	<b>0</b>	<b>82</b>	<b>41</b>
<b>Percentage</b>	<b>100.0</b>	<b>0.0</b>	<b>66.67</b>	<b>33.33</b>

**4.1) Protected status under the law:** There are 123 species of wildlife. When examining the status of this type, it was found that 82 species are designated as protected wildlife, accounting for 66.67% of the total number of wildlife species. The remaining 41 species of wildlife, or 33.33% of the total number of wildlife species, are not protected by law under the Wildlife Conservation Act of 2562. The number of species with this type of status for each group of wildlife is shown in **Table 3.2-15**. The 83 species of protected wildlife consist of three groups, including:

- Mammals, with 3 species: Long-tailed Macaque (*Macaca fascicularis*) Lesser Asiatic yellow house bat (*Scotophilus kuhlii*) Large-footed Bat (*Myotis horsfieldii*)

- Birds, with 67 species, such as Yellow-bellied Prinia (*Prinia flaviventris*) Scarlet-backed flowerpecker (*Dicaeum cruentatum*) Brown shrike (*Lanius cristatus*) Common stonechat (*Saxicola torquatus*) yellow-vented bulbul (*Pycnonotus goiavier*) Red-throated flycatcher (*Ficedula albicilla*) Asian Brown Flycatcher (*Muscicapa dauurica*) common iora (*Aegithina tiphia*) Ashy woodswallow (*Artamus fuscus*) Common tailorbird (*Orthotomus sutorius*) Large-billed crow (*Corvus macrorhynchos*) Barn swallow (*Hirundo rustica*) Paddyfield pipit (*Anthus rufulus*) Plain-backed sparrow (*Passer flaveolus*) Streak-eared bulbul (*Pycnonotus blanfordi*) Sooty-headed bulbul (*Pycnonotus aurigaster*) Green-billed malkoha (*Rhopodytes tristis*) Stenius Muller (*Megalaima haemacephala*) Great white egret (*Ardea alba*) Asian barred owlet (*Glaucidium cuculoides*) rufous treepie (*Dendrocitta vagabunda*) Black-naped Oriole (*Oriolus chinensis*) Vinous-breasted myna (*Acridotheres leucocephalus*) grey heron (*Ardea cinerea*) Red junglefowl (*Gallus gallus*) Black-winged Kite (*Elanus caeruleus*)







- Reptiles, with 12 species: Malayan snail-eating turtle (*Malayemys macrocephala*) Asiatic softshell turtle (*Amyda cartilaginea*) Oriental garden lizard (*Calotes versicolor*) Indo-Chinese Forest Lizard (*Calotes mystaceus*) Forest garden lizard (*Calotes emma*) Reeves's butterfly lizard (*Leiolepis reevesii*) Indo-Chinese Rat Snake (*Ptyas korros*) Banded rat snake (*Ptyas mucosa*) Reticulated Python (*Malayopython reticulatus*) Asian Water Monitor (*Varanus salvator*) Bengal monitor (*Varanus bengalensis*)



Wildlife not protected by law comprises 40 species, categorized into four groups, including

- Mammals, with 12 species: Common Palm Civet (*Paradoxurus hermaphroditus*) Indomalayan Bamboo Rat (*Rhizomys sumatrensis*) Norway rat (*Rattus norvegicus*) Tanezumi rat (*Rattus tanezumi*) Savile's bandicoot rat (*Bandicota savilei*) Greater Bandicoot Rat (*Bandicota indica*) Kleine Pazifikratte (*Rattus exulans*) Cook's mouse (*Mus cookii*) Ricefield rat. (*Rattus argentiventer*) Variable Squirrel (*Callosciurus finlaysonii*) Indochinese ground squirrel (*Menetes berdmorei*) Common tree shrew (*Tupaia glis*)
- Birds, with 5 species: Eurasian tree sparrow (*Passer montanus*) Eastern Spotted dove (*Spilopelia chinensis*) Zebra dove (*Geopelia striata*) Rock pigeon (*Columba livia*)
- Reptiles, with 11 species: Golden Tree Snake (*Chrysopelea ornata*) Long-nosed whip snake (*Ahaetulla nasuta*) Red-necked Keelback (*Rhabdophis subminiatus*) Malayan banded wolf snake (*Lycodon subcinctus*) Cantor's kukri snake (*Oligodon dorsolateralis*) Monocellate Cobra (*Naja kaouthia*) Tokay Gecko (*Gekko gekko*) Flat-tailed House Gecko (*Hemidactylus platyurus*) The Common House-Gecko (*Hemidactylus frenatus*) Common Sun Skink (*Eutropis multifasciata*) Gefleckte Mabuye (*Eutropis macularius*)
- Amphibians, with 13 species: Chinese edible frog (*Hoplobatrachus rugulosus*) Boie's wart frog (*Fejervarya limnocharis*) Dicroglossidae (*Fejervarya tritora*) Green puddle frog (*Occidozyga lima*) Round-tongued floating frog (*Occidozyga martensii*) Red-eared Frog (*Hylarana erythraea*) Three-striped Grass Frog (*Hylarana macrodactyla*) Asian common toad (*Duttaphrynus melanostictus*) The Four-lined (*Polypedates leucomystax*) Ornate Pigmy Frog (*Microhyla ornata*) Guangdong rice frog (*Microhyla pulchra*) Asian painted frog (*Kaloula pulchra*) and Blunt-headed Burrowing Frog (*Glyphoglossus molossus*)

**4.2) Conservation Status:** The wildlife found in the project study area consists of 123 species. Upon examining the status, it was observed that there are wildlife species listed by the Office of Natural Resources and Environmental Policy and Planning (2020) as having a conservation status of Near Threatened (NT). There are 2 species, namely: Reeves's butterfly lizard (*Leiolepis reevesii*) and Blunt-headed Burrowing Frog (*Glyphoglossus molossus*) As for other wildlife, there are 121 species currently classified as Least Concern (LC) according to the IUCN status (2022-2). Upon checking the IUCN status, it was found that there is 3 species listed as Endangered (EN), which is: Crab-eating Macaque (*Macaca fascicularis*), Steppe Eagle (*Aquila nipalensis*), Southeast Asian Box Turtle (*Subspecie in Thailand : Cuora amboinensis kamaroma*). The wildlife species with a Vulnerable (VU) status, indicating a tendency toward endangerment, is one species: Asiatic softshell turtle (*Amyda cartilaginea*) and wildlife species near-threatened (NT) include 3 species: Indo-Chinese Rat Snake (*Ptyas korros*) Reeves's butterfly lizard (*Leiolepis reevesii*) and Blunt-headed Burrowing Frog (*Glyphoglossus molossus*) another 114 wildlife species are categorized as Least Concern (LC).

	
<p>Brown shrike (<i>Lanius cristatus</i>)</p>	<p>Vinous-breasted myna (<i>Acridotheres leucocephalus</i>)</p>
	
<p>Sooty-headed bulbul (<i>Pycnonotus aurigaster</i>)</p>	<p>Ashy woodswallow (<i>Artamus fuscus</i>)</p>
	
<p>Common kestrel (<i>Falco tinnunculus</i>)</p>	<p>Shikra (<i>Accipiter badius</i>)</p>

**FIGURE 3.2-9: THE EXAMPLES OF BIRDS FOUND IN THE PROJECT STUDY AREA**

### 3.2.2 Identification of Habitat Types

From the land use survey data encompassing the project area and its vicinity—specifically within a 3-kilometer radius from the project boundary and a 100-meter radius from the project's power transmission lines—no legally protected conservation areas or ecologically significant areas were identified, and three types of Modified Habitats have been categorized: agricultural areas, community and built-up areas, and other areas (such as roads and vacant lands). These areas have been impacted by various human activities or have been altered from their original state, resulting in a reduced diversity of plant and animal species. Moreover, these habitats play a critical role as living and foraging grounds for wildlife, although the distribution of plant species is relatively low.

Additionally, the consideration of Critical Habitat for the Project, according to the criteria of IFC's Guidance Note 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources (June 27, 2019), is detailed as follows:

#### **Criterion 1: Critically Endangered (CR)/ Endangered (EN) Species**

From verified of wildlife species in the project area along the transmission line corridor and within 100 meters from the center point of the transmission line did not find any wildlife species classified as Endangered (EN) or Critically Endangered (CR) and Vulnerable ( VU) may be possible to find, according to the information reported on the distribution map of each species according to the IUCN, 4 species of wildlife are classified as endangered (EN), including the Long-tailed Macaque (*Macaca fascicularis*), Steppe Eagle (*Aquila nipalensis*), Southeast Asian turtle (Thailand: *Cuora amboinesis kamaroma*) and Vulnerable (VU) is an Asiatic Softshell Turtle (*Amyda cartilaginea*) according to IUCN criteria (2022-2). This classification is consistent with the criteria specified in IFC PS6 (updated 2019) as shown in **Table 3.2-16**.

**TABLE 3.2-16**  
**THE EXAMINATION OF SPECIES IDENTIFIED IN THE SURVEY**  
**ACCORDING TO THE REQUIREMENTS OF CRITERION 1**

Common Name and Scientific Name	Criterion 1	Plant / Wildlife status				
		Thailand red data: Plant (2006)	Prohibited tree in Thailand (1987)	Wildlife Law in Thailand (2019)	IUCN (2022)	CITES (2022)
<b>I. FLORA</b>						
Burma Padauk ( <i>Pterocarpus macrocarpus</i> )*	detect *	-	PTA**	-	EN	-
<b>II. FAUNA</b>						
Long-tailed macaque ( <i>Macaca fascicularis</i> )	detect	LC	-	PR	EN	II
Steppe Eagle ( <i>Aquila nipalensis</i> )	Maybe	NT	-	PR	EN	II
Southeast Asian Box Turtle ( <i>Cuora amboinensis kamaroma</i> )	Maybe	NT	-	PR	EN	II
Asiatic Soft-shelled Turtle ( <i>Amyda cartilaginea</i> )	Maybe	LC	-	PR	VU	II

**Remark:** \* = The species of plants that have been cultivated are not those that naturally grow in wild forest areas.

Thai Red Data: Plants (ONEP, 2006)

- = Not assigned status

IUCN Red List, 2022

EN = Endangered Species

VU = Vulnerable Species

The Royal Decree on Restricted Timber Species B.E. 2530 (1987)

PTA = Prohibited Tree Type A PTB = Prohibited Tree Type B

NTA = Not Prohibited Tree Type

Wild Animal Conservation and Protection Act B.E.2562 (2019)

PR = Protected Wildlife

RE = Reserved Wildlife

- = Not in list

Convention on International Trade in Endangered Species of Wild Fauna and flora (CITES) (UNEP, 2022)

- = Not in list

**Thresholds of Criteria 1 ; found a species that meets the criteria in the details.**

**Long-tailed macaque (*Macaca fascicularis*)** when considering information on distribution, population size, legal status and status assessment from the Office of Natural Resources and Environmental Policy and Planning, Ministry of Natural Resources and Environment (ONEP) Thailand It was found that the species is classified as commonly found throughout Thailand. The macaque's habitat can be found in various environments, including mangrove forests, deciduous forests, evergreen forests, and even small hills outside protected forests. This species is known to adapt to a variety of conditions, including areas with high humidity. Publication information is based on reports from MALAIWIJITNOND & HAMADA (2008) **Figure 3.2-10** and additional documents supporting measures to alleviate problems related to monkeys by the Secretariat of the House of Representatives (2023), which refers to the 2018 macaque population assessment by the Department of National Parks, Wildlife and Plant Conservation, Thailand This survey reports a population of 48,955 animals nationwide. In summary, although macaques are classified as endangered (EN) according to IUCN criteria, Thai law classifies macaques as least concern animals (LC) based on population size and ongoing efforts to increase the population.

In addition, residents of the 3-kilometer study area were interviewed about macaques, which revealed that macaques live only on the mountain and hillside areas, not down below. But sometimes one or two macaques that are familiar with people may come to the temple on a hill 1.5 kilometers away from the project area to find food at the temple.

**Southeast Asian box turtle (Thailand: *Cuora amboinensis kamaroma*)** lives in wetlands, rivers, and canals (according to Turtles of Thailand by Wirot (1980), found in every region of Thailand. Later, there was a review of Thailand Red Data: Mammals, reptile and amphibians Office of Natural Resources and Environmental Policy and Planning, Bangkok (J. Napitaphata and T. Chanakad, 2005, reported only 6 areas in Thailand. Later, the IUCN/SSC Tortoise and Freshwater Turtle special (2007) reviewed and referred to the old report. by Wirot (1980) and Napitaphat J. and T. Chan-at (2005) using the geographic information system of the river basin and the location of box turtles to predict the extent of their distribution in Thailand. Box turtles have not been surveyed or reported in some areas. Currently, naturalist reports indicate that Southeast Asian box turtles can be found in many areas of Thailand, especially in Bangkok and surrounding areas. Southeast Asian box turtles are adaptable to urban areas, parks and wastelands. This information shows no concern about extinction in Thailand. And from the IUCN world population data, the world population is not specified.

([https://www.iucnredlist.org/ja/species/5958/3078812#evaluation information](https://www.iucnredlist.org/ja/species/5958/3078812#evaluation-information)).

The KCB3 project area covers about 70% of the area where field crops such as sugarcane and cassava are grown. The project area also has rice fields (10%) and water sources (1%) where Southeast Asian box turtles may be seen in the rice fields. In farming in such areas, it is always necessary to improve the area before farming, such as plowing fields and adding fertilizer, which interferes with the life of box turtles. In addition, the behavior of turtles prefers to live in low-lying ponds where plants grow densely in clumps (Das 1991, van Dijk 1998, Schoppe and Das 2011). As mentioned, the project area has only 1% water source, so it is quite dry and can only farm once a year, only during the rainy season. Therefore, the area is not suitable for living and breeding Southeast Asian box

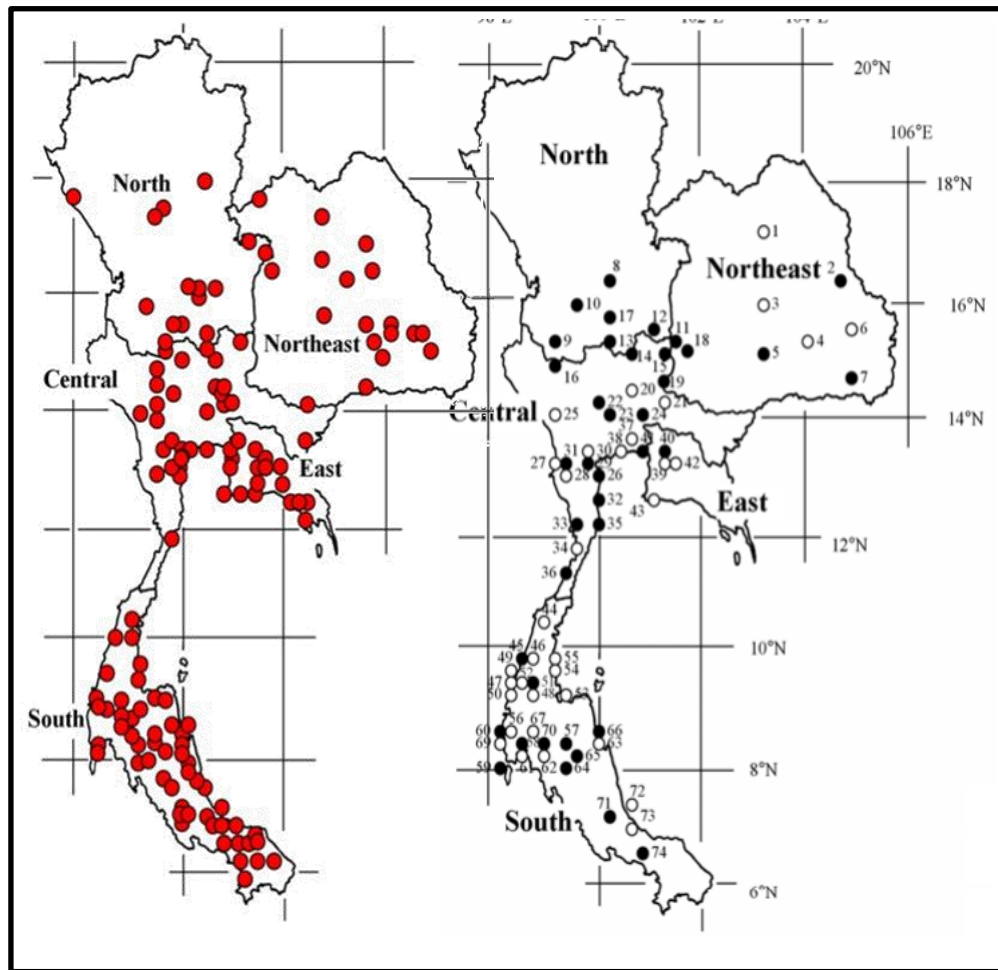
turtle. Therefore, it can be assumed that box turtles are found in this area at less than 0.5 percent of the total population (see **Figure 3.2-11 and Figure 3.2-12**).

**Steppe Eagle (*Aquila nipalensis*)** According to ecological and habitat information, the Steppe Eagle is a winter migratory bird that may be seen in the project area but has not been found in official survey reports that have been released to the public to date and has not been reported. Discovering a Steppe Eagle in the project area or nearby. The nearest location is in a rice field, Khao Yoi District, Phetchaburi Province, where steppe eagles were found more than 120 kilometers from the study project area. The IUCN map is an old data based on Thailand Red Data: Bird, Office of Natural Resources and Environmental Policy and Planning. Bangkok (2005) The data report is 20 years old and the exact location is not specified. The current distribution map of the eagle is found in the northern, upper central, and southern regions of Thailand. (Southern region of Phetchaburi province) according to the distribution of Lynx and Birdlife international Field Guides Bird of Thailand by Ajarn Trisukon and Limprungpattanakit, W. (2018). Ebird shows a number of recent reports of the species across Thailand, but not in such volume that it is likely that more than 0.5 percent of the 50,000-75,000 population occurs within the vicinity of this project.

[https://ebird.org/species/steeag1?\\_ga=2.153599032.1674974729.170](https://ebird.org/species/steeag1?_ga=2.153599032.1674974729.170) (see **Figure 3.2-13 and Figure 3.2-14**)

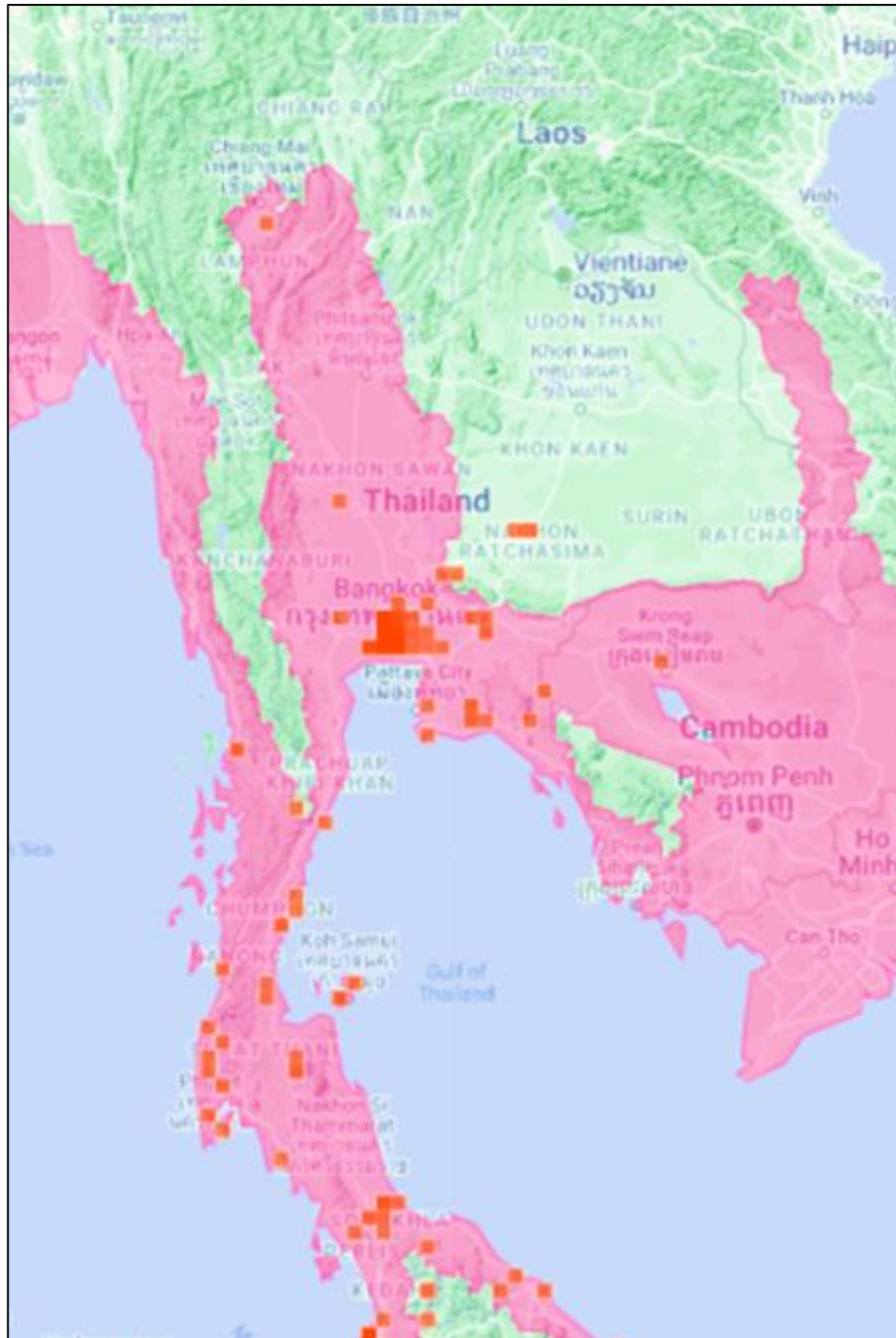
**Burmese Padauk (*Pterocarpus macrocarpus*) (EN):** In the project area, a survey found Burmese Padauk that was intentionally planted in agricultural areas and did not occur naturally in forest areas. Because of the land use of the project area, the study area has a radius of 3 kilometers and the transmission line area is characterized as an agricultural, community, and residential area. Most of the plants found are field crops and around the project there are also common perennial plants planted in the community and along the roadside. Currently, Thailand has enacted a law to promote economic cultivation. Because the Burmese padauk tree can be used, it is not a problem of extinction. It is also widely planted in residential areas throughout the country and In some areas it is a Burmese padauk plantation area. Therefore, it can be said that there are more than 0.5 percent of the world's population. (when comparing unspecified population estimates, IUCN) may not be significant according to Criterion 1 of IFC PS6, as listed in **Table 3.2-16**. Further details are as follows:

**Asiatic Soft-shelled Turtle (*Amyda cartilaginea*) (VU):** This species may occur in the Project area. It is also known from other areas across mainland South-East Asia and Borneo. Populations have been much reduced across this range, but there is no evidence to suggest such very high populations in the project area that even their total loss here would result in the species being uplisted to Endangered. As such, this species does not qualify the project area as Critical Habitat.



**FIGURE 3.2-10 : THE POPULATION DISTRIBUTION DATA OF CRAB-EATING MACAQUES IN THAILAND, AS REPORTED BY MALAIVIJITNOND & HAMADA (2008), INDICATE RED POINTS AS SIGHTINGS OBTAINED THROUGH INTERVIEWS, BLACK POINTS AS SIGHTINGS IN RELIGIOUS SITES, AND WHITE POINTS AS SIGHTINGS IN OTHER AREAS.**





**FIGURE 3.2-11 : THE SOUTHEAST ASIAN BOX TURTLE DISTRIBUTION INATURALIST (RED AREA IS DISTRIBUTION FROM IUCN AND RED OR ORANG POINT ARE CURRENT REPORT FIND)**

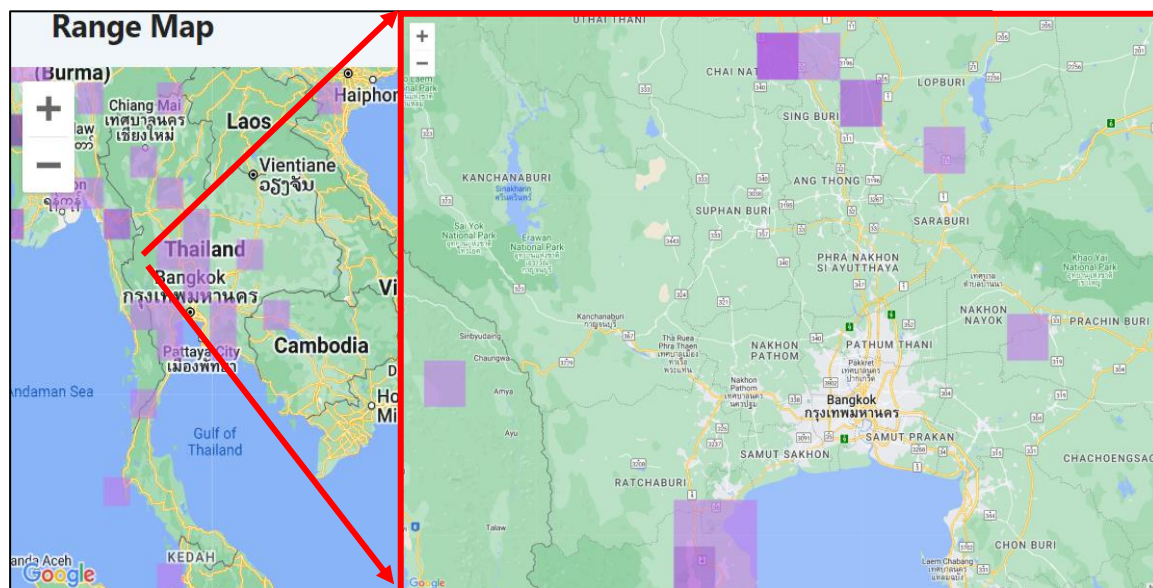
[https://www.inaturalist.org/guide\\_taxa/712185](https://www.inaturalist.org/guide_taxa/712185)



**FIGURE 3.2-12 : SHOWING THE LANDUSE CHARACTERISTICS OF THE KCB3 PROJECT AREA IS DRY, WHICH IS NOT SUITABLE FOR THE SOUTHEAST ASIAN BOX TURTLE TO LIVE IN.**



**FIGURE 3.2-13 : THE STEPP EAGLE DISTRIBUTION FROM LYNX AND BIRDLIFE INTERNATIONAL FIELD GUIDES BRID OF THAILNAD. BY TREESUCON, U. & LIMPARUNGPATTHANAKIJ,W. (2018)**



**Remark :** square purple is current distribution report from ebird.org  
[https://ebird.org/species/steeag1?\\_ga=2.153599032.1674974729.170](https://ebird.org/species/steeag1?_ga=2.153599032.1674974729.170)

**FIGURE 3.2-14 : THE STEPP EAGLE DISTRIBUTION FROM EBIRD.ORG (2024)**

**Criterion 2: Endemic and Restricted-range Species**

From the data collected, no plant or animal species were found to meet the criteria of Criterion 2 of IFC PS6.

**Criterion 3: Migratory and Congregatory Species**

In the project area, the power transmission line zone, and the study area within a 3-kilometer radius from the project area boundary, as well as the study area within a 100-meter radius from the midpoint of the power transmission line, no species of migratory animals exhibiting group migration or main migration routes were found. However, individual migratory bird species, totaling 15, were identified. Some of these species have uncertain global population status, but the overall population size of migratory animals is considered to be less than or equal to 1% of the global population. Based on the survey results of migratory animal populations found in the project area, it is less than 0.001% of the globally aggregated population, and all species are classified as Least Concern according to IUCN. Therefore, they do not meet the criteria of Criterion 3 of IFC PS6, as shown in **Table 3.2-17**.



**TABLE 3.2-17**  
**THE EXAMINATION OF SPECIES IDENTIFIED IN THE SURVEY ACCORDING TO THE REQUIREMENTS OF CRITERION 3**

Type	Specie	IUCN 2022	ONEP in Thailand 2017	Wildlife Law in Thailand 2019	CITES 2022	Population Record in Project Area No	Global Population No *	Confirmed in the project Area	Criterion3		
Bird	Barn Swallow	( <i>Hirundo rustica</i> )	LC	LC	Protect	-	4	290000000-487000000	(< 0.001%)	Yes	No
	Brown Shrike	( <i>Lanius cristatus</i> )	LC	LC	Protect	-	2	Unknown	but likely to be less than1 %	Yes	No
	Burmese Shrike	( <i>Lanius colluriooides</i> )	LC	LC	Protect	-	2	Unknown	but likely to be less than1 %	Yes	No
	Eastern Yellow Wagtail	( <i>Motacilla flava</i> )	LC	LC	Protect	-	1	60000000-109999999	(< 0.001%)	Yes	No
	Amur Stonechat	( <i>Saxicola stejnegeri</i> )	LC	LC	Protect	-	2	55000000-94999999	(< 0.001%)	Yes	No
	Black-naped Oriole	( <i>Oriolus chinensis</i> )	LC	LC	Protect	-	1	Unknown	but likely to be less than1 %	Yes	No
	Asian Brown Flycatcher	( <i>Muscicapa dauurica</i> )	LC	LC	Protect	-	2	Unknown	but likely to be less than1 %	Yes	No
	Red-thoated Flycatcher	( <i>Ficedula albicilla</i> )	LC	LC	Protect	-	2	Unknown	but likely to be less than1 %	Yes	No
	Oriental Pratincole	( <i>Glareola maldivarum</i> )	LC	LC	Protect	-	1	Unknown	but likely to be less than1 %	Yes	No
	Common Kingfisher	( <i>Alcedo atthis</i> )	LC	LC	Protect	-	1	700,000-1,399,999	(< 0.001%)	Yes	No
	Pied Harrier	( <i>Circus melanoleucos</i> )	LC	LC	Protect	-	2	Unknown	(< 0.001%)	Yes	No
	Common Kestrel	( <i>Falco tinnunculus</i> )	LC	LC	Protect	-	1	4300000-6700000	(< 0.001%)	Yes	No
	Black Dongo	( <i>Dicrurus macrocercus</i> )	LC	LC	Protect	-	3	Unknown	but likely to be less than1 %	Yes	No
	Asian Green Bee-eater	( <i>Merops orientalis</i> )	LC	LC	Protect	-	2	Unknown	but likely to be less than1 %	Yes	No
	Steppe Eagle	( <i>Aquila nipalensis</i> )	EN	NT	Protect	-	-	50,000-75,000	but likely to be less than1 %	Yes	No
<b>Total</b>		<b>15</b>	<b>15</b>	<b>15</b>	<b>0</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>15</b>	<b>15</b>	

\* Refferent poppulation data from IUCN and Birdlife international

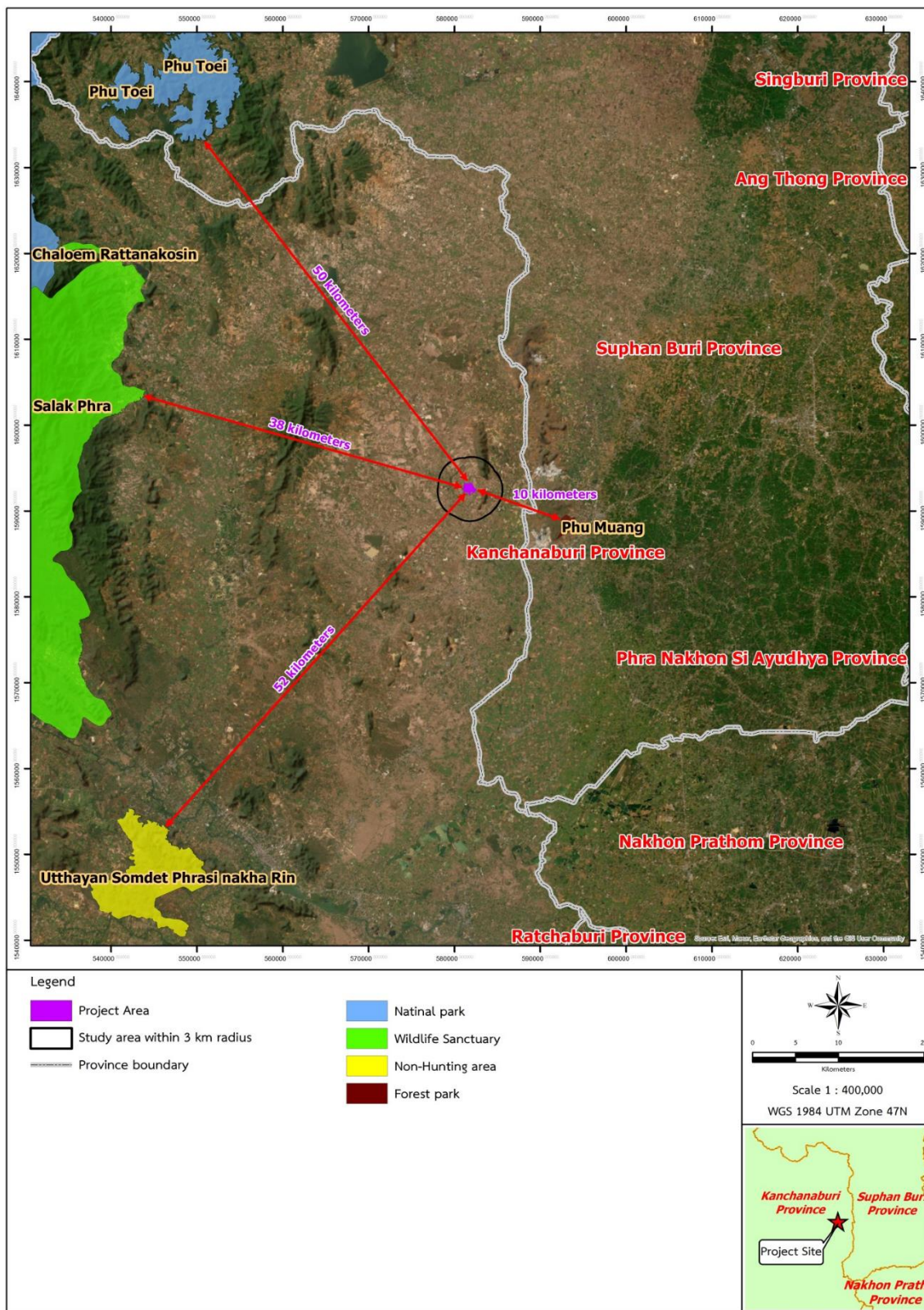
#### **Criterion 4: Highly Threatened and/or Unique Ecosystems**

In the project area, the power transmission line zone, and the study area within a 3-kilometer radius from the project area boundary, as well as the study area within a 100-meter radius from the midpoint of the power transmission line, exhibit characteristics of agricultural land, community areas, built-up areas, and other modified habitats commonly found. In area representing 5 species in the criteria for IUCN, it lower than 5% of the global extant of an ecosystem type meeting the criteria and no areas of significant international, regional, national, or local importance that serve as habitats and food sources for wildlife threatened or characterized by any particular features were identified. The conservationally important forest areas near the project site are Phu Mung Wildlife Sanctuary and Salakpra Wildlife Sanctuary, located approximately 10 kilometers southeast and 38 kilometers west, respectively, from the project area, as shown in **Figure 3.2-15**. Therefore, the project does not meet the criteria of Criterion 4 of IFC PS6.

#### **Criterion 5: Key Evolutionary Processes**

The KCB3 project is located in the western region of Thailand, predominantly in flat areas. The current land use in the area is mainly for agriculture, with nearby areas being residential communities and urban settlements, water sources, and unused land, among others. No significant conservation forests were found within a 10-kilometer radius from the project site. Given the modified habitat conditions, the environmental system in the project area is described as an area that has been continuously disturbed or altered by human activities. Therefore, it can be concluded that the project area, the power transmission line zone, and the study area within a 3-kilometer radius from the project area boundary, as well as the study area within a 100-meter radius from the midpoint of the power transmission line, do not represent ecologically important evolutionary areas.

In summary, based on the results of the Critical Habitat assessment according to the criteria of the International Finance Corporation (IFC) under Performance Standard 6 (PS6; IFC 2012, updated June 27, 2019), it is found that the project area, the transmission line zone, and the study area within a 3-kilometer radius from the project area boundary, as well as the study area within a 100-meter radius from the midpoint of the power transmission line, do not meet the criteria for being classified as Critical Habitat under categories 2-5. However, they do meet the criteria for Critical Habitat under category 1 (Critically Endangered (CR)/Endangered (EN) Species/ Vulnerable (VU)) based on the IUCN classification. Five species were identified in this category: the Long-tailed macaque (*Macaca fascicularis*) as the endangered animal species and the Burma Padauk (*Pterocarpus macrocarpus*) as the endangered plant species.



P06111/Pongsak\_b/22-08-66/3/11 01 SB-KCB3 Eng.mxd

**FIGURE 3.2-15 : FOREST CONSERVATION AREAS**



### 3.2.3 Aquatic Ecology

The project collected samples of aquatic biological resources such as phytoplankton, zooplankton and benthos at 3 stations, as shown in **Figure 3.1-15**. Those stations are the same ones as the surface water sample collection. This is because water quality is directly relevant to aquatic ecology. Sample collection as examples of the dry season was carried out on 30 May 2023, as shown in **Figure 3.2-16**. - Sampling methods of phytoplankton, zooplankton and benthos. Details are as follows:

#### (1) Sampling method

(a) **Plankton:** Using a 5-liter tube to scoop surface water (at a 30-cm depth below the water surface) for 20 liters and pour water into a 20-micron plankton net. Plankton samples were trapped on the filter and then preserved in a sample tube filled with 4-5% concentrated formalin. An analysis was carried out in a laboratory including species identifications, quantity density proportion between phyto and zoo plankton, and biodiversity index.

- **Species identification, density, and biodiversity of plankton**

Density of phytoplankton and zooplankton was reported in cell per square meters, and an analysis was done based on Ladda's manual (1999), Smith (1950), Carr and Whitton (1973), and Bold and Wynne (1978).

(b) **Benthos:** Using the 0.0225-m<sup>2</sup> cross sectional area Ekman dredge to collect samples at each station with three replica. Put the samples on a 450-micron benthos sieve. Samples were collected 3 times per station (total area 0.75 sq. ft.). Unwanted scrap materials were separated by a 1.0 and 0.5mm mesh sieve. The benthos remaining on the sieve were collected in a sampling bottle and maintained by adding neutralizing formaldehyde. The concentration of formaldehyde in the sample was 5% by volume. An analysis was carried out in a laboratory including species identifications and numbers. Data analysis is as follows.

- **Benthos abundance (density)**

Benthos abundance from sediment was calculated with numbers of benthos per square meter (m<sup>2</sup>). The species identifications referred to Prachuab's manual (1982), Saowapha (2015), Brinkhurst (1971), Brandt (1974), Cedhagen (1984), Merritt and Cummins (1984), Williams and Felmate (1992), and Swennen (2001).

## (2) Sample Analysis Methods

- **Phytoplankton/zooplankton and benthos** An analysis included species or family identifications, diversity index using Shannon-Weaver index, density in cells/m<sup>3</sup> or numbers of individual/m<sup>2</sup>, and proportions of phytoplankton to zooplankton.

For species identification and density were determined at each station, the diversity index was calculated using the following equation.

$$H' = - \sum_{i=1}^s (n_i / n) \ln (n_i / n) \text{ (Shannon and Weaver, 1963)}$$

When H' = Biodiversity Index

S = Number of plankton species

N = Number of total plankton

n<sub>i</sub> = Number of plankton in each species

## (3) Results and Discussion

The sample collection of phytoplankton, zooplankton and benthos was on 30 May 2023 in the area of Khlong Pla Soi at 3 stations. The general conditions of Khlong Pla Soi on the date of sample collection are as follows. (Table 3.2-18 to Table 3.2-20)

**SW1 : Klong Pla Soi before flowing closer to the project area** is a shallow water resource, with a 0.5-meter depth, still water, light yellow color, low sediment, and muddy bottom water. It is used for agriculture and receiving water from the community.

- **Phytoplankton** : A total of 35 phytoplankton species are found consisting of 4 species of Division Cyanophyta, 29 species of Division Chlorophyta, and 2 species of Division Chromophyta. *Euglena rubra* is dominant species, with a density of 113,796,000 cells/m<sup>3</sup>. Most of these phytoplankton species indicate that water resource is rich in organic matter and food at medium to high levels. The species diversity shows that the diversity index is 1.40.

- **Zooplankton** : A total of 20 zooplankton species are found consisting of 5 species of Protozoa, 12 species of Rotifera, and 3 species of Arthropoda. The dominant species is *Polyarthra* sp., with a density of 939,600 individuals/m<sup>3</sup>. The species diversity shows that the diversity index is 2.52.

- **Diversity Index** of Phytoplankton/Zooplankton in this station is 1.52. It indicates that the water quality is fair, and organisms can live.

- **Benthos** : There is 1 species. The Family Ceratopogonidae is *Culicoides* sp., with 22 individuals/m<sup>2</sup>.



**FIGURE 3.2-16 : SAMPLE COLLECTION OF PLANKTON AND BENTHOS**

**SW 2 : Khlong Pla Soi flowing near the project area** is a shallow water source, with a 0.2-meter depth, still water, light yellow color, low sediment, sandy bottom water. It is used for agriculture and receiving water from the community.

– **Phytoplankton** : 0.47 A total of 22 phytoplankton species are found consisting of 1 species of Division Cyanophyta, 16 species of Division Chlorophyta, and 5 species of Division chromophyta. The dominant phytoplankton species is *Lepocinclis texa*, with a density of 113,796,000 cells/m<sup>3</sup>. Most of these phytoplankton species indicate that the water resource is rich in organic matter and food at medium to high levels. The species diversity shows that the diversity index is 0.47.

– **Zooplankton** : A total of 11 zooplankton species are found in the project area, consisting of 3 species of Protozoa, 5 species of Rotifera, and 3 species of Arthropoda. The dominant species is *Nauplius* (unable to be classified), with a density of 939,600 individuals/m<sup>3</sup>. The species diversity shows that the diversity index is 1.88.

– **Diversity Index** of Phytoplankton/Zooplankton in this station is 0.53. It indicates that the water quality is low, and it is not appropriate for organisms to live.

– **Benthos** : There is 1 species. The Family Ceratopogonidae is *Culicoides* sp., with 22 individuals/m<sup>2</sup>.

**SW3 : Khlong Pla Soi after flowing near the project area** is a shallow water source, with a 0.3-meter depth, still water, light yellow color, low sediment, fine sand bottom water. It is used for agriculture and receiving water from the community.

– **Phytoplankton** : A total of 7 phytoplankton species are found consisting of 1 species of Division Cyanophyta and 6 species of Division Chlorophyta. The dominant phytoplankton species is *Oscillatoria* sp., with a density of 744,720,000 individuals/m<sup>3</sup>. Most of these phytoplankton species indicate that the water resource is rich in organic matter and food at medium to high levels. The species diversity shows that the diversity index is 0.05.

– **Zooplankton** : A total of 6 zooplankton species are found consisting of 2 species of Rotifera and 4 species of Arthropoda. The dominant species is cyclopid copepod (unable to be classified), with a density of 939,600 individuals/m<sup>3</sup>. The species diversity shows that the diversity index is 1.48.

– **Diversity Index** of Phytoplankton/Zooplankton in this station is 0.08. It indicates that the water quality is low, and it is not appropriate for organisms to live.

– **Benthos** : There are 2 species. They are Family Culicidae, which is *Culicoides* sp. (mosquitos), with 44 individuals/m<sup>2</sup> and Family Corixidae (water Boatmen), which is *Corisella* sp., with 66 individuals/m<sup>2</sup>.

**TABLE 3.2-18**  
**RESULTS OF SURVEY ON SPECIES AND ABUNDANCE OF PHYTOPLANKTON**

Unit : cell/cubic meter

Phytoplankton species	Sample collection stations			Total
	SW1	SW2	SW3	
<b>Division Cyanophyta</b>				
<b>Class Cyanophyceae (Blue green algae)</b>				
<b>Order Nostocales</b>				
<b>Family Oscillatoriaceae</b>				
<i>Oscillatoria</i> sp.	939,600	7,560,000	744,720,000	753,219,600
<b>Family Nostocaceae</b>				
<i>Anabaena affinis</i>	1,229,600	-	-	1,229,600
<i>Anabaena spiroides</i>	290,000	-	-	290,000
<i>Raphidiopsis</i> sp.	25,520,000	-	-	25,520,000
<b>Division Chlorophyta</b>				
<b>Class Chlorophyceae (Green algae)</b>				
<b>Order Volvocales</b>				
<b>Family Volvocaceae</b>				
<i>Pandorina morum</i>	69,600	-	-	69,600
<b>Order Chlorococcales</b>				
<b>Family Hydrodictyaceae</b>				
<i>Pediastrum simplex</i>	5,800,000	56,000	-	5,856,000
<b>Family Oocystaceae</b>				
<i>Tetraedron gracile</i>	220,400			220,400
<i>Tetraedron trigonum</i>	-	291,200	-	291,200
<b>Family Scenedesmaceae</b>				
<i>Actinastrum hantzschii</i>	139,200	-	-	139,200
<i>Crucigenia irregularis</i>	69,600	-	-	69,600
<i>Scenedesmus acuminatus</i>	150,800	-	-	150,800
<i>Scenedesmus armatus</i>	58,000	-	-	58,000
<b>Order Zygnematales</b>				
<b>Family Desmidiaceae</b>				
<i>Closterium ehrenbergii</i>	-	100,800	-	100,800
<i>Euglena acus</i>	1,160,000	1,142,400	24,200	2,326,600
<i>Euglena anabaena</i>	150,800	-	-	150,800
<i>Euglena caudata</i>	104,400	-	-	104,400
<i>Euglena ehrenbergii</i>	81,200	-	-	81,200
<i>Euglena polymorpha</i>	870,000	168,000	-	1,038,000
<i>Euglena proxima</i>	591,600	134,400	-	726,000
<i>Euglena pseudoviridis</i>	371,200	89,600	-	460,800
<i>Euglena rubra</i>	113,796,000	5,947,200	150,800	119,894,000

**TABLE 3.2-18**  
**RESULTS OF SURVEY ON SPECIES AND ABUNDANCE OF PHYTOPLANKTON**  
**(CONT'D)**

Unit : cell/cubic meter

Phytoplankton species	Sample collection stations			Total
	SW1	SW2	SW3	
<b>Class Euglenophyceae (Euglenoid)</b>				
<b>Order Euglenales</b>				
<b>Family Euglenaceae</b>				
<i>Euglena spiroides</i>	522,000	235,200	-	757,200
<i>Euglena subehrenbergii</i>	220,400	-	-	220,400
<i>Lepocinclis texa</i>	2,900,000	248,640,000	6,380,000	257,920,000
<i>Phacus alata</i>	46,400	-	-	46,400
<i>Phacus angulatus</i>	290,000	291,200	-	581,200
<i>Phacus longicauda</i>	301,600	5,868,800	58,000	6,228,400
<i>Phacus platalea</i>	69,600	-	-	69,600
<i>Phacus pleurunctes</i>	1,148,400	145,600	-	1,294,000
<i>Phacus quinquemarginatus</i>	139,200	-	-	139,200
<i>Phacus tortus</i>	220,400	806,400	34,800	1,061,600
<i>Strombomonas gibberosa</i>	139,200	-	-	139,200
<i>Trachelomonas armata</i>	-	22,400	-	22,400
<i>Trachelomonas crebea</i>	3,468,400	-	-	3,468,400
<i>Trachelomonas intermedia</i>	22,330,000	67,200	46,400	22,443,600
<i>Trachelomonas volvocina</i>	69,600	-	-	69,600
<b>Division Chromophyta</b>				
<b>Class Bacillariophyceae (Diatom)</b>				
<b>Order Pennales</b>				
<b>Family Cymbellaceae</b>				
<i>Cymbella tumida</i>	-	89,600	-	89,600
<b>Family Naviculaceae</b>				
<i>Frustulia rhomboides</i>	-	44,800	-	44,800
<i>Navicula anglica</i>	-	380,800	-	380,800
<i>Stauroneis anceps</i>	197,200	537,600	-	734,800
<b>Family Bacillariaceae</b>				
<i>Nitzschia sp.</i>	-	436,800	-	436,800
<b>Family Surirellaceae</b>				
<i>Surirella robusta</i>	371,200	-	-	371,200
<b>Quantity and species of phytoplankton</b>				
<b>Quantity (cells/m<sup>3</sup>)</b>	<b>184,045,600</b>	<b>273,056,000</b>	<b>751,414,200</b>	<b>1,208,515,800</b>
<b>Number (species)</b>	<b>35</b>	<b>22</b>	<b>7</b>	<b>42</b>
<b>Diversity index (H')</b>	<b>1.40</b>	<b>0.47</b>	<b>0.05</b>	<b>0.64</b>

Source: TLT Consultants Co.,Ltd, 30 May 2023

**TABLE 3.2-19**  
**RESULTS OF SURVEY ON SPECIES AND ABUNDANCE OF ZOOPLANKTON**

Unit : individual/cubic meter

Phylum/Zooplankton species	Sample collection stations			Total
	SW1	SW2	SW3	
<b>Phylum Protozoa</b>				
<b>Class Sarcodina</b>				
<b>Order Testacida</b>				
<b>Family Arcellidae</b>				
<i>Arcella vulgaris</i>	220,400	-	-	220,400
<b>Family Diffugiidae</b>				
<i>Diffugia acuminata</i>	69,600	145,600	-	215,200
<i>Diffugia lebes</i>	174,000	67,200	-	241,200
<b>Class Ciliata</b>				
<b>Order Peritrichida</b>				
<b>Family Vorticellidae</b>				
<i>Vorticella</i> sp.	-	33,600	-	33,600
<b>Order Hymenostomatida</b>				
<b>Family Parameciidae</b>				
<i>Paramecium</i> sp.	197,200	-	-	197,200
<b>Order Gymnostomatida</b>				
<b>Family Colepidae</b>				
<i>Coleps hirtus</i>	81,200	-	-	81,200
<b>Phylum Rotifera</b>				
<b>Class Digononta</b>				
<b>Order Bdelloida</b>				
<b>Family Philodinidae</b>				
<i>Rotaria citrinus</i>	290,000	-	-	290,000
<b>Class Monogononta</b>				
<b>Order Ploima</b>				
<b>Family Brachionidae</b>				
<i>Brachionus angularis</i>	522,000	100,800	23,200	646,000
<i>Brachionus calyciflorus</i>	34,800	145,600	104,400	284,800
<i>Brachionus caudatus</i>	150,800	-	-	150,800
<i>Brachionus falcatus</i>	220,400	44,800	-	265,200
<i>Mytilina</i> sp.	34,800	-	-	34,800
<i>Trichotria curta</i>	23,200	-	-	23,200
<b>Family Lecanidae</b>				
<i>Lecane inopinata</i>	23,200	-	-	23,200



**TABLE 3.2-19**  
**RESULTS OF SURVEY ON SPECIES AND ABUNDANCE OF ZOOPLANKTON**  
**(CONT'D)**

Unit : individual/cubic meter

Phylum/Zooplankton species	Sample collection stations			Total
	SW1	SW2	SW3	
<b>Family Trichocercidae</b> <i>Trichocerca</i> sp.	116,000	33,600	-	149,600
<b>Family Synchaetidae</b> <i>Polyarthra</i> sp.	939,600	190,400	-	1,130,000
<b>Order Flosculariacea</b> <b>Family Flosculariidae</b> <i>Ptygura pectinifera</i>	150,800	-	-	150,800
<b>Family Testudinellidae</b> <i>Filinia terminails</i>	371,200	-	-	371,200
<b>Phylum Arthropoda</b> <b>Class Crustacea</b> <b>Order Diplostraca</b> <b>Family Moinidae</b> <i>Moina</i> sp.	23,200	235,200	742,400	1,000,800
<b>Order Cyclopoida</b> *Cyclopoid copepod	127,600	761,600	301,600	1,190,800
<b>Order Podocopa</b> <b>Family Cypridae</b> *Ostracod	-	-	835,200	835,200
*Nauplius	34,800	772,800	591,600	1,399,200
<b>Quantity and species of zooplankton</b> <b>Quantity (individuals/m<sup>3</sup>)</b>	<b>3,804,800</b>	<b>2,531,200</b>	<b>2,598,400</b>	<b>8,934,400</b>
<b>Number (species)</b>	<b>20</b>	<b>11</b>	<b>6</b>	<b>22</b>
<b>Diversity index (H')</b>	<b>2.52</b>	<b>1.88</b>	<b>1.48</b>	<b>1.96</b>

Note : \* = unable to be classified

Source : TLT Consultants Co., Ltd., 30May 2023

**TABLE 3.2-20**

**RESULTS OF SURVEY ON SPECIES AND ABUNDANCE OF BENTHOS**

Unit : individual/square meter

Group/Species of benthos	Sample collection stations			Total
	SW1	SW2	SW3	
<b>PHYLUM ARTHROPODA</b>				
<b>Class Insecta</b>				
Order Diptera				
Family Culicidae (mosquito)				
<i>Culex</i> sp.	-	-	44	44
Family Ceratopogonidae (gnat larvae)				
<i>Culicoides</i> sp.	22	22	-	44
Order Hemiptera (Water Boatman)				
Family Corixidae (Water Boatman)				
<i>Corisella</i> sp.	-	-	22	22
<b>Total number of all benthos (individuals/m<sup>2</sup>)</b>	<b>22</b>	<b>22</b>	<b>66</b>	<b>110</b>
<b>Total benthic species</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>4</b>

Source : TLT Consultants Co.,Ltd, 30 May 2023

### 3.3 QUALITY OF LIFE VALUES

#### 3.3.1 Social Information

The study area of economy and society and opinions covers communities within a 3-kilometer area from the project area, covering some areas of Nong Pradu Subdistrict, Lao Khwan District and Sa Long Ruea Subdistrict, Huai Krachao District, Kanchanaburi Province (**Figure 3.3-1**).

Data for social information was expected to be collected from relevant authorities' documents and via interviews with households within a 300-meter radius of the project boundaries. From a field survey within a radius of 300 meters, 4 buildings were found: 2 houses and 1 pig farm.

There are three local government organizations within the project's study area: Sa Long Ruea Subdistrict Administrative Organization (SAO), Nong Pradu SAO, and Sa Long Ruea Subdistrict Municipality of Huai Krachao District, Kanchanaburi Province. Each of these entities demonstrates diverse social conditions in a variety of ways, as detailed below:



## a. Demography and Population

### (i) Kanchanaburi Province

#### • Administration

Kanchanaburi is divided into administrative areas consisting of provincial administration and local government administration. The provincial administration is divided into 13 districts, 98 sub-districts and 959 villages. Local government administration is divided into 1 provincial administrative organization, 3 city municipalities, 46 subdistrict municipalities and 72 subdistrict administrative organizations. Each district has sub-districts, villages, municipalities, subdistricts, municipalities and sub-district administrative organizations, as shown in **Table 3.3-1**.

#### • Population

There is a total population of 894,283 people in civil registrations on December 2022, Kanchanaburi Province, divided into 448,109 males, 446,174 females, and 359,348 houses (Office of Registration Administration, Department of Provincial Administration, Ministry of Interior, 2023).

#### • Social Aspect

##### **Educational institutions**

In Kanchanaburi, there are 521 educational institutions in elementary-higher education levels. The institutions of higher education are Kanchanaburi Rajabhat University, Mahidol University Kanchanaburi Campus, Ramkhamhaeng University Kanchanaburi Campus in Honour of His Majesty The King and Western University (private educational institution) with a total number of 181,746 students.

##### **Religious institutions**

People in Kanchanaburi are 98.41% Buddhists. There are 600 temples (3 Royal temples, i.e., Wat Chai Chumphon Chana Songkhram, Wat Thewa Sangkharam and Wat Phra Thaen Dong Rang). There are 71 churches comprising 65 Protestant churches and 6 Catholic churches. Also, there are 7 mosques.

### (ii) Huai Krachao District

#### • Administration

Huai Krachao District is divided into 4 subdistricts, 73 villages, consisting of 2 subdistrict administrative organizations and 2 subdistrict municipalities, as follows.

- Huai Krachao Subdistrict, 21 villages
- Wang Phai Subdistrict, 11 villages
- Don Salaep Subdistrict, 24 villages
- Sa Long Ruela Subdistrict, 17 villages

#### • Population

There is total population of 33,863 people in civil registrations on December 2022, divided into 16,643 males, 17,220 females, and 12,157 houses (Office of Registration Administration, Department of Provincial Administration, Ministry of Interior, 2023).

**TABLE 3.3-1**  
**NUMBER OF SUB-DISTRICTS, VILLAGES AND LOCAL GOVERNMENT ORGANIZATIONS CLASSIFIED BY DISTRICTS OF KANCHANABURI PROVINCE**

District	Subdistrict	Village	City municipality	Subdistrict municipality	Local administrative organization
Mueang Kanchanaburi	13	101	2	4	9
Tha Maka	17	153	1	8	12
Tha Muang	13	120	-	9	8
Thong Pha Phum	7	45	-	4	4
Sai Yok	7	57	-	3	6
Bo Phloi	6	80	-	2	6
Lao Khwan	7	90	-	2	7
Phanom Thuan	8	103	-	5	5
Sangkhla Buri	3	20	-	1	3
Dan Makham Tia	4	41	-	1	4
Huai Krachao	4	73	-	2	2
Nong Prue	3	43	-	3	1
Si Sawat	6	33	-	2	5
Total	98	959	3	46	72

**Source:** Kanchanaburi Provincial Development Plan 2027-2023, 2023.

- **Social Aspect**

- **Educational institutions**

In Huai Krachao District, there are 25 educational institutions, including 24 schools under the Kanchanaburi Primary Educational Service Area Office 3 and 1 school under the Secondary Educational Service Area Office 8.

- **Religious institutions**

Most people in Huai Krachao District are Buddhists. There are 32 temples.

- (iii) **Lao Khwan District**

- **Administration**

Lao Khwan District is divided into 7 subdistricts, 90 villages as follows:

- Lao Khwan Subdistrict 16 villages
- Nong Sano Subdistrict 11 villages
- Nong Pradu Subdistrict 12 villages
- Nong Pling Subdistrict 18 villages
- Nong Nok Kaew Subdistrict, 10 villages
- Thung Krabum Subdistrict, 14 villages
- Nong Fai Subdistrict 9 villages

- **Population**

There is a total population of 53,636 people in civil registrations on December 2022, divided into 26,735 males, 26,901 females, and 18,928 houses (Office of Registration Administration, Department of Provincial Administration, Ministry of Interior, 2023).

- **Social Aspect**

- **Educational institutions**

There are 10 schools in Lao Khwan District, including

- Anuban Wat Lao Khwan school, district elementary school,
- Lao Khwan Rat Bamrung School (District high school),
- Ban Krub Yai School, Moo 5, Nong Fai Subdistrict,
- Wat Mai Phum Charoen School, Moo 6, Nong Sano Subdistrict,
- Ban Nong Fai Community School, Moo 1, Nong Fai Subdistrict,
- Ban Nam Klung School, Moo 5, Nong Sano Subdistrict,
- Ban Nong Amphoe Chin School, Moo 2, Thung Krabum Subdistrict,
- Ban Thung Krabum School, Moo 4, Thung Krabum Subdistrict,
- Ratbamrungtham School, Moo 5, Thung Krabum Subdistrict
- Ban Pa Mai School, Moo 6, Thung Krabum Subdistrict.

- **Religious institutions**

Most people in Lao Khwan District are Buddhists. There are 62 temples.

(iv) **Nong Pradu Sub-district Administrative Organization**

- **Administration**

Nong Pradu Sub-district Nong Pradu Subdistrict Administrative Organization is divided into 12 villages, including:

- Moo 1 Ban Nong Ta Kai
- Moo 2 Ban Nong Pradu
- Moo 3 Ban Talung Nuea
- Moo 4 Ban Pong Mai
- Moo 5 Ban Nong Prue
- Moo 6 Ban Nam Chon
- Moo 7 Ban Nong Kai Lueang
- Moo 8 Ban Nong Kae Daeng
- Moo 9 Ban Hiang Ngam
- Moo 10 Ban Nong Masang
- Moo 11 Ban Nong Ta Kerd and
- Moo 12 Ban Nong Kham Pha

- **Population**

There are a total population of 9,960 people in civil registrations on December 2022, divided into 4,851 males, 5,011 females, and 3,643 houses (Office of Registration Administration, Department of Provincial Administration, Ministry of Interior, 2023), as shown in **Table 3.3-2**.

**TABLE 3.3-2**  
**DEMOGRAPHICS CLASSIFIED BY VILLAGE IN NONG PRADU**  
**SUBDISTRICT**

Moo	Village name	Population		Total	number of households
		Male	Female		
1	Moo 1 Ban Nong Takai	480	475	955	296
2	Moo 2 Ban Nong Pradu	465	476	941	370
3	Moo 3 Ban Talung Nuea	849	844	1,693	543
4	Moo 4 Ban Pong Mai	711	767	1,538	843
5	Moo 5 Ban Nong Prue	358	358	716	260
6	Moo 6 Ban Nam Joan	641	628	1,269	360
7	Moo 7 Ban Nong Kai Lueang	208	239	447	191
8	Moo 8 Ban Nong Kae Daeng	275	275	550	166
9	Moo 9 Ban Hiang Ngam	159	153	312	102
10	Moo 10 Ban Nong Masang	281	297	616	215
11	Moo 11 Ban Nong Ta Kerd	283	333	616	215
12	Moo 12 Ban Nong Khampha	141	166	307	82
<b>Total</b>		<b>4,851</b>	<b>5,011</b>	<b>9,960</b>	<b>3,643</b>

**Source:** The bureau of registration administration, Department of Provincial Administration, Ministry of Interior, 2023

- **Social Aspect**

- **Educational institutions**

There are 7 elementary schools, 3 high schools (opportunity expansion school), 2 child development centers and 1 community learning center.

- **Religious institutions**

Most people in Nong Pradu are Buddhist, representing 100%. There are 12 temples, including Nong Takai Temple, Nong Pradu Temple, Talung Nuea Temple, Mai Rang Klong Temple, Pong Mai Wanaram Temple, Khao Pho Pu Rat Bamrung Temple, Nong Prue Temple, Nam Chon Temple, Nong Kai Lueang Temple, Nong Kae Daeng Temple, Nong Ta Kerd Temple and Mai Khiriwong Temple (Wat Khao Pho Pu).

- **(v) Sa Long Ruea Sub-district Municipality.**

- **Administration**

Administrative districts in Sa Long Ruea Subdistrict Municipality Administrative covers the whole district area. There are 17 villages, including:

- Moo 1 Ban Sa Long Ruea
- Moo 2 Ban Phai Si
- Moo 3 Ban Huai Yang
- Moo 4 Ban Nong Bua Hing
- Moo 5 Ban Sa Chan Thong
- Moo 6 Ban Huay Luek
- Moo 7 Ban Nong Charoensuk
- Moo 8 Ban Phu Bon
- Moo 9 Ban Dong Rang
- Moo 10 Ban Yang Thong
- Moo 11 Ban Bo Ngoen



- Moo 12 Ban Krok Ta Pho
- Moo 13 Ban Nong Plodphai
- Moo 14 Ban Don Manao
- Moo 15 Ban Wang Rak
- Moo 16 Ban Nong Phaya Ngu
- Moo 17 Ban Phai Si Thong

- **Population**

There are a total population of 7,915 people in civil registrations on December 2022, divided into 3,921 males, 3,994 females, and 2,953 houses (Office of Registration Administration, Department of Provincial Administration, Ministry of Interior, 2023), as shown in **Table 3.3-3**.

- **Socail Aspect**

- **Educational institutions**

There are 7 elementary schools, including Wat Sa Long Ruea School, Ban Phai Si School, Ban Huay Yang School, Mettajib School, Ban Sa Chan Thong School, Ban Huai Luek School and Ban Nong Charoensuk School, 1 high school, Huai Krachao Pittayakom School and 1 university, Western University.

- **Religious institutions**

Most people are Buddhist. There are 8 temples in Sa Long Ruea subdistrict, including Sa Long Ruea Temple, Si Bua Thong Temple, Huai Yang Temple, Phrom Nimit Temple, Sa Chan Thong Temple, Huai Luek Temple, Bo Ngoen Temple and Sud Prasert Temple. There are 2 monasteries, including Khao Nang Kae Monastery and Nong Kran Monastery.

- **b. Vulnerable Group**

(i) Wang Phai Subdistrict Administrative Organization has carried out the social welfare as follows.

1. Proceed to pay the elderly subsistence allowances, the disabled and AIDS patients.
  - Allowance for the elderly in the amount of 569 cases
  - Allowance for the disabled in the amount of 107 cases
  - Provident money for 10 AIDS patients
2. Registration and coordination of the child support grant
3. Coordinate the identification card for persons with disabilities
4. Initiated a project to help the poor, low-income and the underprivileged.
5. Initiated a project to renovate the home of the poor the elderly as well as those with low incomes

(ii) Sa Long Ruea Subdistrict Municipality has 791 elderly people aged between 60-70 years old, 331 people aged 71-80 years old, 128 people aged 81-90 years old, and 15 people aged 91-over 100 years old.

However, no data were found in the survey for local government organizations in the remaining study areas.

**TABLE 3.3-3  
DEMOGRAPHICS CLASSIFIED BY VILLAGE IN SA LONG RUEA  
SUB-DISTRICT**

Moo	Village name	Population		Total	number of households
		Male	Female		
1	Moo 1 Ban Sa Long Ruela	275	286	561	245
2	Moo 2 Ban Phai Si	411	453	864	301
3	Moo 3 Ban Huai Yang	313	326	639	236
4	Moo 4 Ban Nong Bua Hing	196	191	387	148
5	Moo 5 Ban Sa Chan Thong	263	248	511	158
6	Moo 6 Ban Huai Luek	366	380	746	218
7	Moo 7 Ban Nong Charoensuk	234	251	485	167
8	Moo 8 Ban Phubon	134	154	288	111
9	Moo 9 Ban Dong Rang	194	151	345	85
10	Moo 10 Ban Yang Thong	343	348	691	254
11	Moo 11 Ban Bo Ngoen	175	168	343	382
12	Moo 12 Ban Krok Ta Pho	257	274	531	185
13	Moo 13 Ban Nong Safe	157	151	308	92
14	Moo 14 Ban Don Manao	111	114	225	67
15	Moo 15 Ban Wang Rak	140	131	271	72
16	Moo 16 Ban Nong Phaya Ngu	149	158	307	107
17	Moo 17 Ban Phai Thong Thong	203	210	413	125
<b>Total</b>		<b>3,921</b>	<b>3,994</b>	<b>7,915</b>	<b>2,953</b>

**Source:** The bureau of registration administration, Department of Provincial Administration, Ministry of Interior, 2023

### c. Gender Equality

From Global Gender Gap Report 2023, reports that in the year 2023, it was found that: gender equality in Thai families and society has been a topic of ongoing discussion and progress. Thailand, like many countries, has been working towards achieving greater gender equality and addressing traditional gender roles and stereotypes. Here are some key points related to this topic:

*Legal Framework:* Thailand has promoted gender equality through signing the Convention on the Elimination of All Forms of Discrimination against Women (CEDAW) in 1985 and has taken steps to promote gender equality through legal measures. The Thai constitution guarantees equal rights for men and women, and there are laws in place to combat discrimination and promote gender equity.

*Education and Workforce:* Efforts have been made to improve gender equality in education and the workforce. Women in Thailand have increasingly pursued higher education and professional careers, although certain fields may still be more male-dominated.

*Family Roles and Traditions:* Traditional gender roles within families have been evolving over time. While there may still be some expectations regarding gender-specific roles, many Thai families are becoming more open to shared responsibilities and decision-making.

*Women's Empowerment:* Various initiatives and organizations in Thailand work to empower women, enhance their leadership skills, and provide opportunities for economic and social advancement.

*Violence and Discrimination:* Despite progress, issues such as domestic violence and gender-based discrimination persist. Efforts are being made to raise awareness, provide support services, and strengthen legal protections.

*Cultural Factors:* Thai society is influenced by cultural norms and values, which can impact perceptions of gender roles. Balancing traditional values with modern aspirations for gender equality can be a complex challenge.

*Media and Representation:* Media and popular culture play a role in shaping societal perceptions. Positive and accurate representation of diverse gender roles in media can contribute to changing attitudes.

It's important to note that progress towards gender equality is a dynamic and ongoing process, and the situation may continue to evolve over time. Various government agencies, non-governmental organizations, and civil society groups are actively engaged in promoting gender equality and challenging gender stereotypes in Thai society.

### **3.3.2 Economic Information**

#### **(i) Kanchanaburi Province**

Kanchanaburi has a relatively balanced economic structure, especially in the economic of the agricultural sector, Kanchanaburi Province. Currently, there are industries that are agricultural and food processing factories, with up to 54% of the employment in all industrial sectors in all production sectors. Gross provincial product (GPP) – economic status of Kanchanaburi in 2020 had a gross domestic product of 102,857 million baht and an average product value per capita of 123,679 baht per person per year. (Source of GPP data: Office of the National Economic and Social Development Council, 2022) Most of the population is engaged in agriculture such as corns, chilis, pumpkins, rices, cassavas and tamarinds, etc. Around the reservoirs, people do fishing, cultivating aquatic animals, catching aquatic animals, and finding wild products for sale.

#### **(ii) Huai Krachao District**

The primary Occupation is farmers. The three main economic crops are rice, cassava and sugarcanes.

#### **(iii) Lao Khwan District**

The primary occupation is farmers. (sugarcane and cassava plantation). Secondary occupation is asparagus growing, vegetable gardening, raising beef cattle, cows and other animals, mulberry cultivation - sericulture, tie-dyeing, weaving, sewing and pottery, etc.

#### **(iv) Sa Long Ruea Subdistrict Municipality.**

Most people in Sa Long Ruea subdistrict are engaged in agriculture, including farming, raising animal, economic farming, retail business and buying agricultural crops.

**(v) Nong Pradu Subdistrict Administrative Organization**

Most people in the Nong Pradu subdistrict are engaged in agriculture, including growing sugarcane, cassava, rice, corn, etc. There is also animal husbandry, trading and employment in industrial factories.

- **Socioeconomics Survey**

Data for social information was expected to be collected from relevant authorities' documents and via interviews with households within a 300-meter radius of the project boundaries. From a field survey within a radius of 300 meters, 3 buildings were found: 2 houses and 1 pig farm.

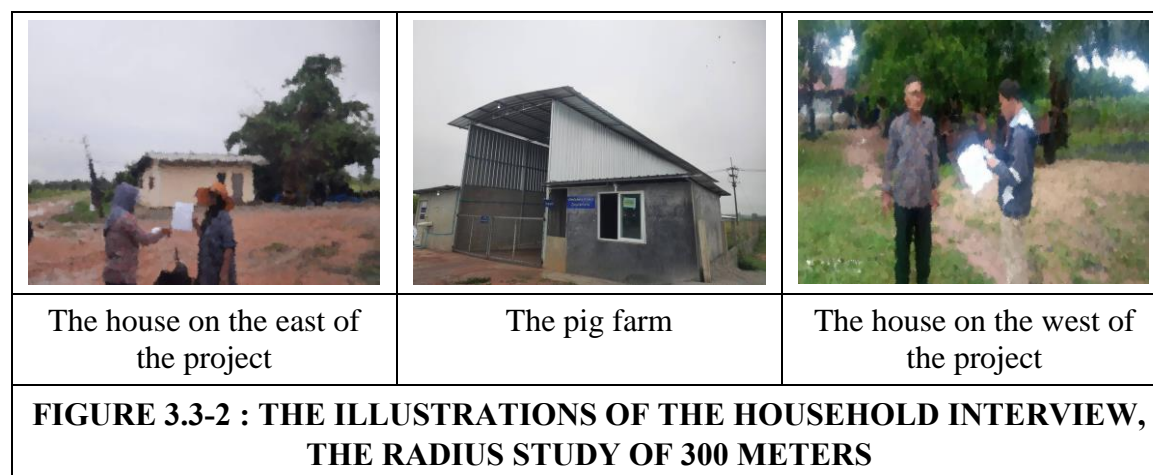
The socioeconomics survey of the household in the radius study area of 300 meters from the project area was implemented during 21-22 October 2023. The interview survey of 3 households with their illustrations are displayed in the **Figure 3.3-2**. The results of the socioeconomics survey are as follows:

- **The household socioeconomic details**

Regarding the numbers of family members in the household, the average number of family members is 8 people, with the maximum of 20 people and the minimum of 1 person. The average male family member is 5 people, with the maximum of 5 people and the minimum of 1 person. The average female family member is 5 people, with the maximum of 12 people and the minimum of 1 person. All the family members in the household have jobs or employed.

The main occupation (100%) of the household is agriculturist, which are the farming of cassava, rice or grain, sugar cane and herdsman. All the interviewees neither have the part-time job or occupation nor any obstacle in doing their career. The average household income is 15,000 Baht/month. The average household expenses is 15,000 Baht/month. The interviewees (66.7%) said that they have some income left for the saving money while the rest of the interviewees (33.3%) do not.

Regarding the land ownership, the interviewees (66.7%) rented the piece of land for their farming while the rest (33.3%) does not own any piece of land. The family members of the household neither are neither the committee nor join any activity group. Most people (66.6%) have kinship relationship and the rest (33.3%) lives mainly in their own group.



### 3.3.3 Health

The secondary data has been collected from document of agencies that provide a public health service for people in the study area, the details are as follows:

- Public health service facilities, i.e. Public health services providers, healthcare personnel and medical durable article list.
- Health status of people i.e. Diseases of outpatients and diseases of inpatients.

In the study area there are public health services providers responsible for the area comprising

- 3 Primary cares i.e. Ban Talung Nuea Subdistrict Health Promoting Hospital Nong Pradu Sub-District Health Promoting Hospital and Sa Long-Ruea Sub-District Health Promoting Hospital. It is found that, when compared to healthcare personnel-to-patient ratio, there is inadequacy for registered nurse.

- 2 Secondary Cares i.e. Lao Khwan hospital and Huai Krachao hospital. It is found that, when compared to healthcare personnel-to-patient ratio, there is inadequacy for Physician, Dentists, registered nurses and Pharmacists.

- Cause of diseases and morbidity rate of outpatient visit data of tambon health promoting hospital in the study area during 2018 - 2022, the top three diseases are (1) upper respiratory tract infection, (2) diseases of the circulatory system, and (3) diseases of connective tissue.

- The top three cause of diseases and morbidity rate of inpatients of hospital in the study area during 2018 - 2022 are (1) pneumonia (2) bronchitis, emphysema and, other chronic obstructive pulmonary disease and, (3) acute bronchitis

- The implementation of the project may cause an impact on public health service system. Some construction workers or project staff will receive services from public health services providers in the study areas, the consultant then collected secondary data from public health services providers in the study areas. The details are as follows:

#### (A) Public Health Services Providers

##### 1. Primary Cares

In the study area there are 3 primary cares responsible for the area, i.e. Ban Talung Nuea Subdistrict Health Promoting Hospital, Nong Pradu Subdistrict Health Promoting Hospital and Sa Long Ruea Subdistrict Health Promoting Hospital. The details are as follows:

- **Ban Talung Nuea Subdistrict Health Promoting Hospital:** address moo 6, Nong Pradu Subdistrict, Lao Khwan District, Kanchanaburi province. Its responsibility consisting of 4 villages in Lao Khwan Subdistrict is also classified as a medium size public health services provider (responsible for 3,000-8,000 people) with 3,019 people under the hospital's responsibility. The hospital is within a 7-kilometer range from the community following the comprehensive city planning criteria and standard 2006 so the hospital is appropriate and sufficient for providing people the services. (vulnerable groups 741 people i.e. The population of 0-5 years old , 126 people, the population of over 60 years old, 578 people and disabled, 37 people). Approximately 21.4 km. From Lao Khwan Hospital (referral hospital cascade). With traveling time of about 20-25 minutes.

– **Nong Pradu Sub-district Health Promoting Hospital:** address moo 2, Nong Pradu Subdistrict, Lao Khwan District, Kanchanaburi province. Its responsibility consisting of 8 villages in Nong Pradu Subdistrict also classified as a medium size public health services provider (responsible for 3,000-8,000 people) with 4,693 people under the hospital's responsibility. The hospital is within a 7-kilometer range from the community following the comprehensive city planning criteria and standard 2006 so the hospital is appropriate and sufficient for providing people the services. (vulnerable groups 1,239 people i.e. The population are 0-5 years, 303 people, the population of over 60 years, 862 people and disabled, 74 people). Approximately 12.0 km. From Lao Khwan hospital (referral hospital cascade). With traveling time of about 12-15 minutes.

– **Sa Long Ruea Sub-district Health Promoting Hospital :** address moo 1, - Sa Long Ruea Subdistrict, Huai Krachao District, Kanchanaburi province. Its responsibility consisting of 17 villages in Sa Long Ruea Subdistrict, Huai Krachao District, Kanchanaburi province also classify as a medium size public health services provider (responsible for 3,000-8,000 people) with 5,412 people under the hospital's responsibility. The hospital is within a 7-kilometer range from the community following the comprehensive city planning criteria and standard 2006 so the hospital is appropriate and sufficient for providing people the services. (vulnerable groups 1,622 people i.e. The population are 0-5 years, 377 people, the population are over 60 years, 1,187 people and disabled, 58 people). Approximately 13.7 km. from huaikrachao hospital (referral hospital cascade). With traveling time of about 13-16 minutes.

## 2. Secondary Care

In the study area have 2 secondary cares responsible for the area, i.e. Huai Krachao hospital and Lao Khwan hospital. The details are as follows:

– **Lao Khwan Hospital:** moo 6, Lao Khwan Subdistrict, Lao Khwan District, Kanchanaburi province. Its responsibility covers of Lao Khwan District, Kanchanaburi province (size of 53 beds and occupancy rate of 61.55 beds, which is unsuitable for inpatient patients).

– **Huai Krachao Hospital:** moo 6, Huai Krachao Subdistrict, Huai Krachao District, Kanchanaburi province. Its responsibility covers of Huai Krachao District, Kanchanaburi province (size of 53 beds and occupancy rate of 80.73 beds, which is suitable for inpatient patients).

## 3. Tertiary care

– **Phaholpolpayuhasena Hospital:** moo 3, Pak Phraek Subdistrict, Mueng district, Kanchanaburi province. Its responsibility covers Kanchanaburi province (size of 568 beds and occupancy rate of 96.96 beds, which is suitable for inpatient patients).

The nearest public health service to the project location is Ban Talung Nuea Subdistrict Health Promotion Hospital, which is 3.6 kilometers away and takes about 5 minutes to reach.

## (B) Healthcare Personnel In The Study Area

### 1. Primary Cares

#### – Ban Talung Nuea Subdistrict Health Promoting Hospital

According to the data on healthcare personnel of primary care facilities in the study area as presented in **Table 3.3-5**, it was found that, when compared to healthcare personnel-to-patient ratio on ministry of public health, ban talung nuea tambon health promoting hospital is adequate of healthcare personnel.

#### – Nong Pradu Subdistrict Health Promoting Hospital

According to the data on healthcare personnel of primary care facilities in the study area as presented in **Table 3.3-5**, it was found that, when compared to healthcare personnel-to-patient ratio on ministry of public health, nong pradu tambon health promoting hospital is adequate of healthcare personnel.

#### – Sa Long Ruea Subdistrict Health Promoting Hospital

According to the data on healthcare personnel of primary care facilities in the study area as presented in **Table 3.3-4**, it was found that, when compared to healthcare personnel-to-patient ratio on ministry of public health, Sa Long Ruea Subdistrict Health Promoting Hospital is short of 1 personnel on registered nurse.

### 2. Secondary Care

#### – Huai krachao hospital

According to the data on proportion of healthcare personnel of Huaikrachao hospital, as presented in **Table 3.3-5**, it was found that the hospital is short of 11 personnel on physicians, short of 7 personnel on dentists, short of 76 personnel on registered nurses and, short of 11 personnel on pharmacists.

#### – Lao Khwan Hospital

According to the data on proportion of healthcare personnel of Laokhwan Hospital, as presented in **Table 3.3-5**, it was found that the hospital is short of 17 personnel on physicians, short of 12 personnel on dentists, short of 152 personnel on registered nurses and, short of 21 personnel on pharmacists.

### 3. Tertiary Care

#### – Phaholpolpayuhasena hospital

It is found that the hospital has 83 physicians, 21 dentists, 513 registered nurses and, 36 pharmacists.

## (C) Medical Durable Article List

- **Huai Krachao Hospital (secondary Care):** According to the data on medical durable article list of huaikrachao hospital (GIS health, ministry of public health, 2023 (information retrieved on september, 4<sup>th</sup> 2023 from [www.gishealth.moph.go.th/](http://www.gishealth.moph.go.th/)), it was found that the hospital has 2 Ultrasounds and, 6 Ambulances

- **Lao Khwan Hospital (secondary Care):** According to the data on medical durable article list of laokhwan Hospital (GIS health, ministry of public health, 2023 (information retrieved on september, 4<sup>th</sup> 2023 from [www.gishealth.moph.go.th/](http://www.gishealth.moph.go.th/)), it is found that the hospital has 2 Ultrasounds and, 5 Ambulances.

- **Phaholpolpayuhasena Hospital (tertiary Care):** According to the data on medical durable article list of phaholpolpayuhasena hospital (GIS health, ministry of public health, 2023 (information retrieved on september, 4<sup>th</sup> 2023 from [www.gishealth.moph.go.th/](http://www.gishealth.moph.go.th/)), it is found that the hospital has 2 CT scans, 1 MRI, 1 ESWL, 14 Ultrasounds, 46 APDS and, 9 Ambulances



**TABLE 3.3-4**  
**ADEQUACY OF HEALTHCARE PERSONNEL IN PRIMARY CARE FACILITIES**

SubDistrict	Responsible Health Facilities	Population	Registered Nurse		Public Health Technical Officer/ Public Health Officer		Thai Traditional Medical Doctor/ Public Health Officer (Thai Traditional Medicine)	
			Actual	Required (1:2,500) <sup>2/</sup>	Actual	Required (1:1,250) <sup>2/</sup>	Actual	Required (1:8,000) <sup>2/</sup>
Nong Pradu Subdistrict	Ban Talung Nuea Subdistrict Health Promoting Hospital	3,019 <sup>1/</sup>	1 <sup>1/</sup>	1 (Adequate)	3 <sup>1/</sup>	2 (Adequate : There is a surplus of 1 Public Health Technical Officer/ Public Health Officer)	1 <sup>1/</sup>	Not Required
Nong Pradu Subdistrict	Ban Nong Pradu Subdistrict Health Promoting Hospital	4,693 <sup>1/</sup>	1 <sup>1/</sup>	1 (Adequate)	4 <sup>1/</sup>	3 (Adequate : There is a surplus of 1 Public Health Technical Officer/ Public Health Officer)	1 <sup>1/</sup>	Not Required
Sa Long Ruea Subdistrict	Sa Long Ruea Subdistrict Health Promoting Hospital	5,410 <sup>1/</sup>	1 <sup>1/</sup>	2 (Inadequate : There is a shortage of 1 registered nurse)	4 <sup>1/</sup>	3 (Adequate : There is a surplus of 1 Public Health Technical Officer/ Public Health Officer)	2 <sup>1/</sup>	Not Required

**Source :** <sup>1/</sup> HDC Report Ministry of Public Health, 2023 (Information retrieved on September 4<sup>th</sup>, 2023 from www.hdcservice.moph.go.th)

<sup>2/</sup> Healthcare Personnel-to-patient ratio on Ministry of Public Health, 2022 (Registered Nurse (1:2,500), Public Health Technical Officer/ Public Health Officer (1:1,250), Thai Traditional Medical Doctor/ Public Health Officer (Thai Traditional Medicine) (1:8,000), Public Health Technical Officer (Pharmacy)/ Pharmacy Technician (1:8,000))

**TABLE 3.3-5  
PROPORTION OF HEALTHCARE PERSONNEL TO POPULATION OF  
SECONDARY CARE, 2022**

Personnel	Proportion of Healthcare Personnel to Population, 2022			Sufficiency of Medical Personnel	
	Number (person) <sup>2/</sup>	Proportion to Population	Target of National Strategy <sup>1/</sup>	Required	Shortage/ Surplus
<b>Lao Khwan Hospital</b>					
Population	58,456 <sup>3/</sup>	-	-	-	-
Physician	15	1:3,897	1: 1,800	32	Shortage 17
Dentist	4	1:14,614	1:3,600	16	Shortage 12
Registered Nurse	43	1: 1,359	1:300	195	Shortage 152
Pharmacist	4	1: 14,614	1:2,300	25	Shortage 21
<b>Huai Krachao Hospital</b>					
Population	33,863 <sup>3/</sup>	-	-	-	-
Physician	8	1: 4,233	1: 1,800	19	Shortage 11
Dentist	2	1: 7,307	1:3,600	9	Shortage 7
Registered Nurse	37	1: 915	1:300	113	Shortage 76
Pharmacist	4	1: 8,465	1:2,300	15	Shortage 11

**Source :** <sup>1/</sup> The National Strategy (2018-2037)

<sup>2/</sup> Office of the Permanent Secretary, Ministry of Public Health, 2023 (Information retrieved on September, 4<sup>th</sup> 2023 from www.hrold.moph.go.th)

<sup>3/</sup> HDC Report, Ministry of Public Health, 2023 (Information retrieved on September, 4<sup>th</sup> 2023 from www.hdcservice.moph.go.th/)

### 3.3.4 Indigenous People

Thai Dum or Thai Song Dam (Lao Song) originated in Muang Tang. (Dian Bien Phu) in the northwest of Vietnam having settled in Thailand for about 227 years (until B.E. 2550)

History of immigration into the reign of King Krungthonburi in 1778 and settled in about 40 provinces, with Phetchaburi being the mother city. The southernmost point is in Surat Thani province. The rest lives in Ratchaburi province. Suphanburi Province, Nakhon Pathom Province, Kanchanaburi Province, Samut Songkhram Province, Samut Sakhon Province, Kamphaeng Phet Province, Phitsanulok Province, Sukhothai Province, Loei Province, etc.

There are other sources indicating that "Thai Song Dam or Lao Song is the name of Tai Dam ethnic group who originally settled alongside the Black and the Red rivers of Northern Vietnam in Sipsong Chu Thai area called Muang Thang or present-day Dien Bien Phu. Throughout the Thon Buri and early Rattanakosin periods, several groups of Lao Song had migrated via LAO PDR, from where the word "Lao" in "Lao Song" derived, to Thailand and lived there for more than 200 years. Thai Song Dam's unique tradition includes wearing mostly black clothes and their expertise in hand-weaving exquisite "Suea" (a shirt or blouse) and "Pah Sinh" (a traditional wraparound skirt), the costume clearly reflecting this ethnic group's identity. Most of Thai Song Dam people in Thailand live in Phetchaburi Province where their traditions, rites, and ceremonies are still maintained strictly."

In the area of Sa Long Ruea subdistrict, there is an ethnic group, Thai Song Dam, who lives in harmony in the communities with the locals, mostly can speak and understand Thai language, and has equal rights to the locals. This is to say, Thai Song Dam is not indigenous people,

Most Thai Song Dam people have a strong connection to the belief in ghosts and Kwan. Because it is believed that ghosts are deities that provide protection and protection or may be punishable by death, especially in ghost stories like a personal prophet, if he does bad things, it will be a misdemeanor and can cause the ghosts to punish him.

Ghosts can be classified according to their priorities and beliefs as follows.

- Phee-Tan Phee-Fah
- Phee-Ban Phee-Mueang
- Ancestral spirit
- Phee-Pa Kuang and others

In Kanchanaburi Province The majority of the Thai Song Dam ethnic group residences in Village No. 3, Ban Laem Thong, Klom Do subdistrict, Dan Makham Tia district Kanchanaburi Province Which is approximately 80 kilometers from the project. This group is an ethnic group that has migrated from Phetchaburi. Sa Long Ruea Subdistrict, there is also an event the Thai Song Dam tradition every year in Village No. 4, Sa Long Ruea Subdistrict.

Through several site visit, meetings with community leaders, pre-engagement meeting, and public hearing conducted so far, it has been observed that people in Kanchanaburi Province, where the Project is located, primarily communicate in standard Thai language. They share cultural practices and a way of life similar to the general population in central Thailand, with no distinctive characteristics found. Therefore, it is not meet the criteria under ADB Safeguard Requirement as follow;

- *Self-identify as members of a distinct indigenous cultural group and recognition of this identity by others;* Thai Song Dam people in Sa Long Ruea Subdistrict have been integrated with Sa Long Ruea Subdistrict Municipality, Huai Krachao District Cultural Council. Sa Long Ruea Subdistrict Cultural Council and other agencies Others in the area of Sa Long Ruea Subdistrict who saw the importance of restoring and preserving the Thai Song Dam cultural tradition joined together to organize an event to preserve and continue the Thai Song Dam tradition at Wat Phrom Nimit, which is an annual Thai Song Dam event that will be organized. It takes place during the month of April every year so that children and youth of the Thai Song Dam can be aware of the value of the Thai Song Dam culture that their ancestors have preserved, continue the cultural traditions of the Thai Song Dam people to continue, and be an expression of pride in Thai Song Dam identity.

- *Collective attachment to geographically distinct habitats or ancestral territories in the project area and to the natural resources in these habitats and territories;* The ancestors were not local people. Thai Song Dam people in Sa Long Ruea Subdistrict Huai Krachao District originally lived in Phetchaburi Province. Later, they immigrated to Ban Don District Suphan Buri Province and moved to Sa Long Ruea Subdistrict, which is a suitable place for farming and fishing. They have earned a living like any other Thai people.

- *Customary cultural, economic, social, or political institutions that are separate from those of the dominant society and culture; There is no separation, but there is integration with the community and society in which they live.*
- *A distinct language, often different from the official language of the country or region; Thai Song Dam ethnic group, which lives in communities with local people, is mostly able to speak and understand the Thai language and has equal rights with the villagers.*

### 3.3.5 Historic And Cultural Heritage

Based on a site survey of archaeological sites, ancient monuments, and historical records in the project area and its surrounding areas, it has been identified that there are six temples in close proximity. These temples are named as follows: Huai Luek Samakkhitham Temple, Mai Khiri Wong Temple (Wat Khao Pho Pu), Sutprasert Thammakayaram Temple, Phrom Nimit Temple, Khao Pho Phu Rat Bamrung Temple and Sa Chan Tong Temple. All of these temples are located within a 3-kilometer radius from the project boundary.

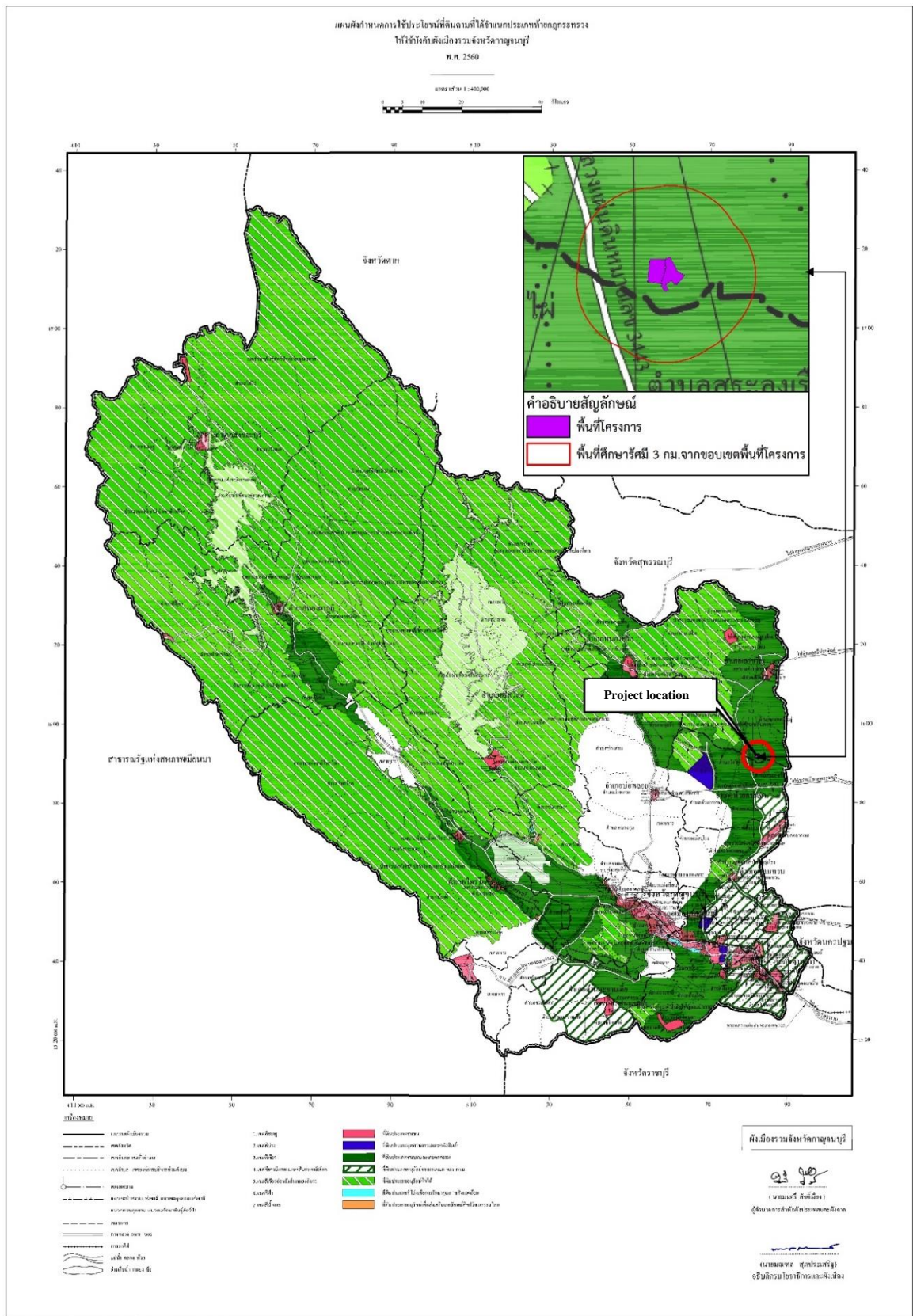
## 3.4 HUMAN USE VALUE

### 3.4.1 Land Use

The secondary data on land use was collected from related documents, laws, and future land use regulations of the principle city plan from the Department of Public Works and Town & Country Planning.

According to the information of the principle city plan of the Department of Public Works and Town & Country Planning, Ministry of Interior, it is found that the project area is located in the administrative area of Kanchanaburi Province. At present, the Department of Public Works and Town & Country Planning and the Office of Public Works and Town Planning, Kanchanaburi Province, has announced four total principle city plans, consisting of (1) Ministerial Regulations on the enforcement of the city plan of Tha Muang Community, Kanchanaburi Province, 2562 B.E. (2) Notification of the Ministry of Interior on prohibited areas for construction, modification or change of certain types of building use in some areas in Kaeng Sian Sub-district and Ban Kao Sub-district, Mueang Kanchanaburi District, Kanchanaburi Province, (3) Ministerial Regulations on the enforcement of the Kanchanaburi Provincial principle city plan, Kanchanaburi Province, B.E. 2016.

However, the result of the land use inspection of the project with the Department of National and Regional Planning, Department of Public Works and Town & Country Planning (**Appendix 2H**) states that the project location is in the area of the Kanchanaburi principle city plan based on the Ministerial Regulation on enforcement of the Kanchanaburi principle city plan B.E. 2560 around number 3.2 (**Figure 3.4-1**). Land use is defined as rural and agricultural land (green) for agriculture or related to agriculture, residence, commerce, educational institutions, religious institutions, government institutions, public utilities and facilities. In the list of types, kinds and classifications of factories that are prohibited for operation at the end of the Ministerial Regulations enforcing the Kanchanaburi Provincial principle city plan, B.E. 2560, it does not prohibit the factories number 88 (1) - a solar thermal plant. Therefore, the project can operate and is not contrary to the Ministerial Regulations.



**FIGURE 3.4-1 : LOCATION OF THE PROJECT IN KANCHANABURI COMPREHENSIVE TOWN PLAN**

The primary data on land use was surveyed in a 3-kilometer area from the project boundaries on 29 April 2023, covering some areas of Nong Pradu Subdistrict, Lao Khwan District, and Sa Long Ruea Subdistrict, Huai Krachao District, Kanchanaburi Province representing approximately 27,527 rai.

### (1) Land Use within the Study Area

The land use data within the study was divided in to 2 areas, namely within 300-meter radius and a radius of 0.3-3 kilometers of the project boundary that cover a total area of 3.15 and 40.89 square kilometers respectively. The details of land use within the study area are as follow.

- **Within a Radius of 300 Meters of the Project Boundary**

The collected data shows that the land use within a radius of 300 meters of the project boundary is divided into 2 main types: 3.06 km<sup>2</sup> of agricultural area and 0.08 km<sup>2</sup> of other area, as shown in **Figure 3.4-2** and **Table 3.4-1**. Details are as follows.

- Agricultural area is approximately 3.06 km<sup>2</sup>, representing 97.14% of the study area. It is the most common land use type in the study area. The agricultural area comprises field crop (maize, sugarcane, cassava) with 1.58 km<sup>2</sup> (50.16%), perennial plant (eucalyptus) with 0.94 km<sup>2</sup> (29.84%), paddy field with 0.39 km<sup>2</sup> (12.38%), livestock farm with 0.14 km<sup>2</sup> (4.44%), oil palm with 0.02 km<sup>2</sup> (0.63%) and

- Other area is approximately 0.08 km<sup>2</sup>, representing 0.53% of the study area. There are unused area with 0.06 km<sup>2</sup> and artificial water resources with 0.02 km<sup>2</sup>

- **Within a Radius of 0.3-3 Kilometers of the Project Boundary**

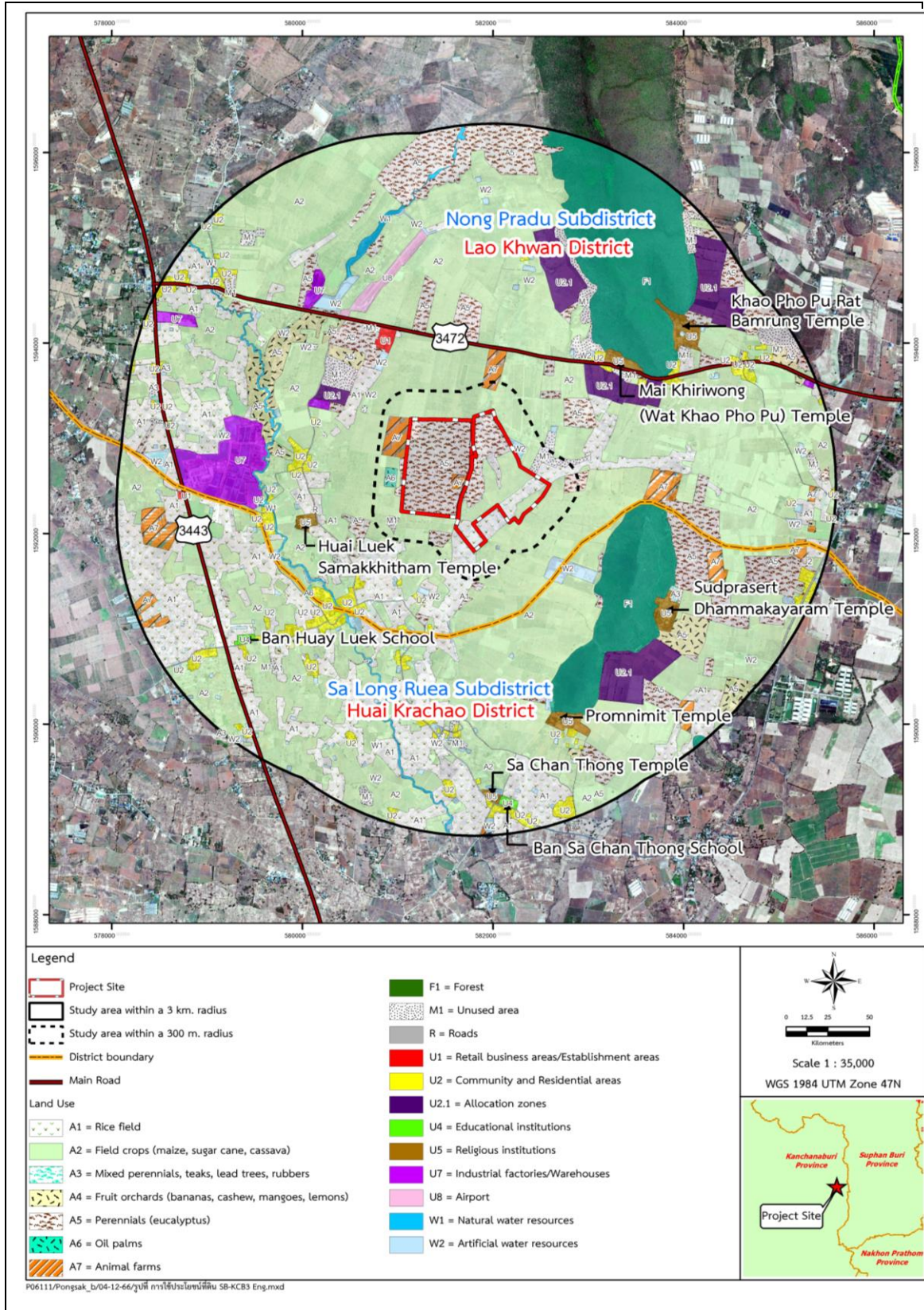
The results of field survey shows that the current land use is divided into 3 main types: as shown in **Figure 3.4-2** and **Table 3.4-1**. Details are as follows.

- Agricultural area is approximately 31.60 km<sup>2</sup>, representing 77.28% of the study area. It is the most common land use type in the study area. The first 3 agricultural areas are upland crops (maize, sugarcane, cassava), with 20.80 km<sup>2</sup>(50.87%), rice fields, with 6.42 km<sup>2</sup>(15.70%) and eucalyptus, with 3.02 km<sup>2</sup>(7.39%), respectively

- Residential and community area is the second most common land use, with 3.44 km<sup>2</sup>, representing 8.40% of the study area. The first 3 common community and built-up areas are Allocation zones areas, with 1.20 km<sup>2</sup>(2.93%), community and residential areas, with 0.99 km<sup>2</sup>(2.93%) and industrial factories/warehouses 0.70 km<sup>2</sup>(1.71%), respectively.

- Other areas is approximately 5.86 km<sup>2</sup>, representing 14.31% of the study area. It is the lowest common land use. There are forest area 3.77 km<sup>2</sup> (9.22%), unused areas, 0.67 km<sup>2</sup> (1.64%), and artificial water resources, with 0.60 km<sup>2</sup> (1.47%), roads, with 0.56 km<sup>2</sup> (1.37%), and natural water sources, with 0.27 km<sup>2</sup> (0.66%).





Source: TLT Consultants Co.,Ltd, 30 May 2023

**FIGURE 3.4-2 : LAND USE IN THE PROJECT STUDY AREA**



**TABLE 3.4-1  
LAND USE IN THE STUDY AREA**

Land use	Symbol	The study area	
		Square kilometer	Percentage
<b>Within a radius of 300 meters of the project boundary</b>			
<b>Agricultural area</b>	<b>A</b>		
- Paddy field	A1	0.39	12.38
- Field crop	A2	1.58	50.16
- Perennials (eucalyptus)	A5	0.94	29.84
- Oil palms	A6	0.02	0.63
- Livestock farm	A7	0.14	0.44
- Unused area	M1	0.06	1.90
- Artificial water resources	W2	0.02	0.63
<b>Total</b>		<b>3.15</b>	<b>100.00</b>
<b>Within a radius of 0.3-3 kilometers of the project boundary</b>			
<b>Agricultural area</b>	<b>A</b>		
Rice field	A1	6.42	15.70
Field crops (maize, sugar cane, cassava)	A2	20.80	50.87
Mixed perennials, teaks, lead trees, rubbers	A3	0.03	0.07
Fruit orchards (bananas, cashew, mangoes, lemons)	A4	0.80	1.96
Perennials (eucalyptus)	A5	3.02	7.39
Oil palms	A6	0.01	0.02
Animal farms	A7	0.53	1.30
<b>Total A</b>		<b>31.60</b>	
<b>Residential and community area</b>	<b>U</b>		
Retail business areas/Establishment areas	U1	0.04	0.10
Community and Residential areas	U2	0.99	2.42
Allocation zones	U2.1	1.20	2.93
Educational institutions	U4	0.04	0.10
Religious institutions	U5	0.33	0.81
Industrial factories/Warehouses	U7	0.70	1.71
Airport	U8	0.13	0.32
<b>Total U</b>		<b>3.44</b>	
<b>Other area</b>			
Forest	F1	3.77	9.22
Unused area	M1	0.67	1.64
Roads	R	0.56	1.37
Natural water resources	W1	0.27	0.66
Artificial water resources	W2	0.60	1.47
<b>Total Other area</b>		<b>5.86</b>	
<b>Total</b>		<b>40.89</b>	<b>100.00</b>

Source: TLT Consultants Co.,Ltd, 30 May 2023

## (2) Land Use within 100-meter Radius from the Transmission Line Route

The survey result shows that the current land use along the 100-meter radius of the transmission line of Sky Power Solar Power Plant and Solar Development Solar Power Plant, including some areas of Sa Long Ruea Subdistrict, Hai Kracho District and Nong Pradu Subdistrict, Lao Khwan District, Kanchanaburi Province representing approximately 4.79 km<sup>2</sup>. The results of field survey shows that the current land use is divided into 3 main types: 3.35 km<sup>2</sup> of agricultural area, 0.64 km<sup>2</sup> of community and construction area and 0.8 square kilometer of other, as shown in **Table 3.4-2 and Figure 3.4-3**. Details are as follows.

- **Agricultural area** is approximately 3.35 km<sup>2</sup>, representing 69.94% of the study area. It is the most common land use type in the study area. The first 3 agricultural areas are upland crops (maize, sugarcane, cassava), with 1.52 km<sup>2</sup> (31.64%), rice fields, with 1.49 km<sup>2</sup> (31.13%) and eucalyptus, with 0.22 km<sup>2</sup> (4.66%), respectively

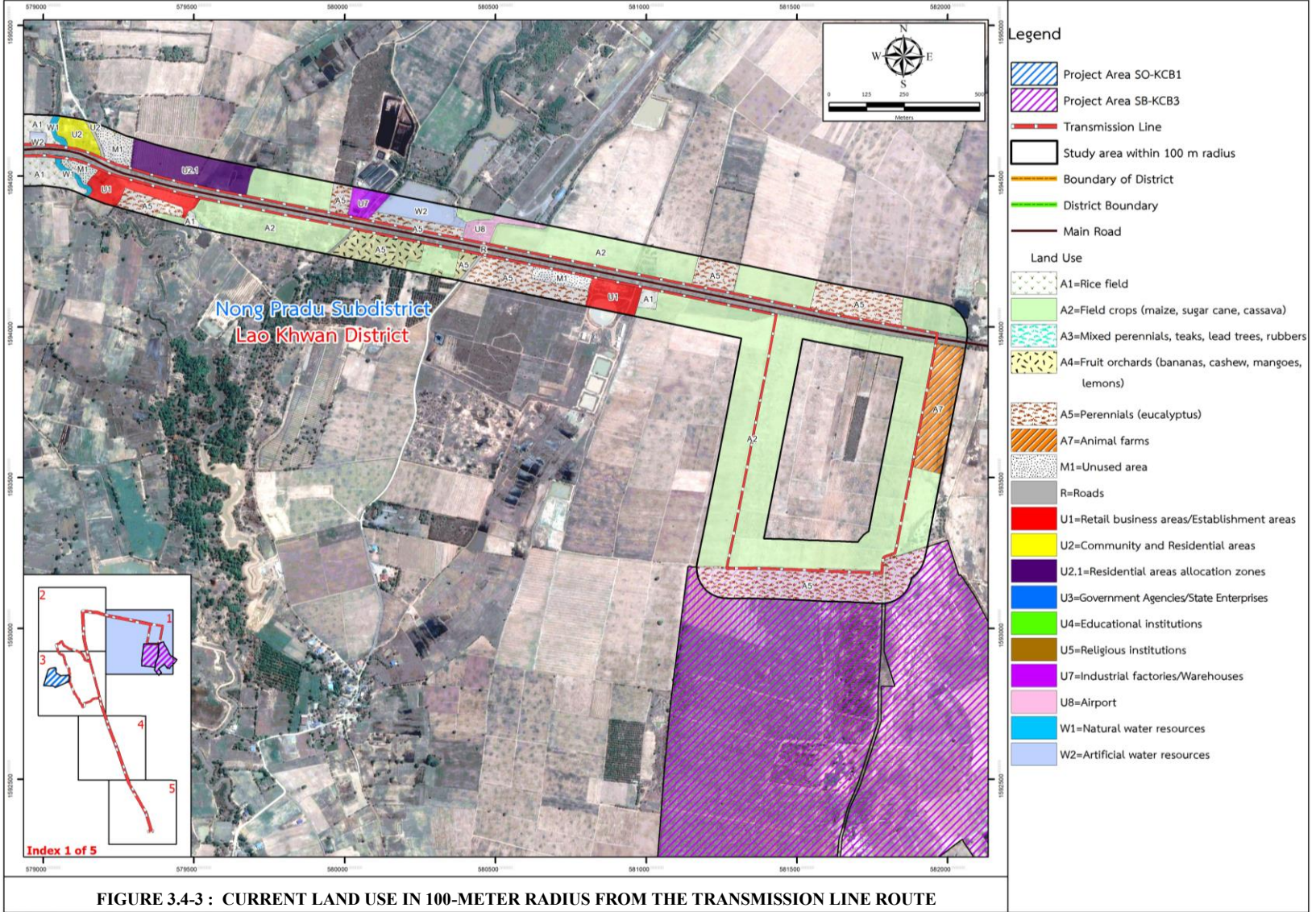
- **Other areas** is the second most common land use, with 0.80 square kilometer, representing 16.70% of the study area. The first 3 other areas are roads, with 0.56 km<sup>2</sup> (11.60%), artificial water resources 0.13 km<sup>2</sup> (2.78 %) and unused area, with 0.10 km<sup>2</sup> (2.17%), respectively.

- **Residential and community area** is the lowest common land use, with 0.64 km<sup>2</sup>, representing 13.36% of the study area. The first 3 common community and built-up areas are community and residential areas, with 0.33 km<sup>2</sup> (6.93%), retail business areas / Establishment areas 0.10 km<sup>2</sup> (2.09%), and respectively.

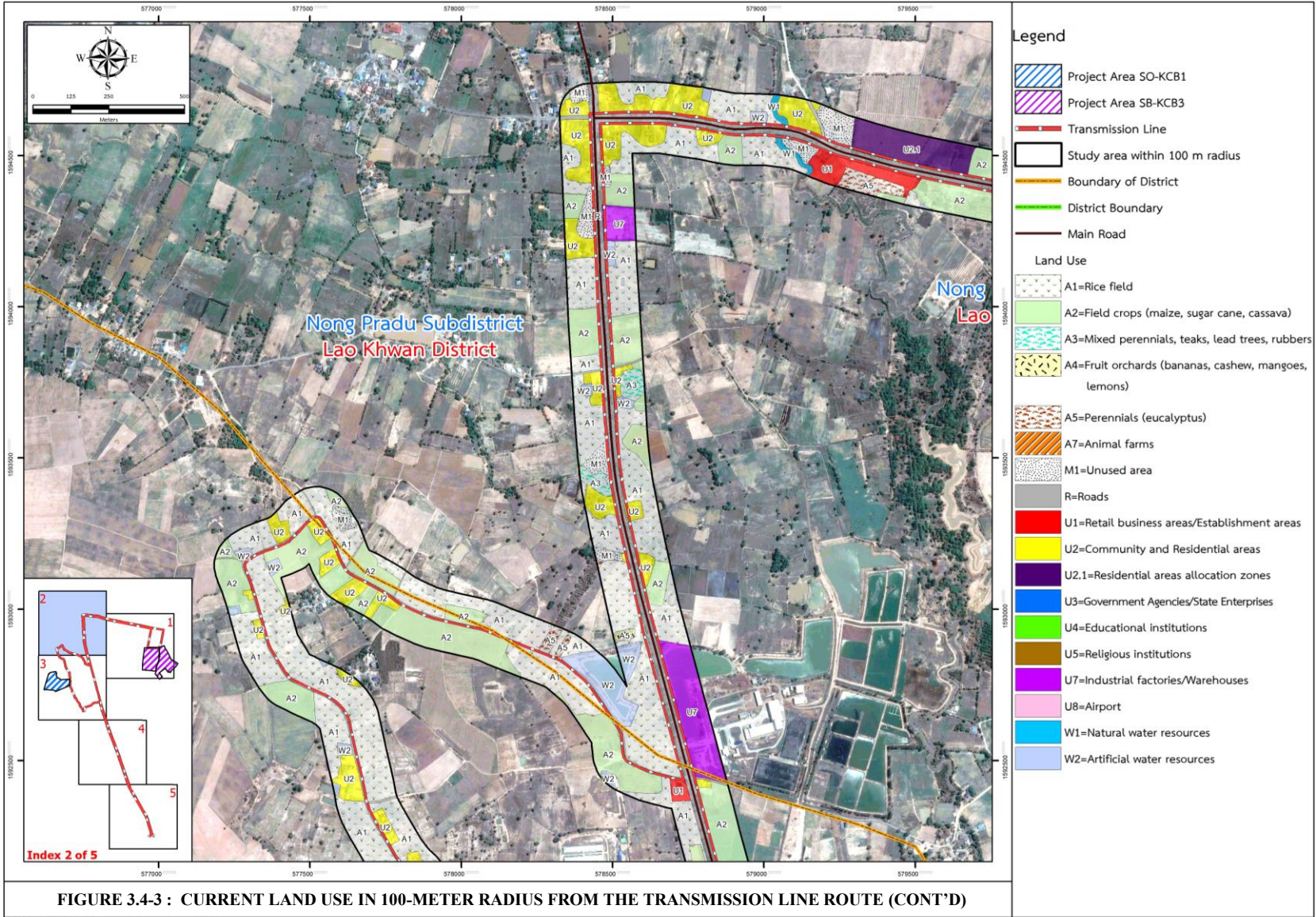
**TABLE 3.4-2**  
**LAND USE IN THE 100-METER RADIUS FROM**  
**THE TRANSMISSION LINE ROUTE**

Land use	Symbol	The study area	
		square kilometer	percentage
<b>Agricultural area</b>	<b>A</b>		
Rice field	A1	1.49	31.13
Field crops (maize, sugar cane, cassava)	A2	1.52	31.64
Mixed perennials, teaks, lead trees, rubbers	A3	0.03	0.56
Perennials (eucalyptus)	A5	0.22	4.66
Fruit orchards (bananas, cashew, mangoes, lemons)	A5	0.03	0.70
Animal farms	A7	0.06	1.21
<b>Total</b>		<b>3.35</b>	<b>69.94</b>
<b>Community areas and buildings</b>	<b>U</b>		
Retail business areas/Establishment areas	U1	0.10	2.09
Community and Residential areas	U2	0.33	6.93
Residential areas allocation zones	U2.1	0.04	0.86
Government Agencies/State Enterprises	U3	0.01	0.19
Educational institutions	U4	0.02	0.46
Religious institutions	U5	0.04	0.75
Industrial factories/Warehouses	U7	0.09	1.92
Airport	U8	0.01	0.22
<b>Total</b>		<b>0.64</b>	<b>13.36</b>
<b>Others</b>			
Unused area	M1	0.10	2.17
Roads	R	0.56	11.60
Natural water resources	W1	0.01	0.11
Artificial water resources	W2	0.13	2.78
<b>Total</b>		<b>0.8</b>	<b>16.70</b>
<b>Summary Total</b>		<b>4.79</b>	<b>100.00</b>

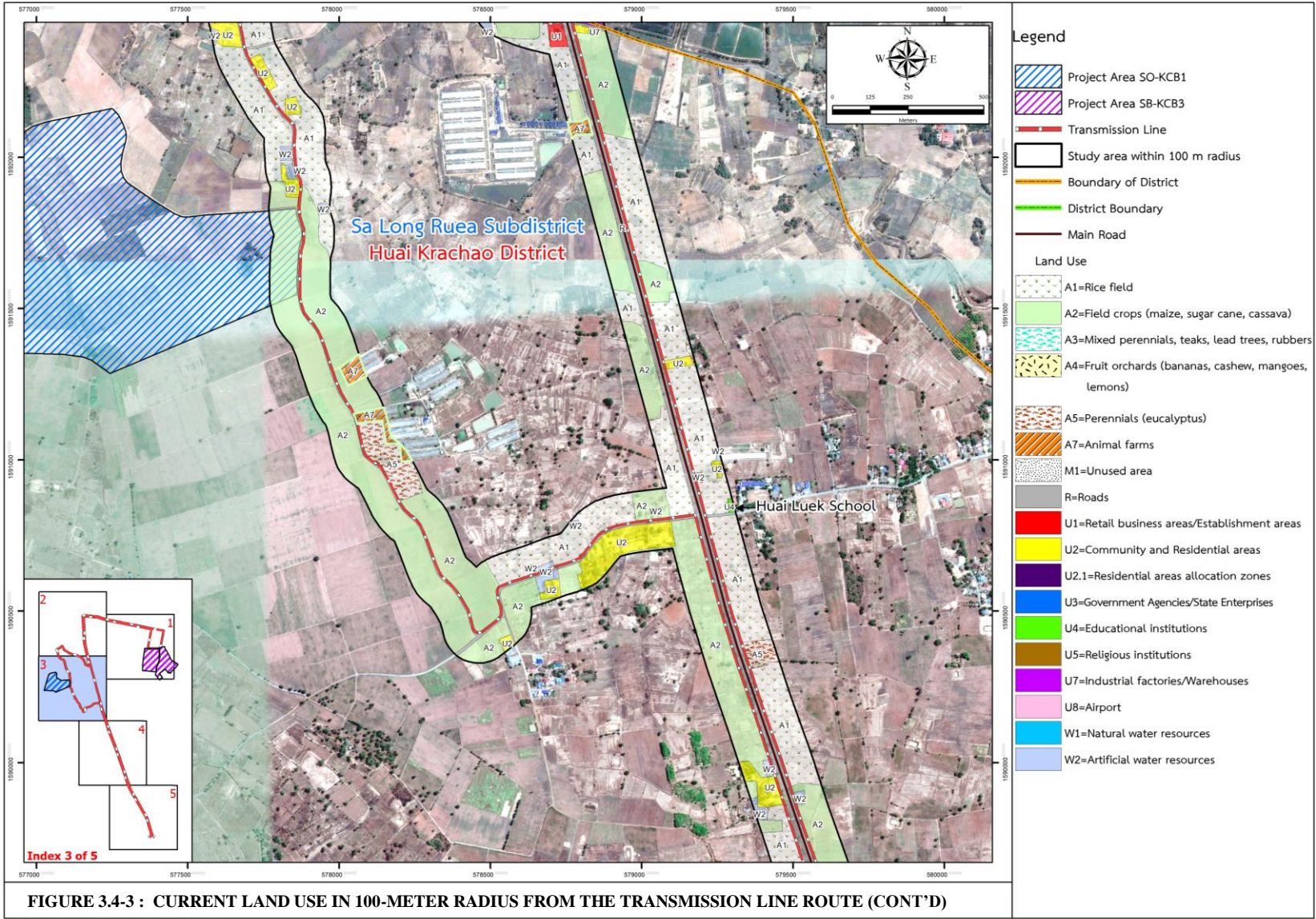
Source: TLT Consultants Co.,Ltd, October 2023.



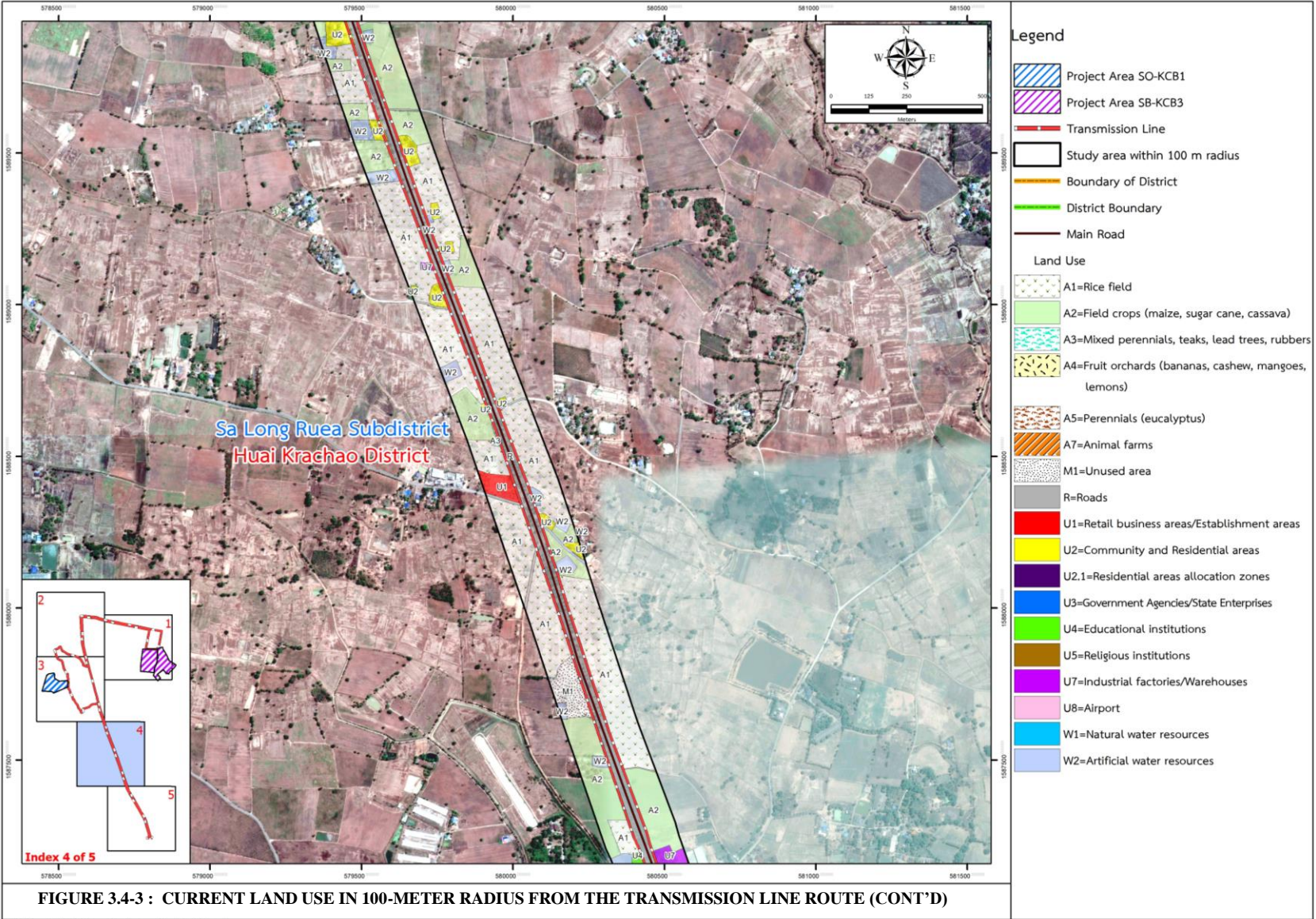






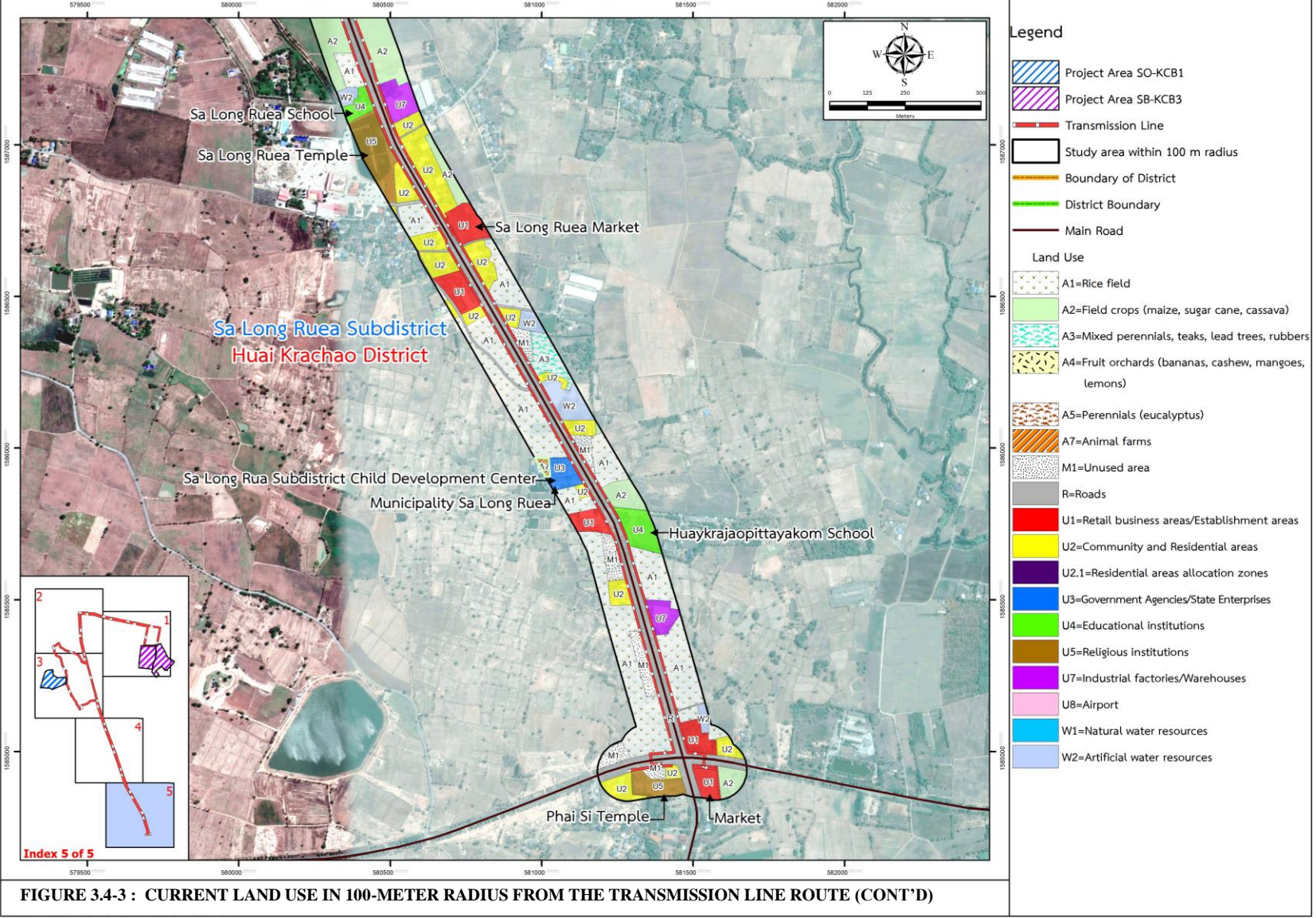






R06111/Pongpak\_D/17-10-66/Figure 1 Land us transmission line KCB1-3.mxd





**FIGURE 3.4-3 : CURRENT LAND USE IN 100-METER RADIUS FROM THE TRANSMISSION LINE ROUTE (CONT'D)**

P06111/Pongak\_b/17-10-66/Figure 1 Land us transmission line KCB1-3.mxd

### 3.4.2 Land Transportation

The secondary data was collected on transport networks from the Kanchanaburi Provincial Briefing 2023 (Kanchanaburi Provincial Office, 2023) can be summarized as follows.

- **Land Transport Network**

Use a private car to travel from Bangkok, go along Petchkasem Road or Borommaratchachonnani Road, pass Nakhon Chai Si District, Nakhon Pathom Province, Ban Pong District, Ratchaburi Province to Tha Maka District, Tha Ruea District and Tha Muang District to Kanchanaburi Province, a distance of 129 kilometers.

The transportation routes to enter the project area are National Highway No. 3443 (Talad Mai - Talung Nuea) and National Highway No. 3472 (U Thong - Talung Nuea) (**Figure 3.4-4**). The details can be summarized as follows.

- **National Highway No. 3443 (Talad Mai - Talung Nuea)**

The road starts from Rang Wai Subdistrict, Phanom Thuan District, to Lao Khwan Subdistrict, Lao Khwan District with a total distance of approximately 42.897 kilometers. The road has an approximate 12-meter width, 2 x 3.50-meter round-trip traffic lanes (separate directions), and approximately 2.50-meter wide road shoulder on each side. The road surface is asphalt. The traffic surface is in good condition.

- **National Highway No. 3472 (U Thong - Talung Nuea)**

The road starts from U Thong District, Suphan Buri Province, to Talung Nuea District Kanchanaburi with a total distance of approximately 19.626 kilometers. The road has an approximately 12-meter width 2x 3.50-meter round-trip traffic lanes (separate directions), and approximately 2.50-meter wide road shoulder on each side. The road surface is asphalt. The traffic surface is in good condition.

- **Railway transport network**

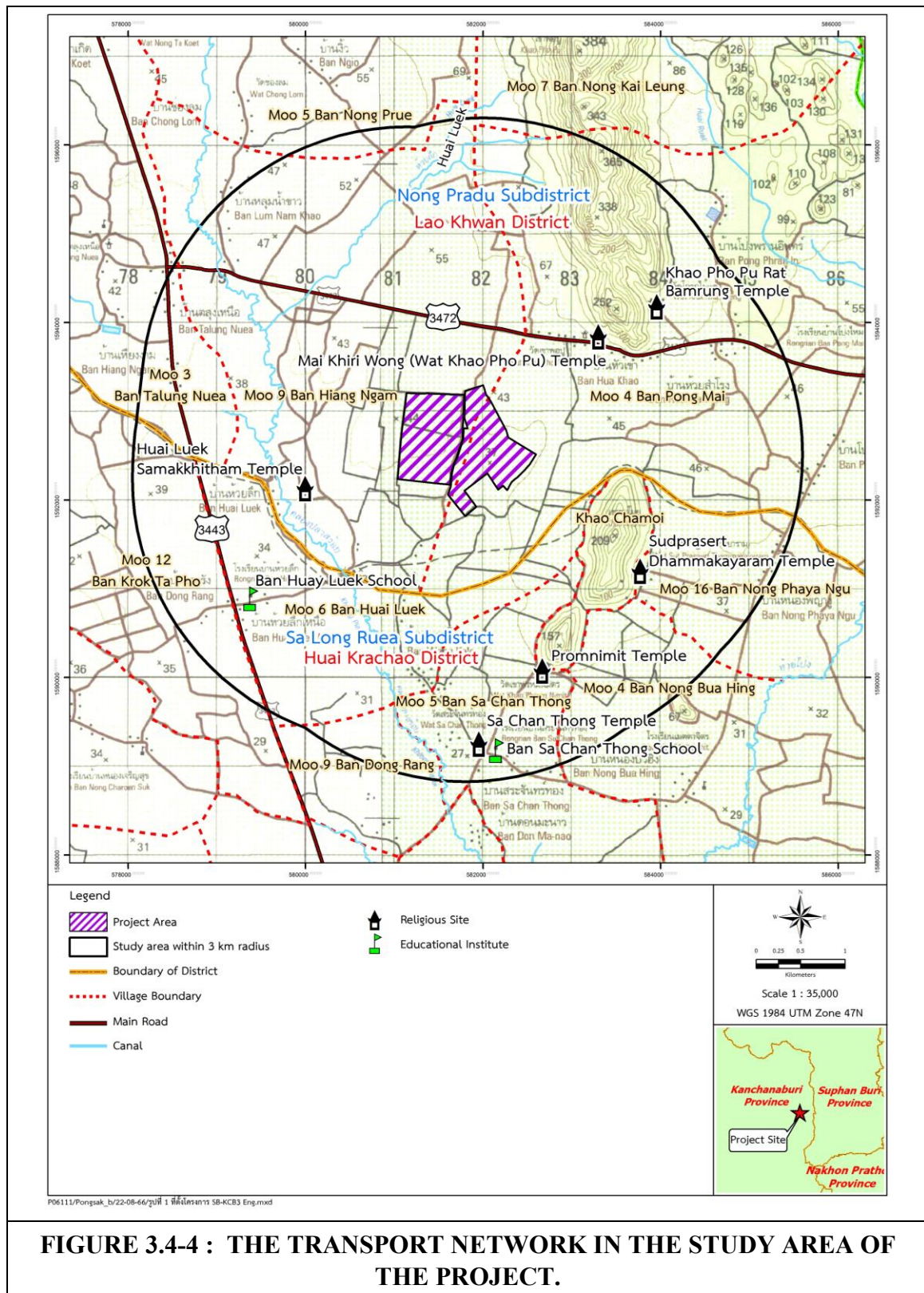
The train leaves Krung Thon Buri Station twice a day at 7: 45 a.m. and 1: 55 p.m., stopping at Kanchanaburi Station, The Bridge of the River Kwai and the final destination at Nam Tok Station, a distance of 193 kilometers. There is a one-day special round-trip train on Saturday, Sunday and public holidays.

Secondary data collection on land traffic volume from the traffic volume report on the highway between 2018-2022 issued by the Bureau of Highway Safety, Department of Highways, which has traffic volume monitoring stations near the project area which are National Highway No. 3443 (Km. 7+700) and National Highway No. 3472 (Km. 9+000). The details can be summarized as follows:

- **Traffic volume on National Highway No. 3443 (Km. 7+700)**, the average traffic volume is 4,105 a day, of which 1,292 4-wheel trucks a day, 880 passenger cars (no more than 7 passengers) a day and 327 passenger cars (more than 7 passengers) a day, respectively. The details are shown in **Table 3.4-3**.

- **Traffic volume on National Highway No. 3472 (Km. 9+000)**, the average traffic volume is 3,597 a day, of which 1,505 4-wheel trucks a day, 738 passenger cars (no more than 7 passengers) a day and 181 passenger cars (more than 7 passengers) a day, respectively. The details are shown in **Table 3.4-4**.





**FIGURE 3.4-4 : THE TRANSPORT NETWORK IN THE STUDY AREA OF THE PROJECT.**

**TABLE 3.4-4**  
**SUMMARY OF TRAFFIC VOLUME ON NATIONAL HIGHWAY NO. 3443 (7+700 KM.) 2018-2022**

B.E.	Route	Traffic volume (car/day)													
		C (< 7P)	C (> 7P)	LB	MB	HB	LT	MT	HT	FT	ST	Total	Truck proportion	BI+TC	MC
2561	inbound	560	262	0	0	4	624	63	54	19	18	1,604	9.85	11	665
	outbound	311	111	0	0	5	773	145	131	102	47	1,625	26.46	2	391
	<b>total</b>	<b>871</b>	<b>373</b>	<b>0</b>	<b>0</b>	<b>9</b>	<b>1,397</b>	<b>208</b>	<b>185</b>	<b>121</b>	<b>65</b>	<b>3,229</b>	<b>18.21</b>	<b>13</b>	<b>1,056</b>
2562	inbound	621	278	0	0	6	605	82	56	14	22	1,684	10.69	3	630
	outbound	242	118	0	0	1	716	125	140	125	62	1,529	29.63	5	370
	<b>total</b>	<b>863</b>	<b>396</b>	<b>0</b>	<b>0</b>	<b>7</b>	<b>1,321</b>	<b>207</b>	<b>196</b>	<b>139</b>	<b>84</b>	<b>3,213</b>	<b>19.70</b>	<b>8</b>	<b>1,000</b>
2563	inbound	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	outbound	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	<b>total</b>	<b>904</b>	<b>323</b>	<b>0</b>	<b>0</b>	<b>8</b>	<b>1,277</b>	<b>170</b>	<b>195</b>	<b>149</b>	<b>67</b>	<b>3,093</b>	<b>19.04</b>	<b>8</b>	<b>1,063</b>
2564	inbound	615	203	0	0	11	586	55	45	9	11	1,535	8.53	3	569
	outbound	260	78	0	0	0	647	99	140	136	51	1,411	30.19	7	407
	<b>total</b>	<b>875</b>	<b>281</b>	<b>0</b>	<b>0</b>	<b>11</b>	<b>1,233</b>	<b>154</b>	<b>185</b>	<b>145</b>	<b>62</b>	<b>2,946</b>	<b>18.91</b>	<b>10</b>	<b>976</b>
2565	inbound	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	outbound	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	<b>total</b>	<b>888</b>	<b>262</b>	<b>0</b>	<b>0</b>	<b>17</b>	<b>1,232</b>	<b>149</b>	<b>191</b>	<b>137</b>	<b>71</b>	<b>2,947</b>	<b>19.172</b>	<b>15</b>	<b>941</b>
Average	inbound	538	207	0	0	7	614	72	70.0	37	24	1,569	9.63	6	573
	outbound	342	120	0	0	4	678	106	121	101	46	1,518	21.07	5	434
	<b>total</b>	<b>880</b>	<b>327</b>	<b>0</b>	<b>0</b>	<b>11</b>	<b>1,292</b>	<b>178</b>	<b>191</b>	<b>138</b>	<b>70</b>	<b>3,087</b>	<b>15.36</b>	<b>11</b>	<b>1,007</b>

**Note :** C ≤ 7 = passenger cars no more than 7 passengers      C > 7 = passenger cars more than 7 passengers      LB = light bus      MB = mid-size bus  
 HB = heavy bus      LT = 4-wheel truck      MT = 2-axle truck (6 wheels)      HT = 3-axle truck (10 wheels)      FT = truck trailer (more than 3 axles)  
 ST = semi-truck trailer (more than 3 axles)      BI+TC = bicycle and tricycle      MC = motorcycle

**Source :** Bureau of Safety, Department of Highways, 2019-2023

**TABLE 3.4-4**  
**SUMMARY OF TRAFFIC VOLUME ON NATIONAL HIGHWAY NO. 3472 (9+000 KM.) 2018-2022**

B.E.	Route	Traffic volume (car/day)													
		C (< 7P)	C (> 7P)	LB	MB	HB	LT	MT	HT	FT	ST	Total	Truck proportion	BI+TC	MC
2561	inbound	149	110	0	3	2	582	36	80	41	11	1,014	17.06	12	301
	outbound	202	159	20	7	0	785	62	88	33	10	1,366	14.64	1	359
	<b>total</b>	<b>351</b>	<b>269</b>	<b>20</b>	<b>10</b>	<b>2</b>	<b>1,367</b>	<b>98</b>	<b>168</b>	<b>74</b>	<b>21</b>	<b>2,380</b>	<b>15.67</b>	<b>11</b>	<b>660</b>
2562	inbound	255	132	1	2	0	664	100	85	56	35	1,330	20.90	0	388
	outbound	204	66	1	4	0	638	59	78	47	10	1,107	17.89	2	422
	<b>total</b>	<b>459</b>	<b>198</b>	<b>2</b>	<b>6</b>	<b>0</b>	<b>1,302</b>	<b>159</b>	<b>163</b>	<b>103</b>	<b>45</b>	<b>2,437</b>	<b>19.53</b>	<b>2</b>	<b>810</b>
2563	inbound	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	outbound	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	<b>total</b>	<b>460</b>	<b>224</b>	<b>5</b>	<b>7</b>	<b>0</b>	<b>1,465</b>	<b>151</b>	<b>168</b>	<b>100</b>	<b>43</b>	<b>2,623</b>	<b>17.88</b>	<b>1</b>	<b>683</b>
2564	inbound	996	35	6	0	0	948	105	46	26	14	2,176	8.78	8	460
	outbound	1,024	26	3	1	3	897	90	51	23	18	2,136	8.71	3	470
	<b>total</b>	<b>2,020</b>	<b>61</b>	<b>9</b>	<b>1</b>	<b>3</b>	<b>1,845</b>	<b>195</b>	<b>97</b>	<b>49</b>	<b>32</b>	<b>4,312</b>	<b>8.74</b>	<b>11</b>	<b>930</b>
2565	inbound	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	outbound	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	<b>total</b>	<b>404</b>	<b>157</b>	<b>7</b>	<b>7</b>	<b>2</b>	<b>1,546</b>	<b>72</b>	<b>198</b>	<b>125</b>	<b>34</b>	<b>2,552</b>	<b>17.16</b>	<b>1</b>	<b>586</b>
Average	inbound	366	93	2	2	1	740	71	79	47	20	1,421	12.85	4	356
	outbound	372	88	6	3	1	765	65	80	43	15	1,438	11.75	1	377
	<b>total</b>	<b>738</b>	<b>181</b>	<b>8</b>	<b>5</b>	<b>2</b>	<b>1,505</b>	<b>136</b>	<b>159</b>	<b>90</b>	<b>35</b>	<b>2,859</b>	<b>12.30</b>	<b>5</b>	<b>733</b>

**Note :** C ≤ 7 = passenger cars no more than 7 passengers      C > 7 = passenger cars more than 7 passengers      LB = light bus      MB = mid-size bus  
 HB = heavy bus      LT = 4-wheel truck      MT = 2-axle truck (6 wheels)      HT = 3-axle truck (10 wheels)      FT = truck trailer (more than 3 axles)  
 ST = semi-truck trailer (more than 3 axles)      BI+TC = bicycle and tricycle      MC = motorcycle

**Source :** Bureau of Safety, Department of Highways, 2019-2023

- **Analysis of traffic data in the study area**

Traffic data analysis is assessed by the traffic density on various routes and flexibility in travel. The focus is the capacity of the road network. For traffic volume calculation, the unit of each type of vehicle will be converted to a single unit equivalent to a passenger car (Passenger Car Unit: PCU Factor) according to the regulations of the Department of Highways. The details of the calibration and the summary of the car quantity calibration (cars per day) to be the same unit (PCU) are as follows.

Car types are defined into 12 categories. Each type has a multiplier of Passenger Car Equivalents (PCE) to convert it into passenger car unit (PCU), as shown in **Table 3.4-5**

**TABLE 3.4-5  
WEIGHT OF EACH TYPE OF VEHICLE**

Type of vehicle	Value of Passenger Car Equivalents Factor (PCE)
passenger cars no more than 7 passengers	1.00
passenger cars more than 7 passengers	1.00
light bus	1.50
mid-size bus	1.50
heavy bus	2.10
4-wheel truck	1.00
2-axle truck (6 wheels)	2.10
3-axle truck (10 wheels)	2.50
truck trailer	2.50
semi-truck trailer	2.50
bicycle and tricycle	0.33
motorcycle and motor-tricycle	0.33

**Source:** Bureau of Safety, Department of Highways, 2019-2023

Let V be the traffic volume (from maximum PCU units per hour) to calculate the V/C Ratio in calibration with the standard value of the Traffic Engineering Division set at a maximum of less than 0.8 (80%). The highway capacity is shown in **Table 3.4-6**.

Calculation of V/C Ratio follows this formula.

$$\text{V/C Ratio} = \frac{\text{Traffic volume increased by the project} + \text{Original traffic volume}}{\text{The highways capacity}}$$

Value V/C Ratio used to calibrate the standard value for classifying traffic conditions in the future, as shown in **Table 3.4-7**.

**TABLE 3.4-6  
HIGHWAYS CAPACITY**

Types of highways	Capacity (PCU/hr)
Multi-lane roads	2,000 (per 1 lane)
2-lane roads, 2 directions	2,000 (both 2 directions)
3-lane roads, 2 directions	4,000 (both 2 directions)

Source: Phaophonng Nillachanphansri, 1997

**TABLE 3.4-7  
THE STANDARD VALUE FOR CLASSIFYING TRAFFIC CONDITIONS  
IN THE FUTURE**

Level of service	Volume Capacity Ratio (V/C Ratio)	Meaning
A	0.00-0.60	- Free-Flow Conditions are not disturbed by other factors, and the driver has high freedom in controlling the vehicle.
B	0.61-0.70	- Traffic conditions are disturbed by other factors, and the driver has less freedom in controlling the vehicle.
C	0.71-0.80	- Static traffic conditions, the driver has more difficulty control of the vehicle, making changing lanes difficult.
D	0.81-0.90	- Traffic conditions become unstable. There is a slight increase in the traffic volume, causing vehicle movement to be delayed.
E	0.91-1.00	- Traffic conditions become unstable. There is an increase in traffic, causing vehicle movement to be highly delayed.
F	> 1.00	- Traffic jam

Source :Transportation Research Board (1994), based on Department of Highways, 2013.

From the traffic volume calculation, it can be summarized as follows.

**A) National Highway No. 3443 (Km.7+700) 2018-2022** It is found that there is a maximum traffic volume of 176 vehicles (PCU) per hour with a V/C Ratio equal to 0.09 (**Table 3.4-8**). There is a level of service at level A - Free-Flow Conditions are not disturbed by other factors, and the driver has high freedom in controlling the vehicle.



**TABLE 3.4-8**  
**PCU TRAFFIC VOLUME OF NATIONAL HIGHWAY NO. 3443 (7+700 KM.)**  
**2018-2022**

Types of vehicles	PCE	Average traffic volume					
		(Vehicle/Day)			(PCU/Day)		
		inbound	outbound	total	inbound	outbound	total
passenger cars no more than 7 passengers	1.00	538	342	880	538	342	880
passenger cars more than 7 passengers	1.00	207	120	327	207	120	327
light bus	1.50	0	0	0	0	0	0
mid-size bus	1.50	0	0	0	0	0	0
heavy bus	2.10	7	4	11	15	8	23
4-wheel truck	1.00	614	678	1,292	614	678	1,292
2-axle truck (6 wheels)	2.10	72	106	178	151	223	374
3-axle truck (10 wheels)	2.50	70	121	191	175	303	478
truck trailer (more than 3 axles)	2.50	37	101	138	93	253	345
semi-truck trailer (more than 3 axles)	2.50	24	46	70	60	115	175
bicycle and tricycle	0.33	6	5	11	2	2	4
motorcycle and motor-tricycle	0.33	573	434	1,007	189	143	332
<b>Total</b>		<b>2,148</b>	<b>1,957</b>	<b>4,105</b>	<b>2,043</b>	<b>2,186</b>	<b>4,229</b>
<b>Traffic volume (V) Vehicle (PCU) per Hour</b>							<b>176</b>
<b>Capacity (C) Vehicle (PCU) per Hour</b>							<b>2,000</b>
<b>V/C Ratio</b>							<b>0.09</b>
<b>Level of Service (LOS)</b>							<b>A</b>

Source: TLT Consultants Co., Ltd., 2023

**B) National Highway No. 3472 (Km. 9+000) 2018-2022** It is found that there is a maximum traffic volume of 154 vehicles (PCU) per hour with a V/C Ratio equal to 0.08 (**Table 3.4-9**). There is a level of service at level A - Free-Flow Conditions are not disturbed by other factors, and the driver has high freedom in controlling the vehicle.

**TABLE 3.4-9  
PCU TRAFFIC VOLUME OF NATIONAL HIGHWAY NO. 3472 (9+000 KM.)  
2018-2022.**

Types of vehicles	PCE	Average traffic volume					
		(Vehicle/Day)			(PCU/Day)		
		inbound	outbound	total	inbound	outbound	total
passenger cars no more than 7 passengers	1.00	366	372	738	366	372	738
passenger cars more than 7 passengers	1.00	93	88	181	93	88	181
light bus	1.50	2	6	8	3	9	12
mid-size bus	1.50	2	3	5	3	5	8
heavy bus	2.10	1	1	2	2	2	4
4-wheel truck	1.00	740	765	1,505	740	765	1,505
2-axle truck (6 wheels)	2.10	71	65	136	149	137	286
3-axle truck (10 wheels)	2.50	79	80	159	198	200	398
truck trailer (more than 3 axles)	2.50	47	43	90	118	108	225
semi-truck trailer (more than 3 axles)	2.50	20	15	35	50	38	88
bicycle and tricycle	0.33	4	1	5	1	0	2
motorcycle and motor-tricycle	0.33	356	377	733	117	124	242
<b>Total</b>		<b>1,781</b>	<b>1,816</b>	<b>3,597</b>	<b>1,840</b>	<b>1,847</b>	<b>3,687</b>
<b>Traffic volume (V) Vehicle (PCU) per Hour</b>							<b>154</b>
<b>Capacity (C) Vehicle (PCU) per Hour</b>							<b>2,000</b>
<b>V/C Ratio</b>							<b>0.08</b>
<b>Level of Service (LOS)</b>							<b>A</b>

**Source:** TLT Consultants Co., Ltd., 2023

### 3.4.3 Water Use

Collect secondary data from related documents or reports, such as data from the Kanchanaburi Provincial Waterworks Authority, Development Plan Fiscal year 2023-2027, revised version 2024, local development plan (2023-2027) and baseline information documents of Nong Pradu Subdistrict Municipality, Lao Khwan District, Kanchanaburi.

The Kanchanaburi Provincial Waterworks Authority has 4 offices, consisting of the Kanchanaburi Provincial Waterworks Authority, Provincial Waterworks Authority, Tha Maka Branch, Provincial Waterworks Authority, Lao Khwan Branch and the Provincial Waterworks Authority, Phanom Thuan Branch. They are in the responsibility area of the Provincial Waterworks Authority Region 3 from the Kanchanaburi Provincial Development Plan Fiscal year 2023-2027, revised edition 2024. The information on water users can be summarized as follows:

- Provincial Waterworks Authority, Kanchanaburi Branch - in 2021, there were a total of 29,845 tap water users, of which 22,108 were for residences, 4,285 were for government agencies and small businesses, 1,212 were for state enterprises and large businesses. The amount of water produced was 9,612,532 cubic meters.
- Provincial Waterworks Authority, Tha Maka Branch - in 2021, there were a total of 12,742 tap water users, of which 10,353 were for residences, 102 were for government agencies, 1,482 were for small businesses, 16 were for state enterprises and 254 were for large businesses. The amount of water produced was 4,048,094 cubic meters.
- Provincial Waterworks Authority, Lao Khwan Branch - in 2021, there were a total of 6,471 tap water users, of which 5,029 were for residences, 109 were for government agencies, 990 were for small businesses, 15 were for state enterprises and 135 were for large businesses. The amount of water produced was 1,647,810 cubic meters.
- Provincial Waterworks Authority, Phanom Thuan Branch - in 2021, there were a total of 8,163 tap water users, of which 6,907 were for residences, 750 were for government agencies and small businesses, 162 were for state enterprises and large businesses. The amount of water produced was 2,398,514 cubic meters.

The project area is located in Nong Pradu Subdistrict Municipality, Lao Khwan District, Kanchanaburi. From Local development plan (2023-2027) of Nong Pradu Subdistrict Administrative Organization, it shows that there are water in the area used for consumption from village tap water, as shown in **Table 3.4-10**.

For water use in agriculture, The area of Nong Pradu subdistrict is outside the irrigation area during the dry season. Water resources used in agriculture are insufficient for the needs of the people.

**TABLE 3.4-10**  
**VILLAGE TAP WATER OF NONG PRADU SUBDISTRICT ADMINISTRATIVE ORGANIZATION, LAO KHWAN DISTRICT, KANCHANABURI PROVINCE**

Community/Village	Number of Village Tap Water (place)
Moo 1 Ban Nong Ta kai	4
Moo 2 Ban Nong Pradu	4
Moo 3 Ban Talung Nuea	4
Moo 4 Ban Pong Mai	9
Moo 5 Ban Nong Prue	3
Moo 6 Ban Nam Jone	3
Moo 7 Ban Nong Kai Lueang	3
Moo 8 Ban Nong Kae Dang	2
Moo 9 Ban Hiang Ngam	3
Moo 10 Ban Nong Masang	3
Moo 11 Ban Nong Ta Koet	3
Moo 12 Ban Nong Kham Pa	3

**Source:** Local development plan (2023-2027) of Nong Pradu Sub-district Administrative Organization

#### 3.4.4 Electricity Use

Collect secondary data from related documents or reports, such as data from the Provincial Electricity Authority in Kanchanaburi Province and Kanchanaburi Provincial Development Plan 2023-2027, revised edition 2024.

The Provincial Electricity Authority, Kanchanaburi Province, is responsible for Provincial Electricity Authority Main Branch and the Provincial Electricity Authority Pakham Sub Branch as follows.

- Provincial Electricity Authority, Tha Muang District Branch
  - Provincial Electricity Authority sub-branch, Talad Samrong
- Provincial Electricity Authority, Phanom Thuan District Branch
  - Provincial Electricity Authority, Huai Krachao District Sub-Branch
- Provincial Electricity Authority, Sai Yok District Branch
- Provincial Electricity Authority, Thong Pha Phum District Branch
  - Provincial Electricity Authority, Sangkhlaburi District Sub-Branch
- Provincial Electricity Authority, Dan Makham Tia District Branch
- Provincial Electricity Authority, Ladya District Branch
  - Provincial Electricity Authority, Si Sawat District Sub-Branch
  - Provincial Electricity Authority, Tha Kradan District Sub-Branch
- Provincial Electricity Authority, Bo Phloi District
- Provincial Electricity Authority, Lao Khwan District Branch
- Provincial Electricity Authority, Tha Maka District
- Provincial Electricity Authority, Tha Ruea Subdistrict Branch

The Kanchanaburi Provincial Development Plan Fiscal Year 2023-2027 of the newly revised edition 2024 shows that electricity consumption data in 2022 there were 199,236 electricity users, divided into 179,824 persons for residential purposes, 6,026 persons for business and industry purposes, 13,263 persons for government agencies purposes and others (pumping water for agriculture) 123 persons.

The project area is located in Tambon Nong Pradu, Lao Khwan District, Kanchanaburi is in the responsibility area of the Provincial Electricity Authority, Lao Khwan District-Branch, Kanchanaburi. At present, the area of Nong Pradu subdistrict has electricity for every village and 3,510 households has electricity.

### 3.4.5 Solid Waste Management

Data on solid waste management has been compiled from the Kanchanaburi Provincial Development Plan Fiscal year 2023-2027, revised edition 2024 and related local agencies. The information on waste management can be summarized as follows:

- **The quantity of waste produced**

The population database from the Department of Local Administration was calculated according to the criteria of the Pollution Control Department. This makes it possible to estimate the quantity of waste produced in Kanchanaburi Province during 2018-2021, as shown in **Table 3.4-11**.

**TABLE 3.4-11**  
**THE QUANTITY OF WASTE PRODUCED IN KANCHANABURI PROVINCE**  
**DURING 2018-2021**

Local Administrative Organization (Number)	2018		2019		2020		2021	
	quantity solid waste		quantity solid waste		quantity solid waste		quantity solid waste	
	ton/day	ton/day	ton/day	ton/day	ton/day	ton/day	ton/day	ton/day
121	822.49	300,208.85	840.85	306,910.25	871.15	317,969.45	869.71	317,442.95

**Source:** Kanchanaburi Provincial Development Plan, fiscal year 2023-2027, revised edition 2024

However, the estimation of the quality of solid waste production according to the administrative area at the local level shows that the Muang Kanchanaburi municipality has a solid waste production rate of 1.15 kg/person/day, Sub-district municipality has a solid waste production rate of 1.02 kg/person/day, and Subdistrict Administrative Organization has the rate of waste production at 0.91 kg/person/day. The local administrative organization is responsible for waste management, including collecting, transporting, and disposing.

- **Solid Waste Management**

The waste management of Kanchanaburi Province in 2021 can be summarized in **Table 3.4-12**. Some of the waste management facilities are located in a military area. Therefore, local government organizations or private companies cannot invest in the waste disposal process. It is another limitation of waste management.

**TABLE 3.4-12  
INFORMATION ON THE QUALITY OF SOLID WASTE AND DISPOSAL  
IN KANCHANABURI PROVINCE, 2021**

Waste disposal B.E. 2021	Detail
Quantity of solid waste generated	869.71 ton/day
Quantity of solid waste managed	725.24 ton/day
Number of local administrative organizations collecting solid waste for disposal	80 locations
Number of local administrative organizations with solid waste disposal stations	34 locations
- Refuse-derived fuel centrifugation (RDF)	2 locations
- Open Dump	30 locations
- Separation and Incineration	2 locations

**Source:** Kanchanaburi Provincial Development Plan, the fiscal year 2023-2027, revised edition 2024

- **In the project area and adjacent area**

Nong Pradu Subdistrict administrative organizations not has waste collection due to lack of solid waste collection truck and all communities has responsible for waste management. Waste data of Nong Pradu Subdistrict administrative organizations from the community solid waste management information system in year 2013-2019 are shown in **Table 3.4-13**.

**TABLE 3.4-13  
WASTE DATA OF NONG PRADU SUB-DISTRICT ADMINISTRATIVE  
ORGANIZATIONS IN YEAR 2013-2019**

Local Authority	Solid Waste (ton/day)						
	Year 2013	Year 2014	Year 2015	Year 2016	Year 2017	Year 2018	Year 2019
Nong Pradu Subdistrict administrative organizations	8.40	4.89	8.60	8.68	8.68	8.72	8.85

**Source:** The community solid waste management information system (<https://thaimsw.pcd.go.th/>)

However, Nong Pradu Subdistrict administrative organizations has implemented a solid waste management project in Nong Pradu subdistrict communities. "Clean Province" for the fiscal year 2023 to determine the direction and goals for every village to properly household waste sorting. Nong Pradu Subdistrict Administrative Organization makes an agreement to manage household waste with the village headman club of Nong Pradu Subdistrict, schools in Nong Pradu Subdistrict and Tambon health promotion hospitals in Nong Pradu subdistrict to expand the results, to create a process of public participation in the village, to promote the preparation of garbage bins for every household, and proper household organic waste management to reduce global warming problems.

The waste management data of Sa Long Ruea Subdistrict Municipality shows that 248,565 tons of community waste are generated per month. 168,565 tons are utilized per month. In total, 2,717 households reach waste management service, representing 100% (data on May 2023). Sa Long Ruea Subdistrict Municipality uses a landfill method. The landfill area is located at Moo 15 Chorakhe Sam Phan Subdistrict, U Thong District, Suphan Buri Province, operated by a private and established in 2015. The waste disposal site has a total area of 16 rai, with a capacity of approximately 89,600 cubic meters, about 50 tons per day of the quantity of solid waste passed to the waste disposal site, about 1.00 tons per day of separated waste and 49.00 tons per day of solid waste to landfill. The site is currently occupied by about 90% of the disposal area. The disposal area can be used for approximately 1 year. (Source: Municipal Solid Waste Management Information System, Pollution Control Department).

### **3.4.6 Disaster Prevention and Mitigation**

There are 5 organizations responsible for disaster prevention and mitigation near the study area. Based on the study of disaster prevention and mitigation data from local administrative organizations in the area, can be summarized as the following:

(1) Nong Pradu Subdistrict Administrative Organization is approximately 6 kilometers away from the Project area. Currently, there are 4 disaster prevention officers. They possess 2 water trucks with a capacity of 6,000 cubic meters and 12,000 cubic meters, totaling 2 vehicle.

(2) Sa Long Ruea Subdistrict Municipality is approximately 9.6 kilometers away from the Project area. Currently, there are 2 disaster prevention officers. They possess a watertrucks with a capacity of 6,000 cubic meters, totaling 1 vehicle.

(3) Huai Krachao Subdistrict Municipality is approximately 24.4 kilometers away from the Project area. Currently, there are 3 disaster prevention officers. They possess a watertrucks with a water capacity of 16,000 cubic meters, totaling 1 vehicle.

(4) Rang Wai Subdistrict Municipality is approximately 27.6 kilometers away from the Project area.

(5) Sra Yai Som Subdistrict Municipality is approximately 30.5 kilometers away from the Project area.



# CHAPTER 4

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## ASSESSMENT OF ENVIRONMENTAL AND SOCIAL IMPACT AND RISKS



## CHAPTER 4

### ASSESSMENT OF ENVIRONMENTAL AND SOCIAL IMPACT AND RISKS

#### 4.1 SCOPE AND METHODOLOGY OF IMPACT ASSESSMENT

##### 4.1.1 Scope of Impact Assessment

All components located in the project area and associated facilities as the transmission line installed from the project to the specified substation, are included in the project components that define the range of environmental and social factors assessed in IEE. Furthermore, the following environmental resource/value impacts were analyzed for each step of project implementation:

##### (1) Construction Phase

The construction area will be land clearing, construction of utilities and offices. The construction of all project components will be done according to construction schedule that takes seasonal constraint into consideration. Major impact will be those associated with construction activities.

##### (2) Operation Phase

After construction works finish, all equipment will be installed and commissioning will be conducted, then, commercial operation of project starts.

##### 4.1.2 Methodology For Impact Assessment And Evaluation

The approach used to assess environmental and social impacts of the project determines the intensity, extent, and duration of the anticipated potential positive or negative impact. These three qualifiers are grouped under one synthesis indicator, the significance of the impact.

The generic definitions which will be used for determination of impact significance are as follows;

- **Insignificant:** At this level, the activities or outcomes from the project development do not cause changes or effects, both directly and indirectly, on natural resources or environment. The environmental condition continues with normal function.
- **Low:** At this level, the activities or outcomes from the project development cause effects or benefits to the environment for a short time and the scope of the impacts is limited to only some areas of the project. The effect time is short and reversible naturally, or the changes are within the standard or naturally acceptable level. The impact may cause psychological effects on people, such as disturbance. This level of environmental impact may be corrected with certain mitigation measures or require no measures at all.
- **Moderate:** At this level, the activities or outcomes from the project development cause moderate impacts or benefits to the environment compared to the standard. The affected area is relatively wide, but limited within the project area. The activities occur at several stages of the project and the effects take a long time, yet impermanently. Some activities affect natural resources and people's health, but not at the life-threatening level. Certain mitigation measures can reduce the impact.

- **High:** At this level, the activities or outcomes from the project development cause impacts or benefits to the environment at a greater level than the standard or cause changes to natural resources and environment severely or permanently. The effects are widespread to people outside at a life-threatening level. Mitigation measures cannot reduce the impact or make such affected natural resources to return their original condition.

It should be noted that the environmental impact from the project can be either positive or negative. The results will be compared to the standard or normal value to identify that the level is high, moderate, low, or no / insignificant impact.

## 4.2 SOLAR POWER PLANT

### 4.2.1 Physical Conditions

#### 4.2.1.1 Air Quality

##### (1) Construction Phase

The activities in the construction phase that might affect air quality include land clearance for the construction of the power generation control building, the storage areas of spare parts, equipment and materials, solid waste, and maintenance area, the switchyard or substation area, and the supporting areas related to power generation. This covers 6,735 square meters or 0.52 percent of the entire Project area. The activities may affect air quality in terms of PM10 which will fall on the ground within 6-9 m in the construction area of the Project.

The method for the prediction of impacts on air quality from project activities during the construction phase includes the following details

##### (A) The method for calculation of the particulate matter concentration

The prediction of particulate matter concentration resulting from construction site surface modification activities is calculated using the Box Model (Steven R. Hanna and colleagues, 1982), which is a modeling approach for assessing the amount of pollutant dispersion in a box-like configuration. It assumes that pollutants originating from sources are uniformly distributed in the air and have a consistent average concentration. The Box Model is applied using **Equation (1)**

$$C = \frac{Q}{d \times w \times m} \times 10^6 \quad \text{_____ (1)}$$

- When
- C = The concentration of air pollutants in the area with air pollutant emissions (micrograms per cubic meter)
  - Q = The emission rate of pollutants from the source (grams per second)
  - d = The width of the area for calculating pollutant concentration (in meters) vertically to the wind direction (the shortest width of the construction area is 33 meters).

- w = The average wind speed (mean) for the entire year (meters per second) from U-Thong Meteorological Station, Station ID 425301/48427, for 17 years (BE 2549-2565) is approximately 0.8 knots, which is approximately 0.41 meters per second.
- m = The mixing height, which is the height of the atmosphere where pollutants are mixed with the air (in meters), considering the lowest monthly average value near the project area, is the highest at the Bang Na Agrometeorological Station in BE 2564, with a value of 541.37 meters (**Table 4.2.1-1**)

**TABLE 4.2.1-1**  
**MIXING HEIGHT FROM BANG NA AGROMETEOROLOGICAL IN BE 2564,**  
**UNDER THE THAI METEOROLOGICAL DEPARTMENT**

<b>Month</b>	<b>Mixing Height (meters)</b>
January	681.79
February	598.72
March	780.98
April	657.54
May	732.82
June	743.61
July	830.48
August	883.50
September	694.97
October	702.39
November	659.30
<b>December</b>	<b>541.37</b>

**Source :** Analyzed by the Faculty of Environment, Kasetsart University, certified by the Ozone and Radiation Center, Thai Meteorological Department, in 2022

**(B) The results of the assessment of total particulate matter concentration (TSP)**

The construction activities of the project may lead to the dispersion of particulate matter, according to U.S. EPA data in AP-42 (Compilation of Air Pollution Emissions Factors, Heavy Construction Operations, 1995). The quantity of particulate matter dispersion can vary depending on the nature of the work, components, soil moisture, wind speed, and construction duration. For construction activities with a silt content of 30% and a Precipitation Evaporation Index of approximately 50%, the average particulate matter emission rate will be 1.2 tons per acre per month or 9.884 grams per square meter per day. The project involves surface modification of approximately 6,735.00 square meters per day (considering the worst-case scenario of completing the entire project within one day). The details are as follows:

Specify a construction duration of 8 hours per day

$$Q = \frac{9.884 \text{ grams/day/ square meters}}{8 \text{ hours/day} \times 60 \text{ minutes/hour} \times 60 \text{ seconds/minute}}$$

$$= 0.000343 \text{ grams/second/ square meters}$$

Specify that the project involves surface modification of approximately 6,735 square meters per day

$$Q = 0.000343 \text{ grams/second/ square meters} \times 6,735 \text{ square meters}$$

$$= 2.310 \text{ grams/second}$$

Substitute the values of various variables into the Box Model according to **Equation (1)**.

$$C = \frac{2.310 \text{ grams/second} \times 10^6}{60 \text{ meters} \times 0.41 \text{ meters/second} \times 541.37 \text{ meters}}$$

$$= 173.45 \text{ micrograms per cubic meter}$$

Therefore, the average 24-hour Total Suspended Particulate (TSP) from the surface modification activity is 173.45 micrograms per cubic meter. When combined with the current measurements for the 24-hour average Total Suspended Particulate (TSP) in the general atmosphere near the monitoring station closest to the project area (Station A2, Huai Luek Samakkhitham Temple), which has a maximum value of 79.00 micrograms per cubic meter, the resulting 24-hour average Total Suspended Particulate (TSP) is 252.45 micrograms per cubic meter. This is equivalent to 76.50 % of the standard value. (Details can be found in **Table 4.2.1-2**), which is within the criteria for the 24-hour average TSP in the general atmosphere as per the 24<sup>th</sup> National Environmental Committee Announcement (BE 2547), which sets the standard at not exceeding 330 micrograms per cubic meter.

**TABLE 4.2.1-2**  
**THE RESULTS OF THE ASSESSMENT OF 24-HOUR AVERAGE TOTAL PARTICULATE MATTER CONCENTRATION (TSP) IN THE CONSTRUCTION PHASE**

Unit: micrograms/cubic meter

The concentration of TSP in ambient air (micrograms/cubic meter)			
The concentration of pollutants	The measurement results <sup>1/</sup>	Total	The Standard value
(1)	(2)	(1)+(2)	
173.45	79.00	252.45	330 <sup>2/</sup>

- Remarks :** 1/ The highest value from monitoring the Total Suspended Particulate (TSP) concentration at Station A2, Huai Luek Samakkhitham Temple, between November 2 and November 7, BE 2566, was conducted by Environment Research and Technology Company Limited.
- 2/ The 24<sup>th</sup> National Environmental Committee Announcement (BE 2547) regarding the General Air Quality Standards.

However, the Project has determined mitigation measures for air quality, such as spraying water at the area with topsoil stripping, material stacking, and entrance of the construction site, and keeping construction materials tidily. Therefore, the impact is low.

**(2) Operation Phase**

The operation phase involves power generation from solar cells. There will be no sources of continuous air pollution from the project operations. No air pollution impact during operation phase is anticipated.

**4.2.1.2 Noise**

**(1) Construction Phase**

**(1.1) Sources of Noise**

The activities in the construction phase that may cause noise include land clearance for the construction of the power generation control building, the storage areas of spare parts, equipment and materials, solid waste, and maintenance area, the switchyard or substation area, and the supporting areas related to power generation. This covers only 6,735 sq.m. or 0.52 percent of the entire Project area. These activities occur only for a short time. Installation of solar panels on the ground would generate low noise because the project will select a low noise pilling method, the maximum sound at a distance of 10 meter is 77 dB(A) (Hydraulic Hammer, refer to noise level values from Update of Noise Database for Prediction of Noise on Construction and Open Sites, UK Government Department (2005)). Solar panel piles are small piles and are not deep from the ground surface. The machine is used at each point only for a short period. The noise generated during this process will be short-lived and temporary. The project uses generators only during the construction period and is not used regularly. Generators will be used in areas where electricity is not accessible and used only for a short period of time, such as to generate electricity for various cutting machines or welding machines, etc. The project uses a small generator with a maximum operating power of approximately 4.5 kilowatts. The maximum sound at a distance of 10 meter is 66.0 dB(A) (refer to noise level values from Update of Noise Database for Prediction of Noise on Construction and Open Sites, UK Government Department (2005)).

Therefore, this study will assess noise impact from construction activities by considering the construction equipment and machines that generate the highest noise to represent the worst-case source of noise. In this case, it is the grader that generates noise level of 86.0 dB(A) at 10 m, refer to the Update of Noise Database for Prediction of Noise on Construction and Open Sites, UK Government Department (2005). More details are shown in **Table 4.2.1-3**.

**TABLE 4.2.1-3**  
**NOISE LEVELS OF CONSTRUCTION MACHINES AND EQUIPMENT**

Construction activities	Construction activities	Number of machines (per day)	Impact Type or not	Noise level at 10 m from source (dB(A)) <sup>1/</sup>	Usage Factor (%) <sup>2/</sup>	Noise level at 10 m from source considering operation time (Usage Factor) <sup>3/</sup>
Land clearing	Tracked Excavator	1	Non-impact	79.0	40	75.0
	Grader	1	Non-impact	86.0	40	82.0
	Compactor	1	Non-impact	78.0	20	71.0
Shallow foundation	Tracked Excavator)	1	Non-impact	79.0	40	75.0
	Concrete Mixer Truck	1	Non-impact	80.0	40	76.0
Structure or building construction	Crane	1	Non-impact	82.0	16	74.0
	Dump Truck	1	Non-impact	81.0	40	77.0

**Sources:** 1/Noise levels of machines and equipment at 10 m from source: Referenced from the Update of Noise Database for Prediction of Noise on Construction and Open Sites, UK Government Department (2005)

2/Usage Factor (%) referenced from FHWA Highway Construction Noise Handbook, Federal Highway Administration (FHWA) (2006)

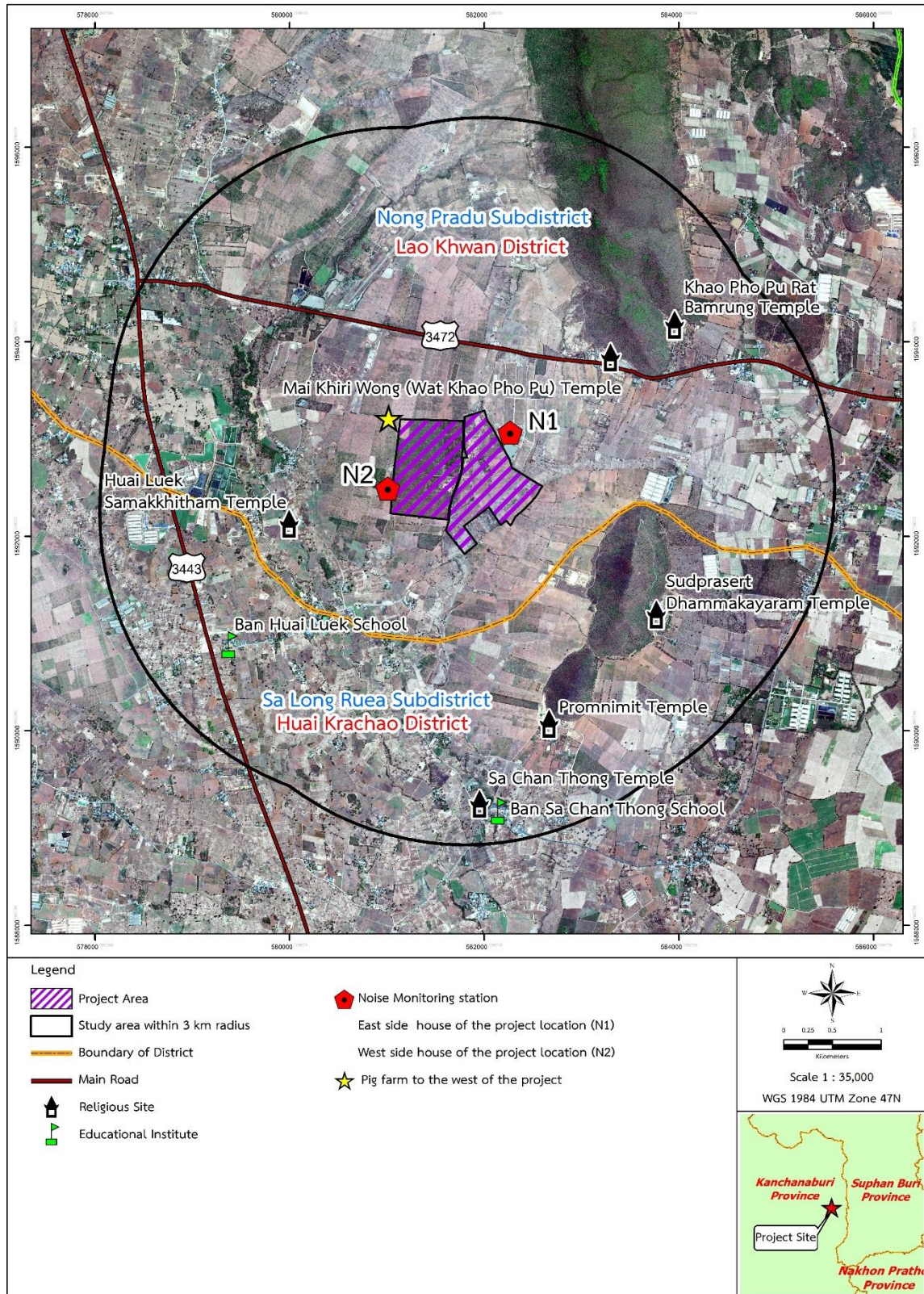
3/Calculate the noise level from the machine that the receiver will receive based on the equation (1)

### (1.2) Sensitive Receptors

Sensitive receptors expected to be affected and located closest to the construction area are shown in **Figure 4.2.1-1**, including

- A house to the east of the Project (N1) is 140 meters from the Project fence line and 876 meters from the land clearing and structure and building construction.
- A house to the west of the Project (N2) is 74 meters from the Project fence line and 721 meters from the land clearing and structure and building construction.
- A pig farm to the west of the Project is 8 meters from the Project fence line and 169 meters from the land clearing and structure and building construction. The pig farm is a long concrete building. The side is closed wall by 50% while the open section is covered with sunscreen net. The front and the back are fully open.





**FIGURE 4.2.1-1: NOISE MONITORING STATIONS AND SENSITIVE RECEPTORS**

### (1.3) Level of noise from construction activities

Transmission loss of noise over the distance to sensitive receptors near the Project area can be calculated using the equation from the FHWA Highway Construction Noise Handbook (FHWA, 2006), as in **Equation (1)**

$$Leq(\text{equip}) = E.L. + 10 \log(U.F.) - 20 \log(D/D_0) - 10G \log(D/D_0) \quad (1)$$

When $Leq(\text{equip})$	=	The noise level from the machine operation over a specified period
E.L.	=	Noise level of each machine at reference distance of 10 m (dB(A))
G	=	Constant from the attenuation or sound absorption from the ground (Ground Factor). It equals 0 for hard ground (G=0)
$D_0$	=	reference distance of 10 m
D	=	Distance from the receptor to the machine (m)
U.F.	=	Usage Factor or the proportion of machine use time per total working time

The forecast results of noise levels from Project construction activities deducted by transmission loss to the affected areas in all 3 sensitive receptors are in the range of 43.1-57.4 dB(A). Details are shown in **Table 4.2-4**.

**TABLE 4.2.1-4**  
**NOISE FORECAST RESULTS FROM PROJECT CONSTRUCTION**  
**ACTIVITIES AT SENSITIVE RECEPTORS**

Sensitive receptors	Distance from construction <sup>1/</sup> (m)	Noise level from construction activities (dB(A))	Noise level from construction activities when deducted by transmission loss through the wall (dB(A))
1. House east of the Project (N1)	876	43.1	43.1
2. House west of the Project (N2)	721	44.8	44.8
3. Pig farm west of the Project	169	57.4	55.5 <sup>2/</sup>

**Remark:** 1/ Distance from construction area with land clearing for structure or building construction  
2/ Calculated from Equation (2) Noise level from activities deducted by transmission through the concrete wall of the pig farm (Noise absorbent made of concrete has TL= 34 dB(A)) with open channel is 0.65 (A0), with the calculated value of 1.9 dB(A)  
- Noise from construction activities : 57.4 - 1.9 = 55.5 dB(A)

The pig farm is a long concrete building. The side is closed wall by 80% while the open section is covered with sunscreen net. The front and the back is closed wall by 50% while the open section is covered with sunscreen net. The transmission loss (TL) of noise when traveling through holes of the building walls is calculated based on the Technical Noise Supplement, California Department of Transportation, Division of Environmental Analysis, November 2009), as in **Equation (2)** below.

$$TL_0 = TL - 10\log_{10}(A_0 * 10^{TL/10} + A_c) \quad (2)$$

When $TL_0 =$	Transmission Loss of sound absorbent with opening
$TL =$	Transmission Loss of sound absorbent with no opening (concrete sound absorbent has $TL = 34 \text{ dB(A)}$ )
$A_0 =$	Ratio of opening to the entire area of sound absorbent (0.65)
$A_c =$	Ratio of closed surface to the entire area of sound absorbent $= 1 - A_0$ ( $1 - 0.65 = 0.35$ )

$$TL_0 = 10\log_{10}(0.65 * 10^{34/10} + 0.35) = 1.9 \text{ dB(A)}$$

Therefore, the characteristic of the pig farm building will cause a transmission loss of 1.9 dB(A), reducing the noise exposure from the activities at the pig farm to 55.5 dB(A) ( $57.4 - 1.9 = 55.5 \text{ dB(A)}$ ). More details are shown in **Table 4.2-4**.

#### Leq 24 hr

Since the noise levels from construction activities are 1-hr average and 8-hr average, we need to convert noise levels into 24-hr average noise to compare against the ambient noise standard level of not more than 70 dB(A) using **Equation (3)**.

$$LeqT = Lp + 10 \log \quad (3)$$

When  $LeqT =$  Noise level occurring at a time (T), dB(A)

$Lp =$  Noise level from the source, dB(A)

$t =$  Duration of noise from noise source, hr.

$T =$  Duration of noise needed to be known, hr.

Therefore, the forecast result of Leq 24 hr from construction activities deducted with the transmission loss to the three sensitive receptors ranges from 38.3-52.6 dB(A). Note that Leq 24 hr at the pig farm, when traveling through the wall, will be deducted by 1.9 dB(A), reducing the noise level to 50.7 dB(A) ( $52.6 - 1.9 = 50.7 \text{ dB(A)}$ ). More details are shown in **Table 4.2.1-5**.

#### Total noise level

Total noise levels at a receptor are calculated from the noise levels from construction activities deducted with transmission loss to the receptor combined with the current maximum noise from monitoring. It is calculated with the sound energy equation as in **Equation (4)** below.

$$L_{p_{total}} = 10 \log \left( \sum_{i=1}^N 10^{L_{p_i}/10} \right) \quad (4)$$

When  $L_{p_{total}}$  = total noise level, dB(A)  
 $L_{p_i}$  = noise level from each source, dB(A)  
 $N$  = the number of noise sources

The forecasted 24-hr average noise level combined with the maximum 24-hr average noise level from monitoring using the sound energy equation as in Equation (4) will result in the total noise of all areas not exceeding the standard of ambient noise which is determined at not more than 70 dB(A), as shown in **Table 4.2.1-5**. It can be summarized below.

- House east of the Project (N1) has a total noise of 49.7 dB(A)
- House west of the Project (N2) has a total noise of 60.0 dB(A)
- Pig farm west of the Project has a total noise of 60.5 dB(A)
- **Comparison of Noise Level Results and International Standard**

The assessment of the noise level from the project construction was done only daytime (08.00-17.00 excepted lunch time, 12.00-13.00). Total noise level at receptors, house east of the Project, house west of the Project and pig farm west of the Project will increase in background level over 3 dB(A). Therefore, incremental noise from construction activities at those receptors exceeded IFC noise level guidelines as shown in **Table 4.2.1-5**.

Therefore, preventive measures are needed to minimize the impact from noise on house east of the project near the construction area.

#### (1.4) Noise impact mitigation measures in the construction phase

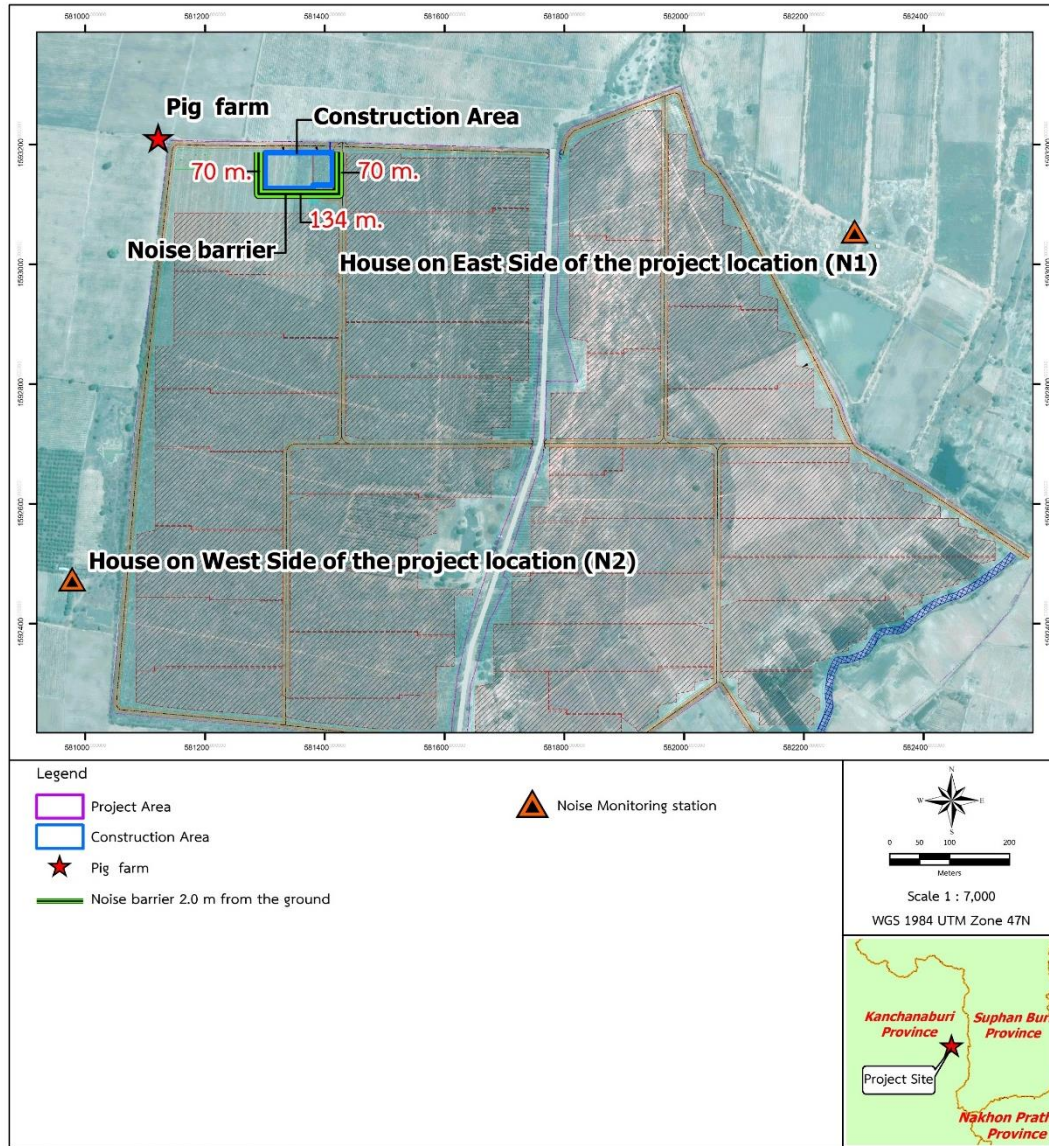
All forecast results of noise disturbance in the three receptors exceed the standard. To minimize noise impact from construction activities on the surrounding communities, the Project has prepared noise impact mitigation measures in the construction phase by installing a U-shaped noise barrier at the construction area with land clearing activities for structure and building construction, as shown in **Figure 4.2.1-2**. Initially, the noise barrier will be 2.0 meters tall from the ground, 274 meters long, made of steel with a minimum thickness of 0.64 mm or other material with a minimum noise absorbability of 18 dB(A). More details are presented in **Table 4.2.1-6**.

**TABLE 4.2.1-5  
THE FORECAST RESULTS OF NOISE LEVEL IN THE CONSTRUCTION PHASE**

Sensitive receptors	Distance from construction area <sup>1/</sup> (m)	Leq 24 hr (dB(A))			Leq 1 hr (Daytime)			
		Noise level from the construction activities	Highest noise level from monitoring <sup>2/</sup>	Total noise level <sup>3/</sup>	Noise level from the construction activities	Noise level from monitoring <sup>2/</sup>	Total noise level <sup>3/</sup>	Differential noise level <sup>6/</sup>
		(1)	(2)	(1)+(2)	(3)	(4)	(3)+(4)	(3)+(4)-(4)
1. House east of the Project (N1)	876	38.3	49.4	49.7	43.1	40.7-50.7	45.1-51.4	0.7-4.4
2. House west of the Project (N2)	721	40.0	60.0	60.0	44.8	40.1-54.4	46.1-54.9	0.5-6.0
3. Pig farm west of the Project	169	50.7 <sup>5/</sup>	60.0 <sup>4/</sup>	60.5	55.5 <sup>5/</sup>	40.1-54.4	55.6-58.0	3.6-15.5
<b>National Standard value<sup>7/</sup></b>		<b>≤70</b>			-	-	-	-
<b>WHO /IFC Guideline</b>	<b>Residential; institutional; education</b>	<b>≤70<sup>8/</sup></b>			<b>≤55<sup>8/9/</sup></b>			
	<b>Industrial; commercial</b>	<b>≤70<sup>8/</sup></b>			<b>≤70<sup>8/9/</sup></b>			

- Remark:**
- 1/ Distance from construction area with land clearing for structure and building construction
  - 2/ Noise monitoring between 2-7 November 2023
  - 3/ Calculated from combining the energy level in Equation (4)
  - 4/ 24-hr average noise of the pig farm west of the Project uses the monitoring value at the house west of the Project (N2) because it has the max 24-hr average noise or the worst-case scenario.
  - 5/ Calculated from Equation (2), noise from activities deducted with transmission through concrete wall of the pig farm (concrete sound absorbent has TL= 34 dB(A)) with opening at the rate of 0.65 (A0), which the calculated value = 1.9 dB(A).  
- Leq 24 hr : 52.6-1.9 = 50.7 dB(A), Leq 1 hr : 57.4-1.9 = 55.5
  - 6/ Difference of noise levels, or the noise level from the project that is increased from the present noise level = total noise level (noise from the sources at receptors plus the monitored noise) minus the monitored noise level
  - 7/ Refer to the ambient noise standard per the Notification of the National Environmental Board No. 15, B.E. 2540
  - 8/ Guidelines for Community Noise, World Health Organization (WHO), 1999.
  - 9/ Environmental, Health and Safety (EHS) Guidelines, General EHS Guidelines : Environmental Noise Management, IFC (2007)





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**FIGURE 4.2.1-2: THE NOISE BARRIER AT THE CONSTRUCTION SITE OF THE PROJECT**

**TABLE 4.2.1-6**  
**TRANSMISSION LOSS FROM USING DIFFERENT NOISE ABSORBENTS**

Material	Thickness (mm)	Surface Density (kg/m <sup>2</sup> )	Transmission Loss* (dB)
Polycarbonate	8-12	10-14	30-33
Acrylic (Poly-Methyl-Meta-Acrylate (PPMA))	15	18	32
Concrete block (200x200x400 light weight)	200	151	34
Dense concrete	100	244	40
Light concrete	150	244	39
Light concrete	100	161	36
Brick	150	288	40
Steel, 18 ga	1.27	9.8	25
Steel, 20 ga	0.95	7.3	22
Steel, 22 ga	0.79	6.1	20
<b>Steel, 24 ga</b>	<b>0.64</b>	<b>4.9</b>	<b>18</b>
Aluminum sheet	1.59	4.4	23
Aluminum sheet	3.18	8.8	25
Aluminum sheet	6.35	17.1	27
Wood	25	18	21
Plywood	13	8.3	20
Plywood	25	16.1	23
Absorptive panels with Polyester film backed by sheet	50-125	20-30	30-47

**Remark:** \*Values assuming no openings or gaps in the barriers

**Source:** Environmental Protection Department and Highways Department, Government of the Hong Kong SAR., 2003

The calculation of noise level with insertion loss to a receptor is based on the equation of the relationship between the Fresnel number (N) and the insertion loss formula by Ma ekawa as in **Equation (5)**. The Fresnel number (N) can be calculated in **Equation (6)**, with the following variables.

$$\Delta L = 10 \log (3+20N) \dots\dots\dots (5)$$

When  $\Delta L =$  Insertion Loss (dB(A))  
 $N =$  Fresnel Number

$$\text{When } N = \frac{2(a+b-c)}{\lambda} \dots\dots\dots(6)$$



- a = Displacement distance from the noise source to the top edge of the wall
- b = Displacement distance from the top edge of the wall to the receptor
- c = Displacement distance from the noise source to the receptor
- $\lambda$  = Sound wave length =  $V/F$
- V = Sound wave velocity at a temperature ( $V_0 [1 + (t^\circ\text{C}/273.2)]^{1/2}$ )
- $V_0$  = Sound wave velocity at  $0^\circ\text{C} = 331.4$  m/sec
- $t^\circ\text{C}$  = Atmospheric temperature ( $^\circ\text{C}$ ) (Climate statistics for the 17-year period, U-Thong Meteorological Station of the Meteorological Department =  $28.1^\circ\text{C}$ )
- F = Sound wave frequency = 550 Hz

Calculation details of noise level reduced by insertion loss to receptors are presented in **Table 4.2.1-7**. Calculation variables are shown in **Figure 4.2.1-3**. It was found that the noise levels from construction activities would be reduced by 17.6 dB(A).

**(1.5) Noise impact assessment results after determining mitigation measures in the construction period**

The noise impact assessment results at the 3 receptors after installing the noise barrier at the construction site with land clearing for building and structure construction are explained below.

- **Leq 24 hr**

The forecast results of Leq 24 hr at the 3 receptors after installing the noise barrier range from 20.7-33.1 dB(A). Details are shown in **Table 4.2.1-8**. Combined with the maximum value of Leq 24 hr from monitoring, the total noise level will be in the range of 49.4-60.0 dB(A), which is within the standard of ambient sound per the Notification of National Environment Board No. 15 B.E. 2540 (1997), specifying that Leq 24 hr shall not exceed 70 dB(A).

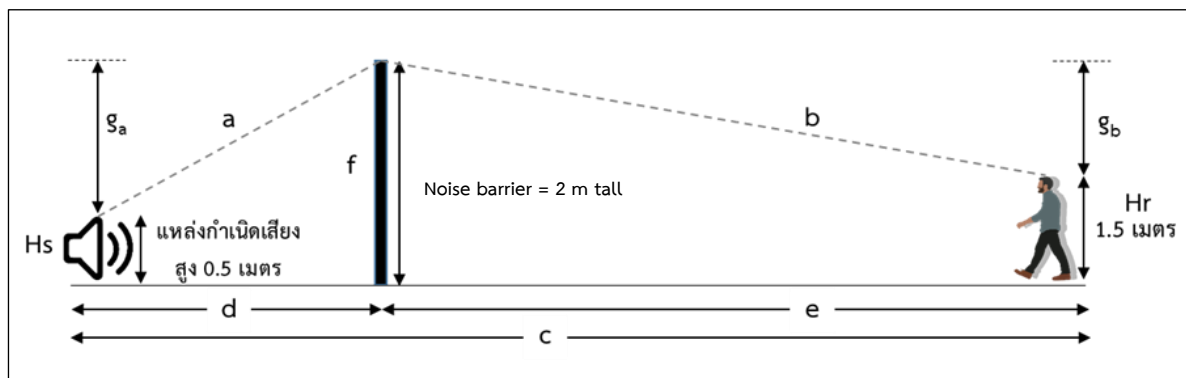
- **Comparison of Noise Level Results and International Standard**

An installation of a noise barrier at the construction sites near receptors, house east of the Project, house west of the Project and pig farm west of the Project will help reduce the noise level from construction activities. The total noise level at those receptors will increase in background level less than 3 dB(A) in accordance with IFC noise level guidelines (**Table 4.2.1-8**).

Apart from installing the noise barrier at the construction site with land clearing for structure and building construction, the Project also determines other mitigation measures. For example, construction activities with noise impact on surrounding communities and lives shall be performed during the day. However, if the activities must be completed, local community leaders must be informed at least 7 days in advance, and low-noise equipment and tools shall be used. In addition, machines and equipment shall receive regular maintenance to ensure good condition. Still, the impact in this category only occurs for a short time. Therefore, the impact in the construction phase is medium.

**TABLE 4.2.1-7**  
**CALCULATION DETAILS OF NOISE LEVEL REDUCED BY INSERTION**  
**LOSS TO RECEPTORS**

Details		House east of the Project (N1)	House west of the Project (N2)	Pig farm west of the Project
Displacement distance from source to top edge of the wall (m)	a	1.8	1.8	1.8
Displacement distance from top edge of the wall to receptors (m)	b	234.0	720.0	168.0
Displacement distance from source to receptors (m)	c	235.0	721.0	169.0
Displacement distance from source to wall (m)	d	1.0	1.0	1.0
Distance from wall to receptors (m)	e	234.0	720.0	168.0
Height of wall (m)	f	2.0	2.0	2.0
Height of noise source (m)	Hs	0.5	0.5	0.5
Height of receptors (m)	Hr	1.5	1.5	1.5
Height from source to top edge of the wall (m)	ga = (f-Hs)	1.5	1.5	1.5
Height from receptor to top edge of the wall (m)	gb = (f- Hr)	0.5	0.5	0.5
Average atmospheric temperature	t°C	28.1	28.1	28.1
Sound wave velocity (m/sect)	$V = (331.4 [1 + (t^{\circ}C/273.2)]^{1/2})$	348.0	348.0	348.0
Sound wave frequency (Hz)	F	550.0	550.0	550.0
Sound wave length (m)	$\lambda = (V/F)$	0.6	0.6	0.6
Fresnel number	$N = 2(a+b-c)/\lambda$	2.7	2.7	2.7
<b>Insertion Loss</b>	<b>10log (3+20N)</b>	<b>17.6</b>	<b>17.6</b>	<b>17.6</b>



**FIGURE 4.2.1-3: REFERENCE DISTANCE USED FOR CALCULATING THE FRESNEL NUMBER**

### **(1.6) Impact on construction workers and employees operating in the construction site**

The calculation of noise impact on people working in the construction is based on the reference noise from the equipment that generates the highest noise: the grader, with the maximum noise at 10 m from source = 82.0 dB(A). It is the loudest activity (**Table 4.2.1-3**), so it will be used to represent noise from construction of the Project throughout the 8 working hours as the worst-case scenario. The 8-hr average noise level can be calculated using Equation (3) as follows:

$$\begin{aligned} \text{Leq } 8 \text{ hr} &= 82.0 + 10 \log (8/8) \\ &= 82.0 \text{ dB(A)} \end{aligned}$$

Considering the impact on construction workers and employees working in the construction site, it was found that the noise that the noise exposure from the construction activities would be 82.0 dB(A), which passes the standard per the Notification of the Ministry of Industry on the Notification of Ministry of Industry on Safety Protection in Industrial Factories Related to the Working Environment, B.E. 2546 (2003), specifying that the average noise throughout the 8 working hours shall not exceed 90 dB(A). Therefore, the noise impact on operators in the construction site is medium.

#### **(2) Operation Phase**

The power generating process of the Project generates power from solar energy using photovoltaic technology or solar cells. There is no source of noise that affects the community and sensitive receptors. Therefore, there is no impact on the surrounding communities in anyway.

### **4.2.1.3 Reflection and Heat**

#### **(1) Construction Phase**

The impact of light reflection and heat during the construction phase of the Project may occur after solar panels are installed on the supporting structures. However, the solar panels used in the Project have an Anti-Reflection coating with the lowest light reflection coefficient. Additionally, the project specifies that the solar panels will be installed at an angle of approximately 10 degrees to the ground, which prevents light reflection towards the surrounding area. Therefore, it is anticipated that there will be no significant impact from light reflection and heat generated by the solar panels.

#### **(2) Operation Phase**

Regarding the impact of light reflection during the operation phase, factors that contribute to this impact include the direction of light impact angles and the type of solar panels used. Current solar panel manufacturing technologies have improved significantly, with external coatings that reduce light reflection. According to the report "PV Systems: Low Levels of Glare and Reflectance vs. Surrounding Environment" by Mark Shields in 2010, which studied light reflection when impacting various materials (details in **Table 4.2.1-9**), it was found that the light reflection coefficient of solar glass is lower than that of other materials.

**TABLE 4.2.1-8**  
**THE FORECAST RESULTS OF NOISE LEVEL IN THE CONSTRUCTION PHASE OF THE PROJECT AFTER**  
**DETERMINING NOISE IMPACT MITIGATION MEASURES IN THE CONSTRUCTION PHASE**

Receptors	Distance from construction site (m)	Noise level reduced from measures	Noise level from activities at receptors (dB(A))	Leq 24 hr (dB(A))			Leq 1 hr (Daytime)			
				Noise level from the construction activities	Highest noise level from monitoring <sup>1/</sup>	Total noise level <sup>2/</sup>	Noise level from the construction activities	Noise level from monitoring <sup>1/</sup>	Total noise level <sup>2/</sup>	Differential noise level <sup>3/</sup>
				(1)	(2)	(1)+(2)	(3)	(4)	(3)+(4)	(3)+(4)-(4)
1. House east of the Project (N1)	876	17.6	25.5 (43.1-17.6=25.5)	20.7 (38.3-17.6=20.7)	49.4	49.4	25.5	40.7-50.7	40.8-50.7	0.0-0.1
2. House west of the Project (N2)	721	17.6	27.2 (44.8-17.6=27.2)	22.4 (40.0-17.6=22.4)	60.0	60.0	27.2	40.1-54.4	40.3-54.4	0.0-0.2
3. Pig farm west of the Project	169	17.6	37.9 (55.5-17.6=37.9)	33.1 (50.7-17.6=33.1)	60.0 <sup>4/</sup>	60.0	37.9	40.1-54.4 <sup>4/</sup>	42.1-54.5	0.1-2.0
<b>National Standard value <sup>5/</sup></b>				<b>≤70</b>			-	-	-	-
<b>WHO/IFC Guideline</b>		<b>Residential; institutional; education</b>		<b>≤70<sup>6/</sup></b>			<b>≤55<sup>6/,7/</sup></b>			<b>≤3<sup>7/</sup></b>
		<b>Industrial; commercial</b>		<b>≤70<sup>6/</sup></b>			<b>≤70<sup>6/,7/</sup></b>			

- Remark:**
- 1/ Noise monitoring between 2-7 November 2023
  - 2/ Calculated from the sound energy summation as in Equation (4)
  - 3/ Difference of noise levels, or the noise level from the project that is increased from the present noise level = total noise level (noise from the sources at receptors plus the monitored noise) minus the monitored noise level
  - 4/ 24-hr average noise of the pig farm west of the Project uses the monitoring value at the house west of the Project (N2) because it has the max 24-hr average noise or the worst-case scenario.
  - 5/ Refer to the ambient noise standard per the Notification of the National Environmental Board No. 15, B.E. 2540
  - 6/ Guidelines for Community Noise, World Health Organization (WHO), 1999.
  - 7/ Environmental, Health and Safety (EHS) Guidelines, General EHS Guidelines : Environmental Noise Management, IFC (2007)

**TABLE 4.2.1-9  
REFLECTION PERCENTAGE OF LIGHT AT DIFFERENT INTERMEDIARY  
MATERIAL**

Intermediary Material	Reflection percentage of light *
Anti Reflection (w/AR coating)	3
Solar glass	4
Smooth water	4
Plastic	7
Plexiglass	4
Standard glass	9
Snow	23
Steel	39

**Remark:** \* Reflection percentage at an angle of 15 degrees.

**Source:** PV Systems: Low Levels of Glare and Reflectance vs. Surrounding Environment; Mark Shields, 2010

However, when an Anti-Reflection coating is applied, the light reflection coefficient is further reduced. Therefore, there will be no impact on the community. Furthermore, the project specifies that solar panels be installed at an angle of approximately 10 degrees to the ground, preventing light reflection towards the surrounding area. Hence, it is expected that light reflection and heat from the solar panels will not have any significant impact.

## 4.2.2 Biological Conditions

### 4.2.2.1 Forest Resources

#### (1) Construction Phase

The study area of the Project is mostly characterized by farmlands (78.68% of the study area). Most of the surrounding areas of the Project are also farmlands. The forest area in the study area of the project is approximately 2,356 rai (8.56% of the study area) located in the northeast of the project area and the southeastern side of the project by about 1 kilometer. This forest area is a community forest area that is not registered as a forest resource conservation area by law. Therefore, the construction activities will be limited to the project area, so there will be no impact on forest resources.

#### (2) Operation Phase

In the Project operation phase, electricity power will be generated from solar panels within the Project premises. Therefore, it will not have any impact on forest resources.

### 4.2.2.2 Wildlife Resources

#### (1) Construction Phase

The study area of the Project is mostly characterized by farmlands (78.68% of the study area). Most of the surrounding areas of the Project are also farmlands. The forest area in the study area of the project is approximately 2,356 rai (8.56% of the study area) located in the northeast of the project area and the southeastern side of the project by about 1 kilometer. Most wild animals found in this area are birds and reptiles commonly living in farming areas. These animals can move quickly and adapt to the environment well.

Construction activities of this Project is limited within its premises. Therefore, the construction activities of this Project would not cause any impact on wildlife.

## (2) Operation Phase

The power generating process of the Project generates power from solar energy using photovoltaic technology or solar cells. Most of the surrounding areas are farmlands. Most wild animals are common birds and reptiles commonly living in farming areas. These animals can move quickly and adapt to the environment well. Therefore, the Project operations would not to cause any impact on wildlife.

### 4.2.2.3 Biodiversity

#### (1) Construction Phase

The primary activities that have an influence on flora and wildlife during the construction phase include site preparation and various construction operations inside the project area. These activities, which can have an effect on both flora and wildlife, include:

- Plants and wildlife habitats in the construction project area may be lost as a result of clearing the land. A land use survey revealed that the project area is agricultural land, totaling roughly 130.36 hectares. The construction of electrical transmission line poles will take place in the public road's right-of-way, with an agricultural area of roughly 0.53 hectares potentially affected. The conservation status according to IUCN (2022-2), which considers the global threat status (IUCN Red List of Threatened Species), One species identified as near-threatened (EN) is: Burma Padauk (*Pterocarpus macrocarpus*) However, the specie of plant still maintain natural populations at safe levels, exhibit high reproductive capabilities, and have a widespread distribution throughout the country. Therefore, forest resources have experienced negative impacts or disadvantages because both the structural and functional aspects of the environment have changed due to construction projects. These negative effects are minimal as there is a limited number of trees being cut down. Additionally, the remaining trees still maintain natural populations at safe levels, exhibit high reproductive capabilities, have a widespread distribution throughout the country, and are not region-specific species. Nevertheless, during the construction phase, clear and stringent measures must be in place to prevent unauthorized logging and ensure sustainable resource utilization. However, the impact of land preparation for construction will be low because it will only occur for a limited period of time inside the project area and the pole construction area.

- The project's construction will cause noise and vibration, which may disturb the wildlife. Since the project area is agricultural land, the wildlife that inhabits it has evolved to live in disturbed agricultural environments as a consequence of long-term human activity. As a result, the construction will mainly cause noise-sensitive species to relocate away from the source of the disturbance. Nonetheless, the disruption time will be short, so the impact will be low.

- In the study area of the project, animals with conservation statuses according to the Department of National Parks, Wildlife and Plant Conservation (2520) and IUCN (2022-2) have been identified. An endangered (EN) species of wildlife including, the Long-tailed Macaque (*Macaca fascicularis*), Steppe Eagle (*Aquila nipalensis*), Southeast Asian turtle (Thailand: *Cuora amboinensis kamaroma*) one species of wildlife is listed as vulnerable (VU), is an Asiatic Softshell Turtle (*Amyda cartilaginea*). Therefore, it is crucial to establish measures that prevent construction workers from harming the nests,

eggs, and larvae of the protected species under the Wildlife Preservation and Protection Act, B.E. 2562 (2019), which are species with a conservation status of Vulnerable (VU) and Near Threatened (NT) according to ONEP (2020) and IUCN (2022-2), in order to reduce the impact on these wildlife species.

## (2) Operation Phase

During the project's operation phase, the transmission line may have an impact on birds due to collisions during migration. The project's 115-kv transmission lines will be built on 22-meter-high concrete poles, similar to the electrical poles seen throughout Thailand, and will run alongside a public road right-of-way. The transmission lines are not located in areas that serve as food sources for birds, such as rivers, wetlands, forests, or large agriculture fields, like large transmission lines (500-kv). Also the right-of-way along public roads do not constitute the primary landing areas for birds. Additionally, the birds found in the project area are only seven migratory species classified as least concern (LC), which include Black drongo (*Dicrurus macrocercus*), Barn swallow (*Hirundo rustica*), Brown shrike (*Lanius cristatus*), Burmese shrike (*Lanius collurioides*), Oriental Pratincole (*Glareola maldivarum*), Grey heron (*Ardea cinerea*) and Pied harrier (*Circus melanoleucos*). These are little birds that can shift direction faster than larger birds and most of them migrate alone or in small groups. Based on this data, it is possible to conclude that the project's location, the size of the birds, and the size of their migratory groups, all of which are common causes of collisions with transmission lines, present a low risk of collisions. As a result, the potential impact of the TL on migrating birds is considered low.



#### 4.2.2.4 Aquatic Ecology

##### (1) Construction Phase

In the construction area and the surrounding areas, there is no source of surface water. The source of surface water closest to the construction area is Khlong Pla Soi, 1.4 km west of the Project area. Wastewater from construction activities (cleaning equipment and tools) and wastewater from consumption of workers amounts 72.63 m<sup>3</sup>/day. Wastewater from construction activities (cleaning equipment and tools) will be collected at a retention pond to separate oil from water before being collected and disposed of by an agency authorized by government agencies. Wastewater from consumption of workers will be treated with a septic tank prepared by the contractor. Treated wastewater and sewage will be collected and disposed of by a local agency according to the principles set forth in the Public Health Act B.E. 2535 (1992) and the Ministerial Regulations on Hygienic Sewage Management B.E. 2561 (2018). The wastewater will not be drained off outside the Project area. Therefore, the construction of the Project will not have any impact on aquatic ecology.

##### (2) Operation Phase

In the operation phase, wastewater will be generated from consumption as follows:

1. Wastewater from consumption (80% of consumption water (Thongchai Phansawat, 1987))

– Staff administering solar cell power generation of the Project and security guards of the Project (5 people) will generate wastewater 0.28 m<sup>3</sup>/day from consumption water 0.35 m<sup>3</sup>/day.

– Solar panel cleaners (20 people) will generate wastewater 1.12 m<sup>3</sup>/day from consumption water 1.40 m<sup>3</sup>/day.

Therefore, in the operation phase, there will be about 25 people working in the project, including staff and solar panel cleaners. They will generate about 1.40 m<sup>3</sup>/day of wastewater from consumption water of 1.75 m<sup>3</sup>/day. This portion of wastewater will be treated with a septic tank. Treated wastewater and sewage will be collected and disposed of by a local agency according to the principles set forth in the Public Health Act B.E. 2535 (1992) and the Ministerial Regulations on Hygienic Sewage Management B.E. 2561 (2018).

2. Wastewater from cleaning solar panels amounts about 6.70 m<sup>3</sup>/day (two times a year). This portion of wastewater is not contaminated with chemicals, but only dust particles. It will be left to evaporate and flow naturally without affecting the quality of surface water.

It should be noted that there is no source of surface water in the Project premises. Therefore, the Project operation activities does not affect aquatic ecosystem.

### 4.2.3 Socio-Economic Conditions

#### 4.2.3.1 Socio-Economics

##### (1) Construction Phase

###### (A) Potential Positive Impacts from the Project

- **Employment of Local People**

In the construction phase, the Project has a policy to hire non-skilled workers, such as gardeners, maids, and security guards. The Project requires the contractor to consider hiring locals first. Works that require special qualifications, knowledge, and skills for the Company's needs, such as installation and electrical systems, local people will be considered as a priority as well. However, employment of employees with special skills require training to ensure safety and efficiency of work and employees will be trained regularly according to the Project's policy. During the construction phase, there will be limited and temporary, positive impact in terms of development of local people and improvement of the quality of life for people in the community.

- **Local Economic Promotion**

The Project determines the construction and installation phase to last about 12 months and use a maximum of 1,297 workers a day. More people from this Project will increase the cash flow and improve the local economy. However, the economic promotion will last only for a short time. Therefore, the impact level is low.

###### (B) Potential Negative Impacts from the Project

- **Disturbance and annoyance to the community from construction activities**

In the construction phase, construction activities may generate noise disturbance. There will be transportation of construction materials, machinery, and workers, which may increase the traffic volume on National Highway No. 3443 and National Highway No. 3472 temporarily at certain times of each day. This may cause traffic problem, road damage, road obstruction, and accidents. This activity will disturb the serenity and safety of communities near the construction site. However, the Project has determined environmental impact mitigation measures for the construction phase. The impact will last for a short time. Therefore, the impact level is low.

##### (2) Operation Phase

###### (A) Potential Positive Impacts from the Project

- **Local Development and Improvement of the Quality of Life for Local People**

In the operation phase, local administrative organizations will collect taxes from the Project, such as local maintenance tax, building and land tax, and a share of value-added tax. This revenue can be used for local development and improving the quality of life for local people. In addition, the Project has several community relations campaigns to establish positive relationships and pay back to the community. The Project will also support local activities throughout the operation phase. Therefore, there will be overall positive impacts in terms of local development and improvement of the quality of life for local people. The positive impact level is moderate.

- **Employment of Local People**

In the operation phase, there will be staff administering the solar power generating system and security guards (5 people in total) and there are approximately 20 solar panel cleaning staff per time. Since the project cleans the panels twice a year, with a duration of about 60 days for washing each time, therefore, during the operation period, there will be some days where the maximum number of employees working in the project area is 25 people per day. The Project understands that local communities want their community members to work for the Project. To serve this need, the Project will consider hiring people in local communities whose qualifications fit the requirements of the Project first, especially during the two times of solar panel cleaning per year. Therefore, the overall impact of employment of local people is positive, and the impact level is moderate.

- **Activities Promoting Community Relations**

The Project has public relations campaigns about its operations regularly to establish an accurate understanding and minimize concerns among people living near the Project. The Project also supports various activities. The operation plans included (1) environmental conservation plans, such as the School in Power Plant Project, the Environmental Field Visit Project, or sponsoring environmental activities of the communities. The second type of operation plans are (2) social, children, and youth-related plans, such as sponsoring activities of local educational institutions and sports activities in local areas. The third type of operation plans are (3) health plans, such as public health volunteer capacity development project. The fourth type of operation plans includes (4) cultural plans, such as sponsoring Thot Kathin Charity and Songkran Festival. The purpose is to establish a good relationship between the Project and the community and for both parties to coexist sustainably. All these activities will be implemented throughout the operation phase. Therefore, activities promoting community relations are positive impacts, and their level is moderate.

**(B) Potential Negative Impacts from the Project**

- **Concerns over the Project Operation**

In the operation phase, the communities around the Project area may have concerns about the Project operations. However, the Project controls the concerns from the design and installation of machinery to be distant from the communities and sensitive receptors as much as possible to mitigate concerns of the communities near the Project. In addition, the Project has several plans to establish an accurate understanding. These plans will assure confidence in the Project development. There are channels to receive complaints and resolve the impacts from the Project development and hear suggestions from relevant parties. Therefore, the impact is low.

### 4.2.3.2 Gender Relate Impacts

Gender impacts refer to the diverse ways in which project initiatives can affect individuals, communities, and societies through the lens of gender identity and roles. Understanding these impacts is crucial not only for ensuring equitable development but also for fostering sustainable and inclusive practices at the project level, as well as at the corporate level and within the renewable energy / solar power sector.

Historically, projects and their impacts have been predominantly viewed from a gender-blind perspective, failing to acknowledge the nuanced ways in which the project activities and impacts intersect with gender dynamics. However, recent discourse and research have shed light on the ways projects have impacts and implications for different genders.

Gender impacts in the renewable energy sector encompass a wide array of considerations, ranging from workforce participation to access to energy resources and decision-making roles within the industry. Understanding these impacts is crucial for promoting gender equality and ensuring that the benefits of Gulf's renewable energy project are distributed equitably across genders. From employment opportunities and labor conditions to access to infrastructure and urban spaces, gender impacts permeate various facets of the projects, influencing societal outcomes at both micro and macro levels.

As part of this IEE, a gender assessment entailed review of national legislation and institutions, summarized with key findings below. Gender engagement in consultation is also summarized, followed by assessment of potential gender impacts associated with the Project. Project commitments to avoid and/or mitigate these impacts are included in **Chapter 5**. A review of gender equality at the national and local levels can provide the following information:

#### (1) Gender Equality at the National Level

On B.E. 2558 (2015), Thailand enacted the Gender Equality Act with the aim of protecting everyone, including males, females, and individuals who express themselves differently from their inborn gender, from gender-based discrimination. The Act mandates the establishment of two committees:

1) The Committee for the Promotion of Gender Equality (Committee for the PGE), which is empowered to formulate policies, mitigation measures, and action plans for promoting gender equality in all sectors. It also outlines guidelines for providing assistance, compensation, and remedies to individuals who have experienced unfair gender discrimination.

2) The Committee on the Determination of Unfair Gender Discrimination and the Department of Women's Affairs and Family Development (Committee on DUGD), which is tasked with considering issues submitted by petitions claiming unfair gender discrimination.

Based on the Gender Gap Index, Thailand scored 0.711 in B.E. 2566 (2023), increase from 0.706 in B.E. 2558 (2015), primarily due to improvements in education attainment and political empowerment dimensions.

## (2) Gender Equality at the Local Level

From the two public meetings held by TLT, there were 2 female participants and 9 male participants during the pre-engagement, and 177 female participants and 101 male participants during the public meeting. All are allowed to express their opinion as per their willingness. This indicates that gender discrimination is not an obvious problem among the locals. Additionally, during the public meeting of the project, a representative from the women's group in the area also participated, and no concerns were raised about project gender impacts.

Following are some key gender impacts in the renewable energy sector, considered and identified as potentially present for this project:

1. **Workforce Participation:** Women are underrepresented in the renewable energy workforce in Thailand, particularly in technical and leadership roles. Although Gulf's Sustainability Policy has a commitment to "Provide a safe and healthy work environment that promotes non-discrimination, gender equality, personal development and well-being", the Project does not have gender targets for its workforce participation levels. It can be predicted that there will be an underrepresentation of women in the Project workforce, which results from various factors, including lack of access to education and training opportunities, gender stereotypes, and biases in hiring and promotion practices.

2. **Income and Economic Empowerment:** By providing women with opportunities for employment and entrepreneurship in the project or to support the project (through supply chain opportunities), projects, it is possible that the Project could enhance their income-generating capabilities, increase women's empowerment and strengthen local economies.

3. **Community Engagement and Benefits Sharing:** Project approaches to community engagement and benefits sharing may disproportionately benefit men unless there is awareness, guidelines and targets for gender participation in community relations and community development activities. These are essential for maximizing the social and economic benefits of the project and ensuring that women are equally involved. Gender balanced targeting and participation by the project can conversely have a positive impact, providing example to other stakeholders locally. Targeting women's involvement in program decision-making processes, ensuring that their voices are heard, and that they have equitable access to project benefits can enhance the project sustainability and contribute to positive social outcomes.

4. **Gender-Based Violence and Safety:** Depending on contractor workforce accommodation plans, some women working in the project or in the nearby communities may face gender-based violence, harassment, and safety risks. This can be avoided by designing facilities, transport and HR mechanisms to prevent the potential impacts. Examples for prevention strategies include creating safe and supportive working environments, implementing gender-sensitive security measures, and providing training on gender equality and workplace conduct, to help address these challenges and ensuring the well-being of all workers.

Regarding the construction of the project, the first priority for labor will be given to local people for both skilled and non-skilled workers. However, a substantial number of workers will come from outside. As such, GBVH risks and issues may arise most specifically from labor influx, as set out below.

Risk Factor	Why this increase GBVH risk
<p><b>Workforce</b></p> <ul style="list-style-type: none"> <li>• Labor Influx</li> </ul> <hr/> <ul style="list-style-type: none"> <li>• Worker Accommodation</li> </ul>	<ul style="list-style-type: none"> <li>• The sudden increase in a temporary workforce can strain local resources and exacerbate tensions between local communities and workers, increasing the risk of GBVH both within the workplace and in the surrounding community.</li> <li>• Inadequately segregated and secured accommodations can increase the risk of GBVH. Poorly designed living spaces may lack privacy and safety measures, making some workers more vulnerable to abuse.</li> </ul>
<p><b>Discrimination</b></p> <ul style="list-style-type: none"> <li>• Labor and working conditions</li> </ul> <hr/> <ul style="list-style-type: none"> <li>• Local recruitment</li> </ul>	<ul style="list-style-type: none"> <li>• Unsafe or discriminatory working conditions can increase the vulnerability of workers to GBVH, particularly for women and marginalized genders. Power imbalances between supervisors and workers can lead to exploitation and harassment.</li> <li>• Discriminatory recruitment practices can exacerbate gender inequalities and create environments conducive to GBVH. Lack of equal opportunity for local women and marginalized groups in employment can lead to economic disparities and increased vulnerability.</li> </ul>
<p><b>Service Provision</b></p> <ul style="list-style-type: none"> <li>• Community Health and Safety</li> </ul>	<ul style="list-style-type: none"> <li>• Projects can negatively impact community health and safety, increasing GBVH risks. For example, disruption of social structures and increased stress on community resources can lead to heightened domestic violence and community conflict.</li> </ul>
<p><b>Security Personnel</b></p> <ul style="list-style-type: none"> <li>• Security Arrangement</li> </ul>	<ul style="list-style-type: none"> <li>• Overly militarized or untrained security forces may themselves become perpetrators of GBVH, especially if they lack awareness and training on gender sensitivity and human rights.</li> </ul>

**Source:** Addressing Gender-Based Violence and Harassment by IFC, 2020.

Overall, addressing potential Project gender impacts requires a holistic approach that considers the intersecting factors of gender, social norms, economic structures, and institutional arrangements. By mainstreaming gender equality principles across all aspects of the Project development and implementation, it is possible to avoid and effectively mitigate potential negative impacts. Furthermore, it is possible for Gulf solar projects gender strategies to help lead the way and harness the sector's potential to advance gender equality, social inclusion, and sustainable development.

To prevent and mitigate GBVH risk, the Project mandates the following measures;

- 1) Establish policies on GBVH to safeguard workers and nearby community of the Project.
- 2) Ensure gender-sensitive policies are in place, promoting equal opportunities for employment, training, and advancement.
- 3) Make a project-specific commitment to provide employment and supply chain opportunities for local women. For example, in service cleaning contracts, no gender specific within local content requirements to ensure the inclusion and participation of women in these opportunities.
- 4) Establish Corporate Social Responsibility (CSR) activities to ensure that all gender can be involved.
- 5) Ensure that all facilities (restrooms, changing rooms) are safe, accessible, and respectful of privacy for all genders.
- 6) Conduct gender sensitivity training for all project work teams, managers, and contractors. This training aims to increase awareness of gender issues, promote inclusivity, and enhance understanding of the importance of gender equality in project implementation.

#### **4.2.3.3 Influx Management**

##### **(1) Construction Phase**

The influx of construction workers during this phase could be caused adverse health impacts on the construction workers and potential environmental impact to surrounding communities. The impact assessment related to influx of construction workers on issues mentioned as follows:

##### **1.1) Impacts within the Construction Workers' Camp**

###### **(a) Sanitation within the Construction Worker's Camp**

There are 1,297 construction workers (Maximum) during construction phase. The potential workers' camp location has not yet been finalized at this stage however, it is expected to be located near the construction area. The contractor will provides the workers' camp with proper welfare and utilities comply with the Notification of the Labor Welfare Committee on Standards of Residence as Labor Welfare for Employees in the Type of Construction Business B.E. 2559 (2016) and relevant laws or international standards, including recommendations and suggestions from ADB, as well as the Project developer's own experiences . include; the surrounding environment, accommodation, bathrooms and toilets, electricity system and equipment, drinking water, wastewater management, solid waste management, rainwater drainage, health management, and fire prevention. Details are shown in **Section 2.4.1**. Based on the welfare and utilities mentioned



above, the Project provides the properly and sanitary accommodation and utilities. Therefore, the health impacts on the construction

### **(b) Medical Welfare Provision**

The construction workers may be at risk from contagious diseases or epidemics among construction workers due to the high density of living in workers' camps, and also be facing personal hygiene problems. For example, sexually transmitted diseases, diarrhea, respiratory diseases, and diseases that are carried by insects, such as dengue fever.

However, the provision of proper utilities as mentioned in *Section 2.4-1* including accommodation, bathrooms and toilets, electricity system and equipment, drinking water, wastewater management, solid waste management, rainwater drainage, health management, and fire prevention; and the provision of proper medical welfare, e.g., first aid equipment and medical supplies, according to the Ministry of Labor Regulations on the provision of welfare in business establishments B.E. 2548 (2005), the Project and the contractors can avoid burdening the health care services.

## **1.2) Impact to the Surrounding Communities**

### **(a) Pollution and environmental impacts**

#### **1. Wastewater Management**

At the workers' camp, the contractor shall provide a septic tank or a prefabricated wastewater treatment systems at suitable size with the number of workers to treat wastewater from worker consumption include toilets and bathrooms.

Waste or sewage that is generated from the prefabricated wastewater treatment systems will be disposed of according to sanitary principles by a local authority. The septic tanks/treatment systems must be located at least 30 meters away from rivers or public water sources. If the contractor discharges treated waste or sewage outside into natural water sources or private areas, the contractor must obtain permission from relevant government agencies or landowner to ensuring that the discharged sewage will not have adverse environmental impacts in the future. In addition, the contractor shall provide a retention pond at workers' camp and conduct water quality monitoring once a month to ascertain the water quality before discharging.

#### **2. Noise level**

Noise impact from workers' camp may disturb the communities at nighttime because of high number of workers. This could cause conflict with local people. The Project and the contractors shall strictly implement preventive and mitigative measures to control and monitor the workers so that they do not create problems to surrounding communities at nighttime.

#### **3. Transportation**

Another majority of impacts may arise from accidents during the logistics of construction equipment. This is one of the concerns expressed by the community at the hearing meeting. Construction equipment will be transported from Laem Chabang Port to the Project area. The main highway for transportation nearest to the Project site is Highway No. 3472. Transportation activity may cause traffic problem, road damage, road obstruction, and accidents. This activity will disturb the serenity and safety of communities near the construction site.

There will be 18 medium trucks and 18 light trucks provided for transportation during the construction phase. According to the assessment in *Section 4.2.4.2*, the results showed that the project's transportation activities during the construction phase do not significantly impact the service level of Highway no. 3472. The road's level of service remains the same (Level A), allowing vehicles to move freely at free-flow speed.

However, the Project has determined environmental and social impact mitigation measures for the construction phase. The impact will last for a short time. Therefore, the impact on the surrounding communities related to the pollution and environmental impacts from the construction activities will be low.

**(b) Impact on public health services and public infrastructure**

With a large number of construction workers, if there is a contagious disease or epidemic occurs in the workers' camp, there is a chance that the disease may spread to the surrounding communities. Communicable diseases such as sexually transmitted diseases, hepatitis, pneumonia, diarrhea, and diseases that are carried by insects, such as dengue fever could be areas of concern. Common cold and flu caused by probably new strains are very well possible, as well as respiratory tract diseases.

Even though the agricultural area is the majority in the area with a radius of 3 kilometers surrounding the project, there are places where the people gather for community activities (temples and schools). There are vulnerable groups that need to be given importance in monitoring the impacts of communicable disease outbreaks. In addition, there are also other communities surrounding the project area. If illness occurs, it will increase the service burden on the local primary health care unit, namely Talung Nuea Sub-district Health Promoting Hospital. It is necessary that the Project and the contractors strictly comply with the relevant laws and regulations.

The nearest medical health service to the construction area is Talung Nuea Subdistrict Health Promoting Hospital (SHPH), located 3.6 kilometers away from the Project site. It is a primary-level healthcare facility with a mission to promote health, restore health, prevent disease, and provide medical treatment services for outpatients (OPD). The Talung Nuea SHPH serves for 3,019 population in Nong Pradu Subdistrict with limited number of healthcare personnel. In the event of illness or injury that exceeds the capability of the local facility, the patient can be transferred to another public facility or private hospital for further treatment. The Project and the contractors can avoid burdening the health service by strictly comply with the Notification of the Labor Welfare Committee regarding standards for residential welfare for construction labor, B.E. 2559 (2016), and provide first aid equipment and medical supplies within the construction area, including a medical shuttle, according to the Ministry of Labor Regulations on the provision of welfare in business establishments B.E. 2548 (2005).

**(c) Conflict with the local people**

Construction workers from other areas, including foreign workers, could have conflicts with local people within the surrounding communities due to differences in culture, value and ways of life. The influx of workers may result in social problems such as crime, gambling, theft, drugs, etc. This is in line with the comments from the hearing meeting where the participants gave their opinion on the social impact that there are concerns about employment. However, the project has given priority to hiring local workers.

However, the project has given priority to hiring local workers. If the local workers do not have the qualifications specified by the project, it is necessary to hire foreign

workers. The project has established preventive and mitigative measures to control and monitor these workers so that they do not create problems for surrounding communities. In order to ensure the efficient operation of the project without causing social and environmental impacts or annoyance and conflict problems between the project and surrounding communities, the project has established procedures for handling complaints. When the complaint is resolved, the project will urgently notify the complainant of the results and actions of the project.

**(d) Economic impact from influx of workers**

The potential influx of people to the project area may create economic opportunity but may also cause negative social impacts such as increased competition for resources and social services, distortion in property values and changes in social dynamics. These potential impacts are elaborated below.

Population influx as well as the presence of sizeable outsider workforce can disturb social dynamics, for example with the increased demand or pressure on services and resources such as housing, education, health services. Differences in social norms as well as income levels can create social jealousy. Artificial inflation of prices locally can also create potential tension.

Population influx and general interest in the development of the Project can give rise to speculative investment in the area, especially at construction stage, with possible positive or negative outcomes. Given the relatively low number of operations employment opportunities and few, long-term spin off economic effects, any over-investment by the community or outsiders at the early stage may result in heavy economic losses.

Changes in land use will affect the previous land owners as well as the users such as farmers and related off-taking entrepreneurs, possibly reducing individuals' incomes or agricultural employment opportunities. However, with the availability of other arable land in the wider area at this time, the immediate impacts on land owners and land users seems negligible, in the longer term, land acquisition contributes to land conversion patterns, with increased pressure for resources and conflicts over competing land use.

**(2) Operation Phase**

There are only 5 permanent employees at the normal operation work in the Project area during this phase, 2 persons as an inspector and a maintenance staff, and additionally, approximately 20 individuals, who are expected to be local residents, will be hired occasionally for cleaning solar panels. Therefore, this will not significantly increase to the demand for medical personnel to serve the population.

**4.2.3.4 Occupational Health Impact Assessment**

**(1) Construction Phase**

The construction activities may cause occupational diseases. For instance, working in open areas and/or in conditions with sweltering heat, the body will try to adjust its temperature to a normal level all the time by eliminating heat from the body. In case that the heat elimination in a timely manner is unable, it will affected the body such as rashes on the skin, itching, sweat ducts blocked, muscle cramps, headaches, dizziness, muscle spasms, fatigue, and possibly loss of consciousness.

The occupational health risk such as fall of objects, hit on head, electric shock, traffic accident, etc. may be occurred by various causes such as the carelessness on the part of workers, improper planning and wrong sequence of operations, inadequate training with respect to handling of the machinery and equipment, and etc. could be effect to the personal health of construction worker and damage to the project properties. Therefore, the project determined the mitigation and prevention measures and adequate training program in occupational health and safety to minimize the occupational health impact.

Moreover, the contractor provide first aid equipment and medical supplies within the construction area, including a medical shuttle, according to the Ministry of Labor Regulations on the provision of welfare in business establishments B.E. 2548 (2005). Therefore, the occupational health impacts on the construction workers will be low.

Dust (Particulate Matter) and noise from the construction activities include land clearance for the construction of the power generation control building, the storage areas of spare parts, equipment and materials, solid waste, and maintenance area, the switchyard or substation area, and the supporting areas related to power generation and could be caused adverse health impact to the construction workers. Besides, the high noise level may interfere with communication and conversation, impact on workers' hearing ability and further causing errors while working.

However, the project spraying water at the area with topsoil stripping, material stacking, and entrance of the construction site, and keeping construction materials tidily to minimizes the dust dispersion and provide personal protective equipment (PPE), consisting of safety helmets, safety shoes, goggles, and task-specific personal safety equipment appropriate to working conditions and risks that may arise from work. Therefore, the occupational health impacts on the construction workers will be low.

## **(2) Operation Phase**

The Project's activities involve generating electricity from solar panels, with approximately 5 employees responsible for monitoring and controlling the electrical systems. Risks associated with the Project's operations include field inspections, safety maintenance, and cleaning of the solar panels. If employees perform maintenance work without proper caution in tool usage, it may pose potential dangers. The project determined the mitigation and prevention measures and adequate training program in occupational health and safety associated with the Project's operations include field inspections, safety maintenance, and cleaning of the solar panels. Regularly inspection and safety shall be carried out in accordance with the criteria prescribed by relevant law and guideline to minimize the occupational health impact. Therefore, the occupational health impacts on the project staff will be low. As a result, the impact on occupational health and safety for employees is considered low.

### 4.2.3.5 Health Impact Assessment

#### (1) Construction phase

Considering the Project Descriptions in Chapter 2, existing environmental conditions in Chapter 3, and environmental impact assessment in Chapter 4, result in the identification of activities that may cause health impacts, health hazards, vulnerable groups that are expected to be affected In the construction phase including construction workers and the public as presented in **Table 4.2.3-1**, where the consultant used the Qualitative Risk Assessment approach to evaluate the health impact assessment with a Health Risk Matrix as presented in **Table 4.2.3-2**, It has a score depending on the likelihood of health impact in **Table 4.2.3-3**, and a score depending on severity of consequences in **Table 4.2.3-4**. The definition of overall impact level between the likelihood and severity of consequences using the risk matrix is presented in **Table 4.2.3-5**. In the construction phase, the health assessment can be summarized by using the health risk matrix assessment are presented in **Table 4.2.3-6**.

**TABLE 4.2.3-1**  
**HEALTH IMPACT, HEALTH HAZARDS, AND VULNERABLE GROUPS**

Health impact	Phase		Health hazards	Vulnerable Groups
	Construction	Operation		
Air quality	✓		<ul style="list-style-type: none"> <li>- Dust from land clearing</li> <li>- Operations of machinery</li> <li>- Pollutants from transportation</li> </ul>	<ul style="list-style-type: none"> <li>- Construction workers</li> <li>- The public</li> </ul>
Noise	✓		<ul style="list-style-type: none"> <li>- Loud noise, disturbance noise, and vibration from construction activities</li> <li>- Stress and panic about noise and vibration</li> </ul>	<ul style="list-style-type: none"> <li>- Construction workers</li> <li>- The public</li> </ul>
Solid Waste	✓		<ul style="list-style-type: none"> <li>- Waste accumulation may attract disease carriers.</li> </ul>	<ul style="list-style-type: none"> <li>- Construction workers</li> <li>- The public</li> </ul>
		✓		<ul style="list-style-type: none"> <li>- The Project staff</li> <li>- The public</li> </ul>
	✓		<ul style="list-style-type: none"> <li>- Environmental contamination</li> </ul>	<ul style="list-style-type: none"> <li>- The public</li> </ul>
Transportation	✓		<ul style="list-style-type: none"> <li>- Accidents from transporting construction workers, and machines</li> <li>- Obstruction to traffic</li> </ul>	<ul style="list-style-type: none"> <li>- The public</li> </ul>
		✓		
Occupational health and safety	✓		<ul style="list-style-type: none"> <li>- Accidents caused by unsafe working environment</li> <li>- Accidents caused by unsafe act</li> <li>- Safety concerns</li> </ul>	<ul style="list-style-type: none"> <li>- Construction workers</li> </ul>
		✓		<ul style="list-style-type: none"> <li>- The Project staff</li> </ul>
Sharing public health services	✓		<ul style="list-style-type: none"> <li>- Sharing public health services caused by illnesses or accidents of workers</li> <li>- Communicable diseases that come with migrant workers</li> </ul>	<ul style="list-style-type: none"> <li>- The public</li> </ul>

Source: TLT Consultants Co., Ltd., 2023

**TABLE 4.2.3-2**  
**THE RISK MATRIX FOR HEALTH IMPACT ASSESSMENT**

Likelihood	Severity of Consequences				
	Very low (1)	Low (2)	Moderate (3)	High (4)	Very high (5)
Very low (1)	1	2	3	4	5
Low (2)	2	4	6	8	10
Moderate (3)	3	6	9	12	15
High (4)	4	8	12	16	20
Very high (5)	5	10	15	20	25

**Remark:** The definition of risk levels in **Table 4.4-5** can be summarized below.

	1-2 points = low impact
	3-9 points = moderate impact
	10-16 points = high impact
	20-25 points = very high impact

**Source :**Adapted from the Health Impact Assessment Guidelines, Office of Natural Resources and Environmental Policy and Planning, March 2022

**TABLE 4.2.3-3**  
**DEFINITION AND SCORING PRINCIPLES FOR THE LIKELIHOOD OF HEALTH IMPACT**

Likelihood		Definition
Level of impact	Score	
Very low	1	No evidence/ low possibility to have happened/ no possibility of stress.
Low	2	Theoretically possible, but no report of occurrence/ very low possibility of stress.
Moderate	3	There are statistics from the available data to support the prediction of the likelihood that this may happen. /Stressful at times.
High	4	This event occurred during the operation of a similar project. / Stress happens often.
Very high	5	This event is happening during the operation of a similar project, or it has occurred more than once in the past 5 years. Stressful all the time.

**Source :**Adapted from the Health Impact Assessment Guidelines, Office of Natural Resources and Environmental Policy and Planning, March 2022

**TABLE 4.2.3-4**  
**SCORING PRINCIPLES FOR THE SEVERITY OF CONSEQUENCES**

Severity of Consequence		Definition
Level of impact	Score	
Very low	1	No injury/no illness/no stress
Low	2	Minor injury/illness/stress
Moderate	3	Moderate injury/illness/stress
High	4	Severe injury/illness/stress
Very high	5	Very severe injury/illness/stress

**Source :**Adapted from the Health Impact Assessment Guidelines, Office of Natural Resources and Environmental Policy and Planning, March 2022

**TABLE 4.2.3-5**  
**DEFINITION OF RISK LEVEL CRITERIA FOR IMPACT ASSESSMENT USING THE RISK MATRIX**

Score from Risk Matrix	Impact level	Definition
1-2	Low	<b>Not causing negative effects on health status</b>
3-9	Moderate	<b>Increasing illness rate, injury, stress, or concerns:</b> It may affect the budget and need to monitor whether the existing mitigation measures are adequate and appropriate.
10-16	High	<b>Having widespread impact on health status, chronic diseases, severe mental health, or prolonged stress:</b> It may need more budget and mitigation measures. If unavoidable, changes of operation method may be needed.
20-25	Very high	<b>Having very widespread impact on health status, disabilities, loss of lives, severe mental health or stress to the level of mental care, prolonged stress to the suicidal level:</b> Immediate budget required. Specific mitigation measures required. Change of operation method required. Immediate care of a consultant needed.

**Source :**Adapted from the Health Impact Assessment Guidelines, Office of Natural Resources and Environmental Policy and Planning, March 2022



**TABLE 4.2.3-6  
ASSESSMENT AND SIGNIFICANCE LEVELS OF HEALTH IMPACTS, AND MITIGATION MEASURES FOR HEALTH  
IMPACT ON THE PUBLIC IN THE CONSTRUCTION PHASE**

Impact issues	Health Risk Matrix			Mitigation measures / Monitoring Measures (presented in Chapter 5)
	Likelihood	Severity	Health impact level	
<b>Air quality</b> – Construction workers – The public	high (4) moderate (3)	low (2) low (2)	moderate (8) (4×2) moderate (6) (3×2)	<b>Environmental Impact Preventive and Correction Measures</b> – Measure on Air Quality – Measure on Social Economic and Public Participation
<b>Noise</b> – Construction workers – The public	high (4) moderate (3)	low (2) low (2)	moderate (8) (4×2) moderate (6) (3×2)	<b>Environmental Impact Preventive and Correction Measures</b> – Measure on Noise – Measure on Social Economic and Public Participation
<b>Solid Waste</b> – Construction workers	moderate (3)	moderate (3)	moderate (9) (3×3)	<b>Environmental Impact Preventive and Correction Measures</b> – Measure on Solid Waste and Waste – Measure on Social Economic and Public Participation

**TABLE 4.2.3-6  
ASSESSMENT AND SIGNIFICANCE LEVELS OF HEALTH IMPACTS, AND MITIGATION MEASURES FOR HEALTH  
IMPACT ON THE PUBLIC IN THE CONSTRUCTION PHASE (CONT'D)**

Impact issues	Health Risk Matrix			Mitigation measures/ Monitoring Measures (presented in Chapter 5)
	Likelihood	Severity	Health impact level	
<b>Transportation</b> – The public	low (2)	high (4)	moderate (8) (2×4)	<b>Environmental Impact Preventive and Correction Measures</b> – Measure on Transportation – Measure on Social Economic and Public Participation
<b>Occupational health and safety</b> – Construction workers	moderate (3)	high (4)	high (12) (3×4)	<b>Environmental Impact Preventive and Correction Measures</b> – Measures On Occupational Health and Safety <b>Environmental Impact Preventive and Correction Measures</b> – Measures On Occupational Health and Safety
<b>Sharing public health services</b> – The public	moderate (3)	moderate (3)	moderate (9) (3×3)	<b>Environmental Impact Preventive and Correction Measures</b> – Measures On Occupational Health and Safety – Measure on Social Economic and Public Participation

Source: TLT Consultants Co., Ltd., 2023

## (2) Operation phase

Considering the Project Descriptions in Chapter 2, existing environmental conditions in Chapter 3, and environmental impact assessment in Chapter 4, result in the identification of activities that may cause health impacts, health hazards, vulnerable groups that are expected to be affected in the operation phase including the Project staff and the public as presented in **Table 4.2.3-1**, where the consultant used the Qualitative Risk Assessment approach to evaluate the health impact assessment with a Health Risk Matrix as presented in **Table 4.2.3-2**, it has a score depending on the likelihood of health impact in **Table 4.2.3-3**, and a score depending on severity of consequences in **Table 4.2.3-4**. The definition of overall impact level between the likelihood and severity of consequences using the risk matrix is presented in **Table 4.2.3-5**. In the operation phase, the health assessment can be summarized by using the health risk matrix assessment as presented in **Table 4.2.3-7**

### 4.2.3.6 History and Cultural Heritage

The project is located in the area of Sa Long Ruea Subdistrict, Huai Krachao District, Kanchanburi Province. Based on the examination of cultural heritage data in the Department of Fine Arts' geographic information system, within a radius of 3 kilometers from the Project boundary, there are no historical sites, archaeological sites, or cultural heritage sites. Therefore, the project's operations will not have any impact on historical and archaeological aspects.

In conclusion, both the construction and operation phases have been evaluated with low significance in terms of impact on history and archaeology. The assessment shows that the Project's activities during both construction and operation phases are not expected to cause significant harm or disruption to the history and archaeology in the area.

**TABLE 4.2.3-7  
ASSESSMENT AND SIGNIFICANCE LEVELS OF HEALTH IMPACTS, AND MITIGATION MEASURES FOR HEALTH  
IMPACT ON THE PUBLIC IN THE OPERATION PHASE**

Impact issues	Health Risk Matrix			Mitigation measures / Monitoring Measures (presented in Chapter 5)
	Likelihood	Severity	Health impact level	
<b>Solid Waste</b> - The Project staff - The public	low (2) low (2)	moderate (3) moderate (3)	moderate (6) (3×2) moderate (6) (3×2)	<b>Environmental Impact Preventive and Correction Measures</b> - Measure on Solid Waste and Waste - Measure on Social Economic and Public Participation
<b>Transportation</b> - The public	low (2)	high (4)	moderate (8) (2×4)	<b>Environmental Impact Preventive and Correction Measures</b> - Measure on Transportation - Measure on Social Economic and Public Participation
<b>Occupational health and safety</b> -The Project staff	moderate (3)	Very high (5)	high (15) (3×5)	<b>Environmental Impact Preventive and Correction Measures</b> -Measures On Occupational Health and Safety <b>Environmental Impact Monitoring Measures</b> -Measures On Occupational Health and Safety

## 4.2.4 Human Use Values

### 4.2.4.1 Land Use

The Project area is predominantly devoted to agriculture, specifically the cultivation of cassava. The Project acquired land tenure through agreements and land purchases from private landowners, with the purchase price being mutually determined by the Project and the previous landowners. Presently, the land in the Project area is owned by the Project developer, Solar Development Company Limited. Consequently, there are no issues related to either physical or economic displacement to be concerned.

#### (1) Construction Phase

The construction of the Project will directly impact the land-use pattern in the Project area. Originally an agricultural area, it will be transformed into an area with solar panels integrated with a battery energy storage system. The construction activities are planned to take place on prepared ground. It is expected that these Project activities during the construction phase will result in a low-level impact on land use.

#### (2) Operation Phase

Once the Project is operational, the utilization of land will change from its previous agricultural use to an area with solar panels integrated with battery energy storage system. The solar power plant will generate electricity using clean energy, supporting the country's greenhouse gas reduction policies. Additionally, it will serve as an educational and renewable energy tourism destination. Therefore, it is anticipated that the project activities will have low impact on land use.

### 4.2.4.2 Land Transportation

#### (1) Construction Phase

The construction phase of the Project involves transportation of construction materials, machinery, and workers. The scope of assessing the impact will cover the road capacity for the increased traffic, traffic obstruction during the construction, and accident from falling of construction materials. The study details are elaborated below.

##### A) Transportation routes and traffic volume

– Transportation of construction machinery and workers will use main roads, including Highway 3443 and Highway 3472.

– The increased traffic volume from the construction activities will be about 40 vehicles/day (**Table 4.2.4-1**) below.

- Transportation of machinery 10 trips/day
- Transportation of construction materials 8 trips/day
- Transportation of sewage 4 trips/week
- Transportation of construction workers 88 trips/day
- Transportation of Staff/ contractor/ inspector 2 trips/day
- Water truck containing 18,000 liters 16 trips/day

**TABLE 4.2.4-1**  
**TRAFFIC VOLUME IN THE CONSTRUCTION PHASE OF THE PROJECT**

Activity	Vehicle	PCE	Number of vehicles (vehicles /day)	Number of trips (trips/day)	PCU/ day	PCU/ hr
Transportation of machinery	Trailer truck (more than 3 axes)	2.5	5	10	25.0	3.13 <sup>2</sup>
Transportation of materials	Medium truck (6-wheel)	2.1	2	8	16.8	2.10 <sup>2</sup>
Transportation of sewage *	Medium truck (6-wheel)	2.1	2	4	8.4	1.05 <sup>2</sup>
Transportation of workers	Medium bus	1.5	22	88	132.0	66.00 <sup>1</sup> /
Staff/ contractor/ inspector	Pickup truck	1.0	1	2	2.0	1.00 <sup>1/</sup>
Water truck containing 18,000 liters	10-wheel trucks	2.5	8	16	40.0	5.00 <sup>2</sup>
<b>Total</b>			<b>40</b>	<b>128</b>	<b>224.2</b>	<b>78.3</b>

**Remark:** 1/ PCU/hr calculated from daily traffic in the morning – evening for 2 hours

2/ PCU/hr calculated from daily traffic during 8 business hours

\* The 6-wheel medium truck collects waste from consumption of workers (worst-case scenario = 1 waste truck per day)

**Source:** Solar Development Co., Ltd., 2023

### B) The Study Principles and Methods

The increased traffic volume from the Project can be calculated in terms of the V/C ratio as follows:

- Vehicles are divided into 12 types. Each type has a multiplier of Passenger Car Equivalents (PCE) into passenger car unit (PCU) to convert as shown in **Table 4.2.4-2**.

- V is the traffic volume (from the max PCU / hr.) and is used to calculate the V/C Ratio to compare with the standard of the Traffic Engineering Division to be not more than 0.8 (80%). The traffic capacity of each type of highway is shown in **Table 4.2.4-3**.

The V/C Ratio is calculated from the equation below.

$$V/C \text{ ratio} = \frac{\text{Increased traffic from the Project} + \text{baseline traffic}}{\text{Traffic capacity of each highway}}$$

The resulted V/C Ratio will be used to compare with the standard of traffic condition in the future, as in **Table 4.2.4-4**.

**TABLE 4.2.4-2**  
**WEIGHTED VALUE OF EACH VEHICLE TYPE**

Type of vehicle	Passenger Car Equivalents Factor (PCE)
Passenger car ≤ 7 seats	1.00
Passenger car > 7 seats	1.00
Light bus	1.50
Medium bus	1.50
Large bus	2.10
Light truck (4-wheel)	1.00
Medium truck (6-wheel)	2.10
Large truck (10 wheel)	2.50
Trailer truck	2.50
Semi-trailer truck	2.50
Bicycle and tricycle	0.33
Motorcycle and motor tricycle	0.33

**Source:** Bureau of Safety, Department of Highways, 2013

**TABLE 4.2.4-3**  
**ROAD CAPACITY OF EACH TYPE OF HIGHWAY**

Types of highways	Road capacity (PCU/hr)
Multi-lane highway	2,000 (per lane)
Two-lane two-way highway	2,000 (both ways)
Three-lane two-way highway	4,000 (both ways)

**Source:** Phaiphong Nilchanphansri, 1997



**TABLE 4.2.4-4**  
**STANDARD FOR CLASSIFYING TRAFFIC CONDITION IN THE FUTURE**

Level of service	Traffic congestion index (V/C Ratio)	Meaning
A	0.00-0.60	- Free-flow conditions with unimpeded maneuverability.
B	0.61-0.70	- Reasonably unimpeded operations with slightly restricted maneuverability
C	0.71-0.80	- Stable operations with somewhat more restrictions in making mid-block lane changes
D	0.81-0.90	- Approaching unstable operations where small increases in volume produce substantial increases in delay and decreases in speed.
E	0.91-1.00	- Operations with significant intersection approach delays and low average speeds.
F	> 1.00	- Operations with extremely low speeds

**Source:** Transportation Research Board (1994), as cited in the Department of Highway, 2013

### C) Baseline Traffic Volume

Based on the secondary statistics on traffic volume on highways of the Department of Highways during 2018-2022, National Highway No. 3443 (km. 7+700) has an average traffic volume of 4,105 vehicles per day, and National Highway No. 3472 (km. 9+000) has an average traffic volume of 3,597 vehicles per day, as shown in **Table 4.2.4-5**. The data will be calculated to find the V/C ratio showing the traffic condition on these highways as the baseline data for assessing transportation impact in the construction phase of the Project.

**TABLE 4.2.4-5**  
**THE CURRENT TRAFFIC VOLUME IN THE STUDY AREA**

Road name	Average traffic (vehicle/day)	PCU / day	PCU / hr.	V/C Ratio	Level of Service (LOS)
National Highway No. 3443 (km. 7+700)	4,105	4,229	176	0.09	A
National Highway No. 3472 (km. 9+000)	3,597	3,687	154	0.08	A

**Source:** Bureau of Safety, Department of Highways, 2019 - 2023

### D) Results

Construction activities that affect public transportation are the transportation of construction machinery and workers. The scope of assessing the impact will cover the road capacity for the increased traffic, traffic obstruction during the construction, and accident from falling of construction materials. The study details are elaborated below.

- **Road capacity to the increased traffic volume**

The impact assessment of traffic density to the V/C ratio concerns the traffic volume increased from the current condition. It will forecast the road capacity and traffic density in the construction phase (**Table 4.2.4-6**) on the main roads that the Project will use for transporting construction machinery and workers, including National Highway No. 3443 and National Highway No. 3472. It can be summarized below.

- **National Highway No. 3443 (km.7+700)**

- In the current traffic condition, the V/C Ratio of National Highway No. 3443 (km.7+700) from the highway traffic data by the Department of Highway from 2018-2022 was 0.09. Compared to the standard of traffic classification (Transportation Research Board (1994), as cited in the Department of Highway, 2023), it is classified as the free-flow condition with unimpeded maneuverability (level of service: LOS = A).

- The traffic condition in the construction phase on National Highway No. 3443 (km.7+700) from the highway traffic data by the Department of Highway from 2018-2022 combined with the traffic volume in the construction phase has the V/C Ratio of 0.13, which increases from before the construction of the Project. Compared to the standard of traffic classification (Transportation Research Board (1994), as cited in the Department of Highway, 2023), it is classified as the free-flow condition with unimpeded maneuverability (level of service: LOS = A). Therefore, the traffic in the construction phase does not increase the traffic volume, and the impact level is low.

**TABLE 4.2.4-6**  
**TRAFFIC CONDITION FROM USING HIGHWAYS IN THE CONSTRUCTION PHASE OF THE PROJECT**

Details		National Highway No. 3443 (km.7+700)	National Highway No. 3472 (km.9+000)
.1 Current traffic volume (vehicles/day)		4,105	3,597
	PCU/day	4,229	3,597
	PCU/hr	176	154
.2 Traffic volume of the Project (vehicles/day)		40	40
	PCU/day in the construction phase	224.2	78.3
	PCU/hr in the construction phase	78.3	78.3
.3 Current traffic condition + traffic volume in the construction (vehicles/day)		4,145	3,637
	PCU/day current + construction phase	4,453	3,821
	PCU/hr current + construction phase	254	232
	Road capacity	2,000	2,000
<b>Before the Project</b>	<b>V/C Ratio</b>	<b>0.09</b>	<b>0.08</b>
	<b>Level of Service (LOS) *</b>	<b>A</b>	<b>A</b>
<b>Construction phase</b>	<b>V/C Ratio</b>	<b>0.13</b>	<b>0.12</b>
	<b>Level of Service (LOS)*</b>	<b>A</b>	<b>A</b>

**Remark:** \* Level of Service (LOS) A refers to the free-flow condition with unimpeded maneuverability

**Source:** Bureau of Safety, Department of Highways, 2019-2023

– **National Highway No. 3472 (km.9+000)**

- In the current traffic condition, the V/C Ratio National Highway No. 3472 (km.9+000) from the highway traffic data by the Department of Highway from 2018-2022 is 0.08. Compared to the standard of traffic classification (Transportation Research Board (1994), as cited in the Department of Highway, 2023), it is classified as the free-flow condition with unimpeded maneuverability (level of service: LOS = A).

- The traffic condition in the construction phase on National Highway No. 3472 (km.9+000) from the highway traffic data by the Department of Highway from 2018-2022 combined with the traffic volume in the construction phase has the V/C Ratio of 0.12, which increases from before the construction of the Project. Compared to the standard of traffic classification (Transportation Research Board (1994), as cited in the Department of Highway, 2023), it is classified as the free-flow condition with unimpeded maneuverability (level of service: LOS = A). Therefore, the traffic in the construction phase does not increase the traffic volume, and the impact level is low.

- **Traffic obstruction during the construction**

The transportation of construction machinery and workers might cause inconvenience for road users, especially when transporting large machinery with large trucks (more than 3 wheels). This might cause a delay in traffic. To minimize the impact, the Project requires this activity to avoid rush hours in the morning and the evening and coordinate with local agencies to facilitate the traffic flow and avoid the obstruction. However, the impact is temporarily limited to the transportation time. When the transportation of large machinery is complete, the impact will be lower. Therefore, the impact on traffic obstruction is low.

- **Accident from falling of construction materials**

The transportation of construction machinery and workers uses 6-wheel trucks and trailer trucks (more than 3 axes). If the vehicles are not covered, the materials might fall on the road and may harm road users and properties. Therefore, the impact level is moderate.

The assessment results can be concluded that the construction phase will not change the traffic condition from before the Project. More precisely, the main roads that the Project uses can adequately support the increased traffic. However, the increase of large vehicle in the construction phase may affect the traffic flow. Therefore, the transportation impact in the construction phase is low.

**(2) Operation Phase**

In the operation phase, traffic in the Project is limited only in the Project premises. Only authorized vehicles are allowed to enter only authorized areas. The traffic increase from the Project is shown in **Table 4.2.4-7**. The maximum transportation traffic is about 7 vehicles/day, including the vehicle of staff administering the power generating system 5 vehicles/day (10 trips/day), vehicles transporting solar panel cleaners 1 vehicle/week (2 trips/week), and the garbage truck to collect waste for disposal 1 truck/month (2 trips/month).

**TABLE 4.2.4-7  
TYPES AND NUMBER OF VEHICLES EXPECTED TO INCREASE IN THE  
OPERATION PHASE**

Activity	Type	PCE	Number of vehicles		PCU/day	PCU/hr.
			vehicles/day	trips/day (out-back)		
Vehicle of staff administering power generating system	Passenger car	1.0	5	10	10.0	5.00 <sup>1/</sup>
Transporting solar panel cleaners*	Medium bus	1.5	1	2	3.0	1.50 <sup>1/</sup>
Garbage truck*	6-wheel truck	2.1	1	2	4.2	0.53 <sup>2/</sup>
<b>Total</b>			<b>7</b>	<b>14</b>	<b>17.2</b>	<b>7.03</b>

**Remark:** <sup>1/</sup> PCU/hr calculated from daily traffic volume for two hours in the morning and evening

<sup>2/</sup> PCU/hr calculated from daily traffic volume throughout the 8 working hours

\* The vehicles of staff administering power generating system, solar panel cleaners, and garbage trucks are calculated based on the worst-case scenario of transporting every day.

- **The road capacity to the increased traffic volume**

The assessment of traffic density to the road capacity (V/C ratio) concerns the impact on the road capacity and traffic density of the operation phase increased traffic from the current condition as shown in **Table 4.2.4-8**. The assessment is based on the worst-case scenario of the increased traffic volume on National Highway No. 3443 (km.7+700) and National Highway No. 3472 (km.9+000) in the operation phase. The results can be summarized below.

- **National Highway No. 3443 (km.7+700)**

- In the current traffic condition, the V/C Ratio of National Highway No. 3443 (km.7+700) from the highway traffic data by the Department of Highway from 2018-2022 is 0.09. Compared to the standard of traffic classification (Transportation Research Board (1994), as cited in the Department of Highway, 2023), it is classified as the free-flow condition with unimpeded maneuverability (level of service: LOS = A).

- The traffic condition in the operation phase on National Highway No. 3443 (km.7+700) from the highway traffic data by the Department of Highway from 2018-2022 combined with the traffic volume in the construction phase has the V/C Ratio of 0.09, which is the same as before the Project development. It has no impact or change on the traffic condition. Compared to the standard of traffic classification (Transportation Research Board (1994), as cited in the Department of Highway, 2023), it is classified as the free-flow condition with unimpeded maneuverability (level of service: LOS = A). Therefore, the traffic in the operation phase does not increase the traffic volume, and the impact level is low.

**TABLE 4.2.4-8**  
**TRAFFIC CONDITION FROM USING NATIONAL HIGHWAYS IN THE**  
**OPERATION PHASE**

Details		National Highway No. 3443 (km.7+700)	National Highway No. 3472 (km.9+000)
1. Current traffic condition (vehicles/day)		4,105	3,597
PCU/day		4,229	3,597
PCU/hr		176	154
2. Traffic volume of the Project (vehicles/day)		7	7
PCU/day in the operation phase		17.2	17.2
PCU/hr in the operation phase		7.03	7.03
3 Current traffic volume + traffic volume in the operation phase (vehicles/day)		4,112	3,604
PCU/days current + operation phase		4,246	3,614
PCU/hr current + operation phase		183	161
Road capacity		2,000	2,000
<b>Before the Project</b>	<b>V/C Ratio</b>	<b>0.09</b>	<b>0.08</b>
	<b>Level of Service (LOS)*</b>	<b>A</b>	<b>A</b>
<b>Operation phase</b>	<b>V/C Ratio</b>	<b>0.09</b>	<b>0.08</b>
	<b>Level of Service (LOS)*</b>	<b>A</b>	<b>A</b>

**Remark:**\* Level of Service (LOS) A refers to the free-flow condition with unimpeded maneuverability

– **National Highway No. 3472 (km.9+000)**

- In the current traffic condition, the V/C Ratio of National Highway No. 3472 (km.9+000) from the highway traffic data by the Department of Highway from 2018-2022 is 0.08. Compared to the standard of traffic classification (Transportation Research Board (1994), as cited in the Department of Highway, 2023), it is classified as the free-flow condition with unimpeded maneuverability (level of service: LOS = A).

- The traffic condition in the operation phase on National Highway No. 3472 (km.9+000) from the highway traffic data by the Department of Highway from 2018-2022 combined with the traffic volume of the Project in the operation phase has the V/C Ratio of 0.08, which is the same as before the Project development. It has no impact or change on the traffic condition. Compared to the standard of traffic classification (Transportation Research Board (1994), as cited in the Department of Highway, 2023), it is classified as the free-flow condition with unimpeded maneuverability (level of service: LOS = A). Therefore, the traffic in the operation phase does not increase the traffic volume, and the impact level is low.

- The assessment results can be concluded that the operation phase will not change the traffic condition compared to before the Project development. The main transportation roads around the Project area have adequate capacity for the increased traffic volume. However, the increase of large vehicles in the operation phase may affect the traffic flow. Therefore, the impact on transportation in the operation is low.

#### 4.2.4.3 Solid Waste Management

##### (1) Construction Phase

Most waste and discarded materials in the construction phase are caused by two main activities.

- Waste from the consumption of a maximum of 1,297 construction workers, such as food waste, plastic bags, and paper, can add up to 1,102.45 kg/day (waste generation rate of 0.85 kg per person per day (Kriengsak Udomsinrot, 1993)). The Project will prepare an adequate number of trash bins at several spots so that Sa Long Ruea Municipality can collect it for disposal outside of the Project area.

- Waste from construction, such as scraps of plastic, wood, and steels, is estimated at 54.53 tons per year. The contractor will collect this part of waste, sort recyclable waste, and sell it to recycle waste buyers. Non-recyclable waste or hazardous waste will be collected in suitable containers. A waste disposer authorized by the Department of Industrial Works will collect it for proper disposal.

Therefore, the impact level is low.

##### (2) Operation Phase

Waste in the operation phase consists of the following:

- Waste generated from the consumption of the Project staff and solar panel cleaners, which make a maximum of 25 persons a day. Most are in the form of general waste, such as food waste, plastic bags, and paper scraps. It is expected to add up to 21.25 kg/day (waste generation rate of 0.85 kg/day (Kriengsak Udomsinrot, 1994)). The Project will prepare sufficient trash bins at various points for Sa Long Ruea Sub-district Municipality to collect and dispose of outside the Project area.

- Waste from scheduled maintenance, such as used lubricant, which is expected to reach about 559 kg/month or 6.7 tons/year. This type of waste will be kept in tightly closed container and collected in an area of 20 sq.m. in the office and material storage building, waiting for a waste disposer authorized by the Department of Industrial Works for disposal outside the Project area.

- Solar panels used in this Project have a lifespan of about 25 years, in case of damage or deterioration, the Project will call a waste disposer authorized by the Department of Industrial Works for disposal outside the Project area.

- Rainwater contaminated with oil near the transformer will be contained in the first 30 minutes. It will be contained in a dike and subsequently sent to the oil sump to separate oil from water. The Project will call an agency authorized by the Department of Industrial Works for disposal outside the Project area.

Therefore, the impact level is low.

#### 4.2.4.4 Wastewater Management

##### (1) Construction Phase

Wastewater from the construction activities has a maximum volume of 82.63 m<sup>3</sup>/day. Details are explained below.

- Wastewater from cleaning equipment and tools is about 10.00 m<sup>3</sup>/day. It will be collected at a retention pond to separate oil from water before disposal by an agency authorized by government agencies.

– Wastewater from consumption of construction workers has a maximum volume of 30.86 m<sup>3</sup>/day. This is based on the assumption of the maximum water consumption volume of 1,297 workers. (Wastewater is estimated at 80% of the consumption water of 90.79 m<sup>3</sup>/day, Thongchai Phansawat, 1987). The Project will treat wastewater with a septic tank provided by the contractor. Regarding treated wastewater and sewage, the contractor will contact a local agency for proper disposal according to the guidelines set forth in the Public Health Act B.E. 2535 (1992) and the Ministerial Regulation on Hygienic Sewage Management. B.E. 2561 (2018). The wastewater will not be discharged to the outside.

Therefore, there is no impact on the quality of surface water.

## **(2) Operation Phase**

In the operation phase, wastewater is generated from the following activities.

1. Wastewater from consumption is calculated by the rate of 80% of the consumption water (Thongchai Phansawat, 1987).

– Staff administering solar cell power generation of the Project and security guards of the Project (5 people) will generate wastewater 0.28 m<sup>3</sup>/day from consumption water 0.35 m<sup>3</sup>/day.

– Solar panel cleaners (20 people) will generate wastewater 1.12 m<sup>3</sup>/day from consumption water 1.40 m<sup>3</sup>/day.

Therefore, in the operation phase, there will be 25 people working in the Project, including staff and solar panel cleaners. They will generate 1.40 m<sup>3</sup>/day of wastewater from consumption water 1.75 m<sup>3</sup>/day. Wastewater will be collected to the septic tank. The Project will contact local agencies to collect and dispose of treated wastewater and sewage according to the principles set forth in the Public Health Act B.E. 2535 (1992) and the Ministerial Regulation on Hygienic Sewage Management. B.E. 2561 (2018).

2. Wastewater from cleaning solar panels will be about 6.70 m<sup>3</sup>/day (cleaning two times a year). Wastewater from this cause is not contaminated with chemicals, but only dust particle. It will be left to evaporate and flow naturally. It will have no impact on the quality of surface water.

Therefore, in the operation phase, there is no impact on the quality of surface water.

### **4.2.4.5 Water Drainage**

#### **(1) Construction Phase**

The construction will take about 12 months. Most of the areas are for power generation using solar panels, empty space, roads, walkways, and parking space. The landscape will remain the same as before the Project development. The land clearing covers 6,735.00 sq.m. or 0.52 percent of the project, particularly the power generation control building, the storage area of spare parts, materials, solid waste, and maintenance area, the switchyard or substation area. The land clearing covers 6,735.00 sq.m may change water drainage condition from the original state. Therefore, the Project will prepare a temporary drain in those areas to collect and drain water to a retention pond in the Project area. Therefore, the impact level is low.



## **(2) Operation Phase**

The land clearing of the Project covers 6,735.00 sq.m. or 0.52 percent of the project area, particularly the power generation control building, the storage area of spare parts, materials, solid waste, and maintenance area, the switchyard or substation area, and the power generation support area and related areas. The land clearing covers 6,735.00 sq.m. may slightly change water drainage condition from the original state. The Project will prepare a retention pond with a capacity of 700 m<sup>3</sup> to collect rainwater near the building in the Project area. The retention pond can collect rainwater that falls continuously at least three hours and will control the draining of rainwater outside the project area not more than the existing draining rate. Therefore, the operation phase of this Project will not have any impact of water drainage on the surrounding areas.

### **4.2.5 Major Hazard**

#### **4.2.5.1 Guideline of Risk and Hazard Assessment**

The guideline of risk and hazard assessment will follow the regulations of Department of Industrial Works : Criteria of hazard indication, risk assessment and risk management plan, B.E. 2543 (2000). The study starts with the analysis and review of implementation in order to indicate the risk activities. Then, the hazard identification will be indicated to display the hazard activities and the results. The level of risk will be assessed by indicating the frequent opportunities of that hazard, and the level of impact to the people, communities, environment and property. The level of risk will be analyzed and the risk management plan and risk reduction plan will be prepared later.

The technique of hazard study in the project consists of 3 parts as follow:

##### **(1) The Technique of Hazard Identification**

The study will identify the potential risk of hazard. The analysis starts from the production procedure and electricity distribution. The results will be analyzed in collaboration with the hazard identification of international standard, emphasizing the opportunities that lead to the error that is able to develop into the hazard impact.

##### **(2) Hazard Identification**

When the hazard can be identified, the consultant will study the consequences of activities to the hazard, employing the Checklist, one of the methods in the regulations of Department of Industrial Works : Criteria of hazard indication, risk assessment and risk management plan, B.E. 2543 (2000) to be the criteria of cause and effect from the error of activities. the hypothesis of equipment fault or failure, regulation-fault or error and human error will be analyzed and assess the risk in the concerning issues.

##### **(3) The Technique of Risk Assessment**

The technique of risk assessment consists of hazard probability and severity of consequences. The quality analysis will be employed in assessing the severity of the impact. The results from the assessments will be categorized into the levels of risk.

#### 4.2.5.2 Hazard Identification

The hazard identification depends on related factors, especially the availability of the project details. The decision to identify the part or unit of production with potential to hazard will be taken into consideration before prioritizing the significance of hazard to be particularly considered.

The study of the project details shows that the solar cell production will be less complicated than other types of power plant. The potential hazards that may occur include the following :

(1) The risk of fire can occur due to non-standard equipment installation or the absence of electrical circuit protection devices. The equipment that has the potential to be hazardous includes:

- Solar panels (PV Module)
- The electrical current inverter along with electrical circuit control devices for direct current (DC) and alternating current (AC) circuit interruption control devices.
- Battery Energy Storage System : BESS
- Materials and components include electrical wires, conduit pipes for electrical wires, and electrical junction boxes.

(2) Electrical shocks occur due to factors such as the absence of electrical insulation, lack of grounding, overloaded circuits, and situations where individuals or equipment come into contact with electricity while wet. Equipment at risk of such dangers in this context includes various electrical devices and electrical wiring.

(3) The occurrence of an electric arc is the flow of electrical charge through gas or air, which happens when there is an overvoltage or when the air surrounding a conductor is at a high temperature. This typically occurs when a high electrical current passes through a point of contact or when there is a separation between electrical conductors. In these situations, the electrical current can generate significant heat, leading to the formation of an electric arc. The intense heat generated by an electric arc can cause injuries such as burns and can even be fatal. Equipment that is at risk of such dangers in this context includes various electrical devices, especially voltage transformers.

From assessing the positions where severe danger could potentially occur, it is evident that the areas at risk of severe danger are those with electrical equipment installations. The causes of severe danger that may occur can result from equipment and tool defects or from operational errors by workers (Operability Problems). To identify potential severe dangers as described above, a checklist approach will be used, comparing them with various relevant standards. The details of the identification process, as shown in **Table 4.2.5-1**.

**TABLE 4.2.5-1  
HAZARD IDENTIFICATION USING THE CHECKLIST METHOD**

**Area/Machinery** Electricity generation area/ solar panels/ Inverter/ battery energy storage system and auxiliary equipment/  
-----  
Solar electricity generation from ground-mounted photovoltaic technology

No.	Checklist	Inspection results			Important remarks
		Yes	No	N/A	
<b>1</b>	<b>Inspect the standard of the electrical equipment installed in the project.</b>				
<b>1.1</b>	<b>Inspect the standard of the electrical equipment installed in the project.</b>				
1.1.1	<b>Solar modules (Monocrystalline Silicon type) and supporting structures</b>				
	Has the equipment been verified or certified by the following standard?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	– TIS.1843 or IEC 61215 standard (Crystalline Silicon Terrestrial Photovoltaic (PV) Modules-Design Qualification and Type Approval)				
	– TIS.2580 or IEC 61730 standard (Photovoltaic (PV) Module Safety Qualification)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
1.1.2	The material of the structure is hot dip galvanizing according to ASTM Standard or stainless metal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
1.1.3	The support structure can hold up solar panels stably and firmly.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
1.1.4	Structural components can be assembled and disassembled easily.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
1.1.5	The solar modules and structure fixers are in appropriate size and made of stainless steel or stainless metal.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
1.1.6	The structure can support the weight and withstand the wind at least 30 meters/second.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

**TABLE 4.2.5-1  
HAZARD IDENTIFICATION USING THE CHECKLIST METHOD (CONT'D)**

**Area/Machinery** Electricity generation area/ solar panels/ Inverter/ battery energy storage system and auxiliary equipment/  
Solar electricity generation from ground-mounted photovoltaic technology

No.	Checklist	Inspection results			Important remarks
		Yes	No	N/A	
<b>1.2</b>	<b>Inverter</b>				
1.2.1	Has the equipment been verified or certified by the following standard?				
	– IEC 61727 standard (Photovoltaic (PV) System- Characteristics of the Utility interface)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	– IEC 62116 standard (Test Procedure of Islanding Prevention Measures for Utility-interconnected Photovoltaic Inverters)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	– IEC 62109 standard (Safety of Power Converters for Use in Photovoltaic Power Systems)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
1.2.2	Has the surge protection device been installed?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
1.2.3	DC overvoltage protection device is available.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
1.2.4	DC short-circuit protection is available.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
1.2.5	Insulation monitoring system is available.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Device inspection plan has been prepared.
1.2.6	AC overvoltage protection device is available.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

**TABLE 4.2.5-1  
HAZARD IDENTIFICATION USING THE CHECKLIST METHOD (CONT'D)**

**Area/Machinery** Electricity generation area/ solar panels/ Inverter/ battery energy storage system and auxiliary equipment/  
Solar electricity generation from ground-mounted photovoltaic technology

No.	Checklist	Inspection results			Important remarks
		Yes	No	N/A	
1.2.7	Ground monitoring system is available.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Device inspection plan has been prepared.
1.2.8	Over temperature protection system is available.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>1.3</b>	<b>Battery Energy Storage System</b>				
1.3.1	Charging control equipment is available.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
1.3.2	Clearly specify the battery type for accuracy in battery maintenance	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>1.4</b>	<b>Auxiliary equipment</b>				
<b>1.4.1</b>	<b>Electric wire</b>				
1.4.1.1	The electric wire is a photovoltaic with a temperature tolerance at least 80 degrees Celsius or is a 0.6/1 KV CV wire according to the IEC 60502 standard or other wires with better properties.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Use XLPO wires that can withstand temperatures up to 120 degrees Celsius
1.4.1.2	For DC, the wire has a maximum current tolerance at least 1.25 times of the short-circuit current of the solar panel set ( $I_{sc}$ ) at STC condition.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
1.4.1.3	For AC, the wire has a maximum current tolerance at least 1.25 times of the rated power at the unity power factor of the electrical equipment.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

**TABLE 4.2.5-1  
HAZARD IDENTIFICATION USING THE CHECKLIST METHOD (CONT'D)**

**Area/Machinery** Electricity generation area/ solar panels/ Inverter/ battery energy storage system and auxiliary equipment/  
Solar electricity generation from ground-mounted photovoltaic technology

No.	Checklist	Inspection results			Important remarks
		Yes	No	N/A	
<b>1.4.2</b>	<b>Electrical conduit</b>				
1.4.2.1	Polyethylene conduit should be high density polyethylene (HDPE) pipe with a PN8 quality class or higher and have TIS.982 certification.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
1.4.2.2	Metal pipe should be EMT metal conduit or those with higher quality.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>1.4.3</b>	<b>DC Junction Box</b>				
1.4.3.1	The box is outdoor type.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
1.4.3.2	Has Ingress Protection (IP) rated IP45 or higher quality.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
1.4.3.3	Electrical wire connectors inside the junction box are installed appropriately, orderly, securely and safely.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>2.</b>	<b>Inspection of equipment design and installation methods</b>				
2.1	The detail design and the system installation must be carried out and certified by an engineer who has a license to practice professional engineering from the Council of Engineers.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2.2	Circuit connection of solar modules must be technically appropriate and have good safety protection with reference to TIS 2572 standard (Electrical Installation - Solar Power Distribution System) or IEC 60364- 7-712 standard (Requirements for Special Installations or locations – Solar Photovoltaic (PV) Power Supply System) or the manufacturer's PV installation manual (if applicable).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

**TABLE 4.2.5-1  
HAZARD IDENTIFICATION USING THE CHECKLIST METHOD (CONT'D)**

**Area/Machinery** Electricity generation area/ solar panels/ Inverter/ battery energy storage system and auxiliary equipment/  
Solar electricity generation from ground-mounted photovoltaic technology

No.	Checklist	Inspection results			Important remarks
		Yes	No	N/A	
2.3	The electrical wires used for electrical wiring between solar modules must be the wires come with the terminal box of the solar modules. The circuit must be connected correctly or using photovoltaic wire or CV type 0.6/1 KV wire or higher quality. PV connector or other types of connectors that is not less stable should be selected.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2.4	For all modules and system equipment with metallic construction and/or equipment specified to be wired, the grounding circuit must be in accordance with technical principles or the installation standards Electricity for Thailand B.E. 2545 (2002) (Revision in B.E. 2551(2008)) of the Engineering Institute of Thailand	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2.5	The electrical wires must have a current rating at least 1.25 times of the maximum current in the circuit.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2.6	Electrical wiring must be in accordance with the relevant regulations and requirements of the Electricity Authority, regulations and academic principles referring to the Electrical Installation Standards for Thailand B.E. 2545 2545 (2002) (Revision in B.E. 2551(2008)) of the Engineering Institute of Thailand. or according to the regulations prescribed by the Electricity Authority.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2.7	When the installation of the system is completed, there must be an inspection by engineer licensed to practice professional engineering from the Engineering Council to ensure that the system is installed correctly and safely according to technical principles.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2.8	There is a monitoring for the efficiency of electricity generation equipment and protection devices and Preventive Maintenance (PM) plan to ensure that all equipment is in good condition with the	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	



**TABLE 4.2.5-1**

**HAZARD IDENTIFICATION USING THE CHECKLIST METHOD (CONT'D)**

**Area/Machinery** Electricity generation area/ solar panels/ Inverter/ battery energy storage system and auxiliary equipment/  
 Solar electricity generation from ground-mounted photovoltaic technology

No.	Checklist	Inspection results			Important remarks
		Yes	No	N/A	
<b>3. Training and provision of Personal Protective Equipment (PPE)</b>					
3.1	Employees are trained to understand the potential hazard from electricity generation.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
3.2	There is training for administrators and relevant staff to understand the operation of systems/equipment.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
3.3	Provide Personal Protective equipment (PPE) that is suitable for the tasks to ensure safety operation.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
3.4	Provide sufficient fire suppression equipment in various areas and trainings to ensure that the staff can suppress the fire correctly in case of incident.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

### 4.2.5.3 Risk Assessment In Hazard Probability

#### 1. Hazard Probability

The Checklist (details in **Table 4.2.5-1**) show that the project installed the dielectric and equipment inspection plan, overvoltage system and equipment inspection plan, and the system to prevent the over temperature in the system. These systems prevent the electrical shock and electrical arc. However, the human error can happen in the project, such as, electrical shock because of the employee or the equipment are in the wet condition. From the review of factory accidents of Safety Technology Office, Departments of Industrial Works, during 2016-2022 (7 years), there are no records of the accidents in the factory of photovoltaic production. The statistics of Department of labour protection and welfare : Establishments of business that do not comply with the safety law in the factory of electricity, gas and water supply during 2013-2021 (9 years), there are no records of report concerning illegal operations according to the safety law (electricity). However, in 2019, the reports of illegal operations according to the safety law were reported. When compared with the level of risk, according to the regulations of Department of Industrial Works : criteria of hazard indication, risk assessment and risk management plan, B.E. 2543 (2000) (**Table 4.2.5-2**), the level 2 (low risk probability) can happen once in 5-10 years.

The project have installed the standard equipment, namely, the lightning and surge protection device and DC short-circuit protection. Therefore, the risk of fire is minimized. From the review of factory accidents of Safety Technology Office, Departments of Industrial Works, during 2016-2022 (7 years), there are no records of the accidents in the factory of photovoltaic production. The statistics of Department of labour protection and welfare : Establishments of business that do not comply with the safety law in the factory of electricity, gas and water supply (fire) during 2013-2021 (9 years), there are no records of report concerning illegal operations according to the safety law (electricity). However, in 2019, the reports of illegal operations according to the safety law (fire) were reported. When compared with the level of risk, according to the regulations of Department of Industrial Works : criteria of hazard indication, risk assessment and risk management plan, B.E. 2543 (2000) (**Table 4.2.5-2**), the level 2 (low risk probability) can happen once in 5-10 years.

**TABLE 4.2.5-2**  
**LEVEL OF LIKELIHOOD FOR THE OCCURRENCE OF VARIOUS EVENTS**

<b>Level</b>	<b>Description</b>
1	There is a rare chance of occurrence e.g., no occurrence in a period of 10 years or more.
2	There is a low chance of occurrence e.g., 1 occurrence in a period of 5 - 10 years.
3	There is a moderate chance of occurrence e.g., 1 occurrence in a period of 1 - 5 years.
4	There is a high chance of occurrence e.g., more than once occurrence in a period of 1 year.

**Source:** The Regulation of Department of Industrial Works on Criteria for Hazard Identification, Risk Assessment, and Establishment of Risk Management Plan, B.E. 2543(2000).

## 2. Severity of Consequences

The consideration of impact of electric shock because of the employee or the equipment are in the wet condition, with the criteria of severity level to the people, communities, environment and property, according to the criteria of hazard indication, risk assessment and risk management plan, B.E. 2543 (2000) (**Table 4.2.5-3**), shows that the electric shock because of the employee or the equipment are in the wet condition will cause the impact of level 4 to the employee: the disability or death. However, the employees do not work with the solar module, except the employees who are responsible for the cleaning of solar module. The procedure of of cleaning is as follows:

- (1) The temperature during the time or date of the cleaning should not be too high to prevent the crack of glass from the repid change of temperature.
- (2) Turn off the electric distribution before cleaning for safety. Do not touch the back of the module to minimize the opportunities of short circuit or electric shock.
- (3) Use fresh water in cleaning and mop with sponge to wipe the module to prevent the scratch and avoid the chemical residue.
- (4) The employee should wear the personal protective equipment (PPE) and follow the indicated instruction of work.

The impact to the communities is level 1 : no impact, because the people cannot approach the project's electricity generator. Only the employees who are authorized can enter the production area. The impact to the environment is level 1 : minor impact or no impact. the impact to the property is level 3 : severe impact and parts of production must be halted.

The short circuit and fire in the equipment cause the impact of level 2 to the employee : injury that needs the medical treatment. However, the project employees do not work in the area of the risky electric equipment, such as , solar module, inverter, transformer and electrical wire. The impact to the community is level 1 : no impact to the nearby communities, since the project location is not in the community area. The impact to the environment is level 2 : moderate, the hazard or accident can be solved in a short period of time. The impact to the property is level 3 : severe impact and parts of production must be halted.

**TABLE 4.2.5-3**  
**CLASSIFICATION OF IMPACTS ON INDIVIDUAL, COMMUNITY,**  
**ENVIRONMENTAL AND PROPERTY**

Level	Severity	Description			
		Individual impact	Community impact	Environmental impact	Property impact
1	Minor	Minor injuries, only first aid level required	Have no or minor impact on nearby communities.	Have minor, controllable and correctable environmental impacts	Have no or minor impact on property.
2	Moderate	Medical treatment required	Have impacts on nearby communities but can be resolved in short period of time.	Have moderate environmental impacts	The property is moderately damaged, and the operation can be resumed.
3	High	Severe injuries or sickness	Have impacts on nearby communities which take time to resolve.	Have environmental impacts which take time to resolve	The property is heavily damaged, and some operation must be paused.
4	Extreme	Disability or death	Have severe impacts on communities in wide area. The government agencies must perform corrective actions.	Have severe environmental impacts which take long time and resources to resolve.	The property is severely damaged, and all operation must be paused.

**Source:** The Regulation of Department of Industrial Works on Criteria for Hazard Identification, Risk Assessment, and Establishment of Risk Management Plan, B.E. 2543(2000).

### 3. The Risk Level

The results of assessment in terms of frequency of impact and severity of impact to the people, environment and property as mentioned above can be evaluated for the output for hazard level as follows:

<p><b>Consideration output = frequency of impact x severity of impact .....(1)</b> <b>(to the people, communities, environment, property)</b></p>
---

If the level of risk to the people, communities, environment or property is different, select the highest risk level. Then compare the output with the **Table 4.2.5-4**.

**TABLE 4.2.5-4  
RISK LEVEL CLASSIFICATION**

<b>Levels</b>	<b>Results</b>	<b>Definition</b>
1	1-2	Low risk
2	3-6	Acceptable risk, controlling measures must be review.
3	8-9	High risk, mitigation measures must be applied.
4	12-16	Unacceptable risk, operation must be paused and the risks must be mitigated immediately.

**Source:** The Regulation of Department of Industrial Works on Criteria for Hazard Identification, Risk Assessment, and Establishment of Risk Management Plan, B.E. 2543 (2000).

In case the employee or the equipment are in the wet condition, then touch the equipment with electricity and cause electric shock, this risk probability of incident is considered level 2. The highest severity is level 4. Then the consideration outcome is  $2 \times 4 = 8$ . When compared to the level of risk in **Table 4.2.5-4**, the risk of hazard from electric shock because of the wet condition of employee or equipment is level 3 : high risk, the action must be done to minimize the risk (details of assessment is in **Table 4.2.5-5**).

In case the short circuit of equipment and fire, the risk probability of incident is level 2. The highest severity to the property is level 3. Then the consideration outcome is  $2 \times 3 = 6$ . When compared to the level of risk in **Table 4.2.5-4**, the risk of hazard from short circuit of equipment and cause fire is level 2 : the risk is acceptable and the review of control measures is needed. (details of assessment is in **Table 4.2.5-5**).

**TABLE 4.2.5-5**  
**THE RESULTS OF THE STUDY, ANALYSIS AND REVIEW OF THE PROJECT IMPLEMENTATION FOR HAZARD IDENTIFICATION AND RISK ASSESSMENT BY THE CHECKLIST METHOD.**

**Area/Machinery** Electricity generation area/ solar panels/ Inverter/ battery energy storage system and auxiliary equipment/

Solar electricity generation from ground-mounted photovoltaic technology

Results from Checklist method	Hazard or consequences	Preventive and controlling measures	Suggestion	Risk assessment			
				Probability	Severity	Results	Risk level
Personnel/equipment being in wet conditions contacts with electrical equipment (Human Error)	The staff, especially solar panels cleaner have electric shock.	<ul style="list-style-type: none"> <li>- Arrange appropriate solar panels washing plan and encourage the staff to strictly follow the prescribed procedures.</li> <li>- Personal Protective Equipment, e.g., helmets, safety gloves, safety shoes, etc., must always be used in the operation and must always be kept in ready to use condition.</li> <li>- Establish clear operational procedure for panels washing to ensure that the electricity is turned off before panel washing.</li> </ul>	-	2	4	2x 4 =8	3 High risk. Mitigation measures are required.

**TABLE 4.2.5-5  
THE RESULTS OF THE STUDY, ANALYSIS AND REVIEW OF THE PROJECT IMPLEMENTATION FOR HAZARD IDENTIFICATION AND RISK ASSESSMENT BY THE CHECKLIST METHOD. (CONT'D)**

**Area/Machinery** Electricity generation area/ solar panels/ Inverter/ battery energy storage system and auxiliary equipment/

Solar electricity generation from ground-mounted photovoltaic technology

Results from Checklist method	Hazard or consequences	Preventive and controlling measures	Suggestion	Risk assessment			
				Probability	Severity	Results	Risk level
In the case of electrical short circuit equipment	Electrical hazards can occur in the vicinity of electrical equipment, including: <ul style="list-style-type: none"> <li>- Solar panels</li> <li>- Electrical current transformers</li> <li>- Battery energy storage system</li> <li>- Electrical transformers</li> <li>- Electrical wires</li> </ul>	<ul style="list-style-type: none"> <li>- Use equipment that meets international standards.</li> <li>- Install a short-circuit protection system.</li> <li>- Install fire suppression equipment in accordance with specified standards.</li> <li>- Establish a regular maintenance and inspection plan for fire suppression equipment to ensure readiness for use.</li> <li>- Provide basic fire safety training to workers to ensure they have the knowledge and understanding to respond effectively and promptly.</li> </ul>	-	2	3	2 x 3 = 6	2 The acceptable level of risk requires a review of control measures.



#### 4.2.5.4 The Safety Management System

Due to the installation of dielectric and equipment inspection plan, the overvoltage system, ground connection and equipment inspection plan and over temperature protection. These systems will minimize the electrical shock and electrical arc. However, the project implementation can cause the hazard due to the human error, such as electrical shock because of the wet condition of the employees and equipment. The risk of electrical shock because of the wet condition of the employees and equipment is acceptable but the measures of control must be taken into consideration. Therefore, to prevent and minimize the impact, the project should prepare the measures to control, prevent and reduce the impact, prepare the management system and risk management during the operation and annually inspect the safety of the operation to ensure the safety for the personnel, communities and environment. Details are displayed in **Table 4.2.5-6**.

Additionally, the project have installed the standard equipment, namely, the lightning and surge protection device and DC short-circuit protection. Therefore, the risk of fire is minimized. The measures to prevent and minimize the impact for the safety of personnel, communities and environment are taking into consideration, such as, apply international standard equipment, prepare the maintenance plan and regularly test of the fire equipment, and hold the basic fire drill for the operators in case of emergency incidents. Details are displayed in **Table 4.2.5-6**.

**TABLE 4.2.5-6  
SAFETY MANAGEMENT PLAN (RISK MITIGATION PLAN)**

**Project** Solar power plants with photovoltaic technology or solar cells ground mounted type

**Objective** To mitigate the risk from electricity generation from solar cells

**Applied area** Electricity generation area of the project

No.	Risk mitigation measures / activities / operations	Responsible by	Implementing period	Monitored by	Remarks
<b>1</b>	<b>Operational safety</b>				
1.1	Personal Protective Equipment, e.g., helmets, safety gloves, safety shoes, etc., must always be used in the operation and must always be kept in ready-to-use condition.	Project staff	Throughout operation phase	Project's safety officer	-
1.2	Establish clear operational procedure for modules washing to ensure that the electricity is turned off before modules washing.	Assigned staff	Throughout operation phase	Project's safety officer	-
1.3	Organize a monitoring system for efficiency of electricity generation equipment and machinery as stated in the manufacturer's manual.	Assigned staff	Throughout operation phase	Engineer	-
1.4	Inspect performance and the availability of equipment used in both direct current and alternating current circuit breakers and the grounding system of various devices to ensure that the equipment is always be in good condition.	Assigned staff	Throughout operation phase	Engineer	-

**TABLE 4.2.5-6  
SAFETY MANAGEMENT PLAN (RISK MITIGATION PLAN) (CONT'D)**

<b>Project</b>	Solar power plants with photovoltaic technology or solar cells ground mounted type
<b>Objective</b>	To mitigate the risk from electricity generation from solar cells
<b>Applied area</b>	Electricity generation area of the project

No.	Risk mitigation measures / activities / operations	Responsible by	Implementing period	Monitored by	Remarks
1.5	Prepare a maintenance plan for equipment and machinery for safety operation throughout the period according to the manufacturer's specifications which are aligned with technical engineering and safety standards.	Assigned staff	Throughout operation phase	Engineer	-
1.6	Organize training about safety and the environment including safety and the environment practices for relevant staff as follows. - Safety system in workplace - Electrical and thermal hazard protection - Personal Protective Equipment utilizing - Safety procedure for each operational task	Project's safety officer	Throughout operation phase	Project's safety officer	-
1.7	Keep the workplace to be in safe environment by removing the obstructions and organize the workplace orderly to reduce the probability of critical hazards.	Assigned staff	Throughout operation phase	Project's safety officer	-
1.8	Organize activities to promote understanding in occupational health and safety.	Project's safety officer	Throughout operation phase	Project's safety officer	-

**TABLE 4.2.5-6  
SAFETY MANAGEMENT PLAN (RISK MITIGATION PLAN) (CONT'D)**

<b>Project</b>	Solar power plants with photovoltaic technology or solar cells ground mounted type
<b>Objective</b>	To mitigate the risk from electricity generation from solar cells
<b>Applied area</b>	Electricity generation area of the project

No.	Risk mitigation measures / activities / operations	Responsible by	Implementing period	Monitored by	Remarks
1.9	Investigate the root causes of the accident. Record the accident and root cause for further prevention and correction.	Assigned staff	Throughout operation phase	Project's safety officer	-
<b>2</b>	<b>Fire prevention measures</b>				
2.1	Inspect the availability of fire suppression equipment regularly. The equipment must always be in a ready-to-use condition.	Assigned staff	Throughout operation phase	Project's safety officer	-
2.2	Organize a fire drill so that staff can act appropriately in the case of an incident.	Assigned staff	Throughout operation phase	Project's safety officer	-

## 4.2.6 Climate Change Risk Assessment

### (1) Overview of Climate Change and Related Risks

Climate change refers to a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods (*Article 1, UNFCCC*). It is directly related to Greenhouse gas (GHG). GHG are those gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and emit radiation at specific wave-lengths within the spectrum of thermal infrared radiation emitted by the earth surface, the atmosphere itself, and by clouds causing greenhouse effect. The six main GHG emissions are Carbon dioxide (CO<sub>2</sub>), Methane (CH<sub>4</sub>), Nitrous oxide (N<sub>2</sub>O), Hydro fluorocarbons (HFCs), Per fluorocarbons (PFCs), and Sulphur hexafluoride (SF<sub>6</sub>).

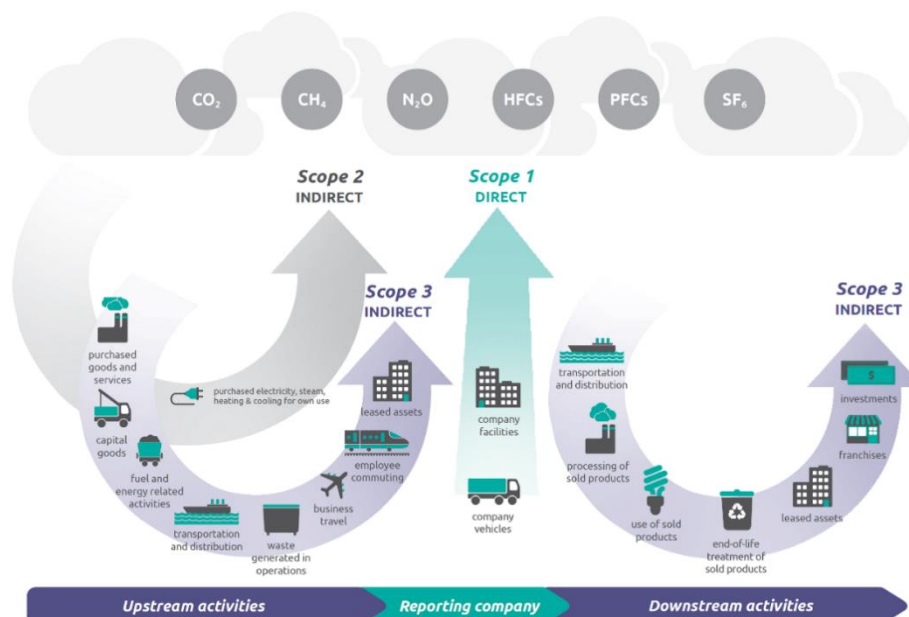
According to the GHG Protocol Corporate Standard, a company's greenhouse gas emissions are classified into three scopes are;

**Scope 1: Direct GHG Emissions** are direct emissions from owned or controlled sources.

**Scope 2: Indirect GHG Emissions** are indirect emissions from the generation of purchased energy.

**Scope 3: Other indirect GHG Emissions** are all indirect emissions (not included in scope 2) that occur in the value chain of the reporting company, including both upstream and downstream emissions.

The overview of scope and emission across a value chain are shown in **Figure 4.2.6-1**.



**FIGURE 4.2.6-1: OVERVIEW OF SCOPES AND EMISSIONS ACROSS A VALUE CHAIN**

## (2) Methodology of Climate Change Risk Assessment

The Climate Change Risk Assessment (CCRA) is the assessment of the probability or likelihood the climate change risks and their potential consequences or impacts with aims to prioritize the appropriate climate action and adaptation for the proposed project or development.

As stated in the Guidance Note on Climate Change Risk Assessment, May 2023, the Client should align the CCRA with Climate Physical Risk and Climate Transition Risk categories of the TCFD<sup>1</sup> as part of the ESIA or other Assessment.

The implementation of the Solar Development Solar Power Plant Project is categorized as “Category B” (Projects with potential limited adverse environmental and social risks and/or impacts that are few in number, generally site-specific, largely reversible and readily addressed through mitigation measures), a CCRA required under EP4 Principle 2 are as follows:

- Physical CCRA - For all Category A and, as appropriate, Category B Projects, and will include consideration of relevant physical risks.
- Transition CCRA and alternatives analysis - For all Projects, in all locations, when combined Scope 1 and Scope 2 emissions are expected to be more than 100,000 tonnes of CO<sub>2</sub> equivalent annually (100 ktpa CO<sub>2</sub>-eq). Consideration must be given to relevant Climate Transition Risks (as defined by the TCFD) and an alternatives analysis completed which evaluates lower GHG intensive alternative.

The Climate Change Risk Assessment matrix has been adopted from the *AZ 5334 – 2013: Climate Change Adaptation for Settlements and Infrastructure – A Risk Bases Approach*, which followed the *ISO 31000: 2009, Risk Management Principle and Guideline*. The 5×5 Risk Analysis Matrix has been used to estimate the level of the identified climate change risk, where the x-axis is the consequences impact and y-axis is the likelihood. (**Table 4.2.6-1**).

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<sup>1</sup> The climate change risk as recommended in the Task Force on Climate Related Financial Disclosures (TCFD) can be divided into 2 categories as following:

1) Physical Risks; those resulting from climate change can be event driven (acute) or longer-term shifts (chronic) in climate patterns.

2) Transitional Risks; that is a risk related to transitioning to a lower-carbon economy may entail extensive policy, legal, technology, reputation and market changes to address mitigation and adaptation requirements related to climate change.

**TABLE 4.2.6-1  
CLIMATE CHANGE RISK ASSESSMENT MATRIX**

Likelihood	Consequence				
	Insignificant	Minor	Moderate	Major	Catastrophic
Almost Certain	L	M	H	E	E
Likely	L	M	M	H	E
Moderate	L	L	H	H	E
Unlikely	L	L	M	M	H
Very Unlikely	L	L	L	M	M

**Risk Consequence Ranking:**

- E = Extreme Risk, requiring immediate action.
- H = High risk, requiring detailed research and planning at senior management level.
- M = Moderate risk, requiring change to design standards and maintenance of assets.
- L = Low risk, requiring action through routine maintenance of assets.

**Source:** Adopted from AS5334:2013 Climate change adaptation for settlements and infrastructure

The description of likelihood and consequences impacts are shown in **Table 4.2.6-2** and **Table 4.2.6-3** respectively.

**TABLE 4.2.6-2  
THE DESCRIPTION OF LIKELIHOOD OF OCCURRENCES ON RECURRENT AND FREQUENCY**

Likelihood of Occurrences	Description	Recurrent or Event Risks	Long Term Risks
Almost Certain	Could occur several times per year	Has happened several times in the past year and in each of the previous 5 years; or could occur several times per year	Has a greater than 90% chance of occurring in the identified time period if the risk is not mitigated
Likely	May arise about once per year	Has happened at least once in the past year and in each of the previous 5 years, or may arise about once per year	Has a 60 – 90% chance of occurring in the identified time period if the risk is not mitigated
Moderate	Maybe a couple of times in a generation	Has happened during the past 5 years but not in every year, or May arise once in 25 years	Has a 40 – 60% chance of occurring in the identified time period if the risk is not mitigated
Unlikely	Maybe once in a generation	May have occurred once in the last 5 years, or may arise once in 25 to 50 years	Has a 10 – 30% chance of occurring in the future if the risk is not mitigated
Rare	Maybe once in a lifetime	Has not occurred in the past 5 years; or unlikely during the next 50 years	May occur in exceptional circumstances, i.e. less than 10% chance of occurring in the identified time period if the risk is not mitigated

**Source:** Adopted from AS5334:2013 Climate change adaptation for settlements and infrastructure



**TABLE 4.2.6-3**  
**THE DESCRIPTION OF LEVEL OF CONSEQUENCES ON CONCERNED SECTORS**

<b>Level Consequence</b>	<b>Infrastructure, Service</b>	<b>Social / Cultural</b>	<b>Environmental</b>
Insignificant	No infrastructure damage, no change to service.	No adverse human health effects.	No adverse effects on natural environment
Minor	Localized infrastructure service disruption. No permanent damage. Some minor restoration work required. Early renewal of infrastructure by 10 - 20%. Need for new/modified ancillary equipment.	Short-term disruption to employees, customers or neighbors. Slight adverse human health effects or general amenity issues.	Minimal effects on the natural environment.
Moderate	Limited infrastructure damage and loss of service. Damage recoverable by maintenance and minor repair. Early renewal of infrastructure by 20 - 50%.	Frequent disruptions to employees, customers, or neighbours. Adverse human health effects.	Some damage to the environment, including local ecosystems. Some remedial action may be required.
Major	Extensive infrastructure damage requiring major repair. Major loss of infrastructure service. Early renewal of infrastructure by 50 - 90%.	Permanent physical injuries and fatalities may occur. Severe disruptions to employees, customers or neighbours.	Significant effect on the environment and local ecosystems. Remedial action likely to be required.
Catastrophic	Significant permanent damage and/or complete loss of the infrastructure and the infrastructure service. Loss of infrastructure support and translocation of service to other sites. Early renewal of infrastructure by 90%.	Severe adverse human health effects, leading to multiple events of total disability or fatalities. Total disruption to employees, customers or neighbours. Emergency response at a major level.	Very significant loss to the environment. May include localized loss of species, habitats or ecosystems. Extensive remedial action essential to prevent further degradation. Restoration likely to be required.

**Source:** Adopted from AS5334:2013 Climate change adaptation for settlements and infrastructure

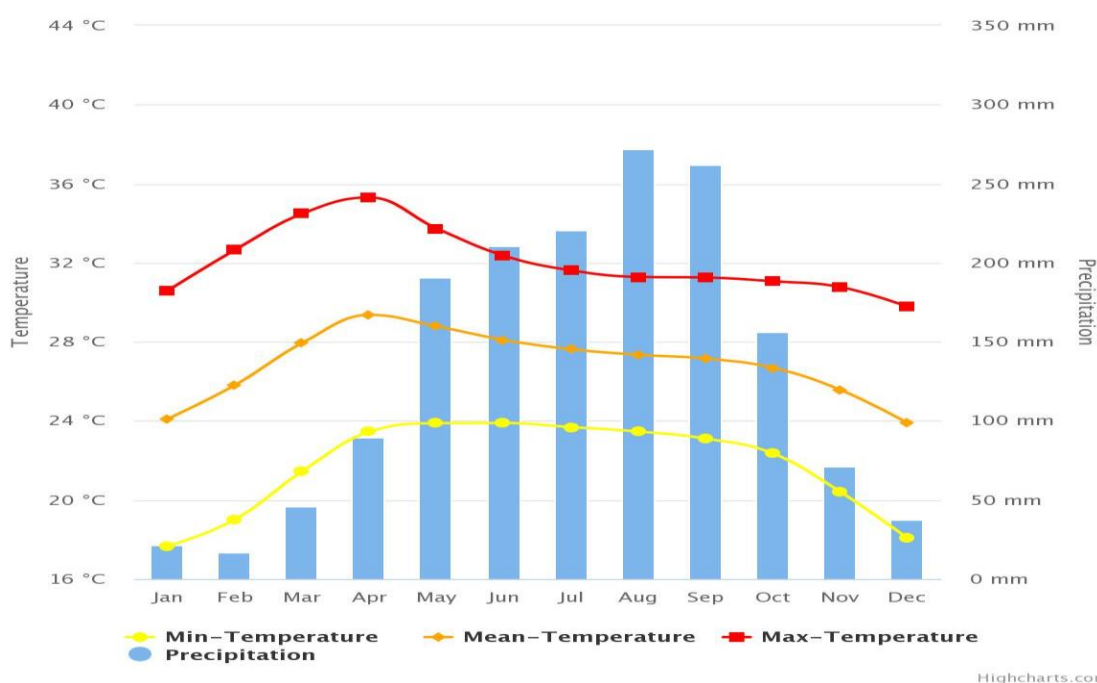
### (3) Baseline Climate Change Data of Thailand

Thailand has a tropical climate influenced by the southwest (SW) and Northeast (NE) monsoons. There are 2 distinct seasons are; Rainy Season: normally from May to October and Dry Season: normally from November to April.

During rainy season, the SW monsoon brings warm and humidity air from the Indian Ocean towards Thailand, causing abundant rainfall over the country. The average annual rainfall is approximately 1,500 mm. intense rainfall usually occurs during August to September, which correspond to the final period of the SW monsoon, cyclones, and also typhoons, with approximately 250-270 mm rainfall recorded during these months.

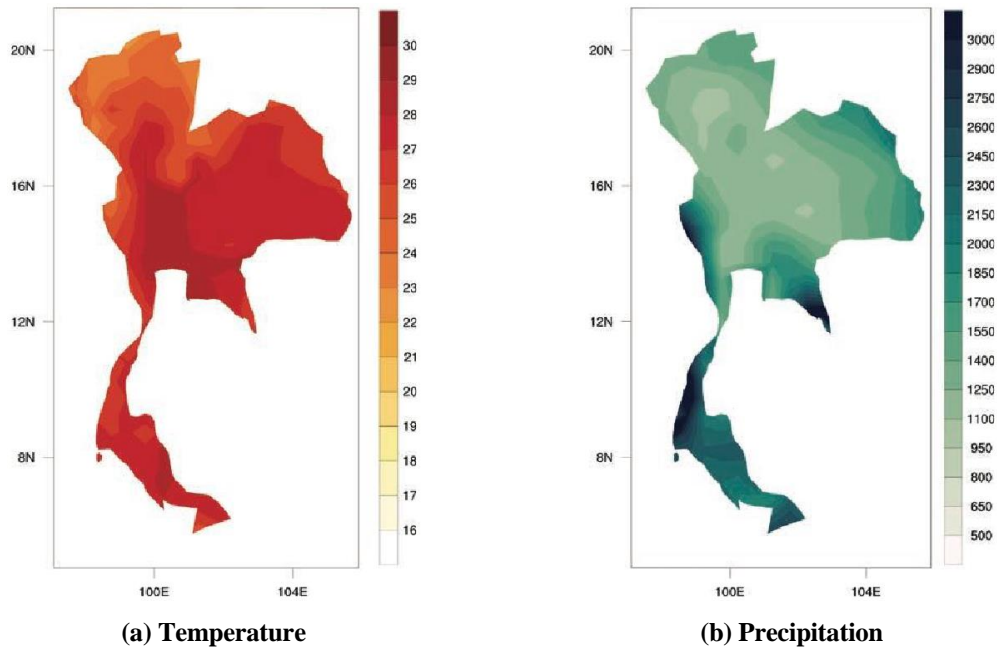
During dry season, the NE monsoon, brings cold and dry air from the anticyclone in China over Thailand. The weather condition is relatively dry and cool. The coolest temperature is found in January. During March to May, the transitional period from the NE monsoon to SW monsoon, the air mass movements bring warm air to the Thailand from a southeast direction, the weather is relatively warm and humid. The hottest temperature is found in April.

The monthly climatology of Thailand during 1991-2020 is shown in **Figure 4.2.6-2**, the mean annual temperature is approximately 26.3 °C. The mean monthly temperature ranged from 23.9-29.4 °C, the min-monthly temperature ranged from 17.7-23.9 °C, and the max-monthly temperature ranged from 29.8-35.3°C, approximately. The annual rainfall is approximately 1,500 mm. and the average monthly rainfall ranged from 16.6-271.5 mm. The spatial differences of observed historical temperature and rainfall in Thailand is shown in **Figure 4.2.6-3**.



Source: Climate Risk Country Profile: Thailand (Asian Development Bank, 2021)

**FIGURE 4.2.6-2: AVERAGE MONTHLY TEMPERATURE AND MONTHLY RAINFALL IN THAILAND DURING 1991-2020**



Source: Climate Risk Country Profile: Thailand (Asian Development Bank, 2021)

**FIGURE 4.2.6-3 : THE VARIATION OF TEMPERATURE AND PRECIPITATION ACROSS THAILAND**

#### **(4) Projected Climate Change Data**

The Intergovernmental Panel on Climate Change (IPCC) has developed four Representative Concentration Pathways (RCP) (i.e. RCP2.6, RCP4.5, RCP6.0, and RCP8.5) used for climate modeling and research for the IPCC Fifth Assessment Report (AR5) in 2014. The pathways describe the different future climate depending on the volume of GHG emitted in the coming year. In this report, RCP2.6 and RCP8.5, the extremes of low and high emissions pathways, are the primary focus RCP2.6 represents a very strong mitigation scenario, whereas RCP8.5 assumes business-as-usual scenario.

The results from IPCC modelled show a trend of consistent warming and an increase in the intensity of heavy precipitation periods and extreme events in Thailand. The projected temperature under RCP 2.6 and RCP 8.5 are shown in **Table 4.2.6-4** to **Table 4.2.6-5**.

**TABLE 4.2.6-4**  
**PROJECTED ANOMALY FOR DAILY TEMPERATURES IN THAILAND**  
**DURING 2040-2059 AND 2080-2099 FOR RCP 2.6 AND RCP 8.5**

Unit: °C

Scenario	Average Daily Maximum Temperature		Average Daily Temperature		Average Daily Minimum Temperature	
	2040-2059	2080-2099	2040-2059	2080-2099	2040-2059	2080-2099
RCP2.6 (Atmospheric concentration of CO <sub>2</sub> projected at approx. 420 ppm by 2100)	1.0 (-0.6-2.9)	1.1 (-0.6-3.0)	1.0 (-0.3-2.4)	1.1 (-0.2-2.5)	1.0 (-0.1-2.2)	1.1 (-0.2-2.4)
RCP8.5 (Atmospheric concentration of CO <sub>2</sub> projected at approx. 940 ppm by 2100 and continuing to increase.)	1.7 (0.0-3.6)	3.6 (1.6-6.1)	1.8 (0.4-3.2)	3.8 (2.0-5.8)	1.9 (0.5-3.2)	3.9 (2.2-5.9)

Source: Climate Risk Country Profile: Thailand (Asian Development Bank, 2021)

**TABLE 4.2.6-5**  
**PROJECTED ANOMALYF AVERAGE MONTHLY TEMPERATURE**  
**IN THAILAND DURING 2040-2059 AND 2080-2099 FOR RCP 2.6 AND RCP 8.5**

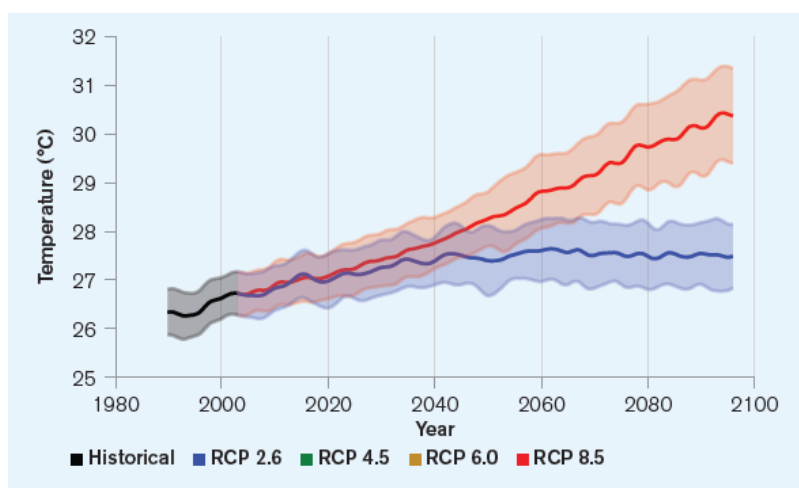
Unit: °C

Scenario	2040–2059		2080–2099	
	Jun-Aug	Dec-Feb	Jun-Aug	Dec-Feb
RCP2.6 (Atmospheric concentration of CO <sub>2</sub> projected at approx. 420 ppm by 2100)	1.0 (0.2-2.0)	1.0 (-0.6-2.6)	1.0 (0.1-2.0)	1.1 (-0.4-2.6)
RCP8.5 (Atmospheric concentration of CO <sub>2</sub> projected at approx. 940 ppm by 2100 and continuing to increase.)	1.6 (0.6-2.8)	1.9 (0.1-3.4)	3.5 (2.4-5.4)	3.8 (1.4-6.1)

Source: Climate Risk Country Profile: Thailand (Asian Development Bank, 2021)

*In terms of Temperature Scenario*, under the RCP2.6 and RCP8.5, the average daily temperatures are projected to increase by 1.1 and 3.8°C by the 2080s, respectively (See **Table 4.2.6-4**). Increasing of the average monthly temperature is lower than average daily temperature, under the RCP8.5 by the 2080s, the average monthly temperatures are projected to increase by 3.5-3.8 °C, and approximately 1.0-1.1 °C under the RCP2.6 (See **Table 4.2.6-5**).

**Figures 4.2.6-4** show the annual average temperature projections under RCP2.6 and RCP8.5, the rises in annual temperature is expected to be slower than the daily and monthly temperature. The projected temperature under RCP2.6 and RCP8.5 are expected to 27.4 and 30.0 °C, approximately. (Increase by 1.1 and 3.7 °C under RCP2.6 and RCP8.5).



Source: Climate Risk Country Profile: Thailand (Asian Development Bank, 2021)

**FIGURE 4.2.6-4 : HISTORIC AND PROJECTED AVERAGE ANNUAL MEAN TEMPERATURE IN THAILAND UNDER RCP2.6 (BLUE) AND RCP8.5 (RED) SCENARIOS**

*In terms of Cyclones, Storm Surge, and Coastal Zone*, climate change is expected to interact with cyclone hazard in complex ways. Climate change caused the sea-level rise and coastal inundation to enhance the cyclone and induced storm surge, and possible to increasing wind speed and rainfall or precipitation intensity. Moreover, the extreme rainfall events (greater than 100 mm/day) are likely to more frequent, the typhoons reaching Thailand in between 2013-2043 are expected to be increased, but the number of monsoon storms are projected to stay relatively stable.

***In terms of Flood,***

Paltan et al. (2018) demonstrate that even under lower emissions pathways coherent with the Paris Climate Agreement almost all Asian countries face an increase in the frequency of extreme river flows. What would historically have been a 1 in 100-year flow, could become a 1 in 50-year or 1 in 25-year event in most of South, Southeast, and East Asia.

**(5) Projected GHG Emissions from Project Implementation**

The GHG emissions related to the Project as defined in Scope 1 and Scope 2 of each implementation phase can be calculated as following.

**A. Projected GHG Emissions during Construction Phase**

The source of GHG emission during this phase are

**1) The Fossil Fuel Combustion for Construction Equipment/ Machine:**

The operation of diesel combustion engine of construction equipment/machine such as backhoe, vibrator roller, grader, tractor, and, etc. covering 14 months during construction phase would be emitted GHG emission including carbon dioxide (CO<sub>2</sub>) and methane (CH<sub>4</sub>).The quantities of GHGs emissions could be estimated from information on the number, diesel consumption rate, their operation hours, and Emission Factor by using the equation as follows;

$$\text{GHG} = E \times C \dots\dots\dots (1)$$

Where

- GHG = GHGs Emissions (kg CO<sub>2</sub>e /year)
- E = Emission factor (kg CO<sub>2</sub>e/litre)
- = 2.9793 kg CO<sub>2</sub>e/litre (Off-road (Emission Factor for Mobile Combustion (Off road) from TGO (IPCC Vol.2 table 3.3.1, DEDE)
- C = Fuel consumption rate (litre/year)

The construction equipment/machines used in the construction activities and their number, operation hour, fuel type, fuel consumption rate, and amount of fuel consumed are summarized in **Table 4.2.6-6**.

Using Equation (1) and amount of fuel consumed in **Table 4.2.6-6**, the GHG emissions from the diesel combustion of construction equipment/machine in 2023 to 2024 is approximately 282,368-3,572,245 kg CO<sub>2</sub>e /year or 282.37-3,572.24 tonne CO<sub>2</sub>e /year.

**TABLE 4.2.6-6**  
**DETAILS OF CONSTRUCTION EQUIPMENT/MACHINE USED IN PROJECT CONSTRUCTION PHASE**

Item	Description	HP	Fuel Consumption Rate (L/hp/hr)	Loading Factor (%)	Working Hour (hr/day)	Number of Construction Equipment (Unit)														Total Working Hour (hr.) <sup>1/</sup>		Fuel Consumed (L)	
						2023		2024												2023	2024	2023	2024
						Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec				
1	Truck & Crane 5 T	240	0.1814	0.50	8	1	2	2	4	6	6	6	6	6	6	3	3	3	2	528	9,328	11,494	203,052
2	Rough terrain Crane 25 T.	250	0.1814	0.50	8	-	1	1	1	1	1	1	1	1	1	1	1	1	1	176	2,112	3,991	47,890
3	Rough terrain Crane 60 T.	350	0.1814	0.50	8	-	-	-	-	-	-	1	1	1	-	-	-	-	-	-	528	-	16,761
4	Rough terrain Crane 200 T.	450	0.1814	0.50	8	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	176	-	7,183
5	Fork Lift 2.5-3 T.	100	0.1814	0.50	8	-	-	-	-	6	6	6	6	6	6	4	-	-	-	-	7,040	-	63,853
6	Excavator PC 20-60	28	0.1814	0.70	8	2	2	2	8	8	8	8	8	8	8	3	3	2	2	704	11,968	2,503	42,552
7	Excavator PC 100-120	90	0.1814	0.70	8	-	1	2	2	2	2	2	2	2	2	1	1	-	-	176	3,168	2,011	36,205
8	Excavator PC 200	158	0.1814	0.70	8	4	6	6	6	6	4	4	4	2	2	2	2	-	-	1,760	6,688	35,311	134,180
9	Back Hoe Loader	92	0.1814	0.70	8	-	1	1	1	1	1	1	1	1	1	1	1	1	-	176	1,936	2,056	22,617
10	Vibrator Roller 10T	112	0.1814	0.70	8	-	2	5	5	5	3	3	3	3	-	-	-	-	-	352	4,752	5,006	67,582
11	Grader	230	0.1814	0.70	8	1	2	3	3	3	2	2	2	2	-	-	-	-	-	528	2,992	15,420	87,383
12	Tractor (D2)	100	0.1814	0.70	8	2	2	2	2	2	-	-	-	-	-	-	-	-	-	704	1,056	8,939	13,409
13	Farm Tractor	90	0.1814	0.70	8	2	2	2	2	2	-	-	-	-	-	-	-	-	-	704	1,056	8,045	12,068
14	Pile Driving Machine	284	0.1814	0.70	8	-	-	-	14	14	14	14	14	14	-	-	-	-	-	-	12,320	-	444,288
<b>Total</b>																				<b>5,808</b>	<b>65,120</b>	<b>94,777</b>	<b>1,199,021</b>

Source : Solar Development Co.,Ltd., 2023

Remark: 1/ Assumed working day is 22 day/month



**2) The Fossil Fuel Combustion for Vehicle Transportation:**

Transportation activities during the construction phase mainly are transportation of construction material, water, and construction workers. The number of transportation during this phase are summarized in **Table 4.8-7**. The quantities of GHGs emissions could be estimated by using the equation (2) and (3) as follows;

$$\text{GHG} = E \times \text{TVM} \dots\dots\dots(2)$$

Where

- GHG = GHGs Emissions (kg CO<sub>2</sub>e /year)
- E = Emission factor (kg CO<sub>2</sub>e/TKM)
- TKM = Tonne-kilometer in transport

$$\text{GHG} = E \times \text{km} \dots\dots\dots(3)$$

Where

- GHG = GHGs Emissions (kg CO<sub>2</sub>e /year)
- E = Emission factor (kg CO<sub>2</sub>e/km)
- km = kilometer in transport for empty vehicle

Using Equation (2) and (3), and assumed the working day of 22 day/month, the GHG emissions from the diesel combustion of transportation vehicle during construction phase is approximately 19,025-253,834 kg CO<sub>2</sub>e/year or 19.02-253.83 tonne CO<sub>2</sub>e/year. Details are shown in **Table 4.2.6-7**.

**3) Electricity Consumption :**

Electricity consumption during the construction phase is approximately 119,520 kWh/year which supplied from the Provincial Electricity Authority, Lao Khwan District Branch, Kanchanaburi. Therefore, the GHG emissions from the electric consumption in construction site and worker campsite could be calculated by using equation (4) as follow;

$$\text{GHG} = E \times C \dots\dots\dots(4)$$

Where;

- GHG = GHG emissions (kg CO<sub>2</sub>e/year)
- E = Emission factor (kg CO<sub>2</sub>e/kWh)
- = 0.4999 kg CO<sub>2</sub>e/kWh (Emission factor for electricity generation of grid mix from Thai National LCI Database, TIIS-MTEC-NSTDA (with TGO electricity 2016-2018)
- C = Electricity consumption (kWh/year)
- Thus; GHG = 0.4999 kg CO<sub>2</sub>e/kWh × 119,520 kWh/year
- = 59,748 kg CO<sub>2</sub>e/year
- = 59.75 tonne CO<sub>2</sub>e/year

**TABLE 4.2.6-7**  
**GHG EMISSIONS FROM DIESEL COMBUSTION OF TRANSPORTATION VEHICLE**

Item	Description	Weight (T)	Distance (km/day)	TKM at 100 % Load	Emission Factor		2023			2024												GHG Emitted (kg CO <sub>2</sub> e/year)		
					100 % Load Truck kgCO <sub>2</sub> e /tkm	Empty Truck kgCO <sub>2</sub> e /km	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2023	2024	Total
1	Truck 6 wheels	8.5	60	510	0.0653	0.4069			1	1	4	6	6	6	6	6	6	6	4	4	2	635	36,189	36,823
2	Dump Truck 10 wheels	16.0	60	960	0.0454	0.5747		3	4	6	6	6	6	6	6	2	1	1	1	1	1	6,011	36,925	42,936
3	Truck 22 wheels	32.0	60	1,920	0.0459	1.0206							1	1	1	1						0	6,572	6,572
4	Water Truck 10 wheels	16.0	60	960	0.0454	0.5747		1	1	2	3	3	3	3	3	3	3	3	2	2	1	1,717	26,621	28,338
5	Light Truck 4 wheels	1.5	250	375	0.2706	0.2415			2	3	3	3	3	3	3	3	3	3	3	3	2	3,561	62,312	65,873
6	Light Truck 4 wheels	1.5	250	375	0.2706	0.2415			2	2	2	2	2	2	2	2	2	2	2	2	2	3,561	42,728	46,289
7	Light Truck 4 wheels	1.5	200	300	0.2706	0.2415			1	1	1	1	1	1	1	1	1	1	1	1	1	1,424	17,091	18,516
8	Minibus 6 wheels	8.5	200	1,700	0.0653	0.4069			1	1	1	1	1	1	1	1	1	1	1	1	1	2,116	25,395	27,512
<b>Total</b>																					<b>19,025</b>	<b>253,834</b>	<b>272,859</b>	

Source : Solar Development Co.,Ltd., 2023

Remark: 1/ Assumed working day is 22 day/month

#### 4) Wastewater Treatment System

The wastewater generated from the consumption of construction workers (Maximum at 1,297 workers) during this phase is 72.63 m<sup>3</sup>/ day. The Project will treat wastewater using a septic tank provided by the contractor.

The related GHG emission from the septic tank are CO<sub>2</sub> and CH<sub>4</sub>. However, CO<sub>2</sub>, a biogenic origin which is not considered in the IPCC Guidelines, therefore, the GHG emission relevant to domestic wastewater is only CH<sub>4</sub>.

The calculation of CH<sub>4</sub> emission could be adopted *Equation 6.1* to *Equation 6.3* in the IPCC 2006 Guidelines as follows;

$$\text{CH}_4 = [\sum_{i,j} (U_i \times T_{i,j} \times \text{EF}_j)] \times (\text{TOW} - \text{S}) - \text{R} \dots (5)$$

Where;

- CH<sub>4</sub> = CH<sub>4</sub> emissions in inventory year, kg CH<sub>4</sub>/year
- TOW = Total organics in wastewater removed in inventory year, kg BOD/year
- S = Organic component removed as sludge in inventory year, kg BOD/year
- = 0 (No removed)
- EF<sub>j</sub> = Emission factor, kg CH<sub>4</sub> / kg BOD
- R = Amount of CH<sub>4</sub> recovered in inventory year, kg CH<sub>4</sub>/year
- = 0 (No recovered)

However, above equation is employed for country or national context, and considered in fraction of population in income group (U<sub>i</sub>) and degree of utilization of treatment/discharge pathway or system (T<sub>i,j</sub>). For this Project, the temporary wastewater treatment system will provided for treat wastewater from worker consumption and canteen. Therefore, U<sub>i</sub> and T<sub>i,j</sub> equal to 100% or 1.

$$\text{EF}_j = \text{B}_0 \times \text{MCF}_j \dots (6)$$

Where

- EF<sub>j</sub> = Emission factor, kg CH<sub>4</sub>/kg BOD
- B<sub>0</sub> = maximum CH<sub>4</sub> producing capacity, kg CH<sub>4</sub>/kg BOD
- = 0.60 CH<sub>4</sub>/kg BOD or 0.25 kg CH<sub>4</sub>/kg COD
- MCF<sub>j</sub> = Methane correction factor (fraction)
- = 0.50
- Therefore, = 0.60 CH<sub>4</sub>/kg BOD × 0.50
- EF<sub>j</sub> = 0.30 CH<sub>4</sub>/kg BOD

$$\text{TOW} = \text{P} \times \text{BOD} \times 0.001 \times \text{I} \times 264^2 \dots \dots \dots (7)$$

Where;

- TOW = Total organics in wastewater in inventory year, kg BOD/year
- P<sup>3</sup> = Country population in inventory year, (person)
- P = 1,297 persons (Construction phases)
- BOD = Country-specific per capita BOD in inventory year, g/person/day, See Table 6.4 in IPCC2006 Guideline.
- P = 40 g/person/day
- 0.001 = Conversion from grams BOD to kg BOD
- I = Correction factor for additional industrial BOD discharged into sewers (for collected the default is 1.25, for uncollected the default is 1.00.)

Therefore, = 1,297 persons × 40  
TOW = g/person/day × 0.001 × 1.00 × 264  
= 13,696.32 kg BOD/year

Using Equation (2), the CH<sub>4</sub> emissions in inventory year is

$$\begin{aligned} \text{CH}_4 &= [\sum_{i,j} (1 \times 1 \times 0.30)] \times (13,696.32 - 0) \\ &= 0.30 \times 13,696.32 \\ &= 4,108.90 \text{ kg CH}_4/\text{year} \end{aligned}$$

According to the IPCC Fifth Assessment Report (AR6), the 100-year Global Warming Potential (GWP) of methane gas from non-fossil origin is 27.2. Therefore, the CH<sub>4</sub> emissions from the wastewater treatment system could be report in CO<sub>2</sub> equivalent (CO<sub>2</sub>-eq) term as 111,762 kg CO<sub>2</sub>-eq /year or 111.76 tonne CO<sub>2</sub>-eq /year.

**B. Projected GHG Emissions during Operation Phase**

The source of GHG emission during this phase are

**1) The Fossil Fuel Combustion :**

During this phase, it expected that approximately 5 full-time working staff, while 20 persons will work for PV module cleaning twice a year. A few of van, passenger car, and pick-up truck may be used for plant visit, operation and maintenance. Therefore, the GHG emission from the fossil fuel combustion of transportation vehicle could be very limited and negligible.

<sup>2</sup> Based on Project working day during construction phase

<sup>3</sup> P in above equation is employed for country or national context. For this Project, P is the number of construction workers during construction phase and project staffs during operation phase.

## 2) Electricity Consumption :

Electricity consumption during the operation phase is approximately 1,200,000 kWh/year which supplied from the Provincial Electricity Authority, Lao Khwan District Branch, Kanchanaburi. It used for lighting and office area. Therefore, the GHG emissions from the electric consumption in construction site and worker campsite could be calculated by using equation (4) as follow;

$$\begin{aligned} \text{GHG} &= 0.4999 \text{ kg CO}_2\text{e/kWh} \times 1,200,000 \text{ kWh/year} \\ &= 599,880 \text{ kg CO}_2\text{e/year} \\ &= 599.88 \text{ tonne CO}_2\text{e/year} \end{aligned}$$

## 3) Wastewater Treatment System

The wastewater generated from the consumption of construction workers (Maximum at 25 staff during PV module cleaning) during this phase is 1.40 m<sup>3</sup>/ day. The Project will treat wastewater using a septic tank.

The calculation of CH<sub>4</sub> emission could be adopted Equation (5) to (7) similar to construction phase. Therefore;

$$\text{CH}_4 = [\sum_{i,j} (U_i \times T_{i,j} \times EF_j)] \times (\text{TOW}-\text{S})-\text{R} \dots \dots (5)$$

Where;

$$\begin{aligned} \text{CH}_4 &= \text{CH}_4 \text{ emissions in inventory year, kg CH}_4\text{/year} \\ \text{TOW}_1 &= \text{Total organics in wastewater removed in inventory year, kg BOD/year} \\ &= 5 \text{ persons} \times 40 \text{ g/person/day} \\ &\quad \times 0.001 \times 1.00 \times 365 \\ &= 73 \text{ kg BOD/year} \\ \text{TOW}_2 &= \text{Total organics in wastewater removed in inventory year, kg BOD/year} \\ &= 20 \text{ persons} \times 40 \text{ g/person/day} \\ &\quad \times 0.001 \times 1.00 \times 60 \\ &= 48 \text{ kg BOD/year} \\ \text{S} &= \text{Organic component removed as sludge in inventory year, kg BOD/year} \\ &= 0 \text{ (No removed)} \\ \text{EF}_j &= \text{Emission factor, kg CH}_4 \text{ / kg BOD} \\ &= 0.60 \text{ CH}_4\text{/kg BOD} \times 0.50 \\ &= 0.30 \text{ CH}_4\text{/kg BOD} \\ \text{R} &= \text{Amount of CH}_4 \text{ recovered in inventory year, kg CH}_4\text{/year} \\ &= 0 \text{ (No recovered)} \end{aligned}$$

$$\begin{aligned}
 \text{Thus, CH}_4 &= [\sum_{i,j} (1 \times 1 \times 0.30)] \times ((73+48)-0)-0 \\
 &= 0.30 \times 121 \\
 &= 36.30 \text{ kg CH}_4/\text{year} \\
 \text{And, GHG} &= 987 \text{ kg CO}_2\text{-eq /year} \\
 &= 0.99 \text{ tonne CO}_2\text{-eq /year.}
 \end{aligned}$$

#### 4) Avoided GHG Emissions

The Solar Development Solar Power Plant Project is a non-combustion power plant that generates electric power from solar energy using photovoltaic technology or solar cells installed on the ground with an energy storage system. It generate electricity from the renewable energy sources that will substitute the electricity generated from the fossil fuel combustion. The installed capacity is 162.129 MW with an average annual energy output of 247.985 GWh or  $247.985 \times 10^6$  kWh. All generated electricity is expected to sell to EGAT. Under 25 year-agreement. The total avoided GHG emission could be calculated by using equation (5) as follows;

$$\text{GHG} = E \times C \dots\dots\dots(5)$$

Where;

$$\begin{aligned}
 \text{GHG} &= \text{GHG emissions (kg CO}_2\text{e/year)} \\
 E &= \text{Emission factor (kg CO}_2\text{e/kWh)} \\
 &= 0.5986 \text{ kg CO}_2\text{e/kWh (Emission factor for} \\
 &\quad \text{electricity generation of grid mix from Thai} \\
 &\quad \text{National LCI Database, TIIS-MTEC-NSTDA} \\
 &\quad \text{(with TGO electricity 2016-2018)} \\
 C &= \text{Electricity consumption (kWh/year)} \\
 &= 247.985 \times 10^6 \text{ kWh} \\
 \text{Thus; GHG} &= 0.5986 \text{ kg CO}_2\text{e/kWh} \times 247.985 \times 10^6 \\
 &\quad \text{kWh/year} \\
 &= 148,443,821.00 \text{ kg CO}_2\text{e/year} \\
 &= 148,443.82 \text{ tonne CO}_2\text{e/year}
 \end{aligned}$$

#### C. Net GHG Emissions

Net annual GHG emissions during construction and operation phases are summarized in **Table 4.2.6-8**, the highest GHG emitted is estimated at 3,997.59 tonne CO<sub>2</sub>-eq/year during construction phase, while the avoided GHG is estimated at -148,443.82 tonne CO<sub>2</sub>-eq/year throughout the operation phase. Therefore, the project caused the positive impact to climate change and the “Transition Risks” is no need to consider.

**TABLE 4.2.6-8**  
**NET GHG EMISSIONS FROM SOLAR DEVELOPMENT SOLAR**  
**POWER PLANT DURING CONSTRUCTION AND OPERATION PHASES**

Year	GHG Emission in Scope 1 and 2 (CO <sub>2</sub> e/year)					
	Fossil Fuel Combustion		Electricity Consumption	Wastewater Treatment	Avoided GHG Emissions	Total
	Construction Equipment	Transportation Vehicle				
<b>Construction Phase</b>						
1	282.37	19.03	0.00	0.00	0.00	301.39
2	3,572.24	253.83	59.75	111.76	0.00	3,997.59
<b>Operation Phase</b>						
1	0.00	0.00	599.88	0.99	-148,443.82	-147,842.95
2	0.00	0.00	599.88	0.99	-148,443.82	-147,842.95
3	0.00	0.00	599.88	0.99	-148,443.82	-147,842.95
4	0.00	0.00	599.88	0.99	-148,443.82	-147,842.95
5	0.00	0.00	599.88	0.99	-148,443.82	-147,842.95
6	0.00	0.00	599.88	0.99	-148,443.82	-147,842.95
7	0.00	0.00	599.88	0.99	-148,443.82	-147,842.95
8	0.00	0.00	599.88	0.99	-148,443.82	-147,842.95
9	0.00	0.00	599.88	0.99	-148,443.82	-147,842.95
10	0.00	0.00	599.88	0.99	-148,443.82	-147,842.95
11	0.00	0.00	599.88	0.99	-148,443.82	-147,842.95
12	0.00	0.00	599.88	0.99	-148,443.82	-147,842.95
13	0.00	0.00	599.88	0.99	-148,443.82	-147,842.95
14	0.00	0.00	599.88	0.99	-148,443.82	-147,842.95
15	0.00	0.00	599.88	0.99	-148,443.82	-147,842.95
16	0.00	0.00	599.88	0.99	-148,443.82	-147,842.95
17	0.00	0.00	599.88	0.99	-148,443.82	-147,842.95
18	0.00	0.00	599.88	0.99	-148,443.82	-147,842.95
19	0.00	0.00	599.88	0.99	-148,443.82	-147,842.95
20	0.00	0.00	599.88	0.99	-148,443.82	-147,842.95
21	0.00	0.00	599.88	0.99	-148,443.82	-147,842.95
22	0.00	0.00	599.88	0.99	-148,443.82	-147,842.95
23	0.00	0.00	599.88	0.99	-148,443.82	-147,842.95
24	0.00	0.00	599.88	0.99	-148,443.82	-147,842.95
25	0.00	0.00	599.88	0.99	-148,443.82	-147,842.95
<b>Total</b>	<b>3,854.61</b>	<b>272.86</b>	<b>15,056.75</b>	<b>136.45</b>	<b>-3,711,095.53</b>	<b>-3,691,774.86</b>

**(6) Results of Climate Change Risk Assessment**

The results of physical climate change risk assessment include: storms, and floods are shown in **Table 4.2.6-9**.

**TABLE 4.2.6-9  
RESULT OF CLIMATE CHANGE RISK ASSESSMENT**

NO.	Potential Risk/ Potential Causes	Risk Evaluation		
		Likelihood	Severity	Risk
1	<p>Storm and Heavy Rain</p> <ul style="list-style-type: none"> <li>– Climate change expected to enhance the cyclone, and possible to increasing wind speed and rainfall or precipitation intensity. Moreover, the extreme rainfall events are likely to more frequent</li> <li>– The typhoons reaching Thailand in between 2013-2043 are expected to be increased, but the number of monsoon storms are projected to stay relatively stable.</li> <li>– The structure of PV Solar structure is design in accordance with DPT. 1311-50 standard, and could be tolerate for wind speed at 30 m/s or 108 km/hr. (the wind speed of storm is range from 89-102 km/hr.)</li> </ul>	Unlikely	Minor	Low
2	<p>Flood</p> <ul style="list-style-type: none"> <li>– Under lower emissions pathways coherent with the Paris Climate Agreement almost all Asian countries face an increase in the frequency of extreme river flows. What would historically have been a 1 in 100-year flow, could become a 1 in 50-year or 1 in 25-year event in most of South, Southeast, and East Asia. (Paltan et al. (2018))</li> <li>– Based on the secondary data collection from the Natural Disaster Prevention and Agricultural Risk Group, Land Use Policy and Planning Department, Department of Land Development (2013), the Project area locate in low flooding risk area (Less than 3 time in 10 year period).</li> </ul>	Unlikely	Minor	Low



### 4.2.7 Human Rights Risk And Impact Assessment

Inherent human right risk assessment specifies the Human Rights risks to which the project is connected based on severity and likelihood, noting where risks intersect or are interrelated, and emphasizing which vulnerable people/groups may be at risk (e.g., Indigenous Peoples; women; national persons with disabilities; and migrant workers and their families). The methods used to conduct the human rights impact assessment (HRIA) are set out in **Appendix 4-1**. The result of the assessment of inherent right risk is shown in **Table 4.2.7-1**.

There is a possibility of human rights implications arising from the development of the project, particularly during the construction phase. The workers have direct association with risk issue such as occupational health and safety, discrimination, wages and working hours. Residual risk assessment evaluates the potential risks with mitigation measures that project have in place. The result of assessment of residual risk is shown in **Table 4.2.7-2**.

As a summary or conclusion of the HRIA, the project includes both inherent and residual human rights impacts, which are assessed as low and medium in nature after mitigation. The key risk area is related to community and worker safety, which is addressed comprehensively as part of the mitigation plans in this IEE (see **Chapter 5**).

**TABLE 4.2.7-1**  
**THE PROJECT INHERENT HUMAN RIGHT RISK ASSESSMENT**

Effectors	Human Right Risk	Severity Scores				Likelihood Scores	Risk Scores (Severity Scores X Likelihood Scores)	Risk Level	Receptors	
		Scale	Scope	Remediability	Absolute scores				Employees	Local community
<ul style="list-style-type: none"> <li>• Project Developer</li> <li>• Contractors</li> </ul>	(1) Occupational health and safety	3	2	2	3	2	6	High	✓	
	(2) Discrimination	1	2	1	2	2	4	Medium	✓	
	(3) Working Hours	2	2	1	2	2	4	Medium	✓	
<ul style="list-style-type: none"> <li>• Project Developer</li> </ul>	(4) Community Safety & Standard of Living	3	2	2	3	3	6	High		✓

**TABLE 4.2.7-2  
THE PROJECT RESIDUAL HUMAN RIGHT RISK ASSESSMENT**

Project Activity	Effectors	Human Right Risk	Description of Impact	Mitigation/ Control	Severity Scores				Likelihood Scores	Risk Scores (Severity Scores X Likelihood Scores)	Risk Level	Receptors	
					Scale	Scope	Remediability	Absolute scores				Employees	Local community
Employment of staff and workers (full time and part time)	<ul style="list-style-type: none"> <li>Project Developer</li> <li>Contractors</li> </ul>	(1) Occupational health and safety	<ul style="list-style-type: none"> <li>Risk that workers will face occupational accident during the project construction and operation period.</li> </ul>	<ul style="list-style-type: none"> <li>Occupational safety management shall be arranged in a systematical and efficient manner in conformity with the requirements of occupational safety, health and environment law relating to construction.</li> <li>Warning signs indicating the perimeter of the project construction zones shall be installed in clearly visible and easily recognizable places.</li> <li>The construction site shall be proportionally divided into construction zone, daytime rest zone, machinery and equipment storage zone, and unused material and equipment storage zone</li> <li>First aid kits including an ambulance or contact number of nearby medical facilities having an ambulance for emergency shall be provided .In addition, first aiders shall be routinely provided at the construction site and ready for transporting an injured person to nearby hospitals at all time; and</li> <li>Assign employees who are exposed to occupational hazards. The company may consider granting them time off as necessary, without affecting their leave entitlement.</li> </ul>	1	2	1	2	1	2	Low	✓	

**TABLE 4.2.7-2**  
**THE PROJECT RESIDUAL HUMAN RIGHT RISK ASSESSMENT (CONT'D)**

Project Activity	Effectors	Human Right Risk	Description of Impact	Mitigation/ Control	Severity Scores				Likelihood Scores	Risk Scores (Severity Scores X Likelihood Scores)	Risk Level	Receptors	
					Scale	Scope	Remediability	Absolute scores				Employees	Local community
Employment of staff and workers (full time and part time) (Cont'd)		(2) Discrimination	<ul style="list-style-type: none"> <li>Risk that workers may be treated unfairly</li> </ul>	<ul style="list-style-type: none"> <li>The Company has established a process for monitoring and assessing human rights impacts. This human rights due diligence process engages with stakeholders to identify, assess, manage, and prevent or mitigate human rights risks and related issues. The process covers three main areas: within the Company, within the Company's projects, and within local communities in the areas where the Company operates.</li> <li>The Company will treat all stakeholders equally and fairly, respecting diversity and emphasizing non-discrimination based on gender, age, race, ethnicity, nationality, or other attributes unrelated to work ability.</li> <li>The Company will communicate its commitment and expectations regarding human rights to stakeholders through relevant and appropriate channels.</li> <li>The Company provides reporting and whistleblowing channels, including a mechanism for receiving conflicting complaints, which establishes equitable and fair solutions as necessary and appropriate.</li> <li>The company supports gender equality and women's rights, including the promotion of equal pay for equal work through the use of a fair and non-discriminatory valuation system.</li> </ul>	1	2	1	2	1	2	Low	✓	

**TABLE 4.2.7-2  
THE PROJECT RESIDUAL HUMAN RIGHT RISK ASSESSMENT (CONT'D)**

Project Activity	Effectors	Human Right Risk	Description of Impact	Mitigation/ Control	Severity Scores				Likelihood Scores	Risk Scores (Severity Scores X Likelihood Scores)	Risk Level	Receptors	
					Scale	Scope	Remediability	Absolute scores				Employees	Local community
Employment of staff and workers (full time and part time) (Cont'd)		(3) Working Hours	<ul style="list-style-type: none"> <li>Mandating unreasonable working hours for employees that are inconsistent with ILO standards</li> </ul>	<ul style="list-style-type: none"> <li>Regular employees are required to work from Monday to Friday, with working hours from 8:00 a.m. to 5:00 p.m. Shift employees are required to work no more than 12 hours per day or a maximum of 48 hours per week.</li> <li>There should be a minimum of 13 traditional holidays per year.</li> <li>The company respects labor rights and adheres to labor laws, including compliance with regulations regarding working hours and proper working conditions. It also acknowledges related freedoms and collective rights as appropriate, while supporting the determination of employee welfare and compensation that exceeds the minimum required by law.</li> </ul>	1	2	1	2	1	2	Low	✓	
Construction of the project	<ul style="list-style-type: none"> <li>Project Developer</li> </ul>	(4) Community Safety & Standard of Living	<ul style="list-style-type: none"> <li>Risk that project transportation incurs road accident;</li> <li>Impact of pollution that is affected by the project construction, such as noise and vibration, and waste;</li> <li>The conflict between migrant workers and the local people;</li> <li>Utilization of public infrastructures affected by migrant workers are inadequate to the local people.</li> </ul>	<ul style="list-style-type: none"> <li>Transportation mitigation measures</li> <li>Noise, vibration, and, waste management measures.</li> <li>The local labour will be given first priority to be chosen for employment.</li> <li>Rules shall be established to control and supervise migrant workers ' behavior to prevent creating disturbance/problems to communities.</li> <li>the provision of worker camp site, sufficient basic infrastructure for workers living in the camp site,</li> <li>The Company shall support a</li> </ul>	1	2	1	2	2	4	Medium		✓

**TABLE 4.2.7-2  
THE PROJECT RESIDUAL HUMAN RIGHT RISK ASSESSMENT (CONT'D)**

Project Activity	Effectors	Human Right Risk	Description of Impact	Mitigation/ Control	Severity Scores				Likelihood Scores	Risk Scores (Severity Scores X Likelihood Scores)	Risk Level	Receptors	
					Scale	Scope	Remediability	Absolute scores				Employees	Local community
Construction of the project (Cont'd)				<ul style="list-style-type: none"> <li>human rights due diligence process to engage with its stakeholders to identify, assess, manage, and, where applicable, prevent or mitigate human rights risks and related issues in key areas including within the company, in its projects, and within the local communities where the company operates.</li> <li>The Company shall support corporate social responsibility programs and initiatives that promote human rights, with a focus on education, health, work and environmental protection, for children, local communities and the general society.</li> </ul>									
Operation activity	Project Developer	(5) Community Safety & Standard of Living	<ul style="list-style-type: none"> <li>Risk that project transportation incurs road accident;</li> <li>Contamination to the environment</li> <li>Infestation of disease carriers</li> </ul>	<ul style="list-style-type: none"> <li>The local labor will be given first priority to be chosen for employment.</li> <li>Human rights due diligence process to engage with its stakeholders to identify, assess, manage, and, where applicable, prevent or mitigate human rights risks and related issues in key areas including within the company, in its projects, and within the local communities where the company operates.</li> <li>The Company shall support corporate social responsibility programs and initiatives that promote human rights, with a focus on education, health, work and environmental protection, for children, local communities and the general society.</li> </ul>	1	1	1	1	1	1	Low		✓

### 4.3 TRANSMISSION LINE

PEA has the authority to set standards for its electrical equipment and fuel, to maintain technical and economic efficiency, and to control electricity generation within its facilities, according to the Provincial Electricity jurisdiction Act (Version 4) B.E. 2542 (1999). The implications of the installation and operation of these power lines are also managed by the PEA. As a result, Solar Development Co., Ltd. (SLD) is not permitted to intervene in PEA's operations. However, during the construction of the transmission line, personnel from the Solar Development Solar Power Plant Project can collaborate with PEA's officials in communicating with local people to observe the transmission line construction.

SLD and TLT Consultants Co., Ltd. obtained information about the construction and operation processes of power transmission lines for potential impact assessment from PEA activities. The following is an assessment of the primary impacts of power transmission lines, both during construction and operation:

#### (1) Construction Phase

Impact sources during the construction phase are the pole installation activities which will take 5-7 days for each pole construction by not over 10 workers. The potential impacts from the construction include:

- **Air quality:** the excavation for pole foundation and pole installation can release dust and exhaust gases into the air; however, these activities will last only a few days. The impact on air quality will be localized and short-term; hence, the level is considered low.

- **Noise:** noise will be generated by construction machinery and equipment such as cranes and backhoes. Given the proximity to communities, this could be disruptive. However, the construction will take place over a short period of time, and the impact will be limited to a close proximity. As a result, the impact will be low.

- **Vibration:** the use of heavy machinery for digging and compacting soil can cause vibrations that may be felt by nearby residents and can affect structures in close proximity to the construction site. Given the size of the operation, vibrations are likely to be minimal and localized.

- **Biodiversity:** the project's construction will cause noise and vibration, which may disturb the wildlife. Since the construction of transmission line will take place within the right-of-way of public roads where the land use is agricultural land, communities, and establishments, the wildlife that inhabits it has evolved to live in disturbed agricultural environments as a consequence of human activity. As a result, the construction will mainly cause noise-sensitive species to relocate away from the source of the disturbance. Nonetheless, the disruption time will be short, so the impact will be low.

- **Occupational Health and Safety / Community Health and Safety:** PEA choose the contractor from an approved list of PEA and will include relevant laws regarding environmental, occupational health, and safety regulations in contract terms to ensure the compliance with requirements in those regulations. In addition, in cases where damage is caused by a tortious act of PEA or arises from the performance of duties by its employees or workers, the following procedures should be undertaken:

- In the event that an external party's property is damaged, consideration should be given to deducting depreciation according to the condition of the

property or using the market price at the time of the incident as part of the assessment before proposing to the authorized person to approve the payment of damages.

– In cases where an external party is deceased and the heirs make a claim for damages from PEA, the authorized person should provisionally approve an initial payment of damages to the heirs of the deceased not exceeding 50,000 baht. Subsequently, a fact-finding committee shall consider determining the damages, taking into account the status and actual damages incurred by the individual concerned.

– In cases where an external party sustains injuries or disabilities, or loses their capacity, a fact-finding committee shall consider determining the damages by comparing guidelines for considering compensation payments as specified in the annex of these regulations. However, this does not include medical expenses and other damages such as loss of earnings or loss of support.

In addition, communities can complain about impacts from PEA's operations can be made through the following channels:

- Hotline 1129
- Complaints via electricity billing officers or local electricity offices
- The website of the Provincial Electricity Authority

When the PEA receives a complaint, they will respond within 30 days, and the complainant can track the progress of the complaint resolution on the PEA's website.

- **Land Use:** although PEA's power transmission line construction is inside the Right-of-Way (RoW) of public roadways, an inspection of land use along the power transmission lines indicated agricultural operations such as rice, sugarcane, and cassava, production. If power transmission poles are built in agricultural areas, that land will be converted into pole construction sites, which require approximately 5 square meters apiece. Furthermore, the PEA has a policy that allows farmers to harvest crops in areas where power transmission poles will be built as early as possible in accordance with the building timetable. As a result, the influence on land use for farmers constructing areas is regarded as low.

- **Transportation:** partial or full lane closures may be necessary to provide space for construction activities. This could disrupt normal traffic flow. However, the regular PEA practices will be followed, including providing adequate signage to inform drivers of construction work ahead or lane closures and keeping local communities informed about construction schedules. Hence, the impact on traffic will be low.

## (2) Operation Phase

During the operation phase, the only activity is to deliver electricity to the substation via power transmission lines. The following are the potential consequences that may be arisen from this operation:

**Electromagnetic field:** design and construction of transmission line will be in accordance with EGAT Operation Code for Transmission Line System. There is requirement of electric field and magnetic field of international commission on non-ionizing radiation protection (ICNIRP) on electromagnetic radiation (**Table 4.3-1**). To check the compliance with the requirement, EGAT has designed the value of electric field, magnetic field, radio interference, audible noise and short circuit current density by selecting type and clearance of transmission line. The expected results of impact are as shown in **Table 4.3-2** that calculated by BVCORONA program. All quantities are not

exceeded the standard. It can be assured that the construction of transmission line by EGAT will not pose impact of electric field and magnetic field to people living near the line.

**TABLE 4.3-1**  
**REQUIREMENT OF ELECTRIC FIELD AND MAGNETIC FIELD OF INTERNATIONAL COMMISSION ON NON-IONIZING RADIATION PROTECTION (ICNIRP) ON ELECTROMAGNETIC RADIATION**

Exposure	Electric Field (kV/m)	Magnetic Field (mG)
Working related to magnetic field		
- All day exposure	10	5000
- Short time exposure	30	50000
- Only arms and legs exposing to magnetic field	-	250000
People		
- 24 hrs/day	5	1000
- 2 - 3 hrs/day	10	10000

**Remark:** Summation of electric field should not exceed 80kV/m for all day work.

**TABLE 4.3-2**  
**RESULTS CALCULATED BY BVCORONA PROGRAM**

Quantity	Unit	Quantity at the boundary of R.O.W.	
		Standard	Calculated value
Electric Field	kV/m	2	1.125
Magnetic Field	mG	200	112.68
Radio Interference	dB	40	28.8
Audible Noise	dBA	55	35.8

**Source :** Electricity Generating Authority of Thailand, 2012

**Biodiversity:** During the project's operation phase, the transmission line may have an impact on birds due to collisions during migration. The project's 115-kv transmission lines will be built on 22-meter-high concrete poles, similar to the electrical poles seen throughout Thailand, and will run alongside a public road right-of-way. The transmission lines are not located in areas that serve as food sources for birds, such as rivers, wetlands, forests, or large agriculture fields, like large transmission lines (500-kv). Also the right-of-way along public roads do not constitute the primary landing areas for birds. Additionally, the birds found in the project area are only seven migratory species classified as least concern (LC), which include Black drongo (*Dicrurus macrocercus*), Barn swallow (*Hirundo rustica*), Brown shrike (*Lanius cristatus*), Burmese shrike (*Lanius collurioides*), Oriental Pratincole (*Glareola maldivarum*), Grey heron (*Ardea cinerea*) and Pied harrier (*Circus melanoleucos*). These are little birds that can shift direction faster than larger birds and most of them migrate alone or in small groups. Based on this data, it is possible to conclude that the project's location, the size of the birds, and the size of their migratory groups, all of which are common causes of collisions with transmission lines, present a low risk of collisions. As a result, the potential impact of the TL on migrating birds is considered low.



**Transportation:** regular maintenance can disturb traffic flow as partial or full lane closures for maintenance activities. However, the regular PEA practices will be followed, including providing adequate signage to inform drivers of construction work ahead or lane closures and keeping local communities informed about construction schedules. Hence, the impact on traffic will be low.

#### **4.4 SUMMARY AND DISCUSSION**

Overview of project implementation and impact assessment in relation to the ADB's Safeguard Requirement, ADB's Social Protection, and IFC Performance Standards as illustrated in **Table 4.4-1**.

**TABLE 4.4-1  
OVERVIEW OF PROJECT IMPLEMENTATION AND IMPACT ASSESSMENT IN RELATION TO THE ADB AND  
IFC PERFORMANCE STANDARDS**

ADB's Requirements	IFC's Requirements	Project Implementation
<p><b>ADB's Safeguard Requirement 1 : Environment Assessment and Environmental Planning and Management</b></p> <p>These requirements include assessing impacts, planning and managing impact mitigations, preparing environmental assessment reports, disclosing information and undertaking consultation, establishing a grievance mechanism, and monitoring and reporting. The document also includes particular environmental safeguard requirements pertaining to biodiversity conservation and sustainable management of natural resources, pollution prevention and abatement, occupational and community health and safety, and conservation of physical cultural resources. The applicability of particular requirements is established through the environmental assessment process and compliance with the requirements is achieved through implementation of environmental management plans agreed to by ADB and the borrower/client.</p> <p>The borrower/client will prepare an environmental management plan (EMP) that addresses the potential impacts and risks identified by the environmental assessment. The EMP will include the proposed mitigation measures, environmental monitoring and reporting requirements, emergency response procedures, related institutional or organizational arrangements, capacity development and training measures, implementation schedule, cost estimates, and performance indicators.</p>	<p><b>PS 1: Assessment and Management of Environmental and Social Risk and Impact</b></p> <p>The Project shall conduct a process of environmental and social assessment, and establish an Environmental and Social Assessment and Management System (ESMS) which will incorporate the following elements:</p> <ol style="list-style-type: none"> <li>1) Policy: Defining the environmental and social objectives and principles that guide the project to achieve environmental and social performance.</li> <li>2) Identification of risks and impacts: Environmental and social risks and impacts will be identified in the context of the project's area of influence.</li> <li>3) Management programs: Describe the mitigation and performance improvement measures and actions that address the identified ES risks and impacts.</li> <li>4) Organizational capacity and competency: Establish, maintain, and strengthen as necessary an organizational structure that defines roles, responsibilities, and authority to implement the ESMS.</li> <li>5) Emergency preparedness and response</li> <li>6) Monitoring and review: Establish procedures to monitor and measure the effectiveness of the management program, as well as compliance with any related legal and/or contractual obligations and regulatory requirements.</li> <li>7) Stakeholder engagement.</li> <li>8) External communications and grievance mechanisms.</li> <li>9) Ongoing reporting to affected communities: Provide periodic reports to the affected communities that describe progress with implementation of the project action plans.</li> </ol>	<p>GULF Energy Development (GED) has established its own Environmental and Social Management System (ESMS) in alignment with various international policies, standards, and management practices to which GED is committed.</p> <p>It is the responsibility of every individual within GED to achieve the objectives of the ESMS.</p> <p>Since Solar Development Co., Ltd. is a subsidiary of GED, it also bears the responsibility of adhering to GED's system and policies.</p> <p>Furthermore, Solar Development Co., Ltd. has developed its own ESMS tailored to the specific characteristics of its project. This includes:</p> <ul style="list-style-type: none"> <li>– ESMS Programme (as discussed in Chapter 1 of this report),</li> <li>– Identification of risks and impacts (as discussed in Chapter 4 of this report),</li> <li>– Management program, Emergency preparedness and response, Monitoring and review (as discussed in Chapter 5 of this report),</li> <li>– Stakeholder engagement (as discussed in Chapter 6 of this report), and</li> <li>– External communications and grievance mechanisms (as discussed in Chapter 7 of this report).</li> </ul>

**TABLE 4.4-1  
OVERVIEW OF PROJECT IMPLEMENTATION AND IMPACT ASSESSMENT IN RELATION TO THE ADB AND  
IFC PERFORMANCE STANDARDS (CONT'D)**

ADB's Requirements	IFC's Requirements	Project Implementation
<p><b>ADB's Safeguard Requirement 1 : Biodiversity Conservation and Sustainable Natural Resource Management</b></p> <p>The borrower/client will assess the significance of project impacts and risks on biodiversity and natural resources as an integral part of the environmental assessment process. The assessment will focus on the major threats to biodiversity, which include destruction of habitat and introduction of invasive alien species, and on the use of natural resources in an unsustainable manner. The borrower/client will need to identify measures to avoid, minimize, or mitigate potentially adverse impacts and risks and, as a last resort, propose compensatory measures, such as biodiversity offsets, to achieve no net loss or a net gain of the affected biodiversity. The focus on Modified Habitats, Natural Habitats, Critical Habitats and Legally Protected Areas.</p>	<p><b>PS 4: Community Health, Safety and Security</b></p> <p>3) Ecosystem services: The project shall identify risks and potential impacts on priority ecosystem services that may be exacerbated by climate change. Adverse impacts should be avoided, and if these impacts are unavoidable, the client will implement mitigation measures.</p> <p><b>PS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources</b></p> <p>The implementation of the actions necessary to meet the requirements of this Performance Standard is managed through the client's Environmental and Social Management System (ESMS), the elements of which are outlined in Performance Standard 1.</p>	<p>A land use survey revealed that the project area is agricultural land, totaling roughly 130.36 hectares. The construction of electrical transmission line poles will take place in the public road's right-of-way, with an agricultural area of roughly 0.53 hectares potentially affected. The conservation status according to IUCN (2022-2), which considers the global threat status (IUCN Red List of Threatened Species), One species identified as near-threatened (EN) : Burma Padauk (<i>Pterocarpus macrocarpus</i>) However, the specie of plant still maintain natural populations at safe levels, exhibit high reproductive capabilities, and have a widespread distribution throughout the country. Therefore, forest resources have experienced negative impacts or disadvantages because both the structural and functional aspects of the environment have changed due to construction projects.</p> <p>However, the impact of land preparation for construction will be low because it will only occur for a limited period of time inside the project area and the pole construction area.</p> <p>In the study area of the project, animals with conservation statuses according to the Department of National Parks, Wildlife and Plant Conservation (2520) and IUCN (2022-2) have been identified. An endangered (EN) species of wildlife including, the Long-tailed Macaque (<i>Macaca fascicularis</i>),</p>

**TABLE 4.4-1  
OVERVIEW OF PROJECT IMPLEMENTATION AND IMPACT ASSESSMENT IN RELATION TO THE ADB AND  
IFC PERFORMANCE STANDARDS (CONT'D)**

ADB's Requirements	IFC's Requirements	Project Implementation
		<p>Steppe Eagle (<i>Aquila nipalensis</i>), Southeast Asian turtle (Thailand: <i>Cuora amboinensis kamaroma</i>) one species of wildlife is listed as vulnerable (VU), is an Asiatic Softshell Turtle (<i>Amyda cartilaginea</i>).</p> <p>These species are protected under the Wildlife Preservation and Protection Act, B.E. 2562 (2019), and are classified as species with a conservation status of Vulnerable (VU) and Near Threatened (NT).</p> <p>Therefore, it is crucial to establish measures that prevent construction workers from harming the nests, eggs, and larvae of the protected species under the Wildlife Preservation and Protection Act, B.E. 2562 (2019), which are species with a conservation status of Vulnerable (VU) and Near Threatened (NT) according to ONEP (2020) and IUCN (2022-2), in order to reduce the impact on these wildlife species.</p>
<p><b>ADB's Safeguard Requirement 1 : Pollution Prevention and Abatement</b></p> <p>During the design, construction, and operation of the project the borrower/client will apply pollution prevention and control technologies and practices consistent with international good practice, as reflected in internationally recognized standards such as the World Bank Group's Environment, Health and Safety Guidelines. These standards contain performance levels and measures that are normally acceptable and applicable to projects. When host country regulations differ from these levels and measures, the borrower/ client will achieve whichever is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, the</p>	<p><b>PS 3: Resource Efficiency and Pollution Preventive</b></p> <p><u>Resource Efficiency</u></p> <ol style="list-style-type: none"> <li>1) Greenhouse gases: Consider alternatives and implement technically and financially feasible and cost-effective options to reduce project-related GHG emissions during the design and operation of the project.</li> <li>2) Water consumption: The project shall adopt measures that avoid or reduce water usage.</li> </ol> <p><u>Pollution Prevention</u></p> <ol style="list-style-type: none"> <li>1) Wastes: The project shall reduce the generation of waste, and recover and reuse waste or treat, destroy, or dispose of it in an environmentally sound manner.</li> <li>2) Hazardous waste: The project shall adopt GIIP alternatives, adhere to the limitations applicable to its</li> </ol>	<p>The Project utilizes photovoltaic (PV) solar panel technology in line with the policy to promote electricity production from alternative and renewable energy sources. This form of power generation is considered one of the cleanest energy sources developed in recent years.</p> <p>During the construction phase of the Project, some pollutants may arise, including air pollution from site preparation. This can be mitigated by regularly watering the construction area to prevent dust dispersion. Wastewater generated from worker consumption will be managed through the provision of toilets with septic tanks by the contractor. Solid waste and construction waste will</p>

**TABLE 4.4-1  
OVERVIEW OF PROJECT IMPLEMENTATION AND IMPACT ASSESSMENT IN RELATION TO THE ADB AND  
IFC PERFORMANCE STANDARDS (CONT'D)**

ADB's Requirements	IFC's Requirements	Project Implementation
<p>borrower/client will provide full and detailed justification for any proposed alternatives that are consistent with the requirements presented in this document.</p> <p><u>Pollution Prevention, Resource Conservation, and Energy Efficiency</u> The borrower/client will avoid, or where avoidance is impossible, will minimize or control the intensity or load of pollutant emission and discharge. In addition the borrower/client will incorporate in its operations resource conservation and energy efficiency measures consistent with the principles of cleaner production. When the project has the potential to constitute a significant source of emissions in an already degraded area, strategies that help improve ambient conditions, such as evaluating alternative project locations and considering emissions offsets, will be introduced.</p> <p><u>Wastes</u> The borrower/client will avoid, or where avoidance is not possible, will minimize or control the generation of hazardous and nonhazardous wastes and the release of hazardous materials resulting from project activities. Where waste cannot be recovered or reused, it will be treated, destroyed, and disposed of in an environmentally sound manner. If the generated waste is considered hazardous, the client will explore reasonable alternatives for its environmentally sound disposal considering the limitations applicable to its transboundary movement. When waste disposal is conducted by third parties, the borrower/client will use contractors that are reputable and legitimate</p>	<p>trans-boundary movement, use contractors that are reputable and licensed, develop their own recovery or disposal facilities at the project site.</p> <p>3) Hazardous materials management: The project shall avoid or, when avoidance is not possible, minimize and control the release of hazardous materials.</p> <p>4) Pesticide use and management</p> <p><b>PS 4: Community Health, Safety and Security</b> <u>Community Health and Safety</u></p> <p>2) Hazardous materials management and safety: The project shall avoid or minimize the potential for community exposure to hazardous materials and substances that may be released by the project.</p>	<p>be systematically collected within the construction area and then handed over to authorized agencies for proper disposal.</p> <p>In the operation phase, the only pollutants generated will be from worker consumption, specifically wastewater and solid waste. Wastewater from cleaning solar panels may occur occasionally to maintain production efficiency by preventing dust accumulation. However, it's important to note that this cleaning process will exclusively use tap water without any added chemical substances. Therefore, it can be assumed that the solar panel cleaning process will not produce any harmful pollutants.</p> <p>Environmental and social prevention and mitigation measures of the Project for both construction phase and operation phase are as shown in Chapter 5 of this report.</p> <p>For waste management , the project is required to follow the guidelines set forth in the Ministry of Industry's announcement regarding the management of pollutants and unused materials in B.E. 2566 (2023). Authorized agencies are responsible for the proper disposal of these materials. The Project should establish procedures for the safe separation and disposal of hazardous waste and provide training to relevant personnel to ensure they understand the importance of not discharging waste into drainage systems, gutters, waterways, or water sources in proximity to the construction site. As well as the management of</p>

**TABLE 4.4-1  
OVERVIEW OF PROJECT IMPLEMENTATION AND IMPACT ASSESSMENT IN RELATION TO THE ADB AND  
IFC PERFORMANCE STANDARDS (CONT'D)**

ADB's Requirements	IFC's Requirements	Project Implementation
<p>enterprises licensed by the relevant regulatory agencies.</p> <p><u>Hazardous Materials</u> The borrower/client will avoid the manufacture, trade, and use of hazardous substances and materials subject to international bans or phaseouts because of their high toxicity to living organisms, environmental persistence, potential for bioaccumulation, or potential for depletion of the ozone layer and will consider the use of less hazardous substitutes for such chemicals and materials.</p> <p><u>Greenhouse Gas Emissions</u> The borrower/client will promote the reduction of project-related anthropogenic greenhouse gas emissions in a manner appropriate to the nature and scale of project operations and impacts. During the development or operation of projects that are expected to or currently produce significant quantities of greenhouse gases, the borrower/client will quantify direct emissions from the facilities within the physical project boundary and indirect emissions associated with the off-site production of power used by the project. The borrower/client will conduct quantification and monitoring of greenhouse gas emissions annually in accordance with internationally recognized methodologies. In addition, the borrower/ client will evaluate technically and financially feasible and cost-effective options to reduce or offset project-related greenhouse gas emissions during project design and operation, and pursue appropriate options.</p>		<p>defective solar panels. This includes following the guidelines:</p> <ul style="list-style-type: none"> <li>– In the case of exporting for disposal abroad, compliance must be observed according to the laws and regulations concerning hazardous substances and international requirements. After the process is completed, notification to the Office of Energy Regulatory Commission must be submitted within 30 days from the date of export for disposal.</li> <li>– For domestic disposal, it must be conducted by burying in secure licensed landfill or incineration in a dedicated hazardous waste incinerator.</li> </ul> <p>For GHG emission,the Project is a non-combustion power plant that generates electric power from solar energy using photovoltaic technology or solar cells installed on the ground with an energy storage system. It generate electricity from the renewable energy sources that will substitute the electricity generated from the fossil fuel combustion. Net annual GHG emissions during construction and operation phases, the highest GHG emitted is estimated at 3,997.59 tonne CO<sub>2</sub>-eq/year during construction phase, while the avoided GHG is estimated at -148,443.82 tonne CO<sub>2</sub>-eq/year throughout the operation phase. Therefore, the project caused the positive impact to climate change.</p>

**TABLE 4.4-1  
OVERVIEW OF PROJECT IMPLEMENTATION AND IMPACT ASSESSMENT IN RELATION TO THE ADB AND  
IFC PERFORMANCE STANDARDS (CONT'D)**

ADB's Requirements	IFC's Requirements	Project Implementation
<p><b>ADB's Safeguard Requirement 1 : Health and Safety</b></p> <p><u>Occupational Health and Safety</u></p> <p>The borrower/client will provide workers with a safe and healthy working environment, taking into account risks inherent to the particular sector and specific classes of hazards in the borrower's/client's work areas, including physical, chemical, biological, and radiological hazards. The borrower/client will take steps to prevent accidents, injury, and disease arising from, associated with, or occurring during the course of work by (i) identifying and minimizing, so far as reasonably practicable, the causes of potential hazards to workers; (ii) providing preventive and protective measures, including modification, substitution, or elimination of hazardous conditions or substances; (iii) providing appropriate equipment to minimize risks and requiring and enforcing its use; (iv) training workers and providing them with appropriate incentives to use and comply with health and safety procedures and protective equipment; (v) documenting and reporting occupational accidents, diseases, and incidents; and (vi) having emergency prevention, preparedness, and response arrangements in place.</p> <p><u>Community Health and Safety</u></p> <p>The borrower/client will identify and assess the risks to, and potential impacts on, the safety of affected communities during the design, construction, operation, and decommissioning of the project, and will establish preventive measures and plans to address them in a manner commensurate with the identified risks and impacts. These measures will favor the prevention or</p>	<p><b>PS 2: Labor and Working Conditions</b></p> <p><u>Working Conditions and Management of Worker Relationship</u></p> <ol style="list-style-type: none"> <li>1) Human resources policies and procedures: Implement human resources policies and procedures consistent with the requirements of this performance standard and national law.</li> <li>2) Working conditions and terms of employment: Provide reasonable working conditions and terms of employment.</li> <li>3) Workers' organizations: Comply with national law recognizes workers' rights to form and to join workers' organizations.</li> <li>4) Non-discrimination and equal opportunity: Base the employment relationship on the principle of equal opportunity and fair treatment, and will not discriminate to any aspects of the employment relationship.</li> <li>5) Retrenchment: Carry out an analysis of alternatives to retrenchment or retrenchment plan will be developed and implemented to reduce the adverse impacts of retrenchment on workers.</li> <li>6) Grievance mechanism: Provide a grievance mechanism for workers to raise workplace concerns.</li> </ol> <p><u>Protecting the Work Force</u></p> <ol style="list-style-type: none"> <li>1) Child labor: The project will not employ children in any manner that is economically exploitative.</li> <li>2) Forced labor: The project will not employ forced labor.</li> </ol>	<p>Solar Development Co., Ltd. is obligated to fully comply with the national laws and regulations pertaining to working conditions and management of worker relationship. Furthermore, the Project shall exercise strict oversight over all contractors within its supply chain who are involved in the Project's development, including the supervision of subcontractors.</p> <p>The Project also establishes policies and frameworks related to non-discrimination, grievance mechanisms, and occupational health and safety that are specifically tailored to the Project's implementation.</p> <p>As of necessary welfare to employees, the Project shall adhere to Ministerial Regulation Concerning Labour Welfare Provision in an Establishment B.E. 2548 (2005) such as drinking water not less than one station for not exceeding forty employees, bathrooms and toilets with the layout and number, maintenance of cleanliness and hygiene, and provision of necessary kits for first aid and medical service in an adequate quantity for employees in the workplace.</p> <p>As for workforce protection, the Project shall strictly adhere to national law. Regarding child labor, the project shall strictly comply with the Thai Labor Protection Act B.E. 2541 (1998), Chapter 4, Employment of Young Workers, section 44, including but not limited to the following:</p> <ul style="list-style-type: none"> <li>– Prohibiting the employment of children under 15 as employees.</li> </ul>

**TABLE 4.4-1  
OVERVIEW OF PROJECT IMPLEMENTATION AND IMPACT ASSESSMENT IN RELATION TO THE ADB AND  
IFC PERFORMANCE STANDARDS (CONT'D)**

ADB's Requirements	IFC's Requirements	Project Implementation
<p>avoidance of risks and impacts over their minimization and reduction. Consideration will be given to potential exposure to both accidental and natural hazards, especially where the structural elements of the project are accessible to members of the affected community or where their failure could result in injury to the community. The borrower/client will avoid or minimize the exacerbation of impacts caused by natural hazards, such as landslides or floods, that could result from land use changes due to project activities</p> <p><b>ADB's Social Protection Strategy</b></p> <p>Aims to contribute to poverty reduction, social inclusion, and sustainable development by strengthening social protection systems in its member countries.</p>	<p><u>Occupational Health and Safety</u></p> <p>The client will take steps to prevent accidents, injury, and disease arising from, associated with, or occurring in the course of work by minimizing, as far as reasonably practicable, the causes of hazards. In a manner consistent with good international industry practice.</p> <p><b>PS 4: Community health, safety and security</b></p> <p><u>Community Health and Safety</u></p> <p>1) Infrastructure and equipment design and safety: The project shall design, construct, operate, and decommission the structural elements or components of the project in accordance with good international industry practice (GIIP).</p> <p>4) Community exposure to disease: The project shall avoid or minimize the potential for community exposure to water-borne, water-based, water-related, and vector-borne diseases, and communicable diseases that could result from project activities.</p> <p>5) Emergency preparedness and response: The project shall assist and collaborate with the affected communities, local government agencies, and other relevant parties, in their preparations to respond effectively to emergency situations.</p>	<ul style="list-style-type: none"> <li>– Prohibiting the use of child employees under the age of 18 to work between 22:00 and 06:00 hours unless permitted.</li> <li>– Prohibiting the use of child employees under the age of 18 for overtime work.</li> </ul> <p>Forced labor is strictly prohibited, and the project shall adhere to the Thai Anti-Trafficking in Persons Act B.E. 2551 (2008), Section 6 and Section 7, which address the use of forced labor or services by compelling employees to work or provide services under the threat of injury to life, body, reputation, or property, including but not limited to the following measures:</p> <ul style="list-style-type: none"> <li>– Ensuring that workers have the freedom to terminate their employment at any time.</li> <li>– Ensuring that workers receive fair wages.</li> <li>– Ensuring that workers retain control over their personal documents.</li> </ul> <p>In addition, the Project shall also strictly comply with International Labor Organization (ILO) Convention No. 138 that is to establish a minimum age for admission to employment or work.</p> <p>Specifically, it aims to set the minimum age at which young people can legally be employed, taking into consideration the need for their physical and psychological development.</p>



**TABLE 4.4-1  
OVERVIEW OF PROJECT IMPLEMENTATION AND IMPACT ASSESSMENT IN RELATION TO THE ADB AND  
IFC PERFORMANCE STANDARDS (CONT'D)**

ADB's Requirements	IFC's Requirements	Project Implementation
	<p><u>Security Personnel</u></p> <ul style="list-style-type: none"> <li>– Assess risk posed by its security arrangements to those within and outside the project site.</li> </ul>	<p>Under Convention No. 138, the minimum age for admission to employment or work should not be less than the age of completion of compulsory schooling and, in any case, not less than 15 years old. However, it does allow for some exceptions in certain circumstances.</p> <p>However, the prevent diseases that may arise due to the migration of workers, especially during the construction phase, the Project is obligated to adhere to the measures outlined by the Ministry of Public Health and other relevant laws pertaining to stringent epidemic control.</p> <p>For emergency preparedness and response, the Project is required to practice emergency response plans within the project area, dividing the plans into three levels according to the severity of emergencies. Establish communication channels for seeking assistance from external organizations. Plans must outline clear steps and responsibilities and comply with legal training frequency requirements.</p>
<p><b>ADB's Safeguard Requirement 1 : Physical Cultural Resources</b></p> <p>The borrower/client is responsible for siting and designing the project to avoid significant damage to physical cultural resources. Such resources likely to be affected by the project will be identified, and qualified and experienced experts will assess the project's potential impacts on these resources using field-based surveys as an integral part of the environmental assessment process</p>	<p><b>PS 8: Cultural Heritage</b></p> <p>The implementation of the actions necessary to meet the requirements of this Performance Standard is managed through the client's Environmental and Social Management System (ESMS), the elements of which are outlined in Performance Standard 1. During the project life-cycle, the client will consider potential project impacts to cultural heritage and will apply the provisions of this Performance Standard.</p>	<p>Within a radius of 3 kilometers from the Project boundary, there are no registered archaeological sites or historical sites as stipulated by relevant legislation, pertaining to archaeological sites, antiquities, cultural artifacts, and national heritage sites.</p>

**TABLE 4.4-1  
OVERVIEW OF PROJECT IMPLEMENTATION AND IMPACT ASSESSMENT IN RELATION TO THE ADB AND  
IFC PERFORMANCE STANDARDS (CONT'D)**

ADB's Requirements	IFC's Requirements	Project Implementation
<p><b>ADB's Safeguard Requirement 2 : Involuntary resettlement.</b></p> <p>The objectives are to avoid involuntary resettlement wherever possible; to minimize involuntary resettlement by exploring project and design alternatives; to enhance, or at least restore, the livelihoods of all displaced persons in real terms relative to pre-project levels; and to improve the standards of living of the displaced poor and other vulnerable groups. Compliance with Safeguard Requirement 2 involves conducting a Resettlement Plan and implementing measures to provide adequate compensation, assistance, and livelihood restoration for affected individuals or communities. The goal is to minimize adverse impacts on displaced persons and support their socio-economic well-being.</p>	<p><b>PS 5: Land Acquisition and Involuntary Resettlement</b></p> <ol style="list-style-type: none"> <li>1) Land rights or land use rights acquired through expropriation or other compulsory procedures in accordance with the legal system of the host country,</li> <li>2) Land rights or land use rights acquired through negotiated settlements with property owners or those with legal rights to the land if failure to reach settlement would have resulted in expropriation or other compulsory procedures,</li> <li>3) Project situations where involuntary restrictions on land use and access to natural resources cause a community or groups within a community to lose access to resource usage where they have traditional or recognizable usage rights,</li> <li>4) Certain project situations requiring evictions of people occupying land without formal, traditional, or recognizable usage rights, or</li> <li>5) Restriction on access to land or use of other resources including communal property and natural resources such as marine and aquatic resources, timber and non-timber forest products, freshwater, medicinal plants, hunting and gathering grounds and grazing and cropping areas.</li> </ol> <p>Nevertheless, this performance standard does not apply to resettlement resulting from voluntary land transactions. It also does not apply to impacts on livelihoods where the project is not changing the land use of the affected groups or communities.</p>	<p>The Project area is predominantly devoted to agriculture, specifically the cultivation of cassava. The Project acquired land tenure through agreements and land purchases from private landowners, with the purchase price being mutually determined by the Project and the previous landowners. Presently, the land in the Project area is owned by the Project developer, Solar Development Company Limited. Consequently, there are no issues related to either physical or economic displacement to be concerned.</p>

**TABLE 4.4-1  
OVERVIEW OF PROJECT IMPLEMENTATION AND IMPACT ASSESSMENT IN RELATION TO THE ADB AND  
IFC PERFORMANCE STANDARDS (CONT'D)**

ADB's Requirements	IFC's Requirements	Project Implementation
<p><b>ADB's Safeguard Requirement 3 : Indigenous Peoples.</b></p> <p>The objective is to design and implement projects in a way that fosters full respect for Indigenous Peoples' identity, dignity, human rights, livelihood systems, and cultural uniqueness as defined by the Indigenous Peoples themselves so that they (i) receive culturally appropriate social and economic benefits, (ii) do not suffer adverse impacts as a result of projects, and (iii) can participate actively in projects that affect them. Compliance with Safeguard Requirement 3 entails conducting a Free, Prior, and Informed Consent (FPIC) process, involving meaningful consultations with Indigenous Peoples to obtain their consent before implementing projects that may impact them. The aim is to promote the active participation of Indigenous Peoples in project decision-making and protect their rights throughout the project lifecycle.</p>	<p><b>PS 7: Indigenous peoples</b></p> <p>The implementation of the actions necessary to meet the requirements of this Performance Standard is managed through the client's Environmental and Social Management System, the elements of which are outlined in Performance Standard 1. However, there is no universally accepted definition of "Indigenous Peoples." The client may be required to seek inputs from competent professionals to ascertain whether a particular group is considered as Indigenous Peoples.</p>	<p>Thai Song Dam or Lao Song is the name of Tai Dam ethnic group who originally settled alongside the Black and the Red rivers of Northern Vietnam in Sipsong Chu Thai area called Muang Thang or present-day Dien Bien Phu. Throughout the Thon Buri and early Rattanakosin periods, several groups of Lao Song had migrated via LAO PDR, from where the word "Lao" in "Lao Song" derived, to Thailand and lived there for more than 200 years. Thai Song Dam's unique tradition includes wearing mostly black clothes and their expertise in hand-weaving exquisite "Suea" (a shirt or blouse) and "Pah Sinh" (a traditional wraparound skirt), the costume clearly reflecting this ethnic group's identity. Most of Thai Song Dam people in Thailand live in Phetchaburi Province where their traditions, rites, and ceremonies are still maintained strictly."</p> <p>In the area of Sa Long Ruea subdistrict, there is an ethnic group, Thai Song Dam, who lives in harmony in the communities with the locals, mostly can speak and understand Thai language, and has equal rights to the locals. This</p>

# CHAPTER 5

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## ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN AND SYSTEM



## CHAPTER 5

### ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN AND SYSTEM

#### 5.1 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

According to the result of Environmental and Social Impact Assessment discussed in the previous chapter, the project development have some impacts during construction and operation phases. Solar Development Co., Ltd. will be responsible for implementation of corresponding mitigation measures and monitoring programs set out for Solar Development Co., Ltd. in order to ensure that the project development during construction and operation phases will have impacts within an acceptable level.

The proposed measures and programs comprise the followings.

1) General measures, which are the mandatory measures established by Lenders to ensure that the Project implementation will comply with the proposed measure and be reported to the relevant authorities; as well as the mitigation measures and monitoring programs will be as a condition in a contract to be implemented by a contractor, are presented in **Table 5.1-1**.

2) Environmental and social impact prevention and correction measures for construction and operation phases as presented in **Table 5.1-2 to Table 5.1-3**. The measures proposed cover the following environmental and social aspect:

- Air quality
- Noise level
- Water quality and drainage
- Reflection and heat
- Biodiversity
- Socio-economics and public participation
- Gender-based violence and harassment
- Public health and safety
- Occupational health and safety
- Transportation
- Solid waste management
- Major hazard and emergency
- Land access/maintenance
- Green area and aesthetics

3) Environmental and social impact monitoring program that are required to follow up the implementation of environmental impact mitigation measures during construction and operation phase are presented in **Table 5.1-4 to Table 5.1-5**. The following are aspects that need to be monitored, namely;

- Air quality
- Noise level
- Water use and Effluent quality
- Socio-economics and public participation
- Occupational health and safety
- Transportation
- Solid waste management

**TABLE 5.1-1  
GENERAL MEASURE OF SOLAR DEVELOPMENT SOLAR POWER PLANT**

Environmental Parameters	Environmental Impact Prevention and Correction Measures	Location	Duration	Responsible Party
General Measures	1. Solar Development Solar Power Plant shall stringently comply with the environmental impact prevention and correction measures and environmental impact monitoring measures in the Code of Practice (CoP) in various phases.	Project area and nearby communities	Throughout project operation	Solar Development Co., Ltd.
	2. The measures in this Code of Practice (CoP) shall be incorporated as the minimum requirements into the contractor contract and strictly implemented to ensure operational effectiveness.	Project area	Throughout project operation	Solar Development Co., Ltd.
	3. In case the results of environmental impact monitoring identify potential problems including community complaints due to the project implementation, the project shall report to Lenders	Project area and nearby communities	Throughout project operation	Solar Development Co., Ltd.
	4. In case of any change in the project details resulting in changes to the measures, a request for changes shall be submitted prior to making any changes by submitting an EIA addendum report presenting the details of specific measures which are relevant or impacted by such changes including justifications, a summary of the overall project implementation at present in comparison with the implementation after change, and a summary of the compliance with the Code of Practice (CoP) in the past 3 years at the minimum (if any) for overall understanding and supporting the report consideration.	Project area	Throughout project operation	Solar Development Co., Ltd.

**TABLE 5.1-2  
ENVIRONMENTAL AND SOCIAL IMPACT PREVENTION AND CORRECTION MEASURES OF SOLAR DEVELOPMENT  
SOLAR POWER PLANT FOR CONSTRUCTION PHASE**

Environmental Parameters	Environmental Impact Prevention and Correction Measures	Location	Duration	Responsible Party
1. Air quality	1. Water shall be sprayed over the construction area where topsoil is excavated, piles of construction materials, and access road to the construction site, at least twice a day (morning-afternoon) or as deemed appropriate for the weather conditions to maintain the ground surface moisture in order to prevent dust diffusion and reduce impacts on nearby communities.	Construction area	Throughout construction phase	Solar Development Co., Ltd..
	2. Construction materials and equipment shall be orderly stored and any part which may cause dust diffusion shall be covered.			
	3. Regular inspection and maintenance shall be carried out for machinery and equipment used in the project to be in good condition and to reduce air pollution emissions.			
	4. Truck body and wheels shall be washed and cleaned before the trucks leave the construction site so as to remove stone/gravel, mud or sand which may cause hazards and dirtiness on the road.			
	5. Limit vehicle speed on site to 30 km/h to assist reduce dust emissions caused by vehicle movement.			
	6. Waste burning on construction sites should be strictly prohibited.			
2. Noise Level	1. The construction plan with activities which may be noisy shall be publicized to inform communities at least 2 weeks prior to construction.	Construction area and nearby communities	Throughout construction phase	Solar Development Co., Ltd.
	2. Construction activities that may create noise impacts on the communities and living things in the surrounding area shall be only carried out during daytime, except those requiring continuous operations to complete. The community leaders in the area shall be informed at least 7 days prior to undertaking such activities.	Construction area	Throughout construction phase	Solar Development Co., Ltd.
	3. A U-shape noise barrier 2 meters-height composed of steel with a thickness of 0.64 mm or other materials with equal efficacy, The length is 274 meters or depends on the suitability of the area, shall be installed on the west, south and east sides of a construction site with structure and building construction, as close to the noise source as practicable.	Construction area	Throughout construction phase	Solar Development Co., Ltd.

**TABLE 5.1-2**  
**ENVIRONMENTAL AND SOCIAL IMPACT PREVENTION AND CORRECTION MEASURES OF SOLAR DEVELOPMENT SOLAR POWER PLANT FOR CONSTRUCTION PHASE (CONT'D)**

Environmental Parameters	Environmental Impact Prevention and Correction Measures	Location	Duration	Responsible Party
2. Noise Level (Cont'd)	4. Low- noise construction equipment and machines shall be used and maintained to always be in good working condition.	Construction area	Throughout construction phase	Solar Development Co., Ltd.
	5. Reducing noise levels at the source by using pile cap cushion on the top of steel piles during pile driving to reduce noise.	Construction area	Throughout construction phase	Solar Development Co., Ltd.
	6. Hearing protection equipment shall be provided for workers working in noisy areas and the general noise level shall be controlled to be within the standard value.	Construction area	Throughout construction phase	Solar Development Co., Ltd.
3. Water Quality and Drainage	1. A temporary site office and workers' camp, bathrooms and sanitary toilets shall be adequately provided for construction workers and shall be located at least 30 meters away from water bodies in order to prevent contamination by wastewater from activities in the temporary site office and workers' camp flowing into nearby water bodies.	Construction area and worker camp	Throughout construction phase	Solar Development Co., Ltd.
	2. Package onsite wastewater treatment system shall be installed for treating wastewater to meet the effluent standard prescribed by the authority before being discharged to the outside area. Discharge of untreated waste into receiving water bodies shall be prohibited and such wastewater or waste shall be pumped out for disposal or treatment in accordance with the Government Agency.	Construction area	Throughout construction phase	Solar Development Co., Ltd.
	3. The wastewater treatment system should be capable of treating wastewater to meet the quality standards according to the announcement of the Ministry of Natural Resources and Environment regarding the standards for controlling the discharge of wastewater from certain types and sizes of buildings, B.E. 2548 (2005) before discharge to environment.	Construction workers' camp	Throughout construction phase	Solar Development Co., Ltd.



**TABLE 5.1-2  
ENVIRONMENTAL AND SOCIAL IMPACT PREVENTION AND CORRECTION MEASURES OF SOLAR DEVELOPMENT  
SOLAR POWER PLANT FOR CONSTRUCTION PHASE (CONT'D)**

Environmental Parameters	Environmental Impact Prevention and Correction Measures	Location	Duration	Responsible Party
3. Water Quality and Drainage (Cont'd)	4. If the contractor discharges treated waste or sewage outside into natural water sources or private areas, the contractor must obtain permission from relevant government agencies or landowner to ensuring that the discharged sewage will not have adverse environmental impacts in the future. In addition, the contractor shall provide a retention pond at worker's camp and conduct water quality monitoring once a month to ascertain the water quality before discharging.	Construction workers' camp	Throughout construction phase	Solar Development Co., Ltd.
	5. Temporary drain ditches and a settling pond shall be constructed and completed within the first month of construction period so as to control wastewater discharge from construction activities and prevent impacts on the surrounding areas. The efficiency of temporary drain ditches shall be regularly inspected. If any damage is found, it shall be quickly repaired to be in good working condition.	Construction area	Throughout construction phase	Solar Development Co., Ltd.
	6. Rainwater drainage channels must surround the worker accommodation area to prevent overflow into surrounding areas and they must be able to accommodate the volume of runoff.	Construction workers' camp	Throughout construction phase	Solar Development Co., Ltd.
	7. The direction of the rainwater drainage channels must flow towards a rainwater retention pit before being discharged into public water sources and should not flow into adjacent areas.	Construction workers' camp	Throughout construction phase	Solar Development Co., Ltd.
	8. Dumping of garbage or construction debris into drain pipes or public water sources shall be strictly prohibited.	Construction area and nearby communities	Throughout construction phase	Solar Development Co., Ltd.
4. Refection and Heat	1. Use anti-reflective coating on solar panels to reduce glare and minimize heat reflection.	Construction area	Throughout construction phase	Solar Development Co., Ltd.
	2. Implement ground-mounted solar panels at angles that minimize direct reflection towards neighboring communities or aviation paths.	Construction area	Throughout construction phase	Solar Development Co., Ltd.
5. Biodiversity	1. Prevent construction workers from harming the nests, eggs, and larvae of the protected species under the Wildlife Preservation and Protection Act, B.E. 2562 (2019), which are species with a conservation status of Vulnerable (VU) and Near Threatened (NT) according to ONEP (2020) and IUCN (2022-2)	Construction area	Throughout construction phase	Solar Development Co., Ltd

**TABLE 5.1-2**

**ENVIRONMENTAL AND SOCIAL IMPACT PREVENTION AND CORRECTION MEASURES OF SOLAR DEVELOPMENT SOLAR POWER PLANT FOR CONSTRUCTION PHASE (CONT'D)**

Environmental Parameters	Environmental Impact Prevention and Correction Measures	Location	Duration	Responsible Party
6. Socio Economic, and Public Participation	1. Information relating to the construction plan shall be publicized and disseminated by installing publicity boards in the project site or other appropriate models in order to inform all the public and stakeholders at least 7 days prior to construction.	Construction area and nearby communities	Throughout construction phase	Solar Development Co., Ltd...
	2. The project staff shall periodically visit nearby communities throughout the construction phase to inquire and listen to opinions about environmental impacts from the project construction activities so as to determine a guideline for mitigating impacts which may arise.	Construction area and nearby communities	Throughout construction phase	Solar Development Co., Ltd...
	3. A coordination center shall be set up to receive recommendations and complaints about disturbances from the project construction.	Construction area	Throughout construction phase	Solar Development Co., Ltd...
	4. In case of complaints by people about impacts from the project construction activities, the project shall immediately investigate and take remedial action.	Construction area and nearby communities	Throughout construction phase	Solar Development Co., Ltd...
	5. A joint committee shall be set up so that communities can participate in the project implementation and community and environmental development in joint cooperation with the project. The joint committee membership shall, at least, comprise representatives of people, local government agencies, local educational institutes or academics, and the project owner. The number of committee members from the people sector shall be, at least, more than half of the total number of the committee members. In establishing the aforesaid committee, the committee structure and composition shall be specified together with number of committee members, power and duties, term of office, type of meeting, frequency of meeting, etc. Moreover, the committee's work will be linked to the project management. The committee's power and duties include, for example, receipt of complaints and consideration of compliance with the project's measures, etc. In addition, the committee may carry on its duties in the operation phase.	Construction area and nearby communities	Throughout construction phase	Solar Development Co., Ltd...

**TABLE 5.1-2  
ENVIRONMENTAL AND SOCIAL IMPACT PREVENTION AND CORRECTION MEASURES OF SOLAR DEVELOPMENT  
SOLAR POWER PLANT FOR CONSTRUCTION PHASE (CONT'D)**

<b>Environmental Parameters</b>	<b>Environmental Impact Prevention and Correction Measures</b>	<b>Location</b>	<b>Duration</b>	<b>Responsible Party</b>
6. Socio Economic, and Public Participation	The appointment of a joint committee shall be completed prior to commencing the project construction. If there is any constraint to the establishment of a joint committee in cooperation with communities and the committee cannot be set up according to the specified proportion, the project shall notify the OERC and set out measures to build good understanding and communicate the results of project implementation to the communities and the project's stakeholders in the surrounding area via various public relations media such as documents, printed matter, personal media or information system, etc., and records of the project implementation throughout the project construction phase.	Construction area and nearby communities	Throughout construction phase	Solar Development Co., Ltd.
	6. Qualified local people shall be given first priority to be hired by posting job recruitment in front of the project area and camp site and coordinating with local leaders and village headmen to publicize job positions.	Construction area and nearby communities	Throughout construction phase	Solar Development Co., Ltd.
	7. Establish Stakeholder Engagement Plan before the construction begins. The SEPs shall cover all stakeholder groups (e.g., project affected persons: stakeholders living within site, along right-of-way, construction campsite) and their expectations (e.g., energy fund, local labor employment). The SEP shall include general guidance for communicating and managing communities' expectations.	Construction area and nearby communities	Throughout construction phase	Solar Development Co., Ltd.
	8. Collaborate with community to establish a Corporate Social Responsibility (CSR) plan to initiate and support community activities to be implemented during the construction phase, including: <ul style="list-style-type: none"> <li>- An environmental conservation plan,</li> <li>- A social, child, and youth development plan,</li> <li>- A health plan, and</li> <li>- A cultural and tradition plan</li> </ul>	Construction area and nearby communities	Throughout construction phase	Solar Development Co., Ltd.

**TABLE 5.1-2**  
**ENVIRONMENTAL AND SOCIAL IMPACT PREVENTION AND CORRECTION MEASURES OF SOLAR DEVELOPMENT**  
**SOLAR POWER PLANT FOR CONSTRUCTION PHASE (CONT'D)**

<b>Environmental Parameters</b>	<b>Environmental Impact Prevention and Correction Measures</b>	<b>Location</b>	<b>Duration</b>	<b>Responsible Party</b>
7. Gender-based violence and harassment (GBVH)	1. Establish policies on GBVH to safeguard workers and community members.	Construction area, construction worker's camp, and nearby communities	Throughout construction phase	Solar Development Co., Ltd.
	2. Establish policies on GBVH to safeguard workers and community members.	Construction area, and nearby communities	Throughout construction phase	Solar Development Co., Ltd.
	3. Make a project-specific commitment to provide employment and supply chain opportunities for local women. For example, in service cleaning contracts, no gender specific within local content requirements to ensure the inclusion and participation of women in these opportunities.	Construction area, and nearby communities	Throughout construction phase	Solar Development Co., Ltd.
	4. Establish Corporate Social Responsibility (CSR) activities to ensure that all gender can be involved.	Construction area, and nearby communities	Throughout construction phase	Solar Development Co., Ltd.
	5. Ensure that all facilities (restrooms, changing rooms) are safe, accessible, and respectful of privacy for all genders.	Construction workers' camp	Throughout construction phase	Solar Development Co., Ltd.
	6. Conduct gender sensitivity training for all project work teams, managers, and contractors. This training aims to increase awareness of gender issues, promote inclusivity, and enhance understanding of the importance of gender equality in project implementation.	Construction area, worker's camp, and nearby communities	Throughout construction phase	Solar Development Co., Ltd.
8. Public Health and Safety	1. Contractor shall prepare Construction Labor Management Plan (to cover labor related requirements for contractors, influx management and community impacts, labor camps conditions and management).	Construction workers' camp and nearby communities	Throughout construction phase	Solar Development Co., Ltd

**TABLE 5.1-2  
ENVIRONMENTAL AND SOCIAL IMPACT PREVENTION AND CORRECTION MEASURES OF SOLAR DEVELOPMENT  
SOLAR POWER PLANT FOR CONSTRUCTION PHASE (CONT'D)**

Environmental Parameters	Environmental Impact Prevention and Correction Measures	Location	Duration	Responsible Party
8. Public Health and Safety (Cont'd)	2. Establish measures on community health as follows: <ul style="list-style-type: none"> <li>– Require contractors to comply with the measures of the Ministry of Public Health and other laws related to strict epidemic control.</li> <li>– Supervise and control contractors to strictly adhere to agreements, including monitoring camps, residences, random drug testing, waste separation in the worker's camp, and closely controlling the behavior of construction workers to prevent nuisances in neighboring communities.</li> <li>– Inform the number of construction workers as information in the preparation of public health facilities in the area before starting work and in case of illness or accident.</li> <li>– Coordinate with local health agencies to provide personal hygiene education, information on communicable diseases, and personal care for construction workers of all levels.</li> <li>– Conduct training in regulations, health, and infectious disease prevention.</li> <li>– Establish a routine for keeping the area clean and hygienic, involving daily cleaning by the staff and regular check-ups by company personnel.</li> </ul>	Construction arera and construction workers' camp	Throughout construction phase	Solar Development Co., Ltd.
	3. Life and asset safety measures shall be established as follows: <ul style="list-style-type: none"> <li>– A project shall be provided to strictly supervise the entrance and exit to the construction site.</li> <li>– The boundaries of the construction workers' camp and construction site shall be clearly demarcated.</li> <li>– Use strict security system in the construction workers' camp.</li> <li>– In the event that the construction workers' camp is close to a community, workers' behavior shall be closely supervised to prevent disturbance and annoyance.</li> <li>– A register of migrant labor and foreign labor shall be established.</li> </ul>	Construction workers' camp	Throughout construction phase	Solar Development Co., Ltd.

**TABLE 5.1-2**  
**ENVIRONMENTAL AND SOCIAL IMPACT PREVENTION AND CORRECTION MEASURES OF SOLAR DEVELOPMENT**  
**SOLAR POWER PLANT FOR CONSTRUCTION PHASE (CONT'D)**

Environmental Parameters	Environmental Impact Prevention and Correction Measures	Location	Duration	Responsible Party
8. Public Health and Safety	4. Contractor shall manage the workers' camp environment to have the following facilities. <ul style="list-style-type: none"> <li>– Clearly display signs indicating residential areas.</li> <li>– Equip sturdy and secure fences around the residential areas.</li> <li>– Ensure sufficient lighting along roads or general areas for safety in residential areas.</li> <li>– Provide adequate parking spaces for the number of residents.</li> <li>– Provide security systems and closed-circuit television.</li> </ul>	Construction workers' camp	Throughout construction phase	Solar Development Co., Ltd.
	5. Provide clean and sufficient water for worker consumption.	Construction area and construction workers' camp	Throughout construction phase	Solar Development Co., Ltd
	6. Drinking water for workers must be clean. <ul style="list-style-type: none"> <li>– If bottled water are provided, the manufacturing company must meet the quality standards for drinking water as required by the law or international standards.</li> <li>– If water filtration systems are installed, the quality of the drinking water must meet the standards set by the Ministry of Public Health, and regular inspections must be conducted every three months.</li> </ul>	Construction area and construction workers' camp	Throughout construction phase	Solar Development Co., Ltd.
	7. Containers for storing drinking water must be tightly sealed and regular cleaning must be carried out consistently.	Construction area and construction workers' camp	Throughout construction phase	Solar Development Co., Ltd.

**TABLE 5.1-2**  
**ENVIRONMENTAL AND SOCIAL IMPACT PREVENTION AND CORRECTION MEASURES OF SOLAR DEVELOPMENT**  
**SOLAR POWER PLANT FOR CONSTRUCTION PHASE (CONT'D)**

Environmental Parameters	Environmental Impact Prevention and Correction Measures	Location	Duration	Responsible Party
9. Occupational Health and Safety	1. Occupational safety management shall be arranged in a systematical and efficient manner in conformity with the requirements of occupational safety, health and environment law relating to construction.	Construction area	Throughout construction phase	Solar Development Co., Ltd.
	2. Warning signs indicating the perimeter of the project construction zones shall be installed in clearly visible and easily recognizable places.	Construction area	Throughout construction phase	Solar Development Co., Ltd.
	3. The construction site shall be proportionally divided into construction zone, daytime rest zone, machinery and equipment storage zone, and unused material and equipment storage zone.	Construction area	Throughout construction phase	Solar Development Co., Ltd.
	4. First aid kits including an ambulance or contact number of nearby medical facilities having an ambulance for emergency shall be provided. In addition, first aiders shall be routinely provided at the construction site and construction workers' camp, and ready for transporting an injured person to nearby hospitals at all times.	Construction area	Throughout construction phase	Solar Development Co., Ltd.
	5. Ensure that personnel capable of providing first aid are stationed in the area at all times to facilitate the prompt transfer of injured individuals to nearby medical facilities.	Construction area	Throughout construction phase	Solar Development Co., Ltd.
	6. Contractors are required to prepare Construction Health and Safety Plan before the commencement of construction.	Construction area	Throughout construction phase	Solar Development Co., Ltd.

**TABLE 5.1-2  
ENVIRONMENTAL AND SOCIAL IMPACT PREVENTION AND CORRECTION MEASURES OF SOLAR DEVELOPMENT  
SOLAR POWER PLANT FOR CONSTRUCTION PHASE (CONT'D)**

Environmental Parameters	Environmental Impact Prevention and Correction Measures	Location	Duration	Responsible Party
10. Transportation	1. Contractor shall prepare traffic management plan before the construction begins.	Construction area and transportation route	Throughout construction phase	Solar Development Co., Ltd.
	2. Warning signs or signals shall be put in place and clearly visible during daytime and nighttime at least 100 meters before reaching the construction site.	Construction area	Throughout construction phase	Solar Development Co., Ltd.
	3. Drivers relating to all types of construction shall be trained and supervised to stringently comply with traffic rules.	Construction area	Throughout construction phase	Solar Development Co., Ltd.
	4. If construction activities cause any damage to signboard, traffic light or road surface, repair shall be urgently conducted.	Construction area	Throughout construction phase	Solar Development Co., Ltd.



**TABLE 5.1-2  
ENVIRONMENTAL AND SOCIAL IMPACT PREVENTION AND CORRECTION MEASURES OF SOLAR DEVELOPMENT  
SOLAR POWER PLANT FOR CONSTRUCTION PHASE (CONT'D)**

Environmental Parameters	Environmental Impact Prevention and Correction Measures	Location	Duration	Responsible Party
11. Solid Waste Management	1. Waste bins must be categorized, such as organic waste, general waste, recyclable waste, and hazardous waste, and they must have tightly sealed lids and be sufficient in size for the amount of waste.	Construction area and construction workers' camp	Throughout construction phase	Solar Development Co., Ltd.
	2. Designate a location for waste storage prior to disposal.	Construction area and construction workers' camp	Throughout construction phase	Solar Development Co., Ltd.
	3. Workforce training in waste management, which includes handling, sorting, storing, and disposing of various sorts of waste.	Construction area and construction workers' camp	Throughout construction phase	Solar Development Co., Ltd.
	4. Waste receptacles shall be sufficiently provided for waste generated by workers at various places in the construction site and worker camp and coordination shall be made with the relevant local agency for waste disposal.	Construction area and construction workers' camp	Throughout construction phase	Solar Development Co., Ltd.
	5. In case the construction activities have hazardous waste having the characteristics and properties as prescribed in the Notification of Ministry of Industry on Disposal of Waste or Unusable Materials B.E. 2566 (2023), the agency permitted by the Department of Industrial Works shall collect hazardous waste for proper disposal. Operating procedure for segregation of hazardous waste shall be established and training provided for relevant workers to inform them of the prohibition against waste dumping in drain ditches, drain pipes and water bodies near the construction site.	Construction area and construction workers' camp	Throughout construction phase	Solar Development Co., Ltd.

**TABLE 5.1-2  
ENVIRONMENTAL AND SOCIAL IMPACT PREVENTION AND CORRECTION MEASURES OF SOLAR DEVELOPMENT  
SOLAR POWER PLANT FOR CONSTRUCTION PHASE (CONT'D)**

Environmental Parameters	Environmental Impact Prevention and Correction Measures	Location	Duration	Responsible Party
12. Major Hazard and Emergency	1. Contractor shall prepare Emergency Preparedness and Response Plan before the beginning of the construction.	Construction area and construction workers' camp	Throughout construction phase	Solar Development Co., Ltd.
	2. Conduct regular drills for fire evacuation and firefighting plans within 1 year of occupancy and annually thereafter following the initial drill.	Construction area and construction workers' camp	Throughout construction phase	Solar Development Co., Ltd.
	3. Provide fire extinguishers in accordance with government regulations and standards for managing occupational health, safety, and environmental conditions related to fire prevention and control, as per the Occupational Safety, Health, and Environment Management in the Workplace to Prevent and Control Hazardous Incidents Act, B.E. 2555 (2012).	Construction area and construction workers' camp	Throughout construction phase	Solar Development Co., Ltd.
	4. Implement an alarm system capable of signaling emergencies to cover the entire area.	Construction area and construction workers' camp	Throughout construction phase	Solar Development Co., Ltd.
13. Land Maintenance	1. Develop Site Maintenance to manage legacy cropping and vacating site, and avoidance of new encroached activities (such as grazing) and mechanism to handle possible future claims by former users or others.	Construction area	Throughout construction phase	Solar Development Co., Ltd.

**TABLE 5.1-3**  
**ENVIRONMENTAL AND SOCIAL IMPACT PREVENTION AND CORRECTION MEASURES OF SOLAR DEVELOPMENT**  
**SOLAR POWER PLANT FOR OPERATION PHASE**

Environmental Parameters	Environmental Impact Prevention and Correction Measures	Location	Duration	Responsible Party
1. Water Quality	<p><b>1. Water Use</b> Provide water use by purchasing tap water from outside the project to be sufficient for the implementation of the project</p>	Project area	Throughout operation phase	Solar Development Co., Ltd.
	<p><b>2. Stormwater Drainage</b> Stormwater discharge rate from the retention pond or the project area shall be controlled not to exceed the runoff rate in the area before the project development.</p>			
	<p><b>3. Maintenance of Wastewater Treatment System</b> Wastewater treatment system shall be maintained to have sufficient capacity for treatment of the project's total wastewater volume including sludge to be in compliance with the standard prior to being discharged to the outside of the project or reused within the project area.</p>			
2. Socio-economic, and Public Participation	<p>1. Opportunities for project visits should be given to the communities so as to ease concerns;</p>	Project area	Throughout operation phase	Solar Development Co., Ltd.
	<p>2. A complaint receiving plan shall be put in place, specifying channels for complaints, steps and duration of problem solving including responsible persons together with a chart clearly showing the procedure. In case remedial actions have not yet been completed, the complainant shall be notified of the progress every 7 days;</p>	Project area and nearby communities	Throughout operation phase	Solar Development Co., Ltd.
	<p>3. A person shall be assigned to be responsible for the project's public relations and shall participate in public relations activities undertaken with communities including follow-up of complaints, disturbances and annoyances arising due to the project;</p>	Project area and nearby communities	Throughout operation phase	Solar Development Co., Ltd.

**TABLE 5.1-3**  
**ENVIRONMENTAL AND SOCIAL IMPACT PREVENTION AND CORRECTION MEASURES OF SOLAR DEVELOPMENT**  
**SOLAR POWER PLANT FOR OPERATION PHASE (CONT'D)**

Environmental Parameters	Environmental Impact Prevention and Correction Measures	Location	Duration	Responsible Party
2. Socio-economic and Public Participation (Cont'd)	4. Information shall be disseminated and publicized regarding the project details and compliance with the Code of Practice so as to inform the local communities and the joint committee. Opportunities shall be offered for the communities to participate in the project monitoring throughout the project operation period;	Project area and nearby communities	Throughout operation phase	Solar Development Co., Ltd.
	5. Community relation activities shall be supported and promotion of community activities shall be undertaken to build good relation with the local communities;	Nearby communities	Throughout operation phase	Solar Development Co., Ltd.
	6. A joint committee shall be set up so that communities can participate in the project implementation and community and environmental development in joint cooperation with the project. The joint committee membership shall, at least, comprise representatives of people, local government agencies, local educational institutes or academics, and the project owner. The number of committee members from the people sector shall be, at least, more than half of the total number of the committee members. In establishing the aforesaid committee, the committee structure and composition shall be specified together with number of committee members, power and duties, term of office, type of meeting, frequency of meeting, etc. Moreover, the committee's work will be linked to the project management. The committee's power and duties include, for example, receipt of complaints and consideration of compliance with the project's measures, etc. In addition, the committee may carry on its duties in the operation phase.  The appointment of a joint committee shall be completed prior to commencing the project construction. If there is any constraint to the establishment of a joint committee in cooperation with communities and the committee cannot be set up according to the specified proportion, the project shall notify the OERC and set out measures to build good understanding and communicate the results of project implementation to the communities and the project's stakeholders in the surrounding area via various public relations media such as documents, printed matter, personal media or information system, etc., and records of the project implementation throughout the project construction phase.	Project area and nearby communities	Throughout operation phase	Solar Development Co., Ltd.

**TABLE 5.1-3**  
**ENVIRONMENTAL AND SOCIAL IMPACT PREVENTION AND CORRECTION MEASURES OF SOLAR DEVELOPMENT**  
**SOLAR POWER PLANT FOR OPERATION PHASE (CONT'D)**

Environmental Parameters	Environmental Impact Prevention and Correction Measures	Location	Duration	Responsible Party
2. Socio-economic and Public Participation (Cont'd)	7. If it is proven that damage has resulted from the project operation, the appointed joint committee shall have power and duty to consider compensation for the damage.	Project area and nearby communities	Throughout operation phase	Solar Development Co., Ltd.
	8. Collaborate with community to establish a Corporate Social Responsibility (CSR) plan to initiate and support community activities to be implemented during the operation phase, including: <ul style="list-style-type: none"> <li>– An environmental conservation plan,</li> <li>– A social, child, and youth development plan,</li> <li>– A health plan, and</li> <li>– A cultural and tradition plan</li> </ul>	Project area and nearby communities	Throughout operation phase	Solar Development Co., Ltd.
3. Occupational Health and Safety	1. EHS division shall implement and maintain site ESMS	Project area	Throughout operation phase	Solar Development Co., Ltd.
	2. The work plan established for the project's risk areas shall be followed and a guideline shall be defined for risk prevention and mitigation in each area.	Project area	Throughout operation phase	Solar Development Co., Ltd.
	3. The relevant laws, occupational health and safety requirements or other relevant and current labor laws shall be complied with.	Project area	Throughout operation phase	Solar Development Co., Ltd.
	4. Training in occupational health and safety shall be adequately provided and suitable for the nature of work such as: <ul style="list-style-type: none"> <li>• Fire drills and proper use of firefighting equipment;</li> <li>• Rules and regulations on working in danger areas;</li> <li>• Inspection of workplace safety;</li> <li>• Training in use of personal protective equipment;</li> <li>• Prevention of danger from machinery, heat and electricity; and</li> <li>• Working at heights of 2 meters or higher</li> </ul>	Project area	Throughout operation phase	Solar Development Co., Ltd.
	5. Regular inspection of warning systems shall be conducted every year.	Project area	Throughout operation phase	Solar Development Co., Ltd.

**TABLE 5.1-3**  
**ENVIRONMENTAL AND SOCIAL IMPACT PREVENTION AND CORRECTION MEASURES OF SOLAR DEVELOPMENT**  
**SOLAR POWER PLANT FOR OPERATION PHASE (CONT'D)**

Environmental Parameters	Environmental Impact Prevention and Correction Measures	Location	Duration	Responsible Party
3. Occupational Health and Safety (Cont'd)	6. Establish and implement project emergency action plan. Emergency action plan exercises shall be carried out within the project area. The plan may be divided into 3 levels based on the severity of emergency. There must be channels for coordination to request assistance from external agencies. The plan shall have operational procedures and responsible persons clearly designated as well as frequency of drills and exercises as prescribed by law.	Project area	Throughout operation phase	Solar Development Co., Ltd.
	7. Regular inspection of the working condition shall be carried out for equipment, machinery and electrical system.	Project area	Throughout operation phase	Solar Development Co., Ltd.
	8. The operation of electrical system in the plant shall be in compliance with technical principles or recognized standards; and	Project area	Throughout operation phase	Solar Development Co., Ltd.
	9. Regular inspection and safety certification shall be carried out for electrical system in the plant every year in accordance with the criteria prescribed by law.	Project area	Throughout operation phase	Solar Development Co., Ltd.
4. Solid Waste Management	1. Collection and transport of damaged or expired equipment for disposal shall be carried out in accordance with the Notification of the Ministry of Industry on Disposal of Waste or Unusable Materials B.E. 2566 (2023) or the latest law in force and shall comply with the following guidelines.	Project area	Throughout operation phase	Solar Development Co., Ltd.
	<ul style="list-style-type: none"> <li>In case of export of waste for management in other countries, the export shall be carried out in accordance with the law governing hazardous substances and international requirements. When the operation is completed, the ERC shall be informed within 30 days after the waste export for management in other countries.</li> </ul>	Store waste at the project area before arranging proper disposal		
	<ul style="list-style-type: none"> <li>In case of waste management in the country, hazardous waste shall be disposed in secure landfills or by incineration in a hazardous waste incinerator.</li> </ul>	Store waste at the project area before arranging proper disposal		

**TABLE 5.1-3  
ENVIRONMENTAL AND SOCIAL IMPACT PREVENTION AND CORRECTION MEASURES OF SOLAR DEVELOPMENT  
SOLAR POWER PLANT FOR OPERATION PHASE (CONT'D)**

Environmental Parameters	Environmental Impact Prevention and Correction Measures	Location	Duration	Responsible Party
4. Solid Waste Management (Cont'd)	2. Regular inspection of waste storage shall be carried out to prevent any impact which may arise from waste contamination or dispersion.	Project area	Throughout operation phase	Solar Development Co., Ltd.
	3. Damaged PV panels shall be gathered in waste storage facility before the disposal. Their disposal method shall be in accordance with the Announcement of Ministry of Industry regarding the Management of Waste and Unused Materials, B.E. 2566 (2023).	Project area	Throughout operation phase	Solar Development Co., Ltd.
5. Major Hazard and Emergency	1. Contractor shall prepare Emergency Preparedness and Response Plan before the beginning of the construction.	Project area	Throughout operation phase	Solar Development Co., Ltd.
	2. Conduct regular drills for fire evacuation and firefighting plans within 1 year of occupancy and annually thereafter following the initial drill.	Project area	Throughout operation phase	Solar Development Co., Ltd.
	3. Provide fire extinguishers in accordance with government regulations and standards for managing occupational health, safety, and environmental conditions related to fire prevention and control, as per the Occupational Safety, Health, and Environment Management in the Workplace to Prevent and Control Hazardous Incidents Act, B.E. 2555 (2012).	Project area	Throughout operation phase	Solar Development Co., Ltd.
	4. Implement an alarm system capable of signaling emergencies to cover the entire area.	Project area	Throughout operation phase	Solar Development Co., Ltd.
6. Green Area and Aesthetics Criteria	1. The environmental impact prevention and correction measures shall be followed. Green areas shall be maintained and when dead plants are found, they shall be replaced with new plants to ensure the sustainability of green areas. Perennial trees shall be mainly considered and planted in the project's green areas as appropriate.	Project area	Throughout operation phase	Solar Development Co., Ltd.
	2. Herbicide use in the Project area is prohibited.	Project area	Throughout operation phase	Solar Development Co., Ltd.
7. Land Access	1. Ensure that access to public road for local communities is not restricted for the landlocked area.	Project area	Throughout operation phase	Solar Development Co., Ltd.

**TABLE 5.1-4  
ENVIRONMENTAL AND SOCIAL MONITORING MEASURES OF SOLAR DEVELOPMENT SOLAR POWER PLANT  
FOR CONSTRUCTION PHASE**

Environment Parameters	Measurement Indices	Analysis/Measurement Method	Monitoring Station	Frequency	Responsible Party
1. Air Quality	<ul style="list-style-type: none"> <li>- 24-hour average total suspended particulate (TSP)</li> <li>- 24-hour average particulate matters smaller than 10 microns (PM-10)</li> <li>- Wind direction and speed (at least 1 station)</li> </ul>	<ul style="list-style-type: none"> <li>- TSP and PM-10 by Gravimetric-High Volume or methods accepted by Pollution Control Department.</li> <li>- Wind direction and speed by using wind speed &amp; direction recording meter.</li> </ul>	3 monitoring stations, namely <ul style="list-style-type: none"> <li>- A0: The Project site</li> <li>- A1: Wat Mai Khiri Wong (Wat Khao Pho Pu)</li> <li>- A2: Wat Huai Luek Samakkhitham</li> </ul>	<ul style="list-style-type: none"> <li>- Twice a year in 2 main wind directions throughout the construction phase. A 5-day consecutive measurement covering working days and holidays, as well as peak construction activities.</li> </ul>	Solar Development Co., Ltd.
2. Noise Level	<ul style="list-style-type: none"> <li>- 24-hour equivalent continuous sound level (<math>L_{eq\ 24\ hr}</math>)</li> <li>- Background noise level (<math>L_{90}</math>)</li> <li>- Day-night average sound level (<math>L_{dn}</math>)</li> <li>- Maximum noise level (<math>L_{max}</math>)</li> </ul>	<ul style="list-style-type: none"> <li>- International Organization for Standardization (ISO1996) or the methods specified by Pollution Control Department</li> </ul>	3 monitoring stations, namely <ul style="list-style-type: none"> <li>- N0 : The Project site</li> <li>- N1: House in the east of the Project</li> <li>- N2: House in the west of the Project</li> </ul>	<ul style="list-style-type: none"> <li>- Twice a year throughout the construction phase. A 7-day consecutive measurement covering working days and holidays, as well as peak construction activities.</li> </ul>	Solar Development Co., Ltd.
3. Effluent Quality	<ul style="list-style-type: none"> <li>- pH</li> <li>- BOD<sub>5</sub></li> <li>- Suspended Solid</li> <li>- Sulfide</li> <li>- Total Dissolved Solid</li> <li>- Settleable Solids</li> <li>- Oil &amp; Grease</li> <li>- TKN</li> <li>- Fecal Coliform Bacteria</li> </ul>	<ul style="list-style-type: none"> <li>- Measurement methods will be in compliance with the Notification of the Ministry of Industry regarding Industrial Effluent Standards B.E. 2560 (2017) and the Notification of Ministry of Natural Resources and Environment regarding Industrial Effluent Standards for Industrial Plants, Industrial Estates and Industrial Zones B.E. 2559 (2016)</li> </ul>	Retention pond at worker's camp	<ul style="list-style-type: none"> <li>- If the contractor discharges treated waste or sewage outside into natural water sources or private area, the Project shall conduct water quality monitoring once a month</li> </ul>	Solar Development Co., Ltd.



**TABLE 5.1-4  
ENVIRONMENTAL AND SOCIAL MONITORING MEASURES OF SOLAR DEVELOPMENT SOLAR POWER PLANT  
FOR CONSTRUCTION PHASE (CONT'D)**

Environment Parameters	Measurement Indices	Analysis/Measurement Method	Monitoring Station	Frequency	Responsible Party
4. Socio-economic and Public Participation	- Complaints from the communities about the project with method and duration of remedial action	- Record	- Project area	- Prepare a summary of monthly data - Report the data every year	Solar Development Co., Ltd.
	- Joint activities undertaken by the project together with the local communities	- Record	- Project area	- Prepare a summary of monthly data - Report the data every year	Solar Development Co., Ltd.
	- The environmental audit committee's performance	- Record	- Project area	- Report the data every year	Solar Development Co., Ltd.
5. Occupational Health and Safety	- Accident statistics specifying causes and nature of accidents, health impact, number of injured or deceased workers including problem-solving methods and recommendations	- Record	- Project area	- Prepare a summary of monthly data - Report the data every year	Solar Development Co., Ltd.
6. Transportation	- Daily record the number and types of vehicles and time to enter the project construction area - Record the number of truck transporting material and equipment - Statistical record of accidents occurred from transportation including cause, location, time, and preventive measures for every accident	- Record	- Project construction area and transportation route	- Everyday throughout the construction phase	Solar Development Co., Ltd.

**TABLE 5.1-4  
ENVIRONMENTAL AND SOCIAL MONITORING MEASURES OF SOLAR DEVELOPMENT SOLAR POWER PLANT  
FOR CONSTRUCTION PHASE (CONT'D)**

<b>Environment Parameters</b>	<b>Measurement Indices</b>	<b>Analysis/Measurement Method</b>	<b>Monitoring Station</b>	<b>Frequency</b>	<b>Responsible Party</b>
7. Solid Waste Management	- Record type and quantity of waste and disposal method	- Record	- Project construction area	- Prepare a summary of monthly data - Report the data every year	Solar Development Co., Ltd.

**TABLE 5.1-5  
ENVIRONMENTAL AND SOCIAL MONITORING MEASURES OF SOLAR DEVELOPMENT SOLAR POWER PLANT  
FOR OPERATION PHASE**

<b>Environment Parameters</b>	<b>Measurement Indices</b>	<b>Analysis/Measurement Method</b>	<b>Monitoring Station</b>	<b>Frequency</b>	<b>Responsible Party</b>
1. Water Quality 1.1) Water Use	<ul style="list-style-type: none"> <li>- The water volume used in the project for comparison with the volume permitted by the permitting agency</li> <li>- Problems and obstacles from the project's water use</li> </ul>	<ul style="list-style-type: none"> <li>- Record</li> </ul>	<ul style="list-style-type: none"> <li>- Project area</li> </ul>	<ul style="list-style-type: none"> <li>- Every 6 months</li> </ul>	Solar Development Co., Ltd.
1.2) Effluent Discharge	<ul style="list-style-type: none"> <li>- Water balance chart</li> <li>- The data on wastewater treatment system and effluent discharges</li> </ul>	<ul style="list-style-type: none"> <li>- Record</li> </ul>	<ul style="list-style-type: none"> <li>- Project area</li> </ul>	<ul style="list-style-type: none"> <li>- Prepare a summary of monthly data</li> <li>- Report the data every year</li> </ul>	Solar Development Co., Ltd.
2. Socio-economic and Public Participation	<ul style="list-style-type: none"> <li>- Complaints from the communities about the project with method and duration of remedial action</li> </ul>	<ul style="list-style-type: none"> <li>- Record and prepare a report</li> </ul>	<ul style="list-style-type: none"> <li>- Project area</li> </ul>	<ul style="list-style-type: none"> <li>- Prepare a summary of monthly data</li> <li>- Report the data every year</li> </ul>	Solar Development Co., Ltd.
	<ul style="list-style-type: none"> <li>- Joint activities undertaken by the project together with the local communities</li> </ul>	<ul style="list-style-type: none"> <li>- Record and prepare a report</li> </ul>	<ul style="list-style-type: none"> <li>- Project area</li> </ul>	<ul style="list-style-type: none"> <li>- Prepare a summary of monthly data</li> <li>- Report the data every year</li> </ul>	Solar Development Co., Ltd.
	<ul style="list-style-type: none"> <li>- The joint committee's performance</li> </ul>	<ul style="list-style-type: none"> <li>- Record and prepare a report</li> </ul>	<ul style="list-style-type: none"> <li>- Project area</li> </ul>	<ul style="list-style-type: none"> <li>- Once a year</li> </ul>	Solar Development Co., Ltd.

**TABLE 5.1-5  
ENVIRONMENTAL AND SOCIAL MONITORING MEASURES OF SKY POWER SOLAR POWER PLANT  
FOR OPERATION PHASE (CONT'D)**

Environment Parameters	Measurement Indices	Analysis/Measurement Method	Monitoring Station	Frequency	Responsible Party
3. Occupational Health and Safety	- Accident statistics specifying causes and nature of accidents, health impact, number of injured or deceased workers as well as remedial actions and recommendations	- Record	- Project area	- Prepare a summary of monthly data - Report the data every year	Solar Development Co., Ltd.
	- Inspection results of electrical system in the plant and safety certification for electrical system in the plant	- Record and prepare a report	- Project area	- Report the data every year	Solar Development Co., Ltd.
	- Results of fire and emergency drills	- Record and prepare a report	- Project area	- Once a year or as requested by law	Solar Development Co., Ltd.
	- Inspection results of warning systems and fire protection and suppression equipment	- Record and prepare a report	- Project area	- Report the data every year	Solar Development Co., Ltd.
4. Solid Waste Management	- Record waste type, volume and disposed method	- Record by using record form of the Department of Industrial Works (Form Sor Kor)	- Project area	- Report the data every year	Solar Development Co., Ltd.

## 5.2 EMERGENCY PREPAREDNESS AND RESPONSE PLAN

Emergency Preparedness and Response Plan (ERP) is to be prepared by EPC Contractor for construction phase and submit to the project proponent for concurrence, while ERP for operation phase is to be prepared Solar Development Co., Ltd. ERP shall cover emergency incidents that may occur in the construction sites during the construction of the Project components and in the project area during operation phase. The emergency incidents could have adverse impacts on the environment, and on health and safety of construction workers, project staff, and nearby communities.

### 5.2.1 ERP for Construction Phase

During construction phase, ERP will mainly cover a construction accident that happens on a construction site and a fire incident occurring on a construction site and at worker camp. The ERPs for those incidents are as follow.

#### (1) Construction Incident

The contractor must provide the following welfare amenities in the construction area in compliance with the Ministry of Labour's regulations on the provision of welfare facilities in establishments, B.E. 2548 (2005):

- Medical supplies and basic first-aid equipment.
- A nursing room and a nurse on duty during work hours
- Vehicles ready to transport staff in the event of an emergency.

As a result, if an accident occurs at work, there will be equipment and medical supplies on hand, a technical nurse, as well as workers trained in first aid to address minor injuries. Vehicles are on standby to transfer patients who need to be referred for additional treatment.

#### (2) Fire Incident

A fire prevention and suppression plan that is to be prepared by EPC Contractor must be complied with the Ministerial Regulation on the Standard for Administration and Management of Occupational Safety, Health and Environment in relation to Fire Prevention and Control B.E. 2555 and the Ministerial Regulation of the Ministry of Labour on the prescribing of Standard for administration and management of occupational safety, health and environment and workplace environments about the fire prevention and prevention (No.2), B.E. 2561; and must be concurred by the project developer. According to the laws, the fire prevention and suppression plan must contain at least the following plans.

State	Details of plan
Before fire incident	Fire prevention campaign plan
	Training plan
	Inspection plan
During fire incident	Fire suppression plan
	Fire evacuation plan
	Relief plan (to be continued after fire incident)
After fire incident	Relief plan (continued from during fire incident state)
	Reform plan

## 5.2.2 ERP for Operation Phase

During the operation phase, emergency situations associated with the project will cover the fire incident. The environmental, health, and safety division shall be responsible for developing a site-specific ERP which shall be placed in the site's emergency response/procedures binder kept in the facility control room.

### 5.2.2.1 Fire Incident

#### (1) Risk Area

- Solar Panel
- Transformer
- Battery room
- Electrical equipment

#### (2) Responsibility

##### (2.1) EHS Division

- Determining the required level of fire prevention and necessary control.
- Tracking the training requirements.
- Organizing and training for all members of Emergency Response Team.
- Inspect all firefighting equipment and maintain as per manufacturer's recommendations.
- Develop the fire response plan.
- Develop the site-specific evacuation plan.

##### (2.2) Emergency Response Team

- Immediately respond to a small fire preventing a major emergency.
- Perform both offensive and defensive activities with the use of protective equipment as per NFPA requirements.

##### (2.3) All Employees

- Constantly alert for fires hazards.
- Eliminate fires hazards.
- Understanding the locations of fire extinguishers and alarm systems within the project.
- Participate in the evacuation drill at least annually.

#### (3) Fire Protection Rules

- a) Know the location of all the fire extinguishers, fire hoses and other fire protection equipment in working area.
- b) Know how to use all the fire protection equipment in working area.
- c) Know the location of all fire exits in working area.
- d) Report all fire to the control room immediately.
- e) Obey "NO SMOKING" signs. Smoking permitted only in designated areas.
- f) Fire equipment is for fire use only and must not be disturbed or used for any other purpose.

**(4) Fire Response Rules**

- a) In the event that a fire does start, to ensure prompt and proper operator actions, thereby minimizing the severity of the fire and extent of damage.
- b) A formal qualification program for plant operators, maintenance personnel shall be implemented to ensure proper fire prevention, firefighting and reporting techniques.
- c) Firefighting will not be done at the risk of injury to the employees involved. At any time a fire appears to be spreading and the situation can't be controlled, back out and wait for the fire department assistance.
- d) Inspection and maintenance of all firefighting equipment and protective clothing shall be performed monthly and the proper documentation maintained.

**(5) Fire Response Plan/Fire Prevention Plans** shall set forth procedures, step by step, of the actions that each employee is to take in the event of a fire including;

- a) Immediate action upon the discovery of a fire
- b) Establish who, how and when the in-house and local emergency personnel should be contacted
- c) Method of notifying employees, main emergency response team, and response team members of the fire
- d) Method of determining mustering location and means of taking attendance for the main emergency response team, response team members, and all other employees
- e) Actions to be taken in the event of personnel injury
- f) Actions to declare the end of the state of emergency
- g) Follow-up actions

**5.2.2.2 Evacuation**

(1) The Environment, Health & Safety Division shall be responsible for developing site-specific evacuation plan addressing multiple evacuation routes throughout the site.

(2) All employees shall muster at pre-assigned locations and attendance will be taken by the Environment, Health and Safety Division, or if the Environment, Health and Safety Division Personnel is not present, the HR & Admin Division Personnel.

(3) Evacuation Routes shall be posted throughout the site.

(4) Planned evacuation drills shall be conducted at least once per year and documented. All persons in the plant must participate.

**5.2.2.3 Emergency Plan Drill**

Emergency plan drill is the preparatory drill for an emergency incident for the personnel and equipment. The drill follows the fire prevention plan of each unit. The drill for Emergency Level 1 will be organized at least once a year with an assessment of each drill to continuously improve the efficiency of the emergency plan.

### 5.3 MONITORING AND REPORTING

Apart from the general measures (as shown in **Table 5.1-1**) which set for ensuring the implementation of the proposed mitigation measures and monitoring program; and reporting. The Project will involve the representative of communities situated within 3-kilometer radius from the Project site, government agencies, and a qualified expert to participate in monitoring activities as Environmental Impact Monitoring Committee. The details of committee member, qualification of the members, terms and roles of the committee, and power and duties of the committee is addressed in **Table 5.1-2** under the economic, social and public participation aspect.

Besides, Solar Development Co., Ltd. is a subsidiary of Gulf Energy Development PCL. (GED) which has established Environmental and Social Management System (ESMS) to apply to a project life cycled owned and managed by GED and its subsidiaries starting from feasibility study, project development to operation for the management of environmental, social, health and safety risk and opportunities.

Monitoring and reporting is a part of ESMS framework which requires the staff at appropriate level in the organization to monitor the environmental and social (ES) performance to measure continual improvement and ensure compliance with the measures by taking the following actions.

- **Site level**
  - Conduct routine inspections to monitor the effectiveness of operating procedures being implemented and compliance
  - Plan and perform ES monitoring program (or hire a third party to perform) regularly as required by the regulations such as air emissions, discharge, ambient noise, etc.).
  - Report the performance against the group ES targets to the Corporate ES function at the frequency of agreed timeline.
  - Conduct an investigation and deploy preventive and corrective actions when non-conformities arise from the inspection, monitoring and target achievements.
- **Corporate level**
  - Review and analyze the group ES performance and make recommendations for continual improvement (including benchmarking and definition of group ES target).
  - Report ES performance to external stakeholders as required by the obligations.
  - Consider conducting a Group ES data verification program to ensure the completeness, accuracy and reliability of data so that ES performance is transparently disclosed.

The details of GED's ESMS are presented in **Appendix 5A**.



## 5.4 MITIGATION MEASURES REGARDING TRANSMISSION LINE

The project 115 kV TL is being constructed and will be operated and maintained by the PEA who owns the TL. The potential risks and impact from the installation and operation of these power lines are therefore managed by the PEA. *[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]* PEA's team, including project manager and supervisor, will carry out regular supervisory inspection of the construction works and identify non-compliances, EHS issues or community impacts the need to be addressed. PEA has weekly construction progress meetings with their contractor, in which they can raise any issues and agree on corrective actions.

The Project's Grievance Redress Mechanism is open to all to raise concerns and grievances relating to the Project. Community members, including those along the TL route are aware of the project GRM. Where the Project receive complaints and grievances related to the TL construction activities or the construction contractor, the Project will communicate these to PEA for evaluation and resolution. It is also noted that the PEA have their own GRM (as described in **Section 7.3**) through which communities can raise their issues and concerns relating to the TL to PEA directly. The PEA will be the designated authority to communicate with affected communities to resolve issues relating to TL.

The Project will ensure close coordination with PEA to gather relevant information relating to TL impacts, issues and mitigation measures implemented to the extent possible, which will be included in the Project's reports to lenders on any and all reported grievances.

# CHAPTER 6

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## STAKEHOLDER ENGAGEMENT



## CHAPTER 6

### STAKEHOLDER ENGAGEMENT

#### 6.1 INTRODUCTION

Stakeholder engagement is a crucial process whereby residents, government agencies and sensitive receptors in the study area are informed about Project-related information, provide feedback, express concerns of affected parties, and offer suggestions to minimize impacts. This stands as a key factor in an effective impact assessment process.

Solar Development Co., Ltd. has a plan to develop Solar Development Solar Power Plant Project, which incorporates ground-mounted PV technology and BESS. The Project recognizes that stakeholder engagement is an important process, through which people in the study area receive information about the Project, express concerns, and offer suggestions. The one-way and two-way communication, initiated from the early stage, will assist the Project owner in incorporating valuable information to refine and tailor the Project details according to community concerns.

For a non-combustion power plant with an installed capacity of 10 megawatts or more, the targeted stakeholder engagement must encompass an area with a radius of at least 3 kilometers from the Project boundary. The designated area for conducting public participation for the Project is illustrated in **Figure 6.1-1**.

#### 6.2 STAKEHOLDER ANALYSIS, INFORMATION DISCLOSURE AND CONSULTATION

Stakeholder engagement is the key activity for any project to obtain full participation from parties concerned. There are 3 steps to be conducted for stakeholder engagement namely stakeholder analysis, stakeholder information disclosure and consultation. Description of each step is to be elaborated in the following sections.

##### 6.2.1 Stakeholder Analysis

Analysis of stakeholder/community readiness prior to conducting the information-gathering meeting, the Project organized a meeting to gather opinions from the public and stakeholders who are affected or involved. This was done in relation to conducting environmental studies and preparing a preliminary Project report. The purpose was to provide detailed Project information to relevant government agencies and community leaders in the vicinity areas within a 3-kilometer radius from the Project boundary. Overall stakeholder engagement of the Project can be illustrated in **Figure 6.2.1-1**.

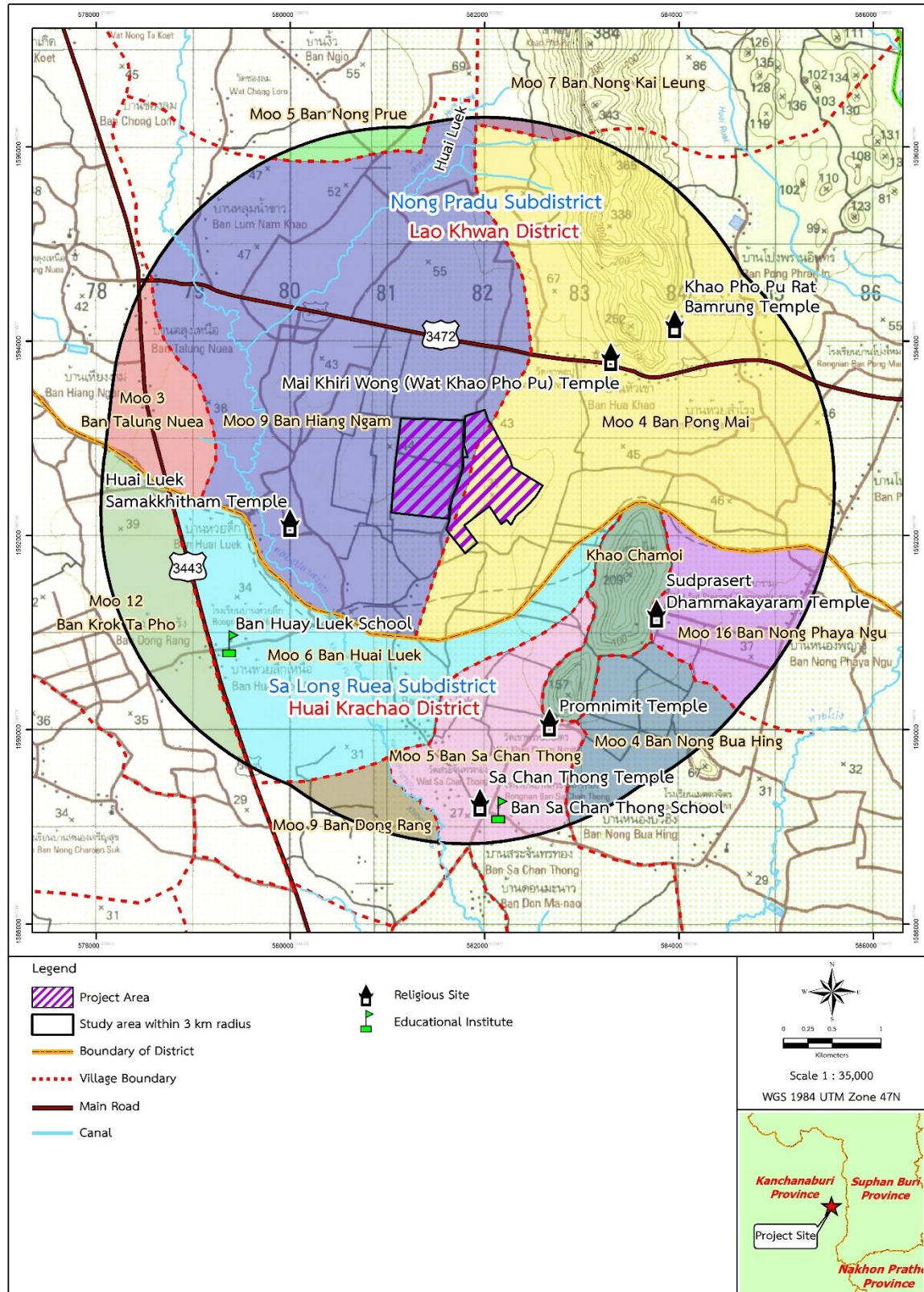


FIGURE 6.1-1: THE STUDY AREA

Implementation Procedure	Implementation Activity
<p>Provide detailed Project information, study results, environmental impact prevention and mitigation measures, and monitoring measures.</p>	<p>Channels for providing information to the public: 1) Directly engage in meetings/forums to promote the Project, solicit opinions, and receive suggestions from community leaders and relevant organizations. 2) Display Project information and an invitation to the public consultation forum on notice boards of government agencies and community centers.</p>
<p>Disseminate Project details to create understanding about the Project, within no less than 15 days.</p>	<p>3) Disseminate a preliminary CoP report at key locations, including: - Project's construction site - Energy Regulatory Commission Office: Regional Office - Provincial Industry Office - District offices and local administrative organization offices within a radius of at least 3-kilometer from the Project boundary - Sub-district administrative offices, community head's offices, and community halls within a radius of at least 3-kilometer from the Project boundary - Schools, religious institutions, community parks, and markets within a radius of at least 3-kilometer from the Project boundary 4) Send letters with documents and invitations to relevant organizations and community leaders. 5) Open pre-registration for interested participants of the public consultation forum.</p>
<p>Organize one opinion-gathering forum to explain Project details and gather opinions from the public and stakeholders who are affected.</p>	<p>Organize a public consultation forum to explain Project details and gather public opinions, and provide channels for receiving opinions, including: 1) During the forum proceedings 2) Comment forms (in case of inability to express opinions directly) 3) Post-meeting evaluation forms</p>
<p>Continuously receive additional comments for no less than 15 days after the opinion-gathering forum is concluded.</p>	<p>Social media, electronic media, internet, postal services, telephone, fax, electronic mail, local newspaper, community radio, and the information system network of the Office of Energy Regulatory Commission (OERC).</p>
<p>Compile and finalize the summary of opinion-gathering results within 30 days from the opinion-gathering forum.</p>	<p>Summary the details as follows: 1) Information about the participants providing opinions 2) Records of opinions from participants 3) Environmental impact prevention and mitigation measures of the Project</p>
<p>Continuously disseminate reports of summarizing opinion-gathering results for a period of no less than 15 days.</p>	<p>Announcement locations include: 1) Project's construction site 2) Energy Regulatory Commission Office, Regional Office 9 (Kanchanaburi) 3) Provincial Industry Office 4) District offices and local administrative organization offices within a radius of at least 3-kilometer from the Project boundary 5) Sub-district administrative offices, community head's offices, and community halls within a radius of at least 3-kilometer from the Project boundary 6) Schools, religious institutions, community parks, and markets within a radius of at least 3-kilometer from the Project boundary</p>
<p>Provide an opportunity for affected parties to express their comments or objections regarding the summary of opinion-gathering results within 30 days from the date of report dissemination.</p>	<p>Social media, electronic media, internet, postal services, telephone, fax, electronic mail, local newspaper, community radio, and the information system network of the Office of Energy Regulatory Commission (OERC).</p>
<p>Office of Energy Regulatory Commission (ERC)</p>	<p>Approach to the consideration process.</p>

Remark: Implementation procedure according to the Energy Regulatory Commission (ERC), regards listening to opinions and creating understanding with the public and stakeholders (B.E. 2565 (2022))

**FIGURE 6.2.1-1 : STAKEHOLDER CONSULTATION PROCESS**

The first stage in engaging stakeholders is to identify the key stakeholders who will be consulted and involved. Based on Safeguard Policy Statement of ADB, IFC Performance Standards, Equator Principles 4, and Public Participation guideline of the Office of Natural Resources and Environmental Policy and Planning (ONEP), the stakeholder category was developed into the following stakeholder groups:

- **Affected Parties:** Local communities related communities leaders within a 3-kilometer radius from the Project boundary, Previous landowners that are;
  - Community leaders and people in each of the project study communities;
  - Gender and vulnerable groups;
  - Key community informants, including community elders and spiritual leader; and
  - Key interest groups including religious leaders
- **Authorizing Agencies**
- **Relevant government agencies:** There are the government agencies at deference levels. That may involve in the project implementation including:
  - Regional agency
  - Provincial agency
  - District agencies
  - Local agencies
  - Public health agencies responsible for health care to the people in the study area
- **Environmentally Sensitive Areas**
- **Mass Media**
- **General Interest Parties**

Their role in the IEE and subsequent implementation process are presented in **Table 6.2.1-1**.

**TABLE 6.2-1**  
**ANALYSIS OF STAKEHOLDER'S ROLE IN ESIA AND SUBSEQUENT**  
**PROJECT IMPLEMENTATION PROCESS**

Stakeholder Groups	Details	Role in the ESIA and Subsequent Implementation Process
<p><b>1. Local communities</b></p>	<p>People in the areas within 3 -km radius from the project boundary <u>Nong Pradu Subdistrict, Lao Khwan District</u></p> <ul style="list-style-type: none"> <li>• Moo 3 Ban Talung Nuea</li> <li>• Moo 4 Ban Pong Mai</li> <li>• Moo 5 Ban Nong Prue</li> <li>• Moo 7 Ban Nong Kai Leung</li> <li>• Moo 9 Ban Hiang Ngam</li> </ul> <p><u>Sa Long Ruea Subdistrict, Huai Krachao District</u></p> <ul style="list-style-type: none"> <li>• Moo 4 Ban Nong Bua Hing</li> <li>• Moo 5 Ban Sa Chan Thong</li> <li>• Moo 6 Ban Huay Luek</li> <li>• Moo 9 Ban Dong Rang</li> <li>• Moo 12 Ban Krok Ta Pho</li> <li>• Moo 16 Ban Nong Phaya Ngu</li> </ul> <p><u>Vulnerable groups</u></p> <ul style="list-style-type: none"> <li>• Thai Song Dam Cultural Center (Thai Song), Sa Long Ruea Sub-district</li> <li>• Female Group, Sa Long Ruea Subdistrict</li> <li>• Child Development Center, Sa Long Ruea Subdistrict</li> <li>• Life Quality Development and Career Promotion Center for the Elderly, Sa Long Ruea Subdistrict</li> <li>• Disabled People Group, Sa Long Ruea Subdistrict</li> <li>• Disabled People Group, Nong Pradu Subdistrict</li> </ul>	<p>To provide information to the villagers to participate in project public consultation activities.</p>
<p><b>2. Person in charge of the report</b></p>	<p><b>Project owner:</b> Solar Development Co., Ltd. <b>Person in charge of the report :</b> TLT Consultants Company Limited</p>	
<p><b>3. Related agencies</b></p>	<p>Government agencies at the regional level, district level and related local government organizations, including public health agencies responsible for health care to the people in the study area :</p> <p><b>Regional agency</b></p> <ul style="list-style-type: none"> <li>• The Office of the Energy Regulatory Commission Region 9 (Kanchanaburi)</li> </ul>	<ul style="list-style-type: none"> <li>▪ To consider and approve CoP report. /Grant Environmental permission for the project implementation</li> </ul>

**TABLE 6.2-1**  
**ANALYSIS OF STAKEHOLDER’S ROLE IN ESIA AND SUBSEQUENT**  
**PROJECT IMPLEMENTATION PROCESS (CONT’D)**

Stakeholder Groups	Details	Role in the ESIA and Subsequent Implementation Process
<p><b>3. Related agencies</b></p>	<p><b>Provincial agency</b></p> <ul style="list-style-type: none"> <li>• Provincial Energy Office of Kanchanaburi</li> <li>• Provincial Industry Office of Kanchanaburi</li> <li>• Director of Natural Resources and Environment of Kanchanaburi</li> <li>• Department of Public Works and Town and Country Planning of Kanchanaburi</li> </ul> <p><b>District agencies</b></p> <ul style="list-style-type: none"> <li>• Huai Krachao District Chief</li> <li>• Lao Khwan District Chief</li> <li>• Huai Krachao District Public Health Office</li> <li>• Lao Khwan District Public Health Office</li> <li>• Superintendent of Huai Krachao Police Station</li> <li>• Superintendent of Lao Khwan Police Station</li> <li>• Department of Agriculture of Huai Krachao District</li> <li>• Department of Agriculture of Lao Khwan</li> <li>• Department of Livestock of Huai Krachao District</li> <li>• Department of Livestock of Lao Khwan District</li> </ul> <p><b>Local agencies</b></p> <ul style="list-style-type: none"> <li>• Mayor of Sa long ruea Subdistrict</li> <li>• President of Nong Pradu Subdistrict Administrative Organization</li> </ul> <p><b>Public health agencies responsible for health care to the people in the study area</b></p> <ul style="list-style-type: none"> <li>• Nong Pradu Subdistrict Health Promoting Hospital</li> <li>• Sa Long Ruea Subdistrict Health Promoting Hospital</li> </ul>	<ul style="list-style-type: none"> <li>▪ To provide information on regulation concerning the project development and to engage in the project public consultation activities.</li> </ul>
<p><b>4. Environmentally Sensitive Areas</b></p>	<p><b>Sensitive receptors that may be affected by the operation within 3 kilometers of the Project fence line</b></p> <ul style="list-style-type: none"> <li>• Huai Luek Samakkhitham Temple</li> <li>• Mai Khiriwong Temple (Wat Khao Pho Pu)</li> <li>• Sudprasert Dhammakayaram Temple</li> <li>• Promnimit Temple</li> <li>• Sa Chan Thong Temple</li> <li>• Khao Pho Pu Rat Bamrung Temple</li> <li>• Ban Huay Luek School</li> <li>• Ban Sa Chan Thong School</li> </ul>	<p>To engage in the project public consultation activities</p>
<p><b>5. The public</b></p>	<p>People who are interested in the Project</p>	<p>To engage in the project public consultation activities</p>

Source: TLT Consultants Co., Ltd., 2023



## 6.2.2 Information Disclosure

### (1) Information Disclosure Techniques

The Project has several techniques used to build relationships with stakeholders, gather information from stakeholders, consult with stakeholders, and disseminate project information to stakeholders consists of;

#### 1) One-way Communication

– Project brochure: Disclosure of the Project information to disseminate to stakeholders.

– Offline and Online Publishing: Disclosure of the Project information through various channels such as Visiting to send an invitation to attend a meeting, Announcements to display information in public places, Website and Facebook page of the consultant company and Google Drive documents at the first step of consultation.

– In relation to land acquisition plan and process, Gulf's personnel carried out direct consultation with individual of landowners during B.E. 2564 (2021) - 2565 (2022).

#### 2) Two-way Communication

– Publicize the project: Meeting with stakeholder to publicize the Project information through the community relations officers of the project.

– Pre-engagement: Disclosure of the Project information to a group of stakeholders, allow stakeholders to provide their views on targeted baseline information, build a relationship with communities, and record responses.

– Public meeting: Disclosure of the Project information to a large group of stakeholders, especially the communities including the vulnerable group, the occupation group, the village health volunteers, the women club, etc., and allow the group to provide their views and opinions, build a relationship with the communities, especially those affected, distribute non-technical information, and facilitate meetings with PowerPoint presentations and related documents.

– Opinion survey: The Project will survey all stakeholders to gather their opinions and concerns to develop the project. The Project will be surveyed within October B.E. 2566 (2023).

### (2) Stakeholder Consultation Process

Stakeholders Consultation activities have been arranged based on the guideline developed by the Energy Regulatory Commission (ERC), regards listening to opinions and creating understanding with the public and stakeholders, particularly when considering the issuance of a license to operate electricity generation (B.E. 2565 (2022)). The objective of consultation activities is to listen and understand the opinions of the communities and stakeholders affected within the 3-kilometer radius from the Project area boundary is a process undertaken with the following steps;

1) Complying with the guidelines from Regulation of the Energy Regulatory Commission: Criteria for Preparing Code of Practice Report and Monitoring Report for the operation of electricity production, B.E. 2565 (2022). This includes summarizing Project details, action plans, and environmental impact prevention and mitigation measures as required by the Energy Regulatory Commission (ERC).

2) Notifying the schedule and location for receiving opinions to the Energy Regulatory Commission (ERC) and relevant parties at least 15 days prior to the opinion-receiving session.

3) Continuously disseminating Project information for a minimum of 15 days before commencing the public participation process. This information must be presented openly and accessible to the public and stakeholders as determined by the Energy Regulatory Commission (ERC).

4) Implementing a registration system to facilitate advanced registration for opinions by the public, stakeholders, and relevant agencies. This process should be convenient and can be conducted through online channels via QR Code as indicated in the meeting invitation documents.

5) Publicizing information to the public and stakeholders using suitable methods, such as social media, local newspaper, community radio, and the information system network of the Energy Regulatory Commission (ERC).

6) Conducting a forum to receive opinions with target groups including residents and affected parties, community leaders, relevant government agencies, educational institutions, and mass media (if available). This should encompass both those residing or working within the Project area and the 3-kilometer radius study area from the Project site. During these sessions, Project information should be presented, and the attendees should be given the opportunity to express opinions, concerns, and adequate suggestions.

7) Ensuring that there are ongoing and additional channels for opinion submission for at least 15 days through various mediums such as social media, electronic media, website, postal service, telephone, fax, electronic mail, local newspaper, community radio, and the information system network of the Energy Regulatory Commission (ERC).

8) Compiling a summary report of the opinions received and completing it within 30 days from the end of the opinion-receiving process.

9) Publicizing the summary report of opinions received by openly presenting it at a location accessible to the public and stakeholders as determined by the Energy Regulatory Commission (ERC). This should occur consistently for a duration of at least 15 days. Furthermore, it provides an opportunity for the public and stakeholders to present their opinions or suggestions regarding the report within 30 days from the day of the summary report is published

## 6.3 RESULTS FROM STAKEHOLDER ENGAGEMENT

### 6.3.1 Pre-engagement Process

Pre-engagement meeting was conducted on May, B.E. 2566 (2023) by TLT to gather the information from the public and stakeholders regarding the preparation of an environmental report. This was initiated at the early stage of Project development with the aim of presenting preliminary Project details to gather feedback, concerns, and suggestions from stakeholders regarding the Project. From the pre-engagement activity, no concerns or complaints were raised regarding the land acquisition for the Project

The individual meeting with the representatives of the government agencies and community leaders is to publicize the preliminary project, and gather information and opinions of important people who involve in the project development. The meeting will be a process of getting to know each other by emphasizing an easy-to-understand communication, jointly discussing stakeholder analysis to determine the appropriate participation format for each stakeholder group (stakeholder engagement) and the format for holding meetings for opinions. The communities in the radius of the project area will be provided with the comprehensive information. The meeting of the target group was held 22-23 May 2023 and 6 June 2023. The target group consists of:

- Provincial Offices for Natural Resources and Environment Kanchanaburi
- Provincial Energy Office Kanchanaburi Province
- Provincial Industry Office Kanchanaburi Province
- Mayor of Sa Long Ruea Subdistrict
- President of Wang Phai Subdistrict Administrative Organization
- Sa Long Ruea Subdistrict Headman
- Village Headman, Village No. 6, Sa Long Ruea Subdistrict
- Village Headman, Village No. 12, Sa Long Ruea Subdistrict
- Nong Pradu Subdistrict Headman
- Village headman, Village No. 3, Nong Pradu Subdistrict
- Village headman, Village No. 4, Nong Pradu Subdistrict
- Village Headman, Village No. 9, Nong Pradu Subdistrict

### 6.3.1.1 Pre-engagement Meeting

The individual meeting was organized to meet representatives of government agencies and community leaders, who have an influence to the local people. This activity is aiming to clarify the initial project information, the scope of work and the environmental study guidelines as well as the public participation plan. The date, time and venue of the subsequent public consultation is also discussed together with the request for any comments, the concern issues and recommendation that will be beneficial to the project. Details of the individual meeting are shown in **Table 6.3.1-1** and **Figure 6.3.1-1**.

**TABLE 6.3.1-1  
SUMMARY OF KEY ISSUES FROM THE PUBLIC CONSULTATION ACTIVITIES BY INDIVIDUAL MEETING.**

Agency	Meeting Date and Time	Questions/Opinions/Recommendations	Explanations
<p><b>1. Provincial Offices for Natural Resources and Environment Kanchanaburi</b></p> <p>Positions of the Meeting Persons :</p> <ul style="list-style-type: none"> <li>- Director Kanchanaburi provincial office of natural resources and environment</li> <li>- Director of Environment Section</li> </ul>	<p>22 May 2023 1.30 p.m.</p>	<ul style="list-style-type: none"> <li>- Has the Project joined the Thailand Voluntary Emission Reduction Program (T-VER)?</li> </ul>	
		<ul style="list-style-type: none"> <li>- What type of solar panel cleaner is used in the project? What is the cleaning process?</li> </ul>	<ul style="list-style-type: none"> <li>- During the operation period, the solar panels will be cleaned twice a year by using the tap water buying from the outside. No chemical is used in the process; so the effluent generated is only the water contaminated with dust, no chemical contamination. Therefore, it will be naturally disposed to the ground which will not cause any impact to the surface water quality.</li> </ul>
		<ul style="list-style-type: none"> <li>- For a long term operation, the solar panels will be required for a replacement (hazardous waste), what is a plan to manage such waste?</li> </ul>	<ul style="list-style-type: none"> <li>- The solar panels used in the project will have a service life of approximately 25 years, however, if there is any damage or deterioration in performance, they will be sent for external disposal which is managed by the agency who is authorized by Department of Industrial Works.</li> </ul>
		<ul style="list-style-type: none"> <li>- Does the project developing area have any certificate of ownership?</li> </ul>	<ul style="list-style-type: none"> <li>- The areas of both projects have the certificate of ownership.</li> </ul>
		<ul style="list-style-type: none"> <li>- Beside the solar panels installation, are there other activities in the project area such as agriculture?</li> </ul>	<ul style="list-style-type: none"> <li>- The activity in the project area is only related to the solar power generation by the technology of Photovoltaic or solar cell without other activity.</li> </ul>

**TABLE 6.3.1-1**  
**SUMMARY OF KEY ISSUES FROM THE PUBLIC CONSULTATION ACTIVITIES BY INDIVIDUAL MEETING. (CONT'D)**

Agency	Meeting Date and Time	Questions/Opinions/Recommendations	Explanations
<b>1. Provincial Offices for Natural Resources and Environment Kanchanaburi (Cont'd)</b>	22 May 2023 1.30 p.m.	- The suitable place for organizing the meeting should be the community hall in the area so that it will be convenient for the people to participate. Moreover, the project has to prepare the answers regarding to the impact on temperature/heat caused by the project development per area.	- The project acknowledged the recommendation for consideration and further action as appropriate.
		- Before organizing the meeting and conducting the project preliminary promotion, the project has to discuss with the community leaders, sub-district headmen, village headmen, president of sub-district Administrative Organization (SAO) in the area.	- The project acknowledged the recommendation for consideration and further action as appropriate.
		- Has the project prior conducted the project promotion or given any information relating to this project development?	- At present, the project has the CSR officer to work in the project area to continuously promote the project to community leaders in order to create well understanding and to get the preliminary information before organizing the public consultation meeting.
		- How will the people in the community get the benefit from the project development?	- The people in the community in the project area will receive the benefit from Power Development Fund according to the Regulation of the Energy Regulatory Commission which comprises of the employment, the supporting budget for community development, the property and land taxes as well as the signboard taxes

**TABLE 6.3.1-1**  
**SUMMARY OF KEY ISSUES FROM THE PUBLIC CONSULTATION ACTIVITIES BY INDIVIDUAL MEETING. (CONT'D)**

Agency	Meeting Date and Time	Questions/Opinions/Recommendations	Explanations
<b>1. Provincial Offices for Natural Resources and Environment Kanchanaburi (Cont'd)</b>	22 May 2023 1.30 p.m.	- To which organization will the power be sold?	- The project will sell the power to the Electricity Generating Authority of Thailand.
		- What rules and regulation the project used for preparing the said report?	- The report of the project, according to the Regulation of Energy Regulatory Commission, is in the scope of the Code of Practice (CoP) report. In this regard, the project will refer to the Notice of Regulation of Energy Regulatory Commission regarding to the Criteria of CoP Report Preparation and CoP Monitor Report for the Operation of Electricity Generation B.E. 2565 (2022)
		- It is recommended to encourage the public network to participate in this activity such as to build up the committee to act as a voice and representative of the people in the project area. -	- According to the regulation of the Energy Regulatory Commission in preparing the CoP report, the defined measure is to appoint the committee in association with the community so that the community can participate in the project implementation as well as to develop their community and environment together with the project. This committee comprises of the people's representative, local agencies, educational institutes, environmental academics and the project owner.
		- It is agreed to develop the project in Lao Khwan and Huai Krachao districts because both areas are in the zone with so relatively higher heat than other districts, hence, they are named as the E-san of central region	- The project acknowledged the recommendation for consideration and further action as appropriate.

**TABLE 6.3.1-1**  
**SUMMARY OF KEY ISSUES FROM THE PUBLIC CONSULTATION ACTIVITIES BY INDIVIDUAL MEETING. (CONT'D)**

Agency	Meeting Date and Time	Questions/Opinions/Recommendations	Explanations
<b>2. Provincial Energy Office Kanchanaburi Province</b> Positions of the Meeting Persons : - Kanchanaburi Provincial Energy Officer - Expert Technician	22 May 2023 3.00 p.m.	- Wish the community to gain benefit from the project development such as the employment during the construction period as appropriate or the cleaning work of solar panels during the project operation. If there is a project development in the area and the community gain more benefits, the project development will not be difficult.	- The project has a policy at the first priority to employ the local people whose no special skill is required, such as gardener, house cleaner, security officer etc. Besides, the community will gain more benefit from the Energy Development Fund in accordance with the Regulation of the Energy Regulatory Commission regarding to the financial supporting budget for community development, the property and land taxes as well as the signboard taxes
		- Has the project conducted the project promotion to public by giving the project information to district administration offices including the Provincial Electricity Authority yet? -	- At present, the project has assigned the CSR officer to work in the project area to continuously promote the project to the local agencies in order to create well understanding and to give preliminary information before organizing the public consultation meeting.
		- In the future, if there is a project development, will there be CSR in the area or not?	- The project has a plan to conduct the CSR in the future by supporting the social activities in the community such as the scholarship, religious activities and etc.
		- The people in Kanchanaburi province are quite much alert about the solar farm project because they have a little understanding on this type of project. Therefore, during the operation period, growing trees is requested to create the greenery area in the project to show that solar farm does not harm the environment by seeing that the trees can grow in this area as well.	- The project acknowledged the recommendation for consideration and further action as appropriate.



**TABLE 6.3.1-1**  
**SUMMARY OF KEY ISSUES FROM THE PUBLIC CONSULTATION ACTIVITIES BY INDIVIDUAL MEETING.(CONT'D)**

Agency	Meeting Date and Time	Questions/Opinions/Recommendations	Explanations
<b>2. Provincial Energy Office Kanchanaburi Province (Cont'd)</b>	22 May 2023 3.00 p.m.	- The effluent generated from the solar panels cleaning is requested for watering the trees in the project area.	- The project acknowledged the recommendation for consideration and further action as appropriated
		- When the project development is completed, it is requested to use the area as a study site for learning to the community and students.	- The project is willing to allow this area to be used as a study site for learning to the community and students in the future.
		- How long does the study and development period take for the whole project?	- The period for developing this project started from the design work, the preparation of CoP report, the permission process from the concerned agencies, construction phase until to the commissioning phase of power generation system and supply the electricity to the system, it takes about 21 months.
<b>3. Provincial Industry Office Kanchanaburi Province</b>  Position of the Meeting persons : - Kanchanaburi Provincial Industry Officer - Director of the Factory Group	23 May 2023 10.00 a.m.	- It is requested to prepare the answers for the climate issue/heat caused by the project.	- The project acknowledge of the recommendation.
		- It is requested to employ the students from the school in the project area to clean the solar panels in order to support the meal expenses, scholarship, including to allow the local community to be the main consultant regarding to the employment of local people. That is for creating the sense of contribution to the project and the area which gains benefit from the project development as well.	- The project has the policy to employ the local people in the first priority, in this regard, the project acknowledged this recommendation for further consideration as appropriate accordingly.

**TABLE 6.3.1-1**  
**SUMMARY OF KEY ISSUES FROM THE PUBLIC CONSULTATION ACTIVITIES BY INDIVIDUAL MEETING.(CONT'D)**

Agency	Meeting Date and Time	Questions/Opinions/Recommendations	Explanations
<b>3. Provincial Industry Office Kanchanaburi Province (Cont'd)</b>	23 May 2023 10.00 a.m.	<ul style="list-style-type: none"> <li>- Before proceeding with the public consultation meeting (big forum) the project should provide preliminary information to the community or organize a small group meeting with community leaders in the study area in order to promote the project as well as to view the trends of it. Such information should be emphasized that the aim of the meeting is for obtaining an opinion, concern, and recommendation to the project for well understanding only not for the referendum.</li> </ul>	<ul style="list-style-type: none"> <li>- At present, the project CSR officer is in the area to continuously promote the project to the community leaders and local agencies to build up the project understanding with the preliminary information prior to proceed the public consultation forum. However, the project acknowledged this recommendation for further consideration and action as appropriate.</li> </ul>
		<ul style="list-style-type: none"> <li>- The public project promotion document in the part of brochure is fine but the large vinyl signs with the same information as stated in the brochure should be prepared as well. These signs will be posted at the local administration offices, sub-district headman and village headman offices including the related places so that the people in the project area can be thoroughly informed of the project implementation more clearly.</li> </ul>	<ul style="list-style-type: none"> <li>- The project acknowledged the said recommendation for further consideration and action as appropriate.</li> </ul>

**TABLE 6.3.1-1**  
**SUMMARY OF KEY ISSUES FROM THE PUBLIC CONSULTATION ACTIVITIES BY INDIVIDUAL MEETING.(CONT'D)**

Agency	Meeting Date and Time	Questions/Opinions/Recommendations	Explanations
<b>4. Mayor of Sra Long Ruea Sub-district</b>	6 June 2023 10.00 a.m.	- In the public consultation meeting, will there be the clarification on greenhouse gas emissions, the occurrence of global warming and hot temperature that are caused by the implementation of the project?	- The project will collect all concerned issues and clarify it in the public consultation meeting.
		- The Mayor would like the project to invite the government agencies such as Provincial Natural Resources and Environment, Kanchanaburi province, the Provincial Energy Office Kanchanaburi province and etc. to attend the public consultation meeting in order to listen and answer the question from the people in the issues that the project development may cause the impacts which are the greenhouse gas emission, global warming, hot temperature, unseasonal rain and more dryer area and etc.	- The project has already made the invitation letter to the related government agencies to participate in the public consultation meeting. Those agencies are in the regional, provincial and district levels in Kanchanaburi province such as the Regional Energy Regulatory Commission, Region 9, the Provincial Energy Office, the Provincial Industry Office, and the Office of Provincial Natural Resources and Environment, and etc.
		- Request for a local employment	- Local employment will possibly be considered during the operation period for the work on cleaning solar panels.
		- Request for the clarification on Power Development Fund	- Direct benefit the community will get is the money on Power Development Fund in accordance to the Energy Regulatory Commission Regulation as well as other supports for the activities of the local community.

**TABLE 6.3.1-1**  
**SUMMARY OF KEY ISSUES FROM THE PUBLIC CONSULTATION ACTIVITIES BY INDIVIDUAL MEETING.(CONT'D)**

Agency	Meeting Date and Time	Questions/Opinions/Recommendations	Explanations
<b>5. Village Headman Moo 4, Ban Pong Mai</b>	6 June 2023 10.00 a.m.	- Since the temperature in this area is normally hotter than others; so the local people are quite concerned about the temperature that may be higher due to the project development.	- The project will collect all concerned issues on the heat and clarify to the people during the public consultation meeting.
		- Agreed to organize the meeting at the Ban Pong Mai School.	- The project has already coordinated with the Director of the Ban Pong Mai School for the preparedness of the public consultation meeting on Friday 23 June 2023.
<b>6. Village Headman Moo3, Ban Talung Nuea</b>	6 June 2023 10.30 a.m.	- Since the temperature in this area is normally hotter than others; so the local people are quite concerned about the temperature that may be higher due to the project development.	- The project will collect all concerned issues on the heat and clarify to the people during the public consultation meeting.
<b>7. Sub-district Headman, Nong Pradu sub-district (Moo 8) and Village Headman, Moo 9 Ban Hieng Ngam (Representatives)</b>	6 June 2023 12.00 a.m.	- Concerned on the weather that will become hotter than today.	- The project will collect all concerned issues on the heat and clarify to the people during the public consultation meeting.
<b>8. Village Headman, Moo 12 Sa Long Ruea subdistrict</b>	6 June 2023 1.00 p.m.	In the public consultation meeting, the clarification will be on the following issues : <ul style="list-style-type: none"> <li>- The temperature will be hotter due to the project operation.</li> <li>- The problem on unseasonal rain.</li> <li>- The comparison on the difference between the old and new model of solar panel should be presented, for example, the light reflection that can cause the hotter temperature and etc.</li> </ul>	- The project will collect all concerned issues on the heat and clarify to the people during the public consultation meeting

**TABLE 6.3.1-1**  
**SUMMARY OF KEY ISSUES FROM THE PUBLIC CONSULTATION ACTIVITIES BY INDIVIDUAL MEETING.(CONT'D)**

Agency	Meeting Date and Time	Questions/Opinions/Recommendations	Explanations
<b>8. Village Headman, Moo 12 Sa Long Ruea subdistrict (Cont'd)</b>	6 June 2023 1.00 p.m.	<ul style="list-style-type: none"> <li>- The project description and the impact that may occur as well as the benefit of project should be presented and explained clearly and comprehensively to the public.</li> <li>- In the long term will those impacts cause any affect to the health of the people?</li> <li>- The benefit the community will get due to the project operation.</li> <li>- The support/community development such as sports, education and various activities of the community.</li> <li>- The number of the meeting participants is approximately 60-70 persons.</li> </ul>	<ul style="list-style-type: none"> <li>- The benefit the community will get is the financial support from the Power Development Fund in accordance with the Energy Regulatory Commission Regulation which can be used for the development of community such as the lights for lightening the roads in the community, and the support of activities in the area like education, sports and etc.</li> <li>- Prior to the meeting date, the consulting company will call for coordinating about the number of participants from Moo 12, Sra Long Ruea sub-district once again.</li> <li>- The consulting company will inform in the public consultation forum to the public and the stakeholders in accordance with the Regulation of Energy Regulatory Commission regarding the public consultation and the understand making with the public and the stakeholders for consideration and granting of licenses in energy industry operation, B.E. 2565 (2022). This meeting will not act like a community arrangement that will only raise their hands to agree with that project. But it will be a forum for listening to the opinions of the public and stakeholders. This time, the public consultation will discuss on the concerned issues, suggestions, as well as give the related answers due to the project implementation in order to alleviate such concerns and to better understand the project operation.</li> </ul>

**TABLE 6.3.1-1**  
**SUMMARY OF KEY ISSUES FROM THE PUBLIC CONSULTATION ACTIVITIES BY INDIVIDUAL MEETING.(CONT'D)**

Agency	Meeting Date and Time	Questions/Opinions/Recommendations	Explanations
<b>9. President of Wang Pai Subdistrict Administrative Organization</b>	6 June 2023 1.30 p.m.	<p><b><u>Concerns :</u></b></p> <ul style="list-style-type: none"> <li>- Be concerned on the higher heat and less rain.</li> </ul> <p><b><u>Recommendation :</u></b></p> <ul style="list-style-type: none"> <li>- Request to prepare the answer to the public for the issue on the heat that may become higher due to the project operation.</li> </ul>	<ul style="list-style-type: none"> <li>- The project will collect all concerns about the heat for clarifying to the public in the public consultation meeting.</li> </ul>
<b>10. Village Headman Moo 6, Sra Long Ruea Subdistrict</b>	6 June 2023 2.30 p.m.	<p><b><u>Concerns:</u></b></p> <ul style="list-style-type: none"> <li>- Unseasonal rain</li> </ul> <p><b><u>Recommendation :</u></b></p> <ul style="list-style-type: none"> <li>- There should be an explanation to the public to understand the operation of the project and the information provided should be clear and comprehensive.</li> <li>- The number of meeting participants is around 50 persons.</li> <li>- Sa Long Ruea subdistrict will organize the sports competitions in the sub-district level during 21-23 June 2023.</li> </ul>	<ul style="list-style-type: none"> <li>- The project will collect all concerns about the heat for clarifying to the public in the public consultation meeting</li> <li>- Prior to the meeting date, the consulting company will call for coordinating about the number of participants of Moo 6, Sa Long Ruea subdistrict once again</li> </ul>
<b>11. Sa Long Ruea Subdistrict Headman</b>	6 June 2023 3.00 p.m.	<ul style="list-style-type: none"> <li>- The project should inform the public what benefit the community will receive from the project operation during the public consultation meeting.</li> </ul> <hr/> <ul style="list-style-type: none"> <li>- The project should construct the fences in order to clearly identify the project area.</li> </ul>	<ul style="list-style-type: none"> <li>- The benefit the community will receive is the financial support from the Power Development Fund in accordance with the Regulation of the Energy Regulatory Commission which can be used to support the community development such as education, sports or other activities and etc. The said benefit will be presented in the public consultation meeting.</li> </ul> <hr/> <ul style="list-style-type: none"> <li>- The project will consider it in detail later.</li> </ul>

Sources: TLT Consultants Co., Ltd., 2023



**FIGURE 6.3.1-1: EXAMPLE OF THE PUBLIC CONSULTATION ACTIVITIES  
BY INDIVIDUAL MEETING**

## 6.3.2 Stakeholder Engagement Process

### 6.3.2.1 Document Preparation prior to Commencing Public Meeting

The Project has followed Regulation of the Energy Regulatory Commission: Criteria for Preparing Code of Practice Report and Monitoring Report for the operation of electricity production, B.E. 2565 (2022), and Regulation of the Energy Regulatory Commission: Opinion Hearing and Understanding with the Public and Stakeholders for the issuance of a license of electricity production, B.E. 2565 (2022). The steps as summarized in **Table 6.3.2-1**

### 6.3.2.2 Notifying the Schedule and venue before Public Participation Meeting

The Project has initiated invitations to participate in the meeting, along with early distribution of preliminary CoP report, summary documents of Project details, and Project brochure to inform and disseminate detail of Project's information to the relevant stakeholders at least 15 days prior to the public meeting date. In addition, the Project has displayed informational signboard and invitations to the meeting venues in public places and community areas. These actions were carried out between June 2-3, B.E. 2566 (2023), as communication channels for receiving feedback and pre-registration for participation were implemented, as shown in **Table 6.3.2-1**.

Project information was disclosed in the stakeholder engagement activities in Thai language including supporting maps. The project information disclosed in the activities cover following contents;

- Project background
- Project features such as location of site and project type
- Core project facilities.
- Project work plan
- Scope of the CoP study
- Stakeholder engagement plan
- Impact Assessment and Mitigation Measures
- Environmental impact prevention and correction measures and the impact monitoring measures

Example billboard, documents for the public consultation meeting and pre-registration forms are shown in **Figure 6.3.2-1**



**TABLE 6.3.2-1**  
**PROCEDURES FOR IMPLEMENTATION ON PUBLIC MEETINGS.**

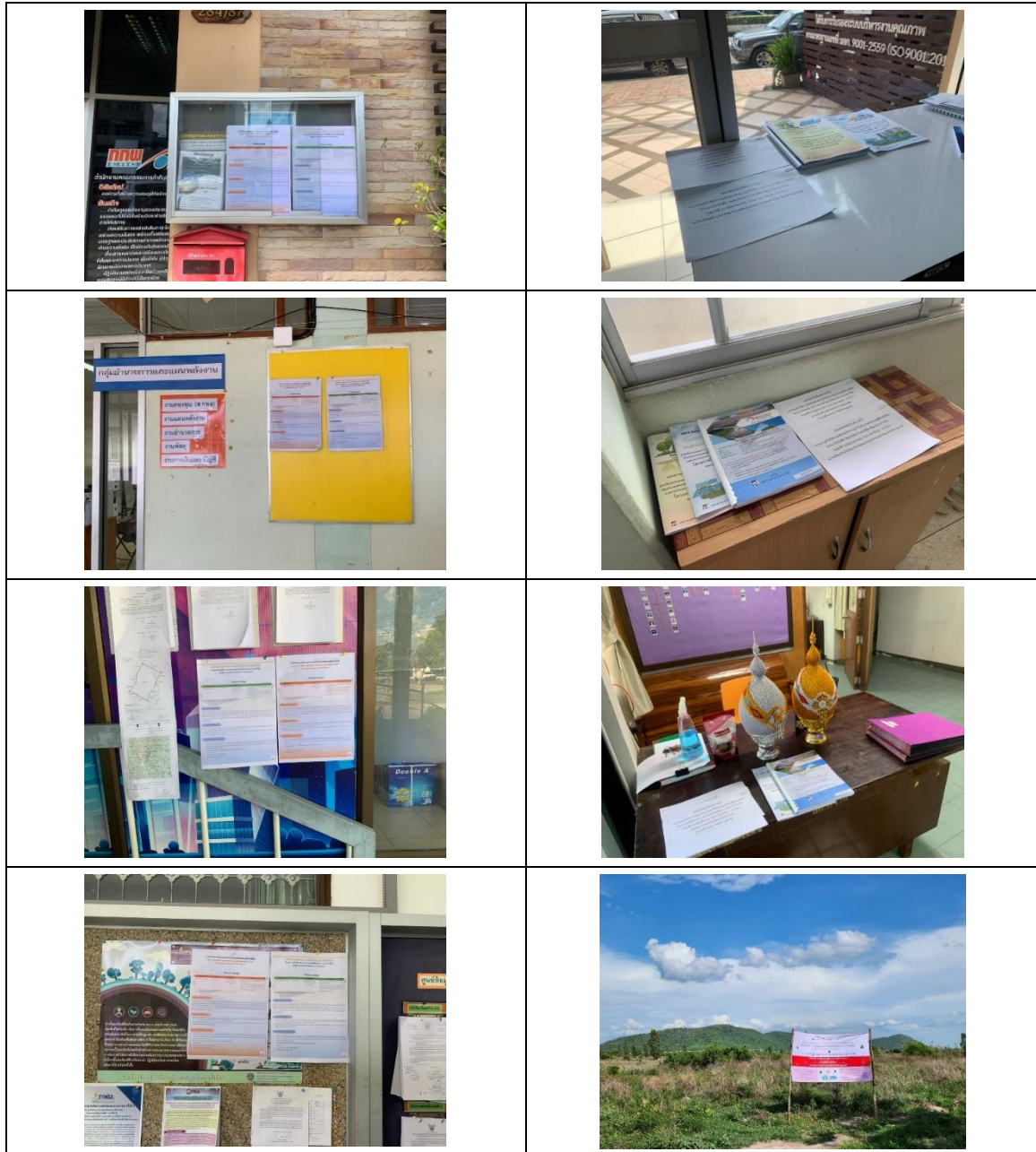
Procedures and Methods of Operation	Period	Operation
1. Preliminary CoP report preparation, project details, and infographic media	15-23 May 2023	Prepare documents for the Office of the Energy Regulatory Commission Region 9 (Kanchanaburi) to consider for use in considering the issuance of a license to operate electricity generation B.E. 2565, consisting of 1) Preliminary Code of practice Report, 2) Summary of project details, and 3) Infographic media
2. Submission of a list of documents that applicants must complete prior to the public hearing	23-29 May 2023	The project has received approval for the Preliminary CoP Report according to the ERC (Energy Regulatory Commission) letter No. 5531/0900 dated 26 May 2023 from the Office of the Energy Regulatory Commission Region 9 (Kanchanaburi).
3. Delivery of invitation letter to participate in public hearing activities	2-3 June 2023	Distribute the invitation letter for the public hearing together with supporting documents to the stakeholder group, consisting of government agencies, educational institutions, religious places, community leaders, and people in the study area to notify interested groups of the meeting schedule and meeting place for such target groups at least 15 days in advance before the hearing date.
4. Public relations dissemination of project information and pre-registration forms for those interested in attending public hearings	4-22 June 2023	<p>To introduce and explain project details, operational plans, including measures to prevent and correct environmental impacts, and measures to monitor environmental impacts by notifying stakeholders of the public hearing schedule at least 15 days prior to the public hearing date through the following channels:</p> <ol style="list-style-type: none"> <li>1) Attaching a public hearing schedule (A3 size) with specified contents consisting of the project name, date, time, and venue of the meeting, along with a presentation of preliminary project details, operation area, project owner, construction plan, and the benefits of the project, including communication channels.</li> <li>2) Placement of meeting documents and reports on the basic code of conduct</li> <li>3) Prepare pre-registration forms, including paper registration forms and QR Codes for pre-registration, placed at places where project information can be easily accessed and seen, such as government agencies, the headman's office/village headman, infirmary, religious places, and educational institutions in the study area.</li> </ol> <p>For places to publicize and disseminate project information, they are displayed to be easily accessible and seen in the following locations:</p> <ul style="list-style-type: none"> <li>• The area where the project will be constructed.</li> <li>• Office of the Energy Regulatory Commission Region 9 Kanchanaburi</li> <li>• Kanchanaburi Provincial Industrial Office</li> <li>• Kanchanaburi Provincial Energy Office</li> <li>• Kanchanaburi Provincial Natural Resources and Environment Office</li> <li>• Huai Krachao District Office</li> <li>• Lao Khwan District Office</li> <li>• Sa Long Ruea Subdistrict Municipality Office</li> <li>• Nong Pradu Subdistrict Administrative</li> </ul>

**TABLE 6.3.2-1  
PROCEDURES FOR IMPLEMENTATION ON PUBLIC MEETINGS. (CONT'D)**

Procedures and Methods of Operation	Period	Operation
4. Public relations dissemination of project information and pre-registration forms for those interested in attending public hearings (cont'd)	4-22 June 2023	<ul style="list-style-type: none"> <li>• Office of the Subdistrict Headman and Office of the Village Headman of Sra Long Ruea Subdistrict Huai Krachao District, including Moo 4, 5, 6, 9, 12 and 16.</li> <li>• Office of the Subdistrict Headman and Office of the Village Headman of Nong Pradu Sub-district, Lao Khwan District, including Moo 3, 4, 5, 7 and 9</li> <li>• Nong Pradu Health Promoting Hospital</li> <li>• Sa Long Ruea Sub-district Health Promoting Hospital</li> <li>• Wat Huai Luek Samakkhitham</li> <li>• Wat Mai Khiriwong (Wat Khao Pho Pu)</li> <li>• Wat Sudprasert Dhammakayaram</li> <li>• Wat Promnimit</li> <li>• Wat Sa Chan Thong</li> <li>• Wat Khao Pho Pu Rat Bamrung</li> <li>• Ban Huay Luek School</li> <li>• Ban Sa Chan Thong School</li> </ul>
		<p>There are two ways to contact and inquire about the project as follows:</p> <p><b>Solar Development Company Limited (Project Owner)</b> Address: 87 M Thai Tower, All Seasons Place, 26th Floor, Wireless Road, Lumpini, Pathumwan, Bangkok 10330 Contact: Mr. Suwat Khun-In (Project Coordinator) Phone: 093-283-9898 Contact: Mr. Kittisak Tanpradab Singha (Project Coordinator) Phone: 083-004-4550</p> <p><b>TLT Consultants Co., Ltd. (environmental consulting company)</b> Address: 151 Team Building, 13th Floor (Environmental Department), Nuanchan Road, Nuanchan, Bueng Kum, Bangkok 10230 Contact: Ms. Khajeewan Charoenpakdee (Social and Public Participation Officer) Phone: 087-709-9089, 0-2509-9000 Ext. 2328 Fax: 0-2509-9047 Email: khajeewan_c@team.co.th Contact: Mr. Manittakarn Thanphisitdecha (Social and Public Participation Officer) Telephone: 092-451-3113, 0-2509-9000 Ext. 2328 Fax: 0-2509-9047 Email: manittakarn_t@team.co.th</p>
5. Public meeting	23 June 2023	Conduct a public hearing meeting on Friday, June 2, 2023 from 2:00 p.m. to 4:30 p.m. at the Municipality of Sa Long Ruea Subdistrict, Sa Long Ruea Subdistrict, Huai Krachao District, Kanchanaburi Province.

**TABLE 6.3.2-1  
PROCEDURES FOR IMPLEMENTATION ON PUBLIC MEETINGS. (CONT'D)**

Procedures and Methods of Operation	Period	Operation
6. Additional hearing for 15 days	24 June to 8 July 2023	<p>After the completion of the public hearing, the project has held a public hearing continuously for at least 15 days, starting from 24 June to 8 July 2023, through the following channels:</p> <ol style="list-style-type: none"> <li>1. Comment via Google Form (QR Code)</li> <li>2. Postal service business</li> </ol> <p><b>TLT Consultants Co., Ltd. (environmental consulting company)</b> Address: 151 Team Building, 13th Floor (Environmental Department), Nuanchan Road, Nuanchan Subdistrict, Bueng Kum District, Bangkok 10230</p> <ol style="list-style-type: none"> <li>3. Telephone channel Ms. Khajeewan Charoenpakdee 087-709-9089 Manittakarn Thanphisitdecha 092-451-3113</li> <li>4. Fax number 02-509-9047</li> <li>5. Email khajeewan_c@team.co.th or manitakarn_t@team.co.th</li> </ol>
7. Preparation of a report summarizing the results of public hearings and stakeholders	9-10 July 2023	<p>After 15 days of additional public hearings, the project has completed the preparation of a summary of the results of public hearings and stakeholders to publicize the results of public hearings of the project to target groups or stakeholders.</p>
8. Closing of the announcement summarizing the results of public hearings and stakeholders	11-13 July 2023	<p>The project proceeds to announce the summary of public hearing results and stakeholders by disseminating them in locations where target groups or stakeholder groups can be easily accessed and seen in places, as mentioned in "4. Public relations disseminating project information."</p>
9. Dissemination of a report summarizing the results of public hearings and stakeholders	14-28 July 2023	<p>The project disseminates a report summarizing the results of public hearings and stakeholders continuously for at least 15 days by disseminating them in places where the target group or stakeholder groups can be easily accessed and seen in the places, as mentioned in "4. Public relations disseminating project information."</p>
10. Expressing opinions or objections to the hearing summary report	14 July to 13 August 2023	<p>The project has allowed the public and stakeholders to express their opinions or objections to the report summarizing the results of public hearings and stakeholders for the study and preparation of the Code of Practice Report: CoP) Solar Development Plant Project of Solar Development Company within 30 days from the date of dissemination of the public hearing summary report, which is open to express opinions, contact the public hearing summary report from 14 July 13 August 2023. For channels to express opinions or objections to the report through the following channels:</p> <ol style="list-style-type: none"> <li>1. Comment via Google Form (QR Code)</li> <li>2. Postal service business</li> </ol> <p><b>TLT Consultants Co., Ltd. (environmental consulting company)</b> Address: 151 Team Building, 13th Floor (Environmental Department), Nuanchan Road, Nuanchan Subdistrict, Bueng Kum District, Bangkok 10230</p> <ol style="list-style-type: none"> <li>3. Telephone channel</li> <li>4.. Fax number 02-509-9047</li> <li>5. Email khajeewan_c@team.co.th or manitakarn_t@team.co.th</li> </ol>



**FIGURE 6.3.2-1: EXAMPLE OF THE NOTICE POSTING FOR DISCLOSURE OF PROJECT INFORMATION AND INVITATION TO THE MEETING**

### 6.3.2.3 Public Meeting

Public meeting were conducted on Friday, June 23, 2023, from 2:00 - 4:30 p.m. at the Municipality of Sa Long Ruea Subdistrict, Sa Long Ruea Subdistrict, Huai Krachao District, Kanchanaburi Province. A total of 296 people participated in the public consultation (excluding officials of project owners and environmental consulting firms and counting the number of attendees individually), consisting of representatives of people in the study area, community leaders, representatives of provincial government agencies, representatives of district government agencies, representatives of sub-district government agencies, infirmaries, educational institutions. The atmosphere of the public hearings went well. Details of the participants in the meeting are shown in **Table 6.3.2-2** and **Figure 6.3.2-2**. The invitation letter to attend the public meeting and its supporting meeting brochure are shown in **Appendix 6A** and **Appendix 6B** and the PowerPoint presentation for this meeting is shown in **Appendix 6C**.

**TABLE 6.3.2-2**  
**NUMBER OF PARTICIPANTS IN THE PUBLIC CONSULTATION**

Stakeholder Groups	No. of participants
<b>1. Local communities</b>	
1.1 Sa Long Ruea Subdistrict	
Moo 4 Ban Nong Bua Hing	20
Moo 5 Ban Sa Chan Thong	2
Moo 6 Ban Huay Luek	53
Moo 9 Ban Dong Rang	22
Moo 12 Ban Krok Ta Pho	1
Moo 16 Ban Nong Phaya Ngu	33
1.2 Nong Pradu Sub-district	
Moo 3 Ban Talung Nuea	25
Moo 4 Ban Pong Mai	24
Moo 5 Ban Nong Prue	22
Moo 7 Ban Nong Kai Lueang	22
Moo 9 Ban Hiang Ngam	20
1.3 Vulnerable groups	4
<b>2. Person in charge of conducting a report</b>	
2.1 Solar Development Co., Ltd.	7
2.2 TLT Consultants Company Limited	7
<b>3. Related agencies</b>	
3.1 Regional agencies	2
3.2 District agencies	6
3.3 Local agencies	8
<b>4. Environmental sensitive area</b>	1



**TABLE 6.3.2-2  
NUMBER OF PARTICIPANTS IN THE PUBLIC CONSULTATION (CONT'D)**

Stakeholder Groups	No. of participants
<b>5. The public</b>	
Moo 7 Ban Nong Charoensuk, Sa Long Ruea Subdistrict	8
Moo 6 Ban Nam Chon, Nong Pradu Subdistrict	1
Moo 8 Ban Nong Kae Daeng, Nong Pradu Subdistrict	22
<b>Total (Except the person in charge of conducting a report)</b>	<b>296</b>

Sources: TLT Consultants Co., Ltd., 2023



**FIGURE 6.3.2-2: EXAMPLE OF THE PUBLIC CONSULTATION  
AT BAN PONG MAI ON 23 JUNE 2023**



**FIGURE 6.3.2-2: EXAMPLE OF THE PUBLIC CONSULTATION  
AT BAN PONG MAI ON 23 JUNE 2023 (CONT'D)**

After presenting information about project details and impacts that may occur directly and indirectly, study results and draft measures of the Project, the consulting company provided the meeting participants with the opportunity to express their opinions by inquiries in the meeting through 2 platforms, including verbal comments in the meeting (Inquiries in the meeting) and opinion form in the meeting (The assessment form on comments from the public participation) as follows:

**(A) Discussion in the meeting**

The consulting company provided the meeting participants with the opportunity to express their opinions by inquiries in the meeting. The project owners and the consulting company responded to those questions. The inquiries, comments and suggestions from the meeting are summarized as shown in **Table 6.3.2-3**

**(B) Opinion form**

After the public consultation by inquiries in the meeting, the consulting company asked the attendees to express their opinions through the opinion form for the public participation and make an understanding with the public and stakeholders of the Solar Development Power Plant Project. The result of the assessment analysis is as follows:

### **Project details**

- There should be a clarification of decommissioning or destroying expired solar panels and whether there are impacts on the environment.
- There should be an explanation of the project methodology, the presentation of solar panel installation and concerns about the project area that may affect plants or animals and how.

### **Environment**

- There are concerns about an impact on higher temperatures and unseasonal rain because there is less rain in normal situations.
- The Project should support tree-planting activities in the communities.
- The Project should take action on an increasing heat issue, which may affect the daily life of villagers. The Project should also increase green space.

### **Social economy and public consultation**

- There should have a campaign promoting local businesses and the employment of people in the communities.
- There should have an activity with communities like reforestation in community areas
- There should be support for water consumption in communities.
- The Project should follow the determined measures seriously, monitor impacts on people in communities and support communities like supporting disadvantaged people etc.

### **Others**

- The Project should distribute high-efficiency electricity to communities.
- It is a good thing if there is less effect on communities.
- The Project should follow the offer made to the communities and minimize negative impacts as much as possible.



**TABLE 6.3.2-3**  
**SUMMARY OF QUESTION, OPINIONS AND RECOMMENDATIONS IN THE MEETING**

Agency	Questions/Opinions/Recommendations	Clarifications
<b>1. Huai Krachao District Chief</b>	<p><b>Questions</b></p> <p>Impacts from the Project, such as</p> <ul style="list-style-type: none"> <li>• Will the Project cause drought or unseasonal rains?</li> <li>• Will Heat from solar panels affect pets, vegetation or agricultural products?</li> </ul> <p><b>Suggestions</b></p> <p>If people living in the study area have concerns, they should ask the officials in the meeting directly to prevent further damage.</p>	<p><b>Environmental Specialist, TLT Consultants Company Limited (Additional clarification)</b></p> <ul style="list-style-type: none"> <li>- Global warming is an increase in the average global temperature from the greenhouse effect caused by humans. It has increased the amount of carbon dioxide from the combustion of various fuels, transportation and industrial production.</li> <li>- Electricity generation from solar panels works with direct sunlight and converts it into direct current electricity passing through the power adapter to convert it into alternating current to the next transmission line. The production of that electricity will not burn fuel at all. This is why there is no pollution causing global warming.</li> <li>- Most heat is accumulated in solar panels themselves. When the distance is removed, the heat is reduced. The heat is exchanged in the atmosphere. In addition, the Project has an empty space reducing the distance between the panels and agricultural areas and nearby communities. Therefore, solar panels do not affect livestock and agricultural areas.</li> </ul>
<b>2. Representatives of people in Moo 6 Nong Pradu subdistrict</b>	<p><b>Questions</b></p> <p>A landlocked property next to the Project has no entrance or exit. Will the Project have an entrance or exit?</p>	<p><b>Project Engineer and Assistant Director of Community Relations, Solar Development Co., Ltd.</b></p> <ul style="list-style-type: none"> <li>- In project design, there is an empty space from the project area according to the law. Community Relations has coordinated with the Engineering Department on project design to prevent damage to the communities. The Project will create more empty spaces, so the owner of the area next to the Project can enter and exit as normal.</li> </ul>

**TABLE 6.3.2-3**  
**SUMMARY OF QUESTION, OPINIONS AND RECOMMENDATIONS IN THE MEETING (CONT'D)**

Agency	Questions/Opinions/Recommendations	Clarifications
<p><b>3. Representatives of people in Moo 4 Nong Pradu subdistrict (Member of the PAO Council)</b></p>	<p><b>Questions</b>            Will Heat from solar panels cause drought or higher temperatures or make plants die?</p>	<p><b>Environmental Specialist, TLT Consultants Company Limited</b></p> <ul style="list-style-type: none"> <li>- Global warming is an increase in the average global temperature from the greenhouse effect caused by humans. It has increased the amount of carbon dioxide from the combustion of various fuels, transportation and industrial production.</li> <li>- Electricity generation from solar panels works with direct sunlight and converts it into direct current electricity passing through the power adapter to convert it into alternating current to the next transmission line. The production of that electricity will not burn fuel at all. This is why there is no pollution causing global warming.</li> <li>- Most heat is accumulated in solar panels themselves. When the distance is removed, the heat is reduced. The heat is exchanged in the atmosphere. In addition, the Project has an empty space reducing the distance between the panels, agricultural areas, and nearby communities. Therefore, solar panels do not affect livestock and agricultural areas.</li> <li>- However, the Project has set measures to allow people to visit and monitor the Project's operation. Therefore, people can see whether the Project follows the plan.</li> </ul>

**TABLE 6.3.2-3**  
**SUMMARY OF QUESTION, OPINIONS AND RECOMMENDATIONS IN THE MEETING (CONT'D)**

Agency	Questions/Opinions/Recommendations	Clarifications
<b>4. Chief Executive of Nong Pradu Subdistrict Administrative Organization</b>	<p><b>Questions</b></p> <ul style="list-style-type: none"> <li>- The issues of heat and drought are completely clarified. Are there any benefits that the people around the project area will get? Is there a healthcare and safety policy?</li> </ul>	<p><b>Assistant Vice President of Community Relations, Solar Development Co., Ltd.</b></p> <ul style="list-style-type: none"> <li>- The benefits that the people around the project area will get are as follows.</li> <li>1) Signboard tax, land tax and power development fund - According to the regulations of the ERC, when a power plant is established, the Project must be made to the Power Development Fund starting from the construction phase at the rate of 50,000 baht per megawatt. For the operation phase, the Project must pay into the Power Development Fund at the rate of 1 satang per unit per month for 25 consecutive years.</li> <li>2) Responsibility to the community and society according to the policy and intention of the Project by conducting community relations activities</li> </ul>
<b>5. Huai Krachao District Public Health</b>	<p><b>Questions</b></p> <ul style="list-style-type: none"> <li>- The Project has a lot of solar panels causing the higher temperature by about 1-2 degrees Celsius, which may result in increasing heat in the area, and decreasing relative humidity. Will it affect the condensation of clouds or lower the opportunity of rain? How can the Project handle this problem or reduce the temperature?</li> </ul>	<p><b>Environmental Specialist, TLT Consultants Company Limited (Additional Explanations)</b></p> <ul style="list-style-type: none"> <li>- Most heat is accumulated in solar panels themselves. When the distance is removed, the heat is reduced. The heat is exchanged in the atmosphere. In addition, the Project has an empty space reducing the distance between the panels and agricultural areas and nearby communities. Therefore, solar panels do not affect livestock and agricultural areas.</li> </ul>

**TABLE 6.3.2-3**  
**SUMMARY OF QUESTION, OPINIONS AND RECOMMENDATIONS IN THE MEETING (CONT'D)**

Agency	Questions/Opinions/Recommendations	Clarifications
<b>5. Huai Krachao District Public Health (Cont'd)</b>	<ul style="list-style-type: none"> <li>- Could the Project increase green space? If not, how can the Project support community green space or tree planting projects?</li> </ul>	<p>In terms of green space in the project area, the Project has to consider appropriateness because the Project needs solar energy for electricity generation. However, the Project has community relations activities to support environmental project activities and coordinate with the communities to support green space.</p>
	<ul style="list-style-type: none"> <li>- What type of battery is used by the Project?</li> </ul>	<p><b>Project Engineer, Solar Development Co., Ltd.</b></p> <ul style="list-style-type: none"> <li>- The battery used in the Project is a lithium type. It is similar to the battery used in a mobile phone, which is a type that is commonly used.</li> </ul>
<b>6. Chief Executive of Nong Pradu Subdistrict Administrative Organization</b>	<p><b>Additional suggestions from Huai Krachao District Public Health</b></p> <ul style="list-style-type: none"> <li>- Could the project promise that there will have more trees in at least the power plant area or an appropriate area for growing plants? Could the Project support the tree-planting project to reduce concerns about heat in the area and nearby areas? The Project should discuss with the Sub-district Administrative Organization or the municipality to plan the Project on where to plant and where to place to heal the villagers' minds.</li> </ul>	<p><b>Assistant Vice President of Community Relations, Solar Development Co., Ltd.</b></p> <ul style="list-style-type: none"> <li>- The Project is willing to cooperate with various agencies, community leaders and villagers through community relations activities to support beneficial projects for communities and the environment, including planting trees in appropriate areas.</li> </ul>
<b>7. Representatives of Energy Regulatory Commission Region 9 Kanchanaburi</b>	<p><b>Questions</b></p> <ul style="list-style-type: none"> <li>- Could the Project explain more about water consumption during the flood because the project area is an area with flooding conditions and use of water during the drought, which the Project stated about 400 cubic meters of water, would be used to wash the panels? During the rainy season, there may be no effect. However, during the drought, there might have an impact. Where will the Project receive water during the dry season and will there be measures to support the use of water?</li> </ul>	<p><b>Environmental Specialist, TLT Consultants Company Limited (Additional clarification)</b></p> <p><u>Water consumption</u></p> <ul style="list-style-type: none"> <li>- The Project uses tap water to wash the panels purchased from outside the Project, using a truck to transport water to the project area. For water consumption for employees, the project purchase tap water from outside the Project to be stored in a water tank, which uses very little water because the Project has a small number of employees in the operation phase.</li> </ul>

**TABLE 6.3.2-3**  
**SUMMARY OF QUESTION, OPINIONS AND RECOMMENDATIONS IN THE MEETING (CONT'D)**

Agency	Questions/Opinions/Recommendations	Clarifications
<p><b>7. Representatives of Energy Regulatory Commission Region 9 Kanchanaburi</b></p>		<p><u>Drainage</u></p> <ul style="list-style-type: none"> <li>- Most constructions are the installation of solar panels with poles. There is no effect on land or blocking the waterway. For this reason, there is no change in drainage, and it will be like before the beginning of the Project. Some areas are designed to be the buildings controlling the power generation system, storage for spare parts, materials, equipment, waste and maintenance, switchyard or power station and supporting areas and others for electricity generation, representing approximately 0.52 of the whole project area. The Project has provided a drainage ditch and a retention pond to control the rate of rainwater drainage like before the beginning of the Project.</li> </ul> <p><b>Project Engineer, Solar Development Co., Ltd.</b></p> <ul style="list-style-type: none"> <li>- The Project cleans some panels when there is dust to keep the power generation capacity. The Project takes about 60 days to clean the panels once and does not need to continue cleaning the panels. During the dry season or without water, cleaning the panels will be postponed. Panel cleaning will be done gradually over a period of approximately 60 days, with the amount of water used to wash approximately 1.5 liters per panel and about 20 workers are required.</li> </ul>

**TABLE 6.3.2-3  
SUMMARY OF QUESTION, OPINIONS AND RECOMMENDATIONS IN THE MEETING (CONT'D)**

Agency	Questions/Opinions/Recommendations	Clarifications
<p><b>7. Representatives of Energy Regulatory Commission Region 9 Kanchanaburi (Cont.)</b></p>	<ul style="list-style-type: none"> <li>- Because the Project uses batteries, could the Project inform the battery life and the plan of a waste storage building?</li> </ul>	<p><b>Environmental Specialist, TLT Consultants Company Limited (Additional clarification)</b></p> <ul style="list-style-type: none"> <li>- Waste and lubricants from maintenance will be stored in the storage building. Moreover, an agency authorized by the Department of Industrial Works will destroy them.</li> <li>- Deteriorated solar panels will be sent to an agency authorized by the Department of Industrial Works to destroy them.</li> </ul> <p><b>Project Engineer, Solar Development Co., Ltd.</b></p> <ul style="list-style-type: none"> <li>- The battery used by the Project looks like a container shape, but the size is not very large. The life span is about 15 years, which will deteriorate depending on the use. The Project will change the battery regularly, like a mobile phone battery that deteriorates. The Project will store deteriorated batteries in the building. For disposal, the Project will follow the law of the Department of Industrial Works.</li> </ul>

## (B) Opinion form

After the public consultation by inquiries in the meeting, the consulting company asked the attendees to express their opinions through the opinion form for the public consultation and make an understanding with the public and stakeholders of the Solar Development Power Plant Project. The result of the assessment analysis is as follows (shown in **Figure 6.3.2-3**)

### Reaction papers in the meeting

After listening to the opinions of the public through the inquiry in the forum, the consulting company has asked for cooperation from the attendees to express their opinions through the assessment form for the public hearing and understanding with the public and Stakeholders of the Solar Development Power Plant Project of Solar Development Co., Ltd. at the meeting in one additional channel. There were 278 attendees responded the assessment form, representing 93.92% of the total 296 attendees (excluding the person in charge of conducting a report).

- **Information of respondents** - The respondents are 63.7% female and 36.3% male. 92.8% are representatives of communities/villages in the study area. 4.0% are representatives of government agencies. 1.8% are unspecified. 0.7 % are representatives of private agencies and educational institutions.

- **Acknowledgement of information** - 70.1% of the respondents state that they acknowledge this information for the first time. 29.9% of them have received information about the Project from these first three platforms: 46.3% from community leaders such as village headmen or village leaders etc., 30.1% from the employees of Solar Development Company Limited and 12.2% from relatives/neighbors/colleagues.

- **Project public relations** - 91.0% of the respondents say that the Project should publicize important additional information, namely, advantages and disadvantages of the operation for 24.7%, measures to prevent and correct environmental impacts and environmental impact monitoring measures for 23.6%, project details for 19.3%, knowledge about electricity generation from solar energy for 12.8% project safety system 12.2%, timeline/operation plan 6.5% and panel installation and demonstration to the meeting 0.9%. Public relations with community leaders is the most appropriate platform to disclose project information.

- **Understanding of the project environmental study** - 93.9% of the respondents understand the project environmental study after listening to the study results presentation and the Code of Practice (CoP) report. 5.0% comment that there should be additional information, such as the necessity of project development and benefits for the public, including concerns about a drought that may cause a negative impact on agriculture in the villagers' arable areas. 0.7% have no comment. 0.4% are not sure.

- **Concerns about the project operation** - 61.9% of the respondents have no concerns. 29.5% have concerns about air quality during transportation, noise, water consumption, transportation and waste. The 8.6% have no comments.

- **Appropriateness/Adequacy for the measures of the project preparation phase** - Most of the respondents, representing 93.9%, thought that the measures during the preparation phase of the Project are appropriate and adequate. 2.9% have no comments. 1.8% think that the measures are not appropriate and adequate. More information should be presented, including global warming. 1.4% are not sure.

- **Appropriateness/Adequacy for the measures during the construction phase** - Most respondents, representing 95.0%, thought that the measures during the project construction phase are appropriate and adequate. 2.1% think that the

measures are not appropriate and adequate. Additional information should be presented, including dust from transportation on the site during construction. 2.5% had no comments. 0.4% are not sure.

- **Appropriateness/Adequacy for measures in the operation phase -**

Most respondents, representing 92.8%, thought that the measures during the Project's operation phase are appropriate and adequate. 2.2% think that the measures are not appropriate and adequate. Additional information should be presented, such as planting trees to increase green space for the community and the project area, water sources and water storage. 4.0% have no comments. 1.0% are not sure.

- **Appropriateness or Adequacy for the measures during decommissioning solar panels, machinery, or equipment -** Most respondents, representing 91.4%, thought that the measures during decommissioning solar panels, machinery or equipment are appropriate and adequate. 2.5% think that the measures are not appropriate and adequate. 4.0% have no comments. 2.1% are not sure.

- **Additional suggestions**

- **Project details**

- There should be a clarification of decommissioning or destroying expired solar panels and whether there are impacts on the environment.

- There should be an explanation of the project methodology, the presentation of solar panel installation and concerns about the project area that may affect plants or animals and how.

- **Environment**

- There are concerns about an impact on higher temperatures and unseasonal rain because there is less rain in normal situations.

- The Project should support tree-planting activities in the communities.

- The Project should take action on an increasing heat issue, which may affect the daily life of villagers. The Project should also increase green space.

- **Social economy and public participation**

- There should have a campaign promoting local businesses and the employment of people in the communities.

- There should have an activity with communities like reforestation in community areas

- There should be support for water consumption in communities.

- The Project should follow the determined measures seriously, monitor impacts on people in communities and support communities like supporting disadvantaged people etc.

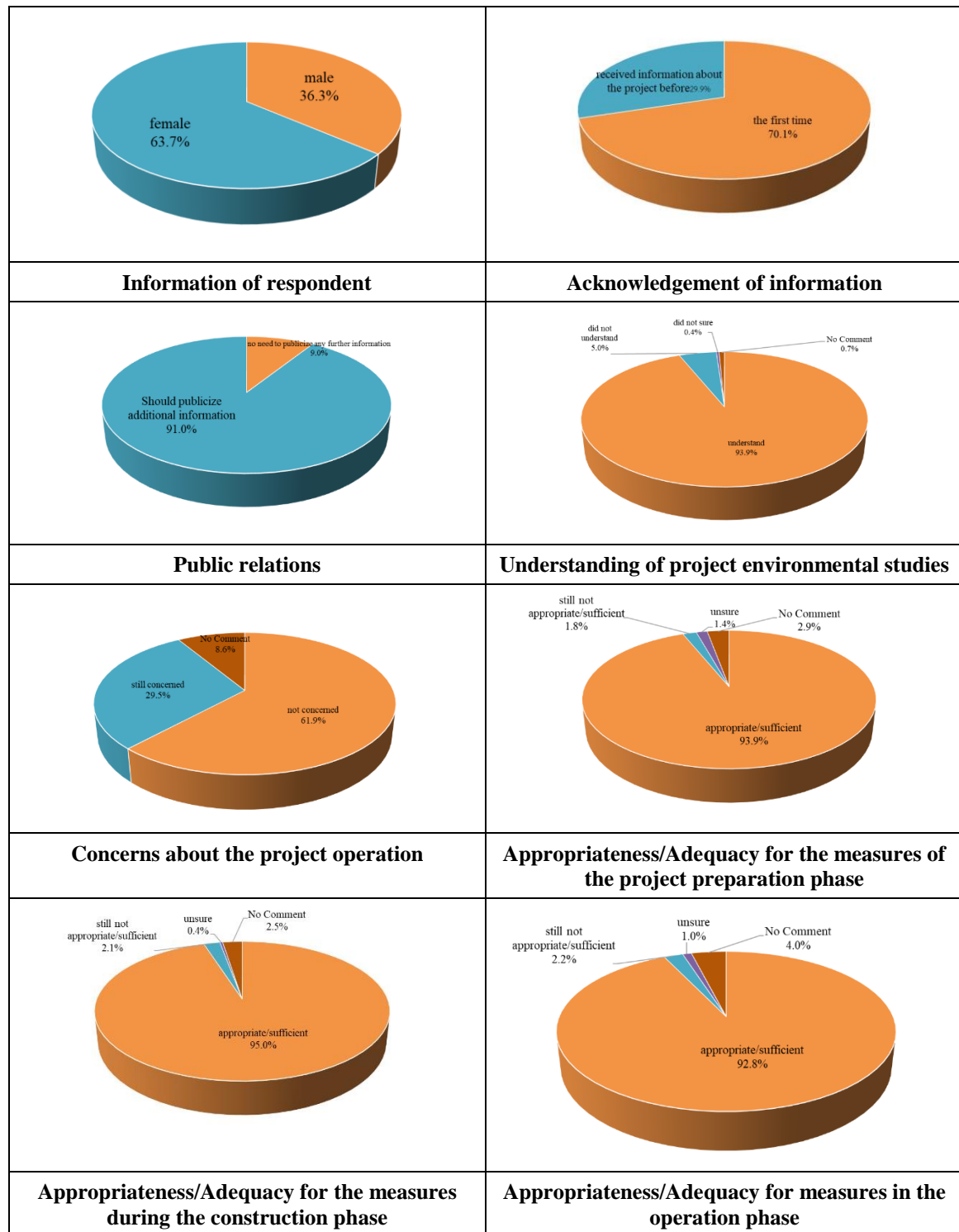
- **Others**

- The Project should distribute high-efficiency electricity to communities.

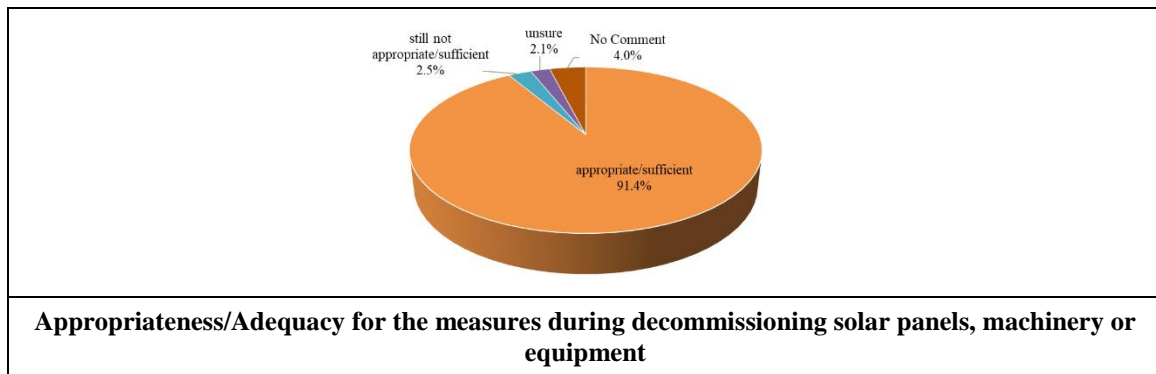
- It is a good thing if there is less effect on communities.

- The Project should follow the offer made to the communities and minimize negative impacts as much as possible





**FIGURE 6.3.2-3: FEEDBACK FROM THE ASSESSMENT FORM FOR PUBLIC CONSULTATION AND ESTABLISHING AN UNDERSTANDING WITH THE PUBLIC AND STAKEHOLDERS OF SOLAR DEVELOPMENT POWER PLANT PROJECT**

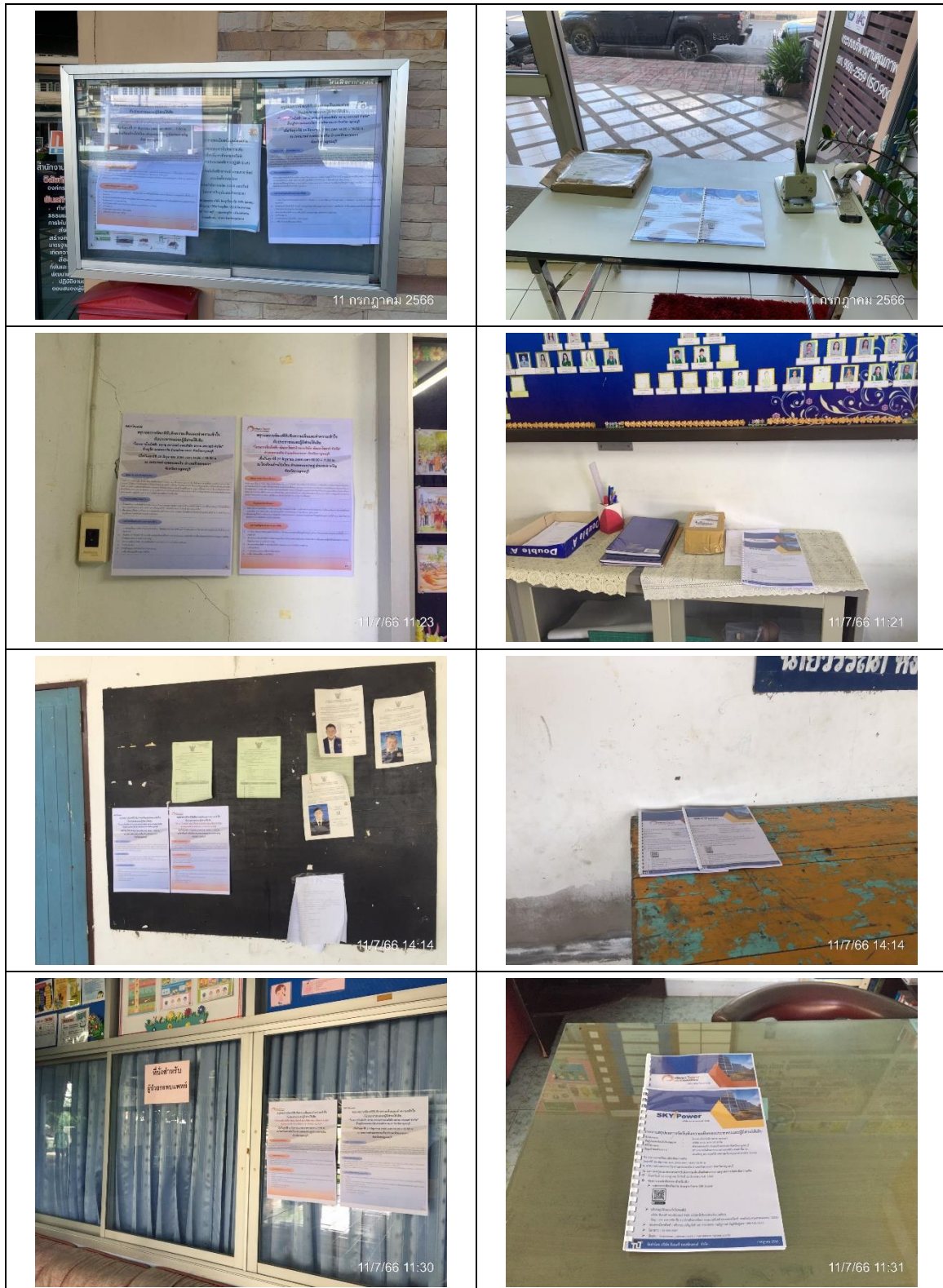


**FIGURE 6.3.2-3: FEEDBACK FROM THE ASSESSMENT FORM FOR PUBLIC CONSULTATION AND ESTABLISHING AN UNDERSTANDING WITH THE PUBLIC AND STAKEHOLDERS OF SOLAR DEVELOPMENT POWER PLANT PROJECT (CONT'D)**

#### **6.3.2.4 Dissemination of Summary Report on Public Meeting Results**

After the completion of public consultation meeting, the project prepared a summary report of public and stakeholder consultation including explanations for disclosing the public consultation results including the results of continuous public consultation and making them available to all sectors. The project sent the summary report to the target groups of the public consultation and also posted the report at public places during 11-13 July 2023. and published continuously for at least 15 days from 14-28 July 2023. Photo examples of the publicized announcements of the summary report are shown in **Figure 6.3.2-4**. The letter for submitting the summary of public meeting is shown **Appendix 6D**. The places where the summary report was publicized such as

- 1) Project area
- 2) Subdistrict and village headmen offices, and community halls
- 3) District offices, SAO
- 4) Relevant government agencies' office
- 5) Schools and religious places



**FIGURE 6.3.2-4: BILLBOARDS FOR THE PUBLIC CONSULTATION RESULTS AND THE RESULT REPORT OF THE PUBLIC CONSULTATION OF THE SOLAR DEVELOPMENT SOLAR POWER PLANT PROJECT**








## 6.4 CONSULTATION IN REGARDING TO TRANSMISSION LINE

### 6.4.1 Description of Consultation

PEA is the government authority with the mandate to plan, construct and operate transmission lines (TL), which may traverse private or public land. In the case of this project, the TL will be in the Right of Way (ROW) on existing public roads, some of which are under the jurisdiction of the Department of Highways. Therefore, PEA seeks approval from the Department and represents the Project in all matters related to the TL, including leading all stakeholder engagement activities. While PEA has corporate stakeholder engagement plans (SEP), the Project also develops a project level SEP, to help ensure smoothly coordinated communication and management of stakeholder concerns, impacts and any potential grievances. The following sets out the TL-related stakeholder engagement to date.

On 20-22 November 2023, the Project's Community Relations (CR) officers, who are in charge of stakeholder engagement, met with representatives of the local communities, namely, the chief of SAO, subdistrict headman, and village headman (as shown in **Figure 6.4-1** and **Appendix 6E** and Brochure Transmission Line **Appendix 6F**), relying on their engagement plan to provide information about the Project's transmission line (TL) (route, construction plan, and responsible authority) that was not presented in the public consultation. Because PEA is the competent authority for TL construction, PEA did not let CR officers to communicate TL information to local residents along the TL route. It is entirely their duty.



	
<p>Headman of village no. 9, Nong Pradu Subdistrict</p>	<p>Headman of village no. 3, Nong Pradu Subdistrict</p>
	
<p>Chief Executive of Nong Pradu SAO</p>	<p>Headman of village no. 12, Sa Long Ruea Subdistrict</p>
	
<p>Headman of Headman of Nong Pradu Subdistrict</p>	
<p><b>FIGURE 6.4-1: LOCALS ENGAGEMENT TO DISSEMINATE TRANSMISSION LINE INFORMATION (CONT'D)</b></p>	

#### **6.4.2 Further Consultation**

There is a need to continue consultation activities further during the project implementation phase. For this purpose, the Project Stakeholder Engagement Plan will be developed, to ensure appropriate communication and engagement activities with the parties affected by the TL. Some of the key content of consultation related to the TL is to:

- (1) Inform the stakeholders about site clearance prior to civil works (in preconstruction phase).
- (2) Inform the stakeholders about tentative project schedule for project works.
- (3) Inform stakeholders about the Project Grievance Redress Mechanism and ensure contacts for Project and PEA CR officers are known.

If the Project receives complaints related to the contractor for the TL, the Project will coordinate with PEA to ensure resolution. As PEA and the Project have separate, but similar, Grievance Redress Mechanisms (GRMs), the Project will record complaints and issues in grievance log.

# CHAPTER 7

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## EXTERNAL COMMUNICATIONS AND GRIEVANCE MECHANISIM



## CHAPTER 7

### EXTERNAL COMMUNICATIONS AND GRIEVANCE MECHANISIM

#### 7.1 EXTERNAL COMMUNICATIONS

The process of external communication, which includes information disclosure and periodical visiting nearby communities to inquire and listen to opinions about environmental impacts from the project, was undertaken as part of the IEE study. It was then suggested as a set of mitigation measures during a construction and operation phase in ESIA of Solar Development Solar Power Plant.

This external communication allows for trust to be built amongst the stakeholders through the sharing of information and also allow for more constructive participation in the other processes of consultation and resolution of grievances due to availability of accurate and timely information.

Following sections describe the information that will be disseminated throughout the project construction and operation, as well as the set of mitigation measures related to the external communication.

##### (a) Key Aspects being Covered in Disclosure

As part of the external communication, project information that will be shared with stakeholders from the beginning of the project through the project life cycle includes:

- The key project information;
- The key project impacts and corresponding mitigation measures and monitoring programs;
- The participation of the local stakeholders in the implementation and monitoring program and other mitigation measures.
- The project's progress; and
- The implementation of mitigation measures and monitoring programs.

##### (b) Process for External Communication

The process of external communication involves the provisioning of information in a timely and accessible manner to the various stakeholders and allowing feedback and participation at the same time. Copies of non-technical summaries document will be made available in the local language at suitable locations in the community.

The list of the mitigation measures related to the external communication are proposed as follows:

- **Construction Phase**
  - Information relating to the construction plan shall be publicized and disseminated by installing publicity boards in the project site or other appropriate models in order to inform all the public and stakeholders at least 7 days prior to construction;



- The project staff shall periodically visit nearby communities throughout the construction phase to inquire and listen to opinions about environmental impacts from the project construction activities so as to determine a guideline for mitigating impacts which may arise;

- A coordination center shall be set up to receive recommendations and complaints about disturbances from the project construction;

- In case of complaints by people about impacts from the project construction activities, the project shall immediately investigate and take remedial action; and

- A joint committee shall be set up so that communities can participate in the project implementation and community and environmental development in joint cooperation with the project. The joint committee membership shall, at least, comprise representatives of people, local government agencies, local educational institutes or academics, and the project owner. The number of committee members from the people sector shall be, at least, more than half of the total number of the committee members. In establishing the aforesaid committee, the committee structure and composition shall be specified together with number of committee members, power and duties, term of office, type of meeting, frequency of meeting, etc. Moreover, the committee's work will be linked to the project management. The committee's power and duties include, for example, receipt of complaints and consideration of compliance with the project's measures, etc. In addition, the committee may carry on its duties in the operation phase.

The appointment of a joint committee shall be completed prior to commencing the project construction. If there is any constraint to the establishment of a joint committee in cooperation with communities and the committee cannot be set up according to the specified proportion, the project shall notify the OERC and set out measures to build good understanding and communicate the results of project implementation to the communities and the project's stakeholders in the surrounding area via various public relations media such as documents, printed matter, personal media or information system, etc., and records of the project implementation throughout the project construction phase.

- **Operation Phase**

- Opportunities for project visits should be given to the communities so as to ease concerns;

- A complaint receiving plan shall be put in place, specifying channels for complaints, steps and duration of problem solving including responsible persons together with a chart clearly showing the procedure. In case remedial actions have not yet been completed, the complainant shall be notified of the progress every 7 days;

- A person shall be assigned to be responsible for the project's public relations and shall participate in public relations activities undertaken with communities including follow-up of complaints, disturbances and annoyances arising due to the project;

- Information shall be disseminated and publicized regarding the project details and compliance with the Code of Practice so as to inform the local communities and the joint committee. Opportunities shall be offered for the communities to participate in the project monitoring throughout the project operation period;

- Community relation activities shall be supported and promotion of community activities shall be undertaken to build good relation with the local communities;

– A committee shall be jointly set up with communities so that communities can participate in the project implementation and community and environmental development in joint cooperation with the project. The joint committee membership shall, at least, comprise representatives of people, local government agencies, local educational institutes or academics, and the project owner. The number of committee members from the people sector shall be, at least, more than half of the total number of the committee members. In establishing the aforesaid committee, the committee structure and composition shall be specified together with number of committee members, power and duties, term of office, type of meeting, frequency of meeting, etc. Moreover, the committee's work will be linked to the project management. The committee's power and duties include, for example, receipt of complaints and consideration of compliance with the project's measures, etc. In the initial period of the operation phase, the aforesaid committee may be the same one as that of the construction phase.

– If there is any constraint to the establishment a joint committee in cooperation with communities and the committee cannot be set up according to the specified proportion, the project shall notify the OERC and set out measures to build good understanding and communicate the results of project implementation to the communities and the project's stakeholders in the surrounding area via various public relations media such as documents, printed matter, personal media or information system, etc., and records of the project implementation throughout the operation phase; and

– If it is proven that damage has resulted from the project operation, the appointed joint committee shall have power and duty to consider compensation for the damage.

– If the Project receives complaints related to the contractor for the TL, the Project will coordinate with PEA to ensure resolution. As PEA and the Project have separate, but similar, Grievance Redress Mechanisms (GRMs), the Project will record complaints and issues in grievance log.

## 7.2 GRIEVANCE PROCEDURE

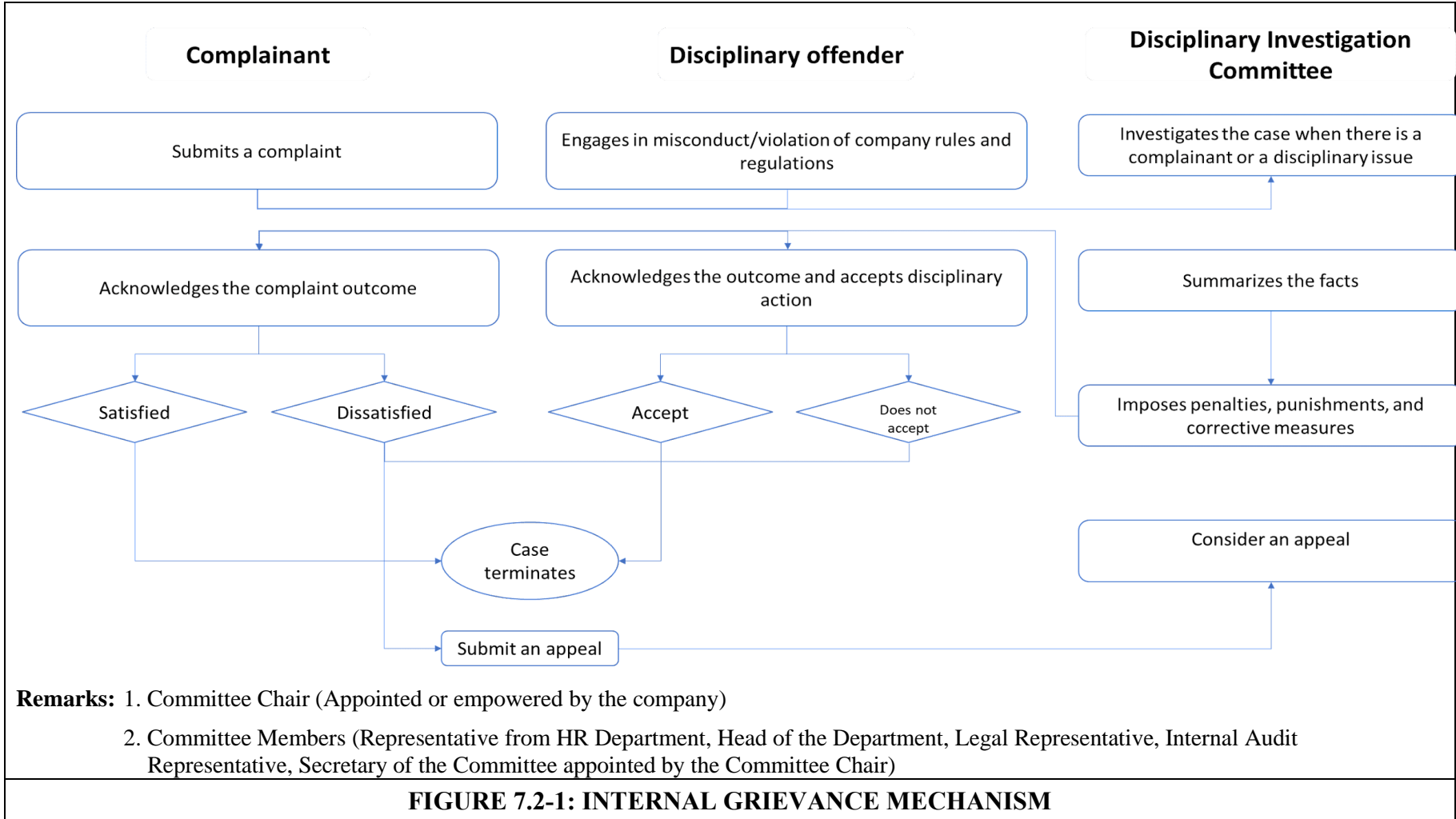
### 7.2.1 Internal Grievance Redress Mechanism

#### (1) Employee

If an employee wishes to raise a grievance regarding any abuse within the company, there are channels for lodging complaints as follows:

- 1) Email: ac@gulf.co.th or id@gulf.co.th or ia@gulf.co.th
- 2) Letter: To Chairman of the Audit Committee  
M.Thai Tower 11th floor, All Seasons Place, Wireless Road,  
Lumpini, Pathumwan Bangkok 10330
- 3) Report to the supervisor or internal audit department
- 4) Phone: 02-0804500

For anonymous complaints, the complainant should raise issues via a phone call. After receiving the issue, the following steps for resolution as shown in **Figure 7.2-1**.



**FIGURE 7.2-1: INTERNAL GRIEVANCE MECHANISM**

In the event that an employee is subjected to disciplinary sanctions or is issued an unjust order of termination, employee possesses the right to file a grievance against the supervisory authority by submitting a written document within 7-day timeframe to the Human Resources department. Subsequently, the Human Resources department shall present the document to the supervisory authority for consideration of the grievance within 15-day period starting from the date of submission. In the event that the employee disagrees with the outcome of the evaluation, they are entitled to submit a second grievance within 7-day timeframe.

## **(2) Supplier and Contractor**

The company's grievance processes do not apply to suppliers. However, the corporation has a supplier code of conduct that states that suppliers must provide a grievance process for any incidents to be reported and investigated.

### **7.2.2 External Grievance Redress Mechanism**

In order to effectively address such circumstances, the Project has established an initial grievance mechanism, which will be made available to relevant stakeholders. The Project is committed to enhancing and upholding a grievance mechanism that is characterized by transparency, gender inclusivity, cultural appropriateness, ease of access, and lack of financial burden for complainants.

#### **(1) Introduction**

Project development may incur impacts to surrounding communities of the Project area, from the construction phase through operation phase. In order to mitigate these impacts and alleviate concerns expressed by the neighboring communities proximate to the Project, grievance mechanism is to be provided. Consequently, mechanism for grievance redressal is established to rectify the potential consequences arising from Project development for both construction and operation phases. Additionally, receptivity is demonstrated towards recommendations and feedback from all pertinent stakeholders.

#### **(2) Objectives**

According a communication channel to receive complaints and address issues that may arise from Project development, the Project defines a clear operational mechanism to facilitate the reception of grievances. The mechanism aims to identify, rectify, mitigate, and monitor potential problems, ensuring the Project's harmonious coexistence within the community while minimizing adverse impacts. Additionally, the mechanism serves as an effective channel to receive suggestions that can benefit the Project's development.

#### **(3) Scope of Implementation**

The implementation comprises of complaints receiving, managing grievances, and considering suggestions from complainants and proposers. This pertains to the surrounding communities, governmental entities, private organizations, and the general public, all of whom are affected by Project operation and dissatisfied with certain aspects of the Project's implementation.

#### (4) Grievance Mechanism

The Project developer establishes the "Center for Receiving Complaints and Suggestions " and delegates responsibility for promoting the Project and listening to comments, recommendations, and complaints about the Project. People can send information or complaints by a variety of channels, including verbal communication, telephone, written form, line, letter, e-mail, or the project's officers. The project manager, who is appointed to oversee the project's development at each stage, will thereafter be in charge of managing the resolution of complaints. The grievance redress mechanism is shown in **Figure 7.2-2**.

1) In case of reporting through verbal communication, telephone or community relations officers, an officer will be assigned to prepare and fill in the complaint form (**Figure 7.2-3**) and send the complaint to the person assigned by the company.

2) If the complaint is received via mail, email, or in person, an officer will be assigned to send the complaint to the person assigned by the company, along with the complaint form.

3) When a complainant files through various channels to the project, the responsible officer will receive and inspect the initial cause. The officer will categorize the nature of complaint and try to confirm if it is caused by the project. Main categorization of complaints include:

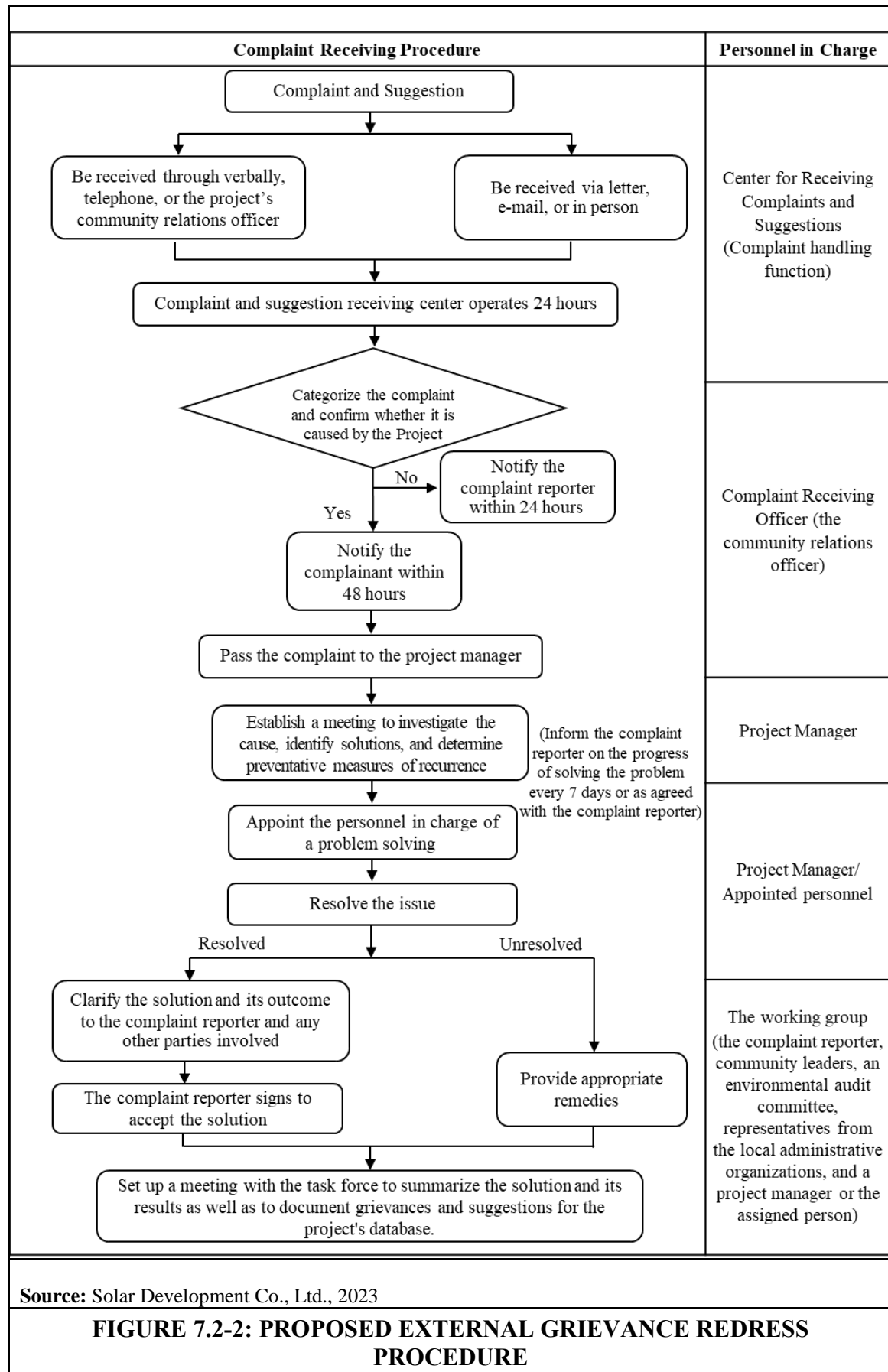
- Complaints about environmental impact
- Complaints about the damage or nuisance
- Complaints about health and safety incident
- Complaints about workforce or employee behavior
- Request for the support, donation, or information

4) If it is found that the problem may be caused by the project, the responsible officer will notify to the relevant section manager. Inform the complainant within 48 hours that they have received the complaint and have sent it to the project manager. If the Project receives complaints related to the contractor or the transmission line, the project will coordinate with PEA to ensure resolution. As PEA and the Project have separate, but similar, GRMs, the Project will also ensure close coordination with PEA to report to lenders on any and all reported grievances, the extent possible.

5) The project manager will arrange a meeting to identify the cause, determine a solution and prevention plan, and assign a person responsible for solving the problem. They must report progress on the problem-solving plan to the complainant every 7 days or as agreed upon until the problem has been resolved.

6) When a complaint has been successfully resolved, the project will provide an explanation of how it was resolved and inform the complainant and relevant parties. The complainant must sign to acknowledge that they have received and accepted the project's resolution of the problem.

7) If the problem cannot be solved and it is proved that the problem was caused by project operation, a fair remedy must be provided to all stakeholders. The ad hoc working group comprised of representatives from 5 parties which are complainants, community leaders, environmental impact monitoring committees, representative from the Office of Energy Regulatory Commission Region 9 (Kanchanaburi), and the project manager or the assigned person will be established.



**FIGURE 7.2-2: PROPOSED EXTERNAL GRIEVANCE REDRESS PROCEDURE**

No.

- /

### Complaint and Suggestion Form

**Details**

Complaint  Suggestion

Complaint follow-up  Others .....

**Complaint Channel**

Self-notification  Verbal notification

Phone call  Via community relations officer

Email  Others (please specify) .....

**Complaint and Suggestion Category**

Environmental impact  Damage and nuisance

Health and safety incident  Workforce or employee behavior

Request for the support, donation, or information

Others (please specify) .....

**Specific area in the Project** ..... **Date** .....

Village name .....Subdistrict.....District.....

Province .....

**Name of a Complainant**

Name-Surname (Mr. / Mrs. / Miss) .....

Occupation .....

Address .....

Telephone ..... Mobile.....

**Complaint / Suggestion**

Details	Suggestion and Resolution

Signature .....

Complainant \*

(\* a complainant signs the form during site investigation with the officer)

**Source:** Solar Development Co., Ltd., 2023

**FIGURE 7.2-3: THE EXAMPLE OF COMPLAINT AND SUGGESTION FORM  
IN THE CONSTRUCTION PHASE AND THE OPERATION PHASE**

**For officer use**

Incident observed.....

**Initial cause (construction phase)**

- Non-compliance with environmental impact mitigation measures
- Non-compliance with rules, requirements, and contract by the contractor
- Delay in operation
- Impropriety or inaccuracy in the operation
- Unsatisfactory or noncompliance with the terms of completed task
- Others (please specify) .....

**Initial cause (operation phase)**

- Non-compliance with environmental impact mitigation measures
- Others (please specify) .....
- Others (please specify) .....

Complaint and suggestion category

- Health and safety
- Environment
- Others (please specify) .....

Signature .....

Complaint recipient

(...../...../.....)

**Source:** Solar Development Co., Ltd., 2023

**FIGURE 7.2-3: THE EXAMPLE OF COMPLAINT AND SUGGESTION FORM  
IN THE CONSTRUCTION PHASE AND THE OPERATION PHASE (CONT'D)**



<b>Investigation Meeting and Corrective/Preventive Actions</b>	
<b>Cause</b> ..... .....	
<b>Corrective/Preventive Actions</b> ..... .....	
<i>(Note: Attach minute of meeting (if any))</i>	
<b>Comment / Instruction</b> ..... .....	
	Signature ..... Company Representative (...../...../.....)
<b>Resolution</b> ..... .....	
	Signature ..... Person responsible for resolution (...../...../.....)
<b>The complaint has been resolved.</b>	
Signature ..... The inspector acknowledged and recorded the complaint (...../...../.....)	Signature ..... Complainant (...../...../.....)
Signature ..... Company Representative (...../...../.....)	
<b>Source:</b> Solar Development Co., Ltd., 2023	
<b>FIGURE 7.2-3: THE EXAMPLE OF COMPLAINT AND SUGGESTION FORM IN THE CONSTRUCTION PHASE AND THE OPERATION PHASE (CONT'D)</b>	

8) Arrange the meeting of the working group to summarize the results and collect complaint and suggestions forms and solutions. These document will be kept as record to support the preparation of a monitoring report according to the CoP Monitor which must be submitted to the Office of the Energy Regulatory Commission (ERC) and report to the Environmental Impact Monitoring Committee in annual meeting or by notification letter.

**(5) Center for Receiving Complaints and Suggestions (Complaint handling function)**

Solar Development Solar Power Plant Project requires the establishment of a center for receiving complaints and suggestions, as follows:

- Local governing authorities (during construction phase)
- Community’s office (during construction phase)
- Project office (during construction and operation phases).

**7.3 COMPLAINTS CHANNELS IN REGARDING TO TRANSMISSION LINE**

Apart from the project’s grievance mechanism that was discussed above, people can also raise their concern regarding to the transmission line through the following channels of PEA;

- Website: <https://complaint.pea.co.th/addnew-stakeholders-complaint>
- Hotline: 1129
- Complaints via electricity billing officers or local electricity office

If the Project receives complaints related to the contractor for the TL, the Project will coordinate with PEA to ensure resolution. As PEA and the Project have separate, but similar, Grievance Redress Mechanisms (GRMs), the Project will record complaints and issues in grievance log.

**7.4 GRIEVANCE MONITORING**

The Project shall record complaints and issues from the community regarding the Project implementation, including the methods and timeframe for addressing complaints and issues. The Project shall provide monthly summary of grievances in a grievance log (**Table 7.4-1**).

**TABLE 7.4-1  
EXAMPLE OF GRIEVANCE LOG**

<b>Monthly Summary Record of Complaint Receipt</b>				
<b>Month/Year:</b> _____		<b>Project Name:</b> _____		
Date of Complaint	Issues	Date of Correction	Result of Correction	Remark

# **APPENDIX**

# **Appendix 2A**

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**Title deeds**

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# **Appendix 2B**

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## **Photovoltaic Modules Information**

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# **Appendix 2C**

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## **PV Solar Structure**

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# **Appendix 2D**

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**Inverter**



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# **Appendix 2E**

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## **Transformer**

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# **Appendix 2F**

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## **Battery Energy Storage System**

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# **Appendix 2G**

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## **Single Line Diagram**

*[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]*

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# **Appendix 2H**

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**Letter notifying the results of the land use  
inspection of the project**



ที่ มท ๐๗๑๑.๘/๖๖๔

สำนักผังประเทศและผังภาค  
กรมโยธาธิการและผังเมือง  
ถนนพระราม ๙ กทม. ๑๐๓๑๐

๖๕ ตุลาคม ๒๕๖๕

เรื่อง แจ้งผลการตรวจสอบการใช้ประโยชน์ที่ดินโครงการผลิตไฟฟ้าจากพลังงานแสงอาทิตย์ จังหวัดกาญจนบุรี

เรียน นายทศพล เจ็มโนธรรม กรรมการ บริษัท พัฒนาโซลาร์ จำกัด

อ้างถึง หนังสือบริษัท พัฒนาโซลาร์ จำกัด ที่ SLD O ๑๐๒๒/๐๐๒ ลงวันที่ ๓ ตุลาคม ๒๕๖๕

- สิ่งที่ส่งมาด้วย ๑. บริเวณที่ตั้งโครงการฯ ตำบลสระลงเรือ อำเภอห้วยกระเจา จังหวัดกาญจนบุรี จำนวน ๑ แปลง  
๒. ข้อกำหนดการใช้ประโยชน์ที่ดินกฎกระทรวงให้ใช้บังคับผังเมืองรวม จังหวัดกาญจนบุรี พ.ศ. ๒๕๖๐

ตามหนังสือที่อ้างถึง บริษัท พัฒนาโซลาร์ จำกัด ขอความอนุเคราะห์ตรวจสอบการใช้ประโยชน์ที่ดินโครงการผลิตไฟฟ้าจากพลังงานแสงอาทิตย์แบบติดตั้งบนพื้นดิน โรงงานลำดับที่ ๘๘ (๑) ในพื้นที่ตำบลสระลงเรือ อำเภอห้วยกระเจา จังหวัดกาญจนบุรี เพื่อจำหน่ายไฟฟ้าให้กับภาครัฐตามระเบียบคณะกรรมการกำกับกิจการพลังงานว่าด้วยการจัดหาไฟฟ้าจากพลังงานหมุนเวียนในรูปแบบ Feed-in Tariff (FIT) ปี พ.ศ. ๒๕๖๕ - ๒๕๗๓ ว่าสามารถดำเนินการได้โดยไม่ขัดต่อกฎหมายว่าด้วยการผังเมือง นั้น

สำนักผังประเทศและผังภาคได้ตรวจสอบแล้ว ขอเรียนว่า ที่ตั้งโครงการผลิตไฟฟ้าจากพลังงานแสงอาทิตย์ ที่ดินบนเอกสารสิทธิ์ จำนวน ๑๙ ไร่ เนื้อที่รวม ๘๑๓ ไร่ ๒ งาน ๓.๕ ตารางวา ตำบลสระลงเรือ อำเภอห้วยกระเจา จังหวัดกาญจนบุรี อยู่ในเขตผังเมืองรวมจังหวัดกาญจนบุรี ตามกฎกระทรวงให้ใช้บังคับผังเมืองรวมจังหวัดกาญจนบุรี พ.ศ. ๒๕๖๐ บริเวณหมายเลข ๓.๒ กำหนดการใช้ประโยชน์ที่ดินเป็นที่ดินประเภทชนบทและเกษตรกรรม (สีเขียว) ให้ใช้ประโยชน์ที่ดินเพื่อเกษตรกรรมหรือเกี่ยวข้องกับเกษตรกรรม การอยู่อาศัย พาณิชยกรรม สถาบันการศึกษา สถาบันศาสนา สถาบันราชการ การสาธารณสุขปิโตรเคมีและสาธารณูปการ และในบัญชีกำหนดประเภท ชนิด และจำพวกของโรงงานที่ห้ามประกอบกิจการในท้ายกฎกระทรวงให้ใช้บังคับผังเมืองรวมจังหวัดกาญจนบุรี พ.ศ. ๒๕๖๐ ไม่ห้ามโรงงานลำดับที่ ๘๘ (๑) โรงงานผลิตพลังงานไฟฟ้าจากพลังงานแสงอาทิตย์ ยกเว้นที่ติดตั้งบนหลังคา าดฟ้า หรือส่วนหนึ่งส่วนใดบนอาคาร ซึ่งบุคคลอาจเข้าอยู่หรือใช้สอยได้ โดยมีขนาดกำลังการผลิตติดตั้งสูงสุดรวมกันของแผงเซลล์แสงอาทิตย์ไม่เกิน ๑,๐๐๐ กิโลวัตต์ ทั้งนี้ จะต้องปฏิบัติให้เป็นไปตามกฎหมายอื่นที่เกี่ยวข้องด้วย

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

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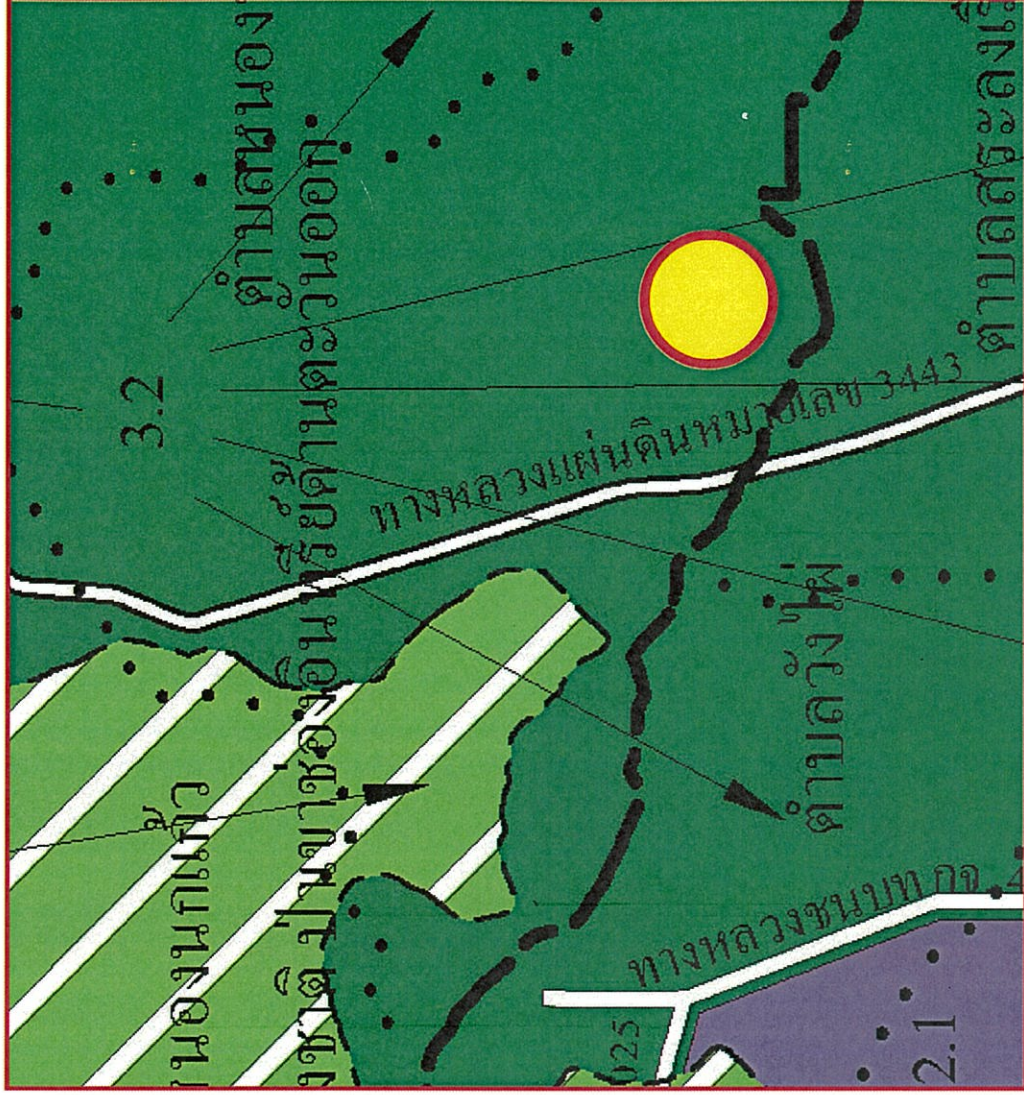
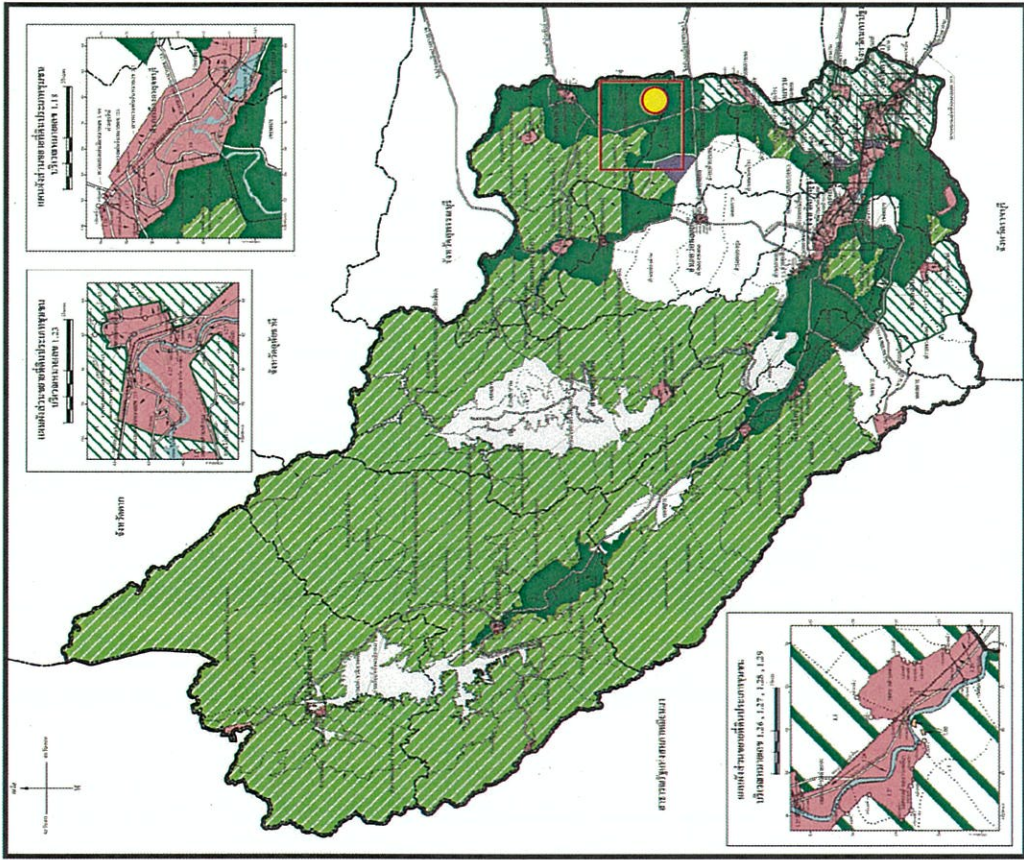
กลุ่มงานผังจังหวัด ๔

โทร. ๐ ๒๒๐๑ ๘๓๑๒

โทรสาร ๐ ๒๖๔๓ ๑๗๑๗



# กฎกระทรวงให้ใช้บังคับผังเมืองรวมจังหวัดกาญจนบุรี พ.ศ. 2560



โครงการผลิตไฟฟ้าด้วยพลังงานแสงอาทิตย์แบบติดตั้งบนพื้นดิน  
ของบริษัท พัฒนาโซลาร์ จำกัด ในพื้นที่ ตำบลสระลงเรือ อำเภอห้วยกระเจา จังหวัดกาญจนบุรี  
อยู่ในที่ดินประเภทชนบทและเกษตรกรรม บริเวณหมายเลข 3.2





## กฎกระทรวง

ให้ใช้บังคับผังเมืองรวมจังหวัดกาญจนบุรี

พ.ศ. ๒๕๖๐

อาศัยอำนาจตามความในมาตรา ๕ แห่งพระราชบัญญัติการผังเมือง พ.ศ. ๒๕๑๘ และ มาตรา ๒๖ วรรคหนึ่ง แห่งพระราชบัญญัติการผังเมือง พ.ศ. ๒๕๑๘ ซึ่งแก้ไขเพิ่มเติมโดย พระราชบัญญัติการผังเมือง (ฉบับที่ ๔) พ.ศ. ๒๕๕๘ รัฐมนตรีว่าการกระทรวงมหาดไทยออกกฎกระทรวงไว้ ดังต่อไปนี้

ข้อ ๑ ให้ใช้บังคับผังเมืองรวม ในท้องที่จังหวัดกาญจนบุรี ภายในแนวเขตตามแผนที่ ท้ายกฎกระทรวงนี้ เว้นแต่พื้นที่ที่อยู่ในแนวเขตดังต่อไปนี้ ให้ใช้ประโยชน์ตามวัตถุประสงค์ของที่ดินนั้น ๆ ตามที่มีกฎหมาย กฎ ระเบียบ ข้อบังคับ หรือประกาศที่เกี่ยวข้องกำหนดไว้ โดยไม่อยู่ในบังคับ การใช้ประโยชน์ที่ดินที่กำหนดในกฎกระทรวงนี้

- (๑) เขตพระราชฐาน
- (๒) พื้นที่ที่ได้ใช้หรือสงวนไว้เพื่อประโยชน์ในราชการทหาร
- (๓) เขตพัฒนาเศรษฐกิจพิเศษที่จัดตั้งขึ้นตามกฎหมาย
- (๔) ท้องที่ที่มีการประกาศใช้บังคับกฎกระทรวงให้ใช้บังคับผังเมืองรวมเมืองหรือผังเมืองรวมชุมชน
- (๕) ที่ดินในเขตปฏิรูปที่ดิน เฉพาะที่ดินที่เป็นของรัฐหรือที่รัฐจัดซื้อหรือเวนคืนจากเจ้าของที่ดิน

เพื่อใช้ประโยชน์ในการปฏิรูปที่ดิน

ข้อ ๒ การวางและจัดทำผังเมืองรวมตามกฎกระทรวงนี้ มีวัตถุประสงค์เพื่อใช้เป็น แนวทางในการพัฒนา และการดำรงรักษาเมืองและบริเวณที่เกี่ยวข้องหรือชนบท ในด้านการใช้ ประโยชน์ในทรัพย์สิน การคมนาคมและการขนส่ง การสาธารณสุขปโภค บริการสาธารณะ และ สภาพแวดล้อมในบริเวณแนวเขตตามข้อ ๑ ให้สอดคล้องกับการพัฒนาระบบเศรษฐกิจและสังคม ของประเทศตามแผนพัฒนาเศรษฐกิจและสังคมแห่งชาติ

ข้อ ๓ ผังเมืองรวมตามกฎกระทรวงนี้ มีนโยบายและมาตรการเพื่อจัดระบบการใช้ประโยชน์ที่ดิน โครงข่ายคมนาคมขนส่งและบริการสาธารณะให้มีประสิทธิภาพ สามารถรองรับและสอดคล้องกับ การขยายตัวของชุมชนในอนาคต รวมทั้งส่งเสริมและพัฒนาเศรษฐกิจ โดยมีสาระสำคัญดังต่อไปนี้

(๑) ส่งเสริมและพัฒนาด้านที่อยู่อาศัย เกษตรกรรม พาณิชยกรรม และอุตสาหกรรม เพื่อให้สอดคล้องกับการขยายตัวของชุมชนและเศรษฐกิจ การใช้ประโยชน์ที่ดินของรัฐและเอกชน รวมทั้งการใช้ทรัพยากรธรรมชาติให้เกิดประโยชน์สูงสุด

(๒) ส่งเสริมและพัฒนาจังหวัดกาญจนบุรีให้เป็นแหล่งท่องเที่ยวเชิงนิเวศน์

(๓) ส่งเสริมการค้าชายแดนและการค้านานาชาติด้านตะวันตก

(๔) อนุรักษ์ทรัพยากรธรรมชาติและสิ่งแวดล้อม

ข้อ ๔ การใช้ประโยชน์ที่ดินภายในเขตผังเมืองรวม ให้เป็นไปตามแผนผังกำหนดการใช้ประโยชน์ที่ดินตามที่ได้จำแนกประเภท และรายการประกอบแผนผังท้ายกฎกระทรวงนี้

ข้อ ๕ การใช้ประโยชน์ที่ดินตามแผนผังกำหนดการใช้ประโยชน์ที่ดินตามที่ได้จำแนกประเภทท้ายกฎกระทรวงนี้ ให้เป็นไปดังต่อไปนี้

(๑) ที่ดินในบริเวณหมายเลข ๑.๑ ถึงหมายเลข ๑.๓๑ ที่กำหนดไว้เป็นสีชมพู ให้เป็นที่ดินประเภทชุมชน

(๒) ที่ดินในบริเวณหมายเลข ๒.๑ ถึงหมายเลข ๒.๕ ที่กำหนดไว้เป็นสีม่วง ให้เป็นที่ดินประเภทอุตสาหกรรมและคลังสินค้า

(๓) ที่ดินในบริเวณหมายเลข ๓.๑ ถึงหมายเลข ๓.๕ ที่กำหนดไว้เป็นสีเขียว ให้เป็นที่ดินประเภทชนบทและเกษตรกรรม

(๔) ที่ดินในบริเวณหมายเลข ๔.๑ และหมายเลข ๔.๒ ที่กำหนดไว้เป็นสีขาวมีกรอบและเส้นทแยงสีเขียว ให้เป็นที่ดินประเภทอนุรักษ์ชนบทและเกษตรกรรม

(๕) ที่ดินในบริเวณหมายเลข ๕.๑ ถึงหมายเลข ๕.๗ ที่กำหนดไว้เป็นสีเขียวอ่อน มีเส้นทแยงสีขาว ให้เป็นที่ดินประเภทอนุรักษ์ป่าไม้

(๖) ที่ดินในบริเวณหมายเลข ๖ ที่กำหนดไว้เป็นสีฟ้า ให้เป็นที่ดินประเภทที่โล่งเพื่อการรักษาคุณภาพสิ่งแวดล้อม

(๗) ที่ดินในบริเวณหมายเลข ๗.๑ ถึงหมายเลข ๗.๑๐ ที่กำหนดไว้เป็นสีน้ำตาลอ่อน ให้เป็นที่ดินประเภทอนุรักษ์เพื่อส่งเสริมเอกลักษณ์ศิลปวัฒนธรรมไทย

ข้อ ๖ ที่ดินประเภทชุมชน ให้ใช้ประโยชน์ที่ดินเพื่อการอยู่อาศัย พาณิชยกรรม เกษตรกรรม สถาบันการศึกษา สถาบันศาสนา สถาบันราชการ การสาธารณสุขและสาธารณูปการ ที่ดินประเภทนี้ ห้ามใช้ประโยชน์ที่ดินเพื่อกิจการตามที่กำหนด ดังต่อไปนี้

(๑) โรงงานตามกฎหมายว่าด้วยโรงงานตามประเภท ชนิด และจำพวกท้ายกฎกระทรวงนี้

(๒) คลังน้ำมันและสถานที่เก็บรักษาน้ำมัน ลักษณะที่สาม ตามกฎหมายว่าด้วยการควบคุม น้ำมันเชื้อเพลิง เพื่อการจำหน่าย



(๓) คลังก๊าซปิโตรเลียมเหลว สถานที่บรรจุก๊าซปิโตรเลียมเหลวประเภทโรงบรรจุ สถานที่บรรจุก๊าซปิโตรเลียมเหลวประเภทห้องบรรจุ และสถานที่เก็บรักษาก๊าซปิโตรเลียมเหลวประเภทโรงเก็บ ตามกฎหมายว่าด้วยการควบคุมน้ำมันเชื้อเพลิง

(๔) จัดสรรที่ดินเพื่อประกอบอุตสาหกรรม

ที่ดินประเภทนี้ในเขตป่าสงวนแห่งชาติ เขตรักษาพันธุ์สัตว์ป่า เขตห้ามล่าสัตว์ป่า และเขตอุทยานแห่งชาติ ให้ใช้ประโยชน์ที่ดินเพื่อการสงวนและคุ้มครองดูแลรักษาหรือบำรุงป่าไม้ สัตว์ป่า ต้นน้ำ ลำธาร และทรัพยากรธรรมชาติอื่น ๆ ตามมติคณะรัฐมนตรีและกฎหมายเกี่ยวกับการป่าไม้ การสงวนและคุ้มครองสัตว์ป่า และการส่งเสริมและรักษาคุณภาพสิ่งแวดล้อมเท่านั้น

ข้อ ๗ ที่ดินประเภทอุตสาหกรรมและคลังสินค้า ให้ใช้ประโยชน์ที่ดินเพื่ออุตสาหกรรมหรือเกี่ยวข้องกับอุตสาหกรรม คลังสินค้า การอยู่อาศัย เกษตรกรรม สถาบันราชการ การสาธารณูปโภคและสาธารณูปการ สำหรับการให้ประโยชน์ที่ดินเพื่อกิจการอื่น ให้ดำเนินการหรือประกอบกิจการได้ในอาคารที่ไม่ใช่อาคารขนาดใหญ่

ที่ดินประเภทนี้ ห้ามใช้ประโยชน์ที่ดินเพื่อกิจการตามที่กำหนด ดังต่อไปนี้

(๑) จัดสรรที่ดินเพื่อประกอบพาณิชย์กรรม เว้นแต่เป็นการจัดสรรที่เป็นส่วนหนึ่งของโครงการอุตสาหกรรม

(๒) จัดสรรที่ดินเพื่อการอยู่อาศัย เว้นแต่เป็นการจัดสรรที่เป็นส่วนหนึ่งของโครงการอุตสาหกรรม

(๓) สถานสงเคราะห์หรือรับเลี้ยงเด็ก เว้นแต่สถานสงเคราะห์หรือรับเลี้ยงเด็กที่ให้บริการแก่พนักงานหรือลูกจ้างของสถานประกอบการในรูปของสวัสดิการ

(๔) สถานสงเคราะห์หรือรับเลี้ยงคนชรา เว้นแต่สถานสงเคราะห์หรือรับเลี้ยงคนชราที่ให้บริการแก่พนักงานหรือลูกจ้างของสถานประกอบการในรูปของสวัสดิการ

ข้อ ๘ ที่ดินประเภทชนบทและเกษตรกรรม ให้ใช้ประโยชน์ที่ดินเพื่อเกษตรกรรมหรือเกี่ยวข้องกับเกษตรกรรม การอยู่อาศัย พาณิชยกรรม สถาบันการศึกษา สถาบันศาสนา สถาบันราชการ การสาธารณูปโภคและสาธารณูปการ

ที่ดินประเภทนี้ ห้ามใช้ประโยชน์ที่ดินเพื่อกิจการตามที่กำหนด ดังต่อไปนี้

(๑) โรงงานตามกฎหมายว่าด้วยโรงงานตามประเภท ชนิด และจำพวกท้ายกฎกระทรวงนี้

(๒) จัดสรรที่ดินเพื่อประกอบอุตสาหกรรม

ที่ดินประเภทนี้ในเขตป่าสงวนแห่งชาติ เขตรักษาพันธุ์สัตว์ป่า เขตห้ามล่าสัตว์ป่า และเขตอุทยานแห่งชาติ ให้ใช้ประโยชน์ที่ดินเพื่อการสงวนและคุ้มครองดูแลรักษาหรือบำรุงป่าไม้ สัตว์ป่า ต้นน้ำ ลำธาร และทรัพยากรธรรมชาติอื่น ๆ ตามมติคณะรัฐมนตรีและกฎหมายเกี่ยวกับการป่าไม้ การสงวนและคุ้มครองสัตว์ป่า และการส่งเสริมและรักษาคุณภาพสิ่งแวดล้อมเท่านั้น

ประเภทหรือชนิดของโรงงานที่ห้ามประกอบกิจการ  
ท้ายกฎกระทรวงให้ใช้บังคับผังเมืองรวมจังหวัดกาญจนบุรี พ.ศ. ๒๕๖๐

ที่ดินประเภทชุมชน			
ลำดับที่	ประเภทหรือชนิดของโรงงาน	จำพวกที่	หมายเหตุ
๔๒	(๑) โรงงานทำเคมีภัณฑ์ สารเคมี หรือวัสดุเคมี ซึ่งมีไขंपุ่ย	๓	
	(๒) โรงงานเก็บรักษา ลำเลียง แยก คัดเลือก หรือแบ่งบรรจุเฉพาะเคมีภัณฑ์อันตราย ซึ่งมีไขंपุ่ย	๓	
๔๔	โรงงานประกอบกิจการเกี่ยวกับการผลิตยางเรซินสังเคราะห์ ยางอีลาสโตเมอร์ พลาสติก หรือเส้นใยสังเคราะห์ซึ่งมีไขंपุ่ยแก้ว	๓	
๔๕	(๑) โรงงานทาสี (Paints) สำหรับใช้ทา พื้น หรือเคลือบ	๓	ยกเว้นจำพวกที่ ๓ เฉพาะสีน้ำ ให้ประกอบกิจการได้
	(๒) โรงงานทำน้ำมันชักเงา น้ำมันผสมสี หรือน้ำยาล้างสี	๓	
	(๓) โรงงานทำเซลแล็ก แล็กเกอร์ หรือผลิตภัณฑ์สำหรับใช้ยาหรืออุด	๓	
๔๘	(๔) โรงงานทำไม้ขีดไฟ วัตถุระเบิด หรือดอกไม้เพลิง	๓	
	(๖) โรงงานทำหมึกหรือคาร์บอนดำ	๓	
๔๙	โรงงานกลั่นน้ำมันปิโตรเลียม	๓	
๕๐	(๔) โรงงานผสมผลิตภัณฑ์จากปิโตรเลียมเข้าด้วยกัน หรือการผสมผลิตภัณฑ์จากปิโตรเลียมกับวัสดุอื่น แต่ไม่รวมถึงการผสมผลิตภัณฑ์จากก๊าซธรรมชาติกับวัสดุอื่น	๓	ยกเว้นจำพวกที่ ๓ เฉพาะแอสฟัลต์ติกคอนกรีต ให้ประกอบกิจการได้
๘๙	โรงงานผลิตก๊าซซึ่งมีไขंपุ่ยก๊าซธรรมชาติ และโรงงานส่งหรือจำหน่ายก๊าซ แต่ไม่รวมถึงโรงงานส่งหรือจำหน่ายก๊าซที่เป็นน้ำมันเชื้อเพลิงตามกฎหมายว่าด้วยการควบคุมน้ำมันเชื้อเพลิง	๓	
๙๑	(๒) โรงงานบรรจุก๊าซ แต่ไม่รวมถึงการบรรจุก๊าซที่เป็นน้ำมันเชื้อเพลิงตามกฎหมายว่าด้วยการควบคุมน้ำมันเชื้อเพลิง	๓	
๙๙	โรงงานผลิต ซ่อมแซม หรือดัดแปลง เครื่องกระสุนปืน วัตถุระเบิด หรือสิ่งอื่นใดที่มีอำนาจในการประหาร ทำลาย หรือทำให้หมดสมรรถภาพ ในทำนองเดียวกับเครื่องกระสุนปืน หรือวัตถุระเบิด และรวมถึงสิ่งประกอบของสิ่งดังกล่าว	๓	
๑๐๑	โรงงานปรับปรุงคุณภาพของเสียรวม (Central Waste Treatment Plant)	๓	ยกเว้นจำพวกที่ ๓ เฉพาะโรงงานบำบัดน้ำเสียรวมของชุมชน ให้ประกอบกิจการได้



ลำดับที่	ประเภทหรือชนิดของโรงงาน	จำพวกที่	หมายเหตุ
๔๓	(๑) โรงงานทำปุ๋ย หรือสารป้องกันหรือกำจัดศัตรูพืชหรือสัตว์ (Pesticides)  (๒) โรงงานเก็บรักษาหรือแบ่งบรรจุปุ๋ย หรือสารป้องกันหรือกำจัดศัตรูพืชหรือสัตว์ (Pesticides)	๓  ๓	ยกเว้นจำพวกที่ ๓ เฉพาะ ปุ๋ยอินทรีย์และปุ๋ยเคมีที่ไม่มี การใช้แอมโมเนียมไนเตรต (Ammonium Nitrate) หรือโปแตสเซียมคลอไรด์ (Potassium Chlorate) ให้ประกอบกิจการได้  ยกเว้นจำพวกที่ ๓ เฉพาะ ปุ๋ยอินทรีย์และปุ๋ยเคมีที่ไม่มี การใช้แอมโมเนียมไนเตรต (Ammonium Nitrate) หรือโปแตสเซียมคลอไรด์ (Potassium Chlorate) ให้ประกอบกิจการได้
๔๔	โรงงานประกอบกิจการเกี่ยวกับการผลิตยางเรซินสังเคราะห์ ยางอีลาสโตเมอร์ พลาสติก หรือเส้นใยสังเคราะห์ซึ่งมีใยแก้ว	๓	
๔๕	(๑) โรงงานทำสี (Paints) สำหรับใช้ทา ฟัน หรือเคลือบ  (๒) โรงงานทำน้ำมันชักเงา น้ำมันผสมสี หรือน้ำยาล้างสี  (๓) โรงงานทำเซลล์แก๊ส แล็กเกอร์ หรือผลิตภัณฑ์สำหรับใช้ยาหรืออุด	๓  ๓  ๓	ยกเว้นจำพวกที่ ๓ เฉพาะ สีน้ำ ให้ประกอบกิจการได้
๔๘	(๔) โรงงานทำไม้ขีดไฟ วัตถุระเบิด หรือดอกไม้เพลิง  (๖) โรงงานทำหมึกหรือคาร์บอนดำ	๓  ๓	
๔๙	โรงงานกลั่นน้ำมันปิโตรเลียม	๓	
๕๐	(๔) โรงงานผสมผลิตภัณฑ์จากปิโตรเลียมเข้าด้วยกัน หรือการผสมผลิตภัณฑ์ จากปิโตรเลียมกับวัสดุอื่น แต่ไม่รวมถึงการผสมผลิตภัณฑ์จากก๊าซ ธรรมชาติกับวัสดุอื่น	๓	ยกเว้นจำพวกที่ ๓ เฉพาะ แอสฟัลต์ติกคอนกรีต ให้ประกอบกิจการได้
๘๙	โรงงานผลิตก๊าซ ซึ่งมีใช้ก๊าซธรรมชาติ และโรงงานส่งหรือจำหน่ายก๊าซ แต่ไม่รวมถึงโรงงานส่งหรือจำหน่ายก๊าซที่เป็นน้ำมันเชื้อเพลิงตามกฎหมาย ว่าด้วยการควบคุมน้ำมันเชื้อเพลิง	๓	
๙๑	(๒) โรงงานบรรจุก๊าซ แต่ไม่รวมถึงการบรรจุก๊าซที่เป็นน้ำมันเชื้อเพลิง ตามกฎหมายว่าด้วยการควบคุมน้ำมันเชื้อเพลิง	๓	



ที่ กจ ๕๕๓๐๑/๗๐๗

สำนักงานเทศบาลตำบลสระลงเรือ

อ.ห้วยกระเจา จ.กาญจนบุรี ๗๑๑๗๐

๒๕ กรกฎาคม ๒๕๖๖

เรื่อง ขอบความอนุเคราะห์ตรวจสอบการใช้ประโยชน์ที่ดินตามเทศบัญญัติของเทศบาลตำบลสระลงเรือ

เรียน นายทศพล เจิงมโนธรรม

อ้างถึง หนังสือพัฒนาโซลาร์ ที่ SLD O ๐๗๒๓/๐๑๔ ลงวันที่ ๔ กรกฎาคม ๒๕๖๖

ตามหนังสือที่อ้างถึง บริษัท พัฒนาโซลาร์ จำกัด (บริษัทฯ) มีแผนพัฒนาและดำเนินโครงการผลิตไฟฟ้าด้วยพลังงานแสงอาทิตย์แบบติดตั้งบนพื้นดินร่วมกับระบบกักเก็บพลังงานในพื้นที่ ตำบลสระลงเรือ จึงขอความอนุเคราะห์ตรวจสอบการใช้ประโยชน์ที่ดินตามเทศบัญญัติของเทศบาลตำบลสระลงเรือ ว่าที่ตั้งโครงการ รายละเอียดดังสิ่งที่ส่งมาด้วย ๑ ถึง ๓ สามารถดำเนินโครงการผลิตไฟฟ้าด้วยพลังงานแสงอาทิตย์แบบติดตั้งบนพื้นดินร่วมกับระบบกักเก็บพลังงานในพื้นที่ตำบลสระลงเรือ อำเภอห้วยกระเจา จังหวัดกาญจนบุรี ได้โดยไม่ขัดต่อเทศบัญญัติของเทศบาลตำบลสระลงเรือ นั้น

เทศบาลตำบลสระลงเรือ ขอแจ้งให้ทาง บริษัท พัฒนาโซลาร์ จำกัด (บริษัทฯ) ได้ทราบว่าเทศบาลฯ ยังไม่ได้ทำผังเมืองรวมชุมชน จึงเห็นควรให้ประสานงานกับสำนักงานโยธาธิการและผังเมืองจังหวัดกาญจนบุรี เพื่อขอข้อมูลที่เกี่ยวข้องและเป็นประโยชน์ในการดำเนินโครงการดังกล่าวข้างต้นต่อไป

จึงเรียนมาเพื่อโปรดทราบ

*[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]*

กองช่าง

เทศบาลตำบลสระลงเรือ

โทร.๐-๓๔๕๕๑-๐๖๐๗ ต่อ ๑๐๖

โทรสาร ๐-๓๔๕๕๑-๐๖๐๗

“ยึดมั่นธรรมาภิบาล บริการเพื่อประชาชน”

# **Appendix 2I**

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**Certificate and confirmation of capacity to  
procure water use  
from the Provincial Waterworks Authority,  
Lao Khwan Branch**

ที่ มท ๕๕๔๒๐-๒๕/ ๑๕๕๑



การประปาส่วนภูมิภาคสาขาเลาขวัญ  
๔๐๑ หมู่ ๑ ตำบลเลาขวัญ  
อำเภอเลาขวัญ จังหวัดกาญจนบุรี  
๗๑๒๑๐

วันที่ ๒๘ มิถุนายน ๒๕๖๖

เรื่อง ขอรับรองและยืนยันศักยภาพในการจัดหาน้ำใช้

เรียน ผู้จัดการบริษัท พัฒนาโซลาร์ จำกัด

ตามหนังสือ SLD O ๐๕๒๓/๐๐๙ ลงวันที่ ๒๕ พฤษภาคม ๒๕๖๖ เรื่อง ขอความอนุเคราะห์  
รับรองและยืนยันศักยภาพในการจัดหาน้ำใช้ โดยบริษัท พัฒนาโซลาร์ จำกัด ได้มีความประสงค์ขอหนังสือ  
รับรองและยืนยันศักยภาพในการจัดหาน้ำใช้ให้กับโครงการโรงไฟฟ้าพัฒนาโซลาร์ เพื่อนำมาใช้ประกอบการจัด  
ทำรายงานประมวลหลักการปฏิบัติ (CoP) นั้น

การประปาส่วนภูมิภาคสาขาเลาขวัญ ขอยืนยันศักยภาพว่าสามารถจัดหาน้ำประปาให้กับ  
โครงการโรงไฟฟ้าพัฒนาโซลาร์ ได้อย่างเพียงพอ โดยทางโครงการฯนำรถบรรทุกน้ำขนส่ง ในช่วงเวลา  
๙.๐๐น.-๑๖.๓๐ น. ทุกวัน

จึงเรียนมาเพื่อโปรดทราบ

ขอแสดงความนับถือ

*[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]*

งานผลิต การประปาส่วนภูมิภาคสาขาเลาขวัญ

โทรศัพท์/โทรสาร ๐ ๓๔๕๗ ๖๑๒๑



การประปาส่วนภูมิภาค  
บุญ - บัน - เฟื่องงาม - สุขความั่งมี

25 พฤษภาคม 2566

เรื่อง ขอบความอนุเคราะห์รับรองและยืนยันศักยภาพในการจัดหาน้ำใช้

เรียน ผู้จัดการการประปาส่วนภูมิภาค สาขาเลขาขวัญ

เอกสารแนบ พิกัดที่ตั้งโครงการโรงไฟฟ้าพัฒนาโซลาร์

เนื่องด้วยบริษัท พัฒนาโซลาร์ จำกัด ("บริษัทฯ") มีแผนพัฒนาโครงการโรงไฟฟ้าพัฒนาโซลาร์ ("โครงการฯ") ซึ่งเป็นโครงการโรงไฟฟ้าพลังงานแสงอาทิตย์แบบติดตั้งบนพื้นดินร่วมกับระบบกักเก็บพลังงาน ตั้งอยู่ในตำบลสระลงเรือ อำเภอห้วยกระเจา จังหวัดกาญจนบุรี โดยบริษัทฯ มีความประสงค์จะขอใช้น้ำจากการประปาส่วนภูมิภาค สาขาเลขาขวัญ ในการดำเนินการโครงการฯ

ปัจจุบัน โครงการฯ อยู่ระหว่างการศึกษาและจัดทำรายงานประมวลหลักการปฏิบัติ (CoP) ตามระเบียบคณะกรรมการกำกับกิจการพลังงาน ว่าด้วยหลักเกณฑ์การจัดทำรายงานประมวลหลักการปฏิบัติและรายงานผลการปฏิบัติตามประมวลหลักการปฏิบัติ สำหรับการประกอบกิจการผลิตไฟฟ้า พ.ศ. 2565 โดยจากการออกแบบพบว่า ในระยะก่อสร้างและระยะดำเนินการ โครงการฯ มีความจำเป็นต้องใช้น้ำสูงสุดประมาณ 4,230 ลูกบาศก์เมตรต่อเดือน และมีแผนเริ่มใช้น้ำเบื้องต้น ตั้งแต่เดือน มกราคม พ.ศ. 2567 เป็นต้นไป ด้วยวิธีการขนส่งทางรถบรรทุก

ในการนี้ บริษัทฯ จึงใคร่ขอความอนุเคราะห์ทางหน่วยงานของท่านพิจารณาออกหนังสือรับรองและยืนยันศักยภาพในการจัดหาน้ำใช้ให้กับทางโครงการฯ ตามรายละเอียดข้างต้น เพื่อนำมาใช้ในการประกอบการจัดทำรายงานประมวลหลักการปฏิบัติ (CoP) ให้มีความครบถ้วนสมบูรณ์ต่อไป

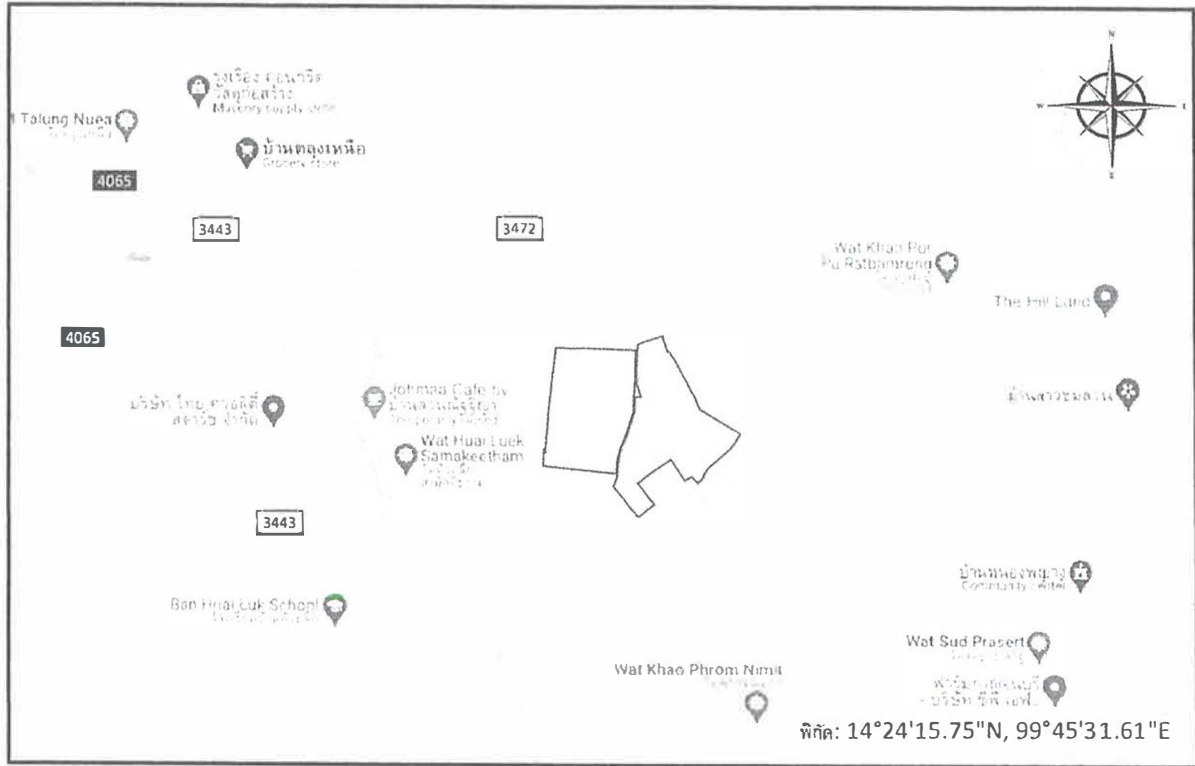
จึงเรียนมาเพื่อโปรดพิจารณา

[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]

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พิกัดที่ตั้งโครงการโรงไฟฟ้าพัฒนาโซลาร์  
ตำบลสระลงเรือ อำเภอห้วยกระเจา จังหวัดกาญจนบุรี



 ขอบเขตที่ดินโครงการโรงไฟฟ้าพัฒนาโซลาร์

# **Appendix 2J**

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## **Calculation of Retention Pond**



CODE OF PRACTICE (COP)

SOLAR AND BESS PLANT

# SOLAR DEVELOPMENT PROJECT

## RETENTION POND CALCULATION

This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]

□

PREPARED FOR



Client Name: Solar Development Co., Ltd.

11 JULY 2023

*[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]*



## การออกแบบบ่อน้ำฝน

- ออกแบบให้มีบ่อน้ำฝนได้อย่างน้อย 3 ชั่วโมง และควบคุมอัตราการระบายน้ำออกจากพื้นที่โครงการไม่ให้เพิ่มขึ้นมากกว่าก่อนมีโครงการ โดยต้องแสดงรายการคำนวณปริมาณน้ำฝนที่ตก ในพื้นที่โครงการและอัตราการระบายน้ำฝนก่อนและหลังพัฒนาโครงการ ตำแหน่งและความจุของบ่อน้ำฝน ช่วงเวลาและอัตราการระบายน้ำฝนออกจากพื้นที่โครงการ

## รายการคำนวณการคำนวณปริมาตรบ่อน้ำฝน

รายละเอียดโครงการ

ชื่อโครงการ : SB-KCB3 สถานที่ : จ.กาญจนบุรี

การใช้งาน : บ่อน้ำฝนภายในโครงการ

### CRITERIA

พื้นที่ของโครงการที่พิจารณาออกแบบ = **1,301,614.00** ตร.ม.

ก่อนมีโครงการ

สภาพพื้นที่เป็นพื้นที่ว่างเปล่ามีหญ้าปกคลุมดิน โดยรอบเป็นพื้นที่โล่งทำการเกษตร

### DESIGN

คำนวณการไหลนองของน้ำฝน

Q = CIA

โดยที่

Q = อัตราการไหลนองของน้ำฝน, ลบ.ม./ชม ( $m^3/hr$ )

C = สัมประสิทธิ์การไหลนองโดยเฉลี่ย

I = ความเข้มของฝน, ม./ชม. ( $m/hr$ )

A = พื้นที่รับน้ำ, ตร.ม. ( $m^2$ )

[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]

**Undeveloped Area** พื้นที่ก่อนการพัฒนา

Q = CIA

โดยที่

C= 0.30

I= 0.1144 m/3hr

A= 1,301,614.00 m<sup>2</sup>

Q=0.30 x (0.1144 m/hr) x (1,301,614.00 m<sup>2</sup>)

Qbefore = 44,671.39 m<sup>3</sup>/3hr

**Developed Area** พื้นที่มีการพัฒนา

**ภาค 3 (SB-KCB3)**

Solar+Batt

**Development Area**

	W m	L m	Area m <sup>2</sup>
Main Power Transformer & Substation	55	33	1,815.00 m <sup>2</sup>
Batt Area	60	80	4,800.00 m <sup>2</sup>
Admin	8	15	120.00 m <sup>2</sup>
Total			6,735.00 m <sup>2</sup>

**Rainfall**

Rainfall Amount	282.1 mm	@25year return period
3 hrs rainfall intensity (I)	114.4 mm/3hr	@25year return period
1 hrs rainfall intensity (I)	90 mm/hr	@25year return period

Frequency Analysis of Maximum Rainfall for Each Period at C. Kanchana Buri  
(1959 - 1983 , 1986 - 1998)

Time (hr)	Rainfall Amount (mm)									
	2 yr	5 yr	10 yr	25 yr	50 yr	100 yr	200 yr	500 yr	1000 yr	
0.25	27.3	36.2	42.0	49.4	54.9	60.4	65.8	73.0	78.4	
0.5	40.0	52.0	59.9	70.0	77.4	84.8	92.2	101.9	109.2	
0.75	46.6	61.8	71.8	84.5	93.9	103.3	112.6	124.9	134.2	
1	50.7	66.3	76.6	89.6	99.3	108.9	118.4	131.1	140.6	
2	57.2	73.7	84.6	98.5	108.7	118.9	129.1	142.4	152.6	
3	63.8	84.0	97.5	114.4	127.0	139.4	151.8	168.2	180.6	
6	72.2	97.8	114.7	136.1	152.0	167.8	183.5	204.3	219.9	
12	76.5	105.3	124.4	148.5	166.4	184.2	201.8	225.2	242.8	
24	86.0	116.1	136.0	161.2	179.8	198.4	216.8	241.2	259.6	

[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]

อ้างอิงจาก “ความสัมพันธ์ระหว่างความเข้มฝน - ช่วงเวลา - ความถี่ฝน และเปอร์เซ็นต์การแผ่กระจายของปริมาณฝนสูงสุดในช่วงเวลา 24 ชั่วโมง ภาคตะวันตก, กรมชลประทาน, กระทรวงเกษตรและสหกรณ์”

[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]

**Developed Area** พื้นที่ที่มีการพัฒนา

โดยที่แบ่งเป็นพื้นที่พัฒนาใหม่

$$Q = CIA$$

$$C = 0.90 \quad (\text{Runoff Coefficient for Asphaltic and Concrete Area})$$

$$I = 0.1144 \quad \text{m/3hr @25Y 3 hrs}$$

$$A = 6,735.00 \quad \text{m}^2$$

$$Q = 0.90 \times (0.1144 \text{ m/3hr}) \times (6,735.00 \text{ m}^2)$$

$$Qd1 = 693.44 \text{ m}^3/3\text{hr} \text{ Used } 800.00 \text{ m}^3/3\text{hr}$$

และแบ่งเป็นพื้นที่ส่วนที่ไม่ได้พัฒนาที่เหลือ

$$Q = CIA$$

โดยที่

$$C = 0.30$$

$$I = 0.1144 \quad \text{m/3hr}$$

$$A = 1,294,879.00 \quad \text{m}^2$$

$$Q = 0.30 \times (0.1144 \text{ m/3hr}) \times (1,294,879.00 \text{ m}^2)$$

$$Qd2 = 44,440.25 \quad \text{m}^3/3\text{hr}$$

$$Q_{\text{after}} = Qd2 + Qd1$$

$$Q_{\text{after}} = 44,440.25 + 800.00 \quad \text{m}^3/3\text{hr}$$

$$Q_{\text{after}} = 45,240.25 \quad \text{m}^3/3\text{hr}$$

$$Q_{\text{after}} - Q_{\text{before}} = 45,240.25 - 44,671.39 \quad \text{m}^3/3\text{hr}$$

$$Q_{\text{remain}} = 568.85 \quad \text{m}^3/3\text{hr}$$

$$\text{used } 700.00 \quad \text{m}^3/3\text{hr SB site}$$

ดังนั้น ปริมาตรบ่อหน่วงน้ำ Retention Pond = 700 ลบ.ม. (m<sup>3</sup>)

[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]

# **Appendix 3A**

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**Statistics on earthquake events with epicenters  
In Thailand 2018-2023**

ตารางที่ 1

สถิติเหตุการณ์แผ่นดินไหวที่มีศูนย์กลางการเกิดในประเทศไทย พ.ศ.2561-2566

วัน/เดือน/ปี	ศูนย์กลางการเกิดแผ่นดินไหว	บันทึกเหตุการณ์	ขนาดที่จุดศูนย์กลาง
พ.ศ.2561			
3 มกราคม 2561	อ.แม่จัน จ.เชียงราย	รู้สึกสั่นไหวบริเวณ ต.แม่จัน บ้านห้วยจอกใน ต.ป่าตึง อ.แม่จัน จ.เชียงราย	2.7
29 พฤษภาคม 2561	อ.แม่ลาว จ.เชียงราย	รู้สึกสั่นไหว บ้านสัน ต.บัวลี่ อ.แม่ลาว จ.เชียงราย	2.7
10 มิถุนายน 2561	อ.วังสะพุง จ.เลย	รู้สึกสั่นไหว บ้านสัน ต.โคกขาม อ.วังสะพุง จ.เลย	3.4
12 ตุลาคม 2561	อ.แม่ลาว จ.เชียงราย	รู้สึกสั่นไหว เขตบ้านสัน ต.แม่พริก อ.แม่ลาว จ.เชียงราย	2.8
16 พฤศจิกายน 2561	อ.พาน จ.เชียงราย	รู้สึกสั่นไหว บ้านสัน ต.จอมหมอกแก้ว อ.แม่ลาว จ.เชียงราย	3.3
30 ธันวาคม 2561	อ.ศรีสวัสดิ์ จ.กาญจนบุรี	รู้สึกสั่นไหว อ.อุ้มผาง จ.ตาก อ.สามง่าม อ.พิพิธ อ.ศรีประจักษ์ อ.สองพี่น้อง จ.สุพรรณบุรี ต.บ่อยาง อ.สว่างอารมณ์ จ.อุทัยธานี ต.บ้านสี อ.บ้านหมี่ จ.สทิงพระ ต.เจ็ดยักษ์ ต.หน้าเมือง อ.เมือง ต.หนองโพ อ.โพธาราม จ.ราชบุรี อ.กำแพงแสน จ.นครปฐม อ.ท่ามะกา อ.โพธาราม อ.สามชัย อ.เมืองหนองปรือ อ.หนองปรือ ต.หนองบัว อ.เมือง จ.กาญจนบุรี อ.ลาดยาว ต.ปากน้ำโพ อ.เมือง จ.นครสวรรค์ เขตยานนาวา หนองบอน ประเวศฯ สทิงพระ ต.ลิขันธ์ กรุงเทพฯ อ.บางกรวย จ.นนทบุรี	4.9
พ.ศ.2562			
22 มกราคม 2562	อ.สันทราย จ.เชียงใหม่	รู้สึกสั่นไหวบ้านสัน ต. แม่แฝกใหม่ อ.สันทราย บ้านป่าม่วง ต.แม่แรม อ.แม่ริม จ.เชียงใหม่	3.2
27 มกราคม 2562	อ.ท่าสองยาง จ.ตาก	รู้สึกสั่นไหว กระเจ๊กสัน ต.แม่ต๋าน อ.ท่าสองยาง จ.ตาก	3.1
29 มกราคม 2562	อ.สันทราย จ.เชียงใหม่	รู้สึกสั่นไหวบ้านสัน บ้านหนองผาคำใหม่ อ.สันทราย จ.เชียงใหม่	2.6
20 กุมภาพันธ์ 2562	อ.วังเหนือ จ.ลำปาง	รู้สึกสั่นไหว บ้านสัน อ.เมือง จ.แม่ฮ่องสอน/ อ.แจ้ห่ม ต.ต้นธงชัย อ.เมือง อ.วังเหนือ ลำปาง /ต.เชียงง่า อ.เมือง จ.ลำพูน/ ต.บ้านปง อ.หางดง, อ.สารภี ต.มอนบ้าน อ.ฝาง, ต.ท่าศาลา ต.วอเวียง ต.วัดเกต ต.หนองป่าครั่ง ต.สุเทพ อ.เมือง อ.ฮอด, อ.พร้าว อ.สันทราย, ต.อินทิล อ.แม่แตง จ.เชียงใหม่/ อ.เวียงป่าเป้า, ต.ป่าตึง อ.แม่สรวย, ต.เมืองพาน อ.พาน จ.เชียงราย/ ต.ป่าสัก อ.แม่ใจ, ต.เวียง อ.เมือง จ.พะเยา	4.9

ตารางที่ 1

สถิติเหตุการณ์แผ่นดินไหวที่มีศูนย์กลางการเกิดในประเทศไทย พ.ศ.2561-2566 (ต่อ)

วัน/เดือน/ปี	ศูนย์กลางการเกิดแผ่นดินไหว	บันทึกเหตุการณ์	ขนาดที่จุดศูนย์กลาง
พ.ศ.2562 (ต่อ)			
23 กุมภาพันธ์ 2562	อ.วังเหนือ จ.ลำปาง	รู้สึกสั่นไหว บ้านสัน ต.วิชัย อ.วังเหนือ จ.ลำปาง	2.5
23 กุมภาพันธ์ 2562	อ.วังเหนือ จ.ลำปาง	รู้สึกสั่นไหว บ้านสัน ต.วิชัย อ.วังเหนือ จ.ลำปาง	2.9
24 กุมภาพันธ์ 2562	อ.วังเหนือ จ.ลำปาง	รู้สึกสั่นไหว อ.เมือง จ.ลำปาง	2.5
14 มีนาคม 2562	อ.วังเหนือ จ.ลำปาง	รู้สึกสั่นไหว บ้านสัน ต.แม่แรม อ.พร้าว จ.เชียงใหม่ ต.ศรีด้อย อ.แม่ใจ ต.หนองท่อม อ.ดอกคำใต้ จ.พะเยา อ.เวียงป่าเป้า ต.ท่าสุด อ.เมือง อ.พาน จ.เชียงราย อ.วังเหนือ จ.ลำปาง	4.2
14 มีนาคม 2562	อ.วังเหนือ จ.ลำปาง	รู้สึกสั่นไหว บ้านสัน ต.วิชัย อ.วังเหนือ จ.ลำปาง ต.บ้านใหม่ อ.เมือง จ.พะเยา อ.พร้าว ต.สะวง อ.แม่ริม อ.สันทราย, จ.เชียงใหม่	4.0
14 มีนาคม 2562	อ.วังเหนือ จ.ลำปาง	รู้สึกสั่นไหว บ้านสัน อ.เวียงป่าเป้า จ.เชียงราย	2.4
15 มีนาคม 2562	อ.พาน จ.เชียงราย	รู้สึกสั่นไหว บ้านสัน ต.จอมหมอกแก้ว อ.แม่ลาว บ้านห้วยผาย ต.สันกลาง อ.พาน จ.เชียงราย	3.0
18 เมษายน 2562	อ.วังเหนือ จ.ลำปาง	รู้สึกสั่นไหว บ้านสัน อ.วังเหนือ จ.ลำปาง	2.9
23 เมษายน 2562	อ.ฝาง จ.เชียงใหม่	รู้สึกสั่นไหว บ้านสัน ต.แม่สุบ อ.ฝาง จ.เชียงใหม่	2.8
27 พฤษภาคม 2562	อ.วังเหนือ จ.ลำปาง	รู้สึกสั่นไหว บ้านสัน อ.วังเหนือ จ.ลำปาง	3.0
16 ตุลาคม 2562	อ.เมืองเลย จ.เลย	รู้สึกสั่นไหว บ้านสัน บ้านท่าปung ต.เมือง ต.ภูค้ำป้อง อ.เมือง จ.เลย	3.9
17 ตุลาคม 2562	อ.เมืองเลย จ.เลย	รู้สึกสั่นไหว บ้านสัน ต.ศรีสองรัก อ.เมืองเลย จ.เลย	2.6
18 ตุลาคม 2562	อ.ดอยสะเก็ด จ.เชียงใหม่	รู้สึกสั่นไหว บ้านสัน ต.ป่าตึง ต.สันผีเสื้อ ต.ศรีภูมิ ต.ฟ้าฮ่าม อ.เมือง ต.ออบน้ำดี อ.สันกำแพง ต.ป่าตึง ต.สันป่าเลียด อ.ดอยสะเก็ด อ.หางดง, ต.หนองหาร อ.สันทราย อ.พร้าว ต.ท่าวังตาล อ.สารภี จ.เชียงใหม่ อ.เวียงป่าเป้า จ.เชียงราย	4.1
27 ตุลาคม 2562	อ.ดอยสะเก็ด จ.เชียงใหม่	รู้สึกสั่นไหว บ้านสัน อ.เมือง, อ.สันทราย จ.เชียงใหม่	3.1
พ.ศ.2563			
26 มกราคม 2563	อ.ตะกั่วป่า จ.พังงา	รู้สึกสั่นไหว บ้านสัน ต.โคกเคียน อ.ตะกั่วป่า จ.พังงา	2.2
6 กุมภาพันธ์ 2563	อ.บางสะพาน จ.ประจวบคีรีขันธ์	รู้สึกสั่นไหว บ้านสัน ต.ธงชัย อ.บางสะพาน อ.ทับสะแก จ.ประจวบคีรีขันธ์	2.8
25 เมษายน 2563	อ.แม่ลาว จ.เชียงราย	รู้สึกสั่นไหว บ้านสัน ต.จอมหมอกแก้ว อ.แม่ลาว จ.เชียงราย	2.3

ตารางที่ 1

สถิติเหตุการณ์แผ่นดินไหวที่มีศูนย์กลางการเกิดในประเทศไทย พ.ศ.2561-2566 (ต่อ)

วัน/เดือน/ปี	ศูนย์กลางการเกิดแผ่นดินไหว	บันทึกเหตุการณ์	ขนาดที่จุดศูนย์กลาง
3 พฤษภาคม 2563	อ.เมือง จ.เชียงราย	รู้สึกสั่นไหว บ้านสั่น บ้านดงมะเฟือง ต.จอมหมอกแก้ว อ.แม่ลาว จ.เชียงราย	2.2
18 พฤษภาคม 2563	อ.แม่ลาว จ.เชียงราย	รู้สึกสั่นไหว บ้านปลวกอ้อ อ.แม่ลาว จ.เชียงราย	1.8
9 มิถุนายน 2563	อ.สันทราย จ.เชียงใหม่	รู้สึกสั่นไหว บ้านสั่น บ้านศรีงาม ต.แม่แฝก อ.สันทราย จ.เชียงใหม่	2.9
25 มิถุนายน 2563	อ.เมือง จ.เลย	รู้สึกสั่นไหว บ้านสั่น บ้านก้อ อ.ทรายขาว อ.วังสะพุง ต.นาอ้อ ต.บ้านนา ต.นาแก ต.ศรีสองรัก บ้านขอนแก่น ต.นาฮาน อ.เมือง ต.บ้านนาสี ต.บ้านนาสี อ.เขาค้อ จ.เลย	3.8
20 กรกฎาคม 2563	อ.เมือง จ.เลย	รู้สึกสั่นไหว บ้านสั่น ต.ศรีสองรัก อ.เมือง จ.เลย	2.8
26 กันยายน 2563	อ.เมือง จ.เชียงราย	รู้สึกสั่นไหว พลับจ๋า บ้านสั่น บ้านหนองหม่ม อ.เวียงชัย บ้านโป่ง อ.ห้วยสัก อ.เมือง วิทยุวิทยุการอาชีพเชียงราย	2.5
30 ธันวาคม 2563	อ.เมืองเลย จ.เลย	รู้สึกสั่นไหว เสียงระฆังของพันบ้าน บ้านม่วง ต.ศรีสองรัก อ.เมือง จ.เลย	2.1
<b>พ.ศ.2564</b>			
22 มีนาคม 2564	อ.แม่สะเรียง จ.แม่ฮ่องสอน	รู้สึกสั่นไหว สะงเขื่อนข้าพพะ เหมือนบรรทุก หน้าแล่นสวน บ้านโป่ง ม.12 ตำบลบ้านกาศ	2.1
24 พฤษภาคม 2564	อ.แม่สรวย จ.เชียงราย	อ.แม่สรวย จ.เชียงราย บ้านชั้นเดียว : รู้สึกสั่นไหว ตึกโครงสร้างใหญ่ระงเขื่อนเสียงดัง อ.แม่สรวย จ.เชียงราย, บ้านด้อยมากกว่า 1 ชั้น บ้านโยก ฝ้าสั่น อ.แม่สรวย จ.เชียงราย	3.0
18 มิถุนายน 2564	อ.วังเหนือ จ.ลำปาง	บ้านเดี่ยว มากกว่า 1 ชั้น ชั้น 2 : เสียงถูกเขย่าแรง จนสามารถหลุดตุ้ตึง เสียงสั่นดังมาก สามแยก แม่จะจาน ต.แม่เจดีย์ อ.เวียงป่าเป้า จ.เชียงราย, บ้านเดี่ยว 1 ชั้น : บ้านใต้ตื้นสูง พื้นบ้านสั่นไหว เล็กน้อย บ้านใหม่ ม.6 วังเหนือ จ.ลำปาง	3.5
30 มิถุนายน 2564	อ.พาน จ.เชียงราย	บ้านเดี่ยว 1 ชั้น: เสียงดังมากเหมือนเสียงฟ้าร้อง วัตถุสั่นไหวระงเขื่อนรู้สึกได้ เช่น หลังคาบ้าน ผู้คนตกใจ บ้านป่ารวกได้ ต.ธาตของ อ.พาน บ้านป่าสัก ตำบลดงมะเดื่อ อำเภอแม่ลาว, บ้านสันทราย อ.พาน จ.เชียงราย, บ้านเดี่ยว มากกว่า 1 ชั้น ชั้น 2 : รู้สึกถึงแรงสั่นไหวได้อย่างชัดเจน ตรงข้ามศูนย์ศิลปชีพสตรีเชียงราย ต.ทรายขาว อ.พาน จ.เชียงราย, หอพัก/อพาร์ทเมนท์/แฟลต/แมนชั่น ชั้น 2 : สั่นแรง 1 ครั้ง เมื่อพานทรายขาว ต.ทรายขาว อ.พาน จ.เชียงราย	2.8

ตารางที่ 1

สถิติเหตุการณ์แผ่นดินไหวที่มีศูนย์กลางการเกิดในประเทศไทย พ.ศ.2561-2566 (ต่อ)

วัน/เดือน/ปี	ศูนย์กลางการเกิดแผ่นดินไหว	บันทึกเหตุการณ์	ขนาดที่จุดศูนย์กลาง
12 กรกฎาคม 2564	อ.พาน จ.เชียงราย	หอพัก/อพาร์ทเมนท์ ชั้น 2 : รู้สึกสั่นไหว อ.พาน ต.ทรายขาว จ.เชียงราย	2.3
21 กรกฎาคม 2564	ต.เขาใจดี อ.ศรีสวัสดิ์ จ.กาญจนบุรี	บ้านเดี่ยว 1 ชั้น : เตียงสั่นไหว ที่ทำกาอุทานแม่ชช ต.พืชมงคล อ.ด่านช้าง จ.สุพรรณบุรี/เตียงและหลังคาสั่นไหวรู้สึกได้ ต.สมเด็จพระเจ้าตากสิน อ.เมือง จ.กาญจนบุรี, บ้านเดี่ยว มากกว่า 1 ชั้น ชั้น 2 : บ้านสั่นไหว อ.ด่านช้าง จ.สุพรรณบุรี	3.7
18 ตุลาคม 2564	ต.บ้านบ่อม อ.แม่ทะ จ.ลำปาง	รู้สึกบ้านสั่น อ.แม่ทะ จ.ลำปาง	2.5
18 ตุลาคม 2564	ต.ดงมะเดื่อ อ.แม่ลาว จ.เชียงราย	ใจหวดกระเพื่อม หมู่บ้านแม่เงิน ต.แม่คำ อ.แม่จัน จ.เชียงราย, ลิงของสั่นไหว อ.พาน จ.เชียงราย, ลิงของสั่นไหว อ.เมือง จ.เชียงราย / บ้านเดี่ยว มากกว่า 1 ชั้น ชั้น 1 : รู้สึกสั่นไหว อ.แม่ลาว จ.เชียงราย / บ้านเดี่ยว มากกว่า 1 ชั้น ชั้น 2 : รู้สึกสั่นไหว อ.แม่ลาว จ.เชียงราย, รู้สึกสั่นไหว ต.แม่กรณ์ อ.เมือง จ.เชียงราย, รู้สึกสั่นไหว ต.ดงมะเดื่อ อ.แม่ลาว จ.เชียงราย / ตึกแถวหรือทาวนเฮาส์ ชั้น 2 : เก้าอี้สั่น สั่นทราย จ.เชียงราย / อาคารสำนักงานไม่เกิน 5 ชั้น ชั้น 2 : ลิงของสั่นไหว ดงมะเดื่อ อ.แม่ลาว จ.เชียงราย / อาคารสำนักงานไม่เกิน 5 ชั้น ชั้น 3 : ลิงของสั่นไหว อ.เมือง จ.เชียงราย	3.5
7 ธันวาคม 2564	ต.แม่ดี อ.ป่าเย็บ อ.แม่ฮ่องสอน	บ้านเดี่ยว 1 ชั้น: ได้ยินเสียงแต่ไม่ทราบที่มา อ.ป่าเย็บ อ.แม่ฮ่องสอน	2.0
7 ธันวาคม 2564	ต.แม่ดี อ.ป่าเย็บ อ.แม่ฮ่องสอน	บ้านเดี่ยว 1 ชั้น: กระชกบ้านสั่น ได้ยินเสียงแต่ไม่ทราบที่มา อ.ป่าเย็บ อ.แม่ฮ่องสอน	2.4
<b>พ.ศ.2565</b>			
4 เมษายน 2565	ต.ไหล่อม อ.สันเขล จ.อุตรดิตถ์	บ้านเดี่ยว มากกว่า 1 ชั้น ชั้น 2: บ้านสั่นสะท้อนแรง ที่ ต.ทุ่งขี้เหล็ก จ.อุตรดิตถ์	3.3
5 เมษายน 2565	ต.ไหล่อม อ.สันเขล จ.อุตรดิตถ์	บ้านเดี่ยว 1 ชั้น: บ้านสั่นรู้สึกได้ถึงแรงสั่นไหว ที่ต.ไหล่อม อ.สันเขล และ อ.เมือง จ.อุตรดิตถ์, รู้สึกสั่นไหวที่ต.นครเขื่อนขันธ์ จ.สุโขทัย/บ้านเดี่ยว มากกว่า 1 ชั้น: เตียงสั่นและรู้สึกสั่นไหว ที่ต.ท่าอิฐ อ.เมือง จ.อุตรดิตถ์/ บ้านเดี่ยว มากกว่า 1 ชั้น ชั้น 2: บ้านสั่น ซัดไหล่อม อ.สันเขล จ.อุตรดิตถ์,บ้านและสิ่งของสั่นไหว มีภาพเตอร์ช็อคตามแม่ที่ ต.ทุ่งขี้เหล็ก อ.สันเขล และต.ข่อยสูง อ.ตรอน จ.อุตรดิตถ์/ หอยทากชั้น 2: เตียงและบ้านสั่นแรง ที่ต.ป่าเถา อ.เมือง จ.อุตรดิตถ์	3.6

ตารางที่ 1

สถิติเหตุการณ์แผ่นดินไหวที่มีศูนย์กลางการเกิดในประเทศไทย พ.ศ.2561-2566 (ต่อ)

วัน/เดือน/ปี	ศูนย์กลางการเกิดแผ่นดินไหว	บันทึกเหตุการณ์	ขนาดที่จุดศูนย์กลาง
14 เมษายน 2565	ต.แม่ศึก อ.แม่แจ่ม จ.เชียงใหม่	บันทึก: ฐิติสัมพันธ์ 2 ครั้ง เสียงคล้ายรถบรรทุกหนักแล่นผ่าน บ้านสี่เหลี่ยมที่ ต.ปากทาง อ.สอง และ ต.ทรายอ้อย อ.เด่นชัย จ.แพร่ (2) บ้านเดี่ยว 1 ชั้น: บ้านสี่เหลี่ยม 2 ครั้ง: ต.แม่ป่า, ต.บ่อเหล็กทอง, ต.ห้วยอ้อย และ ต.บ้านป็น อ.สอง จ.แพร่ (3) บ้านเดี่ยว มากกว่า 1 ชั้น: 1: ฐิติสัมพันธ์และเสียงดังคล้ายระเบิดที่ ต.ห้วยอ้อย อ.สอง จ.แพร่ (4) บ้านเดี่ยว มากกว่า 1 ชั้น: 2: บ้านและสิ่งของล้มที่ ต.เด่นชัย อ.เด่นชัย, ต.ร่องพ่อง อ.แม่ใจ, ต.สลาย อ.สูงเม่น จ.แพร่ และ ต.น้ำพัน อ.ท่าปลา จ.อุตรดิตถ์ (5) ตึกแถว/พาณิชย์/ทาวน์เฮาส์ ชั้น 2: ฝ้ายสันต.ในวัง อ.เมือง จ.แพร่ (6) อาคารสำนักงานบางไม่เกิน 5 ชั้น: 3: ฐิติสัมพันธ์ไหวที่ ต.วัง อ.วังชิ้น จ.แพร่	3.2
28 เมษายน 2565	ต.นายง อ.สปะปรัง จ.ลำปาง	บันทึก: ฐิติสัมพันธ์ไหวที่ ต.นายง อ.สปะปรัง จ.ลำปาง	3.2
26 พฤษภาคม 2565	ต.จอมหมอกแก้ว อ.แม่ลาว จ.เชียงราย	ทวารนิมโอม/ทวารโมโอม ชั้น 1: ฐิติสัมพันธ์ไหวที่รอบเวียง อ.เมือง จ.เชียงราย/ บ้านเดี่ยว มากกว่า 1 ชั้น: 1: บ้านและสิ่งของล้มไหวที่ต.แม่สรวย อ.แม่สรวย จ.เชียงราย/ บ้านเดี่ยว มากกว่า 1 ชั้น: 2: ฐิติสัมพันธ์ไหวที่อ.แม่ลาว จ.เชียงราย/ อาคารสำนักงานไม่เกิน 5 ชั้น: 1: เก้าอี้ล้มไหวที่สำนักงานเทศบาลตำบลทราย อ.เมือง จ.เชียงราย	2.9
29 พฤษภาคม 2565	ต.เมืองพาน อ.พาน จ.เชียงราย	บ้านเดี่ยว 1 ชั้น: บ้านสี่เหลี่ยมและฐิติสัมพันธ์ไหวที่ ต.ป่าตุง ต.เมืองพานและอ.พาน จ.เชียงราย/ บ้านเดี่ยว มากกว่า 1 ชั้น: 2: เพดานล้มและฐิติสัมพันธ์ไหวที่ต.แม่จันและต.สันกลาง อ.พาน จ.เชียงราย	2.6
14 กันยายน 2565	ต.แม่ข้า อ.ฝาง จ.เชียงใหม่	(1) บ้านเดี่ยว 1 ชั้น: พื้นและบ้านล้มที่ อ.ฝาง จ.เชียงใหม่ และหลังคาชั้นที่ 2 อ.ไชยปราการ จ.เชียงใหม่ (2) บ้านเดี่ยว มากกว่า 1 ชั้น: 1: บ้านสี่เหลี่ยมที่ต.แม่ฮอน อ.ฝาง จ.เชียงใหม่ (3) บ้านเดี่ยว มากกว่า 1 ชั้น: 2: ฐิติสัมพันธ์ไหวที่ต.แม่ฮอน อ.ฝาง จ.เชียงใหม่ (4) บ้านเดี่ยว มากกว่า 1 ชั้น: 3: เตียงล้มที่ ต.แม่ฮอน อ.ฝาง จ.เชียงใหม่ (5) หอพัก/อพาร์ทเมนท์/เฟลต/แมนชั่น ชั้น 1: อาคารชั้นที่ ต.ศรีดงเย็น อ.ไชยปราการ จ.เชียงใหม่ (6) หอพัก/อพาร์ทเมนท์/เฟลต/แมนชั่น ชั้น 2: ฐิติสัมพันธ์ไหวที่ ต.ป่าตูด อ.เมือง จ.เชียงใหม่ (7) หอพัก/อพาร์ทเมนท์/เฟลต/แมนชั่น ชั้น 3: ตึกล้มที่ อ.ไชยปราการ จ.เชียงใหม่	3.6
18 กันยายน 2565	ต.บ้านน้ำแพร่ อ.หางดง จ.เชียงใหม่	(1) บ้านเดี่ยว มากกว่า 1 ชั้น: 2: บ้านสี่เหลี่ยมสองคาช อ.หางดง จ.เชียงใหม่ (2) หอพัก/อพาร์ทเมนท์/เฟลต/แมนชั่น ชั้น 3: อาคารล้มไหวที่ อ.ไชยปราการ จ.เชียงใหม่	2.3
24 กันยายน 2565	ต.อนเหนือของหมู่เกาะสุมาตรา ประเทศอินโดนีเซีย	(1) อาคารสำนักงานบางไม่เกิน 10 ชั้น: 4: เตียงล้มที่ตึกแถว/ทวารนิมโอม/ทวารโมโอม ชั้น 3: ฐิติสัมพันธ์ไหวที่ อ.สะเตา จ.สงขลา (3) หอพัก/อพาร์ทเมนท์/เฟลต/แมนชั่น ชั้น 6: ประตู ตู้และเตียง น้ำมันขวด กระเบื้องที่ จ.พังงา (4) หอพัก/อพาร์ทเมนท์/เฟลต/แมนชั่น ชั้น 7: เตียงล้มที่อ.หาดใหญ่ จ.สงขลา	6.2

ตารางที่ 1

สถิติเหตุการณ์แผ่นดินไหวที่มีศูนย์กลางการเกิดในประเทศไทย พ.ศ.2561-2566 (ต่อ)

วัน/เดือน/ปี	ศูนย์กลางการเกิดแผ่นดินไหว	บันทึกเหตุการณ์	ขนาดที่จุดศูนย์กลาง
20 ตุลาคม 2565	ต.แม่ป่า อ.สอง จ.แพร่	(1) บันทึก: ฐิติสัมพันธ์ไหวที่ ต.แม่ป่า, ต.บ่อเหล็กทอง, ต.ห้วยอ้อย และ ต.บ้านป็น อ.สอง จ.แพร่ (3) บ้านเดี่ยว มากกว่า 1 ชั้น: 1: ฐิติสัมพันธ์และเสียงดังคล้ายระเบิดที่ ต.ห้วยอ้อย อ.สอง จ.แพร่ (4) บ้านเดี่ยว มากกว่า 1 ชั้น: 2: บ้านและสิ่งของล้มที่ ต.เด่นชัย อ.เด่นชัย, ต.ร่องพ่อง อ.แม่ใจ, ต.สลาย อ.สูงเม่น จ.แพร่ และ ต.น้ำพัน อ.ท่าปลา จ.อุตรดิตถ์ (5) ตึกแถว/พาณิชย์/ทาวน์เฮาส์ ชั้น 2: ฝ้ายสันต.ในวัง อ.เมือง จ.แพร่ (6) อาคารสำนักงานบางไม่เกิน 5 ชั้น: 3: ฐิติสัมพันธ์ไหวที่ ต.วัง อ.วังชิ้น จ.แพร่	3.7
20 ตุลาคม 2565	ต.แม่คือ อ.ดอยสะเก็ด จ.เชียงใหม่	(1) บันทึก: ผนังตึกบ้านล้มที่ อ.สันทราย อ.แม่ริม จ.เชียงใหม่ (2) บ้านเดี่ยว 1 ชั้น: ฐิติสัมพันธ์ไหว ลิงของล้มไหวที่ อ.สันทราย อ.สารภี ลำพูน จ.ลำพูน, บ้านสี่เหลี่ยมที่ อ.หางดง อ.แม่แตง อ.สันกำแพง อ.ดอยสะเก็ด อ.แม่ออน อ.หางดง จ.เชียงใหม่และ อ.สอง จ.แพร่, ฐิติสัมพันธ์ ไหว น้ำกระเพื่อม บ้านล้มที่ อ.ดอยสะเก็ด จ.เชียงใหม่ (3) บ้านเดี่ยว มากกว่า 1 ชั้น: 2: ฐิติสัมพันธ์ไหว ลิงของล้มไหวที่ อ.สันทราย อ.ดอยสะเก็ด อ.เมืองเชียงใหม่ อ.หางดง อ.แม่ออน อ.สันกำแพง อ.สารภี อ.แม่ริม อ.สันป่าตอง จ.เชียงใหม่ อ.เมืองลำพูน อ.บ้านธิ จ.ลำพูน อ.ศรีเชียงใหม่ จ.สุโขทัยและ อ.ดอยคำได้	4.1
		จ.พะเยา (4) บ้านเดี่ยว มากกว่า 1 ชั้น: 3: ฐิติสัมพันธ์ไหว ลิงของล้มไหวที่ อ.เมือง จ.เชียงใหม่ (5) ตึกแถว/ทวารนิมโอม/ทวารโมโอม ชั้น 1: ฐิติสัมพันธ์ไหว และสิ่งของล้มไหวที่ อ.เมือง เชียงใหม่ อ.สารภี จ.เชียงใหม่ (6) ตึกแถว/ทวารนิมโอม/ทวารโมโอม ชั้น 2: ลิงของล้มไหวที่ อ.ดอยสะเก็ด อ.สันทราย อ.เมืองเชียงใหม่ จ.เชียงใหม่ (7) ตึกแถว/ทวารนิมโอม/ทวารโมโอม ชั้น 3: ฐิติสัมพันธ์ไหวที่ อ.สันทราย อ.เมืองเชียงใหม่ จ.เชียงใหม่ (8) ตึกแถว/ทวารนิมโอม/ทวารโมโอม ชั้น 4: ฐิติสัมพันธ์ไหวที่ อ.เมืองเชียงใหม่ จ.เชียงใหม่ (9) ตึกแถว/ทวารนิมโอม/ทวารโมโอม ชั้น 5: ฐิติสัมพันธ์ไหว และสิ่งของล้ม	

ตารางที่ 1

สถิติเหตุการณ์แผ่นดินไหวที่มีศูนย์กลางการเกิดในประเทศไทย พ.ศ.2561-2566 (ต่อ)

วัน/เดือน/ปี	ศูนย์กลางการเกิดแผ่นดินไหว	บันทึกเหตุการณ์	ขนาดที่จุดศูนย์กลาง
20 ตุลาคม 2565	ด.บ้านปิน อ.สอง จ.แพร่	ไหวที่ อ.เมืองเชียงใหม่ จ.เชียงใหม่/ (10) หอพัก/อาหารแม่บท/เฟลต/แม่ชู้บ ชั้น 1: ฐีสักสันไหวที่ อ.เมืองเชียงใหม่ อ.สารภี อ.สันกำแพง จ.เชียงใหม่/ (11) หอพัก/อาหารแม่บท/เฟลต/แม่ชู้บ ชั้น 2: ฐีสักสันไหว และสิ่งของสันไหวที่อ.เมืองเชียงใหม่ อ.สันทราย จ.เชียงใหม่/ (12) หอพัก/อาหารแม่บท/เฟลต/แม่ชู้บ ชั้น 3: ฐีสักสันไหว และสิ่งของสันไหวที่ อ.ดอยสะเก็ด อ.สันทราย อ.เมืองเชียงใหม่ อ.หางดง จ.เชียงใหม่/ (13) หอพัก/อาหารแม่บท/เฟลต/แม่ชู้บ ชั้น 4: ฐีสักสันไหว และสิ่งของสันไหวที่ อ.เมืองเชียงใหม่ อ.หางดง อ.สันทราย จ.เชียงใหม่/ (14) หอพัก/อาหารแม่บท/เฟลต/แม่ชู้บ ชั้น 5: ฐีสักสันไหว และสิ่งของสันไหวที่ อ.เมืองเชียงใหม่ จ.เชียงใหม่/ (15) หอพัก/อาหารแม่บท/เฟลต/แม่ชู้บ ชั้น 6: ฐีสักสันไหวที่ อ.เมืองเชียงใหม่ จ.เชียงใหม่/ (16) คอนโดเมียม ชั้น 2: ฐีสักสันไหวที่ อ.เมืองเชียงใหม่ จ.เชียงใหม่/ (17) คอนโดเมียม ชั้น 3: ฐีสักสันไหวที่ สิ่งของสันไหว อ.เมืองเชียงใหม่ จ.เชียงใหม่/ (18) คอนโดเมียม ชั้น 4: ฐีสักสันไหวที่ อ.เมืองเชียงใหม่ จ.เชียงใหม่/ (19) คอนโดเมียม ชั้น 6: ฐีสักสันไหวที่ อ.เมืองเชียงใหม่ จ.เชียงใหม่/ (20) คอนโดเมียม ชั้น 8: ฐีสักสันไหว และสิ่งของสันไหวที่ อ.เมืองเชียงใหม่ จ.เชียงใหม่/ (21) อาคารสำนักงานมากกว่า 10 ชั้น ชั้น 1: ฐีสักสันไหว และสิ่งของสันไหวที่ อ.เมืองเชียงใหม่ จ.เชียงใหม่/ (22) อาคารสำนักงานมากกว่า 10 ชั้น ชั้น 10: ฐีสักสันไหว และสิ่งของสันไหวที่ อ.เมืองเชียงใหม่ จ.เชียงใหม่	2.9
21 ตุลาคม 2565	ด.ห้วยอ้อ อ.สอง จ.แพร่	(1)บ้านเดี่ยว 1 ชั้น ฐีสักสันไหวที่ด.ห้วยอ้อ อ.สอง จ.แพร่/ (2)บ้านเดี่ยว มากกว่า 1 ชั้น ชั้น 1: ฐีสักสันไหว เตียงสันไหวที่ด.ห้วยอ้อ อ.สอง จ.แพร่	3.4
27 ตุลาคม 2565	ด.แม่บ้าน อ.สอง จ.แพร่	บ้านเดี่ยว 1 ชั้น ฐีสักสันไหวที่บรรทุกรักบี้บ้านที่ ด.แม่บ้าน อ.สอง จ.แพร่	2.0
15 พฤศจิกายน 2565	ด.แม่ต๋องนอก อ.แม่พริกทอง จ.เชียงราย	บ้านเดี่ยว มากกว่า 1 ชั้น ชั้น 2: บ้านสันที่ ด.แม่คำ อ.แม่จัน จ.เชียงราย	3.2
21 พฤศจิกายน 2565	ด.ห้วยสา อ.เมืองแม่ฮ่องสอน จ.แม่ฮ่องสอน	บ้านเดี่ยว มากกว่า 1 ชั้น ชั้น 2: ฐีสักสันไหวที่ ด.จองคำ อ.เมืองแม่ฮ่องสอน จ.แม่ฮ่องสอน	3.8

ตารางที่ 1

สถิติเหตุการณ์แผ่นดินไหวที่มีศูนย์กลางการเกิดในประเทศไทย พ.ศ.2561-2566 (ต่อ)

วัน/เดือน/ปี	ศูนย์กลางการเกิดแผ่นดินไหว	บันทึกเหตุการณ์	ขนาดที่จุดศูนย์กลาง
31 ธันวาคม 2565	ด.สারণูราษฎร์ อ.ดอยสะเก็ด จ.เชียงใหม่	บ้านเดี่ยว 1 ชั้น ฐีสักสันไหวที่ด.บ้านป้อง อ.ดอยสะเก็ด จ.เชียงใหม่	1.8
พ.ศ.2566			
4 กุมภาพันธ์ 2566	ด.ท่านก อ.กะปง จ.พังงา	(1) น้ร้อน/ซุ้ม/กระท่อม: น้ำกระเพื่อมที่เฉพาะ อ.กะปง จ.พังงา/ (2) บ้านเดี่ยว 1 ชั้น: ได้ยินเสียงดังเหมือนระเบิด บ้านสันที่ด.พุด อ.กะปง จ.พังงา/ (3) บ้านเดี่ยว มากกว่า 1 ชั้น ชั้น 2: เตียงและบ้านสันที่ ด.พินา อ.กะปง จ.พังงา	2.3
13 กุมภาพันธ์ 2566	ด.ท่านก อ.กะปง จ.พังงา	(1) บนที่: ฐีสักสันไหวแรงที่ ด.คึกคัก อ.ตะกั่วป่า และด.กะปง อ.กะปง จ.พังงา/ (2) บ้านเดี่ยว 1 ชั้น: บ้านสันที่ ด.พุดคาโงก อ.เมืองพังงา จ.พังงา/ (3) บ้านเดี่ยว มากกว่า 1 ชั้น ชั้น 1: ได้ยินเสียงดังและบ้านสันที่ ด.พินา อ.กะปง จ.พังงา/ บ้านเดี่ยว มากกว่า 1 ชั้น ชั้น 2: บ้านและกระท่อมเดี่ยว มากกว่า 1 ชั้น ชั้น 2: บ้านและกระท่อมเดี่ยว บ้านสันที่ ด.พุดและ ด.ตะกั่วป่า อ.กะปง จ.พังงา/ (4) ดึกแถว/ทาวริโอ/ทาวริโอส์ ชั้น 2: ฐีสักสันไหวที่ ด.คึกคัก อ.ตะกั่วป่า จ.นครศรีธรรมราช/ (5) อาคารสำนักงานไม่เกิน 10 ชั้น ชั้น 2: ฐีสักสันไหวที่ด.บางม่วง อ.ตะกั่วป่า จ.พังงา/ (6) อาคารสำนักงานไม่เกิน 5 ชั้น ชั้น 1: ฐีสักสันไหวและมีเสียงดังที่ ด.ท่านกและ ด.มณีชัย อ.กะปง จ.พังงา/ (7) อาคารสำนักงานไม่เกิน 5 ชั้น ชั้น 2: อาคารสันที่ด.บางไพร อ.ตะกั่วป่า จ.พังงา/ (8) อาคารสำนักงานไม่เกิน 5 ชั้น ชั้น 3: ได้ยินเสียงดังและบ้านสันที่ ด.คึกคัก อ.ตะกั่วป่า จ.พังงา	3.7

ที่มา: กองเฝ้าระวังแผ่นดินไหว กรมอุตุนิยมวิทยา, 2566



# **Appendix 3B**

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**Documents for registration  
of analytical laboratories**

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**Environment Research & Technology Co., Ltd.**  
**(ERTC)**



ที่ อภ ๐๓๑๐(๑)/๗ ๒๕

กรมโรงงานอุตสาหกรรม  
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท  
เขตราชเทวี กรุงเทพฯ ๑๐๔๐๐

**๒๕ กรกฎาคม ๒๕๖๕**

เรื่อง ต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน  
เรียน กรรมการผู้จัดการ บริษัท เอ็มไวรอนเมนท์ รีเสิร์ช แอนด์ เทคโนโลยี จำกัด  
อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารเคมีของห้องปฏิบัติการวิเคราะห์เอกชน  
ลงวันที่ ๓๐ มีนาคม ๒๕๖๔

- สิ่งที่ส่งมาด้วย ๑. รายชื่อผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๑ แผ่น
  - ๒. รายชื่อเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๒ แผ่น
  - ๓. ขอบข่ายสารเคมีที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๑๒ แผ่น
- ตามหนังสือที่อ้างถึง บริษัท เอ็มไวรอนเมนท์ รีเสิร์ช แอนด์ เทคโนโลยี จำกัด ขอต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ๖-๐๕๙๙-๖-๒๕๖๔-๒๕/๑๑๔ หน้าที่ ๖ ขอยืนยันเขต ๑ ถนนงามวงศ์วาน แขวงทุ่งสองห้อง เขตหลักสี่ กรุงเทพมหานคร ต่อมกรมโรงงานอุตสาหกรรม นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว ให้บริษัท เอ็มไวรอนเมนท์ รีเสิร์ช แอนด์ เทคโนโลยี จำกัด ต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน โดยมีองค์ประกอบดังนี้

- ก. ผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๑๖ ราย ตามสิ่งที่ส่งมาด้วย ๑
- ข. เจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๔๙ ราย ตามสิ่งที่ส่งมาด้วย ๒
- ค. ขอบข่ายสารเคมีที่ได้รับขึ้นทะเบียนไว้วิเคราะห์ในน้ำเสีย จำนวน ๒๗ รายการ นำได้ดิน จำนวน ๕๘ รายการ อากาศเสีย จำนวน ๒๖ รายการ สิ่งปฏิกูลหรือวัสดุที่ไม่ใช้แล้ว จำนวน ๒๐ รายการ และดิน จำนวน ๕๖ รายการ รวมทั้งสิ้นจำนวน ๑๘๗ รายการ ตามสิ่งที่ส่งมาด้วย ๓

หนังสือฉบับนี้จะหมดอายุในวันที่ ๑๘ พฤษภาคม ๒๕๖๗ หากประสงค์จะต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน ให้ยื่นคำขอต่ออายุพร้อมเอกสารประกอบคำขอต่อกรมโรงงานอุตสาหกรรมภายใน ๓๐ วัน ก่อนวันสิ้นสุดอายุของหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน ซึ่งคำขอต่ออายุดังกล่าวขอรับได้ที่กรมโรงงานอุตสาหกรรม

จึงเรียนมาเพื่อทราบ

*[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]*

กองวิจัยและเตือนภัยพิษโรงงาน  
กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบเคมีพิษและทะเบียนห้องปฏิบัติการ  
โทร. ๐ ๒๒๐๒ ๔๐๐๒ ๐ ๒๒๐๒ ๔๑๕๖  
โทรสาร ๐ ๒๓๕๔ ๓๔๑๕

เอกสารแนบท้ายหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน  
บริษัท เอ็มไวรอนเมนท์ รีเสิร์ช แอนด์ เทคโนโลยี จำกัด เลขทะเบียน ๖-๐๕๙๙  
ที่ อภ ๐๓๑๐(๑)/๗ ๒๕๕ ลงวันที่ ๒๕ กรกฎาคม ๒๕๖๕

ก. ผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๑๖ ราย

- ๑) นางสาวปวีณา พรหมชัย ทะเบียนเลขที่ ๖-๐๕๙๙-๖-๒๕๑๔
- ๒) นางณัฐรดา เลี้ยวรักษา ทะเบียนเลขที่ ๖-๐๕๙๙-๖-๓๐๐๒
- ๓) นายมงคล บุรภักดิ์ ทะเบียนเลขที่ ๖-๐๕๙๙-๖-๕๕๐๐
- ๔) นางสาวอนิศา บุญรุ่งเรือง ทะเบียนเลขที่ ๖-๐๕๙๙-๖-๗๐๒๓
- ๕) นางสาวมิตา แต่งไทย ทะเบียนเลขที่ ๖-๐๕๙๙-๖-๗๖๖๔
- ๖) นางสาวไรวินทร์ โพธิ์สิทธิ์ ทะเบียนเลขที่ ๖-๐๕๙๙-๖-๗๖๖๕
- ๗) นางสาวณัฐนิชา เสริมดวงค์ ทะเบียนเลขที่ ๖-๐๕๙๙-๖-๗๖๖๖
- ๘) นายบพสิทธิ์ ทวีพรประดิษฐ์ ทะเบียนเลขที่ ๖-๐๕๙๙-๖-๗๖๖๗
- ๙) นางสาวอติรัตน์ ปุ๊กคะ ทะเบียนเลขที่ ๖-๐๕๙๙-๖-๘๘๐๑
- ๑๐) นายอภิชาติ พูลพล ทะเบียนเลขที่ ๖-๐๕๙๙-๖-๘๘๐๒
- ๑๑) นายนิทัศน์ ศิริชาติ ทะเบียนเลขที่ ๖-๐๕๙๙-๖-๘๘๐๓
- ๑๒) นายสุพทธิชาญ สิงข์ทอง ทะเบียนเลขที่ ๖-๐๕๙๙-๖-๘๘๐๔
- ๑๓) นางสาววดี ณ ระนอง ทะเบียนเลขที่ ๖-๐๕๙๙-๖-๘๘๐๕
- ๑๔) นางสาววาสนา ชันเงิน ทะเบียนเลขที่ ๖-๐๕๙๙-๖-๘๘๐๖
- ๑๕) นางสาวสุภาวรรณ สุวรรณภา ทะเบียนเลขที่ ๖-๐๕๙๙-๖-๘๘๐๗
- ๑๖) นางสาวภาวรัศ หิมม่วงซ์ ทะเบียนเลขที่ ๖-๐๕๙๙-๖-๘๘๐๘

เอกสารแนบท้ายหนังสือรื้อถอนต่ออายุทะเบียนท้องถิ่นของปฏิบัติกรวิเคราะหฺ์เอกชน  
 บริษัท เอ็มไวรอนเมนท์ รีเสิร์ช แอนด์ เทคโนโลยี จำกัด เลขทะเบียน ๖-๐๕๕  
 ที่ อท ๐๓๑๐(๑)/ ลงวันที่

ข. เจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๔๔ ราย

- ๑) นางสาวปรวดี ปวีใส
- ๒) นางสาวจิตวรรณ ลิ้มสมบูรณ์
- ๓) นางสาวธัญพร คนแฉง
- ๔) นางสาวสุภาวรัตน์ เจริญรักษ์
- ๕) นางสาวลลิตา โพธิ์เจริญ
- ๖) นางสาวรัตนวรรณ ภูประเสริฐ
- ๗) นายภาณุพล โพธิ์แดง
- ๘) นายวันชนะ สีหามาตร
- ๙) นายไสพล ป้อยแก้ว
- ๑๐) นายอภิวัฒน์ ชำนาญเวช
- ๑๑) นางสาวอริยาภรณ์ อ่อนน้อม
- ๑๒) นายวัชรกร กองแสง
- ๑๓) นางสาวสุธาทิพย์ อัมมอย
- ๑๔) นายชยณัฐ บุญานตง
- ๑๕) นางสาวพิชิตา เขียวรัมย์
- ๑๖) นางสาวสายใจ ลาตบัวขาว
- ๑๗) นางสาวรัตนวรรณ วงศ์ประโคน
- ๑๘) นางสาวจตุรกรรม เป็นจันทร์
- ๑๙) นางสาวพูนพิท กสิ์สิน
- ๒๐) นางสาววิวรรณ สุธรรมย์
- ๒๑) นางสาวนัฐกรนถ นวนุ่ม
- ๒๒) นางสาวอรอนงค์ นวนุ่ม
- ๒๓) นางสาวสรวรรณ พุฒพันธ์มาก
- ๒๔) นางสาวปิยธิดา ประแดงโค
- ๒๕) นางสาวปิยธิดา ประแดงโค
- ๒๖) นางสาวปวีตรา นาเหล็ก
- ๒๗) นางสาวนิตา นิลผาย
- ๒๘) นางสาวพิชิตา จาสุชัย
- ๒๙) นางสาวกษพร ไกรสิงห์
- ๓๐) นางสาววิวรรณ บุญจันทร์
- ๓๑) นางสาวนงเยาวรรณ คำหงษา
- ๓๒) นางสาวพัชรา แก้วน้อย
- ๓๓) นางสาวณัฐชา สัมฤทธิ์ดี
- ๓๔) นางสาวอังคณา อุณา
- ๓๕) นางสาวบุศดี ภูภาษา

- ๓๖) นายอรอนชี ภาดิชะ ทะเบียนเลขที่ ๖-๐๕๕-๖-๘๘๓๕
- ๓๗) นายสุริยะ ชูทอง ทะเบียนเลขที่ ๖-๐๕๕-๖-๘๘๓๖
- ๓๘) นายศักรินทร์ มีภานันท์ ทะเบียนเลขที่ ๖-๐๕๕-๖-๘๘๓๗
- ๓๙) นายอภิเดช ยาสมติ ทะเบียนเลขที่ ๖-๐๕๕-๖-๘๘๓๘
- ๔๐) นายฉันทวิบูลย์ เหลาภูล ทะเบียนเลขที่ ๖-๐๕๕-๖-๘๘๔๐
- ๔๑) นายศิวาวุฒ ธรรมนิทา ทะเบียนเลขที่ ๖-๐๕๕-๖-๘๘๔๑
- ๔๒) นายณัฐพล สุทธิมล ทะเบียนเลขที่ ๖-๐๕๕-๖-๘๘๔๒
- ๔๓) นายอภิสิทธิ์ นุชบุงา ทะเบียนเลขที่ ๖-๐๕๕-๖-๘๘๔๔
- ๔๔) นายอนุวัฒน์ เรืองออน ทะเบียนเลขที่ ๖-๐๕๕-๖-๘๘๔๕
- ๔๕) นายฉัตรชัย ไวยะฟู ทะเบียนเลขที่ ๖-๐๕๕-๖-๘๘๔๗
- ๔๖) นายกลยุทธิ์ อินทร์คำ ทะเบียนเลขที่ ๖-๐๕๕-๖-๘๘๔๘
- ๔๗) นางสาวนันทา เมื่อนวล ทะเบียนเลขที่ ๖-๐๕๕-๖-๙๕๒๑
- ๔๘) นางสาวพิไลวรรณ แปงทา ทะเบียนเลขที่ ๖-๐๕๕-๖-๙๕๒๒
- ๔๙) นางสาวจตุรกรรม กระจ่างพันธุ์

๓๖) นายอรอนชี...

เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน  
บริษัท เอ็มไวรอนเม้นท์ รีเสิร์ช แอนด์ เทคโนโลยี จำกัด เลขทะเบียน ว-๐๙๙  
ที่ อภ ๐๓๑๐(๑)/ ลงวันที่

-๖-

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
22	Temperature	Laboratory and Field Methods <sup>(3)</sup>
23	Total Dissolved Solids	Dried at 180 °C <sup>(3)</sup>
24	Total Kjeldahl Nitrogen	1) Macro Kjeldahl Method <sup>(3)</sup> 2) Semi-Micro Kjeldahl Method <sup>(3)</sup>
25	Total Suspended Solids	Dried at 103-105 °C <sup>(3)</sup>
26	Trivalent Chromium	Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation <sup>(3)</sup>
27	Zinc	Digestion, Inductively Coupled Plasma Method <sup>(3)</sup>

ขอขยายสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๑๘๗ รายการ

น้ำเสีย จำนวน 27 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Arsenic	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>(3)</sup>
2	Barium	2) Digestion, Inductively Coupled Plasma Method <sup>(3)</sup>
3	Biochemical Oxygen Demand	Digestion, Inductively Coupled Plasma Method <sup>(3)</sup>
4	Cadmium	1) 5-Day BOD Test, Azide Modification Method <sup>(3)</sup> 2) 5-Day BOD Test, Membrane Electrode Method <sup>(3)</sup>
5	Chemical Oxygen Demand	Digestion, Inductively Coupled Plasma Method <sup>(3)</sup>
6	Chromium	Closed Reflux, Titrimetric Method <sup>(3)</sup>
7	Color	Digestion, Inductively Coupled Plasma Method <sup>(3)</sup> ADMI Weighted-Ordinate Spectrophotometric Method <sup>(3)</sup>
8	Copper	Digestion, Inductively Coupled Plasma Method <sup>(3)</sup>
9	Cyanide	Distillation, Colorimetric method <sup>(3)</sup>
10	Formaldehyde	Distillation, Colorimetric Method <sup>(2)</sup>
11	Free Chlorine	1) Iodometric Method <sup>(3)</sup> 2) DPD Colorimetric Method <sup>(3)</sup>
12	Hexavalent Chromium	Colorimetric Method <sup>(3)</sup>
13	Lead	1) Digestion, Electrothermal Atomic Absorption Spectrometric Method <sup>(3)</sup> 2) Digestion, Inductively Coupled Plasma Method <sup>(3)</sup>
14	Manganese	Digestion, Inductively Coupled Plasma Method <sup>(3)</sup>
15	Mercury	Digestion, Inductively Coupled Plasma Method <sup>(3)</sup> Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>(3)</sup>
16	Nickel	Digestion, Inductively Coupled Plasma Method <sup>(3)</sup>
17	Oil & Grease	Liquid-Liquid, Partition-Gravimetric Method <sup>(3)</sup>
18	pH	Electrometric Method <sup>(3)</sup>
19	Phenols	Distillation, Direct Photometric Method <sup>(3)</sup>
20	Selenium	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>(3)</sup> 2) Digestion, Inductively Coupled Plasma Method <sup>(3)</sup>
21	Sulfide	Iodometric method <sup>(3)</sup>

[This information has been removed as it falls within the  
exceptions to disclose specified in paragraph 17(2) of ADB's  
Access to Information Policy.]

22 Temperature...

น้ำใต้ดิน จำนวน 58 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Acetone	Purge and Trap Gas Chromatographic/ Mass Spectrometric Method <sup>(3)</sup>
2	Antimony	Digestion, Inductively Coupled Plasma Method <sup>(3)</sup>
3	Arsenic	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>(3)</sup> 2) Digestion, Inductively Coupled Plasma Method <sup>(3)</sup>
4	Barium	Digestion, Inductively Coupled Plasma Method <sup>(3)</sup>
5	Benzene	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>(3)</sup>
6	Beryllium	Digestion, Inductively Coupled Plasma Method <sup>(3)</sup>
7	Bromodichloromethane	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>(3)</sup>
8	Bromoform	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>(3)</sup>
9	Cadmium	Digestion, Inductively Coupled Plasma Method <sup>(3)</sup>
10	Carbon Disulfide	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>(3)</sup>
11	Carbon Tetrachloride	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>(3)</sup>
12	Chlorobenzene	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>(3)</sup>
13	Chlorodibromomethane	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>(3)</sup>

[This information has been removed as it falls within the  
exceptions to disclose specified in paragraph 17(2) of ADB's  
Access to Information Policy.]

14 Chloroform...



ลำดับที่	สารเคมี	วิธีวิเคราะห์
14	Chloroform	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>(3)</sup>
15	Chromium	Digestion, Inductively Coupled Plasma Method <sup>(3)</sup>
16	Chromium (III)	Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation <sup>(3)</sup>
17	Chromium (VI)	Colorimetric Method <sup>(3)</sup>
18	Cyanide	Colorimetric Method <sup>(3)</sup>
19	1,2-Dichlorobenzene	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>(3)</sup>
20	1,3-Dichlorobenzene	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>(3)</sup>
21	1,4-Dichlorobenzene	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>(3)</sup>
22	1,1-Dichloroethane	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>(3)</sup>
23	1,2-Dichloroethane	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>(3)</sup>
24	1,1-Dichloroethylene	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>(3)</sup>
25	cis-1,2-Dichloroethylene	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>(3)</sup>
26	trans-1,2-Dichloroethylene	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>(3)</sup>
27	1,2-Dichloropropane	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>(3)</sup>
28	1,3-Dichloropropane	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>(3)</sup>
29	1,3-Dichloropropene	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>(3)</sup>
30	Ethylbenzene	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>(3)</sup>
31	Hexachloro-1,3-butadiene	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>(3)</sup>

[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]

32 Lead...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
32	Lead	1) Digestion, Electrothermal Atomic Absorption Spectrometric Method <sup>(3)</sup> 2) Digestion, Inductively Coupled Plasma Method <sup>(3)</sup>
33	Manganese	Digestion, Inductively Coupled Plasma Method <sup>(3)</sup>
34	Mercury	Digestion, Inductively Coupled Plasma Method <sup>(3)</sup> Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>(3)</sup>
35	Methyl Bromide	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>(3)</sup>
36	Methylene Chloride	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>(3)</sup>
37	Methyl Tert-Butyl Ether	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>(3)</sup>
38	Naphthalene	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>(3)</sup>
39	Nickel	Digestion, Inductively Coupled Plasma Method <sup>(3)</sup>
40	pH	Electrometric method <sup>(3)</sup>
41	Selenium	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>(3)</sup> 2) Digestion, Inductively Coupled Plasma Method <sup>(3)</sup>
42	Silver	Digestion, Inductively Coupled Plasma Method <sup>(3)</sup>
43	Styrene	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>(3)</sup>
44	1,1,2,2-Tetrachloroethane	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>(3)</sup>
45	Tetrachloroethylene	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>(3)</sup>
46	Toluene	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>(3)</sup>
47	1,2,4-Trichlorobenzene	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>(3)</sup>
48	1,1,1-Trichloroethane	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>(3)</sup>
49	1,1,2-Trichloroethane	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>(3)</sup>

[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]

50 Trichloroethylene...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
50	Trichloroethylene	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>(3)</sup>
51	1,3,5-Trimethylbenzene	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>(3)</sup>
52	Vanadium	Digestion, Inductively Coupled Plasma Method <sup>(3)</sup>
53	Vinyl Chloride	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>(3)</sup>
54	m-Xylene	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>(3)</sup>
55	o-Xylene	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>(3)</sup>
56	p-Xylene	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>(3)</sup>
57	Xylene (Total)	Purge and Trap Gas Chromatographic/ Mass spectrometric Method <sup>(3)</sup>
58	Zinc	Digestion, Inductively Coupled Plasma Method <sup>(3)</sup>

ภาคผนวก (ต่อระบอบ) จำนวน 26 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Antimony	Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>(4)</sup>
2	Arsenic	1) Isokinetic Sampling, Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>(4)</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>(4)</sup>
3	Beryllium	Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>(4)</sup>
4	Cadmium	Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>(4)</sup>
5	Carbon Monoxide	Instrumental Analyzer Method <sup>(4)</sup>
6	Chlorine	1) Absorption Sampling, Ion Chromatographic Method <sup>(4)</sup> 2) Isokinetic Sampling, Ion Chromatographic Method <sup>(4)</sup>

[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
7	Chromium	Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>(4)</sup>
8	Cobalt	Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>(4)</sup>
9	Copper	Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>(4)</sup>
10	Dioxin/Furans	Isokinetic Sampling <sup>(4)</sup>
11	Hydrogen Chloride	1) Absorption Sampling, Ion Chromatographic Method <sup>(4)</sup> 2) Isokinetic Sampling, Ion Chromatographic Method <sup>(4)</sup>
12	Hydrogen Fluoride	1) Absorption Sampling, Ion Chromatographic Method <sup>(4)</sup> 2) Isokinetic Sampling, Ion Chromatographic Method <sup>(4)</sup>
13	Hydrogen Sulfide	Absorption Sampling, Iodometric Method <sup>(4)</sup>
14	Lead	1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method <sup>(4)</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>(4)</sup>
15	Manganese	Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>(4)</sup>
16	Mercury	Isokinetic Sampling, Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>(4)</sup>
17	Nickel	Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>(4)</sup>
18	Opacity	Ringelmann's Method <sup>(1)</sup>
19	Oxide of Nitrogen	1) Absorption Sampling, Phenoldisulfonic acid Method <sup>(4)</sup> 2) Instrumental Analyzer Method <sup>(4)</sup>
20	Selenium	1) Isokinetic Sampling, Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>(4)</sup> 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>(4)</sup>

[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
21	Sulfur Dioxide	1) Absorption Sampling, Barium-Thorin Titrimetric Method <sup>(4)</sup> 2) Isokinetic Sampling, Barium-Thorin Titrimetric Method <sup>(4)</sup> 3) Instrumental Analyzer Method <sup>(4)</sup>
22	Sulfuric Acid	Isokinetic Sampling, Barium-Thorin Titrimetric Method <sup>(4)</sup>
23	Tin	Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>(4)</sup>
24	Total Suspended Particulate	Isokinetic Sampling, Gravimetric Method <sup>(4)</sup>
25	Vanadium	Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>(4)</sup>
26	Xylene	Adsorption Sampling, Gas Chromatographic Method <sup>(4)</sup>

## สิ่งปฏิกูลหรือวัสดุที่ไม่ใช้แล้ว จำนวน 20 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Antimony	Digestion, Inductively Coupled Plasma Method <sup>(5,8)</sup>
2	Arsenic	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>(5,9)</sup> 2) Digestion, Inductively Coupled Plasma Method <sup>(5,8)</sup>
3	Barium	Digestion, Inductively Coupled Plasma Method <sup>(5,8)</sup>
4	Beryllium	Digestion, Inductively Coupled Plasma Method <sup>(5,8)</sup>
5	Cadmium	Digestion, Inductively Coupled Plasma Method <sup>(5,8)</sup>
6	Chromium	Digestion, Inductively Coupled Plasma Method <sup>(5,8)</sup>
7	Chromium (III)	Digestion, Inductively Coupled Plasma Method; Alkaline Digestion, Colorimetric Method; Calculation Method <sup>(5,6,8,10)</sup>
8	Chromium (VI)	Alkaline Digestion, Colorimetric Method <sup>(6,10)</sup>
9	Cobalt	Digestion, Inductively Coupled Plasma Method <sup>(5,8)</sup>
10	Copper	Digestion, Inductively Coupled Plasma Method <sup>(5,8)</sup>
11	Lead	Digestion, Inductively Coupled Plasma Method <sup>(5,8)</sup>
12	Mercury	Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>(11)</sup>
13	Molybdenum	Digestion, Inductively Coupled Plasma Method <sup>(5,8)</sup>
14	Nickel	Digestion, Inductively Coupled Plasma Method <sup>(5,8)</sup>

[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.] 15 pH...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
15	pH	Electrometric Method <sup>(14)</sup>
16	Selenium	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>(5,12)</sup> 2) Digestion, Inductively Coupled Plasma Method <sup>(5,8)</sup>
17	Silver	Digestion, Inductively Coupled Plasma Method <sup>(5,8)</sup>
18	Thallium	Digestion, Inductively Coupled Plasma Method <sup>(5,8)</sup>
19	Vanadium	Digestion, Inductively Coupled Plasma Method <sup>(5,8)</sup>
20	Zinc	Digestion, Inductively Coupled Plasma Method <sup>(5,8)</sup>

## ดิน จำนวน 56 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Acetone	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(7,13)</sup>
2	Antimony	Digestion, Inductively Coupled Plasma Method <sup>(5,8)</sup>
3	Arsenic	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>(5,9)</sup> 2) Digestion, Inductively Coupled Plasma Method <sup>(5,8)</sup>
4	Barium	Digestion, Inductively Coupled Plasma Method <sup>(5,8)</sup>
5	Benzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(7,13)</sup>
6	Beryllium	Digestion, Inductively Coupled Plasma Method <sup>(5,8)</sup>
7	Bromodichloromethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(7,13)</sup>
8	Bromoform	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(7,13)</sup>
9	Cadmium	Digestion, Inductively Coupled Plasma Method <sup>(5,8)</sup>
10	Carbon Disulfide	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(7,13)</sup>
11	Carbon Tetrachloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(7,13)</sup>
12	Chlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(7,13)</sup>
13	Chlorodibromomethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(7,13)</sup>

[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.] 14 Chloroform...



ลำดับที่	สารเคมี	วิธีวิเคราะห์
14	Chloroform	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(7,13)</sup>
15	Chromium	Digestion, Inductively Coupled Plasma Method <sup>(5,8)</sup>
16	Chromium (III)	Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation Method <sup>(5,7,9,11)</sup>
17	Chromium (VI)	Alkaline Digestion, Colorimetric Method <sup>(7,11)</sup>
18	1,2-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(7,13)</sup>
19	1,3-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(7,13)</sup>
20	1,4-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(7,13)</sup>
21	1,1-Dichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(7,13)</sup>
22	1,2-Dichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(7,13)</sup>
23	1,1-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(7,13)</sup>
24	cis-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(7,13)</sup>
25	trans-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(7,13)</sup>
26	1,2-Dichloropropane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(7,13)</sup>
27	1,3-Dichloropropane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(7,13)</sup>
28	1,3-Dichloropropene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(7,13)</sup>
29	Ethylbenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(7,13)</sup>
30	Hexachloro-1,3-butadiene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(7,13)</sup>
31	Lead	Digestion, Inductively Coupled Plasma Method <sup>(5,8)</sup>
32	Manganese	Digestion, Inductively Coupled Plasma Method <sup>(5,8)</sup>
33	Mercury	Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>(11)</sup>

[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]

34 Methyl...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
34	Methyl Bromide	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(7,13)</sup>
35	Methylene Chloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(7,13)</sup>
36	Methyl Tert-Butyl Ether	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(7,13)</sup>
37	Naphthalene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(7,13)</sup>
38	Nickel	Digestion, Inductively Coupled Plasma Method <sup>(5,8)</sup>
39	Selenium	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>(5,12)</sup> 2) Digestion, Inductively Coupled Plasma Method <sup>(5,8)</sup>
40	Silver	Digestion, Inductively Coupled Plasma Method <sup>(5,8)</sup>
41	Styrene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(7,13)</sup>
42	1,1,2,2-Tetrachloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(7,13)</sup>
43	Tetrachloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(7,13)</sup>
44	Toluene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(7,13)</sup>
45	1,2,4-Trichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(7,13)</sup>
46	1,1,1-Trichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(7,13)</sup>
47	1,1,2-Trichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(7,13)</sup>
48	Trichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(7,13)</sup>
49	1,3,5-Trimethylbenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(7,13)</sup>
50	Vanadium	Digestion, Inductively Coupled Plasma Method <sup>(5,8)</sup>
51	Vinyl Chloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method <sup>(7,13)</sup>

[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]

52 m-Xylene...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
52	m-Xylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(7.13)</sup>
53	o-Xylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(7.13)</sup>
54	p-Xylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(7.13)</sup>
55	Xylene (Total)	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(7.13)</sup>
56	Zinc	Digestion, Inductively Coupled Plasma Method <sup>(5.8)</sup>

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[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]



ที่ อภ ๐๓๑๐๑/ ๒๐๓ ๙

กรมโรงงานอุตสาหกรรม  
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท  
เขตราชเทวี กรุงเทพฯ ๑๐๕๐๐

๑๐ กุมภาพันธ์ ๒๕๖๕

เรื่อง เปลี่ยนแปลงสารมลพิษที่วิเคราะห์

บริษัท เอนเนอร์จี้ แอนด์ เทคโนโลยี จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงสารมลพิษของปฏิบัติการวิเคราะห์อากาศ  
ลงวันที่ ๒๔ ธันวาคม ๒๕๖๔

สิ่งที่ส่งมาด้วย เอกสารแนบท้ายหนังสือเปลี่ยนแปลงสารมลพิษที่วิเคราะห์

บริษัท เอนเนอร์จี้ แอนด์ เทคโนโลยี จำกัด จำนวน ๑ แผ่น

ตามที่ส่งมาถึง บริษัท เอนเนอร์จี้ แอนด์ เทคโนโลยี จำกัด ห้องปฏิบัติการ  
วิเคราะห์อากาศ เลขทะเบียน ๖-๐๙๙ สถานที่ตั้งเลขที่ ๒๕/๑๑๔ หมู่ที่ ๖ ซอยจินตนา ๑ ถนนงามวงศ์วาน  
แขวงทุ่งสองห้อง เขตหลักสี่ กรุงเทพมหานคร ขอเปลี่ยนแปลงสารมลพิษที่วิเคราะห์ ความละเอียดตั้งแต่ในวัน

กรมโรงงานอุตสาหกรรมพิจารณาแล้วได้ บริษัท เอนเนอร์จี้ แอนด์ เทคโนโลยี  
จำกัด เห็นชอบดำเนินการที่ได้รับขึ้นทะเบียนให้วิเคราะห์เพิ่มเติม ตามสิ่งที่ส่งมาด้วย

อนึ่ง หนังสือฉบับนี้จะหมดอายุพร้อมหนังสือขออนุญาตขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์อากาศ  
ที่ อภ ๐๓๑๐๑/๒๐๓๕ ลงวันที่ ๒๙ กรกฎาคม ๒๕๖๕ คือในวันที่ ๑๙ พฤษภาคม ๒๕๖๙ ทั้งนี้ สามารถยื่น  
คำขอผ่านระบบอิเล็กทรอนิกส์ได้ที่หน้าเว็บไซต์กรมโรงงานอุตสาหกรรม ตาม QR Code ท้ายหนังสือฉบับนี้

จึงเรียนมาเพื่อทราบ

*[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]*



ยื่นคำขอผ่านระบบอิเล็กทรอนิกส์

กองวิจัยและเตือนภัยมลพิษโรงงาน  
กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ  
โทร. ๐ ๒๕๓๐ ๖๓๑๒ ต่อ ๒๐๓๕-๕ โทรสาร ๐ ๒๕๓๐ ๖๓๑๒ ต่อ ๒๑๙๙  
ไปรษณีย์อิเล็กทรอนิกส์ sarabang@dlw.mail.go.th

เอกสารแนบท้ายหนังสือเปลี่ยนแปลงสารมลพิษที่วิเคราะห์  
บริษัท เอนเนอร์จี้ แอนด์ เทคโนโลยี จำกัด เลขทะเบียน ๖-๐๙๙  
ที่ อภ ๐๓๑๐๑/ ๒๐๓ ๙ ลงวันที่ ๑ กุมภาพันธ์ ๒๕๖๕

ขอเชิญสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๓ รายการ

ดิน จำนวน ๓ รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	TPH (C <sub>5</sub> - C <sub>6</sub> )	Purge and Trap, Gas Chromatographic Method <sup>(๒,๓)</sup>
2	TPH (C <sub>๘</sub> - C <sub>๑๐</sub> )	Ultrasonic Extraction, Gas Chromatographic Method <sup>(๑,๒,๓)</sup>
3	TPH (C <sub>๑๑</sub> - C <sub>๑๖</sub> )	Ultrasonic Extraction, Gas Chromatographic Method <sup>(๑,๒,๓)</sup>

### เอกสารอ้างอิง

1. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Ultrasonic Extraction. SW-846 Method 3550C, 2007.
2. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Closed System Purge and Trap and Extraction for Volatile Organics in Soil and Waste Sample. SW-846 Method 5035A, 2002.
3. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Nonhalogenated Organics Using GC/FID. SW-846 Method 8015D, 2003





ที่ อก ๐๓๑๐(๑)/ ๑ ๕ ๖ ๗

กรมโรงงานอุตสาหกรรม  
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท  
เขตราชเทวี กรุงเทพฯ ๑๐๕๐๐

๒ ๔ สิงหาคม ๒๕๖๕

เรื่อง เปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท เอ็นไวรอนเมนท์ รีเสิร์ช แอนด์ เทคโนโลยี จำกัด

อ้างถึง ๑. คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารเคมีของห้องปฏิบัติการวิเคราะห์เอกชน

ลงวันที่ ๑๑ สิงหาคม ๒๕๖๕  
๒. หนังสือบริษัท เอ็นไวรอนเมนท์ รีเสิร์ช แอนด์ เทคโนโลยี จำกัด ลงวันที่ ๑๑ สิงหาคม ๒๕๖๕

ตามที่ห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ๖-๐๕๙๙-๖-๐๐๑๑๖  
ขอเปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์  
ตามหนังสือที่อ้างถึง ๑ และ ๒ บริษัท เอ็นไวรอนเมนท์ รีเสิร์ช แอนด์ เทคโนโลยี จำกัด  
ถนนวงเวียน ๖ ประตูน้อย กรุงเทพมหานคร ขอเปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์  
ความละเอียดแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว มีความเห็นดังนี้

๑. ให้ออกเลขาเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๙ ราย

- ๑) นายเสพล บัณฑิต
- ๒) นางสาวชัชวาลย์ อ่อนน้อม
- ๓) นางสาวรัตนภรณ์ วงศ์ประโคน
- ๔) นางสาวสรรรณ พุฒพันธ์
- ๕) นางสาวกัญญา จรุงไชย
- ๖) นางสาววิมลวรรณ บุญจันทร์
- ๗) นายศักดิ์กริรินทร์ นิกามันท์
- ๘) นายอภิเดช ยาสมดี
- ๙) นางสาวพัชรีวรรณ แสงพา
- ๑๐) นายเสพล บัณฑิต

๒. ให้เพิ่มเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๕ ราย

- ๑) ว่าที่ร้อยตรีหญิงกัญจกรนันท์ วิจิตรศักดิ์
- ๒) นางสาวนัฐธิดา ขาวสุทธิ
- ๓) นางสาวพรภรณ์ พงษ์พันธ์
- ๔) นางสาวพัชรีนันท์ คำยา
- ๕) นางสาวสุธิดา ทองประภา
- ๖) นางสาววรัญญา เด็อมรัมย์
- ๗) นายจิรายุทธ สามารถ
- ๘) นายอชัญญา ไชยวงศ์
- ๙) นางสาวนัฐธิดา บุญคุ้ม
- ๑๐) นางสาวสุพัชรา สุรินทร์

๑๑) นายพงศ์ปริวี...

- ๑๑) นายพงศ์ปริวี สัตระ ทะเบียนเลขที่ ๖-๐๕๙๙-๖-๐๐๑๑๑
- ๑๒) นายณเดชน์ โชติกาญจน์ ทะเบียนเลขที่ ๖-๐๕๙๙-๖-๐๐๑๑๒
- ๑๓) นางสาวพรทิพย์ อิ่มภรณ์ ทะเบียนเลขที่ ๖-๐๕๙๙-๖-๐๐๑๑๓
- ๑๔) นางสาวจันทน์ ปิติพิทักษ์ ทะเบียนเลขที่ ๖-๐๕๙๙-๖-๐๐๑๑๔
- ๑๕) นายอัศวรัตน์ ศงษาก ทะเบียนเลขที่ ๖-๐๕๙๙-๖-๐๐๑๑๕
- ๓. ให้เปลี่ยนชื่อผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จากเดิมนางสาววาสนา ชื่นเงิน ทะเบียนเลขที่ ๖-๐๕๙๙-๖-๕๕๖๖ เป็น นางสาวศิริณี สิบสรร
- ๔. ให้เปลี่ยนชื่อ-สกุลเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จากเดิมนางสาวปรวดี ปุรีไสง ทะเบียนเลขที่ ๖-๐๕๙๙-๖-๕๕๖๖ เป็น นางเตชินี สิบสรร

อนึ่ง หนังสือฉบับนี้จะหมดอายุพร้อมหนังสืออายุรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน  
ที่ อก ๐๓๑๐(๑)/๑๕๖๕ ลงวันที่ ๒๙ กรกฎาคม ๒๕๖๕ คือในวันที่ ๑๘ พฤษภาคม ๒๕๖๗ ทั้งนี้ สามารถยื่นคำขอ  
ผ่านระบบอิเล็กทรอนิกส์ได้ที่หน้าเว็บไซต์กรมโรงงานอุตสาหกรรม ตาม QR Code ข้างหนังสือฉบับนี้

จึงเรียนมาเพื่อทราบ

*[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]*



ยื่นคำขอผ่านระบบอิเล็กทรอนิกส์

กองวิจัยและประเมินผลพืชโรงงาน  
กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบและทะเบียนห้องปฏิบัติการ  
โทร. ๐ ๒๕๓๐ ๖๓๑๖ ต่อ ๒๑๐๓-๕  
โทรสาร ๐ ๒๕๓๐ ๖๓๑๖ ต่อ ๒๑๕๙  
ไปรษณีย์อิเล็กทรอนิกส์ saraban@div.mail.go.th

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**Geotechnical & Foundation Engineering Co., Ltd.**  
**(GFE)**

ที่ อก ๐๓๑๐(๑)/ ๘ ๑ ๕ ๑



กรมโรงงานอุตสาหกรรม  
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท  
เขตราชเทวี กรุงเทพฯ ๑๐๕๐๐

**๐ ๑ กันยายน ๒๕๖๕**

เรื่อง เปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์  
เรียน กรรมการผู้จัดการ บริษัท วิศวกรรมธรณีและฐานราก จำกัด  
อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารเคมีของห้องปฏิบัติการวิเคราะห์เอกชน  
ลงวันที่ ๑๗ สิงหาคม ๒๕๖๔

ตามหนังสือที่ยังถึง บริษัท วิศวกรรมธรณีและฐานราก จำกัด ห้องปฏิบัติการวิเคราะห์เอกชน  
เลขทะเบียน ๖-๐๔๘๘ สถานที่ตั้งเลขที่ ๑๕๑ ถนนนวลจันทร์ แขวงนวลจันทร์ เขตป้อมปราบศัตรูพ่าย กรุงเทพมหานคร  
ขอเปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์ ความละเอียดแจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว มีความเห็นดังนี้

1. ให้ออกเลขผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๑ ราย  
นายภัทรารัฐ หัตถสวน ทะเบียนเลขที่ ๖-๐๔๘๘-ค-๔๓๕๗
2. ให้นำผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๑ ราย  
นายวิชพรพล ศรีทา ทะเบียนเลขที่ ๖-๐๔๘๘-ค-๔๓๕๗

อนึ่ง หนังสือฉบับนี้จะหมดอายุพร้อมหนังสืออายุรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน  
ที่ อก ๐๓๑๐(๑)/๕๑๗๖ ลงวันที่ ๑๒ พฤษภาคม ๒๕๖๔ คือในวันที่ ๒๖ มีนาคม ๒๕๖๗

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

*[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]*

กองวิจัยและเตือนภัยมลพิษโรงงาน  
กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ  
โทร. ๐ ๒๒๐๒ ๔๐๐๒ ๐ ๒๒๐๒ ๔๑๑๖  
โทรสาร ๐ ๒๓๕๔ ๓๔๑๕

ที่ อก ๐๓๑๐(๑)/ ๗ ๕ ๕ ๓



กรมโรงงานอุตสาหกรรม  
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท  
เขตราชเทวี กรุงเทพฯ ๑๐๕๐๐

**๐ ๖ สิงหาคม ๒๕๖๕**

เรื่อง เปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์  
เรียน กรรมการผู้จัดการ บริษัท วิศวกรรมธรณีและฐานราก จำกัด  
อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารเคมีของห้องปฏิบัติการวิเคราะห์เอกชน  
ลงวันที่ ๒๓ กรกฎาคม ๒๕๖๔

ตามหนังสือที่ยังถึง บริษัท วิศวกรรมธรณีและฐานราก จำกัด ห้องปฏิบัติการวิเคราะห์เอกชน  
เลขทะเบียน ๖-๐๔๘๘ สถานที่ตั้งเลขที่ ๑๕๑ ถนนนวลจันทร์ แขวงนวลจันทร์ เขตป้อมปราบศัตรูพ่าย กรุงเทพมหานคร  
ขอเปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์ ความละเอียดแจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว มีความเห็นดังนี้

1. ให้ออกเลขเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑ ราย  
นายศุภกฤช หลัดหิละ ทะเบียนเลขที่ ๖-๐๔๘๘-จ-๗๕๑๒
2. ให้เพิ่มเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑ ราย  
นางสาวภณิศา พงษ์เดช ทะเบียนเลขที่ ๖-๐๔๘๘-จ-๙๕๕๒

อนึ่ง หนังสือฉบับนี้จะหมดอายุพร้อมหนังสืออายุรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน  
ที่ อก ๐๓๑๐(๑)/๕๑๗๖ ลงวันที่ ๑๒ พฤษภาคม ๒๕๖๔ คือในวันที่ ๒๖ มีนาคม ๒๕๖๗

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

*[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]*

กองวิจัยและเตือนภัยมลพิษโรงงาน  
กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ  
โทร. ๐ ๒๒๐๒ ๔๐๐๒ ๐ ๒๒๐๒ ๔๑๑๖  
โทรสาร ๐ ๒๓๕๔ ๓๔๑๕

เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

บริษัท วิศกรกรรมธรณีและฐานราก จำกัด เลขทะเบียน ว-048

ที่ อภ ๐๓๑๐/๑) ๘๙ ๕๖๘ ลงวันที่ ๒๕ มิถุนายน ๒๕๖๑

สามารถพิมพ์เพิ่มเติมขอให้บริการ จำนวน 7 รายการ

**น้ำเสีย จำนวน 7 รายการ**

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Biochemical Oxygen Demand	5-Day BOD Test, Azide Modification Method <sup>[2]</sup>
2	Chemical Oxygen Demand	Closed Reflux, Titrimetric Method <sup>[1]</sup>
3	Oil & Grease	Soxhlet Extraction Method <sup>[2]</sup>
4	pH	Electrometric Method <sup>[2]</sup>
5	Temperature	Laboratory and Field Methods <sup>[2]</sup>
6	Total Dissolved Solids	Dried at 180 °C <sup>[2]</sup>
7	Total Suspended Solids	Dried at 103-105°C <sup>[2]</sup>

**เอกสารอ้างอิง**

1. สมาคมวิศวกรรมสิ่งแวดล้อมแห่งประเทศไทย. คู่มือวิเคราะห์น้ำเสีย. พิมพ์ครั้งที่ 4 กรุงเทพฯ ; เรือนแก้วการพิมพ์, 2547.
2. APHA, AWWA, WEF. Standard Methods for the Examination of Water and Wastewater. 22<sup>nd</sup> ed. Washington, DC : APHA, 2012.

*[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]*

# **Appendix 3C**

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## **Analysis Report**



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**Ambient Air**



**ANALYSIS REPORT**

**Customer Name** : TLT Consultants Company Limited  
**Address** : 152 Nuan Chan Road, Nuan Chan, Bueng Kum, Bangkok 10230  
**Project Name** : โครงการรถไฟฟ้ามหานคร สายเฉลิมรัชมงคล  
**Project Location** : ส่วนขนส่งมวลชน สายฉลองราษฎร์ จังหวัดกรุงเทพมหานคร  
**Sampling Source** : Ambient Air Quality  
**Sampling Point** : จุดติดตั้งสาร (สถานีวัด) ส่วนขนส่งมวลชน สายฉลองราษฎร์ จังหวัดกรุงเทพมหานคร  
**GPS. Coordinate** : UTM (WGS84) 47P 0583263 E, 1593776 N  
**Quotation No.** : 2023-00605  
**Folder No.** : 2023-AC101  
**Received Date** : May 31, 2023  
**Analytical Date** : May 31-June 6, 2023  
**Report No.** : 2023-RAAK206  
**Report Date** : June 6, 2023  
**Sampling Time** : 08:00  
**Sampling Method** : U.S. EPA-40 CFR Part 50  
**Sampling By** : Mr.Nitad Sirichad  
**Analyzed By** : Environment Research & Technology Co., Ltd.

Parameter	Unit	Method of Analysis	Result			Standard <sup>1)</sup>
			May 25-26, 23	May 26-27, 23	May 27-28, 23	
Total Suspended Particulate (TSP) 24 Hours Average	mg/m <sup>3</sup>	High-Volume, Gravimetric	0.093	0.076	0.071	0.048
Particulate Size Less Than 10 Micron (PM10) 24 Hours Average	mg/m <sup>3</sup>	PM10 Size Selective, High-Volume, Gravimetric	0.053	0.041	0.040	0.026

Remark : <sup>1)</sup> Notification of National Environmental Board, No.10, B.E.2538 (1995), published in the Royal Government Gazette No.112 Part 42D dated May 25, B.E.2538 (1995) and Notification No.24, B.E.2547 (2004), published in the Royal Government Gazette No.121 Special Part 1040 dated September 23, B.E.2547 (2004), under the Enhancement and Conservation of National Environmental Quality Act B.E.2535 (1992).

[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]



**ANALYSIS REPORT**

**Customer Name** : TLT Consultants Company Limited  
**Address** : 152 Nuan Chan Road, Nuan Chan, Bueng Kum, Bangkok 10230  
**Project Name** : โครงการรถไฟฟ้ามหานคร สายเฉลิมรัชมงคล  
**Project Location** : ส่วนขนส่งมวลชน สายฉลองราษฎร์ จังหวัดกรุงเทพมหานคร  
**Sampling Source** : Ambient Air Quality  
**Sampling Point** : จุดติดตั้งสาร (สถานีวัด) ส่วนขนส่งมวลชน สายฉลองราษฎร์ จังหวัดกรุงเทพมหานคร  
**GPS. Coordinate** : UTM (WGS84) 47P 0580042 E, 1592069 N  
**Quotation No.** : 2023-00605  
**Folder No.** : 2023-AC101  
**Received Date** : May 31, 2023  
**Analytical Date** : May 31-June 6, 2023  
**Report No.** : 2023-RAAK207  
**Report Date** : June 6, 2023  
**Sampling Time** : 07:40  
**Sampling Method** : U.S. EPA-40 CFR Part  
**Sampling By** : Mr.Nitad Sirichad  
**Analyzed By** : Environment Research & Technology Co., Ltd.

Parameter	Unit	Method of Analysis	Result			Standard <sup>1)</sup>
			May 25-26, 23	May 26-27, 23	May 27-28, 23	
Total Suspended Particulate (TSP) 24 Hours Average	mg/m <sup>3</sup>	High-Volume, Gravimetric	0.078	0.076	0.060	0.040
Particulate Size Less Than 10 Micron (PM10) 24 Hours Average	mg/m <sup>3</sup>	PM10 Size Selective, High-Volume, Gravimetric	0.042	0.036	0.032	0.018

Remark : <sup>1)</sup> Notification of National Environmental Board, No.10, B.E.2538 (1995), published in the Royal Government Gazette No.112 Part 42D dated May 25, B.E.2538 (1995) and Notification No.24, B.E.2547 (2004), published in the Royal Government Gazette No.121 Special Part 1040 dated September 23, B.E.2547 (2004), under the Enhancement and Conservation of National Environmental Quality Act B.E.2535 (1992).

[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]



**ANALYSIS REPORT**

**Customer Name** : TLT Consultants Company Limited  
**Address** : 152 Nuan Chan Road, Nuan Chan, Bueng Kum, Bangkok 10230  
**Project Name** : โครงการโรงไฟฟ้า พหลโยธิน  
**Project Location** : ตำบลหนองเต็ง อำเภอตาคลี จังหวัดตาก  
**Measured Source** : Ambient Air Quality  
**Measured Point** : วัดโนนศิลา (วัดตาพาด) ตำบลหนองเต็ง อำเภอตาคลี จังหวัดตาก  
**GPS. Coordinate** : UTM (WGS84) 47P 0583275 E, 1593767 N  
**Measured Date** : May 25-30, 2023  
**Measured By** : Mr.Nitad Sirichad  
**Analyzed By** : Environment Research & Technology Co., Ltd.

**Customer Name** : TLT Consultants Company Limited  
**Address** : 152 Nuan Chan Road, Nuan Chan, Bueng Kum, Bangkok 10230  
**Project Name** : โครงการโรงไฟฟ้า พหลโยธิน  
**Project Location** : ตำบลหนองเต็ง อำเภอตาคลี จังหวัดตาก  
**Measured Source** : Ambient Air Quality  
**Measured Point** : วัดโนนศิลา (วัดตาพาด) ตำบลหนองเต็ง อำเภอตาคลี จังหวัดตาก  
**GPS. Coordinate** : UTM (WGS84) 47P 0583275 E, 1593767 N  
**Measured Date** : May 25-30, 2023  
**Measured By** : Mr.Nitad Sirichad  
**Analyzed By** : Environment Research & Technology Co., Ltd.

Date/Time	May 25-26, 23		May 27-28, 23		May 28-29, 23		May 29-30, 23	
	WS	WD	WS	WD	WS	WD	WS	WD
08:00-09:00	1.3	NW	2.7	WNW	1.3	NW	0.9	NE
09:00-10:00	1.3	WNW	1.3	W	1.3	WNW	0.9	WNW
10:00-11:00	1.3	WNW	1.8	WNW	2.2	W	2.2	NW
11:00-12:00	1.8	W	2.2	WNW	3.1	WNW	1.3	NW
12:00-13:00	2.2	NW	2.7	WNW	3.1	NW	2.2	NE
13:00-14:00	2.7	WNW	2.7	WNW	3.1	NW	2.7	E
14:00-15:00	1.3	S	1.8	NW	1.8	WNW	1.3	SE
15:00-16:00	1.3	WSW	1.3	NW	2.2	NW	1.3	SE
16:00-17:00	1.8	W	1.3	WNW	1.3	ENE	1.8	ESE
17:00-18:00	1.3	W	3.1	NW	3.6	WNW	3.6	E
18:00-19:00	0.9	W	3.1	ESE	1.8	WNW	2.7	ESE
19:00-20:00	1.3	WNW	1.3	E	3.1	WNW	1.8	NE
20:00-21:00	0.9	WNW	0.9	ENE	0.9	WNW	1.3	NW
21:00-22:00	<0.4	Calm	0.4	NNW	0.4	NW	1.8	N
22:00-23:00	0.4	NW	0.9	NW	0.4	NNW	0.9	ENE
23:00-00:00	0.4	NNE	0.4	NNW	1.3	NW	1.3	NW
00:00-01:00	0.4	NW	0.9	NNW	0.4	WNW	2.7	WNW
01:00-02:00	0.9	NW	1.3	NNW	0.9	NW	4.0	NW
02:00-03:00	0.9	NNW	1.3	NW	0.4	NW	4.9	NW
03:00-04:00	0.4	NNW	1.8	NW	0.4	WNW	1.8	E
04:00-05:00	0.4	NNW	1.3	NW	0.9	NW	0.4	ESE
05:00-06:00	0.9	NW	0.4	NW	1.8	NE	1.3	E
06:00-07:00	<0.4	Calm	1.3	NW	2.2	E	0.9	ESE
07:00-08:00	0.4	NNW	1.8	NW	2.2	E	1.3	ENE

Remark : WS = Wind Speed (m/s)  
 WD = Wind Direction  
 Height of wind vane and anemometer above ground 10 meters.

[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]

**ANALYSIS REPORT**

**Customer Name** : TLT Consultants Company Limited  
**Address** : 152 Nuan Chan Road, Nuan Chan, Bueng Kum, Bangkok 10230  
**Project Name** : โครงการโรงไฟฟ้า พหลโยธิน  
**Project Location** : ตำบลหนองเต็ง อำเภอตาคลี จังหวัดตาก  
**Measured Source** : Ambient Air Quality  
**Measured Point** : วัดโนนศิลา (วัดตาพาด) ตำบลหนองเต็ง อำเภอตาคลี จังหวัดตาก  
**GPS. Coordinate** : UTM (WGS84) 47P 0583275 E, 1593767 N  
**Measured Date** : May 25-30, 2023  
**Measured By** : Mr.Nitad Sirichad  
**Analyzed By** : Environment Research & Technology Co., Ltd.

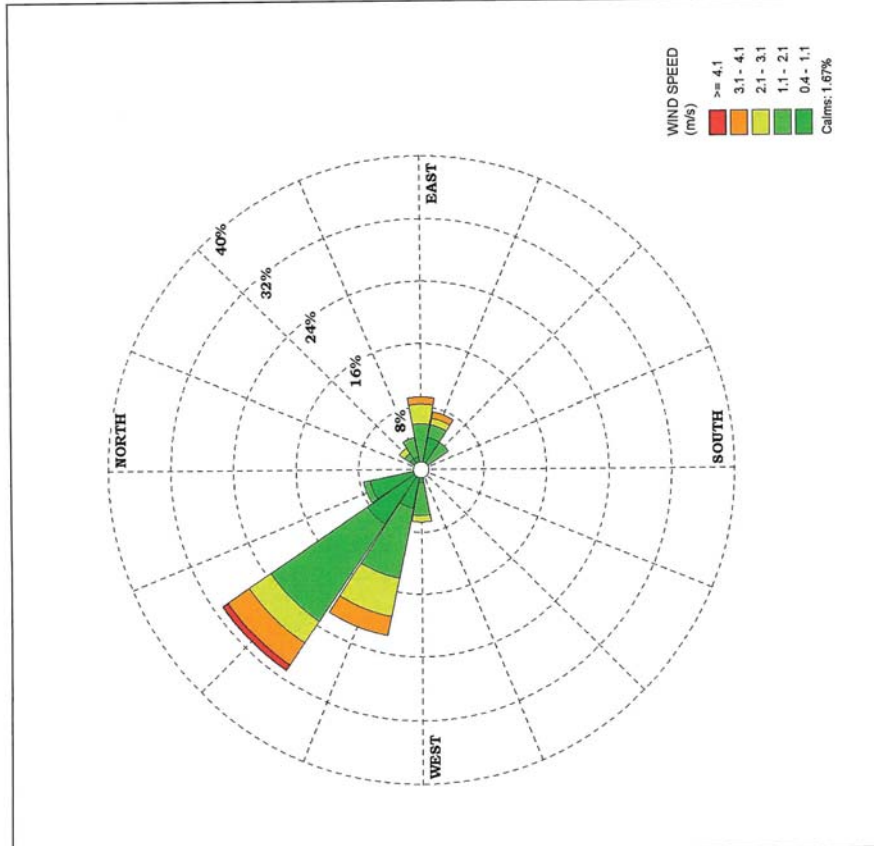
**Customer Name** : TLT Consultants Company Limited  
**Address** : 152 Nuan Chan Road, Nuan Chan, Bueng Kum, Bangkok 10230  
**Project Name** : โครงการโรงไฟฟ้า พหลโยธิน  
**Project Location** : ตำบลหนองเต็ง อำเภอตาคลี จังหวัดตาก  
**Measured Source** : Ambient Air Quality  
**Measured Point** : วัดโนนศิลา (วัดตาพาด) ตำบลหนองเต็ง อำเภอตาคลี จังหวัดตาก  
**GPS. Coordinate** : UTM (WGS84) 47P 0583275 E, 1593767 N  
**Measured Date** : May 25-30, 2023  
**Measured By** : Mr.Nitad Sirichad  
**Analyzed By** : Environment Research & Technology Co., Ltd.

Wind Direction	Percentage frequency of wind in each speed and direction					Total
	0.4-1.1	1.1-2.1	2.1-3.1	3.1-4.1	≥4.1	
N	0.83333	0.00000	0.00000	0.00000	0.00000	0.83333
NNE	0.83333	0.00000	0.00000	0.00000	0.00000	0.83333
NE	1.66667	0.83333	0.83333	0.00000	0.00000	3.33333
ENE	1.66667	2.50000	0.00000	0.00000	0.00000	4.16667
E	0.83333	5.00000	2.50000	0.83333	0.00000	9.16666
ESE	4.16667	1.66667	0.83333	0.83333	0.00000	7.50000
SE	0.83333	3.33333	0.00000	0.00000	0.00000	4.16666
SSE	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
S	0.00000	0.83333	0.00000	0.00000	0.00000	0.83333
SSW	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
SW	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
WSW	0.00000	0.83333	0.00000	0.00000	0.00000	0.83333
W	1.66667	4.16667	0.83333	0.00000	0.00000	6.66667
WNW	5.00000	9.16667	5.00000	2.50000	0.00000	21.66667
NW	8.33333	15.00000	3.33333	3.33333	0.83333	30.83332
NNW	6.66667	0.83333	0.00000	0.00000	0.00000	7.50000
Calm						1.66667



ANALYSIS REPORT

Customer Name : TLT Consultants Company Limited  
 Project Name : โครงการสร้างที่พัก ร้านอาหาร  
 Measured Point : บริเวณพื้นที่จอดรถ (หน้าอาคาร) ด้านบนถนนฝั่งด้านนอกทางแยก ซอยท่ารถบางคูแก้ว  
 Report No. : 2023-RAAK418



ANALYSIS REPORT

Customer Name : TLT Consultants Company Limited  
 Address : 152 Nuan Chan Road, Nuan Chan, Bueng Kum, Bangkok 10230  
 Project Name : โครงการสร้างที่พัก ร้านอาหาร  
 Project Location : ด้านบนถนนฝั่งด้านนอกทางแยก ซอยท่ารถบางคูแก้ว  
 Measured Source : Ambient Air Quality  
 Measured Point : บริเวณพื้นที่จอดรถ (หน้าอาคาร) ด้านบนถนนฝั่งด้านนอกทางแยก  
 GPS Coordinate : UTM (WGS84) 47P 0580042 E, 1592069 N  
 Measured Date : May 25-30, 2023  
 Measured By : Mr.Nitad Sirichad  
 Analyzed By : Environment Research & Technology Co., Ltd.

Date/Time	May 25-26, 23		May 26-27, 23		May 27-28, 23		May 28-29, 23		May 29-30, 23	
	WS	WD	WS	WD	WS	WD	WS	WD	WS	WD
08:00-09:00	0.4	SW	0.4	N	0.9	SW	0.9	NW	<0.4	Calim
09:00-10:00	0.9	WSW	0.4	NE	1.3	SSE	1.3	N	2.2	SW
10:00-11:00	0.9	SW	0.9	NNE	0.4	S	1.8	N	0.9	SW
11:00-12:00	<0.4	Calim	0.9	N	0.9	SW	1.3	N	0.4	WSW
12:00-13:00	<0.4	Calim	0.4	ESE	0.9	WSW	1.8	N	0.9	SW
13:00-14:00	<0.4	Calim	1.3	E	0.4	NW	1.8	N	<0.4	Calim
14:00-15:00	<0.4	Calim	2.2	E	0.9	NNW	1.8	N	<0.4	Calim
15:00-16:00	<0.4	Calim	1.8	E	1.8	NNW	1.8	N	<0.4	Calim
16:00-17:00	<0.4	Calim	0.9	NNW	1.8	NNW	1.3	ENE	0.4	ESE
17:00-18:00	0.4	MNE	0.4	N	1.3	NNW	0.9	MNE	<0.4	Calim
18:00-19:00	<0.4	Calim	0.4	ESE	0.4	NNW	1.3	N	0.4	ESE
19:00-20:00	<0.4	Calim	0.4	ESE	<0.4	Calim	0.9	N	0.9	SE
20:00-21:00	<0.4	Calim	0.9	E	0.4	S	0.9	N	0.4	SSE
21:00-22:00	<0.4	Calim	0.4	E	0.4	SE	1.3	ENE	<0.4	Calim
22:00-23:00	<0.4	Calim	1.3	SE	0.4	SE	0.4	ENE	<0.4	Calim
23:00-00:00	0.4	E	2.2	E	0.4	SE	0.4	NNW	0.4	SE
00:00-01:00	0.9	ENE	2.2	E	<0.4	Calim	0.4	SSW	<0.4	Calim
01:00-02:00	0.9	ENE	2.2	E	<0.4	Calim	<0.4	Calim	<0.4	Calim
02:00-03:00	0.4	E	0.9	ESE	0.9	E	<0.4	Calim	0.4	E
03:00-04:00	0.4	ESE	0.4	SE	0.9	E	<0.4	Calim	<0.4	Calim
04:00-05:00	0.4	ENE	0.9	S	0.9	ENE	<0.4	Calim	0.4	ESE
05:00-06:00	0.4	WNW	2.2	SW	<0.4	Calim	<0.4	Calim	0.4	SE
06:00-07:00	0.4	NW	2.2	SW	0.4	N	<0.4	Calim	0.4	SSE
07:00-08:00	0.4	NNW	1.3	SW	0.9	NW	<0.4	Calim	<0.4	Calim

Remark : WS = Wind Speed (m/s)  
 WD = Wind Direction  
 Height of wind vane and anemometer above ground 10 meters.

[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]

### ANALYSIS REPORT

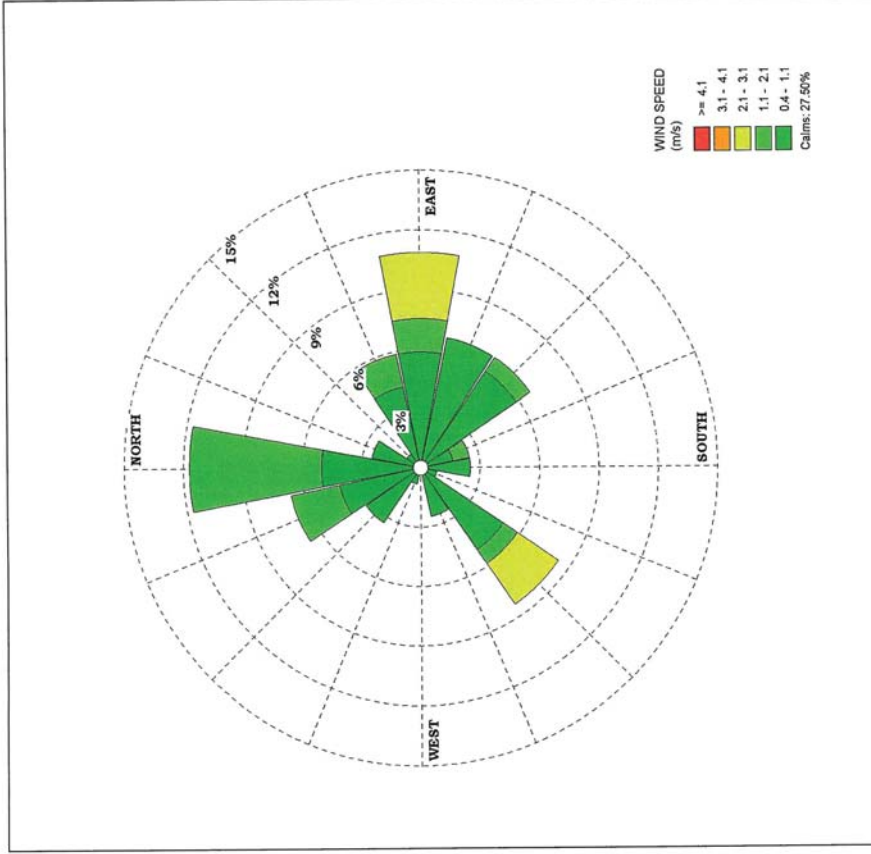
**Customer Name** : TLT Consultants Company Limited  
**Address** : 152 Nuan Chan Road, Nuan Chan, Bueng Kum, Bangkok 10230  
**Project Name** : โครงการรถไฟฟ้ามหานครสายใหม่  
**Project Location** : ส่วนขยายของเส้นทางสายใหม่จากถนนพหลโยธิน  
**Measured Source** : Ambient Air Quality  
**Measured Point** : สถานีรถไฟฟ้ามหานครสายใหม่จากถนนพหลโยธิน  
**GPS. Coordinate** : UTM (WGS84) 47P 0580042 E, 1592069 N  
**Measured Date** : May 25-30, 2023  
**Measured By** : Mr.Nitad Sirichad  
**Analyzed By** : Environment Research & Technology Co., Ltd.

**Quotation No.** : 2023-06065  
**Analysis No.** : 2023-AC101-006 - 010  
**Report No.** : 2023-RAAK420  
**Report Date** : June 8, 2023

Wind Direction	Percentage frequency of wind in each speed and direction					Total
	0.4-1.1	1.1-2.1	2.1-3.1	3.1-4.1	>4.1	
N	5.00000	6.66667	0.00000	0.00000	0.00000	11.66667
NNE	2.50000	0.00000	0.00000	0.00000	0.00000	2.50000
NE	0.83333	0.00000	0.00000	0.00000	0.00000	0.83333
ENE	4.16667	1.66667	0.00000	0.00000	0.00000	5.83334
E	5.83333	1.66667	3.33333	0.00000	0.00000	10.83333
ESE	6.66667	0.00000	0.00000	0.00000	0.00000	6.66667
SE	5.83333	0.83333	0.00000	0.00000	0.00000	6.66666
SSE	1.66667	0.83333	0.00000	0.00000	0.00000	2.50000
S	2.50000	0.00000	0.00000	0.00000	0.00000	2.50000
SSW	0.83333	0.00000	0.00000	0.00000	0.00000	0.83333
SW	5.00000	0.83333	2.50000	0.00000	0.00000	8.33333
WSW	2.50000	0.00000	0.00000	0.00000	0.00000	2.50000
W	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
WNW	0.83333	0.00000	0.00000	0.00000	0.00000	0.83333
NW	3.33333	0.00000	0.00000	0.00000	0.00000	3.33333
NW	4.16667	2.50000	0.00000	0.00000	0.00000	6.66667
Calm						27.50000

### ANALYSIS REPORT

**Customer Name** : TLT Consultants Company Limited  
**Project Name** : โครงการรถไฟฟ้ามหานครสายใหม่  
**Measured Point** : สถานีรถไฟฟ้ามหานครสายใหม่จากถนนพหลโยธิน  
**Measured Date** : May 25-30, 2023  
**Report No.** : 2023-RAAK420



### ANALYSIS REPORT

**Customer Name** : TLT Consultants Company Limited  
**Address** : 152 Nuan Chan Road, Nuan Chan, Bueng Kum, Bangkok 10230  
**Project Name** : โครงการวิจัยเพื่อพัฒนาที่อยู่อาศัย  
**Project Location** : ส่วนขยายแหล่ง อากาศภายในวัง อิมพีเรียล  
**Sampling Source** : Ambient Air Quality  
**Sampling Point** : บริเวณพื้นที่ก่อสร้างอาคารภายในวัง อิมพีเรียล  
**GPS. Coordinate** : UTM (WGS84) 47P 0583215 E, 1593799 N  
**Quotation No.** : 2023-01515  
**Folder No.** : 2023-AE851  
**Received Date** : November 9, 2023  
**Analytical Date** : November 9-10, 2023  
**Report No.** : 2023-RAAV910  
**Report Date** : November 10, 2023  
**Sampling Time** : 09:15  
**Sampling Method** : U.S. EPA 40 CFR Part 50, S3  
**Sampling By** : Mr.Sittiporn Wongkham  
**Analyzed By** : Environment Research & Technology Co., Ltd.

Parameter	Unit	Method of Analysis	Result				Standard <sup>1*</sup>	Standard <sup>2*</sup>
			Nov 2-3, 23	Nov 3-4, 23	Nov 4-5, 23	Nov 6-7, 23		
Total Suspended Particulate (TSP) 24 Hours Average	mg/m <sup>3</sup>	High-Volume, Gravimetric	0.051	0.059	0.074	0.051	0.330	-
Particulate Size Less Than 10 Micron (PM10) 24 Hours Average	mg/m <sup>3</sup>	PM10 Size Selective, High-Volume, Gravimetric	0.024	0.029	0.042	0.028	0.120	-
Particulate Size Less Than 2.5 Micron (PM2.5) 24 Hours Average	µg/m <sup>3</sup>	PM2.5 Size, Low-Volume Air Sampler, Gravimetric Method	15.7	22.2	26.6	19.4	11.1	37.5

**Remark :** <sup>1\*</sup> Notification of National Environmental Board, No.10, B.E.2538 (1995), published in the Royal Government Gazette No.112 Part 420 dated May 25, B.E.2538 (1995) and Notification No.24, B.E.2547 (2004), published in the Royal Government Gazette No.121 Special Part 1040 dated September 22, B.E.2547 (2004), under the Enhancement and Conservation of National Environmental Quality Act B.E.2535 (1992).  
<sup>2\*</sup> Notification of National Environmental Board, B.E.2555 (2012), published in the Royal Government Gazette No.139 Special Part 1630 dated July 8, B.E.2555 (2012) under the Enhancement and Conservation of National Environmental Quality Act B.E.2535 (1992).

[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]

### ANALYSIS REPORT

**Customer Name** : TLT Consultants Company Limited  
**Address** : 152 Nuan Chan Road, Nuan Chan, Bueng Kum, Bangkok 10230  
**Project Name** : โครงการวิจัยเพื่อพัฒนาที่อยู่อาศัย  
**Project Location** : ส่วนขยายแหล่ง อากาศภายในวัง อิมพีเรียล  
**Sampling Source** : Ambient Air Quality  
**Sampling Point** : บริเวณพื้นที่ก่อสร้างอาคารภายในวัง อิมพีเรียล  
**GPS. Coordinate** : UTM (WGS84) 47P 0580042 E, 1592064 N  
**Quotation No.** : 2023-01515  
**Folder No.** : 2023-AE851  
**Received Date** : November 9, 2023  
**Analytical Date** : November 9-10, 2023  
**Report No.** : 2023-RAAV911  
**Report Date** : November 10, 2023  
**Sampling Time** : 09:50  
**Sampling Method** : U.S. EPA 40 CFR Part 50, S3  
**Sampling By** : Mr.Sittiporn Wongkham  
**Analyzed By** : Environment Research & Technology Co., Ltd.

Parameter	Unit	Method of Analysis	Result				Standard <sup>1*</sup>	Standard <sup>2*</sup>
			Nov 2-3, 23	Nov 3-4, 23	Nov 4-5, 23	Nov 6-7, 23		
Total Suspended Particulate (TSP) 24 Hours Average	mg/m <sup>3</sup>	High-Volume, Gravimetric	0.053	0.071	0.079	0.047	0.330	-
Particulate Size Less Than 10 Micron (PM10) 24 Hours Average	mg/m <sup>3</sup>	PM10 Size Selective, High-Volume, Gravimetric	0.030	0.038	0.043	0.027	0.120	-
Particulate Size Less Than 2.5 Micron (PM2.5) 24 Hours Average	µg/m <sup>3</sup>	PM2.5 Size, Low-Volume Air Sampler, Gravimetric Method	23.5	28.0	23.3	18.4	12.0	37.5

**Remark :** <sup>1\*</sup> Notification of National Environmental Board, No.10, B.E.2538 (1995), published in the Royal Government Gazette No.112 Part 403 dated May 25, B.E.2538 (1995) and Notification No.24, B.E.2547 (2004), published in the Royal Government Gazette No.121 Special Part 1040 dated September 22, B.E.2547 (2004), under the Enhancement and Conservation of National Environmental Quality Act B.E.2535 (1992).  
<sup>2\*</sup> Notification of National Environmental Board, B.E.2555 (2012), published in the Royal Government Gazette No.139 Special Part 1630 dated July 8, B.E.2555 (2012) under the Enhancement and Conservation of National Environmental Quality Act B.E.2535 (1992).

[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]



**ANALYSIS REPORT**

**Customer Name** : TLT Consultants Company Limited  
**Address** : 152 Nuan Chan Road, Nuan Chan, Bueng Kum, Bangkok 10230  
**Project Location** : โครงการก่อสร้างท่าอากาศยาน  
**Measured Source** : ส่วนผสมของอากาศภายในห้องปฏิบัติการ  
**Measured Point** : รัศมีในทิศทาง (ทิศทางเหนือ) ด้านผสมของอากาศภายในห้องปฏิบัติการ  
**GPS, Coordinate** : UTM (WGS84) 47P 0583269 E, 1593771 N  
**Measured Date** : November 2-7, 2023  
**Measured By** : Mr.Sittiporn Wongkham  
**Analyzed By** : Environment Research & Technology Co., Ltd.

**Quotation No.** : 2023-01515  
**Analysis No.** : 2023-ABES1-001 - 005  
**Report No.** : 2023-RAAV900  
**Report Date** : November 14, 2023

Date/Time	Nov 2-3, 23		Nov 3-4, 23		Nov 4-5, 23		Nov 5-6, 23		Nov 6-7, 23	
	WS	WD	WS	WD	WS	WD	WS	WD	WS	WD
09:00-10:00	1.8	N	1.3	N	1.3	N	1.3	N	1.3	N
10:00-11:00	1.8	N	1.8	SSW	0.9	SW	1.3	N	0.9	N
11:00-12:00	3.1	S	2.7	SSE	1.3	N	0.9	SSE	0.9	NW
12:00-13:00	2.7	S	2.2	S	1.3	N	0.9	N	1.3	NW
13:00-14:00	1.8	N	2.2	SSE	0.9	N	0.9	SW	0.9	N
14:00-15:00	2.2	N	1.8	SSE	0.9	WNW	1.8	N	1.3	S
15:00-16:00	2.2	N	1.8	SSE	1.3	N	1.3	N	2.7	SSE
16:00-17:00	1.8	N	1.3	S	1.3	N	1.8	SSE	2.2	SSE
17:00-18:00	1.3	NW	1.3	SE	1.8	S	0.9	SSW	2.7	SSE
18:00-19:00	0.9	N	0.9	SSE	1.8	SSW	2.7	S	0.9	SSE
19:00-20:00	0.4	NNE	0.4	E	1.8	SSW	0.9	NNE	0.4	SSE
20:00-21:00	0.9	NNE	0.9	ESE	1.3	SE	0.9	N	0.4	N
21:00-22:00	0.4	NE	0.4	NNE	0.4	E	1.3	N	0.9	N
22:00-23:00	0.9	N	0.4	NNE	1.3	SE	0.4	N	1.3	N
23:00-00:00	1.3	N	<0.4	Calm	1.8	ESE	0.9	S	1.3	NE
00:00-01:00	1.3	N	1.3	NNE	0.4	ENE	0.4	N	2.7	SSE
01:00-02:00	2.7	N	0.4	NNE	0.4	ENE	0.9	NNE	2.2	N
02:00-03:00	2.7	N	0.4	NW	0.4	ENE	0.4	NNE	1.8	N
03:00-04:00	1.8	N	<0.4	Calm	0.4	NNE	0.4	NNE	1.8	SE
04:00-05:00	1.3	NNE	0.4	S	0.4	NNE	1.3	N	2.7	N
05:00-06:00	0.4	NNE	0.4	NNE	<0.4	Calm	0.9	N	2.7	N
06:00-07:00	0.4	NNE	0.4	SSE	<0.4	Calm	<0.4	NW	1.3	N
07:00-08:00	<0.4	Calm	<0.4	Calm	<0.4	Calm	<0.4	Calm	0.9	N
08:00-09:00	0.9	NNE	0.4	SSE	0.4	NNE	0.4	N	0.9	NNE

Remark : WS = Wind Speed (m/s)  
 WD = Wind direction  
 Height of wind vane and anemometer above ground 10 meters.

[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]

**ANALYSIS REPORT**

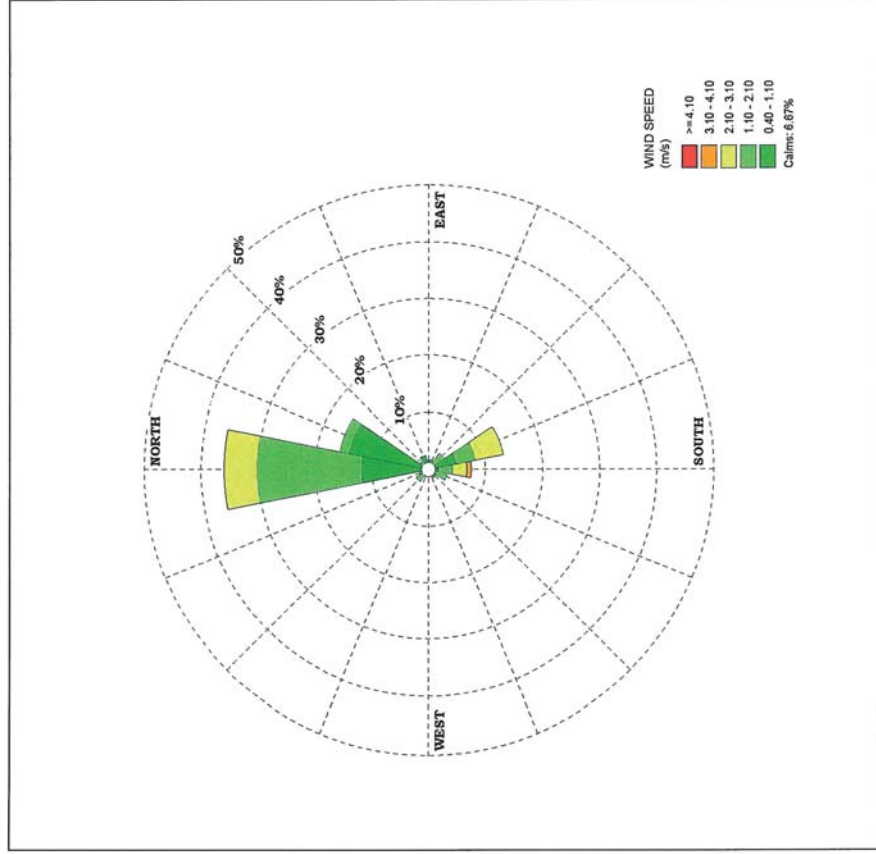
**Customer Name** : TLT Consultants Company Limited  
**Address** : 152 Nuan Chan Road, Nuan Chan, Bueng Kum, Bangkok 10230  
**Project Location** : โครงการก่อสร้างท่าอากาศยาน  
**Measured Source** : ส่วนผสมของอากาศภายในห้องปฏิบัติการ  
**Measured Point** : รัศมีในทิศทาง (ทิศทางเหนือ) ด้านผสมของอากาศภายในห้องปฏิบัติการ  
**GPS, Coordinate** : UTM (WGS84) 47P 0583269 E, 1593771 N  
**Measured Date** : November 2-7, 2023  
**Measured By** : Mr.Sittiporn Wongkham  
**Analyzed By** : Environment Research & Technology Co., Ltd.

**Quotation No.** : 2023-01515  
**Analysis No.** : 2023-ABES1-001 - 005  
**Report No.** : 2023-RAAV900  
**Report Date** : November 14, 2023

Wind Direction	Percentage frequency of wind in each speed and direction							Total
	0.4-1.1	1.1-2.1	2.1-3.1	3.1-4.1	≥4.1			
N	11.66670	18.33330	5.83333	0.00000	0.00000	0.00000	35.83333	
NNE	14.16670	1.66667	0.00000	0.00000	0.00000	0.00000	15.83337	
NE	0.83333	0.83333	0.00000	0.00000	0.00000	0.00000	1.66666	
ENE	2.50000	0.00000	0.00000	0.00000	0.00000	0.00000	2.50000	
E	1.66667	0.00000	0.00000	0.00000	0.00000	0.00000	1.66667	
ESE	0.83333	0.83333	0.00000	0.00000	0.00000	0.00000	1.66666	
SE	0.00000	3.33333	0.00000	0.00000	0.00000	0.00000	3.33333	
SSE	5.00000	3.33333	5.00000	0.00000	0.00000	0.00000	13.33333	
S	1.66667	2.50000	2.50000	0.83333	0.00000	0.00000	7.50000	
SSW	0.83333	2.50000	0.00000	0.00000	0.00000	0.00000	3.33333	
SW	1.66667	0.00000	0.00000	0.00000	0.00000	0.00000	1.66667	
WSW	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
W	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
WNW	0.83333	0.00000	0.00000	0.00000	0.00000	0.00000	0.83333	
NW	0.83333	1.66667	0.00000	0.00000	0.00000	0.00000	2.50000	
NW	1.66667	0.00000	0.00000	0.00000	0.00000	0.00000	1.66667	
Calm							6.66667	

### ANALYSIS REPORT

Customer Name : TLT Consultants Company Limited  
 Project Name : โครงการจัดวางผังชุมชนโกลด์ฟิช  
 Measured Point : จุดวัดลมที่สวน (สวนโกลด์ฟิช) ด้านถนนบ่อประมง ด้านตลาดเจริญกรุง  
 Measured Date : November 2-7, 2023  
 Report No. : 2023-RAAV900



WIND SPEED (m/s)  
 >=4.10  
 3.10 - 4.10  
 2.10 - 3.10  
 1.10 - 2.10  
 0.40 - 1.10  
 Calm: 6.67%

### ANALYSIS REPORT

Customer Name : TLT Consultants Company Limited  
 Address : 152 Nuan Chan Road, Nuan Chan, Bueng Kum, Bangkok 10230  
 Project Name : โครงการจัดวางผังชุมชนโกลด์ฟิช  
 Project Location : ด้านถนนบ่อประมง ด้านตลาดเจริญกรุง  
 Measured Source : Ambient Air Quality  
 Measured Point : จุดวัดลมที่สวน (สวนโกลด์ฟิช) ด้านถนนบ่อประมง ด้านตลาดเจริญกรุง  
 GPS Coordinate : UTM (WGS84) 47P 0580042 E, 1592064 N  
 Measured Date : November 2-7, 2023  
 Measured By : Mr. Sittiporn Wongkham  
 Analyzed By : Environment Research & Technology Co., Ltd.

Date/Time	Nov 2-3, 23		Nov 3-4, 23		Nov 4-5, 23		Nov 5-6, 23		Nov 6-7, 23	
	WS	WD	WS	WD	WS	WD	WS	WD	WS	WD
10:00-11:00	2.2	N	1.3	N	0.4	SW	0.9	NNW	0.4	NNW
11:00-12:00	2.2	NE	1.8	N	0.9	N	0.9	NNE	0.4	NNE
12:00-13:00	2.2	NE	1.8	E	1.3	N	0.9	NNW	0.9	NE
13:00-14:00	2.2	NE	1.3	E	0.9	N	0.9	N	1.3	N
14:00-15:00	1.8	N	1.3	NE	0.9	N	0.9	SSW	1.3	NE
15:00-16:00	2.2	NE	1.8	E	0.9	N	1.3	NNW	1.8	E
16:00-17:00	2.2	NE	1.3	E	1.3	NE	0.9	NW	1.8	ENE
17:00-18:00	1.8	NE	0.9	E	1.8	NE	0.4	SW	1.3	ENE
18:00-19:00	0.9	NE	0.4	E	1.3	ENE	3.1	S	0.4	ENE
19:00-20:00	0.4	NE	<0.4	Calm	0.9	ENE	0.9	NNW	<0.4	Calm
20:00-21:00	<0.4	Calm	<0.4	Calm	<0.4	Calm	<0.4	Calm	<0.4	Calm
21:00-22:00	<0.4	Calm	<0.4	Calm	<0.4	Calm	<0.4	Calm	<0.4	NNE
22:00-23:00	<0.4	Calm	0.4	NNW	0.4	S	<0.4	Calm	0.4	N
23:00-00:00	<0.4	Calm	<0.4	Calm	<0.4	Calm	<0.4	Calm	0.9	NW
00:00-01:00	0.9	N	0.4	W	<0.4	Calm	<0.4	Calm	0.9	ENE
01:00-02:00	0.9	NNW	<0.4	Calm	<0.4	Calm	<0.4	Calm	0.9	NE
02:00-03:00	1.3	N	0.4	NNW	<0.4	Calm	<0.4	Calm	0.9	W
03:00-04:00	0.9	N	0.4	NNW	<0.4	Calm	<0.4	Calm	0.4	WSW
04:00-05:00	0.4	N	0.4	NNW	<0.4	Calm	<0.4	Calm	0.9	NW
05:00-06:00	0.9	N	0.9	NNW	<0.4	Calm	<0.4	Calm	0.9	NNW
06:00-07:00	0.4	N	<0.4	Calm	<0.4	Calm	<0.4	Calm	1.8	N
07:00-08:00	0.4	N	<0.4	Calm	<0.4	Calm	<0.4	Calm	0.9	N
08:00-09:00	1.3	N	<0.4	Calm	<0.4	Calm	<0.4	Calm	0.4	N
09:00-10:00	1.8	N	<0.4	Calm	0.9	N	0.4	NNW	1.3	N

Remark : WS = Wind Speed (m/s)  
 WD = Wind Direction  
 Height of wind vane and anemometer above ground 10 meters.

[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]



### ANALYSIS REPORT

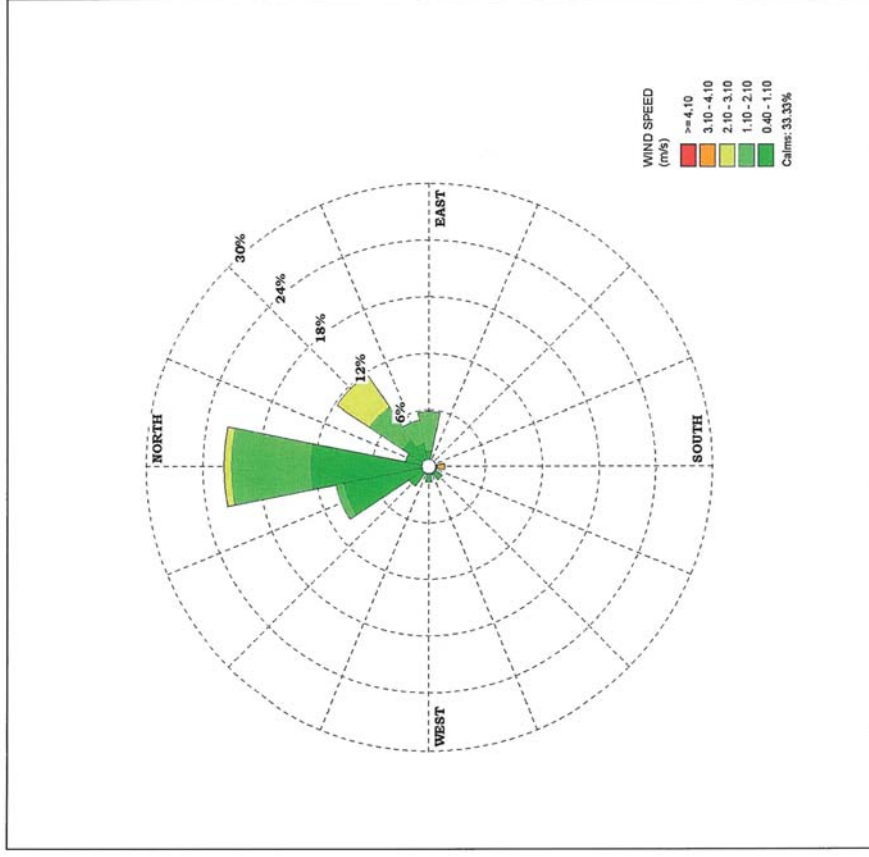
**Customer Name** : TLT Consultants Company Limited  
**Address** : 152 Nuan Chan Road, Nuan Chan, Bueng Kum, Bangkok 10230  
**Project Name** : โครงการจัดวางพื้นที่พัฒนาระบบ  
**Project Location** : ส่วนประกอบด้านคุณภาพอากาศ จังหัดกาญจนบุรี  
**Measured Source** : Ambient Air Quality  
**Measured Point** : ฟ้ามนัสการก่อสร้าง ส่วนประกอบด้านคุณภาพอากาศ จังหัดกาญจนบุรี  
**GPS. Coordinate** : UTM (WGS84) 47P 0580042 E, 1592064 N  
**Measured Date** : November 2-7, 2023  
**Measured By** : Mr.Sittiporn Wongkham  
**Analyzed By** : Environment Research & Technology Co., Ltd.

**Quotation No.** : 2023-01515  
**Analysis No.** : 2023-AE850-006 - 010,  
2023-AE851-008 - 012  
**Report No.** : 2023-RAAV902  
**Report Date** : November 14, 2023

Wind Direction	Percentage frequency of wind in each speed and direction					Total
	0.4-1.1	1.1-2.1	2.1-3.1	3.1-4.1	≥4.1	
N	12.50000	8.33333	0.83333	0.00000	0.00000	21.66666
NNE	2.50000	0.00000	0.00000	0.00000	0.00000	2.50000
NE	3.33333	4.16667	4.16667	0.00000	0.00000	11.66667
ENE	2.50000	2.50000	0.00000	0.00000	0.00000	5.00000
E	1.66667	4.16667	0.00000	0.00000	0.00000	5.83334
ESE	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
SE	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
SSE	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
S	0.83333	0.00000	0.00000	0.83333	0.00000	1.66666
SSW	0.83333	0.00000	0.00000	0.00000	0.00000	0.83333
SW	1.66667	0.00000	0.00000	0.00000	0.00000	1.66667
WSW	0.83333	0.00000	0.00000	0.00000	0.00000	0.83333
W	1.66667	0.00000	0.00000	0.00000	0.00000	1.66667
WNW	0.83333	0.00000	0.00000	0.00000	0.00000	0.83333
NW	2.50000	0.00000	0.00000	0.00000	0.00000	2.50000
NNW	9.16667	0.83333	0.00000	0.00000	0.00000	10.00000
Calm	33.33333					0.00000

### ANALYSIS REPORT

**Customer Name** : TLT Consultants Company Limited  
**Project Name** : โครงการจัดวางพื้นที่พัฒนาระบบ  
**Measured Point** : ส่วนประกอบด้านคุณภาพอากาศ จังหัดกาญจนบุรี  
**Measured Date** : November 2-7, 2023  
**Report No.** : 2023-RAAV902



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**Noise Level**



**ANALYSIS REPORT**

**Customer Name** : TLT Consultants Company Limited  
**Address** : 152 Nuan Chan Road, Nuan Chan, Bueng Kum, Bangkok 10230  
**Project Name** : โครงการจัดพื้นที่ เขื่อนน้ำโจน  
**Project Location** : ตำบลหนองปรือ อำเภอบางกรวย จังหวัดกาญจนบุรี  
**Measured Source** : Ambient Noise  
**Measured Point** : บริเวณประตูระบายน้ำโครงการ หมู่ที่ 4 บริเวณฝั่งขวา ตำบลหนองปรือ อำเภอบางกรวย จังหวัดกาญจนบุรี  
**GPS. Coordinate** : UTM (WGS84) 47P 0582266 E, 1593064 N  
**Quotation No.** : 2023-00605  
**Analysis No.** : 2023-AC101-011  
**Report No.** : 2023-04AK432  
**Measured Date** : May 25-26, 2023  
**Measured By** : Mr.Nitad Sirichad  
**Analyzed By** : Environment Research & Technology Co., Ltd.  
**Measured Instrument** : Integrating Sound Level Meter RION Model NL-21 Serial Number 00754448

Interval Time	Noise Level, dB(A)									
	Leq	Lmax	LS	L10	L50	L90	LS	L10	L50	L90
08:00-09:00	38.6	64.5	42.2	44.4	33.9	31.1	42.2	44.4	33.9	31.1
09:00-10:00	34.5	52.6	39.4	37.0	31.6	30.7	39.4	37.0	31.6	30.7
10:00-11:00	38.0	66.3	49.2	42.1	33.6	31.0	42.1	33.6	31.5	30.1
11:00-12:00	34.5	56.8	39.3	36.8	31.5	30.1	36.8	31.5	30.5	29.6
12:00-13:00	34.5	60.0	42.1	36.8	30.5	29.6	42.1	36.8	30.5	29.6
13:00-14:00	44.9	70.1	51.1	44.9	39.5	34.5	51.1	44.9	39.5	34.5
14:00-15:00	44.9	71.1	53.2	48.8	38.7	34.5	48.8	38.7	38.7	34.5
15:00-16:00	47.6	74.3	56.2	51.4	40.3	34.4	51.4	40.3	36.6	31.5
16:00-17:00	43.7	70.7	54.0	50.0	36.6	31.5	50.0	36.6	39.5	32.8
17:00-18:00	46.8	73.2	56.0	51.0	39.5	32.8	51.0	39.5	38.1	34.2
18:00-19:00	42.5	78.1	55.3	48.4	38.1	34.2	48.4	38.1	45.2	39.4
19:00-20:00	43.3	74.3	47.1	45.2	40.6	39.4	45.2	40.6	41.2	39.5
20:00-21:00	41.5	67.5	43.4	42.8	41.2	39.8	43.4	41.2	41.9	39.7
21:00-22:00	40.6	51.9	41.9	41.4	40.4	40.9	41.9	41.4	41.7	40.9
22:00-23:00	42.2	57.0	44.2	43.1	41.7	40.9	44.2	43.1	44.1	39.5
23:00-00:00	40.5	63.9	44.1	41.2	40.2	39.5	44.1	40.2	41.6	39.9
00:00-01:00	40.2	78.0	41.6	40.8	39.9	39.4	41.6	40.8	41.8	38.9
01:00-02:00	40.2	75.2	45.0	41.8	39.8	38.9	45.0	41.8	44.9	39.1
02:00-03:00	39.9	71.7	43.4	41.9	39.1	38.4	43.4	41.9	40.7	39.4
03:00-04:00	39.9	71.8	43.6	40.7	39.4	38.4	43.6	40.7	42.2	38.3
04:00-05:00	39.9	74.1	45.4	42.2	38.3	36.7	42.2	38.3	45.2	40.0
05:00-06:00	47.6	76.5	62.2	57.4	45.2	40.0	57.4	45.2	54.1	44.9
06:00-07:00	49.7	84.5	57.2	54.1	44.9	38.6	54.1	44.9	54.2	37.3
07:00-08:00	50.3	75.7	56.7	54.2	44.9	37.3	56.7	54.2	48.9	40.3
<b>24 Hours Measurement</b>	<b>44.1</b>	<b>84.5</b>	<b>53.5</b>	<b>48.9</b>	<b>40.3</b>	<b>37.2</b>	<b>53.5</b>	<b>48.9</b>	<b>40.3</b>	<b>37.2</b>
<b>Standard<sup>1</sup></b>	<b>70</b>	<b>115</b>	-	-	-	-	-	-	-	-
<b>Ldn</b>	<b>50.5</b>	-	-	-	-	-	-	-	-	-

Remark : <sup>1</sup> Notification of National Environmental Board, No.15, B.E.2540 (1997) under the Enhancement and Conservation of National Environmental Quality Act B.E.2535 (1992), published in the Royal Government Gazette No.114 Part 270 dated April 3, B.E.2540 (1997).

[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]



**ANALYSIS REPORT**

**Customer Name** : TLT Consultants Company Limited  
**Address** : 152 Nuan Chan Road, Nuan Chan, Bueng Kum, Bangkok 10230  
**Project Name** : โครงการจัดพื้นที่ เขื่อนน้ำโจน  
**Project Location** : ตำบลหนองปรือ อำเภอบางกรวย จังหวัดกาญจนบุรี  
**Measured Source** : Ambient Noise  
**Measured Point** : บริเวณประตูระบายน้ำโครงการ หมู่ที่ 4 บริเวณฝั่งขวา ตำบลหนองปรือ อำเภอบางกรวย จังหวัดกาญจนบุรี  
**GPS. Coordinate** : UTM (WGS84) 47P 0582266 E, 1593064 N  
**Quotation No.** : 2023-00605  
**Analysis No.** : 2023-AC101-011  
**Report No.** : 2023-04AK432  
**Measured Date** : May 26-27, 2023  
**Measured By** : Mr.Nitad Sirichad  
**Analyzed By** : Environment Research & Technology Co., Ltd.  
**Measured Instrument** : Integrating Sound Level Meter RION Model NL-21 Serial Number 00754448

Interval Time	Noise Level, dB(A)									
	Leq	Lmax	LS	L10	L50	L90	LS	L10	L50	L90
08:00-09:00	48.3	75.7	54.3	51.4	42.9	35.4	54.3	51.4	42.9	35.4
09:00-10:00	51.0	77.3	59.5	55.0	44.7	38.0	59.5	55.0	44.7	38.0
10:00-11:00	48.5	76.0	54.1	51.7	41.6	36.4	54.1	51.7	41.6	36.4
11:00-12:00	48.1	86.6	53.9	48.1	44.1	38.5	53.9	48.1	44.1	38.5
12:00-13:00	47.8	73.5	54.4	51.3	41.2	35.5	54.4	51.3	41.2	35.5
13:00-14:00	45.8	70.0	52.7	50.1	39.5	34.3	52.7	50.1	40.6	33.6
14:00-15:00	45.2	71.3	51.4	47.3	38.3	34.0	51.4	47.3	45.0	39.8
15:00-16:00	45.6	73.5	51.5	49.2	41.6	36.3	51.5	49.2	41.6	36.3
16:00-17:00	44.3	73.8	49.4	49.4	40.6	34.1	49.4	40.6	41.7	40.7
17:00-18:00	43.1	69.9	47.1	44.7	41.7	40.7	47.1	44.7	47.8	47.0
18:00-19:00	48.0	70.6	49.2	48.8	44.6	43.3	49.2	48.8	44.6	43.3
19:00-20:00	44.9	60.0	46.1	45.8	46.1	45.3	46.1	45.8	46.2	45.3
20:00-21:00	46.7	71.9	48.2	47.5	46.2	45.3	48.2	47.5	46.2	45.3
21:00-22:00	44.1	53.9	45.8	45.3	43.7	42.8	45.8	45.3	46.9	45.1
22:00-23:00	46.1	59.4	47.2	46.9	45.9	45.1	47.2	46.9	46.7	45.7
23:00-00:00	46.9	51.5	48.5	48.2	46.7	45.7	48.5	48.2	37.8	36.9
00:00-01:00	38.3	58.7	39.7	39.3	38.0	37.1	39.7	39.3	38.0	37.1
01:00-02:00	39.8	76.9	41.5	41.5	39.0	38.1	41.5	41.5	46.4	41.0
02:00-03:00	52.0	77.2	62.4	57.2	46.4	40.1	62.4	57.2	57.0	40.1
03:00-04:00	51.1	97.6	75.0	57.0	46.3	40.1	75.0	57.0	53.0	43.2
04:00-05:00	49.0	75.9	55.9	53.0	43.2	37.1	55.9	53.0	43.2	41.0
05:00-06:00	47.4	84.5	56.7	54.2	44.9	37.3	56.7	54.2	48.9	40.3
06:00-07:00	44.1	84.5	53.5	48.9	40.3	37.2	53.5	48.9	40.3	37.2
07:00-08:00	44.1	84.5	53.5	48.9	40.3	37.2	53.5	48.9	40.3	37.2
<b>24 Hours Measurement</b>	<b>47.4</b>	<b>97.6</b>	<b>62.1</b>	<b>51.5</b>	<b>43.8</b>	<b>41.0</b>	<b>62.1</b>	<b>51.5</b>	<b>43.8</b>	<b>41.0</b>
<b>Standard<sup>1</sup></b>	<b>70</b>	<b>115</b>	-	-	-	-	-	-	-	-
<b>Ldn</b>	<b>53.7</b>	-	-	-	-	-	-	-	-	-

Remark : <sup>1</sup> Notification of National Environmental Board, No.15, B.E.2540 (1997) under the Enhancement and Conservation of National Environmental Quality Act B.E.2535 (1992), published in the Royal Government Gazette No.114 Part 270 dated April 3, B.E.2540 (1997).

[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]





**ANALYSIS REPORT**

**Customer Name** : TLT Consultants Company Limited  
**Address** : 152 Nuan Chan Road, Nuan Chan, Bueng Kum, Bangkok 10230  
**Project Name** : โครงการโรงไฟฟ้า พหลโยธิน  
**Project Location** : ส่วนพัฒนาแหล่ง อากาศภายใน จังหวัดกาญจนบุรี  
**Measured Source** : Ambient Noise  
**Measured Point** : บริเวณด้านทิศตะวันตกของโครงการ หมู่ที่ 4 บริเวณฝั่งเหนือ ส่วนพัฒนาแหล่ง อากาศภายใน จังหวัดกาญจนบุรี  
**GPS. Coordinate** : UTM (WGS84) 47P 0582266 E, 1593064 N  
**Measured Date** : May 27-28, 2023  
**Measured By** : Mr.Nitad Srichad  
**Analyzed By** : Environment Research & Technology Co., Ltd.  
**Measured Instrument** : Integrating Sound Level Meter RION Model NL-21 Serial Number 00754448

**ANALYSIS REPORT**

**Customer Name** : TLT Consultants Company Limited  
**Address** : 152 Nuan Chan Road, Nuan Chan, Bueng Kum, Bangkok 10230  
**Project Name** : โครงการโรงไฟฟ้า พหลโยธิน  
**Project Location** : ส่วนพัฒนาแหล่ง อากาศภายใน จังหวัดกาญจนบุรี  
**Measured Source** : Ambient Noise  
**Measured Point** : บริเวณด้านทิศตะวันตกของโครงการ หมู่ที่ 4 บริเวณฝั่งเหนือ ส่วนพัฒนาแหล่ง อากาศภายใน จังหวัดกาญจนบุรี  
**GPS. Coordinate** : UTM (WGS84) 47P 0582266 E, 1593064 N  
**Measured Date** : May 28-29, 2023  
**Measured By** : Mr.Nitad Srichad  
**Analyzed By** : Environment Research & Technology Co., Ltd.  
**Measured Instrument** : Integrating Sound Level Meter RION Model NL-21 Serial Number 00754448

Interval Time	Noise Level, dB(A)						
	Leq	Lmax	L5	L10	L50	L90	L90
08:00-09:00	49.3	75.4	57.4	54.0	44.4	36.7	36.7
09:00-10:00	49.2	75.5	54.1	51.7	44.7	39.7	39.7
10:00-11:00	49.5	77.4	56.8	52.7	44.3	39.5	39.5
11:00-12:00	50.2	79.5	56.5	53.9	45.7	40.8	40.8
12:00-13:00	46.4	75.9	55.1	50.6	43.2	38.4	38.4
13:00-14:00	44.2	74.5	53.8	50.2	37.2	32.5	32.5
14:00-15:00	43.1	71.0	48.5	45.8	37.6	32.9	32.9
15:00-16:00	43.3	89.5	51.8	47.2	37.6	30.9	30.9
16:00-17:00	48.5	94.9	56.4	53.0	44.6	39.9	39.9
17:00-18:00	46.9	94.5	53.5	50.8	41.3	35.8	35.8
18:00-19:00	45.6	71.5	50.0	47.8	42.1	38.1	38.1
19:00-20:00	42.9	68.3	48.0	44.7	40.2	39.0	39.0
20:00-21:00	42.2	86.9	44.3	43.0	41.5	40.8	40.8
21:00-22:00	47.2	99.8	48.3	48.3	46.5	45.4	45.4
22:00-23:00	47.4	74.4	48.8	48.2	47.0	46.3	46.3
23:00-00:00	42.7	68.4	44.1	43.4	42.3	41.5	41.5
00:00-01:00	43.1	56.0	44.2	43.9	42.9	42.2	42.2
01:00-02:00	43.3	54.6	45.6	45.2	42.7	41.6	41.6
02:00-03:00	42.4	44.2	44.2	43.7	42.1	41.2	41.2
03:00-04:00	44.1	61.6	45.3	45.1	43.9	42.9	42.9
04:00-05:00	44.4	76.6	52.1	45.5	43.8	42.9	42.9
05:00-06:00	47.8	77.6	57.7	53.4	44.3	40.0	40.0
06:00-07:00	50.9	78.6	63.0	58.7	45.5	38.7	38.7
07:00-08:00	49.5	72.0	56.3	53.2	43.4	36.3	36.3
<b>24 Hours Measurement</b>	<b>46.9</b>	<b>94.9</b>	<b>54.6</b>	<b>51.0</b>	<b>43.5</b>	<b>40.7</b>	<b>40.7</b>
<b>Standard<sup>1)</sup></b>	<b>70</b>	<b>115</b>	-	-	-	-	-
<b>Ldn</b>	<b>52.7</b>	-	-	-	-	-	-

Remark: <sup>1)</sup> Notification of National Environmental Board, No.15, B.E.2546 (1997) under the Enhancement and Conservation of National Environmental Quality Act, B.E.2535 (1992), published in the Royal Government Gazette No.114 Part 27D dated April 3, B.E.2540 (1997).

[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]

Interval Time	Noise Level, dB(A)						
	Leq	Lmax	L5	L10	L50	L90	L90
08:00-09:00	49.4	72.8	57.5	52.6	43.6	37.5	37.5
09:00-10:00	50.6	77.7	56.6	53.9	45.7	38.5	38.5
10:00-11:00	49.8	79.6	54.3	52.4	47.1	44.3	44.3
11:00-12:00	51.5	82.4	56.8	55.3	48.3	43.2	43.2
12:00-13:00	51.5	79.4	60.7	57.3	45.9	39.6	39.6
13:00-14:00	48.2	73.1	54.8	51.3	41.4	36.7	36.7
14:00-15:00	48.8	66.5	55.4	52.8	43.5	35.2	35.2
15:00-16:00	43.5	71.7	53.7	50.2	37.5	31.4	31.4
16:00-17:00	45.7	65.0	51.8	49.7	41.3	35.3	35.3
17:00-18:00	40.3	72.3	49.4	42.5	36.2	32.8	32.8
18:00-19:00	51.6	75.4	58.5	56.0	43.6	32.9	32.9
19:00-20:00	42.8	65.6	47.3	45.1	40.5	38.7	38.7
20:00-21:00	48.6	71.1	52.0	51.2	47.7	44.9	44.9
21:00-22:00	49.8	78.4	55.5	53.6	47.5	43.4	43.4
22:00-23:00	55.1	94.4	63.2	62.8	54.1	52.1	52.1
23:00-00:00	48.8	63.6	50.5	50.1	48.6	46.9	46.9
00:00-01:00	42.5	58.2	44.8	44.2	41.9	40.1	40.1
01:00-02:00	41.6	51.2	43.2	42.8	41.3	40.3	40.3
02:00-03:00	40.5	45.5	41.4	41.1	40.2	39.4	39.4
03:00-04:00	42.4	50.0	43.6	43.4	42.1	41.3	41.3
04:00-05:00	42.1	74.2	48.5	45.4	40.6	39.6	39.6
05:00-06:00	47.1	76.1	59.2	52.0	42.9	39.1	39.1
06:00-07:00	49.7	72.8	57.1	53.9	45.0	37.6	37.6
07:00-08:00	48.0	72.2	54.3	51.3	42.7	37.3	37.3
<b>24 Hours Measurement</b>	<b>48.8</b>	<b>94.4</b>	<b>55.9</b>	<b>53.6</b>	<b>45.7</b>	<b>42.5</b>	<b>42.5</b>
<b>Standard<sup>1)</sup></b>	<b>70</b>	<b>115</b>	-	-	-	-	-
<b>Ldn</b>	<b>54.9</b>	-	-	-	-	-	-

Remark: <sup>1)</sup> Notification of National Environmental Board, No.15, B.E.2546 (1997) under the Enhancement and Conservation of National Environmental Quality Act, B.E.2535 (1992), published in the Royal Government Gazette No.114 Part 27D dated April 3, B.E.2540 (1997).

[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]



**ANALYSIS REPORT**

**Customer Name** : TLT Consultants Company Limited  
**Address** : 1152 Nuan Chan Road, Nuan Chan, Bueng Kum, Bangkok 10230  
**Project Name** : โครงการวิจัยพัฒนาโรงงาน  
**Project Location** : ส่วนผสมและห้อง อากาศภายใน โรงไฟฟ้าถ่านหิน  
**Measured Source** : Ambient Noise  
**Measured Point** : บริเวณด้านตะวันออกของโครงการ หมู่ที่ 4 บริเวณฝั่งขวา ส่วนผสมและห้อง อากาศภายใน โรงไฟฟ้าถ่านหิน  
**GPS. Coordinate** : UTM (WGS84) 47P 0582266 E, 1593064 N  
**Measured Date** : May 29-30, 2023  
**Measured By** : Mr.Nitad Sirichad  
**Analyzed By** : Environment Research & Technology Co., Ltd.  
**Measured Instrument** : Integrating Sound Level Meter RION Model NL-21 Serial Number 00754448

**ANALYSIS REPORT**

**Customer Name** : TLT Consultants Company Limited  
**Address** : 1152 Nuan Chan Road, Nuan Chan, Bueng Kum, Bangkok 10230  
**Project Name** : โครงการวิจัยพัฒนาโรงงาน  
**Project Location** : ส่วนผสมและห้อง อากาศภายใน โรงไฟฟ้าถ่านหิน  
**Measured Source** : Ambient Noise  
**Measured Point** : บริเวณด้านตะวันออกของโครงการ หมู่ที่ 9 บริเวณฝั่งขวา ส่วนผสมและห้อง อากาศภายใน โรงไฟฟ้าถ่านหิน  
**GPS. Coordinate** : UTM (WGS84) 47P 0581010 E, 1592490 N  
**Measured Date** : May 25-26, 2023  
**Measured By** : Mr.Nitad Sirichad  
**Analyzed By** : Environment Research & Technology Co., Ltd.  
**Measured Instrument** : Integrating Sound Level Meter RION Model NL-21 Serial Number 01009847

Interval Time	Noise Level, dB(A)									
	Leq	Lmax	LS	L10	L50	L90	LS	L10	L50	L90
08:00-09:00	47.1	79.3	53.4	50.6	43.2	37.8	47.1	50.6	43.2	37.8
09:00-10:00	49.7	80.3	57.1	54.3	45.4	39.0	49.7	54.3	45.4	39.0
10:00-11:00	47.8	69.0	53.8	50.8	43.3	38.1	47.8	50.8	43.3	38.1
11:00-12:00	45.9	71.3	51.3	49.0	42.9	38.3	45.9	49.0	42.9	38.3
12:00-13:00	43.2	83.4	48.2	46.1	39.4	35.5	43.2	46.1	39.4	35.5
13:00-14:00	48.6	76.6	54.0	51.8	43.3	36.6	48.6	51.8	43.3	36.6
14:00-15:00	47.6	89.1	57.4	54.2	41.6	35.3	47.6	54.2	41.6	35.3
15:00-16:00	45.2	68.3	51.1	48.9	41.3	36.2	45.2	48.9	41.3	36.2
16:00-17:00	43.5	69.6	50.5	47.0	36.6	30.6	43.5	47.0	36.6	30.6
17:00-18:00	42.0	69.3	48.4	45.0	35.8	31.3	42.0	45.0	35.8	31.3
18:00-19:00	41.9	61.8	47.4	45.2	38.1	33.1	41.9	45.2	38.1	33.1
19:00-20:00	44.6	57.0	46.4	45.9	44.3	42.5	44.6	45.9	44.3	42.5
20:00-21:00	45.4	62.8	46.9	46.5	44.9	43.4	45.4	46.5	44.9	43.4
21:00-22:00	43.4	72.6	45.2	44.5	43.0	41.9	43.4	44.5	43.0	41.9
22:00-23:00	49.5	63.9	52.8	51.6	49.0	48.2	49.5	51.6	49.0	48.2
23:00-00:00	46.4	50.8	46.4	48.8	46.2	45.2	46.4	48.8	46.2	45.2
00:00-01:00	44.6	57.1	45.5	45.3	44.2	42.8	44.6	45.3	44.2	42.8
01:00-02:00	44.9	49.8	45.8	45.6	44.7	43.1	44.9	45.6	44.7	43.1
02:00-03:00	42.6	48.7	43.4	43.2	42.3	41.3	42.6	43.2	42.3	41.3
03:00-04:00	39.8	57.8	42.1	41.4	39.0	38.2	39.8	41.4	39.0	38.2
04:00-05:00	37.6	74.7	54.5	41.6	37.2	36.5	37.6	41.6	37.2	36.5
05:00-06:00	48.7	74.9	59.3	54.9	44.4	39.1	48.7	54.9	44.4	39.1
06:00-07:00	48.3	76.3	55.4	52.9	43.2	36.7	48.3	52.9	43.2	36.7
07:00-08:00	50.1	99.0	58.7	52.8	43.3	36.1	50.1	52.8	43.3	36.1
<b>24 Hours Measurement</b>	<b>46.4</b>	<b>99.0</b>	<b>53.3</b>	<b>50.0</b>	<b>43.4</b>	<b>40.7</b>	<b>46.4</b>	<b>50.0</b>	<b>43.4</b>	<b>40.7</b>
<b>Standard<sup>1)</sup></b>	<b>70</b>	<b>115</b>	-	-	-	-	<b>70</b>	-	-	-
<b>Ldn</b>	<b>52.6</b>	-	-	-	-	-	<b>58.1</b>	-	-	-

Remark : <sup>1)</sup> Notification of National Environmental Board, No.15, B.E.2540 (1997) under the Enhancement and Conservation of National Environmental Quality Act B.E.2535 (1992), published in the Royal Government Gazette No.114 Part 27D dated April 3, B.E.2540 (1997).

[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]

Interval Time	Noise Level, dB(A)									
	Leq	Lmax	LS	L10	L50	L90	LS	L10	L50	L90
08:00-09:00	48.0	82.6	54.5	50.7	42.2	35.9	48.0	50.7	42.2	35.9
09:00-10:00	45.6	74.1	52.8	49.3	36.3	31.5	45.6	49.3	36.3	31.5
10:00-11:00	43.4	72.1	55.8	52.4	38.2	30.7	43.4	52.4	38.2	30.7
11:00-12:00	44.6	66.6	53.0	49.3	40.7	34.8	44.6	49.3	40.7	34.8
12:00-13:00	45.2	67.7	50.4	48.5	42.1	36.8	45.2	48.5	42.1	36.8
13:00-14:00	43.3	66.7	51.1	45.8	38.4	31.2	43.3	45.8	38.4	31.2
14:00-15:00	46.0	84.6	55.1	51.4	43.2	37.6	46.0	51.4	43.2	37.6
15:00-16:00	50.2	77.6	57.9	52.9	41.6	37.2	50.2	52.9	41.6	37.2
16:00-17:00	46.4	85.8	53.8	49.4	39.2	32.3	46.4	49.4	39.2	32.3
17:00-18:00	44.7	85.7	51.1	48.4	39.6	33.9	44.7	48.4	39.6	33.9
18:00-19:00	47.2	85.2	57.6	51.9	42.9	37.4	47.2	51.9	42.9	37.4
19:00-20:00	44.3	68.5	46.4	45.7	43.7	42.2	44.3	45.7	43.7	42.2
20:00-21:00	48.2	74.4	48.9	48.7	48.0	47.4	48.2	48.7	48.0	47.4
21:00-22:00	50.8	76.1	50.5	50.3	49.4	48.7	50.8	50.3	49.4	48.7
22:00-23:00	50.8	58.0	51.4	51.2	50.7	50.1	50.8	51.2	50.7	50.1
23:00-00:00	51.2	72.0	51.8	51.6	51.1	50.5	51.2	51.6	51.1	50.5
00:00-01:00	50.9	66.7	51.8	51.3	50.6	50.1	50.9	51.3	50.6	50.1
01:00-02:00	50.0	79.4	55.8	50.7	49.3	48.6	50.0	50.7	49.3	48.6
02:00-03:00	50.8	77.7	54.6	51.1	50.5	49.7	50.8	51.1	50.5	49.7
03:00-04:00	48.1	78.9	49.4	48.9	47.4	46.7	48.1	48.9	47.4	46.7
04:00-05:00	47.4	79.8	57.2	51.0	43.7	42.2	47.4	51.0	43.7	42.2
05:00-06:00	57.8	80.9	68.9	63.5	44.3	38.8	57.8	63.5	44.3	38.8
06:00-07:00	52.2	89.0	60.2	57.2	45.7	36.7	52.2	57.2	45.7	36.7
07:00-08:00	49.9	95.8	58.9	55.1	43.8	37.8	49.9	55.1	43.8	37.8
<b>24 Hours Measurement</b>	<b>49.7</b>	<b>95.8</b>	<b>57.9</b>	<b>53.5</b>	<b>46.3</b>	<b>44.9</b>	<b>49.7</b>	<b>53.5</b>	<b>46.3</b>	<b>44.9</b>
<b>Standard<sup>1)</sup></b>	<b>70</b>	<b>115</b>	-	-	-	-	<b>70</b>	-	-	-
<b>Ldn</b>	<b>58.1</b>	-	-	-	-	-	<b>58.1</b>	-	-	-

Remark : <sup>1)</sup> Notification of National Environmental Board, No.15, B.E.2540 (1997) under the Enhancement and Conservation of National Environmental Quality Act B.E.2535 (1992), published in the Royal Government Gazette No.114 Part 27D dated April 3, B.E.2540 (1997).

[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]



**ANALYSIS REPORT**

**Customer Name** : TLT Consultants Company Limited  
**Address** : 152 Nuan Chan Road, Nuan Chan, Bueng Kum, Bangkok 10230  
**Project Name** : โครงการวิจัยฯ ฟ้าผ่า ฟ้าผ่า ฟ้าผ่า  
**Project Location** : สถานพัฒนาและจัดการทรัพยากรจังหวัดกาญจนบุรี  
**Measured Source** : Ambient Noise  
**Measured Point** : บริเวณด้านทิศตะวันตกของโครงการ หมู่ที่ 9 บ้านต้นจามร ตำบลหนองปรือ อำเภอลาดบัวหลวง จังหวัดกาญจนบุรี  
**GPS. Coordinate** : UTM (WGS84) 47P 0581010 E, 1592490 N  
**Measured Date** : May 26-27, 2023  
**Measured By** : Mr.Nitad Srichad  
**Analyzed By** : Environment Research & Technology Co., Ltd.  
**Measured Instrument** : Integrating Sound Level Meter RION Model NL-21 Serial Number 01009847

**Quotation No.** : 2023-AC101-012  
**Report No.** : 2023-RAAK925  
**Report Date** : June 8, 2023

Interval Time	Noise Level, dB(A)									
	Leq	Lmax	LS	L10	L50	L90	LS	L10	L50	L90
08:00-09:00	48.8	67.4	54.8	52.4	44.2	38.0	48.8	52.4	44.2	38.0
09:00-10:00	48.3	67.0	55.9	51.5	41.0	35.5	48.3	51.5	41.0	35.5
10:00-11:00	43.3	70.4	49.4	46.6	38.4	33.9	44.4	45.6	37.2	33.9
11:00-12:00	46.5	80.1	55.5	52.7	42.7	35.1	47.8	53.7	40.4	38.3
12:00-13:00	42.3	75.4	51.1	44.6	35.0	32.0	42.6	46.1	44.9	36.4
13:00-14:00	41.6	82.0	52.5	44.8	37.7	34.0	45.0	52.7	45.0	34.9
14:00-15:00	43.0	79.9	54.2	49.8	37.3	33.0	43.7	75.1	48.4	33.9
15:00-16:00	42.9	74.9	49.0	45.8	36.1	32.0	48.0	81.7	56.4	34.8
16:00-17:00	49.0	84.4	56.8	53.7	45.1	41.1	49.5	79.7	54.7	39.4
17:00-18:00	45.9	78.5	54.5	50.1	41.5	36.8	49.5	79.4	54.9	38.1
18:00-19:00	47.7	77.8	53.1	50.4	42.7	37.5	46.7	70.4	50.6	40.3
19:00-20:00	43.9	70.0	46.1	42.4	43.4	42.4	43.2	63.6	44.9	41.6
20:00-21:00	47.4	76.2	49.1	47.9	47.2	46.5	50.0	65.1	51.1	48.9
21:00-22:00	49.4	82.1	50.0	49.8	49.2	48.6	57.1	51.0	50.9	49.5
22:00-23:00	49.5	66.5	50.2	49.9	49.3	48.6	49.7	63.3	50.5	48.9
23:00-00:00	49.2	56.5	50.0	49.8	48.8	48.0	49.6	77.8	54.4	48.7
00:00-01:00	48.6	55.5	49.1	49.0	48.4	47.8	48.8	64.9	49.4	48.2
01:00-02:00	48.4	78.7	57.8	52.4	47.7	47.0	48.6	70.3	49.4	47.8
02:00-03:00	47.5	78.7	49.4	47.5	47.3	46.7	48.6	56.5	49.4	47.9
03:00-04:00	47.5	73.4	48.9	48.1	47.4	46.7	48.8	77.4	56.4	46.9
04:00-05:00	51.2	79.7	62.7	55.9	43.1	41.7	47.6	78.6	59.8	44.6
05:00-06:00	58.8	87.9	68.3	63.8	41.5	37.1	54.3	87.6	69.5	38.7
06:00-07:00	46.6	70.5	54.3	50.7	40.1	36.2	47.8	86.0	55.2	33.2
07:00-08:00	51.6	80.6	57.0	53.7	46.7	44.1	48.4	83.5	54.4	33.2
<b>24 Hours Measurement</b>	<b>49.5</b>	<b>87.9</b>	<b>57.5</b>	<b>53.3</b>	<b>45.2</b>	<b>43.8</b>	<b>48.5</b>	<b>87.6</b>	<b>57.6</b>	<b>44.4</b>
<b>Standard<sup>1*</sup></b>	<b>70</b>	<b>115</b>	-	-	-	-	<b>70</b>	<b>115</b>	-	-
<b>Ldn</b>	<b>57.8</b>	-	-	-	-	-	<b>56.0</b>	-	-	-

Remark: <sup>1\*</sup> Notification of National Environmental Board, No.15, B.E.2546 (1997) under the Enhancement and Conservation of National Environmental Quality Act B.E.2535 (1992), published in the Royal Government Gazette No.114 Part 270 dated April 3, B.E.2546 (1997).

[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]

**ANALYSIS REPORT**

**Customer Name** : TLT Consultants Company Limited  
**Address** : 152 Nuan Chan Road, Nuan Chan, Bueng Kum, Bangkok 10230  
**Project Name** : โครงการวิจัยฯ ฟ้าผ่า ฟ้าผ่า ฟ้าผ่า  
**Project Location** : สถานพัฒนาและจัดการทรัพยากรจังหวัดกาญจนบุรี  
**Measured Source** : Ambient Noise  
**Measured Point** : บริเวณด้านทิศตะวันตกของโครงการ หมู่ที่ 9 บ้านต้นจามร ตำบลหนองปรือ อำเภอลาดบัวหลวง จังหวัดกาญจนบุรี  
**GPS. Coordinate** : UTM (WGS84) 47P 0581010 E, 1592490 N  
**Measured Date** : May 27-28, 2023  
**Measured By** : Mr.Nitad Srichad  
**Analyzed By** : Environment Research & Technology Co., Ltd.  
**Measured Instrument** : Integrating Sound Level Meter RION Model NL-21 Serial Number 01009847

**Quotation No.** : 2023-AC101-012  
**Report No.** : 2023-RAAK925  
**Report Date** : June 8, 2023

Interval Time	Noise Level, dB(A)									
	Leq	Lmax	LS	L10	L50	L90	LS	L10	L50	L90
08:00-09:00	46.8	70.4	52.5	48.8	40.8	39.5	46.8	48.8	40.8	39.5
09:00-10:00	43.2	72.6	51.4	47.3	36.1	31.9	43.2	47.3	36.1	31.9
10:00-11:00	44.4	69.8	50.2	45.6	37.2	33.9	44.4	45.6	37.2	33.9
11:00-12:00	47.8	71.7	53.7	50.7	44.3	38.3	47.8	50.7	44.3	38.3
12:00-13:00	42.6	62.4	46.1	44.9	40.4	36.4	42.6	44.9	40.4	36.4
13:00-14:00	45.0	52.7	45.0	46.4	38.8	34.9	45.0	46.4	38.8	34.9
14:00-15:00	43.7	75.1	48.4	45.1	36.8	32.9	43.7	45.1	36.8	32.9
15:00-16:00	48.0	81.7	56.4	52.2	40.2	34.8	48.0	52.2	40.2	34.8
16:00-17:00	49.5	79.7	54.7	50.9	43.4	39.4	49.5	50.9	43.4	39.4
17:00-18:00	49.5	79.4	54.9	51.7	43.1	38.1	49.5	51.7	43.1	38.1
18:00-19:00	46.7	70.4	50.6	48.7	43.7	40.3	46.7	48.7	43.7	40.3
19:00-20:00	43.2	63.6	44.9	44.3	42.7	41.6	43.2	44.9	42.7	41.6
20:00-21:00	50.0	65.1	51.1	50.9	49.6	48.9	50.0	50.9	49.6	48.9
21:00-22:00	57.1	51.0	50.9	50.9	49.5	48.9	57.1	51.0	49.5	48.9
22:00-23:00	49.7	63.3	50.5	50.3	49.5	48.9	49.7	63.3	50.5	48.9
23:00-00:00	49.6	77.8	54.4	51.0	49.2	48.7	49.6	77.8	54.4	48.7
00:00-01:00	48.8	64.9	49.4	49.2	48.2	48.2	48.8	49.4	49.2	48.2
01:00-02:00	48.6	70.3	49.4	49.2	48.2	47.8	48.6	49.4	49.2	47.8
02:00-03:00	48.6	56.5	49.4	49.2	48.2	47.9	48.6	49.4	49.2	47.9
03:00-04:00	48.8	77.4	56.4	50.8	47.9	46.9	48.8	50.8	47.9	46.9
04:00-05:00	47.6	78.6	59.8	52.4	45.7	44.6	47.6	52.4	45.7	44.6
05:00-06:00	54.3	87.6	69.5	64.5	44.6	38.7	54.3	64.5	44.6	38.7
06:00-07:00	47.8	86.0	55.2	50.4	38.5	33.2	47.8	50.4	38.5	33.2
07:00-08:00	48.4	83.5	54.4	50.3	38.8	33.2	48.4	50.3	38.8	33.2
<b>24 Hours Measurement</b>	<b>48.5</b>	<b>87.6</b>	<b>57.6</b>	<b>53.2</b>	<b>45.6</b>	<b>44.4</b>	<b>48.5</b>	<b>57.6</b>	<b>45.6</b>	<b>44.4</b>
<b>Standard<sup>1*</sup></b>	<b>70</b>	<b>115</b>	-	-	-	-	<b>70</b>	<b>115</b>	-	-
<b>Ldn</b>	<b>56.0</b>	-	-	-	-	-	<b>56.0</b>	-	-	-

Remark: <sup>1\*</sup> Notification of National Environmental Board, No.15, B.E.2546 (1997) under the Enhancement and Conservation of National Environmental Quality Act B.E.2535 (1992), published in the Royal Government Gazette No.114 Part 270 dated April 3, B.E.2546 (1997).

[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]



**ANALYSIS REPORT**

**Customer Name** : TLT Consultants Company Limited  
**Address** : 152 Nuan Chan Road, Nuan Chan, Bueng Kum, Bangkok 10230  
**Project Name** : โครงการโรงไฟฟ้า พหลโยธิน  
**Project Location** : ตำบลหนองเสือ อำเภอลาดบัวหลวง จังหวัดลพบุรี  
**Measured Source** : Ambient Noise  
**Measured Point** : บริเวณด้านทิศตะวันตกของโครงการ หมู่ที่ 9 บ้านต้นจวง ตำบลหนองเสือ อำเภอลาดบัวหลวง จังหวัดลพบุรี  
**GPS. Coordinate** : UTM (WGS84) 47P 0581010 E, 1592490 N  
**Measured Date** : May 28-29, 2023  
**Measured By** : Mr.Nitad Sirichad  
**Analyzed By** : Environment Research & Technology Co., Ltd.  
**Measured Instrument** : Integrating Sound Level Meter RION Model NL-21 Serial Number 01009847

**ANALYSIS REPORT**

**Customer Name** : TLT Consultants Company Limited  
**Address** : 152 Nuan Chan Road, Nuan Chan, Bueng Kum, Bangkok 10230  
**Project Name** : โครงการโรงไฟฟ้า พหลโยธิน  
**Project Location** : ตำบลหนองเสือ อำเภอลาดบัวหลวง จังหวัดลพบุรี  
**Measured Source** : Ambient Noise  
**Measured Point** : บริเวณด้านทิศตะวันตกของโครงการ หมู่ที่ 9 บ้านต้นจวง ตำบลหนองเสือ อำเภอลาดบัวหลวง จังหวัดลพบุรี  
**GPS. Coordinate** : UTM (WGS84) 47P 0581010 E, 1592490 N  
**Measured Date** : May 29-30, 2023  
**Measured By** : Mr.Nitad Sirichad  
**Analyzed By** : Environment Research & Technology Co., Ltd.  
**Measured Instrument** : Integrating Sound Level Meter RION Model NL-21 Serial Number 01009847

Interval Time	Noise Level, dB(A)									
	Leq	Lmax	LS	L10	L50	L90	LS	L10	L50	L90
08:00-09:00	48.5	71.3	54.2	52.0	42.0	35.1	47.5	51.7	41.7	37.4
09:00-10:00	49.6	74.9	56.0	52.5	39.9	33.5	50.6	53.0	41.4	36.4
10:00-11:00	48.2	68.5	54.7	51.7	42.4	40.3	50.6	57.1	44.6	38.6
11:00-12:00	46.3	70.8	53.6	50.7	41.1	39.0	47.9	54.0	42.8	35.7
12:00-13:00	49.6	72.4	55.2	52.7	45.8	42.7	43.2	69.5	36.2	32.6
13:00-14:00	42.9	66.0	49.1	44.9	33.3	29.2	43.3	44.3	46.5	34.4
14:00-15:00	43.6	76.8	52.0	48.6	36.8	33.1	46.0	86.0	36.7	33.5
15:00-16:00	44.9	75.9	52.0	49.1	36.2	28.9	46.0	90.0	38.6	34.4
16:00-17:00	44.0	85.1	53.3	44.0	48.8	34.2	47.8	89.8	38.7	32.4
17:00-18:00	47.0	81.0	53.5	49.3	39.3	34.8	48.7	78.4	42.5	37.0
18:00-19:00	46.4	51.9	46.4	49.8	41.3	36.4	44.4	51.2	47.7	33.9
19:00-20:00	43.6	69.1	45.2	44.8	42.8	41.4	44.1	73.1	43.8	42.6
20:00-21:00	48.0	72.1	49.4	48.7	47.4	45.6	52.0	55.9	51.7	51.0
21:00-22:00	49.5	78.9	53.3	51.7	48.0	46.2	50.8	72.2	50.6	49.9
22:00-23:00	56.4	83.5	59.5	58.0	55.7	52.6	50.5	72.2	50.3	49.7
23:00-00:00	48.2	49.1	48.8	48.8	47.8	47.1	46.7	68.7	49.0	48.6
00:00-01:00	48.8	53.1	49.6	49.4	48.5	48.0	47.9	47.7	46.3	45.6
01:00-02:00	48.2	62.0	48.9	48.8	47.9	47.4	49.8	53.5	49.4	46.5
02:00-03:00	48.5	78.8	56.5	49.3	47.8	47.8	49.8	50.4	49.5	49.2
03:00-04:00	47.6	79.0	56.7	50.1	46.0	45.2	49.4	51.4	49.2	48.8
04:00-05:00	50.9	80.1	68.0	61.0	45.5	44.3	55.7	66.1	46.1	45.0
05:00-06:00	51.9	88.5	69.8	61.9	40.6	37.7	56.5	69.1	40.2	36.9
06:00-07:00	47.5	87.0	56.8	51.5	40.1	36.7	45.1	55.5	36.6	30.9
07:00-08:00	46.5	85.5	65.7	50.7	41.7	36.8	48.1	79.6	43.3	39.0
<b>24 Hours Measurement</b>	<b>48.9</b>	<b>88.5</b>	<b>60.2</b>	<b>53.7</b>	<b>46.2</b>	<b>44.2</b>	<b>49.9</b>	<b>59.0</b>	<b>46.0</b>	<b>44.8</b>
<b>Standard<sup>1)</sup></b>	<b>70</b>	<b>115</b>	-	-	-	-	<b>70</b>	<b>115</b>	-	-
<b>Ldn</b>	<b>56.9</b>	-	-	-	-	-	<b>57.8</b>	-	-	-

Remark : <sup>1)</sup> Notification of National Environmental Board, No.15, B.E.2540 (1997) under the Enhancement and Conservation of National Environmental Quality Act B.E.2535 (1992), published in the Royal Government Gazette No.114 Part 270 dated April 3, B.E.2540 (1997).

[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]

Interval Time	Noise Level, dB(A)									
	Leq	Lmax	LS	L10	L50	L90	LS	L10	L50	L90
08:00-09:00	47.5	84.1	58.9	51.7	41.7	37.4	47.5	51.7	41.7	37.4
09:00-10:00	50.6	82.3	56.5	53.0	41.4	36.4	50.6	53.0	41.4	36.4
10:00-11:00	50.6	81.7	57.1	54.4	44.6	38.6	47.9	54.0	42.8	35.7
11:00-12:00	47.9	72.6	54.0	51.0	42.8	36.2	43.2	46.4	36.2	32.6
12:00-13:00	43.2	69.5	50.4	46.4	36.2	34.4	44.3	46.5	37.9	34.4
13:00-14:00	43.3	86.0	52.9	48.0	36.7	33.5	43.3	48.0	36.7	33.5
14:00-15:00	46.0	90.0	58.6	50.1	38.6	34.4	46.0	50.1	38.6	34.4
15:00-16:00	47.8	89.8	61.1	51.3	38.7	32.4	47.8	51.3	38.7	32.4
16:00-17:00	48.7	78.4	57.2	52.6	42.5	37.0	48.7	52.6	42.5	37.0
17:00-18:00	44.4	44.4	44.4	47.7	39.1	33.9	44.4	47.7	39.1	33.9
18:00-19:00	44.1	73.1	45.5	45.0	43.8	42.6	44.1	45.5	43.8	42.6
19:00-20:00	52.0	55.9	52.7	52.5	51.7	51.0	52.0	52.7	51.7	51.0
20:00-21:00	50.8	72.2	51.7	51.5	50.6	49.9	50.8	51.5	50.6	49.9
21:00-22:00	50.5	72.2	51.1	50.9	50.3	49.7	50.5	50.9	50.3	49.7
22:00-23:00	46.7	68.7	47.7	47.2	46.3	45.6	46.7	47.2	46.3	45.6
00:00-01:00	47.9	77.1	53.5	49.4	47.3	46.5	49.8	50.3	49.5	49.2
01:00-02:00	49.4	76.9	51.4	50.0	49.2	48.8	49.4	50.0	49.2	48.8
03:00-04:00	55.7	80.0	66.1	59.2	46.1	45.0	55.7	66.1	46.1	45.0
04:00-05:00	56.5	83.9	69.1	62.1	40.2	36.9	56.5	69.1	40.2	36.9
05:00-06:00	45.1	86.8	55.5	49.3	36.6	30.9	45.1	49.3	36.6	30.9
06:00-07:00	48.1	79.6	53.8	51.4	43.3	39.0	48.1	51.4	43.3	39.0
<b>24 Hours Measurement</b>	<b>49.9</b>	<b>90.0</b>	<b>59.0</b>	<b>53.2</b>	<b>46.0</b>	<b>44.8</b>	<b>49.9</b>	<b>53.2</b>	<b>46.0</b>	<b>44.8</b>
<b>Standard<sup>1)</sup></b>	<b>70</b>	<b>115</b>	-	-	-	-	<b>70</b>	<b>115</b>	-	-
<b>Ldn</b>	<b>57.8</b>	-	-	-	-	-	<b>57.8</b>	-	-	-

Remark : <sup>1)</sup> Notification of National Environmental Board, No.15, B.E.2540 (1997) under the Enhancement and Conservation of National Environmental Quality Act B.E.2535 (1992), published in the Royal Government Gazette No.114 Part 270 dated April 3, B.E.2540 (1997).

[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]



### ANALYSIS REPORT

**Customer Name** : TLT Consultants Company Limited  
**Address** : 152 Nuan Chan Road, Nuan Chan, Bueng Kum, Bangkok 10230  
**Project Name** : โครงการโรงไฟฟ้า พลังงานชีวมวล  
**Project Location** : ตำบลหนองปรือ อำเภอบางพลี จังหวัดสมุทรปราการ  
**Measured Source** : Ambient Noise  
**Measured Point** : บริเวณหอคอยระบายความร้อนของโรงไฟฟ้า พลังงานชีวมวล  
**GPS. Coordinate** : UTM (WGS84) 47P 0582256 E, 1593060 N  
**Measured Date** : November 2-3, 2023  
**Analysis No.** : 2023-AE851-006  
**Report No.** : 2023-RAAW249  
**Measured By** : Mr. Sittiporn Wongkham  
**Analyzed By** : Environment Research & Technology Co., Ltd.  
**Measured Instrument** : Integrating Sound Level Meter Scarlett Tech Model ST-21D Serial Number 820445

Interval Time	Noise Level, dB(A)					
	Leq	Lmax	L5	L10	L50	L90
08:00-09:00	49.9	74.2	55.0	53.3	74.2	41.6
09:00-10:00	48.5	72.7	54.4	51.7	43.2	40.1
10:00-11:00	48.5	71.9	54.6	52.7	43.8	39.7
11:00-12:00	47.9	78.6	53.4	50.8	43.1	40.1
12:00-13:00	48.0	72.9	53.0	51.2	44.9	41.1
13:00-14:00	46.1	51.8	46.1	49.7	41.5	37.9
14:00-15:00	44.6	67.2	50.1	47.7	41.0	37.7
15:00-16:00	44.7	67.1	51.9	49.5	41.6	37.8
16:00-17:00	40.7	63.5	45.9	43.8	38.5	36.9
17:00-18:00	39.0	57.7	43.9	41.7	38.1	37.0
18:00-19:00	47.7	66.8	52.1	49.7	45.8	44.5
19:00-20:00	47.9	66.8	49.5	48.7	47.3	46.7
20:00-21:00	47.6	66.0	48.6	48.3	47.3	46.5
21:00-22:00	45.1	68.4	48.7	45.7	44.7	44.0
22:00-23:00	43.9	68.4	45.9	44.6	43.5	42.7
23:00-00:00	44.8	68.3	47.7	46.2	43.6	42.3
00:00-01:00	46.8	70.5	51.0	48.2	44.2	42.5
01:00-02:00	44.1	76.7	47.1	44.9	42.8	41.9
02:00-03:00	44.8	63.9	49.3	46.7	42.8	41.7
03:00-04:00	43.6	67.7	48.6	45.7	41.7	40.1
04:00-05:00	42.6	76.2	53.5	46.6	39.9	38.2
05:00-06:00	45.3	70.8	52.2	48.6	41.9	38.8
06:00-07:00	46.5	66.8	52.1	49.4	43.6	39.8
07:00-08:00	49.2	74.8	54.4	52.4	45.9	41.5
<b>24 Hours Measurement</b>	<b>46.4</b>	<b>78.6</b>	<b>51.5</b>	<b>49.2</b>	<b>43.8</b>	<b>41.8</b>
<b>Standard**</b>	<b>70</b>	<b>115</b>	-	-	-	-
<b>Ldn</b>	<b>51.7</b>	-	-	-	-	-

Remark : \* Notification of National Environmental Board, No.15, B.E.2540 (1997) under the Enhancement and Conservation of National Environmental Quality Act B.E.2535 (1992), published in the Royal Government Gazette No.114 Part 270 dated April 3, B.E.2540 (1997).

[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]

### ANALYSIS REPORT

**Customer Name** : TLT Consultants Company Limited  
**Address** : 152 Nuan Chan Road, Nuan Chan, Bueng Kum, Bangkok 10230  
**Project Name** : โครงการโรงไฟฟ้า พลังงานชีวมวล  
**Project Location** : ตำบลหนองปรือ อำเภอบางพลี จังหวัดสมุทรปราการ  
**Measured Source** : Ambient Noise  
**Measured Point** : บริเวณหอคอยระบายความร้อนของโรงไฟฟ้า พลังงานชีวมวล  
**GPS. Coordinate** : UTM (WGS84) 47P 0582256 E, 1593060 N  
**Measured Date** : November 3-4, 2023  
**Analysis No.** : 2023-AE851-006  
**Report No.** : 2023-RAAW249  
**Measured By** : Mr. Sittiporn Wongkham  
**Analyzed By** : Environment Research & Technology Co., Ltd.  
**Measured Instrument** : Integrating Sound Level Meter Scarlett Tech Model ST-21D Serial Number 820445

Interval Time	Noise Level, dB(A)					
	Leq	Lmax	L5	L10	L50	L90
08:00-09:00	45.9	67.4	51.5	49.8	42.9	38.9
09:00-10:00	48.0	72.6	51.9	50.6	44.7	40.4
10:00-11:00	45.0	62.1	49.7	48.1	43.1	39.3
11:00-12:00	48.9	66.1	54.1	52.5	46.5	41.7
12:00-13:00	45.1	59.8	49.3	48.0	43.8	40.4
13:00-14:00	44.0	49.1	44.4	46.4	39.9	37.3
14:00-15:00	44.3	71.5	49.7	47.9	41.2	37.7
15:00-16:00	44.9	63.4	50.6	48.5	41.6	38.0
16:00-17:00	46.2	74.4	51.5	49.7	42.6	38.5
17:00-18:00	42.0	64.2	48.3	46.4	38.3	37.5
18:00-19:00	45.8	64.4	49.1	48.5	44.8	43.1
19:00-20:00	46.2	63.2	48.0	47.4	45.7	45.1
20:00-21:00	46.2	67.5	46.9	46.7	45.9	45.3
21:00-22:00	45.4	67.4	46.0	46.0	45.2	44.7
22:00-23:00	45.1	69.0	46.8	46.0	44.5	43.9
23:00-00:00	44.6	67.5	47.6	45.8	43.8	43.2
00:00-01:00	43.9	78.5	45.6	44.8	43.4	42.6
01:00-02:00	43.2	68.5	46.4	45.2	42.4	41.5
02:00-03:00	43.5	70.0	48.1	45.0	42.3	41.4
03:00-04:00	42.4	74.0	44.8	44.0	41.7	40.6
04:00-05:00	41.3	62.5	43.5	42.5	40.7	39.7
05:00-06:00	46.8	74.4	51.4	48.6	43.6	40.6
06:00-07:00	47.3	68.6	52.4	49.7	42.0	39.1
07:00-08:00	49.6	75.9	55.4	52.8	45.2	40.7
<b>24 Hours Measurement</b>	<b>45.7</b>	<b>78.5</b>	<b>50.0</b>	<b>48.3</b>	<b>43.6</b>	<b>41.6</b>
<b>Standard**</b>	<b>70</b>	<b>115</b>	-	-	-	-
<b>Ldn</b>	<b>51.4</b>	-	-	-	-	-

Remark : \* Notification of National Environmental Board, No.15, B.E.2540 (1997) under the Enhancement and Conservation of National Environmental Quality Act B.E.2535 (1992), published in the Royal Government Gazette No.114 Part 270 dated April 3, B.E.2540 (1997).

[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]





**ANALYSIS REPORT**

**Customer Name** : TLT Consultants Company Limited  
**Address** : 152 Nuan Chan Road, Nuan Chan, Bueng Kum, Bangkok 10230  
**Project Name** : โครงการโรงไฟฟ้า พหลโยธินฯ  
**Project Location** : ตำบลหนองปรือ อำเภอบางพลี จังหวัดสมุทรปราการ  
**Measured Source** : Ambient Noise  
**Measured Point** : บริเวณด้านตะวันออกของโรงถลุงแร่ 4 บริเวณโรงงาน ตำบลหนองปรือ จังหวัดสมุทรปราการ  
**GPS. Coordinate** : UTM (WGS84) 47P 0582256 E, 1593060 N  
**Measured Date** : November 4-5, 2023  
**Quotation No.** : 2023-01515  
**Analysis No.** : 2023-AE851-006  
**Report No.** : 2023-RAAW249  
**Measured By** : M. Stittiporn Wongkham  
**Analyzed By** : Environment Research & Technology Co., Ltd.  
**Measured Instrument** : Integrating Sound Level Meter Scarlett Tech Model ST-21D Serial Number 820445

Interval Time	Noise Level, dB(A)						
	Leq	Lmax	L5	L10	L50	L90	Ldn
08:00-09:00	48.7	69.9	54.6	52.3	44.6	40.1	-
09:00-10:00	48.5	77.0	54.6	52.0	43.9	40.4	-
10:00-11:00	47.7	80.8	52.3	50.6	44.4	39.8	-
11:00-12:00	45.8	70.3	49.6	49.6	43.2	40.0	-
12:00-13:00	46.9	74.7	52.3	50.8	45.0	42.0	-
13:00-14:00	43.5	68.6	48.5	46.6	39.5	37.5	-
14:00-15:00	42.2	64.2	48.0	46.3	40.1	37.7	-
15:00-16:00	44.9	68.2	51.3	49.5	41.2	37.9	-
16:00-17:00	41.6	74.5	45.7	43.8	39.4	37.4	-
17:00-18:00	40.9	63.2	45.3	43.4	38.2	37.2	-
18:00-19:00	45.6	71.9	46.9	43.1	48.8	42.0	-
19:00-20:00	45.3	73.8	46.9	46.0	44.8	44.1	-
20:00-21:00	45.6	66.9	48.8	47.5	44.6	44.1	-
21:00-22:00	43.5	60.0	44.8	44.2	43.2	42.6	-
22:00-23:00	44.5	66.1	45.2	45.0	44.2	43.7	-
23:00-00:00	44.1	64.2	44.9	44.6	43.8	44.9	-
00:00-01:00	43.6	65.3	44.8	44.4	43.4	42.6	-
01:00-02:00	43.4	63.8	45.7	44.9	42.8	41.7	-
02:00-03:00	42.5	77.3	48.0	44.9	41.1	40.3	-
03:00-04:00	40.9	73.0	43.8	42.5	39.5	38.7	-
04:00-05:00	41.8	63.7	45.8	43.3	40.0	38.7	-
05:00-06:00	46.6	66.8	52.4	49.3	42.8	39.7	-
06:00-07:00	47.3	69.5	53.2	48.7	42.6	39.3	-
07:00-08:00	50.7	80.4	56.5	54.4	47.5	41.7	-
<b>24 Hours Measurement</b>	<b>45.6</b>	<b>80.8</b>	<b>50.5</b>	<b>48.4</b>	<b>43.2</b>	<b>41.1</b>	-
<b>Standard**</b>	<b>70</b>	<b>115</b>	-	-	-	-	-
<b>Ldn</b>	<b>51.1</b>	-	-	-	-	-	-

Remark : \* Notification of National Environmental Board, No.15, B.E.2540 (1997) under the Enhancement and Conservation of National Environmental Quality Act B.E.2535 (1992), published in the Royal Government Gazette No.114 Part 270 dated April 3, B.E.2540 (1997).

[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]



**ANALYSIS REPORT**

**Customer Name** : TLT Consultants Company Limited  
**Address** : 152 Nuan Chan Road, Nuan Chan, Bueng Kum, Bangkok 10230  
**Project Name** : โครงการโรงไฟฟ้า พหลโยธินฯ  
**Project Location** : ตำบลหนองปรือ อำเภอบางพลี จังหวัดสมุทรปราการ  
**Measured Source** : Ambient Noise  
**Measured Point** : บริเวณด้านตะวันออกของโรงถลุงแร่ 4 บริเวณโรงงาน ตำบลหนองปรือ จังหวัดสมุทรปราการ  
**GPS. Coordinate** : UTM (WGS84) 47P 0582256 E, 1593060 N  
**Measured Date** : November 5-6, 2023  
**Quotation No.** : 2023-01515  
**Analysis No.** : 2023-AE851-006  
**Report No.** : 2023-RAAW249  
**Measured By** : M. Stittiporn Wongkham  
**Analyzed By** : Environment Research & Technology Co., Ltd.  
**Measured Instrument** : Integrating Sound Level Meter Scarlett Tech Model ST-21D Serial Number 820445

Interval Time	Noise Level, dB(A)						
	Leq	Lmax	L5	L10	L50	L90	Ldn
08:00-09:00	49.2	73.9	54.7	52.7	45.7	40.1	-
09:00-10:00	49.2	67.5	54.5	52.2	45.6	41.0	-
10:00-11:00	46.7	65.6	50.1	52.1	43.1	38.6	-
11:00-12:00	48.9	76.5	54.3	52.0	45.1	40.6	-
12:00-13:00	47.9	65.5	53.1	51.3	44.8	40.3	-
13:00-14:00	45.8	67.5	51.0	48.9	41.9	38.8	-
14:00-15:00	45.6	70.0	53.1	51.0	41.8	38.5	-
15:00-16:00	45.2	65.3	50.8	48.5	41.7	37.9	-
16:00-17:00	47.9	74.1	52.6	50.7	43.8	41.3	-
17:00-18:00	55.7	83.1	60.8	59.5	52.7	49.2	-
18:00-19:00	53.4	74.6	58.3	57.5	52.3	47.6	-
19:00-20:00	45.5	63.5	47.4	46.9	45.2	44.2	-
20:00-21:00	46.5	66.3	47.5	47.2	46.3	45.6	-
21:00-22:00	46.3	60.9	47.6	47.1	46.1	45.4	-
22:00-23:00	46.8	61.9	47.7	47.5	46.6	45.8	-
23:00-00:00	45.1	63.8	46.0	45.7	44.8	44.2	-
00:00-01:00	43.8	60.8	44.6	44.4	43.7	43.1	-
01:00-02:00	43.9	59.1	44.7	44.5	43.6	43.3	-
02:00-03:00	42.8	67.1	44.8	43.6	42.2	41.4	-
03:00-04:00	42.0	68.5	43.8	42.7	41.4	40.7	-
04:00-05:00	43.2	65.4	46.8	45.2	41.9	40.9	-
05:00-06:00	46.8	65.0	52.6	49.6	43.7	41.3	-
06:00-07:00	46.8	65.2	52.1	50.0	43.1	39.8	-
07:00-08:00	48.7	70.9	54.5	52.6	44.9	40.1	-
<b>24 Hours Measurement</b>	<b>48.2</b>	<b>83.1</b>	<b>53.0</b>	<b>51.4</b>	<b>45.9</b>	<b>43.2</b>	-
<b>Standard**</b>	<b>70</b>	<b>115</b>	-	-	-	-	-
<b>Ldn</b>	<b>52.3</b>	-	-	-	-	-	-

Remark : \* Notification of National Environmental Board, No.15, B.E.2540 (1997) under the Enhancement and Conservation of National Environmental Quality Act B.E.2535 (1992), published in the Royal Government Gazette No.114 Part 270 dated April 3, B.E.2540 (1997).

[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]



**ANALYSIS REPORT**

**Customer Name** : TLT Consultants Company Limited  
**Address** : 152 Nuan Chan Road, Nuan Chan, Bueng Kum, Bangkok 10230  
**Project Name** : โครงการปรับปรุงพื้นที่พัฒนาที่อยู่อาศัย  
**Project Location** : ส่วนพัฒนาแหล่งข้อมูลเขตรักษาพันธุ์สัตว์ป่าดงพญาเย็น  
**Measured Source** : Ambient Noise  
**Measured Point** : บริเวณด้านทิศตะวันตกของโครงการ หมู่ที่ 4 ตำบลวังใหม่ อำเภอเขาค้อ จังหวัดกาฬสินธุ์  
**GPS. Coordinate** : UTM (WGS84) 47P 0582256 E, 1593060 N  
**Measured Date** : November 6-7, 2023  
**Quotation No.** : 2023-01515  
**Analysis No.** : 2023-AE851-006  
**Report No.** : 2023-RAAW249  
**Report Date** : November 16, 2023  
**Analyzed By** : M: Sitthiporn Wongkham  
**Measured By** : Environment Research & Technology Co., Ltd.  
**Measured Instrument** : Integrating Sound Level Meter Scarlet Tech Model ST-21D Serial Number 820445

Interval Time	Noise Level, dB(A)									
	Leq	Lmax	L5	L10	L50	L90	L5	L10	L50	L90
08:00-09:00	50.6	71.0	57.3	54.1	44.9	42.1	55.7	53.2	44.7	40.2
09:00-10:00	47.9	68.5	53.2	50.8	43.8	39.3	53.7	51.0	41.9	38.8
10:00-11:00	47.0	63.5	52.3	50.5	44.0	39.3	50.4	53.9	43.7	41.3
11:00-12:00	49.0	76.0	53.6	51.0	43.2	40.2	50.3	50.3	42.9	39.9
12:00-13:00	49.8	73.9	56.7	54.3	46.2	40.6	55.1	53.3	48.5	44.2
13:00-14:00	47.7	70.6	52.8	50.6	43.0	38.9	53.6	51.2	42.6	39.6
14:00-15:00	46.1	69.7	52.1	49.2	41.3	38.3	52.1	50.0	42.8	39.0
15:00-16:00	46.2	79.7	52.9	49.4	40.1	38.5	50.9	50.9	40.6	38.6
16:00-17:00	45.3	73.7	51.2	47.8	39.0	37.6	46.6	46.6	40.0	37.5
17:00-18:00	41.2	70.8	45.8	43.9	38.6	37.2	49.6	48.8	45.2	43.6
18:00-19:00	45.4	70.6	47.8	46.9	44.2	42.8	52.4	49.5	45.9	45.1
19:00-20:00	47.9	61.2	49.5	49.3	47.2	45.9	46.5	46.1	45.2	44.5
20:00-21:00	45.3	65.6	48.2	46.7	44.4	43.7	46.4	46.2	45.3	44.8
21:00-22:00	46.1	70.1	47.1	46.8	45.6	45.0	47.3	47.3	45.5	44.8
22:00-23:00	45.7	66.7	46.6	46.3	45.4	44.7	46.8	45.8	45.0	44.2
23:00-00:00	47.2	69.1	51.5	49.7	45.3	43.0	46.0	45.3	44.5	43.7
00:00-01:00	51.3	73.7	56.1	54.7	49.1	45.8	42.8	42.8	42.7	42.0
01:00-02:00	52.2	72.7	55.9	54.8	48.5	45.8	43.5	43.5	42.7	42.5
02:00-03:00	49.1	69.1	51.4	50.4	48.8	46.4	47.0	46.2	46.2	42.7
03:00-04:00	41.9	59.1	43.1	42.7	41.7	40.9	49.6	49.6	46.2	42.7
04:00-05:00	41.5	64.1	43.1	42.6	41.3	40.3	50.9	48.9	43.1	39.9
05:00-06:00	43.4	78.8	46.2	44.9	42.0	40.1	66.2	66.2	60.5	57.4
06:00-07:00	47.8	72.1	52.7	51.1	44.7	41.1	76.9	61.6	57.4	53.4
07:00-08:00	50.9	85.2	56.7	53.9	45.5	42.1	77.1	61.5	59.3	46.8
<b>24 Hours Measurement</b>	<b>47.9</b>	<b>85.2</b>	<b>52.7</b>	<b>50.6</b>	<b>45.2</b>	<b>42.9</b>	<b>79.4</b>	<b>54.2</b>	<b>47.3</b>	<b>44.3</b>
<b>Standard<sup>1/</sup></b>	<b>70</b>	<b>115</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>
<b>Ldn</b>	<b>54.5</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>

Remark : <sup>1/</sup> Notification of National Environmental Board, No.15, B.E.2540 (1997) under the Enhancement and Conservation of National Environmental Quality Act B.E.2535 (1992), published in the Royal Government Gazette No.114 Part 270 dated April 3, B.E.2540 (1997).

[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]



**ANALYSIS REPORT**

**Customer Name** : TLT Consultants Company Limited  
**Address** : 152 Nuan Chan Road, Nuan Chan, Bueng Kum, Bangkok 10230  
**Project Name** : โครงการปรับปรุงพื้นที่พัฒนาที่อยู่อาศัย  
**Project Location** : ส่วนพัฒนาแหล่งข้อมูลเขตรักษาพันธุ์สัตว์ป่าดงพญาเย็น  
**Measured Source** : Ambient Noise  
**Measured Point** : บริเวณด้านทิศตะวันตกของโครงการ หมู่ที่ 4 ตำบลวังใหม่ อำเภอเขาค้อ จังหวัดกาฬสินธุ์  
**GPS. Coordinate** : UTM (WGS84) 47P 0582256 E, 1593060 N  
**Measured Date** : November 7-8, 2023  
**Quotation No.** : 2023-01515  
**Analysis No.** : 2023-AE851-006  
**Report No.** : 2023-RAAW249  
**Report Date** : November 16, 2023  
**Analyzed By** : M: Sitthiporn Wongkham  
**Measured By** : Environment Research & Technology Co., Ltd.  
**Measured Instrument** : Integrating Sound Level Meter Scarlet Tech Model ST-21D Serial Number 820445

Interval Time	Noise Level, dB(A)									
	Leq	Lmax	L5	L10	L50	L90	L5	L10	L50	L90
08:00-09:00	48.7	77.5	55.7	53.2	44.7	40.2	55.7	53.2	44.7	40.2
09:00-10:00	47.6	78.9	53.7	51.0	41.9	38.8	53.7	51.0	41.9	38.8
10:00-11:00	50.4	79.4	55.9	53.9	43.7	41.3	50.4	53.9	43.7	41.3
11:00-12:00	47.8	74.4	52.8	50.3	42.9	39.9	50.3	50.3	42.9	39.9
12:00-13:00	50.0	65.5	55.8	54.2	46.4	41.2	55.1	53.3	48.5	44.2
13:00-14:00	50.7	74.2	55.1	53.3	48.5	44.2	53.6	51.2	42.6	39.6
14:00-15:00	47.2	66.4	53.6	52.1	42.8	39.0	52.1	50.0	42.8	39.0
15:00-16:00	46.9	72.7	52.1	50.0	42.8	39.0	50.9	50.9	40.6	38.6
16:00-17:00	46.4	68.0	53.3	50.9	40.6	38.6	46.6	46.6	40.0	37.5
17:00-18:00	44.1	76.7	49.6	46.6	40.0	37.5	49.6	48.8	45.2	43.6
18:00-19:00	46.7	71.4	51.4	48.8	45.2	43.6	52.4	49.5	45.9	45.1
19:00-20:00	48.4	72.9	52.4	49.5	45.9	45.1	46.5	46.1	45.2	44.5
20:00-21:00	45.4	71.2	46.5	46.1	45.2	44.5	46.4	46.2	45.3	44.8
21:00-22:00	45.6	70.5	46.4	46.2	45.3	44.8	47.3	47.3	45.5	44.8
22:00-23:00	46.0	71.7	47.3	46.0	45.0	44.2	46.8	45.8	45.0	44.2
23:00-00:00	45.3	65.9	46.8	45.8	45.0	44.2	46.0	45.3	44.5	43.7
00:00-01:00	44.7	61.7	46.0	45.3	44.5	43.7	42.8	42.8	42.7	42.0
01:00-02:00	42.8	67.3	42.8	42.7	42.7	42.0	43.5	43.5	42.7	42.5
02:00-03:00	43.7	71.2	45.9	45.2	43.2	42.5	49.6	49.6	46.2	42.7
03:00-04:00	47.0	62.4	50.9	49.6	46.2	42.7	66.2	66.2	60.5	57.4
04:00-05:00	42.2	66.2	44.2	43.4	41.1	40.6	76.9	61.6	57.4	53.4
05:00-06:00	45.4	70.5	48.9	47.3	43.1	40.6	77.1	61.5	59.3	46.8
06:00-07:00	58.1	76.9	61.6	60.5	57.4	53.4	79.4	54.2	47.3	44.3
07:00-08:00	55.0	85.2	59.3	59.3	51.0	46.8	79.4	54.2	47.3	44.3
<b>24 Hours Measurement</b>	<b>49.4</b>	<b>79.4</b>	<b>54.2</b>	<b>52.3</b>	<b>47.3</b>	<b>44.3</b>	<b>79.4</b>	<b>54.2</b>	<b>47.3</b>	<b>44.3</b>
<b>Standard<sup>1/</sup></b>	<b>70</b>	<b>115</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>
<b>Ldn</b>	<b>56.2</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>

Remark : <sup>1/</sup> Notification of National Environmental Board, No.15, B.E.2540 (1997) under the Enhancement and Conservation of National Environmental Quality Act B.E.2535 (1992), published in the Royal Government Gazette No.114 Part 270 dated April 3, B.E.2540 (1997).

[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]





**ANALYSIS REPORT**

**Customer Name** : TLT Consultants Company Limited  
**Address** : 152 Nuan Chan Road, Nuan Chan, Bueng Kum, Bangkok 10230  
**Project Name** : โครงการโรงไฟฟ้า พานาน้อยราย  
**Project Location** : ส่วนผสมของเสียง ส่วนกลางสถานี จังหวัดกาญจนบุรี  
**Measured Source** : Ambient Noise  
**Measured Point** : บริเวณด้านทิศตะวันออกเฉียงใต้ของอาคาร 9 บริเวณชั้นงาน ส่วนผสมของเสียง ส่วนกลางสถานี จังหวัดกาญจนบุรี  
**GPS. Coordinate** : UTM (WGS84) 47P 0582256 E, 1593060 N  
**Measured Date** : November 8-9, 2023  
**Report No.** : 2023-AE851-006  
**Measured By** : Mr.Sittiporn Wongkham  
**Analyzed By** : Environment Research & Technology Co., Ltd.  
**Measured Instrument** : Integrating Sound Level Meter Scarlett Tech Model ST-21D Serial Number 820445

Interval Time	Noise Level, dB(A)				
	Leq	Lmax	L5	L10	L90
08:00-09:00	50.7	71.1	56.7	54.8	41.9
09:00-10:00	50.0	74.2	55.8	53.6	41.2
10:00-11:00	50.2	70.0	55.5	52.3	41.9
11:00-12:00	46.7	68.8	51.7	49.7	39.8
12:00-13:00	47.9	66.0	52.8	51.2	40.2
13:00-14:00	45.4	68.0	50.6	48.4	38.3
14:00-15:00	45.1	65.0	50.7	48.6	37.8
15:00-16:00	45.2	65.3	50.7	48.4	37.9
16:00-17:00	43.5	65.8	48.8	46.8	37.4
17:00-18:00	40.2	62.8	45.7	43.7	37.2
18:00-19:00	48.0	68.3	49.8	49.2	46.1
19:00-20:00	48.9	65.8	50.8	49.7	47.6
20:00-21:00	48.4	62.3	50.3	49.5	47.2
21:00-22:00	47.5	61.4	48.9	48.2	46.2
22:00-23:00	46.7	57.8	47.5	47.3	45.5
23:00-00:00	46.0	58.5	47.0	46.9	44.6
00:00-01:00	44.8	64.9	46.0	45.8	42.7
01:00-02:00	48.4	69.2	53.8	51.6	41.5
02:00-03:00	54.5	79.1	59.1	55.8	49.1
03:00-04:00	50.9	74.1	55.5	51.4	45.2
04:00-05:00	49.3	70.6	53.3	51.0	47.9
05:00-06:00	52.1	68.5	57.1	55.9	44.7
06:00-07:00	45.3	67.1	49.7	48.2	40.9
07:00-08:00	50.4	74.2	55.2	52.3	41.5
<b>24 Hours Measurement Standard<sup>1</sup></b>	<b>48.8</b>	<b>79.1</b>	<b>53.3</b>	<b>51.2</b>	<b>44.0</b>
<b>Ldn</b>	<b>56.0</b>	<b>115</b>	<b>-</b>	<b>-</b>	<b>-</b>

Remark : <sup>1</sup> Notification of National Environmental Board, No.15, B.E.2540 (1997) under the Enhancement and Conservation of National Environmental Quality Act B.E.2535 (1992), published in the Royal Government Gazette No.114 Part. 27D dated April 3, B.E.2540 (1997).

[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]



**ANALYSIS REPORT**

**Customer Name** : TLT Consultants Company Limited  
**Address** : 152 Nuan Chan Road, Nuan Chan, Bueng Kum, Bangkok 10230  
**Project Name** : โครงการโรงไฟฟ้า พานาน้อยราย  
**Project Location** : ส่วนผสมของเสียง ส่วนกลางสถานี จังหวัดกาญจนบุรี  
**Measured Source** : Ambient Noise  
**Measured Point** : บริเวณด้านทิศตะวันออกเฉียงใต้ของอาคาร 9 บริเวณชั้นงาน ส่วนผสมของเสียง ส่วนกลางสถานี จังหวัดกาญจนบุรี  
**GPS. Coordinate** : UTM (WGS84) 47P 0581001 E, 1592475 N  
**Measured Date** : November 2-3, 2023  
**Report No.** : 2023-AE851-007  
**Measured By** : Mr.Sittiporn Wongkham  
**Analyzed By** : Environment Research & Technology Co., Ltd.  
**Measured Instrument** : Integrating Sound Level Meter Scarlett Tech Model ST-21D Serial Number 820448

Interval Time	Noise Level, dB(A)				
	Leq	Lmax	L5	L10	L90
08:00-09:00	49.6	72.8	55.3	52.7	41.2
09:00-10:00	48.6	75.0	53.8	50.4	44.3
10:00-11:00	43.7	65.5	49.1	46.5	41.9
11:00-12:00	44.5	77.6	50.7	48.8	40.6
12:00-13:00	41.3	60.9	45.4	44.0	40.4
13:00-14:00	41.3	66.4	47.1	44.5	39.6
14:00-15:00	44.9	74.5	53.8	47.5	41.9
15:00-16:00	45.9	71.1	52.0	48.5	42.1
16:00-17:00	43.9	67.1	49.3	47.1	42.1
17:00-18:00	46.6	78.1	52.5	50.4	38.9
18:00-19:00	63.5	73.1	65.0	64.8	61.0
19:00-20:00	64.6	69.8	66.4	66.1	62.8
20:00-21:00	65.7	68.8	65.2	66.5	62.7
21:00-22:00	65.7	76.4	66.9	66.7	64.2
22:00-23:00	65.1	69.6	66.5	66.3	63.2
23:00-00:00	62.0	79.7	64.8	63.9	58.4
00:00-01:00	56.0	69.9	58.7	57.8	53.6
01:00-02:00	58.9	84.0	60.7	60.1	56.8
02:00-03:00	60.8	84.5	64.1	61.9	58.4
03:00-04:00	58.9	75.9	60.9	60.6	56.0
04:00-05:00	59.4	82.1	66.4	62.6	56.6
05:00-06:00	57.0	82.2	66.1	61.3	52.7
06:00-07:00	52.8	74.8	59.2	54.5	46.6
07:00-08:00	47.7	79.3	54.8	50.5	41.7
<b>24 Hours Measurement Standard<sup>1</sup></b>	<b>59.6</b>	<b>84.5</b>	<b>62.4</b>	<b>61.2</b>	<b>57.4</b>
<b>Ldn</b>	<b>70</b>	<b>115</b>	<b>-</b>	<b>-</b>	<b>-</b>

Remark : <sup>1</sup> Notification of National Environmental Board, No.15, B.E.2540 (1997) under the Enhancement and Conservation of National Environmental Quality Act B.E.2535 (1992), published in the Royal Government Gazette No.114 Part. 27D dated April 3, B.E.2540 (1997).

[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]

**ANALYSIS REPORT**

**Customer Name** : TLT Consultants Company Limited  
**Address** : 152 Nuan Chan Road, Nuan Chan, Bueng Kum, Bangkok 10230  
**Project Name** : โครงการโรงไฟฟ้า พหลโยธินรั้ว  
**Project Location** : ตำบลหนองปรือ อำเภอบางพลี จังหวัดสมุทรปราการ  
**Measured Source** : Ambient Noise  
**Measured Point** : บริเวณด้านทิศตะวันออกของโรงบ่มปุ๋ย 9 บริเวณต้นสวน ต้นสนามบ่อประมง ต้นตาลตามรั้ว จังหวัดสมุทรปราการ  
**GPS. Coordinate** : UTM (WGS84) 47P 0581001 E, 1592475 N  
**Measured Date** : November 3-4, 2023  
**Report No.** : 2023-AE851-007  
**Report Date** : November 16, 2023  
**Measured By** : Mr.Sittiporn Wongkham  
**Analyzed By** : Environment Research & Technology Co., Ltd.  
**Measured Instrument** : Integrating Sound Level Meter Scarlett Tech Model ST-21D Serial Number 820448

Interval Time	Noise Level, dB(A)					
	Leq	Lmax	L5	L10	L50	L90
08:00-09:00	42.6	67.8	47.7	44.5	42.2	40.9
09:00-10:00	42.7	76.3	47.7	44.4	42.3	41.1
10:00-11:00	44.2	76.7	51.1	48.8	43.8	42.6
11:00-12:00	46.5	71.8	55.7	50.7	44.5	41.8
12:00-13:00	43.7	66.0	48.8	46.6	42.9	41.5
13:00-14:00	43.1	79.0	49.2	47.0	39.9	38.6
14:00-15:00	45.4	71.4	50.9	48.8	42.0	39.8
15:00-16:00	45.5	77.4	52.5	49.5	41.3	38.7
16:00-17:00	45.0	73.5	49.9	47.5	41.1	38.9
17:00-18:00	44.7	74.6	53.5	50.8	42.9	40.4
18:00-19:00	61.1	66.9	62.4	61.9	60.3	58.3
19:00-20:00	61.4	67.3	63.0	62.8	60.9	59.0
20:00-21:00	59.5	66.0	61.9	61.5	58.8	56.5
21:00-22:00	63.1	72.7	64.7	64.4	62.3	60.4
22:00-23:00	60.8	67.3	62.6	62.3	60.3	58.8
23:00-00:00	61.8	67.0	63.5	63.2	61.0	59.5
00:00-01:00	60.6	67.3	62.1	61.8	60.2	58.9
01:00-02:00	60.5	61.6	61.9	61.6	59.8	58.5
02:00-03:00	59.0	78.6	61.0	60.3	58.5	56.6
03:00-04:00	61.4	81.2	66.1	63.3	60.4	58.5
04:00-05:00	59.8	81.2	65.7	62.3	59.0	56.9
05:00-06:00	60.7	85.9	67.7	62.3	58.7	56.2
06:00-07:00	50.8	86.5	62.6	56.5	46.0	43.5
07:00-08:00	49.1	75.4	54.6	51.1	44.2	40.1
<b>24 Hours Measurement</b>	<b>58.1</b>	<b>86.5</b>	<b>61.5</b>	<b>59.7</b>	<b>57.2</b>	<b>55.4</b>
<b>Standard<sup>1*</sup></b>	<b>70</b>	<b>115</b>	-	-	-	-
<b>Ldn</b>	<b>66.2</b>	-	-	-	-	-

Remark : <sup>1\*</sup> Notification of National Environmental Board, No.15, B.E.2540 (1997) under the Enhancement and Conservation of National Environmental Quality Act B.E.2535 (1992), published in the Royal Government Gazette No.114 Part 27D dated April 3, B.E.2540 (1997).

[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]

**ANALYSIS REPORT**

**Customer Name** : TLT Consultants Company Limited  
**Address** : 152 Nuan Chan Road, Nuan Chan, Bueng Kum, Bangkok 10230  
**Project Name** : โครงการโรงไฟฟ้า พหลโยธินรั้ว  
**Project Location** : ตำบลหนองปรือ อำเภอบางพลี จังหวัดสมุทรปราการ  
**Measured Source** : Ambient Noise  
**Measured Point** : บริเวณด้านทิศตะวันออกของโรงบ่มปุ๋ย 9 บริเวณต้นสวน ต้นสนามบ่อประมง ต้นตาลตามรั้ว จังหวัดสมุทรปราการ  
**GPS. Coordinate** : UTM (WGS84) 47P 0581001 E, 1592475 N  
**Measured Date** : November 4-5, 2023  
**Report No.** : 2023-AE851-007  
**Report Date** : November 16, 2023  
**Measured By** : Mr.Sittiporn Wongkham  
**Analyzed By** : Environment Research & Technology Co., Ltd.  
**Measured Instrument** : Integrating Sound Level Meter Scarlett Tech Model ST-21D Serial Number 820448

Interval Time	Noise Level, dB(A)					
	Leq	Lmax	L5	L10	L50	L90
08:00-09:00	50.5	74.6	57.0	54.2	45.7	43.6
09:00-10:00	46.1	73.8	51.4	48.2	39.2	38.8
10:00-11:00	45.2	79.6	52.8	49.6	42.3	41.9
11:00-12:00	43.9	68.5	51.0	48.0	42.6	42.2
12:00-13:00	41.7	70.8	46.4	44.2	40.4	40.0
13:00-14:00	40.9	66.6	45.2	42.9	39.6	39.2
14:00-15:00	41.5	66.0	45.4	43.3	40.2	39.8
15:00-16:00	41.9	72.1	47.8	44.7	40.6	40.2
16:00-17:00	43.4	72.1	48.3	44.8	42.0	41.6
17:00-18:00	47.3	77.2	55.1	52.5	45.2	40.5
18:00-19:00	59.3	76.3	61.0	60.7	58.7	57.1
19:00-20:00	64.3	68.1	65.9	65.7	63.6	61.4
20:00-21:00	61.9	68.8	66.2	64.9	63.9	61.7
21:00-22:00	61.8	66.7	63.3	63.1	61.5	59.7
22:00-23:00	63.1	67.7	64.5	64.2	62.6	61.2
23:00-00:00	61.2	69.8	62.7	62.5	61.0	59.0
00:00-01:00	60.5	66.3	62.1	61.8	60.0	58.3
01:00-02:00	60.7	66.4	62.4	62.1	60.6	58.8
02:00-03:00	60.4	66.8	62.2	61.9	60.3	58.4
03:00-04:00	60.9	78.1	62.9	62.5	60.6	57.6
04:00-05:00	61.5	81.1	67.2	64.4	61.1	58.9
05:00-06:00	58.4	82.6	69.7	65.5	54.5	51.3
06:00-07:00	50.5	88.7	61.2	57.4	46.5	43.2
07:00-08:00	48.0	85.1	58.6	55.4	44.3	41.1
<b>24 Hours Measurement</b>	<b>58.9</b>	<b>88.7</b>	<b>62.4</b>	<b>60.9</b>	<b>58.3</b>	<b>56.3</b>
<b>Standard<sup>1*</sup></b>	<b>70</b>	<b>115</b>	-	-	-	-
<b>Ldn</b>	<b>66.6</b>	-	-	-	-	-

Remark : <sup>1\*</sup> Notification of National Environmental Board, No.15, B.E.2540 (1997) under the Enhancement and Conservation of National Environmental Quality Act B.E.2535 (1992), published in the Royal Government Gazette No.114 Part 27D dated April 3, B.E.2540 (1997).

[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]





**ANALYSIS REPORT**

**Customer Name** : TLT Consultants Company Limited  
**Address** : 152 Nuan Chan Road, Nuan Chan, Bueng Kum, Bangkok 10230  
**Project Name** : โครงการรถไฟฟ้ามหานครสาย  
**Project Location** : ส่วนพัฒนาแหล่งข้อมูลและทรัพยากร จังหวัดกาญจนบุรี  
**Measured Source** : Ambient Noise  
**Measured Point** : บริเวณด้านทิศตะวันตกของโครงการ หมู่ที่ 9 บ้านห้วยนางวน ส่วนพัฒนาแหล่งข้อมูลและทรัพยากร จังหวัดกาญจนบุรี  
**GPS. Coordinate** : UTM (WGS84) 47P 0581001 E, 1592475 N  
**Measured Date** : November 5-6, 2023  
**Analysis No.** : 2023-AE851-007  
**Report No.** : 2023-RAAW250  
**Measured By** : Mr. Sittiporn Wongkham  
**Analyzed By** : Environment Research & Technology Co., Ltd.  
**Measured Instrument** : Integrating Sound Level Meter Scarlett Tech Model ST-21D Serial Number 820448

Interval Time	Noise Level, dB(A)					
	Leq	Lmax	L5	L10	L50	L90
08:00-09:00	45.5	66.2	51.3	48.4	41.0	39.0
09:00-10:00	49.5	71.0	55.7	52.9	44.5	41.9
10:00-11:00	43.3	61.1	50.5	49.2	41.2	39.9
11:00-12:00	45.0	73.7	53.2	49.3	43.2	42.1
12:00-13:00	44.2	74.9	52.0	48.1	43.4	40.6
13:00-14:00	44.6	69.4	51.2	46.9	41.9	40.8
14:00-15:00	53.1	77.7	59.9	59.0	49.1	46.0
15:00-16:00	49.2	73.9	56.7	54.2	43.5	40.7
16:00-17:00	44.0	72.7	54.2	50.9	40.6	38.9
17:00-18:00	54.5	79.3	67.7	66.8	51.4	48.3
18:00-19:00	53.8	72.8	62.4	61.9	50.4	48.0
19:00-20:00	61.9	73.3	64.2	63.8	61.6	58.8
20:00-21:00	61.2	64.7	62.3	62.1	60.6	58.9
21:00-22:00	61.0	65.4	62.3	62.1	60.4	58.8
22:00-23:00	60.5	65.3	61.9	61.7	59.8	58.8
23:00-00:00	60.5	66.5	62.1	61.8	59.9	58.1
00:00-01:00	57.4	61.6	58.7	58.6	56.4	55.1
01:00-02:00	58.5	60.4	60.4	60.1	58.4	55.3
02:00-03:00	52.1	71.1	53.7	53.1	51.8	50.7
03:00-04:00	60.5	65.5	62.3	61.8	60.1	58.6
04:00-05:00	62.8	82.6	67.9	64.2	61.2	59.1
05:00-06:00	63.1	90.4	69.2	64.1	57.9	55.7
06:00-07:00	54.9	89.5	60.9	56.1	48.6	41.1
07:00-08:00	49.0	72.1	56.7	52.9	42.2	38.8
<b>24 Hours Measurement</b>	<b>57.8</b>	<b>90.4</b>	<b>62.2</b>	<b>60.3</b>	<b>56.4</b>	<b>54.4</b>
<b>Standard<sup>1*</sup></b>	<b>70</b>	<b>115</b>	-	-	-	-
<b>Ldn</b>	<b>66.0</b>	-	-	-	-	-

Remark : <sup>1\*</sup> Notification of National Environmental Board, No.15, B.E.2540 (1997) under the Enhancement and Conservation of National Environmental Quality Act B.E.2535 (1992), published in the Royal Government Gazette No.114 Part 270 dated April 3, B.E.2540 (1997).

[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]

**ANALYSIS REPORT**

**Customer Name** : TLT Consultants Company Limited  
**Address** : 152 Nuan Chan Road, Nuan Chan, Bueng Kum, Bangkok 10230  
**Project Name** : โครงการรถไฟฟ้ามหานครสาย  
**Project Location** : ส่วนพัฒนาแหล่งข้อมูลและทรัพยากร จังหวัดกาญจนบุรี  
**Measured Source** : Ambient Noise  
**Measured Point** : บริเวณด้านทิศตะวันตกของโครงการ หมู่ที่ 9 บ้านห้วยนางวน ส่วนพัฒนาแหล่งข้อมูลและทรัพยากร จังหวัดกาญจนบุรี  
**GPS. Coordinate** : UTM (WGS84) 47P 0581001 E, 1592475 N  
**Measured Date** : November 6-7, 2023  
**Analysis No.** : 2023-AE851-007  
**Report No.** : 2023-RAAW250  
**Measured By** : Mr. Sittiporn Wongkham  
**Analyzed By** : Environment Research & Technology Co., Ltd.  
**Measured Instrument** : Integrating Sound Level Meter Scarlett Tech Model ST-21D Serial Number 820448

Interval Time	Noise Level, dB(A)					
	Leq	Lmax	L5	L10	L50	L90
08:00-09:00	53.1	74.8	60.4	56.5	47.8	45.8
09:00-10:00	49.2	71.0	54.8	52.3	46.9	46.1
10:00-11:00	50.4	78.0	58.1	55.7	49.6	48.8
11:00-12:00	40.1	65.3	44.0	42.1	39.3	38.5
12:00-13:00	41.2	64.5	46.7	43.2	40.4	39.6
13:00-14:00	46.2	74.9	52.2	48.8	45.4	44.6
14:00-15:00	42.9	79.6	50.3	46.1	42.1	41.1
15:00-16:00	41.6	68.4	45.3	44.2	40.8	40.0
16:00-17:00	43.6	79.3	53.9	51.6	42.3	40.7
17:00-18:00	48.2	81.2	54.1	52.4	44.7	40.5
18:00-19:00	67.3	79.4	68.4	68.2	66.8	65.8
19:00-20:00	65.6	70.3	67.3	67.0	65.0	63.3
20:00-21:00	64.3	68.4	65.8	65.5	63.9	62.6
21:00-22:00	66.0	70.3	67.2	67.0	65.5	64.2
22:00-23:00	64.5	69.5	65.9	65.6	63.9	62.7
23:00-00:00	61.1	68.7	62.9	62.5	60.8	58.2
00:00-01:00	50.9	68.9	54.2	53.1	50.0	47.8
01:00-02:00	51.6	78.5	54.6	52.4	51.9	50.3
02:00-03:00	51.6	78.5	53.3	52.9	51.3	49.9
03:00-04:00	59.0	72.4	60.8	60.4	58.6	55.7
04:00-05:00	57.8	81.4	65.6	60.8	56.6	54.7
05:00-06:00	60.0	89.3	69.6	64.2	57.1	54.7
06:00-07:00	55.8	94.2	64.0	57.4	50.7	48.1
07:00-08:00	52.5	79.1	57.6	55.4	48.7	43.8
<b>24 Hours Measurement</b>	<b>60.0</b>	<b>94.2</b>	<b>63.0</b>	<b>61.5</b>	<b>59.3</b>	<b>57.8</b>
<b>Standard<sup>1*</sup></b>	<b>70</b>	<b>115</b>	-	-	-	-
<b>Ldn</b>	<b>65.7</b>	-	-	-	-	-

Remark : <sup>1\*</sup> Notification of National Environmental Board, No.15, B.E.2540 (1997) under the Enhancement and Conservation of National Environmental Quality Act B.E.2535 (1992), published in the Royal Government Gazette No.114 Part 270 dated April 3, B.E.2540 (1997).

[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]

**ANALYSIS REPORT**

**Customer Name** : TLT Consultants Company Limited  
**Address** : 152 Nuan Chan Road, Nuan Chan, Bueng Kum, Bangkok, 10230  
**Project Name** : โครงการรถไฟฟ้ามหานคร  
**Project Location** : ส่วนแผนงานและจัดการจราจร  
**Measured Source** : Ambient Noise  
**Measured Point** : บริเวณด้านทิศตะวันตกของโครงการ หมู่ที่ 9 บริเวณฝั่งงาน ส่วนแผนงานและจัดการจราจร จังหวัดกาญจนบุรี  
**GPS. Coordinate** : UTM (WGSR4) 47P 0581001 E, 1592475 N  
**Measured Date** : November 7-8, 2023  
**Quotation No.** : 2023-01515  
**Analysis No.** : 2023-AE851-007  
**Report No.** : 2023-RAAW250  
**Measured By** : Mr. Sitthiporn Wongkham  
**Analyzed By** : Environment Research & Technology Co., Ltd.  
**Report Date** : November 16, 2023  
**Measured Instrument** : Integrating Sound Level Meter Scarlett Tech Model ST-21D Serial Number 820448

Interval Time	Noise Level, dB(A)										
	Leq	L5	Lmax	L10	L50	L90	L5	Lmax	L10	L50	L90
08:00-09:00	48.4	55.5	78.8	52.3	43.8	39.1	46.8	67.3	52.8	42.3	41.5
09:00-10:00	45.3	79.2	51.2	49.5	43.2	42.5	42.5	78.2	47.7	39.8	39.0
10:00-11:00	44.0	70.2	46.7	50.1	40.8	40.4	40.2	63.2	46.4	38.9	38.1
11:00-12:00	41.2	65.7	48.0	44.6	40.3	39.9	42.1	65.9	48.6	40.1	39.3
12:00-13:00	41.8	68.8	47.5	40.2	44.7	39.8	44.6	70.1	52.1	48.4	41.0
13:00-14:00	43.0	79.0	51.7	50.4	41.0	39.6	43.0	79.0	50.2	40.1	39.3
14:00-15:00	40.8	77.0	48.0	46.4	38.8	38.2	53.7	79.0	63.0	46.6	45.8
15:00-16:00	43.7	80.7	52.4	49.8	40.1	39.7	46.1	72.0	52.6	45.3	44.5
16:00-17:00	45.2	85.8	55.6	53.8	42.3	39.9	48.7	79.8	52.9	46.1	45.1
17:00-18:00	49.1	74.7	53.7	51.4	45.1	40.1	56.0	78.3	58.2	54.4	52.4
18:00-19:00	59.3	74.8	61.6	61.3	74.8	56.6	61.0	67.6	62.4	60.4	59.3
19:00-20:00	61.4	66.6	63.2	63.0	60.6	58.7	61.0	67.6	62.4	60.4	59.3
20:00-21:00	62.2	66.8	63.7	63.4	61.7	60.6	61.0	67.4	62.1	60.6	59.2
21:00-22:00	63.4	67.9	64.8	64.6	62.8	61.7	61.2	65.1	62.5	60.3	59.3
22:00-23:00	63.6	67.6	65.2	64.9	63.1	61.8	60.0	63.9	61.3	59.1	57.7
23:00-00:00	61.3	67.7	62.3	62.3	60.5	59.3	54.5	65.0	56.2	54.1	53.0
00:00-01:00	58.7	66.4	59.9	59.8	57.9	57.2	51.4	52.2	54.1	51.9	50.9
01:00-02:00	63.6	67.1	64.8	64.6	61.2	61.2	57.4	80.8	64.2	60.8	53.0
02:00-03:00	63.0	67.4	64.1	63.8	62.6	61.7	51.8	73.8	56.0	53.2	48.4
03:00-04:00	60.3	77.7	62.5	61.7	60.0	57.8	61.2	83.4	65.2	60.9	53.1
04:00-05:00	60.7	80.9	66.1	62.9	59.9	57.8	61.2	84.8	71.5	65.8	59.7
05:00-06:00	65.0	83.2	71.5	66.4	60.5	57.5	51.4	89.6	63.3	55.7	42.9
06:00-07:00	55.2	79.7	61.5	56.5	50.7	45.6	46.6	75.7	52.8	41.8	37.6
07:00-08:00	46.9	69.8	53.2	50.1	42.7	39.6	56.3	89.6	62.2	59.0	53.8
<b>24 Hours Measurement Standard<sup>1</sup></b>	<b>70</b>	<b>115</b>	-	-	-	-	<b>70</b>	<b>115</b>	-	-	-
<b>Ldn</b>	<b>68.0</b>	-	-	-	-	-	<b>63.9</b>	-	-	-	-

Remark : <sup>1</sup> Notification of National Environmental Board, No.15, B.E.2540 (1997) under the Enhancement and Conservation of National Environmental Quality Act B.E.2535 (1992), published in the Royal Government Gazette No.114 Part 270 dated April 3, B.E.2540 (1997).

[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]

**ANALYSIS REPORT**

**Customer Name** : TLT Consultants Company Limited  
**Address** : 152 Nuan Chan Road, Nuan Chan, Bueng Kum, Bangkok, 10230  
**Project Name** : โครงการรถไฟฟ้ามหานคร  
**Project Location** : ส่วนแผนงานและจัดการจราจร  
**Measured Source** : Ambient Noise  
**Measured Point** : บริเวณด้านทิศตะวันตกของโครงการ หมู่ที่ 9 บริเวณฝั่งงาน ส่วนแผนงานและจัดการจราจร จังหวัดกาญจนบุรี  
**GPS. Coordinate** : UTM (WGSR4) 47P 0581001 E, 1592475 N  
**Measured Date** : November 8-9, 2023  
**Quotation No.** : 2023-01515  
**Analysis No.** : 2023-AE851-007  
**Report No.** : 2023-RAAW250  
**Measured By** : Mr. Sitthiporn Wongkham  
**Analyzed By** : Environment Research & Technology Co., Ltd.  
**Report Date** : November 16, 2023  
**Measured Instrument** : Integrating Sound Level Meter Scarlett Tech Model ST-21D Serial Number 820448

Interval Time	Noise Level, dB(A)										
	Leq	L5	Lmax	L10	L50	L90	L5	Lmax	L10	L50	L90
08:00-09:00	46.8	52.8	67.3	50.9	42.3	41.5	46.8	67.3	52.8	42.3	41.5
09:00-10:00	42.5	78.2	47.7	45.2	39.8	39.0	42.5	78.2	47.7	39.8	39.0
10:00-11:00	40.2	70.2	46.4	43.1	38.9	38.1	40.2	63.2	46.4	38.9	38.1
11:00-12:00	42.1	65.9	48.6	45.5	40.1	39.3	42.1	65.9	48.6	40.1	39.3
12:00-13:00	44.6	70.1	52.1	48.4	41.8	41.0	44.6	70.1	52.1	41.8	41.0
13:00-14:00	43.0	74.6	50.2	47.7	40.1	39.3	43.0	74.6	50.2	40.1	39.3
14:00-15:00	53.7	79.0	63.0	59.5	46.6	45.8	53.7	79.0	63.0	46.6	45.8
15:00-16:00	54.4	79.8	66.5	62.5	54.1	53.3	46.1	72.0	52.6	45.3	44.5
16:00-17:00	48.7	79.8	52.9	51.1	46.1	45.1	48.7	79.8	52.9	46.1	45.1
17:00-18:00	56.0	78.3	58.2	57.7	54.4	52.4	56.0	78.3	58.2	54.4	52.4
18:00-19:00	61.0	62.6	62.4	62.4	60.4	59.3	61.0	62.6	62.4	60.4	59.3
19:00-20:00	61.0	62.6	62.4	62.4	60.4	59.3	61.0	62.6	62.4	60.4	59.3
20:00-21:00	60.7	62.1	61.8	61.8	60.6	59.2	60.7	62.1	61.8	60.6	59.2
21:00-22:00	61.0	62.1	61.9	61.9	60.2	58.6	61.2	65.1	62.5	60.3	59.3
22:00-23:00	60.0	61.3	61.0	61.0	59.1	57.7	60.0	61.3	61.3	59.1	57.7
23:00-00:00	54.5	55.9	56.2	55.9	54.1	53.0	54.5	56.0	56.2	54.1	53.0
00:00-01:00	51.4	52.2	54.1	52.2	51.9	50.9	51.4	52.2	54.1	51.9	50.9
01:00-02:00	57.4	64.2	64.2	60.8	56.5	53.0	57.4	64.2	64.2	56.5	53.0
02:00-03:00	51.8	73.8	56.0	53.2	49.8	48.4	51.8	73.8	56.0	49.8	48.4
03:00-04:00	61.2	83.4	65.2	60.9	55.7	53.1	61.2	83.4	65.2	55.7	53.1
04:00-05:00	61.2	84.8	71.5	65.8	59.7	57.2	61.2	84.8	71.5	59.7	57.2
05:00-06:00	51.4	89.6	63.3	55.7	44.9	42.9	46.6	75.7	52.8	41.8	37.6
06:00-07:00	46.6	75.7	52.8	49.7	41.8	37.6	46.6	75.7	52.8	41.8	37.6
07:00-08:00	56.3	89.6	62.2	59.0	55.3	53.8	56.3	89.6	62.2	59.0	53.8
<b>24 Hours Measurement Standard<sup>1</sup></b>	<b>70</b>	<b>115</b>	-	-	-	-	<b>70</b>	<b>115</b>	-	-	-
<b>Ldn</b>	<b>63.9</b>	-	-	-	-	-	<b>63.9</b>	-	-	-	-

Remark : <sup>1</sup> Notification of National Environmental Board, No.15, B.E.2540 (1997) under the Enhancement and Conservation of National Environmental Quality Act B.E.2535 (1992), published in the Royal Government Gazette No.114 Part 270 dated April 3, B.E.2540 (1997).

[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]

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## **Water Quality**





**ANALYSIS REPORT**

**Customer Name** : TLT Consultants Company Limited  
**Address** : 152 Nuan Chan Road, Nuan Chan, Bueng Kum, Bangkok 10230  
**Project Name** : โครงการจัดหาน้ำดื่ม ฟ้าประทาน  
**Project Location** : ตำบลกระดังงา อำเภอวังน้อย จังหวัดกาฬสินธุ์  
**Sampling Source** : Surface Water Sampling  
**Sampling Point** : คลองน้ำร้อนบนเขาน้ำร้อนบ้านท่าเรือกรม (SW1)  
**GPS, Coordinate** :-  
**Sampling Date** : May 30, 2023  
**Sampling Time** : 10:20  
**Sampling Method** : Grab  
**Sampling By** : Customer  
**Analyzed By** : Environment Research & Technology Co., Ltd.  
**Physical Properties** : Turbid, Light Yellow, Sediment, Odor

**Quotation No.** : 2023-00769  
**Analysis No.** : 2023-AC070-001  
**Received Date** : May 30, 2023  
**Analytical Date** : May 30-June 9, 2023  
**Report No.** : 2023-RAAK133  
**Report Date** : June 9, 2023

Parameter	Unit	Method of Analysis <sup>1*</sup>	Result	Standard <sup>2*</sup>	
				Class 3	Class 4
Biochemical Oxygen Demand	mg/L	5-Day BOD Test, Membrane Electrode	12	2.0	4.0
Total Coliform Bacteria	MPN/100 mL	Most Probable Number	7,900	20,000	-
Fecal Coliform Bacteria	MPN/100 mL	Most Probable Number	2,200	4,000	-
Chemical Oxygen Demand	mg/L	Closed Reflux, Titrametric	70	-	-

Remark : <sup>1\*</sup> Standard Method for Examination of Water and Wastewater, 23rd Edition, 2017.  
<sup>2\*</sup> The Standard of the National Environmental Quality Act B.E.2535 (1992), published in the Royal Government Gazette No.111 Part 15, dated February 24, B.E.2537 (1994), (Standard Value of Surface Water for Class 3, 4)

[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]



**ANALYSIS REPORT**

**Customer Name** : TLT Consultants Company Limited  
**Address** : 152 Nuan Chan Road, Nuan Chan, Bueng Kum, Bangkok 10230  
**Project Name** : โครงการจัดหาน้ำดื่ม ฟ้าประทาน  
**Project Location** : ตำบลกระดังงา อำเภอวังน้อย จังหวัดกาฬสินธุ์  
**Sampling Source** : Surface Water Sampling  
**Sampling Point** : คลองน้ำร้อนบนเขาน้ำร้อนบ้านท่าเรือกรม (SW2)  
**GPS, Coordinate** :-  
**Sampling Date** : May 30, 2023  
**Sampling Time** : 11:10  
**Sampling Method** : Grab  
**Sampling By** : Customer  
**Analyzed By** : Environment Research & Technology Co., Ltd.  
**Physical Properties** : Turbid, Light Yellow, Sediment, Odor

**Quotation No.** : 2023-00769  
**Analysis No.** : 2023-AC070-002  
**Received Date** : May 30, 2023  
**Analytical Date** : May 30-June 9, 2023  
**Report No.** : 2023-RAAK134  
**Report Date** : June 9, 2023

Parameter	Unit	Method of Analysis <sup>1*</sup>	Result	Standard <sup>2*</sup>	
				Class 3	Class 4
Biochemical Oxygen Demand	mg/L	5-Day BOD Test, Membrane Electrode	8.6	2.0	4.0
Total Coliform Bacteria	MPN/100 mL	Most Probable Number	7,900	20,000	-
Fecal Coliform Bacteria	MPN/100 mL	Most Probable Number	4,900	4,000	-
Chemical Oxygen Demand	mg/L	Closed Reflux, Titrametric	67	-	-

Remark : <sup>1\*</sup> Standard Method for Examination of Water and Wastewater, 23rd Edition, 2017.  
<sup>2\*</sup> The Standard of the National Environmental Quality Act B.E.2535 (1992), published in the Royal Government Gazette No.111 Part 15, dated February 24, B.E.2537 (1994), (Standard Value of Surface Water for Class 3, 4)

[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]





## ANALYSIS REPORT

**Customer Name** : TLT Consultants Company Limited  
**Address** : 152 Nuan Chan Road, Nuan Chan, Bueng Kum, Bangkok 10230  
**Project Name** : โครงการก่อสร้างท่าอากาศยานสุวรรณภูมิ  
**Project Location** : ตำบลระสา อำเภอลำทะเมนชัย จังหวัดกาฬสินธุ์  
**Sampling Source** : Surface Water Sampling  
**Sampling Point** : กองน้ำท่าส่งน้ำสู่อำเภอท่าคันโท  
**GPS, Coordinate** : -  
**Sampling Date** : May 30, 2023  
**Sampling Time** : 11:20  
**Sampling Method** : Grab  
**Sampling By** : Customer  
**Analyzed By** : Environment Research & Technology Co., Ltd.  
**Physical Properties** : Turbid, Yellow, Sediment, Odor

Quotation No. : 2023-00769  
 Analysis No. : 2023-AC070-003  
 Received Date : May 30, 2023  
 Analytical Date : May 30-June 9, 2023  
 Report No. : 2023-RAAK135  
 Report Date : June 9, 2023

Parameter	Unit	Method of Analysis <sup>1</sup>	Result	Standard <sup>2</sup>	
				Class 3	Class 4
Biochemical Oxygen Demand	mg/L	5-Day BOD Test, Membrane Electrode	21	2.0	4.0
Total Coliform Bacteria	MPN/100 mL	Most Probable Number	7,900	20,000	-
Fecal Coliform Bacteria	MPN/100 mL	Most Probable Number	3,300	4,000	-
Chemical Oxygen Demand	mg/L	Closed Reflux, Titrimetric	187	-	-

Remark 1 : <sup>1</sup> Standard Method for Examination of Water and Wastewater, 23rd Edition, 2017.  
<sup>2</sup> Ministry of the National Environment Board, No. 8, B.E.2537 (1994), issued under the Subchapter and Constitution of National Environmental Quality Act B.E.2535 (1992), published in the Royal Government Gazette No.111 Part 15, dated February 24, B.E.2537 (1994), (Standard Value of Surface Water for Class 3, 4).

## WATER AND WASTEWATER ANALYSIS REPORT

**CLIENT NAME** : บริษัท ทีแอลที คอนซัลตันส์ จำกัด  
**PROJECT NAME** : โครงการก่อสร้างท่าอากาศยานสุวรรณภูมิ  
**SAMPLING SOURCE** : แหล่งน้ำท่าส่งน้ำสู่อำเภอท่าคันโท  
**SAMPLING METHOD** : GRAB  
**SAMPLING BY** : คุณวิรัช ศรีมา และคุณพรชัย ชูเจน  
**CONTRACTED BY** : คุณพงศ์กฤษ คุ้มเกียรติ

REPORT DATE : 12/06/2023  
 RECEIVED DATE : 30/05/2023  
 ANALYTICAL DATE : 30/05-06/06/2021  
 PROJECT NO. : PRC1111  
 ANALYSIS NO. : W66009/4-5

PARAMETER/ITEM	UNITS	ANALYSIS METHOD	SW1	SW2	SW3
ANALYSIS NO.			W66009/4	W66009/5	W66009/6
SAMPLING DATE			30/5/2023	30/5/2023	30/5/2023
SAMPLING TIME			10.20 น.	11.15 น.	12.10 น.
DEPTH	m	-	0.5	0.2	0.3
pH	-	4500-H (B)	7.5	7.5	8.7
WATER TEMPERATURE	°C	2540(B)	30.2	31.7	35.6
TRANSPARENCY	m	-	0.15	0.15	0.03
CONDUCTIVITY	µS/cm	2510(B)	411.0	468.1	1004.0
DISSOLVED OXYGEN	mg/L	4500-OID)	5.2	5.1	7.0
SALINITY	ppm	2530(B)	0.2	0.2	0.5
CURRENT VELOCITY	m/s	-	*	*	*
SUSPENDED SOLIDS	mg/L	2540(D)	107.3	134.1	71.0
TOTAL DISSOLVED SOLIDS	mg/L	2540(C)	206.0	228.0	488.4

### REFER STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER 23<sup>RD</sup> EDITION (APHA AWWA WEF)

Remark : SAMPLE CONDITION : ใส, นิ่ง.  
 SW1 - กองน้ำท่าส่งน้ำสู่อำเภอท่าคันโทชั้นน้ำผิวน้ำ (จุดวัด SW6222, SW6433(B), SW6500, SW6504)  
 SW2 - กองน้ำท่าส่งน้ำสู่อำเภอท่าคันโทชั้นน้ำผิวน้ำ (จุดวัด SW6225, SW6351(B), SW6500, SW6504)  
 SW3 - กองน้ำท่าส่งน้ำสู่อำเภอท่าคันโทชั้นน้ำผิวน้ำ (จุดวัด SW6433(B), SW6500, SW6504)

ปริมาณน้ำที่ส่งมาวิเคราะห์ค่าต่างๆที่ได้ทดสอบทั้งหมด  
 นั้นจัดทำขึ้นเป็นรายงานผลการทดสอบโดยได้รับอนุญาตจากทางบริษัทผู้จัดทำเป็นรายงานผลการวิเคราะห์

[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]

[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]

# **Appendix 4A**

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**HRIA Process**

## HRIA PROCESS

The process of HRIA includes scoping, baseline data collection and assessment as follows:

### (1) Scoping of Impact and Risks

The first step of HRIA is to scope the potential impact and risk from following sources :

- Human right issues and related data from Environmental, Health and Social Impact Assessment Report (EIA, HIA, SIA).
- Human rights risks reference from relevant organization such as Guidance Note on Implementation of Human Rights Assessments under the Equator Principles, Guide to Human Rights Impact Assessment and Management (HRIAM), Guiding Principles on Business and Human Right.
- Human rights risks that have already occurred and those likely to occur throughout the entire value chain. This includes direct project activities by the project and indirect activities by suppliers or contractors; both of which may cause complicity in human rights violation.

These potential human rights issues are then grouped by topics with potential negative impact/risk and effectors as presented in **Table 1**.

### (2) Baseline Data Collection

Baseline data collection is an important step to collect human right risks issues, from participants of human right risks assessment process, who have direct association with those risks issue as initially scoped in **Table 1**.

The Baseline data collection were collected through public consultation with project stakeholders. The result of the public consultation was analyzed and assessed as presented in **Table 2**.

**TABLE 1**  
**SCOPING OF RELEVANT HUMAN RIGHTS ISSUES FROM PROJECT IMPLEMENTATION ACTIVITIES**

<b>Relevant Human Rights Issues</b>	<b>Potential Negative Impact/Risk</b>	<b>Effectors</b>
<b>Labour rights</b>		
Occupational health and safety	<ul style="list-style-type: none"> <li>• Risk that workers will face occupational accident during the project construction and operation phase.</li> </ul>	<ul style="list-style-type: none"> <li>• Project Developer</li> <li>• Contractors</li> </ul>
Discrimination	<ul style="list-style-type: none"> <li>• Risk that workers may be treated unfairly (either through recruitment, hiring, management, compensation, career progression/ opportunities, or termination practices) due to certain attributes such as on the basis of their disability, religion, health, ethnicity, gender, sexual orientation, gender, age, indigenous origin, migrant worker status, etc. (as such, it intersects with other rights e.g. right to health).</li> </ul>	<ul style="list-style-type: none"> <li>• Project Developer</li> <li>• Contractors</li> </ul>
Wages (pay equity, standard of life)	<ul style="list-style-type: none"> <li>• Using staff that are paid extremely low wages with no or very limited entitlements to sick pay or leave.</li> </ul>	<ul style="list-style-type: none"> <li>• Project Developer</li> <li>• Contractors</li> </ul>
Working Hours	<ul style="list-style-type: none"> <li>• Mandating unreasonable working hours for employees that are inconsistent with ILO standards, which generally indicate that employees should not be required to work more than 48 hours per week, or ten hours a day, and should have one day off per week.</li> </ul>	<ul style="list-style-type: none"> <li>• Project Developer</li> <li>• Contractors</li> </ul>
<b>Community rights</b>		
Community Safety & Standard of Living	<ul style="list-style-type: none"> <li>• Risk that project transportation incurs road accident;</li> <li>• Impact of pollution that is affected by project construction, such as noise and vibration, and waste;</li> <li>• Impacts on public utility services which is affected by labour migration into the area</li> </ul>	<ul style="list-style-type: none"> <li>• Project Developer</li> </ul>

**TABLE 2**  
**HUMAN RIGHTS RISKS IN THE PROJECT IMPLEMENTATION ACTIVITIES**

Project activity	Respective rights	Description of human rights risks	Receptor	
			Employees	Local community
<b>Labour rights</b>				
Employment of staff and workers (full time and part time)	Occupational health and safety	<ul style="list-style-type: none"> <li>Risk that workers will face occupational accident during the project construction and operation period.</li> </ul>	✓	
	Discrimination	<ul style="list-style-type: none"> <li>Risk that workers may be treated unfairly (either through recruitment, hiring, management, compensation, career progression/ opportunities, or termination practices) due to certain attributes such as on the basis of their disability, religion, health, ethnicity, gender, sexual orientation, gender, age, indigenous origin, migrant worker status, etc. (as such, it intersects with other rights e.g. right to health services).</li> </ul>	✓	
	Working Hours	<ul style="list-style-type: none"> <li>Mandating unreasonable working hours for employees that are inconsistent with ILO standards, which generally indicate that employees should not be required to work more than 48 hours per week, or ten hours a day, and should have one day off per seven days.</li> </ul>	✓	
<b>Community Right</b>				
Construction of the project	Community Safety & Standard of Living	<ul style="list-style-type: none"> <li>Risk that project transportation incurs road accident;</li> <li>Impact of pollution that is affected by the project construction, such as noise and vibration, and waste;</li> <li>the conflict between migrant workers and the local people;</li> <li>Utilization of public infrastructures affected by migrant workers are inadequate to the local people.</li> <li>Infestation of disease carriers</li> </ul>		✓
Operation of the project	Community Safety & Standard of Living	<ul style="list-style-type: none"> <li>Risk that project transportation incurs road accident;</li> <li>Contamination to the environment</li> <li>Infestation of disease carriers</li> </ul>		✓

### (3) Assessment

#### (a) Human Right Risks Assessment Criteria

According to the UN Guiding Principles, Human right assessment considers 2 key parameters i.e. severity of Risk and Likelihood of Occurrence. Consideration on Severity of the identified human rights risks consider the impacts through the 3 factors of which are most severe (based on scale, scope, and remediability),

These two dimensions (severity and likelihood), human rights risk assessment criteria is developed to identify level of risks from 1-4 as presented in **Table 3**.

**TABLE 3**  
**HUMAN RIGHT RISKS ASSESSMENT CRITERIA**

<b>Criteria for Severity</b>				
	<b>Low (1)</b>	<b>Medium (2)</b>	<b>High (3)</b>	<b>Critical (4)</b>
<b>Scale</b>	Minor impact to health and safety: first aid case	Slight impact to health and safety: minor injury or illness (no loss time)	Moderate impact to health and safety: serious injury that needs rehabilitation (loss time injury)	Significant impact to health and safety: physical disability or fatality
<b>Scope</b>	No negative impact to stakeholder	Impact to some stakeholders in particular stakeholder group	Impact to most stakeholders in particular stakeholder group	Impact to all stakeholders group (such as local communities, affected community members, and vulnerable)
<b>Remediability</b>	Take less than a year (<1 year) to restore the impact	Take 1-3 years to restore the impact	Take 3-5 years to restore the impact	Impossible to restore or will take longer than 5 years (>5 years) to restore the impact
<b>Criteria for Likelihood</b>				
	<b>Rare (1)</b>	<b>Unlikely (2)</b>	<b>Possible (3)</b>	<b>Likely (4)</b>
	Incident has occurred within the industry, but it is very improbable that the incident will occur in the company's area of operations (<1%)	Incident rarely occurs within the area of operations, but it is possible (1-10%)	Incident occasionally occurs within the area of operations occasionally (10-25%)	Incident occurs within the area of operations several times per year (>25%)

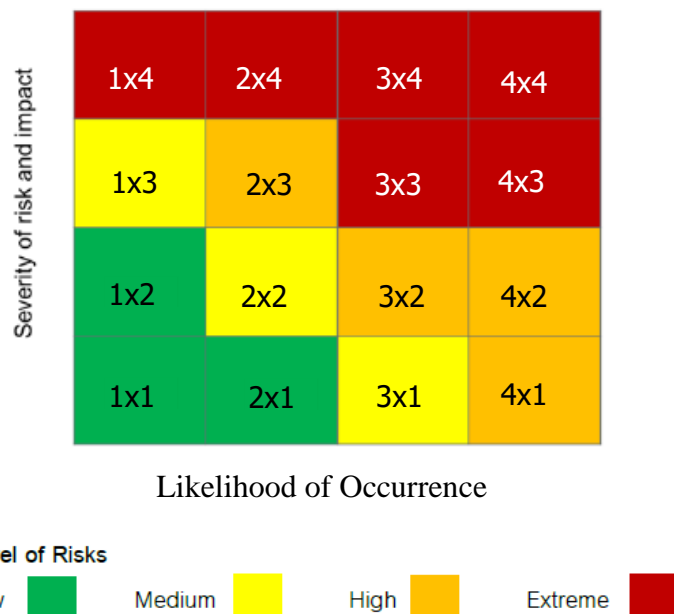
**(b) Assessment of Level of Human Right Risk**

Considering the severity and likelihood of occurrence of each implement activity and plot in the Human Right risk assessment matrix as show in **Figure 1** the level of Human Rights Risk can be obtained in the level of low, medium high or critical with definition of Impact/Risk describe in **Table 4**.

**(c) Assessment for Type of Human Rights Risk**





For Human Rights Risks and Impact Assessment, there are two types of risk to consider :

- Inherent risk, which is the level of risk inherent, or natural, to the situation. It is based on the nature of the context when no mitigation measures are in place.
- Residual risk, which is the level of risk with all the measures and controls are in place.



**FIGURE 1 : THE HUMAN RIGHTS RISK AND IMPACT ASSESSMENT MATRIX**

**TABLE 4**  
**DESCRIPTION OF THE LEVEL OF HUMAN RIGHTS RISK/IMPACT**

Level of Risk Impact	Type of Impact
Extreme 	<ul style="list-style-type: none"> <li>• Human rights impact covers a wide scope of area or population, extending beyond the area of operations.</li> <li>• The project cannot control or mitigate human rights impacts to remediate the affected victims and restore them to their original condition.</li> <li>• The impact / incident related to human rights requires the support of an independent, trusted third party to mediate the issue.</li> </ul>
High 	<ul style="list-style-type: none"> <li>• The project is complicit in assisting or supporting an activity that resulted in human rights violation (legal complicity).</li> <li>• The human rights impact was caused by the activities of the project or the activities in the project's supply chain, and created impacts on stakeholders in the area of operations.</li> <li>• The project has a human rights conflict with a vulnerable group.</li> </ul>
Medium 	<ul style="list-style-type: none"> <li>• The project benefited from activities conducted by external parties that resulted in human rights violation (non-legal complicity).</li> <li>• The project cannot respond to the human rights concerns of internal or external stakeholders.</li> </ul>
Low 	<ul style="list-style-type: none"> <li>• Potential human rights impacts and concerns raised by internal or external stakeholders are resolved, with prevention measures put in place. The project's grievance mechanisms are effective.</li> </ul>

The process to assess impact of identified human right risks is as follows:

1. Assess **inherent risk level** of identified human right risks using the risk criteria in **Table 3**, which assess the likelihood and the severity (scale, scope and remedability), and determine the significance of the risks prior to the project's activities of control or mitigation measures.
2. Assess **residual risks level** by using the same assessment criteria with inherent risk level .However, in this step, the project needs to consider current mitigation measure and controls to assess the level of residual risk .
3. Select the top **human rights salient issues** once all residual risks are finalized and placed in the matrix. The salient issues refer high priority risks that require further actions to appropriately mitigate the risks. In other words, those human rights risks are determined to have high level of impact, the project should therefore prioritize them. This can be achieved by reviewing existing risk management measure, as well as publishing additional measures to further mitigate risks.



# **Appendix 5A**

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## **Environmental and Social Management System Manual**



## ES Policy

GED aspires to become a trusted company that innovates to develop premier energy across boundaries. GED is committed to conducting business operations towards a sustainable long-term growth taking into account of economic, environmental and social risks and opportunities. The ESMS Framework provides foundation for our approach in everything we do across the Group and in line with international standards.

Key attributes of the Policy are:

1. Implement and maintain the ESMS in order to continuously improve and escalate ES performance throughout the organization;
2. Comply with environmental, social, health and safety related laws, applicable environmental and social safeguard requirements, customers' requirements, and other regulations as a minimum criterion;
3. Conduct business with responsibilities towards environment and society by reducing our footprint along the value chains in which operate whilst balancing the interests of a diverse range of stakeholders to assure sustainable business growth;
4. Embed and foster good ES culture and behaviour throughout the organization with emphasis on participation from management and employees at all levels;
5. Manage, cooperate and improve ES performance with key contractors, suppliers and business partners; and
6. Regularly review our ES performance and publicly report our progress.

This policy shall be communicated and made available to all of Company staff. The policy shall be reviewed on every three (3) years and modified to incorporate changes as arising from change and progress of the Company business.

*[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]*

President

**Date:** December 25, 2017

**Rev:**0

# GULF ENERGY DEVELOPMENT PUBLIC COMPANY

## Environmental and Social Management System Manual



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# GED Environmental and Social Management System Manual

**Area of Applicability:** Gulf Group Plant Facilities

**Responsible Center:** Environment, Health and Safety

**Revision:** 0

**Effective Date:** December 26, 2017

**Approved By:**

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**Senior Executive Vice President and  
Chief Operating Officer**

# 1 Introduction

## 1.1 Purpose

The Manual describes the application of GED Environmental and Social (ES) Management System (ESMS) to a project cycle owned and managed by GED Energy Development (GED) starting from Feasibility Study, Project Development to Operation.

The ESMS also incorporates elements from, or are aligned with, other international policies, standards and management practices to which GED has committed, such as Asian Development Bank's Safe Guard Policy Statement 2009, ISO 14001: 2015, Global Reporting Initiative (GRI) and International Standards ISO 26000: 2010.

The purpose of ESMS is to establish the system requirements and tools required for the management of environmental, social, health and safety risks and opportunities throughout the project cycle. Further, the ESMS describe corporate level ES Policy and its management and demarcate roles and responsibilities at each stage of project cycle.

Implementation of ESMS is the responsibility of everyone in GED in order to accomplish the set objectives. Moreover, each operating site is responsible for developing their own plan, procedures and programs plans specific and applicable to the nature of the business.

## 1.2 Scope of Application

All GED businesses, their managed sites and functional locations must implement, or demonstrate conformance to the requirements of this ESMS.

The ESMS applies to:

- (a) feasibility studies;
- (b) implementation;
- (c) operation;
- (d) decommissioning<sup>1</sup>
- (e) goods provided to GED; and
- (f) services delivered/ performed by contractors undertaken on GED sites or under GED management.

Newly acquired businesses or sites must conform to GED's ESMS by performing a gap analysis and by developing and starting to implement an action plan to close the gaps within three (3) years or upon the reasonable timeline agreed with the target company.

---

<sup>1</sup> The ES requirements for decommissioning phase will be included in the next update of this ESMS Manual as the decommissioning of the operating site is not expected in the next 10 years.

GED aspires to become a trusted company that innovates to develop premier energy across boundaries. GED is committed to conducting business operations towards a sustainable long-term growth taking into account of economic, environmental and social risks and opportunities. The ESMS Framework provides foundation for our approach in everything we do across the Group and in line with international standards.

Key attributes of the Policy are:

1. Implement and maintain the ESMS in order to continuously improve and escalate ES performance throughout the organization;
2. Comply with environmental, social, health and safety related laws, applicable environmental and social safeguard requirements, customers' requirements, and other regulations as a minimum criterion;
3. Conduct business with responsibilities towards environment and society by reducing our footprint along the value chains in which operate whilst balancing the interests of a diverse range of stakeholders to assure sustainable business growth;
4. Embed and foster good ES culture and behaviour throughout the organization with emphasis on participation from management and employees at all levels;
5. Manage, cooperate and improve ES performance with key contractors, suppliers and business partners; and
6. Regularly review our ES performance and publicly report our progress.

This policy shall be communicated and made available to all of Company staff. The policy shall be reviewed on every three (3) years and modified to incorporate changes as arising from change and progress of the Company business.



### 3 ESMS Framework, Structure and Responsibilities

In achieving GED Sustainable Development Policy, GED is required to apply its ESMS throughout a project lifecycle of the business.

The project lifecycle of GED are from feasibility study, project development (implementation) to operation. This ESMS framework in the document is split into three (3) types:

- Feasibility Study and Implementation
- Merger & Acquisition
- Operation

The ESMS frameworks for these three types are described as follows.

#### 3.1 ESMS Framework for Feasibility and Implementation

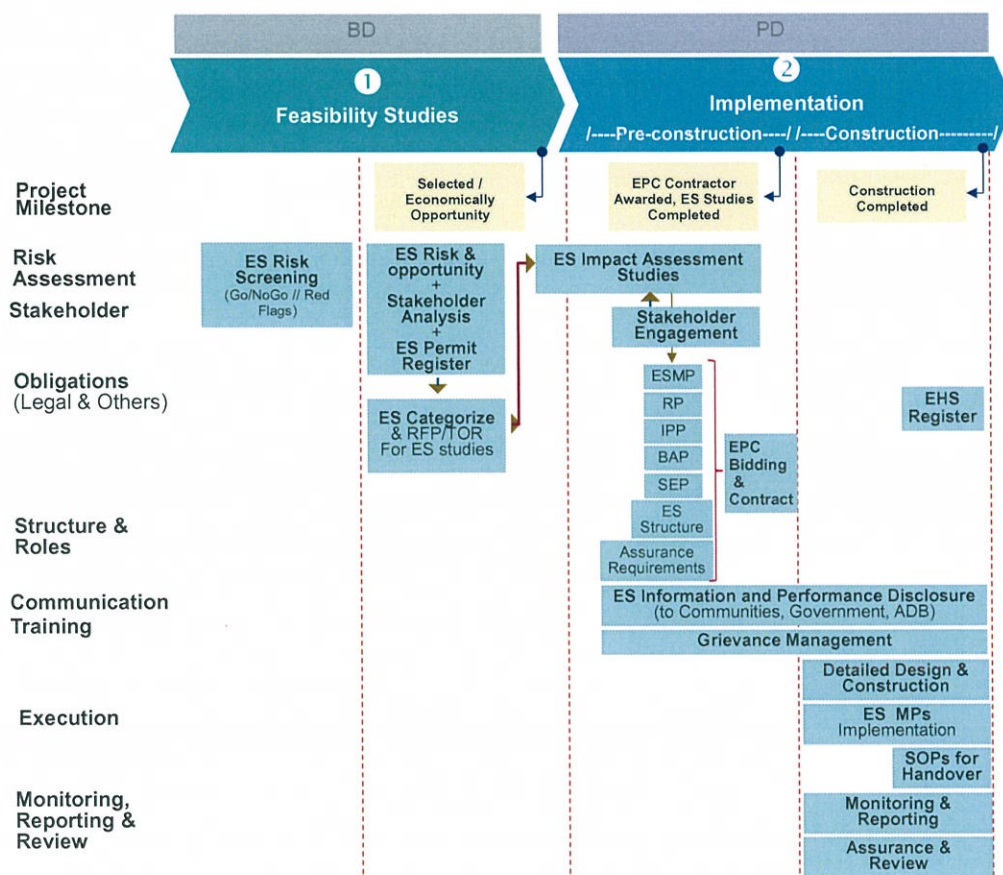
A feasibility study is where new opportunities are initiated and is subject to screening and evaluated prior to entering the implementation phase.

The implementation is where an economically feasible opportunity is furthered developed through (a) pre-construction [scoping, conceptual design, planning, tendering and awarding to Engineering, Procurement and Construction (EPC) Contractor]; and (b) construction [detailed design, mobilization, construction, commissioning and evaluation].

The ESMS framework for the feasibility and implementation can be demonstrated in *Figure 1* overleaf.

Figure 1

ESMS Framework for Feasibility and Implementation



Milestones or ES indicators related to this phase are summarized as follows.

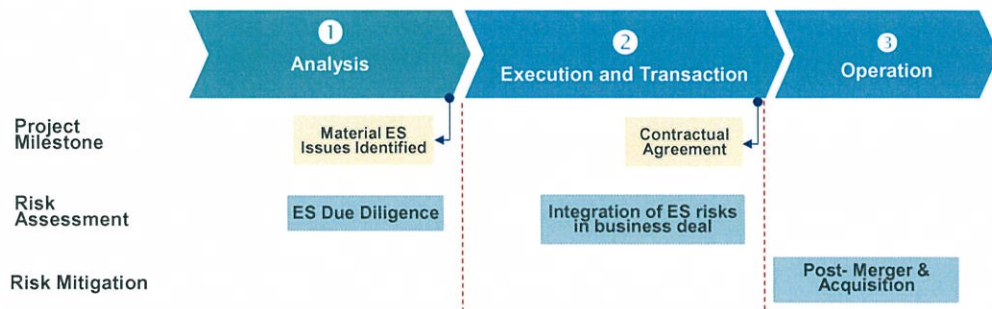
- ES Indicators for the Feasibility Study
  - Key ES risks and opportunities influence to business decision identified
  - Key stakeholders' views and interests considered in the scoping of ES impact assessment study
- ES Indicators for the Pre-construction
  - ES licenses/ permits and their timelines incorporated into an overall project master plan
  - Required ES Studies e.g. EIA/IEE/ESIA approved against the overall project master plan
  - Number of formal/written complaints unaddressed
  - Number of complaints impacting the project schedule
- ES Indicators for the Construction
  - Review of detailed design as per project ES specifications completed
  - ES Management Plans integrated into EPC contractor's Management Plan
  - ES performance of EPC contractors during construction activities
  - Number of formal/written complaints unaddressed
  - Percentage of corrective actions for ES issues closed
  - Number of complaints impacting the project schedule

### 3.2 ESMS Framework for Merger & Acquisition

Mergers and Acquisition (M&A) is another type of investment beyond the project development where due diligence is required. This is another way GED grows the business operations and services.

The ESMS framework for the M&A is described in *Figure 2* as follows.

**Figure 2 ESMS Framework for Mergers & Acquisition**



Milestones or ES indicators related to the M&A are summarized as follows.

- Material ES issues are identified and incorporated in business deals/negotiations.
- ES liabilities to address material ES issues are taken into account in a contractual arrangement.
- Action plan to address material ES issues are implemented and tracked after the mergers and acquisition.

### 3.3 ESMS Framework for Operation

An operational phase is when the project starts a commercial run/ plant operation and maintenance activities. The ESMS framework for the operational phase is demonstrated in *Figure 3* as follows.

**Figure 3 ESMS Framework for the Operation**



ES Elements for Operation comprises 16 topics as follows:

1. Management Leadership and Commitment;
2. Risk and Opportunities;
3. Change Management;
4. Compliance;
5. Goal and Improvement Plan;
6. Stakeholder Engagement;
7. Awareness and Competency;
8. Contractor and Suppliers;
9. Operational Control & Maintenance;
10. Emergency Preparedness and Response;
11. Communication;
12. Incident Management;
13. Monitoring and Reporting;
14. Audit;
15. Handling of Non-Conformities; and
16. Management Review.

Milestones or ES indicators related to the operational phase are

- ES risks mitigated and reduced to an acceptable level throughout the operation.
- Compliance with environmental, social, health and safety related obligations.
- ES performance improvement made during the operation.

### **3.4 Roles and Responsibilities**

Each phase of the project requires different project management roles and responsibilities, as business and commercial conditions including levels of authorisation vary throughout the project lifecycle.

Thus, the roles and responsibilities of ESMS shall be appropriately designed and tailor-made to fit with each project phase through the lifecycle to address ES risks and opportunities.

Below are the key roles and responsibilities at various phases of relevant functions/ groups within GED.

#### **3.4.1 Business Development Group (BD)**

- Feasibility Study
  - Be accountable for a feasibility study for new opportunities
  - Conducts ES risk screening to identify potential ES red-flag issues to inform business decision for new project development
  - In case of M&A, ensure that environmental and social due diligence is conducted for the selected opportunities to inform material ES issues for business deals/ negotiations

### 3.4.2 Community Relation Department (CR)

- Feasibility Study
  - Conduct a stakeholder identification to inform scope of studies for relevant ES impact assessment
  - Support Business Development Group (BD) for information regarding social-related risks that could arise from the identified opportunities
- Pre-construction
  - Develop stakeholder engagement plan and provide the results to EIA/IEE/ESIA study
  - Implement stakeholder engagement activities as planned
- Construction
  - Drive the implementation of Indigenous People Plan (IPP), Resettlement Plan (RP) and Stakeholder Engagement Plan (SEP) as planned
  - Report the implementation progress of IPP, IR and SEP and results to relevant stakeholders

### 3.4.3 EIA Department (EIA)

- Feasibility Study
  - Identify ES permits and licenses required for the opportunity to be further developed e.g. IEE/ ESA, EIA, ESIA and related permits
  - Determine environmental issues associated to the project to further inform the scope of ES studies
- Pre-construction
  - Facilitate and ensure that IEE/ ESA/ EIA/ ESIA study is completed and approved before the construction
  - Report implementation progress and results of ES studies to relevant stakeholders
- Construction
  - Support and guide the implementation of ES Management Plans to PD where needed

### 3.4.4 Engineering Group

- Feasibility Study
  - Perform technology studies to be applied for the project
  - Identify relevant permit required for the selected technology with support from BD and Legal Department
- Pre-construction
  - Incorporate requirements regarding engineering requirements and requirements associated ES issues (e.g. environmental pollution abatement equipment, ES specification as per regulations, etc.) into TOR for EPC Contactor Bidding
  - Work with PD to select EPC Contractor using ES selection criteria
- Construction
  - Provide support in engineering design to Project Implementation Team
  - Provide support in review and approval to ensure the design and construction are in compliance with project specifications including performance guarantee

### **3.4.5 Project Development Group (PD)**

- Pre-construction
  - Develop TOR for the required ES studies e.g. EIA/IEE/ESIA study and engages qualified third parties to conduct detailed studies
  - Incorporate results from ES studies (e.g. EIA) from each relevant department into TOR for EPC Contractor Bidding
  - Work with Engineering Department to select EPC Contractor using the ES selection criteria
  - Develop contract with the awarded EPC Contractor and incorporate ES management requirements into the contract
  - Monitor for all contracts and required permits/licenses are finalized and important studies are completed
  - Handover the project requirements and information to Project Implementation Team to be ready for construction
  - Work with Engineering Group to develop contract with the awarded EPC Contractor and incorporate ES management requirements into the contract
- Construction
  - Oversight EPC contractor for ES management for detailed design and construction
  - Monitor and review EPC contractor's ES management implementation and performance
  - Report the ES performance to relevant stakeholders

### **3.4.6 Asset Management Group (AM)**

- Pre-construction
  - Prepare relevant ESMS procedures/ documents/ plan to be ready for operation team
  - Deploy GED's ESMS and related procedures, and plan to Operation team for standardization
- Operation
  - Support the operating site to conform to GED ESMS within one (1) year
  - Assure effective implementation and maintenance of ESMS
  - Consolidate, analyse the ES performance from each operating site and report to GED executive management
  - Provide supports for the ESMS implementation for each operating site as required

### **3.4.7 Operating Site**

- Operation
  - Adopt GED ESMS Policy and requirements and implement for continuously improvement and minimize ES impacts
  - Report performance of ESMS implementation to Asset Management Department

## 4 ESMS Elements for Feasibility Study and Implementation

### 4.1 Feasibility Study

#### 4.1.1 Risk Screening

##### Intent

- Determine 'Go/No Go' or 'Red Flag' risks that call for attention at early stage
- Confirm compliance with the fund's policy and Exclusion List.

##### Requirements

- Identify critical ES risks and liabilities specific to project type, locations based on publicly available information using ES Feasibility Study Checklist as a tool for assessment
  - ES issues to be reviewed for ES risks comprise, but not limited to, the followings:
    - Land availability and proximity to supporting infrastructures;
    - Environmentally sensitive areas including biodiversity;
    - Community receptiveness and concerns;
    - Involuntary resettlement of people;
    - Water risk/ water scarcity;
    - Utility availability and capacity;
    - Transmission line locations and distance; and
    - Environmental concerns such as emission limits.
  - No-Go conditions:
    - Environmental and social conditions which prompt an early decision in potential investment review not to proceed further (e.g. critical habitats, illegal business, area legally protected)
  - Red Flag conditions:
    - Environmental and social conditions which require further attention in the review process to identify potential management and mitigation measures relating to these conditions.
- Review compliance against ADB's PIAL (Prohibited Investment Activities List) *Annex 2*.
- Develop actions to address Red Flag by considering alternative(s) or gaining more specific project info for further assessment/ re-assessment in Feasibility Stage
- Integrate risk screening as part of the project feasibility study/ decision-making process

##### Documents

- ES Risk Matrix

## 4.1.2

### Stakeholder Identification

#### Intent

- Identify stakeholders and consider their opinions and interests as inputs to investment analysis

#### Requirements

- Identify stakeholders that can have a direct influence in the project development in terms of permitting and acceptance of the project
  - who have ability to impact to and interests in the project and their concerns (i.e. to go forward with the project or vice versa)
  - who are directly affected by the project, whether from the use of land at the project site or effects of the environment changed, or even the socio-economic effects throughout the supply chain
- Develop engagement plan to address stakeholder associated with 'Red Flag' issues
- Integrate stakeholder analysis results/ stakeholder map as part of the project feasibility study/ decision-making process

#### Documents

- Stakeholder Analysis and Engagement Procedure

## 4.1.3

### ES Obligations and Permits

#### Intent

- Identify what ES studies and permits being required, e.g. IEE, ESA, EIA, ESIA
- Determine resources required as inputs to investment analysis and project schedule

#### Requirements

- Identify relevant environmental and social permits required by reviewing against:
  - Relevant host country laws
  - ADB's 2009 Safeguard Policy Statement (SPS);
  - Ratified international agreements on environmental, health and safety, land acquisition and involuntary resettlement, indigenous peoples, human resource and labour practices, gender and other social matters, which are in full effect at the time of authorization;
  - IFC General Environmental and Social (ES) Guidelines (2007); and
  - IFC ES sector-specific guidelines, including Thermal Power and others as applicable
- Review related local regulations of the host country to identify whether an ES permits (e.g. EIA/ ESIA report) is compulsory required.
- Integrate list of ES studies and permits/ licenses together with time and schedule identification as part of the project feasibility study/ overall project master plan.

#### Documents

- Standard list of ES studies, permits and licenses



#### 4.1.4 Project Categorization (A, B, C)

##### Intent

- Determine project categorization

##### Requirements

- Assess scope of project against ADB's Categorization (Environment, Involuntary Resettlement, Indigenous People)
- Advise project categorization and ES screening to ADB
- Identify safeguard requirements as input into the project feasibility study/ decision-making process
- Develop scope of ES study based on identified ES inputs (risk, stakeholder, project category, permit and license) from feasibility assessment to develop an appropriate Terms of Reference for required ES study
- Integrate scope of ES studies (e.g. EIA, ESIA) in the Terms of Reference

**Figure 1** *ABD's Environment and Social Safeguards Categorization Definition*

Category	Environment	Involuntary Resettlement	Indigenous Peoples
<b>A – Significant</b>	Subprojects that anticipate significant adverse environmental impacts that are irreversible, diverse, or unprecedented. These impacts may affect an area larger than the sites or facilities subject to physical works.	Subprojects where 200 or more persons will experience major impacts, which are defined as (i) being physically displaced from housing, or (ii) losing 10% or more of their productive assets (income generating).	Subprojects that are expected to significantly affect the dignity, human rights, livelihood systems, or culture of Indigenous Peoples or affects the territories or natural or cultural resources that Indigenous Peoples own, use, occupy, or claim as an ancestral domain or asset.
<b>B – Less Significant</b>	Subprojects with potential adverse impacts that are site-specific, few if any of them are irreversible, and in most cases mitigation measures can be more readily designed than Category A subprojects.	Subprojects with involuntary resettlement impacts that are not deemed significant.	Subprojects that are likely to have limited impacts on Indigenous Peoples.
<b>C – Minimal or impact</b>	Subprojects that have minimal or no adverse environmental impacts	Subprojects with no involuntary resettlement impacts.	Subprojects that are not expected to have impacts on Indigenous Peoples.

## 4.2 Implementation (Pre-construction and Construction)

### Pre-construction

#### 4.2.1 ES Impact Assessment Study & Management Plan (EMP) Development

##### Intent

- Assess environmental and social impacts and risks, and determine mitigation measures and monitoring requirements to mitigate the impacts and risks.

##### Requirements

- Engage a qualified independent ES expert to undertake ES studies (e.g. IEE, ESA, EIA, ESIA) in compliance with relevant standards and in consultation with stakeholders, including affected people and local community stakeholders.
- Submit ES studies information to ADB for disclosure and periodically monitoring report along the implementation as required.
- Provide all necessary supports and assign delegates to accomplish any activities required to accomplish the ES studies.
- Participate or assign delegates to disseminate the project information to the public in all stakeholder engagement activities.
- Keep the original final ES studies and their-related mandatory reports, e.g. Monitoring report, and Compliance Audit report.
- In case of any deviations of project information and/ or EMP in the ES study report, communicate, and take these issues to consult with consent agencies whether such deviation may pose significantly adverse impacts to sensitive receptors.

##### Documents

- ES studies (e.g. IEE, ESA, EIA, ESIA)
- Related reports to ES studies (e.g. monitoring reports, compliance audit reports)

##### References

- ADB's Safeguard Requirements (SR1)
- ADB's SPS, 2009 – Safeguard Requirements (SR2) on Involuntary Resettlement
- ADB's Public Communication Policy

#### 4.2.2 Biodiversity Action Plan (BAP) Development

##### Intent

- Assess impacts to biodiversity and develop mitigation plan aiming at a net positive impact on biodiversity
- Avoid impacts on critical habitats and high value species
  - Commit not to explore/mine/drill in World Heritage areas and IUCN Category I-IV protected areas
  - Ensure that its activities will not lead to the extinction of IUCN listed endangered species

### **Requirements**

- Assess the need for a Biodiversity Action Plan (BAP) based on identified ES inputs (risks, stakeholders, project category, permit and license) from the feasibility stage:
  - Are there legal, regulatory, planning, permitting or third party requirements for biodiversity?
  - Are there significant observed or predicted biodiversity impacts i.e. project is located in natural habitats or potential presence of high value species?
  - Are there business benefits and a business case for biodiversity?
- Engage a qualified party to conduct the baseline survey of biodiversity and prepare the BAP. The study of BAP preparation can be part of the EIA study
- Develop BAP outlining
  - priorities for conservation by identifying species, habitats and ecosystems and ecosystem services that need special management, taking into account international, national and local priorities within existing national and local biodiversity action plans and relation priorities.
  - conservation plan by identifying the objectives of the BAP; measures to avoid, minimize, or mitigate potentially adverse impacts and risks; propose compensatory measures to achieve no net loss or a net gain of the affected biodiversity
  - Prioritized actions to achieve the objectives and targets set which progress can be monitored
- Submit BAP to ADB (could be as a part of EIA study) for disclosure and periodically monitoring report along the implementation.

### **Documents**

- Biodiversity Action Plan (BAP)

### **References**

- UN Convention on Biological Diversity - <http://www.cbd.int>
- Convention on International Trade in Endangered Species of Wild Fauna and Flora - <http://www.cites.org/>
- UNESCO World Heritage Centre - <http://whc.unesco.org/>
- International Union for Conservation of Nature - <http://www.iucn.org/>
- Guideline for biodiversity studies from Thailand's Fine Arts Department and Thailand's Royal Forest Department

## **4.2.3 Resettlement Plan (RP) Development**

### **Intent**

- Avoid involuntary resettlement wherever possible
- Provide adequate and appropriate compensation including replacement land and structures, or cash
- Enhance, or as minimum least restore, the livelihoods of all displaced persons in real terms relative to pre-project levels.

### **Requirements**

- Assess the project impacts causing involuntary resettlement (physically and economically) based on identified ES inputs (risks, stakeholders, project category, permit and license) from the feasibility stage

- Conduct meaningful consultations with affected persons, their host communities, and civil society to understand the need of disadvantaged or vulnerable groups
- Develop Project Resettlement Plan (RP), to ensure that livelihoods and standards of living of displaced persons are improved, or at least restored to pre-project (physical and/or economic) levels. At minimum RP should include
  - Minimizing the acquisition of land resulting in physical or economic displacement
  - Disclosure of displacement eligibility and entitlements as early as possible in project planning
  - Fair determination of compensation for land acquisition and other assets
  - Development of Resettlement Action Plans for physical displacement
  - Development of Livelihood Restoration Plans for economic displacement
  - Physical and economic displacement grievance redress mechanisms
  - Periodic audit and assessment of Resettlement Action Plans and/or Livelihood Restoration Plans
- Submit of RP to ADB (could be as part of EIA study) for disclosure and periodically monitoring report along the implementation.

#### **Documents**

- Resettlement Plan (RP)

#### **References**

- IFC Performance Standard 5: Land Acquisition and Involuntary Resettlement
- ADB's SPS, 2009 – Safeguard Requirements (SR2) on Involuntary Resettlement

### **4.2.4**

#### **Indigenous People Plan (IPP) Development**

##### **Intent**

- Avoid negative impacts to Indigenous People
- Develop mitigation measures to minimize negative impacts to Indigenous People

##### **Requirements**

- Assess the need for Social Impact Assessment (SIA) based on identified ES inputs (risks, stakeholders, project category, permit and license) from the feasibility stage and the scale to the potential effects on Indigenous Peoples
- Develop Indigenous Peoples Plan (IPP) outlining the measures to
  - Identifying affected Indigenous People
  - Understanding the local context for engaging with Indigenous People
  - Principles of good engagement of Indigenous People
  - Free Prior and Informed Consent
  - Cultural preservation
  - Grievance redress mechanisms
  - Audit and assessment of relocation/ resettlement
- Submit IPP to ADB (could be as part of EIA study) for disclosure and periodically monitoring report along the implementation.

##### **Document**

- Indigenous People Plan (IPP)

##### **References**

- ADB's SPS SR 3 on Indigenous Peoples

- IFC Performance Standard 7: Indigenous Peoples
- ICMM Indigenous Peoples and Mining Good Practice Guide 2016
- ILO Convention 169 on Indigenous and Tribal Peoples 1989
- United Nations Declaration on the Rights of Indigenous Peoples 2007

#### 4.2.5 Stakeholder Engagement Plan (SEP) Development

##### Intent

- Maintain the alignment of stakeholders' expectations with the project's objectives.

##### Requirements

- Identify and analyse stakeholders who have ability to impact and have interests in ES matters and performance of the project development, such as local agencies, community leaders, customers and local NGOs.
- Develop a stakeholder engagement plan, taking into account of the results of stakeholder analysis including priorities given to those stakeholders.
- Assign responsible parties/ engagement team (e.g. CR) to implement the stakeholder engagement plan. The selection of the team takes into consideration of subject knowledge, experience, and the style/ approach of engagement.
- Tracks the progress of the implementation of the stakeholder engagement program. Upon any deviation from the plan, corrective actions and/ or changes will be implemented as necessary to ensure the engagement objective is being met.
- Participate or assign delegates to disseminate the project information to the public in all stakeholder engagement activities.
- Review and update the stakeholder analysis and engagement plan annually/ during the project development.

##### Documents

- Stakeholder Analysis and Engagement Procedure
- Stakeholder Analysis and Mapping Format
- Stakeholder Engagement Program Format

#### 4.2.6 Grievance Redress Management

##### Intent

- Provide channel to receive grievances including feedbacks and complaints.
- To be able to handle grievances in an appropriate and timely manner.

##### Requirements

- Develop a systematic process to receive, record, investigate, respond to ES related concerns or complaints from internal and external stakeholders.
- Provide local communication channels that stakeholders can raise their grievances or complaints such as through staff, security officers or contractors
- Train frontline staff to be familiar with grievance mechanism to ensure the system is active properly.
- Document the issues in the grievance system when receiving grievances.
- Escalate grievances to the Corporate ES Function to provide assistance and management support as necessary.

- Provide internal communication and report evaluation results to the management.

**Document:**

- Grievance Handling Procedure ENV-P-004

#### **4.2.7 EPC Bidding and Contracting**

**Intent**

- Set out ES expectations for EPC tender or Terms of Reference (TOR)
- Establish ES organization structure with clear accountabilities in executing the project detailed design and construction

**Requirements**

- Identify and integrate ES requirements in the TOR for EPC contractors bidding. The ES requirements to be requested from EPC contractor shall comprise, but not limited to, the following requirements;
  - National, local regulation including relevant international ES regulation that any particular project is obliged to
  - ES Management Plans where GED would like EPC contractor to be responsible e.g. EMP, IPP, RP, BAP and SEP, etc.
  - ES organization for the project construction. The organization should include all required ES personnel per applicable requirements and at least ES Management Representative.
  - Monitoring of ES Management Plans implementation, inspection and audit
- Evaluate EPC Contractors bidding document considering the ability to manage ES requirements as part of the supplier/ contractor selection. Example of ES criteria for EPC contractor review are;
  - EPC's ability to implement the ES requirements defined in the TOR;
  - Information relating to the EPC's ES history, non-conformances and performance reviews where available;
- Integrate ES requirements into Contract clauses for the selected EPC. Contract Documents should contain:
  - ES requirements defined in the TOR;
  - Measurement, monitoring and reporting of ES Management Plans implementation, progress and performance;
  - Any special conditions relating to the work and ES provisions such as
    - Environmental standards for supplier's processes, products or services
    - Fundamental human rights (e.g. forced or child labour, freedom of association) (ILO conventions)
    - Labour influx management plan
    - Emergency preparedness and response management plan including community
    - Traffic management
    - Grievance redress mechanisms
    - Working conditions (e.g. working hours, lay-off practices, remuneration)
    - Occupational health and safety
    - Business ethics (e.g. corruption, anti-competitive practices)
    - Management System for environmental and social matters

- Environmental performance data available (e.g. waste generation, water consumption, electricity consumption)
- Social, including safety performance data available (e.g. incidents, injuries rate, near-miss, worker conditions)
- Guidance regarding sub-contracting (i.e. requiring to replicate own standards down the supply chain)

#### **Documents**

- Standard ES Provisions in EPC Terms of Reference
- Standard ES Provisions in EPC Contract

### **4.2.8 ES Information and Performance Disclosure**

#### **Intent**

- Inform project information to relevant stakeholders for transparency and obtain timely input

#### **Requirements**

- Develop communication and reporting plan to internal and external stakeholders throughout the construction phase
  - List of reporting required e.g. progress report, implementation & monitoring report, etc.
  - Stakeholders who GED reported to
  - Frequency/timeline
- Report ES program, progress, performance and compliance status communicated to relevant stakeholders (e.g. ADB, government, communities) at appropriate channels and frequency

#### **Document**

- Communication and Reporting Plan

## **Construction**

### **4.2.9 Project Detailed Design and Construction**

#### **Intent**

- Ensure the project has been appropriately developed to address ES issues

#### **Requirements**

- Execute the detailed design as per Project's Basis of Design and ES specifications
- Implement Change Management Process in case of changes in design
- Review and approve the detailed designs and drawings to conform with Project ES specifications
- Provide ES induction to the selected EPC contractor prior to start construction activities to communicate GED's minimum ES requirements
- Develop ES measures and requirements as rules for EPC contractor to follow during construction activities <contractors must have the followings>
  - Implementation of ES measures and requirements such as recommendations from required ES study e.g. EIA/ IEE, ESMP for construction activities
  - Construction management plan for contractor and subcontractor
  - Occupational health and safety management plan

- Contractor management and oversight plan
- Labour influx management plan
- Waste management plan
- Emergency preparedness and responsible management including community plan
- Traffic management plan
- Grievance redress mechanisms
- Emergency prepare
- Execute the construction activities as planned
- Assess the change, its impacts and cost incorporated to the investment project modification as well as identifies mitigation actions. Factors which trigger change include
  - Change in design and layout
  - Change in construction activities
- Develop updated project progress and other important information as per GED request. In case such project undergoes the delay, cost overrun, scope change, or any other significant issues which PD considers as severe, more information shall be reported to GED accordingly

**Documents**

- EPC's ES Management Plan
- ES Daily Report Work Instruction
- Change Management Procedure

**4.2.10 Implementation of ES Management Plans**

**Intent**

- Execute the ES Management Plans to minimize the identified impacts and comply with the ES obligations and commitments

**Requirements**

- Execute ES Management Plans and other relevant plans such as EMP, BAP, RP, IPP for construction activities by GED
- Execute ES Management Plans (including labor and human rights issues) for construction activities by EPC Contractor
- Execute Corporate Chance-Find Procedure in case of cultural heritage found during construction

**Documents**

- Corporate Chance-Find Procedure

**4.2.11 Monitoring & Reporting of ES Management Plans**

**Intent**

- Ensure all ES Management Plans implemented completely and effectively

**Requirements**

- Develop systematic processes and tools to daily monitor ES performance (GED and EPC) to ensure compliance with ES Management Plans and other relevant plans such as EMP, BAP, RP, IPP



- Conduct routine inspection and audit of construction activities in accordance to the systematic process developed
- Engage competent 3rd party to conduct the compliance review against requirements prescribed in required ES study e.g. IEE/ EIA/ ESIA management and monitoring plans and other regulations
- Identify and execute routine reporting requirements to related parties (e.g. ADB, government, etc.) regarding compliance status, progress of ES Management Plans implementation.

#### **Documents**

- ES Daily Report Work Instruction (PD)

### **4.2.12 Assurance and Continual Improvement**

#### **Intent**

- Validate the implementation of ES Management Plans
- Inform performance of ES Management to Management
- Evaluate the quality of project management

#### **Requirements**

- Engage the qualified and experienced external experts to conduct the audit to verify the information of ES management and monitoring implementation and performances compliance issues at least on quarterly basis
- Develop corrective action plan for any non-compliance issues identified from the audit and update the progress toward the closure
- Execute management review of ES management and performances on a six monthly basis
- Provide supports needs from management to address key ES issues from ES Management Plans implementations
- Submit reporting to regulator and ADB as required
- Assess, address issues and identify lesson learnt from the past project management process
  - What worked and what didn't?
  - What and how can we do better?
  - What are the key success factors and what are the constraints?

#### **Documents**

- Lesson Learnt Report
- Environmental and social audit report template
- Scope for an Annual ES Safeguards Monitoring Report to ADB

### **4.2.13 Standard Procedures for Handover**

#### **Intent**

- Prepare handover packages to be readily available for implementation during operation
- Ensure the project is effectively transferred to operation phase with standard of quality

### **Requirements**

- Identify and develop procedures for ESMS to be used during plant operation (taking into consideration equipment and process design/manufacture recommendations, applicable standard requirements and good industry practices)
- Communicate and provide training to operation team to ensure continuation of project ES knowledge
- Engage contractors and suppliers to ensure technology and experience transfer from licensors to operation team

### **Documents**

- ES Operation Preparation Plan
- Completion & Handover Form
- Acceptance Certificate
- Completion Report

## **4.2.14 Operational ES Compliance**

### **Intent**

- Establish ES Compliance register to enable the compliance management for operation stage

### **Requirements**

- Identify ES related regulatory requirements and other requirements (a register of ES requirements) applicable to the operational phase by reviewing against:
  - ES provisions stipulated from permits and licenses obtained;
  - Relevant host country laws;
  - ADB's 2009 Safeguard Policy Statement (SPS);
  - Ratified international agreements on environmental, health and safety, land acquisition and involuntary resettlement, indigenous peoples, human resource and labour practices, gender and other social matters, which are in full effect at the time of authorization;
  - IFC General Environmental and Social (ES) Guidelines (2007);
  - IFC ES sector-specific guidelines, including Thermal Power and others as applicable.
- Assess if there are any discrepancies or potential non-compliance with respect to the hand over from the project construction to plant operations.
- Address such discrepancies and also inform the Operation Team to be prepared.

### **Documents**

- Register of ES Requirements Template

## 5 ESMS Elements for Merger & Acquisition

### 5.1.1 Due Diligence

#### Intent

- Assess the ES risks and opportunities of the proposed investment in order to make an informed decision.

#### Requirements

- Execute a desktop review to collect and review ES documentation, including publicly available information and documents requested from the target company.
- Assess whether there are potential 'red-flag' ES risks or opportunities which may impact on the Target's investment, its growth assumptions, or its forecasted cash flows. A potential 'red-flag' ES risks in the context of this Assessment will include any and/or all of the following criteria:
  - Potential significant impact on valuation or reputation;
  - May be an issue which should be factored into the SPA (share/ sale and purchase agreement) negotiations;
  - May need to be referenced against other Due Diligence work streams (e.g. insurance, financials, etc.); and
  - Issues to factor into post-Due Diligence phase
- Define the scope of ES Due Diligence based on specific subproject requirements to ensure that relevant assessments are covered
- Conduct ES Due Diligence (including site visit) of the target project by the competent persons or engage a qualified independent ES expert/consultant.
- Assess target site's capacity to address risks and capitalise on opportunities.
- Consider ES issues into business deal for further ES action plan development.

#### Documents:

- Scope for Environmental and Social Due Diligence Assessment Template
- Outline of an Environmental and Social Due Diligence Report

### 5.1.2 Integration of ES Issues into Business Deals

#### Intent

- Factor ES issues into cost of deal to ensure the plan to eliminate/ minimize ES liabilities budgeted and implemented.

#### Requirements

- Develop ES Action Plan addressing ES issues identified from ES Due Diligence
- Integrate ES Action Plans into cost of deal
- Integrate ES Action Plans to be implemented operation phase into Transaction/Integration Plan

#### Documents

- ES Action Plan

### 5.1.3

#### Post-Merger & Acquisition

##### Intent

- Ensure that the acquired target is effectively and efficiently synergized for ES management system

##### Requirements

- Implement ES Action Plan as per Transaction/ Integration plan (such as 90 days plan, 120 days plan).
- Report the implementation of ES Action Plan to the Corporate EHS Function on a monthly basis.
- Adopt GED ES Policy and ESMS requirements to ensure compliance, risks controls and continuously improvement in ES performance within three years or upon reasonable timeline after the mergers and acquisition.
- Conduct look-back session to obtain lesson learnt for ES improvements and knowledge sharing regarding ES related matter during the mergers and acquisition.

##### Documents

- ES Integration Plan after M&A
- Progress of ES Action Plan

## 6 ESMS Elements for Operation

### 6.1 Planning

#### 6.1.1 Management Leadership and Commitment

##### Intent

- To demonstrate visible leadership from the senior management in driving ES Management System (ESMS) and culture within the organization.
- To continually provide all necessary supports towards excellence in ES management and performance.

##### Requirements

###### Corporate Level

1. Review and update ES policy at least every a year or where appropriate based on changed circumstances. The ES policy shall be appropriate to nature, scale, significant ES risks and opportunities and be compatible with the strategic direction and the context of the organization.
2. Communicate the ES policy to all corporate functions, sites and also to interested parties including contractors and suppliers.

###### Site Level

1. Communicate the ES policy to all employees, suppliers and contractors through existing programs and channels including orientations, bulletins and other campaigns.
2. Allocate necessary resources including man-power and budget to implement, maintain and improve the site ESMS and ES performance. This allocation should be part of annual budget setting.
3. Appoint an ES management representative to facilitate and help drive the implementation of the site ESMS.
4. Integrate ES matters such as performance reporting, incidents and lessons learned/ sharing as part of the agenda in formal routine discussion amongst management.
5. Act as a role model by consistently participating in and contributing in ES initiatives, campaigns and activities to continually demonstrate visible leadership in ES performance and culture.
6. Recognize, reinforce and reward on ES initiatives, desired behaviors and achievement of expected performance to create motivation for implementation of ES programs.
7. Ensure that employees realize their right and responsibility to stop work or refuse to work whenever they consider unsafe.

##### Document

- Corporate Environmental and Social Policy

## 6.1.2

### Risks and Opportunities

#### Intent

- To identify, assess and manage ES risks and opportunities associated with the operations, products and services/ throughout the value chain.

#### Requirements

##### Site Level

1. Identify and document ES aspects associated with all existing assets, equipment, activities, products and services across the value chain, including potential implications to the environment, employees, contractors, suppliers, and other relevant stakeholders including communities. ES aspects and impacts from the environmental studies (e.g. ESIA, EIA, IEE) shall be taken into account when identifying ES aspects.
2. Assess and prioritize ES risks and opportunities associated with the ES aspects so that mitigation plans/ measures can be arranged to reduce the risks down to an acceptable level, whereas ES opportunities can be captured. Opportunities may include those related to eco-efficiency, environmental enhancement and corporate social responsibility/ enterprise.
3. ES risk and opportunities assessment shall be carried out by competent individuals/ group with support from subject matter experts as appropriate.
4. Review and update the ES risk assessment at least annually and on an as-needed basis to reflect changes in organization, assets, activities, products and services.
5. Develop and implement mitigation measures such as documented procedures and/ or plans for managing ES risks and opportunity management [Refer to *Element – Operational Control and Maintenance*].
6. Inform employees and relevant suppliers and contractors to be aware of ES risks and mitigation measures/ plans

#### Document

- Identification of hazards and risks assessment (ENV-P-003)

### 6.1.3

## Change Management

### Intent

- To assess and properly manage ES risks associated with changes throughout the whole process from prior-to change and to post-change. Changes include materials, products, equipment, machinery and operating procedures.

### Requirements

#### Site Level

1. Define the scope of change potentially causes ES implications, required to implement change management process, covering the change of raw materials, operations, activities, equipment and machines both temporary and permanent changes occurring at the site.
2. Conduct ES risk assessment of proposed changes shall be assessed, considering potential implications for ES performance, and risk reduction measures shall be defined by competent staff and approved by authorized person prior to change.
3. Conduct ES risk assessment of propose changes prior to change by competent personnel according to nature of change together with a working team comprising personnel related to change. The assessment shall take into account of potential impacts and compliance with regulatory requirements, customers' requirements and other applicable requirements as well as impacts to ES performance.
4. Define appropriate mitigation measures/ plans for ES risks associated with change. The measures/ plans shall cover actions towards compliance including regulatory permits.
5. Monitor change implementation progress including ES risk mitigation measures/ plans to ensure completion within the defined timeline.
6. Develop or update relevant information resulting from the change such as operating procedures, as-built drawings, ES risk register and other related documents, to reflect the change.
7. Provide necessary communication and training to those personnel affected by the change including employees and external stakeholders, as relevant.
8. If the scope of change is defined as new project development, such change shall be managed in accordance with *ESMS for Phase I Feasibility Study and Implementation*.

### Document

- Change Management Procedure

## 6.1.4

### Compliance

#### Intent

- To continually comply with ES regulatory requirements, customers' requirements, and other applicable requirements that are applicable or being adopted.

#### Requirements

##### Corporate Level

1. Monitor emerging regulatory issues and trends (including participation in external panels that formulate ES public policies and regulations, lending agreements, etc.) that may affect the business and operations.
2. Conduct an overall ES compliance evaluation program for all operating sites to assure compliance and mitigate liability at least every three years (or having a third-party to conduct the assessment).
3. Report an overall compliance status and critical findings from the ES compliance evaluation program to the senior management to ensure necessary resources and efforts are made to assure compliance.

##### Site Level

1. Develop a register of ES requirements including regulatory requirements, customers' requirements and other applicable requirements (including lenders' agreements/ requirements) being adopted to cover the requirements during the operation [If a register has been developed during the hand-over of the project to the operation, the action here is to update the register].
2. Define, communicate and implement actions to achieve compliance by integrating into the day-to-day jobs and tasks as much as practicable.
3. Review and update ES requirements (register of ES requirements) at least every quarter or upon changes of requirements. In case of new or changed requirements, compliance evaluation shall be conducted and necessary efforts are to be made to address such changes. Also the changes shall be made to the register of ES requirements.
4. Conduct a compliance evaluation at least once a year. Non-compliance or potential non-compliance issues identified from the evaluation shall be corrected and prevented [Refer to *Element – Non-compliance Handling*].
5. Identify and consolidate ES standards and guidelines of the industry or best practices from other industries for further communicating, developing and implementing the practices as appropriate to the organization.

#### Documents

- Environmental, Health and Safety Laws and Regulations (ENV-P-002)



## 6.1.5

### Goals and Improvement Plan

#### Intent

- To ensure that ES objectives, performance indicators, targets and improvement plan are established and implemented to drive continual performance improvement.

#### Requirements

##### Corporate Level

1. Review and analyse the group ES performance (i.e. ES performance indicators) annually to understand the status and identify areas for improvement.
2. Define corporate-level ES objectives and targets which require consistency in improving group ES performance. Considerations shall be given to the ES policy, business direction and strategy, significant risks and opportunities, group ES past performance and views of interested parties including lender's requirements.
3. Deploy corporate-level ES objectives and targets to all sites including provision of necessary supports such as training, tools, etc.

##### Site Level

1. Define site-level ES objectives and targets as part of the business planning process, taking into account of ES policy, business contexts, significant risks and opportunities, performance improvement and views of interested parties. The site-level ES objectives and targets shall at least include corporate-level ES objectives and targets. The targets set shall be specific to the objectives, measurable, and practical with clear timeframe. The target shall demonstrate commitment on reduction of impacts to environment and stakeholders, reduction of resource use, minimization of potential hazards, and continual improvement.
2. Define performance indicators including leading indicators and lagging indicator together with those targets.
3. Establish ES improvement plan that specifies actions, responsible person, timeline and budget. Those defined actions should be integrated into the existing processes/ platforms to ensure the target achievement.
4. Report the performance resulting from the improvement plan detailing effectiveness analysis and recommendations where the programs tend not to be achieved, to the site senior management as well as to the Corporate ES Function at the frequency of agreed timeline.

#### Document

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## 6.1.6 Stakeholder Engagement

### Intent

- To identify and prioritize stakeholders/ interested parties relevant to the business and organization based on their interests and the level of influence on the company with respect to ES matters.
- To develop and implement suitable engagement programs so that mutual respect, understanding, transparency, trust and relationship can be built and maintained between the company and relevant stakeholders.

### Requirements

#### Corporate-Level

1. Identify and analyse external stakeholders who have ability to impact and have interests in ES matters and performance of the company, such as government agencies, other policy makers, industry associations, customers, lenders and country-level/ international NGOs.
2. Develop corporate-level stakeholder engagement program and its approach, taking into account of the results of stakeholder analysis including priorities given to those stakeholders.
3. Assign responsible parties/ engagement team to implement the stakeholder engagement program. The selection of the team takes into consideration of subject knowledge, experience, and the style/ approach of engagement.
4. Tracks the progress of the implementation of the stakeholder engagement program. Upon any deviation from the plan, corrective actions and/ or changes will be implemented as necessary to ensure the engagement objective is being met.
5. Review and update a corporate-level stakeholder analysis and engagement program annually.

#### Site Level

1. Identify and analyse site-specific internal and external stakeholders who have ability to impact and have interests in ES matters and performance of the site, such as local agencies, community leaders, customers and local NGOs.
2. Develop site-level stakeholder engagement program and its approach, taking into account of the results of stakeholder analysis including priorities given to those stakeholders.
3. Assign responsible parties/ engagement team to implement the stakeholder engagement program. The selection of the team takes into consideration of subject knowledge, experience, and the style/ approach of engagement.
4. Tracks the progress of the implementation of the stakeholder engagement program. Upon any deviation from the plan, corrective actions and/ or changes will be implemented as necessary to ensure the engagement objective is being met.
5. Review and update the site-level stakeholder analysis and engagement program annually. In order to evaluate the success of the engagement program and/ or gain perceptions from certain group of stakeholders, attitude surveys may be considered.

### Documents

- Stakeholder Analysis and Engagement Procedure
- Stakeholder Analysis and Mapping Format
- Stakeholder Engagement Program Format

## 6.2 Implementation (Do)

### 6.2.1 Awareness and Competency

#### Intent

- To ensure that the employees and the contractors have knowledge, understanding and skills in performing their job according to the legal requirements and ESMS.
- To motivate the employees and the contractors to become aware of the benefit of ESMS.

#### Requirements

##### Site Level

1. Define ES competencies, qualifications and performance expectations for key positions (i.e. certified ES personnel, managers, supervisors) in the job profile/description.
2. Incorporate ES qualifications, competencies and performance expectations in the hiring and promotion process.
3. Ensure ES competency and knowledge of each position prior to commencement of tasks associated with significant ES risks.
4. Develop ES training matrix for each job title of employees and contractors based on associated risks specific to the job including the key positions and those that have significant implication to ESMS and performance.
5. Develop and implement training programs covering topics specific to the risks of jobs associated with significant ES risks and according to regulatory requirements in order to enhance competency of employees and contractors to the defined level.
6. Conduct pre-training and post-training evaluations as necessary and maintain documented training records.
7. Conduct a post-training follow-up for key positions (e.g. job observation) to ensure the trainee performs the job in accordance with the operating procedures. Re-training shall be required as necessary to ensure the employees are able to perform their job as per expectation.
8. Promote ES initiatives/ campaigns to motivate and raise awareness of employees and contractors on the ES policy, significant ES risks, and their contributions to the effectiveness of ESMS, as well as the implications of not conforming with the ESMS requirements.
9. Define channels for employees at all levels and contractors to contribute in providing feedbacks or recommendation for improving ES initiatives/campaigns.

#### Relevant Document

- EH&S Training Awareness and Competence (EHS-P-016)

## 6.2.2

### Contractors and Suppliers

#### Intent

- To manage ES risks associated with goods and services provided by contractors and suppliers to minimize any adverse ES consequences.

#### Requirements

##### Corporate Level & Site Level

1. Define the ES criteria for screening contractors and suppliers, taking into account of the ES past performance, in order to include contractors and suppliers into the company vendor list.
2. Prioritize contractors and suppliers based on ES risks arisen from use of products and services provided by contractors and suppliers, volume of products and services, and level of influence that the company has control over such contractors and suppliers.
3. Define ES Management criteria specific to the ES risks associated with products and services as part of the bidding and selection criteria for key contractors and procurement of product and critical equipment and materials from key suppliers.
4. Specify ES conditions, e.g. requirements, rules, regulations, standards specific to ES risks arisen from products or services, as well as consequences from not following such conditions into purchase order, contract, agreement or contract's attachment for key contractors and suppliers.
5. Perform onsite regular monitoring and inspection including evaluation after the service completion or prior to contract renewal by contract owner or user to ensure compliance with ES conditions stated in the contract document or agreement.
6. Conduct ES assessment at the premises of key contractors and suppliers especially those customers' requirements and issues of interest of the community and public.
7. Track the ES performance of those contractors and suppliers routinely. Corrective actions, as the result of routine internal audit within the company and at the premise of contractor and supplier, shall be in place.
8. Support the development and improvement of ES management system of the key contractors and suppliers having significant ES impacts to the company, especially to serve customer's requirements and interests of the community and public.

#### Document

- Green Procurement (ENV-P-005)

## 6.2.3

### Operational Control & Maintenance

#### Intent

- To manage ES risks associated with the activities related to business operations and comply with the relevant applicable requirements through operational control and maintenance programs.

#### Requirements

##### Site Level

1. Develop operating procedures and maintenance programs to properly manage ES risks and compliance associated with operational activities (identified from *Element - Risks and Opportunities* and from the *related ES Management Plans* during the operations developed during the Project Development Stage). The operating procedures and maintenance programs shall address ES risks arising from normal, abnormal and emergency situations.
2. Educate relevant personnel on the defined operating procedures and maintenance programs through training, including on-the-job training, coaching and/ or communication program where appropriate.
3. Monitor the effectiveness of implementation of the defined operating procedures and maintenance programs through inspections and audits as part of the site ESMS.
4. Maintain the documented operating procedures, their relevant documents and tools as per the company document control procedure.
5. Review and continually update the operating procedures, maintenance programs, relevant documents and tools at least every two years and also upon changes.

#### Documents

- Environmental and Social Management Plan (ESMP) during the Operation
- Resettlement Plan (RP) if relevant
- Indigenous People Plan (IPP) if relevant
- Biodiversity Action Plan (BAP) if relevant
- Laboratory Safety (EHS-P-003)
- Powered Industrial Trucks (EHS-P-004)
- Plant Security (EHS-P-005)
- General First Aid (EHS-P-006)
- Health and Medical Program (EHS-P-007)
- Bloodborne Pathogen (EHS-P-008)
- Hearing Conservation (EHS-P-009)
- Respiratory Protection (EHS-P-010)
- Physical Heat Exposure (EHS-P-011)
- General Safety Practice (EHS-P-012)
- Safety Committee (EHS-P-014)
- Personal Protective Equipment (EHS-P-017)
- Hazardous Work Permit (EHS-P-018)
- Lock out-Tag out (EHS-P-019)
- General Electrical Safety (EHS-P-020)
- Sling, Rigging and Crane (EHS-P-021)
- Ladder and Scaffolding (EHS-P-022)

- Walking Surface, Stairs and Floor (EHS-P-023)
- Confined Space Entry (EHS-P-024)
- Portable Tools, Machines and Machinery Guarding (EHS-P-025)
- Cutting Welding and Brazing (EHS-P-026)
- Safety Sign and Color Coding (EHS-P-027)
- General Fire Safety (EHS-P-029)
- Fire Protection Plan (EHS-P-030)
- Fire System Impairment (EHS-P-031)
- Fire Extinguisher (EHS-P-032)
- Fire Pump, Sprinklers, Fixed and Detection System (EHS-P-033)
- Combustible and Flammable Liquid (EHS-P-034)
- Stand Pipes and House System (EHS-P-035)
- Compressed Gas (EHS-P-036)
- Waste Management (ENV-P-006)
- Relevant equipment/ machinery maintenance programs

#### 6.2.4 Emergency Preparedness and Response

##### Intent

- To identify reasonably foreseeable emergencies and appropriate response measures are planned together with proper response equipment to minimize or mitigate any adverse impacts to the environment, personnel and relevant external parties.

##### Requirements

###### Site Level

1. Identify potential emergency and crisis situations and their impacts related to site activities as well as those associated with neighbouring activities.
2. Establish an emergency preparedness and response plan and related procedures to mitigate ES and associated business impacts. The response plan shall specify roles and responsibilities of relevant personnel; effective procedures for communication to employees and external stakeholders; and simulation of scenarios for periodic drill exercise.
3. Assign personnel/ response team and periodically train and enhance skills of personnel related to emergency response.
4. Provide adequate response equipment and routinely inspect the equipment to be ready for use at all times.
5. Implement and maintain a crisis communication plan to inform relevant internal and external stakeholders (including nearby communities) in the event of emergencies.
6. Plan and conduct drills of emergency response and crisis communication plans at least annually and with involvement from external emergency agencies, as appropriate.
7. Lessons learned from actual emergencies and emergency drill shall be documented, used to review and amend existing plan, and shared amongst other sites as appropriate.
8. Report emergency events to corporate ES department upon occurrence.

### Documents

- Spill Prevention and Control Plan (EHS-P-001)
- Emergency Preparedness (EHS-P-037)

## 6.2.5

### Communication

#### Intent

- To provide effective and transparent communication to internal and external stakeholders to encourage participation and contribution in ES performance improvement and ensure that concerns/ grievances are counted and responded in a timely manner.

#### Requirements

##### Corporate Level

1. Communicate corporate ES requirements and the requirements the group are obliged to the sites when appropriate.
2. Conduct an ES forum annually to enhance sharing, networking and enhancing the group ESMS. The forum may cover the topics such as overall group ES performance, best practices, lessons learned, other knowledge sharing, and deployment of group/ medium-term ES targets.
3. Disclose ES information related to ESMS to external interested stakeholders such as lenders, agencies and shareholders. This could be by means of annual reporting, sustainability reporting, etc.

##### Site Level

1. Establish a process/ plan for ES communication to internal and external stakeholders in accordance with their relevance and interest. The process shall include what to communicate, channels/ means, frequency and target audience. The topics may cover the followings:
  - a. ES policy;
  - b. Objectives, targets, performance indicators, improvement plans;
  - c. Applicable ES requirements;
  - d. Key contents of operating procedures and rules;
  - e. ES performance against targets and monitoring results; and
  - f. Incidents and emergency drills with lessons learned.
2. Exchange and share of ES information, knowledge and good practices within the site through the effective means of communications.
3. Establish a process to motivate employees, contractors and suppliers to involve in providing opinions and suggestions for continually improving ES management and performance.
4. Deploy a process for recording, handling and responding internal and external ES related grievances to ensure that responses are made in addressing such grievances in a timely manner.
5. Define criteria and method of evaluation that reflect internal and external communication performance in order to achieve the communication objectives.

### Documents

- Hazardous Communication (EHS-P-002)
- General Safety Meeting (EHS-P-012)
- Receipt of Complaint (ENV-P-004)

## 6.2.6 Incident Management

### Intent

- To timely report and investigate ES incidents as well as to mitigate impacts from the incidents
- To share lessons learned across the sites to prevent recurrence and to improve ES performance.

### Requirements

#### Corporate Level

1. Develop and deploy a *Corporate Incident Reporting and Investigation Procedure* to ensure consistency amongst all sites that cover:
  - a. Types of incidents. The incidents shall cover those that could impact the environment, personnel and other stakeholders outside the company;
  - b. Reporting requirements (what incidents to be reported to whom);
  - c. Level of investigation required;
  - d. Requirements for the level of investigation (i.e. root cause analysis method, investigation team, facilitator/ leader, time for report completion); and
  - e. Guidance for performing the root cause analysis/ investigation.
2. Shares lessons learned from incidents, especially for serious cases, to relevant functions and all sites through briefings, notices, meeting or other effective communications.
3. Review and analyze the group ES incidents and make recommendations for reducing the group incidents and for continual improvement.

#### Site Level

1. Report all incidents (e.g. accidental releases, spills, permit violation, injuries, fires, property damage, etc.) in accordance with *Corporate Incident Reporting and Investigation Procedure*. Where required, serious incident shall be reported to the Corporate ES Function.
2. Sets up the investigation team according to level of investigation required as per *Corporate Incident Reporting and Investigation Procedure*.
3. Conduct incident investigations to identify root causes and contributing factors to determine where improvements in the systems and practices are required. Incident investigation shall be performed by a designated team with combination of competent and experienced individuals including external subject matter expert, where required, for serious incident. Appropriate technique for investigation shall be deployed.
4. Develop and implement corrective and preventive actions within due date to reduce the likelihood of a recurrence.
5. Follows up the progress and tracks the completion of corrective and preventive actions through closure, and report the progress of completion of corrective and preventive action to the site senior management.



6. Communicate and share knowledge and lessons learned from the incidents throughout the site to avoid recurrence.

**Document**

- Accident and Incident Investigation (EHS-P-015)

## **6.3 Checking**

### **6.3.1 Monitoring and Reporting**

**Intent**

- To monitor ES performance periodically to measure continual improvement and ensure compliance with obligations.

**Requirements**

Corporate Level

1. Hire a third party to conduct ES monitoring as required by the environmental studies, such as ESIA, EIA and IEE.
2. Review and analyse the group ES performance and make recommendations for continual improvement (including benchmarking and the definition of group ES target).
3. Report ES performance to external stakeholders as required by the obligations. This may include (but are not limited to)
  - a. Incident reporting to Government Agencies
  - b. Progress reporting of Resettlement Action Plan (RAP), Indigenous People Plan (IPP) and Biodiversity Action Plan (BAP) to Lenders such as Asian Development Bank
4. Consider conducting a Group ES data verification program to ensure the completeness, accuracy and reliability of data so that ES performance is transparently disclosed.

Site Level

1. Conduct routine inspections to monitor the effectiveness of operating procedures being implemented and compliance.
2. Plan and perform ES monitoring program (or hire a third party to perform) regularly as required by the regulations such as air emissions, discharge, ambient noise, etc.).
3. Track the performance indicators and progress against ES targets and report the performance to the site senior management on a monthly basis in meetings.
4. Report the performance against the group ES targets to the Corporate ES Function at the frequency of agreed timeline.
5. Conduct an investigation and deploy preventive and corrective actions when non-conformities arise from the inspection, monitoring and target achievements.

**Document**

- Monitoring Corrective Action for Nonconformity with Standard of Environmental Monitoring Result (ENV-P-001)

## 6.3.2

### Audit

#### Intent

- To evaluate the effectiveness of ESMS periodically to drive continual improvement.
- To ensure that the top management acknowledges the ESMS performance and supports the continual improvement.

#### Requirements

##### Corporate Level

1. Develop a corporate audit plan that cover the whole organization and sites to assess the effectiveness of the group ESMS.
2. Conduct a corporate audit at least once every 3 years or more frequent depending upon the group performance.
3. Report the group ESMS audit results to the top management of the company to seek views and support for continual improvement.

##### Site Level

1. Develop an annual internal audit plan that cover all elements of the site ESMS.
2. Conduct a refresh training of internal auditors at least every two years on the auditing skills and ESMS requirements and objective evidences against the ESMS.
3. Conduct an internal audit to assess the effectiveness of the site ESMS implementation. The internal audit shall be conducted by competent team.
4. Report the internal audit results to the site senior management in the management review to seek views and recommendations for continual improvement.

#### Documents

- Audit Procedure

## 6.4 Improvement (Act)

### 6.4.1 Handling of Non-conformities

#### Intent

- To manage ES non-conformities properly through implementation of preventive and corrective actions to avoid recurrence, so that the ESMS is effectively maintained.

#### Requirements

##### Site Level

1. Define scope of ES non-conformities to include those arisen from, but not limited to, internal inspections and audits, corporate audits, external audits, inspections by governmental authorities, customer audit, and any other deviation from normal work that could lead ES incident.
2. Initiate and report non-conformities to relevant functions to immediately mitigate impacts and also to the site ES department for initiating a root cause analysis.
3. Conduct a root cause analysis of non-conformity by competent and trained personnel. Corrective and preventive actions shall be initiated based on the identified root causes in order to rectify and avoid repetition.
4. Track the progress of preventive and corrective actions shall be systematically monitored to ensure completion within the timeline.
5. Evaluate the completion of corrective and preventive actions through closure (in which the effectiveness of actions are achieved in a way that such risks/ findings are mitigated and prevented).
6. Shares lessons learned from non-conformities within the site and also to the corporate ES department so that lessons learned can be shared amongst all sites to avoid reoccurrence.

#### Relevant Documents

- Procedure Handling of Non-conformities

**Intent**

- To review an overall ESMS by the top management to ensure the ESMS is achieving the desired outcomes and promoting a continual improvement in ES performance.

**Requirements**Corporate Level

1. Organize and conduct at least once a year the group ESMS review at corporate level, chaired by top management of the company. The agenda may include:
  - a. Changes in business contexts including internal and external factors associated with threats and opportunities that have implications to the direction and contexts of ESMS;
  - b. Overall ES compliance status and audit results;
  - c. Overall complaints/grievances and status;
  - d. Achievement of the group ES objectives and targets;
  - e. Review of ES budgets required;
  - f. Follow-up of actions proposed in the previous management review; and
  - g. Recommendations for future ESMS implementation.
2. Assign responsibilities to execute the recommendations and/ or proposed actions made from the management review so that they are deployed to all relevant functions and sites.
3. Document the management review minutes, and tracks the progress of the actions defined from the management review.
4. Considers an overall validation of the ESMS every five years by a competent party to reflect suitability and adequacy of the ESMS.

Site Level

1. Organize and plan the agenda for the site management review which will be conducted at least once a year. The management review on the adequacy and effectiveness of ESMS, programs and performance.  
The agenda or areas of interest must, at minimum, cover the following topics:
  - Changes in site contexts including external factors associated with threats and opportunities that have implications to the direction and contexts of the site ESMS
  - Results of compliance evaluations
  - Achievement of ES objectives, targets and specific action plans
  - Adequacy of resources
  - ES complaints/grievances and status
  - Results of audits and follow-up of corrective/ preventive actions
  - Follow-up of actions proposed in the previous management review
  - ES initiatives and campaigns
  - Support required to promote awareness and improve ESMS performance (including human and financial resources)
2. Assign responsibilities to execute the recommendations and/ or proposed actions made from the management review.
3. Document the management review minutes, and tracks the progress of the actions defined from the management review.

Relevant Documents

- Management review minutes

## 7.1 Abbreviation and Glossary

### Abbreviations

ADB	Asian Development Bank
AM	Asset Management Group
BAP	Biodiversity Action Plan
BD	Business Development Group
CR	Community Relation Department
EHS	Environmental, Health and Safety
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPC	Engineering, Procurement and Construction
ES	Environmental and Social
ESA	Environmental Safety Assessment
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
ESMS	Environmental and Social Management System
GAD	Gender and Development
GED	Gulf Energy Development Public Company
GRI	Global Reporting Initiative
ICMM	International Council on Mining and Metals
IEE	Initial Environmental Examination
IFC	International Finance Corporation
ILO	International Labour Organization
IPP	Indigenous People Plan
IR	Involuntary Resettlement
ISO	International Organization for Standardization
IUCN	International Union for Conservation of Nature
M&A	Mergers and Acquisition
NGOs	Non-Governmental Organizations
ONEP	Office of Natural Resources and Environmental Policy and Planning
OHSMS	Occupational Health and Safety Management Systems
PD	Project Development Group
PIAL	Prohibited Investment Activities List
RAP	Resettlement Action Plan
RFP	Request for Proposal
RP	Resettlement Plan
SEP	Stakeholder Engagement Plan
SIA	Social Impact Assessment
SOP	Standard Operating Procedure
SPS	ADB's 2009 Safeguard Policy Statement
SR	ADB's Safeguard Requirements
TOR	Terms of Reference

## Glossary

Biodiversity		The variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.
Chance Procedure	Find	A project-specific procedure that outlines what will happen if previously unknown physical resources are encountered during project construction or operation. The procedure includes record-keeping and expert verification procedures, chain of custody instructions for movable finds, and clear criteria for potential temporary work stoppages that could be required for rapid disposition of issues related to the finds.
Critical Habitat		A subset of both natural and modified habitat that deserves particular attention. Critical habitat includes areas with high biodiversity value, including habitat required for the survival of critically endangered or endangered species; areas having special significance for endemic or restricted-range species; sites that are critical for the survival of migratory species; areas supporting globally significant concentrations or numbers of individuals of congregator species; areas with unique assemblages of species or that are associated with key evolutionary processes or provide key ecosystem services; and areas having biodiversity of significant social, economic, or cultural importance to local communities.
Displaced Persons		In the context of involuntary resettlement, displaced persons are those who are physically displaced (relocation, loss of residential land, or loss of shelter) and/or economically displaced (loss of land, assets, access to assets, income sources, or means of livelihoods) as a result of (i) involuntary acquisition of land, or (ii) involuntary restrictions on land use or on access to legally designated parks and protected areas.
Economic Displacement		Loss of land, assets, access to assets, income sources, or means of livelihoods as a result of (i) involuntary acquisition of land, or (ii) involuntary restrictions on land use or on access to legally designated parks and protected areas.
Environmental and Social Assessment		A generic term used to describe a process of environmental and social analysis and planning to address the environmental and social impacts and risks associated with a project. The assessment may take the form of an EIA, IEE, ESIA, ESA, environmental audit, or Matrix of Environmental Impacts.
Environmental and Social Management Plan (ESMP)		A plan that guides the implementation of environmental and social management and mitigation measures. It contains the following key elements: mitigation measures, implementation and monitoring program, cost estimates, resource requirements, budget, and institutional arrangements.
Environmental and Social Monitoring Plan		A plan that details environmental and social monitoring and reporting requirements, including parameters to be measured, methods, sampling locations, frequency of measurements, detection limits, and definition of thresholds that will signal the need for corrective actions; typically a part of an ESMP.
External Experts		Experts not involved in day-to-day project implementation or supervision.

Free Prior and Informed Consent	<p><i>Free</i> implies that there is no coercion, intimidation or manipulation.</p> <p><i>Prior</i> implies that consent is to be sought sufficiently in advance of any authorization or commencement of activities and respect is shown to time requirements of indigenous consultation/consensus processes.</p> <p><i>Informed</i> implies that information is provided that covers a range of aspects, including the nature, size, pace, reversibility and scope of any proposed project or activity; the purpose of the project as well as its duration; locality and areas affected; a preliminary assessment of the likely economic, social, cultural and environmental impact, including potential risks; personnel likely to be involved in the execution of the project; and procedures the project may entail. This process may include the option of withholding consent. Consultation and participation are crucial components of a consent process.</p>
Indigenous People	<p>Broadly defined as a distinct social and cultural group possessing the following characteristics in varying degrees: self-identification as members of a distinct indigenous cultural group and recognition of this identity by others; collective attachment to geographically distinct habitats or ancestral territories in the Project area and to the natural resources in these habitats and territories; customary cultural, economic, social or political institutions that are separate from those of the dominant society or culture; and/or an indigenous language often different from the official language of the country or region.</p>
Involuntary Resettlement	<p>Refers both to physical displacement and economic displacement as a result of Project related land acquisition. Resettlement is considered involuntary when affected individuals or communities do not have the right to refuse land acquisition that result in displacement.</p>
Mismanagement of stakeholder engagement	<p>A situation where stakeholder engagement is organized or controlled inadequately and ineffectively</p>
Meaningful Consultations	<p>A process that (i) begins early in the project preparation stage and is carried out on an ongoing basis throughout the project cycle; (ii) provides timely disclosure of relevant and adequate information that is understandable and readily accessible to affected people; (iii) is undertaken in an atmosphere free of intimidation or coercion; (iv) is gender inclusive and responsive, and tailored to the needs of disadvantaged and vulnerable groups; and (v) enables the incorporation of all relevant views of affected people and other stakeholders into decision making, such as project design, mitigation measures, the sharing of development benefits and opportunities, and implementation issues.</p>
Natural Habitat	<p>Movable or immovable objects, sites, structures, groups of structures, and natural features and landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance. Physical cultural resources may be located in urban or rural settings and may be above or below ground or underwater. Their cultural interest may be at the local, provincial, national, or international level</p>
Physical Displacement	<p>Relocation, loss of residential land, or loss of shelter as a result of (i) involuntary acquisition of land, or (ii) involuntary restrictions on land use or on access to legally designated parks and protected areas.</p>
Significant Conversion or	<p>(i) the elimination or severe diminution of the integrity of a habitat caused by a major, long-term change in land or water use; or (ii) the</p>

Degradation	modification of a habitat that substantially reduces the habitat's ability to maintain viable populations of its native species.
Subproject	A subproject is defined as a set of separately executed activities. Separate financial and economic analyses would typically be carried out at appraisal for each subproject, together with overall financial and economic analyses



## 7.2 Correspondence to ADB's Safeguard Policy and ISO

GED's ESMS Framework	ADB's Safeguard Policy	ISO 14001	ISO26000
2. Policy	ADB SPS, V. Safeguard Policy Statement, 43	5.2 Environmental Policy	-
4. ESMS Elements for Feasibility Study and Implementation			
4.1 Feasibility Study			
4.1.1 Risk Screening	ADB SPS. V. Safeguarding Policy Statement, 49 - 52, p.24 ADB SPS. V. Safeguarding Policy Statement, 66, p.29	-	6.3.4 Human rights risk situations
4.1.2 Stakeholder Identification	ADB SPS. V. Safeguarding Policy Statement, 54, p.25	-	3.3.3 The role of stakeholders in social responsibility 4.5 Respect to stakeholder interests
4.1.3 ES Obligations and Permits	ADB SPS. V. Safeguarding Policy Statement, 58, p.26	-	6.5.1.1 Organizations and the environment
4.1.4 Project Categorization (A, B, C)	ADB SPS. V. Safeguarding Policy Statement, 50, 57, p.24	-	-
4.2 Implementation			
Pre-construction			
4.2.1 ES Impact Assessment Study & Management Plan (EMP) Development	ADB SPS. V. Safeguarding Policy Statement, 13-16,p.25 ADB SPS. Safeguarding: Environment, 4-9, p.35-36 ADB SPS. Safeguarding: Environment, 12-18, p.37-38	-	5.2.1 Impacts, interests and expectations 6.6.7 Fair operating practices issue: Respect for property rights
4.2.2 Biodiversity Action Plan (BAP) Development	ADB SPS. Safeguard Requirement 1: Environment, 8, p.34-38	-	6.5.6 Environmental issue 4: Protection of the environment, biodiversity and restoration of natural habitats
4.2.3 Resettlement Plan (RP) Development	ADB SPS. Safeguard Requirements 2: Involuntary Resettlement, 7-33, p. 50-55	-	7.3.2 Determining relevance and significance of core subjects and issues to an organization
4.2.4 Indigenous People Plan (IPP) Development	ADB SPS. Safeguard Requirements 3: Indigenous Peoples, 10-37, p. 61-66	-	6.3.7 Human rights issue 5: Discrimination and vulnerable groups
4.2.5 Stakeholder Engagement Plan (SEP) Development	ADB SPS. Safeguard Requirements 1: Environment, Outline of an Environmental Impact Assessment Report, G. Information Disclosure, Consultation, and Participation, p.47 ADB SPS. Safeguard Requirements 2: Involuntary Resettlement, 28, p. 54 ADB SPS. Safeguard Requirements 2: Involuntary Settlement, Outline of a Resettlement Plan, E. Information Disclosure, Consultation, and Participation, p.51-52 ADB SPS. Safeguard Requirements 3: Indigenous Peoples, 10-12, p.61-62 ADB SPS. Safeguard Requirements 3: Indigenous Peoples, Outline of an Indigenous Peoples Plan, D. Information	-	5.3.3 Stakeholder engagement

GED's ESMS Framework	ADB's Safeguard Policy	ISO 14001	ISO26000
	Disclosure, Consultation, and Participation, p.64		
4.2.6 Grievance Redress Management	ADB SPS. Safeguard Requirements 1: Environment, 20, p.38 ADB SPS. Safeguard Requirements 2: Involuntary Resettlement, 29, p.54 ADB SPS. Safeguard Requirements 3: Indigenous Peoples, 22, p.63	-	6.3.6 Resolving grievances
4.2.7 EPC Bidding	ADB SPS. V. Safeguarding Policy Statement, 73, p.31	-	-
4.2.8 ES Organizational Structure	ADB SPS. V. Safeguarding Policy Statement, 66, p.29	-	6.2.1 Overview of organizational governance 6.2.2 Principles and consideration 6.2.3 Decision-making processes and structures
4.2.9 ES Information and Performance Disclosure	ADB SPS. Safeguard Requirements 1: Environment, Outline of an Environmental Impact Assessment Report, G. Information Disclosure, Consultation, and Participation, p.47 ADB SPS. Safeguard Requirements 2: Involuntary Settlement, Outline of a Resettlement Plan, E. Information Disclosure, Consultation, and Participation, p.51-52 ADB SPS. Safeguard Requirements 3: Indigenous Peoples, Outline of an Indigenous Peoples Plan, D. Information Disclosure, Consultation, and Participation, p.64	-	6.5.3 Environmental issue 1: Prevention of pollution
Construction			
4.2.10 Project Detailed Design and Construction	ADB SPS. Safeguard Requirements 1: Environment, 12-16, p.37-38 ADB SPS. Safeguard Requirements 2: Involuntary Settlement, 18-24, p.52-53	-	-
4.2.11 Implementation of ES Management Plans	ADB SPS. Safeguard Requirements 1: Environment, 21-22, p.39 ADB SPS. Safeguard Requirements 1: Environment, Outline of an Environmental Impact Assessment Report, I. Environmental Management Plan, p.47 ADB SPS. Safeguard Requirements 2: Involuntary Settlement, 30, p.55 ADB SPS. Safeguard Requirements 2: Involuntary Settlement, Outline of a Resettlement Plan, M. Implementation schedule – N.	-	6.8.9 Community Involvement and development issue 7: Social investment



GED's ESMS Framework	ADB's Safeguard Policy	ISO 14001	ISO26000
	Monitoring and Reporting, p.58-59 ADB SPS. Safeguard Requirements 3: Indigenous Peoples, 16-19, p.62-63 ADB SPS. Safeguard Requirements 3: Indigenous Peoples, Outline of an Indigenous Peoples Plan, I. Monitoring, Reporting and Evaluation, p.69		
4.2.12 Standard Procedures for Handover	ADB SPS. Safeguard Requirements 1: Environment, 12-16, p.37 ADB SPS. Safeguard Requirements 2: Involuntary Settlement, 17-24, p.52-53 ADB SPS. Safeguard Requirements 3: Indigenous Peoples, 13-19, p.62-63	-	-
4.2.13 Operational ES Compliance	ADB SPS. Safeguard Requirements 1: Environment, 1, p.35 ADB SPS. Safeguard Requirements 2: Involuntary Settlement, 2, p.49 ADB SPS. Safeguard Requirements 3: Indigenous Peoples, 2, p.60	-	4.6 Respect for the rule of law
4.2.14 Monitoring & Reporting of ES Management Plans	ADB SPS. Safeguard Requirements 2: Involuntary Settlement, 21, p.39 ADB SPS. Safeguard Requirements 2: Involuntary Settlement, 30, p.55 ADB SPS. Safeguard Requirements 3: Indigenous Peoples, 23, p.63	-	7.7.2 Monitoring activities on social responsibility 7.7.3 Review an organization's progress and performance on social responsibility 7.7.4 Enhancing the reliability of data and information collection and management
4.2.15 Assurance and Continual Improvement	ADB SPS. Safeguard Requirements 2: Involuntary Settlement, 21, p.39 ADB SPS. Safeguard Requirements 2: Involuntary Settlement, 30-31, p.55 ADB SPS. Safeguard Requirements 3: Indigenous Peoples, 23-24, p.63	-	7.7.5 Improving performance
5 ESMS Elements for Merger & Acquisition			
5.1.1 Due Diligence	ADB SPS. V. Safeguarding Policy Statement, 43, p.19 ADB SPS. V. Safeguarding Policy Statement, 56, p.26	-	7.3.1 Due diligence
5.1.2 Integration of ES Issues into Business Deals	ADB SPS. V. Safeguarding Policy Statement, 44, p.19	-	-
5.1.3 Post-Merger & Acquisition	ADB SPS. V. Safeguarding Policy Statement, 44, p.19	-	-
6 ESMS Elements for Operation			
6.1 Management Leadership and Commitment	-	5.1 Leadership and Commitment	-
6.2 Risks and	-	6.1.2 Significant environmental	6.3.4 Human rights risk situation

GED's ESMS Framework	ADB's Safeguard Policy	ISO 14001	ISO26000
Opportunities		aspects 6.1.4 Risk associated with threats and opportunities, 6.1.5 Planning to take action	6.3.5 Avoidance of complicity
6.3 Change Management	-	6.1 Actions to address 7.4.2 Internal communication 7.5.3 Control of documented information	-
6.4 Compliance	-	6.1.3 Compliance obligations 9.1.2 Evaluation of Compliance	4.6 Respect to the rule of laws 4.7 Respect to international norms of behavior
6.5 Goals and Improvement Plan	-	6.2.1 Environmental objectives 6.2.2 Planning actions to achieve environmental objectives	7.7.3 Reviewing an organization's progress and performance on social responsibility
6.6 Stakeholder Engagement	-	4.2 Understanding the needs and expectations of interested parties	4.5 Respect to stakeholder interests 5.3 Stakeholder identification and engagement 7.5.4 Stakeholder dialogue on communication about social responsibility
6.7 Awareness and Competency	-	7.2 Competency 7.3 Awareness	7.4 Practices for integrating social responsibility throughout an organization
6.8 Contractors and Suppliers	-	8.1 Operational planning and control	6.6.1 Overview of fair operating practices 6.6.6 Fair operating practices issue, 4: Promoting social responsibility in the value chain
6.9 Operational Control & Maintenance	-	8.1 Operational planning and control	6.1 Guidance on social responsibility core subjects – general
6.10 Emergency Preparedness and Response	-	8.2 Emergency preparedness and response	6.5.2.1 Principles and consideration – environmental risk management 6.5.3.1 Environmental issue 1: Prevention of pollution
6.11 Communication	-	7.4.2 Internal communication 7.4.3 External communication 7.5.2 Creating and updating (Documented information) 7.5.3 Control of documented information	6.4.5 Labor practice issue 3: Social dialogue 7.5 Communication on social responsibility
6.12 Incident Management	-	-	6.4.6 Labor practice issue 4: Health and safety at work
6.13 Monitoring and Reporting	-	9.1.1 Monitoring, measurement, analysis (General)	7.7.2 Monitoring activities on social responsibility 7.7.3 Review an organization's progress and performance on social responsibility 7.7.4 Enhancing the reliability of data and information collection and management
6.14 Audit	-	9.2 Internal audit	7.6 Enhancing credibility regarding social responsibility
6.15 Handling of Non-conformities	-	10.1 Non-conformity, corrective action and preventive action	-

GED's ESMS Framework	ADB's Safeguard Policy	ISO 14001	ISO26000
6.16 Management Review	-	10. Improvement	7.7.5 Improving performance

## 7.3 Applicable Environmental and Social Safeguards Requirements

A legal framework detailing the applicable host country legislations is an integral part of compliance as per the ESMS system. It primarily covers the local laws, rules, regulations and policies pertaining to environment, social (labor and community) and health and safety.

### 7.3.1 National and Local Laws

All activities included in the proposed subprojects that will be developed and implemented by the Company will be reviewed and evaluated against the applicable national laws, regulations, and standards on environment, health, safety, involuntary resettlement, indigenous peoples, and labor. Subprojects are also encouraged to apply good international industry practice during construction, operation and maintenance and decommissioning phase of the subprojects. The Company shall ensure compliance to the national and local laws and regulations and conformance to the international standards and systems, which countries of operations are signatory, in all its existing subprojects and its future initiatives. These laws and regulations include but are not limited to:

- Environment and Conservation of the National Environment Quality Act B.E. 2535 (1992), including various Environmental Quality Standards as defined by the Act:
  - Water quality standards for river, canal, swamp, marsh, lake, reservoir and other public inland water sources
  - Water quality standards for coastal and estuarine water areas
  - Groundwater quality standards
  - Atmospheric ambient air standards
  - Ambient standards for noise and vibration
  - Environmental quality standards for other matters
- Department of Labour Regulation (2006)
- Department of Industrial Work Regulation (2003)
- Department of Industrial Estate Authority of Thailand

1. ADB's **Safeguard Policy Statement (SPS), 2009**. The SPS sets out the policy objectives scope and trigger, and principles for following three key safeguard areas: (i) Environmental safeguard; (ii) Involuntary resettlement safeguard; and (iii) Indigenous Peoples safeguard. The objective and scope of above these key areas are briefly described below.
2. **Safeguards Requirement 1 (SR1) on Environment**. SR1 ensures the environmental soundness and sustainability of subprojects and supports the integration of environmental considerations into the subproject decision-making process. Environmental safeguards are triggered if a subproject is likely to have potential environmental risks and impacts. During the design, construction, and operation of a subproject, the Company will apply technologies and practices consistent with international good practice, as reflected in internationally recognized standards such as the World Bank Group's Environment, Health and Safety Guidelines. (Annex 3).
3. **Safeguards Requirement 2 (SR2) on Involuntary Resettlement**. SR2 requires avoidance or minimization of involuntary resettlement by exploring subproject design alternatives; to enhance, or at least restore, the livelihoods of all displaced person(s) in real terms relative to pre-project levels; and to improve the standards of living of the displaced poor and other vulnerable groups. The involuntary resettlement safeguards cover physical displacement (relocation loss of residential land or loss of shelter) and economic displacement (loss of land assets, access to assets, income sources, or means of livelihoods) because of involuntary restrictions on land use or on access to legally designated parks and protected areas. It covers them whether such losses and involuntary restrictions are full or partial, permanent or temporary. (Annex 4).
4. **Safeguards Requirement 3 (SR3) on Indigenous Peoples**. SR3 requires the design and implementation of subprojects in a way that fosters full respect for indigenous peoples' identity, dignity, human rights, livelihood systems, and cultural uniqueness as defined by the indigenous peoples themselves so that they: (i) receive culturally appropriate social and economic benefits, (ii) do not suffer adverse impacts because of subprojects, and (iii) can participate actively in subprojects that affect them. SR3 is triggered if a subproject directly or indirectly affects the dignity, human rights, livelihood systems or culture of indigenous peoples or affects the territories or natural or cultural resources that Indigenous Peoples own, use, occupy, or claim as an ancestral domain or asset. (Annex 5).
5. ADB Policy on Gender and Development (GAD), 1998. ADB's policy on GAD included mainstreaming as a key strategy in promoting gender equity. With respect to subprojects, the GAD Policy requires:
  - Gender analysis: to assess systematically the impact of a subproject on men and women, and on the economic and social relationship between them
  - Gender planning: to formulate specific strategies that aim to bring about equal opportunities for men and women
  - Mainstreaming: to consider gender issues in all aspects of Company operations, accompanied by efforts to encourage women's participation in the decision-making process in development activities
6. **ADB Social Protection Strategy, 2001**. ADB's Social Protection Strategy 2001 requires the Company to comply with applicable labor laws in relation to the subproject, and take measures to comply with the core labor standards. Core

labor standards include a set of four internationally recognized basic rights and principles at work: (i) Freedom of association and the effective recognition of the right to collective bargaining; (ii) Elimination of all forms of forced or compulsory labor; (iii) Effective abolition of child labor; and (iv) Elimination of discrimination in respect of employment and occupation. The Company and its contractors and subcontractors will employ local labor whenever possible and take measures to comply with ADB's Social Protection Requirements (Annex 2).

7. **ADB Public Communications Policy, 2011.** ADB's Public Communications Policy recognizes that transparency and accountability are essential to development effectiveness. The objective of the policy is to enhance stakeholders' trust in and ability to engage with ADB. The policy recognizes the right of people to seek, receive, and impart information about ADB operations. It supports knowledge sharing and enables participatory development or two-way communications with affected people. The policy is based on a presumption in favour of disclosure unless there is a compelling reason for nondisclosure. It commits ADB to disclose subproject-related information proactively on its website, following strictly time limits, and provides mechanisms to handle responses and complaints.

### **7.3.3 International Organization for Standardization**

There exist globally recognized management system standards pertaining to ESMS aspects. Leading among them is the Geneva based International Organization for Standardization (ISO) promoted management system standards covering Quality management systems (ISO 9000 series), Environment (ISO 14000 series) among many other aspects. Among the H&S aspects, the Occupational Health and Safety Management Systems (OHSMS), OHSAS 18001 is the internationally recognized assessment specification for occupational health and safety systems.





**Gulf**

The logo features a stylized checkmark symbol to the left of the word "Gulf". The checkmark is dark blue with a small green leaf-like shape at its base. The word "Gulf" is written in a bold, dark blue, sans-serif font. Below the logo, there are two large, abstract, curved shapes: a light green one on the left and a dark blue one on the right, both curving upwards.

# **Appendix 6A**

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**Invitation letter to attend the public meeting**

**[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]**

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# **Appendix 6B**

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**Brochure for the public meeting**





เหตุผล ความเป็นมาของโครงการ บริษัท พัฒนาโซลาร์ จำกัด มีแนวคิดที่จะพัฒนาโครงการโรงไฟฟ้า พัฒนาโซลาร์ ซึ่งเป็นโครงการผลิตไฟฟ้าจากพลังงานแสงอาทิตย์โดยเทคโนโลยีแผงโฟโตโวลเทอิกหรือโซลาร์เซลล์แบบติดตั้งบนพื้นดินร่วมกับระบบกักเก็บพลังงานเนื่องจากพลังงานแสงอาทิตย์เป็นพลังงานสะอาด สามารถนำมาใช้งานได้โดยไม่จำกัด มีความมั่นคงในระยะยาว และไม่ก่อให้เกิดมลภาวะทางสิ่งแวดล้อม ทั้งนี้ การพัฒนาดังกล่าว เข้าข่ายต้องจัดทำรายงานประเมินผลกระทบบัญชี (CoP) และรายงานการศึกษามาตรการป้องกันและแก้ไขผลกระทบต่อคุณภาพสิ่งแวดล้อมและความปลอดภัย (ESA) เพื่อประกอบการขออนุญาตดำเนินโครงการสำหรับวัตถุประสงค์ของการดำเนินงานในครั้งนี เพื่อเป็นการเตรียมความพร้อมให้กับชุมชน โดยการสร้างความรู้ความเข้าใจ พร้อมทั้งเปิดโอกาสให้ประชาชนและผู้มีส่วนได้เสียได้มีส่วนร่วมกับการพัฒนาโครงการตั้งแต่เริ่มต้นโครงการ ทำให้โครงการสามารถนำข้อมูลที่ได้รับจากการประชุมหาแนวทางลดผลกระทบสิ่งแวดล้อมและข้อห่วงกังวลที่จะเกิดขึ้นจากการพัฒนาโครงการ

# “โครงการโรงไฟฟ้า พัฒนาโซลาร์ ของบริษัท พัฒนาโซลาร์ จำกัด จังหวัดกาญจนบุรี”

### วัตถุประสงค์ของโครงการ

1. เพื่อสนับสนุนให้ประเทศไทยสามารถมุ่งสู่พลังงานสะอาดและลดการปล่อยคาร์บอนไดออกไซด์สุทธิเป็นศูนย์ ภายในปี พ.ศ. 2608-2609 โดยการเพิ่มสัดส่วนการผลิตไฟฟ้าจากพลังงานทดแทน
2. เพื่อส่งเสริมการผลิตไฟฟ้าจากพลังงานหมุนเวียน ตามแผนการเพิ่มการผลิตไฟฟ้าจากพลังงานสะอาด ภายใต้แผน PDP2018 Revision 1 โดยการเพิ่มสัดส่วนกำลังการผลิตไฟฟ้าจากพลังงานสะอาดในรูปแบบต่างๆ และแผนพัฒนาพลังงานทดแทนและพลังงานทางเลือก พ.ศ. 2561-2580

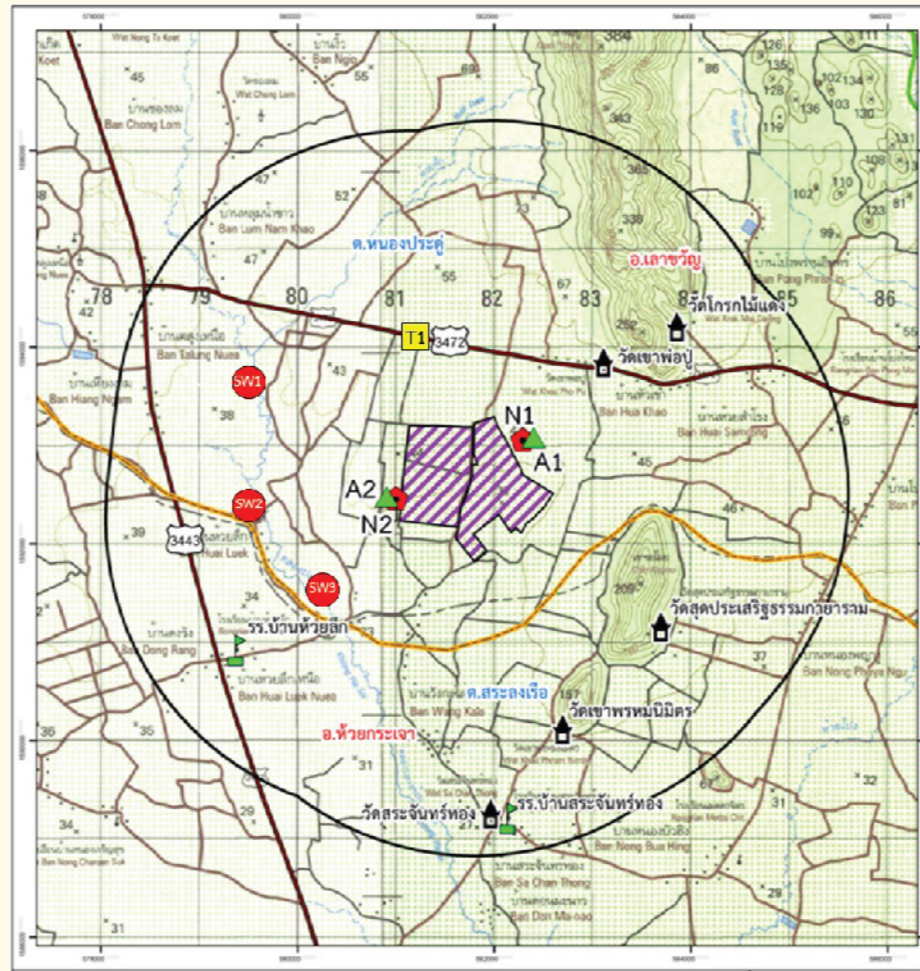
### ประโยชน์ของโครงการ

1. การพัฒนาโครงการพลังงานแสงอาทิตย์ซึ่งจัดเป็นพลังงานสะอาดที่ส่งผลกระทบต่อชุมชนรอบพื้นที่โครงการค่อนข้างต่ำ
2. เพิ่มสัดส่วนกำลังผลิตไฟฟ้าจากพลังงานหมุนเวียนภายในประเทศ และช่วยลดการผลิตไฟฟ้าจากเชื้อเพลิงฟอสซิลที่เป็นต้นเหตุของการปล่อยก๊าซเรือนกระจก ตามนโยบายภาครัฐ
3. สามารถพัฒนาชุมชนในพื้นที่ใกล้เคียงโรงไฟฟ้าจากกองทุนพัฒนาไฟฟ้า
4. ภาษีโรงเรือนและที่ดิน และภาษีป้าย
5. การจ้างแรงงาน และการสนับสนุนงบประมาณสำหรับพัฒนาชุมชน

บริษัท ทีแอลที คอนซิลแตนต์ จำกัด  
152 ถนนพหลโยธิน แขวงจตุจักร เขตจตุจักร กรุงเทพฯ 10230  
มีนาคม 2566

### การศึกษาสภาพแวดล้อมปัจจุบัน

โครงการกำหนดการสำรวจสิ่งแวดล้อมภาคสนามของปัจจัยสิ่งแวดล้อมที่เกี่ยวข้อง ประกอบด้วย คุณภาพอากาศในบรรยากาศระดับเสียง คุณภาพน้ำผิวดิน นิเวศวิทยาทางน้ำ และคมนาคม ดังรูปที่ 3



(หมายเหตุ: สถานีตรวจวัด/จุดเก็บตัวอย่าง เป็นการกำหนดเบื้องต้น อาจมีการเปลี่ยนแปลงได้ตามความเหมาะสมของพื้นที่หรือเปลี่ยนแปลงในกรณีที่ดินของสถานที่ ไม่อนุญาติหรือไม่สะดวก)

### สถานีตรวจวัดคุณภาพอากาศ

- A1 : บ้านด้านทิศตะวันออกของโครงการ
- A2 : บ้านด้านทิศตะวันตกของโครงการ

### สถานีตรวจวัดระดับเสียง

- N1 : บ้านด้านทิศตะวันออกของโครงการ
- N2 : บ้านด้านทิศตะวันตกของโครงการ

### จุดเก็บตัวอย่างคุณภาพน้ำ

### ผิวดินและนิเวศวิทยาทางน้ำ

SW1 : ห้วยลึกก่อนไหลเข้าใกล้พื้นที่โครงการ

SW2 : คลองปลาสร้อยก่อนไหลเข้าใกล้พื้นที่โครงการ

SW3 : คลองปลาสร้อยหลังไหลเข้าใกล้พื้นที่โครงการ

### จุดตรวจนับปริมาณจราจร

T1 : ทางหลวงหมายเลข 3472

### รูปที่ 3 การศึกษาสภาพแวดล้อมปัจจุบันของโครงการ

### กลุ่มผู้มีส่วนได้ส่วนเสียของโครงการ

1. กลุ่มผู้ได้รับผลกระทบหรือผู้มีส่วนได้เสีย ประกอบด้วย
  - ประชาชนในพื้นที่ศึกษา
  - ผู้นำชุมชนในพื้นที่ศึกษา
  - กลุ่มเปราะบาง เช่น กลุ่มสตรี เด็ก คนพิการ แรงงานข้ามชาติ เป็นต้น
  - กลุ่มชาติพันธุ์
2. กลุ่มหน่วยงานราชการในระดับต่างๆ ที่เกี่ยวข้อง
3. ประชาชน/ผู้สนใจทั่วไป

### การเผยแพร่และประชาสัมพันธ์ของโครงการ

โครงการดำเนินการนำเอกสารเผยแพร่ข้อมูลของโครงการไปประชาสัมพันธ์ ณ บอร์ดประชาสัมพันธ์ของสถานที่ต่างๆ ในพื้นที่ศึกษา ประกอบด้วย

- 1) ที่ว่าการอำเภอ
- 2) องค์กรปกครองส่วนท้องถิ่นในพื้นที่ศึกษา
- 3) ที่ทำการผู้นำชุมชนในพื้นที่ศึกษา หรือศาลาประชาคมหมู่บ้านที่อยู่ในพื้นที่ศึกษา
- 4) หน่วยงานพื้นที่อ่อนไหวต่อผลกระทบสิ่งแวดล้อมในพื้นที่ศึกษา



ช่องทางการติดต่อและสอบถามข้อมูลเพิ่มเติม ติดต่อสอบถามหรือแสดงความคิดเห็นต่อโครงการได้ที่

[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]



**ข้อมูลโครงการเบื้องต้น**

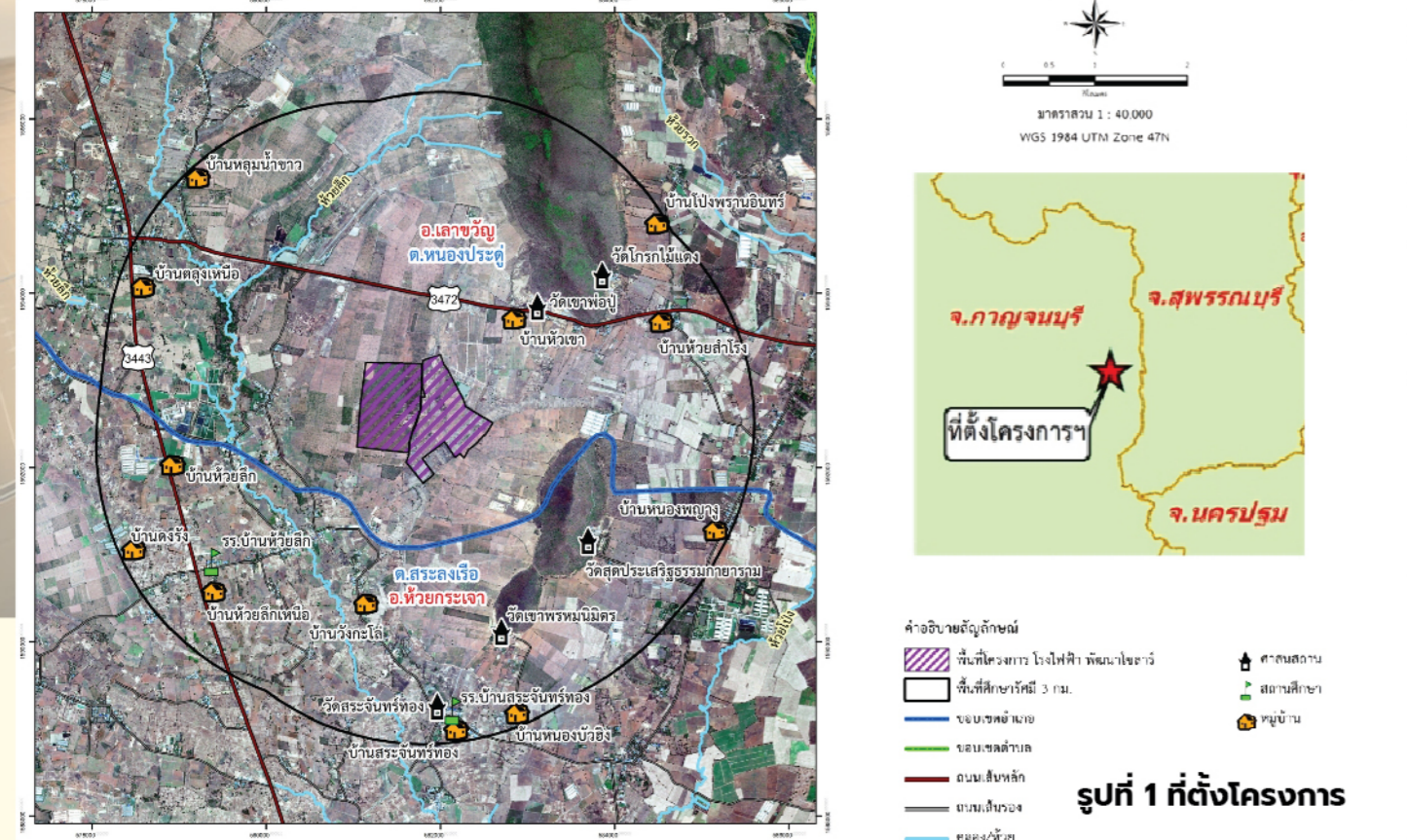
**เจ้าของโครงการ :** บริษัท พัฒนาโซลาร์ จำกัด

**ที่ตั้งโครงการ :** ตำบลหนองปรือ อำเภอบางบัวทอง จังหวัดกาญจนบุรี (รูปที่ 1)

**ขนาดพื้นที่โครงการ :** 800 ไร่

**ประเภทโครงการ :** โรงงานที่ผลิตไฟฟ้าจากพลังงานแสงอาทิตย์โดยเทคโนโลยีโฟโตโวลเทอิก ที่ติดตั้งบนพื้นดินร่วมกับระบบกักเก็บพลังงาน

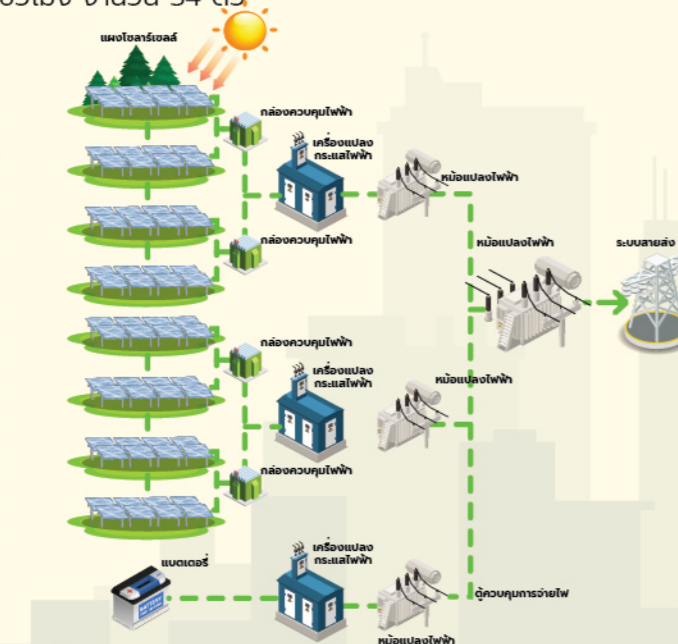
**กำลังการผลิตไฟฟ้า :** มีกำลังการผลิตได้สุทธิ 162 เมกะวัตต์



**เครื่องจักรหลักที่มีการติดตั้ง :**

- แผงโซลาร์เซลล์ : ซิลิคอน ชนิดโมโนคริสตัลไลน์ (Monocrystalline) ขนาด 605 วัตต์ต่อแผงหรือเทียบเท่า ประมาณ 267,982 แผง
- เครื่องแปลงกระแสไฟฟ้า (Inverter) : ขนาด 3.437 เมกะวัตต์ต่อตัว จำนวน 33 ตัว หรือขนาด 300 กิโลวัตต์ต่อตัว จำนวน 386 ตัว หรือเทียบเท่า
- หม้อแปลงไฟฟ้า (Transformer) : ขนาด 70 เมกะโวลต์แอมแปร์ จำนวน 1 ตัว
- ระบบกักเก็บพลังงานไฟฟ้า (Battery) : ขนาด 2,752 กิโลวัตต์ต่อชั่วโมง จำนวน 34 ตัว

**กระบวนการผลิตกระแสไฟฟ้า :** กระบวนการผลิตกระแสไฟฟ้า จะเริ่มจาก แสงอาทิตย์ซึ่งเป็นคลื่นแม่เหล็กไฟฟ้ามากระทบที่แผงโซลาร์เซลล์ที่มีสารกึ่งตัวนำ จะเกิดอนุภาคที่มีประจุไฟฟ้าบวกและลบ เคลื่อนที่ไปในทิศทางที่ตรงข้ามกันซึ่งการเคลื่อนที่ของอนุภาคประจุบวกและลบดังกล่าวจะทำให้เกิดไฟฟ้ากระแสตรงขึ้น โดยไฟฟ้ากระแสตรงดังกล่าวจะส่งเข้าอุปกรณ์ที่เรียกว่า “เครื่องแปลงกระแสไฟฟ้า หรือ อินเวอร์เตอร์ (Inverter)” เพื่อแปลงไฟฟ้ากระแสตรงให้เป็นไฟฟ้ากระแสสลับ แล้วส่งเข้าสู่หม้อแปลงไฟฟ้าเพื่อแปลงเป็นไฟฟ้าแรงดันสูง โดยไฟฟ้าแรงดันสูงนี้จะจ่ายไฟฟ้าเข้าสู่ระบบสายส่งหรือจัดเก็บในระบบกักเก็บพลังงานไฟฟ้า (Battery) ตามสัญญาการซื้อขายไฟของการไฟฟ้าฝ่ายผลิต ทั้งนี้โครงการจะจ่ายไฟฟ้าจากพลังงานแสงอาทิตย์ที่ได้เข้าสู่ระบบสายส่งให้กับการไฟฟ้าฝ่ายผลิตก่อน ส่วนไฟฟ้าส่วนเกินจะจัดเก็บในระบบกักเก็บพลังงานไฟฟ้า (Battery) สำหรับช่วงที่ผลิตไฟฟ้าจากแสงอาทิตย์ไม่ได้ (รูปที่ 2)



รูปที่ 2 กระบวนการผลิตไฟฟ้าจากพลังงานแสง

**ระบบสาธารณูปโภคของโครงการ**

**แหล่งน้ำใช้ :** ระยะก่อสร้างและระยะดำเนินการ โครงการอยู่ระหว่างพิจารณาแหล่งน้ำใช้ที่เหมาะสม เช่น จากการประปาส่วนภูมิภาค หรือแหล่งน้ำในท้องถิ่น การขุดเจาะบ่อบาดาลภายในพื้นที่โครงการ การซื้อน้ำจากภายนอกโครงการ ซึ่งสามารถจัดหาน้ำใช้ให้กับโครงการได้อย่างเพียงพอ

**แหล่งไฟฟ้า :** ระยะก่อสร้าง โครงการจะใช้ไฟฟ้าจากการไฟฟ้าส่วนภูมิภาค และระยะดำเนินการ จะนำไฟฟ้าที่ผลิตได้มาใช้ภายในโครงการ

**ระยะเวลาในการก่อสร้าง**

โครงการใช้ระยะเวลาในการก่อสร้าง ติดตั้งอุปกรณ์ จนทดสอบระบบประมาณ 18 เดือน

**ผลกระทบที่อาจเกิดขึ้นและการจัดการเบื้องต้นของโครงการ**

ผลกระทบจากการดำเนินโครงการพลังงานแสงอาทิตย์จะค่อนข้างต่ำ โดยส่วนใหญ่แล้วพื้นที่รอบโครงการ จะได้รับผลกระทบในช่วงระยะก่อสร้างโครงการ โดยสามารถจำแนกผลกระทบได้ดังนี้

ปัจจัย	กิจกรรมที่ก่อให้เกิดผลกระทบ	มาตรการเบื้องต้น
<b>ระยะก่อสร้าง</b>		
<b>คุณภาพอากาศ</b>	การปรับสภาพและขุดเจาะดิน และการขนส่งอุปกรณ์เข้าพื้นที่	<ul style="list-style-type: none"> <li>การล้างล้อ</li> <li>ฉีดพรมน้ำในพื้นที่โครงการและส่วนของถนนที่โครงการ</li> <li>ดูแลอุปกรณ์ใช้งานในการก่อสร้าง</li> </ul>
<b>ระดับเสียง</b>	การเดินเครื่องยนต์ เครื่องจักรในการปรับสภาพ/ขุดเจาะดิน	<ul style="list-style-type: none"> <li>เลือกใช้อุปกรณ์เครื่องจักรที่มีเสียงเบา</li> <li>กำหนดช่วงเวลาดำเนินการที่ลดเสียงในช่วงเวลากลางวัน</li> </ul>
<b>คมนาคม</b>	การขนส่งอุปกรณ์ก่อสร้าง และคนงาน	<ul style="list-style-type: none"> <li>จัดให้มีป้ายหรือสัญญาณเตือนที่เห็นได้ชัดเจน</li> <li>อบรมและควบคุมพนักงานขับรถให้ปฏิบัติตามกฎจราจรอย่างเคร่งครัด</li> </ul>
<b>การใช้น้ำ/กึ่งน้ำ</b>	จากกิจกรรมการก่อสร้าง และคนงานก่อสร้าง	<ul style="list-style-type: none"> <li>เลือกใช้น้ำจากแหล่งน้ำที่เหมาะสม</li> <li>หลีกเลี่ยงการใช้น้ำร่วมกับชุมชน</li> <li>พิจารณาเลือกวิธีจัดการน้ำทิ้งอย่างเหมาะสม</li> </ul>
<b>ระยะดำเนินการ</b>		
<b>การใช้น้ำ/กึ่งน้ำ</b>	การล้างแผงเซลล์แสงอาทิตย์ และพนักงานของโครงการ	<ul style="list-style-type: none"> <li>เลือกใช้น้ำจากแหล่งน้ำที่เหมาะสม</li> <li>หลีกเลี่ยงการใช้น้ำร่วมกับชุมชน</li> <li>พิจารณาเลือกวิธีจัดการน้ำทิ้งอย่างเหมาะสม</li> </ul>

**วิธีการดำเนินงานของโครงการ**



**การคัดเลือกพื้นที่โครงการและเทคโนโลยีเบื้องต้น**

**การคัดเลือกพื้นที่โครงการ :** โครงการกำหนดให้พื้นที่โครงการต้องไม่ขัดต่อกฎหมายใดๆ เกี่ยวกับสถานที่ประกอบกิจการในปัจจุบัน อาทิ

- 1) ต้องไม่ขัดต่อกฎหมายว่าด้วยการผังเมือง
- 2) ต้องไม่ขัดต่อกฎหมายว่าด้วยส่งเสริมและรักษาคุณภาพสิ่งแวดล้อมแห่งชาติ
- 3) ต้องไม่ขัดต่อกฎหมายว่าด้วยการโบราณสถานและโบราณวัตถุ
- 4) ต้องไม่ขัดต่อมติคณะรัฐมนตรี

ทั้งนี้ พื้นที่โครงการโรงไฟฟ้า พัฒนาโซลาร์ ของบริษัท พัฒนาโซลาร์ จำกัด ซึ่งตั้งอยู่ที่ตำบลหนองปรือ อำเภอบางบัวทอง จังหวัดกาญจนบุรี ไม่ขัดต่อกฎหมายใดๆ เกี่ยวกับเรื่องทำเลที่ตั้งที่มีผลบังคับใช้ในปัจจุบัน

**การคัดเลือกเทคโนโลยี :** โครงการเลือกใช้แผงซิลิคอน ชนิดโมโนคริสตัลไลน์ (Monocrystalline) เนื่องจากเป็นเทคโนโลยีที่มีประสิทธิภาพการผลิตไฟฟ้าที่ดีที่สุด

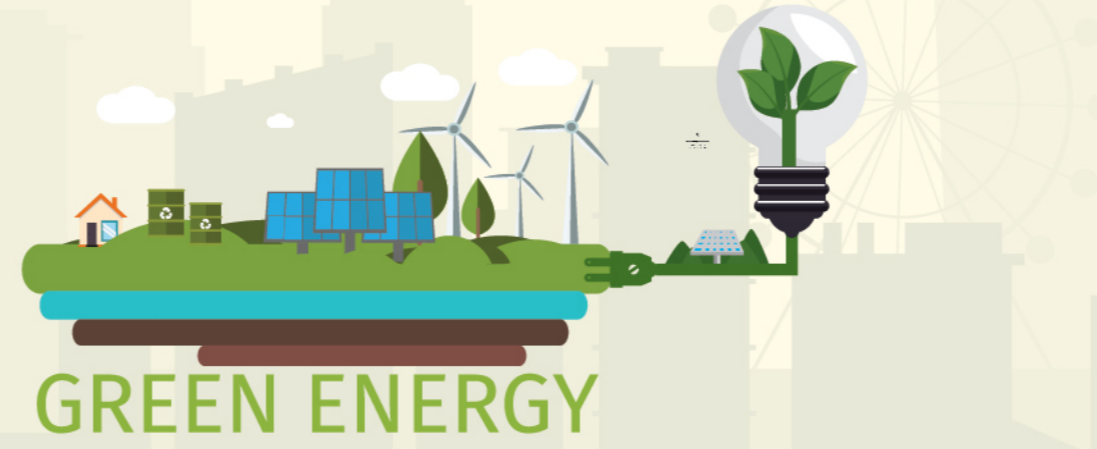
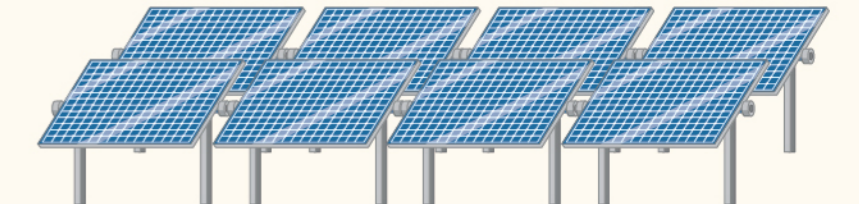
แผงซิลิคอนชนิดโมโนคริสตัลไลน์	แผงซิลิคอนชนิดโพลีคริสตัลไลน์	แผงชนิดอะมอร์ฟัส
<p>การผลิตไฟฟ้า</p> <p><b>ผลิตได้ดีที่สุด</b></p> <p>การใช้พื้นที่</p> <p><b>ใช้น้อย</b></p> <p>อายุงาน</p> <p><b>&gt;25 ปี</b></p> <p>ผลกระทบของเงาต่อการผลิตไฟฟ้า</p> <p><b>เงามีผลกระทบต่อการผลิต</b></p>	<p>การผลิตไฟฟ้า</p> <p><b>ผลิตน้อยกว่าโมโนคริสตัลไลน์</b></p> <p>การใช้พื้นที่</p> <p><b>ใช้มาก</b></p> <p>อายุงาน</p> <p><b>&gt;25 ปี</b></p> <p>ผลกระทบของเงาต่อการผลิตไฟฟ้า</p> <p><b>เงามีผลกระทบต่อการผลิต</b></p>	<p>การผลิตไฟฟ้า</p> <p><b>ผลิตได้น้อยที่สุด</b></p> <p>การใช้พื้นที่</p> <p><b>ใช้มากที่สุด</b></p> <p>อายุงาน</p> <p><b>เสื่อมสภาพเร็ว/ประกันสินค้าสั้น</b></p> <p>ผลกระทบของเงาต่อการผลิตไฟฟ้า</p> <p><b>เงามีผลกระทบต่อการผลิตน้อย</b></p>

**ขอบเขตการศึกษารายงานของโครงการ**



**พื้นที่ศึกษาของโครงการ**

โครงการกำหนดพื้นที่ศึกษารวม 3 ไร่ โดยพิจารณาจากขอบเขตพื้นที่โครงการ ตามระเบียบคณะกรรมการกำกับกิจการพลังงาน ว่าด้วย การรับฟังความเห็นและทำความเข้าใจกับประชาชนและผู้มีส่วนได้เสีย ในการพิจารณาออกใบอนุญาตประกอบกิจการผลิตไฟฟ้า พ.ศ.2565 ซึ่งครอบคลุมพื้นที่บางส่วนของตำบลหนองปรือ อำเภอบางบัวทอง ตำบลสระลงเรือ อำเภอยี่งอ และ จังหวัดกาญจนบุรี



**GREEN ENERGY**



# **Appendix 6C**

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**Presentation for the public meeting**



การประชุมรับฟังความเห็นและทำความเข้าใจ  
กับประชาชนและผู้มีส่วนได้เสีย



## โครงการโรงไฟฟ้า พัฒนาโซลาร์

ของ  
บริษัท พัฒนาโซลาร์ จำกัด

มีถนน 2566

# Pre-engagement Presentation



## เหตุผลและความจำเป็นของโครงการ

บริษัท พัฒนาโซลาร์ จำกัด มีแนวคิดที่จะพัฒนาโครงการโรงไฟฟ้า พัฒนาโซลาร์ ซึ่งเป็นโครงการผลิตไฟฟ้าจากพลังงานแสงอาทิตย์ โดยเทคโนโลยีแผงโพลีโวลเทอิกหรือโซลาร์เซลล์แบบติดตั้งบนพื้นดินร่วมกับระบบเก็บพลังงาน เนื่องจากพลังงานแสงอาทิตย์เป็นพลังงานสะอาด สามารถนำมาใช้งานได้อย่างไม่จำกัด มีความมั่นคงในระยะยาว และไม่ก่อให้เกิดมลภาวะทางสิ่งแวดล้อม



การพัฒนาโครงการเข้าช่ยต้องจัดทำ

- รายงานประมวลผลการปฏิบัติ (Code of Practice: CoP)
- รายงานการศึกษามาตรการป้องกันและแก้ไขผลกระทบต่อคุณภาพสิ่งแวดล้อมและความปลอดภัย (Environmental and Safety Assessment : ESA)



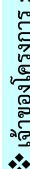
วัตถุประสงค์ของโครงการ

- เพื่อส่งเสริมการผลิตไฟฟ้าจากพลังงานหมุนเวียน
- เพื่อสนับสนุนให้ประเทศไทยสามารถมุ่งสู่พลังงานสะอาดและลดการปล่อยคาร์บอนไดออกไซด์

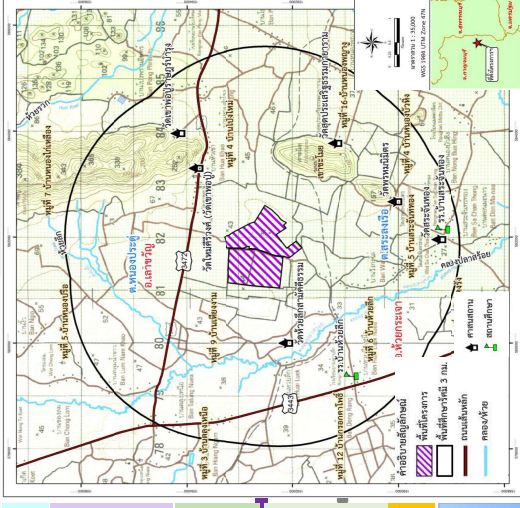


## ประโยชน์ที่ชุมชนหรือประชาชนจะได้รับจากการดำเนินโครงการ

- ใช้ทรัพยากรธรรมชาติที่มีอยู่เป็นวัตถุดิบพลังงาน
- เพิ่มสัดส่วนกำลังผลิตไฟฟ้าจากพลังงานหมุนเวียนภายในประเทศ
- และช่วยลดการผลิตไฟฟ้าจากเชื้อเพลิงฟอสซิล
- พัฒนาชุมชนในพื้นที่ใกล้เคียงโรงไฟฟ้าจากกองทุนพัฒนาไฟฟ้า
- ภาษีบำรุงท้องถิ่น
- การจ้างแรงงาน
- การสนับสนุนงบประมาณในการพัฒนาชุมชน

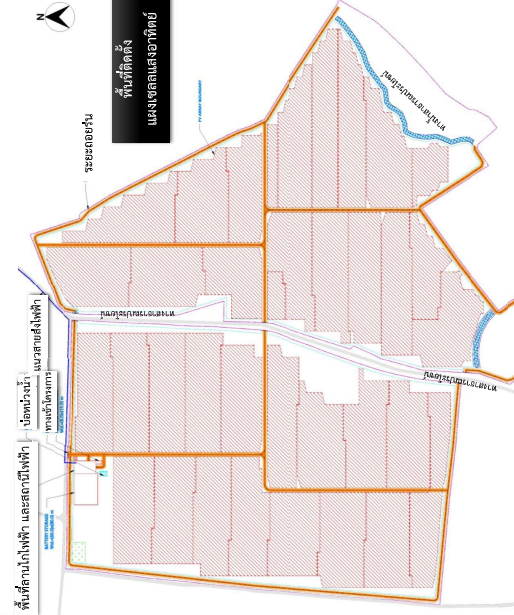


## รายละเอียดโครงการ



- ❖ **เจ้าของโครงการ** : บริษัท พัฒนาโซลาร์ จำกัด
- ❖ **ประเภทโครงการ** : โครงการผลิตไฟฟ้าจากพลังงานแสงอาทิตย์ โดยเทคโนโลยีแผงโพลีโวลเทอิกหรือโซลาร์เซลล์ แบบติดตั้งบนพื้นดินร่วมกับระบบเก็บพลังงาน
- ❖ **ที่ตั้งโครงการ** : ที่ดินเอกสิทธิ์ชื่อของ ต.สรรคบุรี อ.ห้วยกระเจา จ.กาญจนบุรี
- ❖ **ตรวจที่ตั้ง** **แผนที่ภูมิประเทศ+ขอบเขตการปกครอง** พบว่าโครงการตั้งอยู่ในเขต ต.หนองปรือ อ.เสาวชัย จ.กาญจนบุรี **ปัจจุบันอยู่ระหว่างการตรวจสอบกับสำนักงานที่ดิน**
- ❖ **ขนาดพื้นที่โครงการ** : 813 ไร่ 2 งาน 3.5 ตารางวา (1,901,614.1 ตารางเมตร)
- ❖ **กำลังการผลิตติดตั้ง** : 162.129 เมกะวัตต์
- ❖ **พลังงานไฟฟ้าที่ผลิตได้ต่อปี** : 264.377 จิกะวัตต์-ชั่วโมงต่อปี

- สัญลักษณ์
- ระยะถนน
  - ขอบเขตพื้นที่โครงการ
  - ทางเข้าโครงการ
  - พื้นที่สีเขียว
  - พื้นที่ติดตั้งแผงโซลาร์เซลล์
  - ทางสาธารณประโยชน์
  - ถนน
  - ทางน้ำ สาธารณประโยชน์
  - ป่าม. รพค.

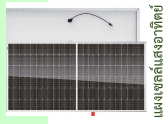


บริเวณพื้นที่ตั้งโครงการ มีทางสาธารณประโยชน์พาดผ่าน โครงการได้กำหนดระยะถนนให้เป็นไปตามกฎหมายว่าด้วยการควบคุมอาคาร

รายการ	การใช้จ่ายลงทุนพื้นที่โครงการ	
	ขนาดพื้นที่ (ตารางเมตร)	ร้อยละ
พื้นที่บริเวณติดตั้งแผงโซลาร์เซลล์	895,116.3	68.76
พื้นที่อาคารที่ทำการเชื่อมระบบของสถานีจ่าย	288.0	0.02
พื้นที่ติดตั้งแผงโซลาร์ รั้วคอกปุ๋ยคอก กากขี้หมู และขี้วัว	120.0	0.01
พื้นที่สีเขียว และแนวรั้วถนน	39,548.7	3.04
พื้นที่ถนนใกล้ฟ้า (Vicinity Road) หรือสถานีไฟฟ้า (Substation)	1,527.0	0.12
พื้นที่รั้ว รั้วถนน และของอาคาร	352,576.7	27.09
พื้นที่บริเวณถนนและรั้วซึ่งเกี่ยวข้องกับไฟฟ้า	4,800.0	0.37
ป่า (Forest, Existing Drain)	7,638.4	0.59
รวม	1,201,614.1	100.00

กำลังการผลิต : กำลังการผลิตติดตั้ง 162.129 เมกะวัตต์ (MWp) **จำหน่ายให้กับภาครัฐ**

- เครื่องจักรหลักที่มีการติดตั้ง :
- แผงเซลล์แสงอาทิตย์ชนิดโมโนคริสตัลไลน์ ขนาด 605 วัตต์ต่อแผง หรือเทียบเท่ากับประมาณ 267,982 แผง
  - เครื่องแปลงกระแสไฟฟ้า (Inverter) ขนาด 3.437 เมกะวัตต์ต่อตัว จำนวน 33 ตัว หรือ ขนาด 300 กิโลวัตต์ต่อตัว จำนวน 386 ตัว หรือเทียบเท่า
  - หม้อแปลงไฟฟ้า ขนาด 70 เมกะโวลต์แอมแปร์ จำนวน 1 ตัว
  - ระบบกักเก็บพลังงาน (Battery Energy Storage System: BESS) ขนาด 2,752 กิโลวัตต์ชั่วโมง จำนวน 34 ตัว

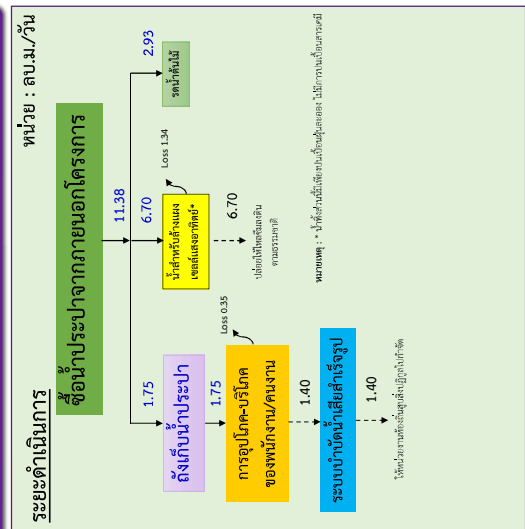
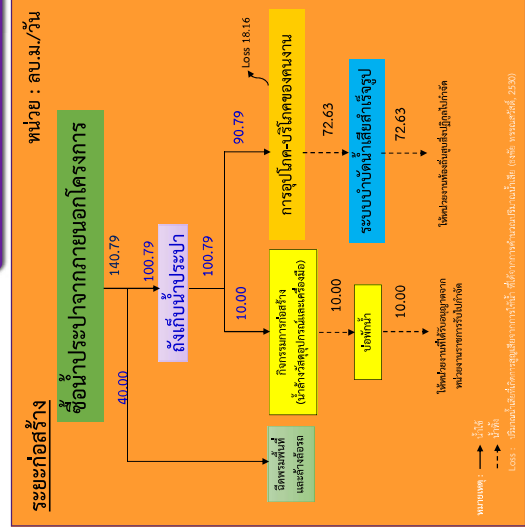
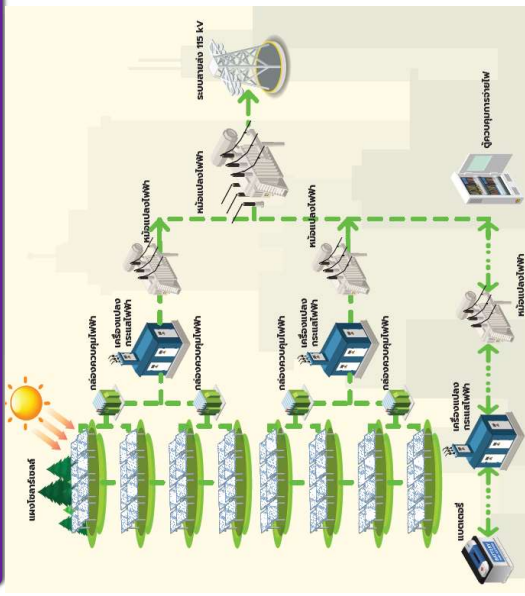


แผงเซลล์แสงอาทิตย์

เครื่องแปลงกระแสไฟฟ้า

หม้อแปลงไฟฟ้า

ระบบกักเก็บพลังงานไฟฟ้า





งบประมาณของโครงการ : ประมาณ 5,500 ล้านบาท

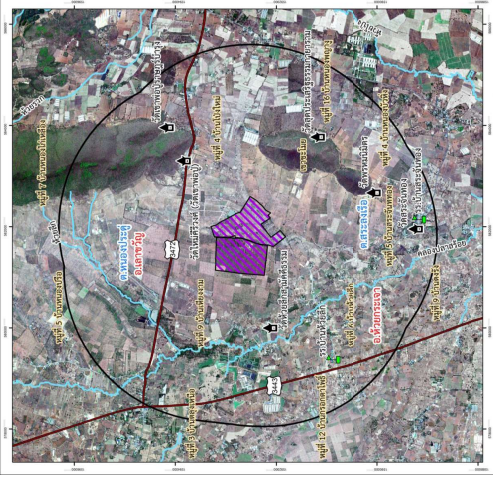
ระยะเวลาในการก่อสร้าง : ตั้งแต่งานออกแบบ การจัดทำรายงาน COP การขออนุญาตหน่วยงานที่เกี่ยวข้อง ดำเนินการงานก่อสร้าง จนถึงการผลิตไฟฟ้า และจ่ายไฟฟ้าเข้าระบบ ประมาณ 21 เดือน

สำหรับกิจกรรมระยะก่อสร้าง จะใช้ระยะเวลา 12 เดือน



กิจกรรม	ระยะเวลา (เดือน)	เดือน																				
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1 งานออกแบบ	2	←→																				
2 การจัดทำรายงาน CoP & ESA	7		←→																			
3 ขออนุญาต	3			←→																		
4 งานก่อสร้าง	12				←→																	
4.1 ออกแบบรายละเอียดทางวิศวกรรม	2				←→																	
4.2 จัดส่งอุปกรณ์	5					←→																
4.3 ก่อสร้างอาคาร และงานโยธา	5						←→															
4.4 ติดตั้งเครื่องจักร และแผงเซลล์แสงอาทิตย์	4							←→														
4.5 ติดตั้งอินเวอร์เตอร์ แผงเซลล์และขาติดตั้ง และแบตเตอรี่	7								←→													
4.6 ติดตั้งอุปกรณ์สถานีไฟฟ้าและหม้อแปลงไฟฟ้า	4									←→												
4.7 ติดตั้งระบบอาคารควบคุมภาค (ระบบป้องกันอัคคีภัย ระบบป้องกันฟ้าผ่า และระบบน้ำใช้)	2										←→											
5 ทดลองเดินระบบผลิตไฟฟ้า	2											←→										
6 จ่ายไฟฟ้าเข้าระบบ	-																				←→	

สภาพแวดล้อมปัจจุบัน



สัญลักษณ์ที่แสดง  
 พื้นที่โครงการ พื้นที่รัศมี 3 กม.  
 ถนนเส้นหลัก ถนนทั่วไป  
 ควบคุมสถาน สถานีไฟฟ้า  
 สถานีรถไฟ สถานีรถโดยสาร

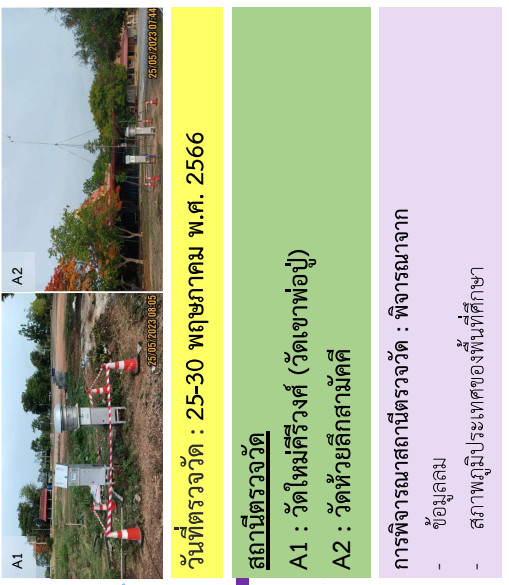
1:50,000  
 UTM Zone 47N  
 WGS 1984

พื้นที่ศึกษาของโครงการ

- กำหนดพื้นที่ศึกษารัศมี 3 กิโลเมตร จากขอบเขตพื้นที่โครงการ ตามระเบียบคณะกรรมการกำกับกิจการพลังงาน ว่าด้วยการรับฟังความเห็นและทำความเข้าใจกับประชาชนและผู้มีส่วนได้เสีย ในการพิจารณาออกใบอนุญาตประกอบกิจการผลิตไฟฟ้า พ.ศ.2565
- ครอบคลุมพื้นที่ บางส่วนของตำบลหนองประจักษ์ อำเภอลำพูน และตำบลสระลงเรือ อำเภอห้วยกระเจา จังหวัดกาญจนบุรี

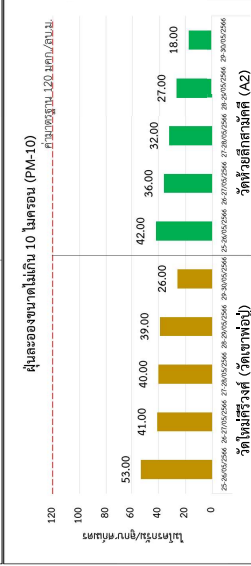
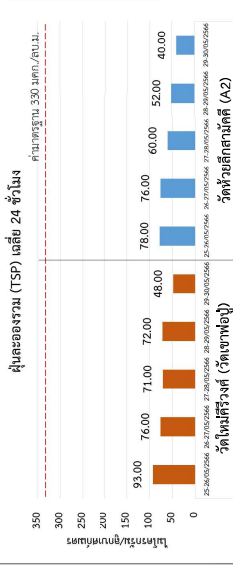
วันที่ตรวจวัด : 25-30 พฤษภาคม พ.ศ. 2566  
 สถานีตรวจวัด  
 A1 : วัดใหม่ศรีวงศ์ (วัดเขาทัพปู้)  
 A2 : วัดห้วยถิกถลัมคณี

การพิจารณาสถานีตรวจวัด : พิจารณาจาก  
 - ข้อมูลเดิม  
 - สภาพภูมิประเทศของพื้นที่ศึกษา



## การตรวจวัดคุณภาพอากาศ

ผลการตรวจวัด ระหว่างวันที่ 25-30 พฤษภาคม พ.ศ. 2566



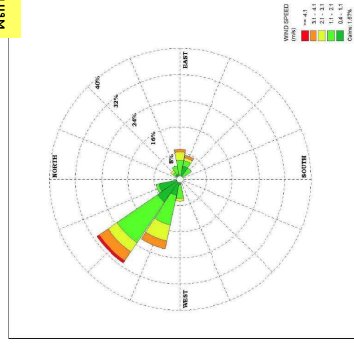
ฝุ่นละอองรวม มีค่าอยู่ในช่วง 40.00-93.00 ไมโครกรัม/ลูกบาศก์เมตร (ร้อยละ 12.12-28.18 ของค่ามาตรฐาน) **อยู่ในเกณฑ์มาตรฐานทั้งหมด**

ฝุ่นละอองขนาดเล็กไม่เกิน 10 ไมครอน มีค่าอยู่ในช่วง 18.00-53.00 ไมโครกรัม/ลูกบาศก์เมตร (ร้อยละ 15.00-44.17 ของค่ามาตรฐาน) **อยู่ในเกณฑ์มาตรฐานทั้งหมด**

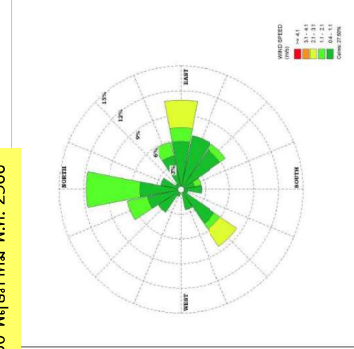
หมายเหตุ : มาตรฐานคุณภาพอากาศในบรรยากาศโดยทั่วไปตามประกาศคณะกรรมการสิ่งแวดล้อมแห่งชาติ ฉบับที่ 24 (พ.ศ. 2547)

## การตรวจวัดคุณภาพอากาศ

ผลการตรวจวัด ระหว่างวันที่ 25-30 พฤษภาคม พ.ศ. 2566

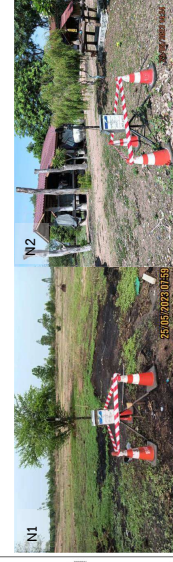
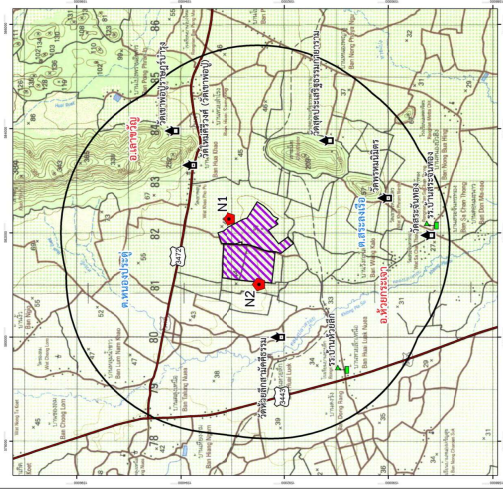


**วัดใหม่ศรีวังฯ (วัดเขาพญา) (A1)**  
ทิศทางลม : ลมส่วนใหญ่พัดมาจากทิศตะวันตกเฉียงเหนือ  
ความเร็วลม : น้อยกว่า 0.4 ถึง 4.9 เมตร/วินาที  
ลมสงบ 1.67 %



**วัดหัวปลี**  
ทิศทางลม : ลมส่วนใหญ่พัดมาจากทิศเหนือ  
ความเร็วลม : น้อยกว่า 0.4 ถึง 2.2 เมตร/วินาที  
ลมสงบ 27.50 %

## การตรวจวัดระดับเสียง



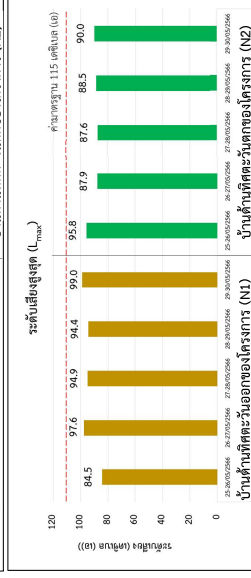
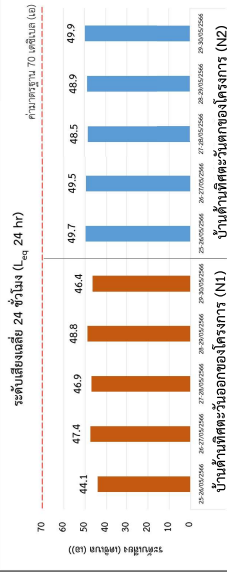
วันที่ตรวจวัด : 25-30 พฤษภาคม พ.ศ. 2566

### สถานีตรวจวัด

- N1 : บ้านด้านทิศตะวันออกของโครงการ
- N2 : บ้านด้านทิศตะวันตกของโครงการ

การพิจารณาสถานีตรวจวัด : พิจารณาจาก  
- บริเวณใกล้เคียงพื้นที่ตั้งโครงการที่อาจได้รับผลกระทบจากโครงการ

## การตรวจวัดระดับเสียง



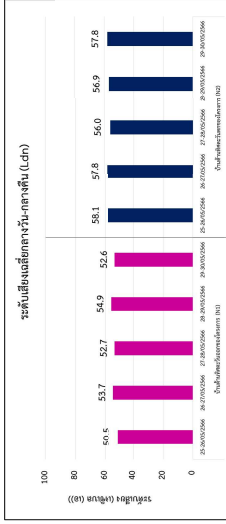
ผลการตรวจวัด ระหว่างวันที่ 25-30 พฤษภาคม พ.ศ. 2566

ระดับเสียงเฉลี่ย 24 ชั่วโมง มีค่าอยู่ในช่วง 44.1-49.9 เดซิเบล(เอ)  
(ร้อยละ 63.00-71.29 ของค่ามาตรฐาน)  
**อยู่ในเกณฑ์มาตรฐานทั้งหมด**

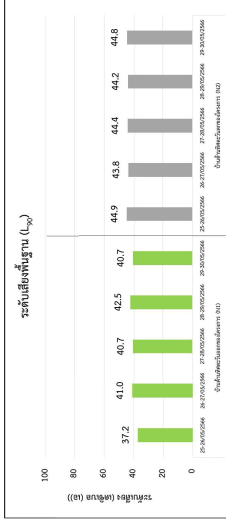
ระดับเสียงสูงสุด มีค่าอยู่ในช่วง 84.5-99.0 เดซิเบล(เอ)  
(ร้อยละ 73.48-86.09 ของค่ามาตรฐาน)  
**อยู่ในเกณฑ์มาตรฐานทั้งหมด**



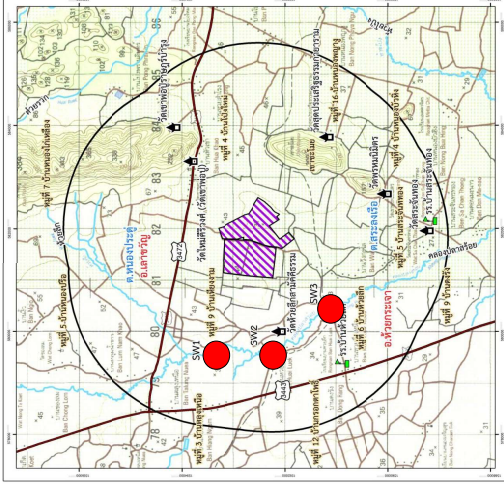
ผลการตรวจวัด ระหว่างวันที่ 25-30 พฤษภาคม พ.ศ. 2566



ระดับเสียงเฉลี่ยกลางวัน-กลางคืน มีค่าอยู่ในช่วง 50.5-58.1 เดซิเบล(เอ)



ระดับเสียงพื้นฐาน มีค่าอยู่ในช่วง 37.2-44.9 เดซิเบล(เอ)

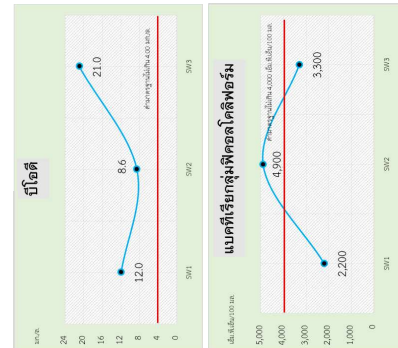
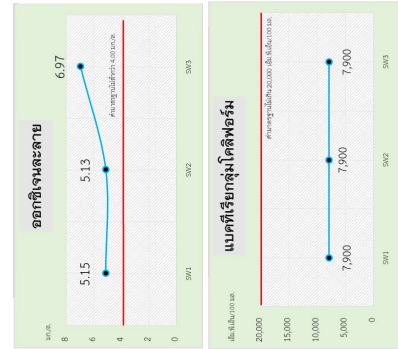
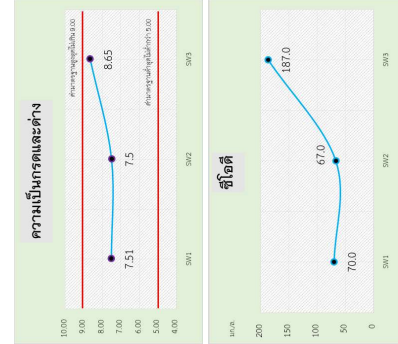


วันที่ตรวจวัด : 30 พฤษภาคม พ.ศ. 2566

### สถานีตรวจวัด

- SW1 : คลองปลาร้อยก่อนไหลเข้าใกล้พื้นที่โครงการ
- SW2 : คลองปลาร้อยไหลเข้าใกล้พื้นที่โครงการ
- SW3 : คลองปลาร้อยหลังไหลเข้าใกล้พื้นที่โครงการ

การพิจารณาสถานีตรวจวัด : พิจารณาจาก - บริเวณแหล่งน้ำที่อยู่ใกล้เคียงพื้นที่โครงการ



คุณภาพน้ำผิวดินส่วนใหญ่ มีค่าอยู่ในเกณฑ์มาตรฐาน ประเภทที่ 3 คือ แหล่งน้ำที่ได้รับน้ำที่จากกิจกรรมบางประเภท และสามารถเป็นประโยชน์เพื่อ (1) การอุปโภคและบริโภค โดยต้องผ่านการฆ่าเชื้อโรคตามปกติ และผ่านการบำบัดน้ำทิ้งก่อน (2) การเกษตร

ปัจจัยสิ่งแวดล้อมที่อาจได้รับผลกระทบจากโครงการ

### ระยะก่อสร้าง

1. คุณภาพอากาศ
2. เสียง
3. การใช้น้ำ
4. คุณภาพน้ำ และการระบายน้ำ
5. การจัดการมูลฝอยและกากของเสีย
6. ทรัพยากรดิน
7. การคมนาคมขนส่ง
8. อาชีวอนามัยและความปลอดภัย
9. เศรษฐกิจ-สังคม



## การประเมินผลกระทบสิ่งแวดล้อม (ระยะก่อสร้าง)

### 1. คุณภาพอากาศ:

**ระยะก่อสร้าง:** ในการก่อสร้างจะมีการปรับเปลี่ยนสภาพพื้นที่ร้อยละ 0.52 ของพื้นที่โครงการทั้งหมดเท่านั้น ส่วนในการติดตั้งแผงเซลล์แสงอาทิตย์ จะดำเนินการทำฐานรากแบบเสาเข็มเหล็ก (Screw pile) ซึ่งการก่อสร้างก่อให้เกิดฝุ่นละอองระดับต่ำ ผลกระทบด้านคุณภาพอากาศในระดับต่ำ

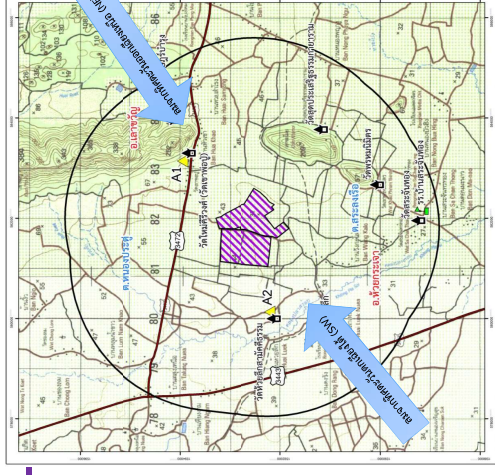


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มาตรการป้องกันและแก้ไขผลกระทบสิ่งแวดล้อมระยะก่อสร้าง

- ฉีดพรมน้ำในบริเวณพื้นที่ที่มีการเปิดหน้าดิน
- กองวัสดุ อย่างน้อยวันละ 2 ครั้ง (เช้า-บ่าย)
- วัสดุอุปกรณ์ส่วนที่ก่อให้เกิดฝุ่นต้องมีวัสดุคลุมปิดทับ
- เครื่องจักรและอุปกรณ์ ตรวจสอบสภาพและบำรุงรักษาอย่างสม่ำเสมอให้สามารถทำงานได้
- ก่อนนำรถออกจากพื้นที่ก่อสร้างให้ล้างทำความสะอาดตัวรถและล้อรถ

## การประเมินผลกระทบสิ่งแวดล้อม (ระยะก่อสร้าง)



จุดติดตามตรวจสอบคุณภาพอากาศ ระยะก่อสร้าง

**สถานีตรวจวัด**  
A1 : วัดไนโตรเจนไดออกไซด์ (วัดเขาพอ)  
A2 : วัดห้วยลึกสามัคคี

**ดัชนีที่ตรวจวัด**

- ผู้ละอองแขวนลอยรวม (TSP) เฉลี่ย 24 ชม.
- ผู้ละอองขนาดเล็กไม่เกิน 10 ไมครอน (PM-10) เฉลี่ย 24 ชม.
- ความเร็วและทิศทางลม (WS/WVD)

**ความถี่**

- ระยะก่อสร้าง : ทุก 6 เดือน ครึ่งละ 5 วันต่อเนื่อง

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## การประเมินผลกระทบสิ่งแวดล้อม (ระยะก่อสร้าง)

### 2. เสียง:

- กิจกรรมการปรับพื้นที่ และก่อสร้างโครงสร้างหรืออาคารต่างๆ อาจก่อให้เกิดเสียงดังรบกวนชุมชนที่อยู่ในพื้นที่โครงการ ภายหลังกำหนดมาตรการป้องกัน ระดับเสียงเฉลี่ย 24 ชั่วโมง และค่าระดับการรบกวนอยู่ในเกณฑ์มาตรฐานทั้งหมด
- ในการก่อสร้างติดตั้งแผงเซลล์แสงอาทิตย์ จะดำเนินการทำฐานรากแบบเสาเข็มเหล็ก (Screw pile) ซึ่งก่อให้เกิดเสียงขณะติดตั้งในระดับต่ำ

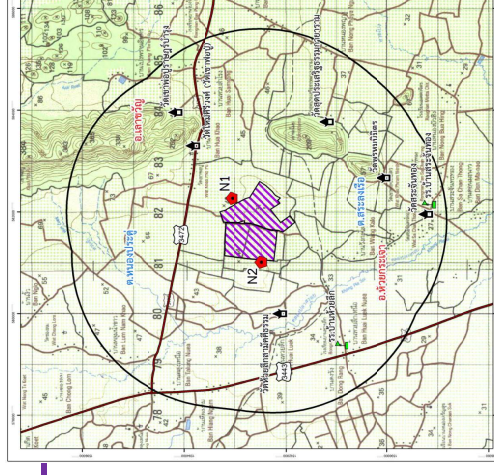
**ผลกระทบต่อชุมชนที่อยู่ในพื้นที่ใกล้เคียงในระดับต่ำ**

### มาตรการป้องกัน

- แจ้งแผนก่อสร้างที่ก่อให้เกิดเสียงดังให้ชุมชนทราบอย่างน้อย 2 สัปดาห์ ก่อนก่อสร้าง
- กิจกรรมที่เกิดผลกระทบด้านเสียงต่อชุมชน ให้มีการดำเนินการเฉพาะในช่วงเวลากลางวัน
- ให้ติดตั้งกำแพงหรือรั้วที่มีความสูงกว่าระดับสายตา บริเวณพื้นที่ก่อสร้างด้านที่อยู่ติดกับชุมชน
- เลือกใช้อุปกรณ์และเครื่องจักรในการก่อสร้างที่มีระดับเสียงต่ำ
- จัดให้มีอุปกรณ์ป้องกันเสียงให้แก่งานที่ทำงานบริเวณที่มีเสียงดัง

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## การประเมินผลกระทบสิ่งแวดล้อม (ระยะก่อสร้าง)



จุดติดตามตรวจสอบระดับเสียงระยะก่อสร้าง

**สถานีตรวจวัด**

- N1 : บ้านด้านทิศตะวันออกของโครงการ
- N2 : บ้านด้านทิศตะวันตกของโครงการ

**ดัชนีที่ตรวจวัด**

- ระดับเสียงเฉลี่ย 24 ชม. ( $L_{eq}$  24 hrs.)
- ระดับเสียงกลางคืนกลางคืน ( $L_{dn}$ )
- ระดับเสียงสูงสุด ( $L_{max}$ )
- ระดับเสียงพื้นฐาน ( $L_{90}$ )

**ความถี่**

- ระยะก่อสร้าง : ทุก 6 เดือน ครึ่งละ 5 วันต่อเนื่อง



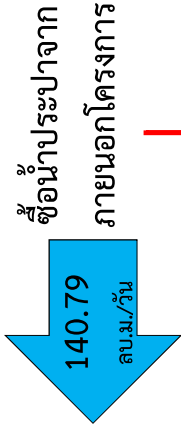
## การพัฒนา โยธินา SOIL DEVELOPMENT

### 3. การใช้ น้ำ

#### การประเมินผลกระทบสิ่งแวดล้อม (ระยะก่อสร้าง)

##### ระยะก่อสร้าง :

- นำใช้เพื่อการก่อสร้าง
  - นำเพื่อการฉีดพรมพื้นที่และล้างล้อรถ 40.00 ลบ.ม./วัน
  - นำล้างวัสดุอุปกรณ์และเครื่องมือ 10.00 ลบ.ม./วัน
- นำใช้ในการอุปโภคของคนงาน 90.79 ลบ.ม./วัน



ไม่ส่งผลกระทบต่อชุมชนโดยรอบ

## การพัฒนา โยธินา SOIL DEVELOPMENT

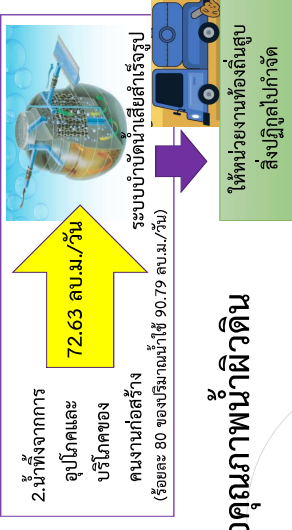
### 4. คุณภาพน้ำและการระบายน้ำ

#### การประเมินผลกระทบสิ่งแวดล้อม (ระยะก่อสร้าง)

##### 4.1 คุณภาพน้ำ

##### ระยะก่อสร้าง :

- น้ำล้างวัสดุ อุปกรณ์และเครื่องมือ
  - 10.00 ลบ.ม./วัน
- น้ำทิ้งจากการอุปโภคและบริโภคและระบบบำบัดน้ำเสียก่อสร้าง (ร้อยละ 80 ของปริมาณน้ำใช้ 90.79 ลบ.ม./วัน)
  - 72.63 ลบ.ม./วัน



ไม่ส่งผลกระทบต่อคุณภาพน้ำผิวดิน

##### มาตรการป้องกันฯ ระยะก่อสร้าง

- จัดให้มีห้องน้ำห้องส้วมที่ถูกสุขลักษณะเพียงพอแก่คนงาน
- ติดตั้งระบบบำบัดน้ำเสียสำหรับจากห้องส้วม เพื่อให้ได้มาตรฐานน้ำทิ้ง

## การพัฒนา โยธินา SOIL DEVELOPMENT

### 4.2 การระบายน้ำ

## การพัฒนา โยธินา SOIL DEVELOPMENT

### 5. การจัดการมูลฝอยและกากของเสีย

#### การประเมินผลกระทบสิ่งแวดล้อม (ระยะก่อสร้าง)

มีการปรับปรุงพื้นที่ร้อยละ 0.52 ของพื้นที่โครงการทั้งหมด ซึ่งอาจทำให้สภาพการระบายน้ำในพื้นที่เดิมของโครงการเปลี่ยนแปลงไป โดยโครงการจะจัดสร้างรางระบายชั่วคราวในบริเวณพื้นที่ดังกล่าว เพื่อระบายน้ำลงสู่บ่อบดกตะกอน/บ่อบำบัดน้ำภายในพื้นที่โครงการต่อไป

ผลกระทบที่เกิดขึ้นจะอยู่ในระดับต่ำ

##### มาตรการป้องกันฯ

- จัดทำรางระบายน้ำชั่วคราวและบ่อบดกตะกอน ให้แล้วเสร็จในช่วง 1 เดือนแรกของการก่อสร้าง
- ห้ามทิ้งขยะหรือเศษวัสดุจากการก่อสร้างลงในที่ระบายน้ำ
- ตรวจสอบประสิทธิภาพรางระบายน้ำชั่วคราวเป็นประจำ หากพบว่าชำรุดเสียหายให้ซ่อมแซมให้อยู่ในสภาพใช้งานได้โดยเร็ว

##### ระยะก่อสร้าง :

- มูลฝอยจากถนนก่อสร้างประมาณ 1,102.45 กิโลกรัมต่อวัน จัดให้เรียงขยะรองรับมูลฝอยอย่างเพียงพอตามจุดต่างๆ
- ขยะที่เกิดจากการก่อสร้าง (เศษพลาสติก เศษไม้ และเศษเหล็ก) รวบรวมและคัดแยกหรือเป็นของเสียอันตรายใส่ภาชนะที่เหมาะสม และติดต่อนำหน่วยงานที่ได้รับอนุญาตจากกรมโรงงานอุตสาหกรรมรับไปดำเนินการกำจัดภายนอก

ผลกระทบที่เกิดขึ้นจะอยู่ในระดับต่ำ

##### มาตรการป้องกันฯ

- จัดเตรียมวัสดุอุปกรณ์รองรับขยะให้พอเพียงและประสานกับหน่วยงานท้องถิ่นเพื่อดำเนินการกำจัดขยะ
- กรณีมีของเสียอันตราย จะประสานให้หน่วยงานที่ได้รับอนุญาตจากกรมโรงงานอุตสาหกรรมมารับไปกำจัดอย่างถูกต้อง
- กำหนดเรื่องการแยกทิ้งขยะหรือของเสียอันตราย/อบรมให้คนงานที่เกี่ยวข้องทราบห้ามทิ้งมูลฝอยลงในทางระบายน้ำที่อน้ำทิ้งและแหล่งน้ำในบริเวณใกล้เคียงพื้นที่ก่อสร้าง

##### มาตรการติดตามฯ

บันทึกชนิด ปริมาณ เศษวัสดุจากกิจกรรมก่อสร้างและวิธีการจัดการกากของเสีย เดือนละ 1 ครั้ง และรายงานผลการดำเนินการทุก 1 ปี

## 6. ทรัพยากรที่ดิน

โครงการจะปรับปรุงสภาพพื้นที่ ร้อยละ 0.52 ของพื้นที่โครงการทั้งหมดเท่านั้น

### ผลกระทบต่อความอุดมสมบูรณ์ของดินในระดับต่ำ



## 7. การคมนาคมขนส่ง

โครงการขนส่งวัสดุก่อสร้าง และการรับส่งคนงานก่อสร้าง ทำให้ปริมาณการจราจรบริเวณทางหลวงแผ่นดินหมายเลข 3472 มีปริมาณเพิ่มมากขึ้น

- ความเร็วในการขับที่ลดลง เกิดโอกาสเสี่ยงในการเกิดอุบัติเหตุเพิ่มขึ้น และเกิดปัญหาฝกรจราจรขังรถเสียหาย

### ผลกระทบที่จะเกิดขึ้นจะอยู่ในระดับต่ำ

**มาตรการป้องกัน**

- จัดให้มีป้ายหรือสัญญาณเตือนที่เห็นได้ชัดเจนทั้งเวลากลางวันและกลางคืน
- อบรมและควบคุมพนักงานขับรถให้ปฏิบัติตามกฎจราจรอย่างเคร่งครัด
- หากกิจกรรมการก่อสร้าง ทำให้ป้าย สัญญาณไฟหรือผิวถนนชำรุดต้องรีบดำเนินการซ่อมแซมอย่างเร่งด่วน

## 6. ทรัพยากรที่ดิน

โครงการจะปรับปรุงสภาพพื้นที่ ร้อยละ 0.52 ของพื้นที่โครงการทั้งหมดเท่านั้น

### ผลกระทบต่อความอุดมสมบูรณ์ของดินในระดับต่ำ



## 7. การคมนาคมขนส่ง

โครงการขนส่งวัสดุก่อสร้าง และการรับส่งคนงานก่อสร้าง ทำให้ปริมาณการจราจรบริเวณทางหลวงแผ่นดินหมายเลข 3472 มีปริมาณเพิ่มมากขึ้น

- ความเร็วในการขับที่ลดลง เกิดโอกาสเสี่ยงในการเกิดอุบัติเหตุเพิ่มขึ้น และเกิดปัญหาฝกรจราจรขังรถเสียหาย

### ผลกระทบที่จะเกิดขึ้นจะอยู่ในระดับต่ำ

**มาตรการป้องกัน**

- จัดให้มีป้ายหรือสัญญาณเตือนที่เห็นได้ชัดเจนทั้งเวลากลางวันและกลางคืน
- อบรมและควบคุมพนักงานขับรถให้ปฏิบัติตามกฎจราจรอย่างเคร่งครัด
- หากกิจกรรมการก่อสร้าง ทำให้ป้าย สัญญาณไฟหรือผิวถนนชำรุดต้องรีบดำเนินการซ่อมแซมอย่างเร่งด่วน

## 8. อาชีวอนามัยและความปลอดภัย :

**ระยะก่อสร้าง :**

- ผู้รับเหมาจะจัดให้มีการอบรมเรื่องความปลอดภัยในการทำงานให้กับคนงานก่อนเริ่มงานทุกวัน
- จัดให้มีอุปกรณ์คุ้มครองความปลอดภัยสวมใส่กับส่วนบุคคลที่มีความเสี่ยงพอและเหมาะสมกับลักษณะงานให้กับคนงานก่อสร้าง

**ผลกระทบที่เกิดขึ้นจะอยู่ในระดับต่ำ**

**มาตรการป้องกัน**

- มีการบริหารจัดการความปลอดภัยในการทำงานตามข้อกำหนดของกฎหมายว่าด้วยความปลอดภัย อาชีวอนามัย และสภาพแวดล้อมในการทำงานเกี่ยวกับกรก่อสร้างและเป็นระบบและมีประสิทธิภาพ
- ติดตั้งป้ายประกาศเตือนแนวเขตพื้นที่ก่อสร้างของโครงการ
- จัดแบ่งเขตโมบริเวณพื้นที่ก่อสร้างอย่างเป็นสัดส่วน
- จัดเตรียมอุปกรณ์ปฐมพยาบาลเบื้องต้น รวมทั้งรถฉุกเฉินจำนวน 1 คัน หรือเบอร์ติดต่อสถานพยาบาลใกล้เคียงที่มีรถพยาบาลสำหรับกรณีฉุกเฉินพร้อมทั้งผู้สามารถให้การปฐมพยาบาลได้ประจำพื้นที่

**มาตรการติดตามตรวจสอบ**

บันทึกสถิติการเกิดอุบัติเหตุ และให้สรุปข้อมูลเป็นรายเดือนและรายงานผลการดำเนินงานการทุก 1 ปี

## 9. เศรษฐกิจ-สังคม

**ระยะก่อสร้าง :**

- ผลกระทบทางบวก : การจ้างแรงงานในท้องถิ่น
- ผลกระทบทางลบ : การรบกวนและสร้างความรำคาญต่อชุมชนจากกิจกรรมการก่อสร้าง

**ผลกระทบที่เกิดขึ้นจะอยู่ในระดับต่ำ**

**มาตรการป้องกัน**

- ประชาสัมพันธ์และเผยแพร่ข้อมูลแผนการก่อสร้างล่วงหน้าอย่างน้อย 7 วัน ก่อนการดำเนินการก่อสร้าง (บริเวณพื้นที่ตั้งโครงการ หรือรูปแบบอื่นที่เหมาะสม)
- จัดให้มีเจ้าหน้าที่ของโครงการพื้นที่เป็นระยะๆ ตลอดช่วงก่อสร้าง
- จัดให้มีศูนย์ประสานงานการรับข้อเสนอแนะ และข้อร้องเรียน
- กรณีที่มีการร้องเรียนโครงการจะต้องทำการตรวจสอบและแก้ไขทันที
- จัดตั้งคณะกรรมการร่วมกับชุมชน ภายใต้ชื่อ “คณะกรรมการตรวจสอบผลกระทบสิ่งแวดล้อม”

**มาตรการติดตามตรวจสอบ**

- บันทึกปัญหาข้อร้องเรียนต่างๆ ที่เกิดขึ้นของชุมชน
- บันทึกกิจกรรมที่โครงการดำเนินการร่วมกับชุมชนในพื้นที่
- บันทึกผลการดำเนินงานของคณะกรรมการตรวจสอบผลกระทบสิ่งแวดล้อม

## ปัจจัยสิ่งแวดล้อมที่อาจได้รับ

### ผลกระทบจากโครงการ



1. คุณภาพอากาศ
2. เสียง
3. การใช้ไฟฟ้า
4. คุณภาพน้ำ
5. การระบายน้ำ
6. การจัดการมูลฝอยและกากของเสีย
7. ทรัพยากรดิน
8. การคมนาคมขนส่ง
9. อาชีวอนามัยและความปลอดภัย
10. เศรษฐกิจ-สังคม

## 1. คุณภาพอากาศ:

### ระยะดำเนินการ:

กิจกรรมการผลิตไฟฟ้าจากแผงเซลล์แสงอาทิตย์ ไม่มีเครื่องจักรที่ก่อให้เกิดฝุ่นละอองหรือระบายน้ำเสีย  
**ดังนั้น ไม่ก่อให้เกิดผลกระทบด้านคุณภาพอากาศต่อชุมชนโดยรอบพื้นที่โครงการแต่อย่างใด**

## 2. เสียง :

### ระยะดำเนินการ:

กระบวนการผลิตกระแสไฟฟ้าของโครงการ เป็นการผลิตไฟฟ้าจากพลังงานแสงอาทิตย์ ด้วยเทคโนโลยีแผงโซลาร์เซลล์ หรือโซลาร์เซลล์ ซึ่งไม่มีแหล่งกำเนิดเสียงที่จะส่งผลกระทบต่อชุมชนและพื้นที่อันไหน

**ดังนั้น ไม่ก่อให้เกิดผลกระทบต่อชุมชนโดยรอบพื้นที่โครงการแต่อย่างใด**

## 3. การใช้ไฟฟ้า:

### ระยะดำเนินการ:

- ใช้ไฟฟ้าเพื่อการอุปโภคและบริโภคของพนักงานของโครงการ/การล้างแผงเซลล์แสงอาทิตย์/รดน้ำต้นไม้
- คาดการณ์ปริมาณน้ำใช้ในระยะดำเนินการสูงสุดรวม 1.38 ลูกบาศก์เมตรต่อวัน
- โครงการจะจัดซื้อน้ำประปาจากภายนอกโครงการ ให้เพียงพอต่อการดำเนินการของโครงการ

**ดังนั้น จึงไม่ส่งผลกระทบต่อชุมชนโดยรอบ**



## การประเมินผลกระทบสิ่งแวดล้อม (ระยะดำเนินการ)

### 4. คุณภาพน้ำ:

#### ระยะดำเนินการ:

- น้ำทิ้งจากอาคารอุปโภคและบริโภคประจำวัน ประมาณ 1.40 ลูกบาศก์เมตรต่อวัน รวบรวมเข้าระบบบำบัดน้ำเสียหลักเสร็จแล้ว สำหรับน้ำทิ้งที่ผ่านการบำบัดแล้วจะส่งไปกำจัดด้วยวิธีการบำบัดน้ำเสีย
- น้ำทิ้งจากอาคารที่ความสะอาดเหมาะสมแล้ว ส่งออกที่ทิ้งเป็นน้ำล้างพื้นและอ่างล้างมือเป็นไปตามสารเคมีที่เกิดขึ้นปีละ 2 ครั้ง ประมาณ 6.70 ลูกบาศก์เมตรต่อวัน ปล่อยให้ไหลซึมลงดินตามธรรมชาติโดยไม่ส่งผลกระทบต่อคุณภาพน้ำผิวดิน

#### มาตรการป้องกัน:

- การใช้น้ำ : จัดทำน้ำโดยการซื้อน้ำประปาจากภายนอกโครงการ ให้เพียงพอการดำเนินการ
- การระบายน้ำฝน : ความคุ้มครองการระบายน้ำฝนจากอาคารก่อนที่โครงการให้โอตรการระบายน้ำฝนกว่าอาคารระบายน้ำฝนในพื้นที่ก่อนพัฒนาโครงการ
- การบำรุงรักษาระบบบำบัดน้ำเสีย : บำรุงรักษาระบบบำบัดน้ำเสียให้มีประสิทธิภาพ รวมถึงการซ่อมแซมของโครงการให้เป็นไปตามเกณฑ์มาตรฐาน

#### มาตรการติดตาม:

- การตรวจวัดค่า pH : แสดงถึงสมดุลน้ำใช้-น้ำทิ้ง (Water balance) พร้อมแสดงข้อมูลระบบบำบัดน้ำเสีย และการระบายน้ำทิ้ง
- การตรวจวัดค่าความขุ่น : และการตรวจวัดค่าความขุ่นผิวดิน (เฉพาะกรณีที่มีการสูบน้ำหรือระบายน้ำทิ้งลงสู่แหล่งน้ำผิวดิน) : โครงการไม่มีกิจกรรมน้ำทิ้งลงสู่แหล่งน้ำผิวดิน



## การประเมินผลกระทบสิ่งแวดล้อม (ระยะดำเนินการ)

### 5. การระบายน้ำ:

#### ระยะดำเนินการ:

- ปรับปรุงสภาพพื้นที่เฉพาะบริเวณพื้นที่อาคารที่ทำการเพื่อควบคุมระบบผลิตไฟฟ้า พื้นที่จัดเก็บอะไหล่วัสดุอุปกรณ์ กากของเสีย และขี้เถ้า (Switchyard) หรือสถานีไฟฟ้า (Substation) และพื้นที่ส่วนสนับสนุนและเกี่ยวข้องกับการผลิตไฟฟ้า ร้อยละ 0.52 ของพื้นที่โครงการทั้งหมด
- ส่งผลให้การระบายน้ำภายในพื้นที่ดังกล่าวมีสภาพเปลี่ยนแปลงไปจากก่อนการพัฒนาโครงการเล็กน้อย
- จึงไม่ส่งผลกระทบต่อพื้นที่โดยรอบ โดยโครงการได้จัดให้มีรางระบายน้ำเพื่อรวบรวมและระบายน้ำฝนลงสู่ท่อระบายน้ำ ขนาด 700 ลูกบาศก์เมตร เพื่อรองรับปริมาณน้ำฝนส่วนเกินที่เปลี่ยนไป

ดังนั้น จึงไม่ส่งผลกระทบต่อพื้นที่โดยรอบ



## การประเมินผลกระทบสิ่งแวดล้อม (ระยะดำเนินการ)

### 6. การจัดการมูลฝอยและกากของเสีย :

#### ระยะดำเนินการ:

- ขยะมูลฝอยจากอาคารอุปโภคของพนักงาน คาดว่าจะเกิดขึ้นประมาณ 21.25 กิโลกรัมต่อวัน
- ของเสียจากอาคารซ่อมบำรุง เช่น น้ำมันหล่อลื่นที่ใช้น้ำมัน ทำการเก็บรวบรวมใส่ภาชนะที่มีฝาปิดมิดชิด และติดต่อให้หน่วยงานรับกำจัดของเสียที่ได้รับอนุญาตมารับไปดำเนินการกำจัดภายนอกต่อไป
- แผงเซลล์แสงอาทิตย์ : มีอายุการใช้งานประมาณ 25 ปี ในกรณีที่เกิดการชำรุดหรือเสื่อมประสิทธิภาพการใช้งาน โครงการจะมีการส่งไปกำจัดภายนอก
- น้ำฝนบนหลังคาเป็นบริเวณที่แผ่รังสี UV สูง เก็บรวบรวมน้ำฝนไปเป็นน้ำเพื่อแยกน้ำและน้ำฝน และติดต่อหน่วยงานที่ได้รับอนุญาตมารับไปกำจัดอย่างถูกต้องต่อไป
- ดังนั้น ผลกระทบที่เกิดขึ้นจะอยู่ในระดับต่ำ

#### มาตรการป้องกัน:

- จัดเก็บและส่งออกกำจัดของเสียหรือของเสียจากอาคารใช้งาน ดำเนินการตามประกาศกระทรวงอุตสาหกรรม เรื่องการกำจัดสิ่งมีพิษหรือวัสดุที่ไม่ใช้แล้ว พ.ศ. 2548
- ตรวจสอบสถานที่จัดเก็บของมูลฝอย และวัสดุที่ไม่ใช้แล้วเป็นประจำ เพื่อป้องกันผลกระทบที่อาจเกิดขึ้นจากการปนเปื้อนหรือฟุ้งกระจายของกากของเสีย

#### มาตรการติดตาม:

- บันทึกชนิดปริมาณและจัดการของเสียของโครงการ โดยสรุปข้อมูลสถิติรายปีตามแบบบันทึกของกรมโรงงานอุตสาหกรรม (แบบ สก.)



## การประเมินผลกระทบสิ่งแวดล้อม (ระยะดำเนินการ)

### 7. ทรัพยากรดิน:

#### ระยะดำเนินการ:

- กระบวนการผลิตกระแสไฟฟ้าของโครงการ เป็นการผลิตไฟฟ้าจากพลังงานแสงอาทิตย์ด้วยเทคโนโลยีแผงโซลาร์เซลล์ หรือโซลาร์เซลล์ ไม่มีกิจกรรมการขุดเปิดหน้าดิน

ไม่ส่งผลกระทบต่อสิ่งแวดล้อมของดิน





## การประเมินผลกระทบสิ่งแวดล้อม (ระยะดำเนินการ)

### 8. การคมนาคมขนส่ง:

#### ระยะดำเนินการ:

จำกัดพื้นที่และอนุญาตให้ยานพาหนะที่เข้า-ออกเฉพาะพื้นที่ที่ได้รับอนุญาตเท่านั้น และรถผู้มาติดต่อ ส่วนรถบรรทุก เช่น รถขยะทั่วไป รถขนส่งสิ่งปฏิกูล รถขนน้ำใช้ จะเข้ามาเป็นครั้งคราวตามความจำเป็น ผลกระทบด้านคมนาคมขนส่งที่เกิดขึ้นจะอยู่ในระดับต่ำ

#### ระยะดำเนินการ:

- ผลกระทบทางบวก : การพัฒนาท้องถิ่นและคุณภาพชีวิตของคนในชุมชน
  - ผลกระทบทางลบ : ชุมชนโดยรอบโครงการ อาจมีความกังวลต่อการดำเนินโครงการ
- ผลกระทบที่เกิดขึ้นจะอยู่ในระดับต่ำ

#### มาตรการติดตามตรวจสอบ

- บันทึกปัญหาข้อร้องเรียนต่างๆ ที่เกิดขึ้นของชุมชน
- บันทึกกิจกรรมที่โครงการดำเนินการร่วมกับชุมชนในพื้นที่
- บันทึกผลการดำเนินงานของคณะกรรมการตรวจสอบผลกระทบสิ่งแวดล้อม

#### มาตรการป้องกัน

- เปิดโอกาสให้ชุมชนเข้ามาเยี่ยมชมโครงการ
- จัดตั้งศูนย์รับเรื่องร้องเรียนและข้อเสนอแนะ (ระบุช่องทาง การรับเรื่องร้องเรียน ขั้นตอน/ระยะเวลาในการดำเนินการแก้ไข/ผู้รับผิดชอบ/แผนผังประกอบ)
- กรณีที่ได้รับเรื่องร้องเรียน ให้เจ้าหน้าที่รับเรื่องร้องเรียนส่งไปให้ผู้จัดการโครงการ และให้นัดผู้ร้องเรียนเข้าพูดคุยที่ประสบปัญหา
- จัดให้มีผู้รับผิดชอบงานด้านมวลชนสัมพันธ์ของโครงการ เข้าร่วมกิจกรรมมวลชนสัมพันธ์ต่างๆ กับชุมชน
- เผยแพร่ข้อมูลข่าวสารและประชาสัมพันธ์รายละเอียดโครงการและผลการดำเนินการตามประมวลผลสำเร็จแก่ผู้ปฏิบัติ ให้กับชุมชนในพื้นที่และคณะกรรมการตรวจสอบผลกระทบสิ่งแวดล้อมรับทราบ
- จัดตั้งคณะกรรมการร่วมกับชุมชนภายใต้ชื่อ “คณะกรรมการตรวจสอบผลกระทบสิ่งแวดล้อม”



## การประเมินผลกระทบสิ่งแวดล้อม (ระยะดำเนินการ)

### 10. เศรษฐกิจ-สังคม :



## การประเมินผลกระทบสิ่งแวดล้อม (ระยะดำเนินการ)

### 9. อาชีวอนามัยและความปลอดภัย:

#### มาตรการป้องกัน

- ดำเนินการตามแผนงานที่กำหนดและแก้ไขความเสียหายในแต่ละพื้นที่
- ดำเนินการตามกฎหมาย ซึ่งกำหนดด้านอาชีวอนามัยและความปลอดภัยหรือกฎหมายแรงงานอื่นๆ ที่เกี่ยวข้อง และเป็นปัจจุบัน
- จัดให้มีการอบรมเกี่ยวกับทางด้านอาชีวอนามัยและความปลอดภัย
- ตรวจสอบการทำงานจากระยะไกลให้มีความปลอดภัย
- เป็นประจำทุกปี
- ฝึกซ้อมแผนปฏิบัติการกรณีเกิดเหตุฉุกเฉินภายในพื้นที่โครงการ
- ตรวจสอบสภาพการใช้อุปกรณ์เครื่องจักร และระบบไฟฟ้าต่างๆ สม่ำเสมอ
- การใช้งานระบบไฟฟ้าในโรงงาน ต้องดำเนินการให้เป็นไปตามหลักวิชาการหรือมาตรฐานที่ยอมรับ
- ตรวจสอบระบบไฟฟ้าในโรงงานและรับรองความปลอดภัยของระบบไฟฟ้า

#### ผลกระทบที่เกิดขึ้นจะอยู่ในระดับต่ำ

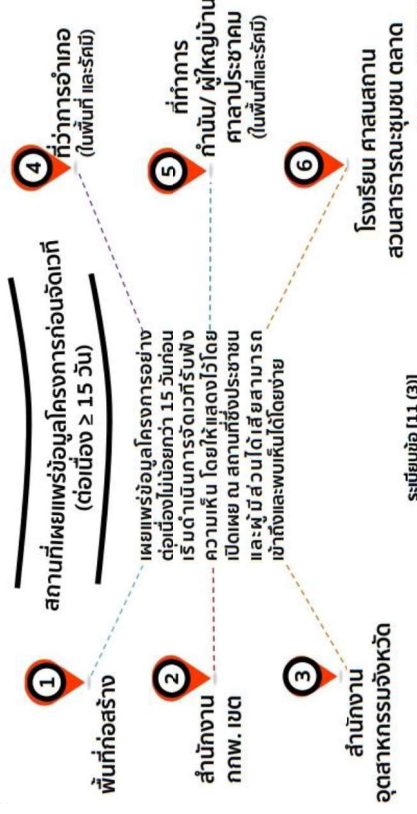
#### มาตรการติดตาม

- บันทึกสถิติการเกิดอุบัติเหตุ
- แสดงผลการตรวจสอบระบบไฟฟ้าในโรงงานและรับรองความปลอดภัยเป็นประจำทุกปี
- แสดงผลการซ้อมดับเพลิงและเหตุฉุกเฉิน อย่างน้อยปีละ 1 ครั้ง หรือตามที่กฎหมายกำหนด
- แสดงผลการตรวจสอบการทำงานจากระยะไกลและระบบอัตโนมัติต่างๆ เป็นประจำทุกปี



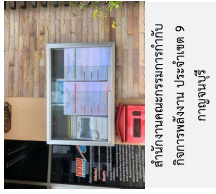
## การดำเนินการด้านการมีส่วนร่วมของประชาชน

### สถานที่ติดประกาศ (33 แห่ง)

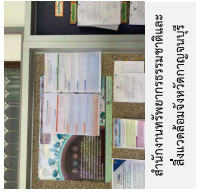




### การดำเนินการด้านการมีส่วนร่วมของประชาชน



สำนักงานคณะกรรมการกำกับ  
กิจการพลังงาน ประจำปีเขต 9  
กาญจนบุรี



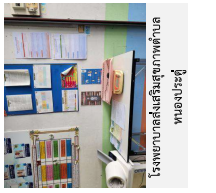
สำนักงานทรัพยากรธรรมชาติและ  
สิ่งแวดล้อมจังหวัดกาญจนบุรี



สำนักงานพลังงานจังหวัด  
กาญจนบุรี



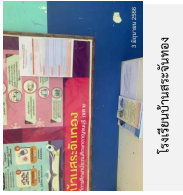
สำนักงานเทศบาลนครสรรพยา  
หนองปรือ



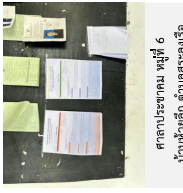
โรงพยาบาลส่งเสริมสุขภาพตำบล  
หนองปรือ



วัดสระจันทอง



โรงเรียนบ้านสระจันทอง



ศาลาประชาคม หมู่ที่ 6  
บ้านห้วยลึก ตำบลสรรพยา  
อำเภอห้วยกระเจา



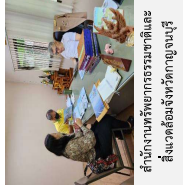
ที่ทำการผู้ใหญ่บ้านตำบลประชาคม  
หมู่ที่ 16 บ้านหนองเข็ง  
ตำบลสรรพยา อำเภอห้วยกระเจา



พื้นที่โครงการ



### การดำเนินการด้านการมีส่วนร่วมของประชาชน



สำนักงานทรัพยากรธรรมชาติและ  
สิ่งแวดล้อมจังหวัดกาญจนบุรี



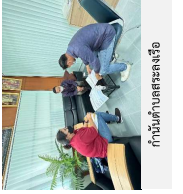
หลังคาตั้งหัดกาญจนบุรี



นายกเทศมนตรีตำบลสรรพยา



กัมกับหนองปรือ



กัมกับตำบลสรรพยา

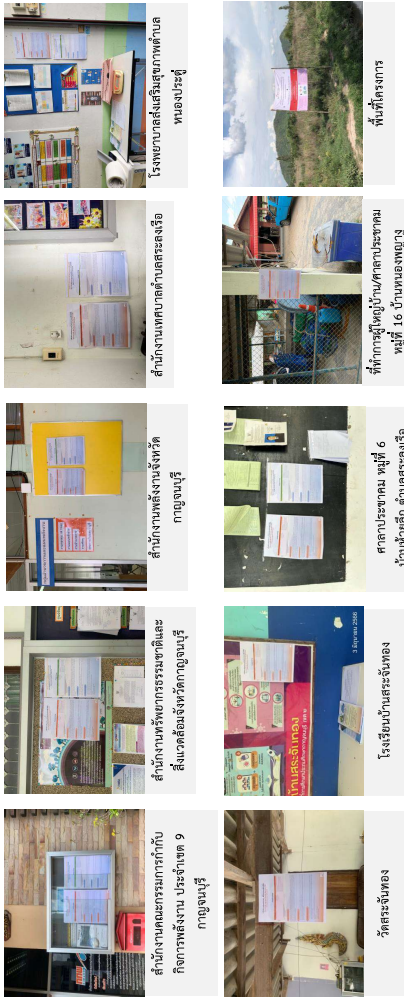


ผู้ใหญ่บ้านหมู่ที่ 4  
บ้านไร่ใหม่ ตำบลหนองปรือ  
อำเภอตาคลี



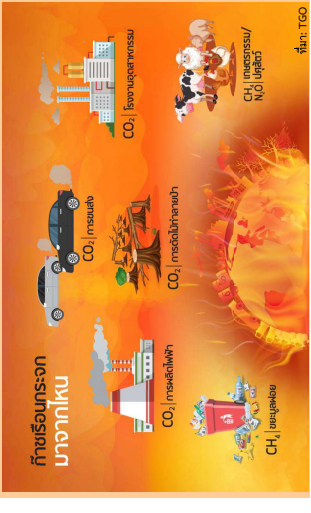
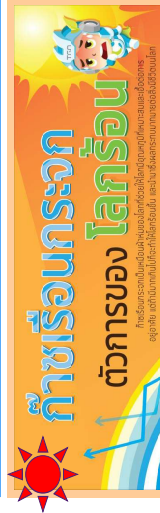
ผู้ใหญ่บ้านหมู่ที่ 12  
บ้านรอบคอก ตำบลสรรพยา  
อำเภอห้วยกระเจา

### ตัวอย่างการติดประกาศเผยแพร่รายละเอียดโครงการ



### ข้อวิตกกังวลที่ได้จากการเข้าพบ

1. โครงการจะทำให้โลกร้อนขึ้น หรือไม่ หรือทำให้เกิดปัญหาฝนไม่ตกตามฤดูกาล หรือไม่



### ข้อวิตกกังวลที่ได้จากการเข้าพบ

1. โครงการจะทำให้อุณหภูมิในพื้นที่เพิ่มสูงขึ้น หรือทำให้พื้นที่ที่มีความร้อนเพิ่มมากขึ้น หรือไม่

อยู่ระหว่างหารือ กับฝ่ายวิศวกรรม



### 3. โครงการจะก่อให้เกิดปัญหาด้านแสงสะท้อนในพื้นที่หรือไม่?

- ✓ โครงการออกแบบและติดตั้งอุปกรณ์ เครื่องจักร โดยคำนึงถึงระยะห่างจากชุมชน และพื้นที่อ่อนไหวให้มากที่สุด
- ✓ ออกแบบการวางแผงเซลล์แสงอาทิตย์ทำมุม 11 องศาจากแนวราบ และเลือกใช้วัสดุเซลล์แสงอาทิตย์ชนิดโมโนคริสตัลไลน์ จึงไม่เกิดแสงสะท้อน

ปัจจัย	แผงซิลิคอนชนิด โมโนคริสตัลไลน์	แผงซิลิคอนชนิด โพลีคริสตัลไลน์	แผงชนิด อะมอร์ฟัส
การผลิตไฟฟ้า	ผลิตได้ดีที่สุด	ผลิตน้อยกว่าโมโนคริสตัลไลน์	
การใช้พื้นที่	ใช้ย่อย	ใช้มาก	ใช้มากที่สุด
อายุงาน	>25 ปี	>25 ปี	เสื่อมสภาพเร็ว/ประกันสั้น
ผลกระทบของเงาต่อการผลิตไฟฟ้า	เงินมีผลกระทบต่อการผลิต	เงินมีผลกระทบต่อการผลิต	เงินมีผลกระทบต่อการผลิตน้อย

- ✓ ไม่ส่งผลกระทบต่อมุมมองเห็นของประชาชนที่อยู่ใกล้เคียงโครงการ
- ✓ ไม่ส่งผลกระทบต่อทัศนวิสัยการบินของอากาศยาน

ช่องทางการติดต่อและสอบถามข้อมูลเพิ่มเติม

[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]

[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]

# **Appendix 6D**

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**Letter for submitting  
the summary of public meeting**

**[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]**

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**[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]**

# **Appendix 6E**

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## **Stakeholder Engagement for Transmission Line**

ตารางสรุปการลงพื้นที่ปฏิบัติงานด้านชุมชนสัมพันธ์  
บริษัท สกาย เพาเวอร์ จำกัด/บริษัท พัฒนา โซลาร์ จำกัด

วันที่เวลาที่เข้าพบ	บุคคล/หน่วยงานที่เข้าพบ	ประเด็นสอบถาม / ข้อเสนอแนะ	ข้อมูลที่ตัวแทนโครงการชี้แจง	หมายเหตุ
20/11/2023	[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]	ในระหว่างการก่อสร้างสายส่ง หากมีสิ่งกีดขวางทางสัญจร ชาวบ้านจะสามารถติดต่อประสานงานกับหน่วยงานไหนเพื่อแก้ปัญหา	เจ้าหน้าที่ชุมชนสัมพันธ์ได้แจ้งเบอร์โทรศัพท์ของฝ่ายชุมชนสัมพันธ์เพื่อเป็นตัวกลางในการประสานงานแก้ปัญหาในกรณีที่บ้านได้รับผลกระทบระหว่างการก่อสร้าง และจะลงพื้นที่อย่างต่อเนื่องเพื่อรับทราบข้อมูล เพื่อนำไปสู่การแก้ไขปัญหาได้อย่างรวดเร็วและมีประสิทธิภาพ	
20/11/2023	[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]	การก่อสร้างสายส่งจะมีผลกระทบต่อชาวบ้านอย่างไรบ้าง และจะมีการแก้ปัญหาอย่างไร	การติดตั้งสายส่งแรงสูงจะอยู่ในแนวสายส่งเดิม ซึ่งจะไม่มีการรุกล้ำพื้นที่ชาวบ้าน  ในระหว่างการก่อสร้างผู้ปฏิบัติงานมีมาตรการด้านความปลอดภัยที่ต้องปฏิบัติตามอย่างเคร่งครัดเพื่อป้องกันอุบัติเหตุ และไม่ก่อให้เกิดผลกระทบต่อชาวบ้านและชุมชนในแนวสายส่ง	
22/11/2023	[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]	เมื่อถึงเวลาติดตั้งสายส่ง ผู้ติดตั้งจะมีการตัดไฟ หรือสร้างความไม่สะดวกแก่ชุมชนหรือไม่	หากมีเหตุจำเป็นจะต้องตัดไฟ จะมีการประชาสัมพันธ์แจ้งข้อมูลให้ชุมชนได้รับทราบ เพื่อเตรียมความพร้อม ซึ่งจะไม่ก่อให้เกิดความเสียหายกับการประกอบอาชีพ ฟาร์มเลี้ยงสัตว์ที่จำเป็นต้องใช้ไฟฟ้ายอย่างต่อเนื่อง และหากมีความจำเป็นต้องตัดไฟในระหว่างการก่อสร้างบางเวลา ผู้รับผิดชอบจะวางแผนในการจัดหาไฟสำรอง เช่น เครื่องปั่นไฟ เพื่อช่วยเหลือไม่ให้เกิดผลกระทบ	

22/11/2023	[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]	การติดตั้งจะส่งผลกระทบต่อการเดินทางสัญจรของชาวบ้านในพื้นที่หรือไม่	ในระหว่างการก่อสร้าง ผู้รับเหมาจะมีมาตรการด้านความปลอดภัย และการอำนวยความสะดวกด้านการจราจร เพื่อลดความเสี่ยงที่จะก่อให้เกิดผลกระทบต่อสัญจร	
22/11/2023	[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]	การติดตั้งสายส่งมีความเสี่ยงหรืออันตรายที่จะส่งผลกระทบต่อชาวบ้านหรือไม่	การไฟฟ้าส่วนภูมิภาคจะเป็นผู้รับผิดชอบในการดำเนินการ ซึ่งเป็นหน่วยงานที่มีความรู้และประสบการณ์ โดยยึดถือมาตรฐานความปลอดภัยอย่างเข้มงวด โดยก่อนและระหว่างดำเนินการจะมีการแจ้งประชาสัมพันธ์ข้อมูลต่างๆ ให้ผู้นำชุมชน และชาวบ้านรับทราบอย่างต่อเนื่อง	
22/11/2023	[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]	หากชาวบ้านได้รับผลกระทบในระหว่างการก่อสร้างสายส่ง จะมีวิธีการปัญหาอย่างไร	ตัวแทนได้ชี้แจงว่า ผู้รับผิดชอบในการดำเนินการก่อสร้างสายส่ง คือ การไฟฟ้าส่วนภูมิภาค แต่หากมีประเด็นปัญหาในระหว่างการดำเนินการ เจ้าของโครงการโดยเฉพาะฝ่ายชุมชนสัมพันธ์ที่ทำงานด้านสังคมและชุมชน จะเข้าไปรับรู้ปัญหา สร้างความเข้าใจ และเป็นผู้ประสานงานป้องกัน และแก้ไข ไม่ให้เกิดผลกระทบต่อชุมชน หรือลดผลกระทบในระหว่างการก่อสร้างให้น้อยที่สุด	

22/11/2023	[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]	การติดตั้งสายส่งจะมีการรื้อถอนเข้ามาในพื้นที่ของชาวบ้านหรือไม่	แนวทางการก่อสร้างสายส่งจะอยู่ในแนวเสาไฟฟ้าที่มีอยู่ หรืออยู่ในเขตทางสาธารณะที่มีการขออนุญาตดำเนินการตามกฎหมายอย่างถูกต้อง ซึ่งจะไม่รื้อถอนพื้นที่ของชาวบ้าน จึงไม่ส่งผลกระทบต่อที่ดินของเอกชนใดๆ	
22/11/2023	[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]	การติดตั้งสายส่งจะส่งผลกระทบต่อกิจการหรือชาวบ้านในพื้นที่ที่จำเป็นต้องใช้ในการใช้ไฟฟ้าในการก่อสร้างหรือไม่	<p>ในระหว่างการก่อสร้างถ้ามีความจำเป็นต้องตัดไฟฟ้าเพื่อความปลอดภัย จะมีการวางแผนลดผลกระทบต่อให้น้อยที่สุด โดยการแจ้งข้อมูลให้ชุมชนรับทราบผ่านช่องทางต่างๆ เช่น แจ้งผู้นำชุมชน เพื่อประชาสัมพันธ์ให้ชาวบ้านทราบล่วงหน้า</p> <p>ในกรณีที่เกิดความเสี่ยงต่อการได้รับผลกระทบ เช่น ฟาร์มเลี้ยงสัตว์ ผู้รับผิดชอบอาจอำนวยความสะดวกด้วยการจัดหาแหล่งไฟฟ้าสำรอง เช่น เครื่องปั่นไฟเพื่อช่วยเหลือไม่ได้รับผลกระทบ ซึ่งสิ่งเหล่านี้ผู้ดำเนินการตระหนัก เข้าใจและรับทราบก่อนดำเนินการ จึงมีการวางแผนงานต่างๆ ที่เหมาะสมที่สุด</p>	
22/11/2023	[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]	บางพื้นที่แม้เป็นที่ดินในเขตทางหลวง แต่ชาวบ้านมีการปลูกพืช ถ้ามีการก่อสร้างและทำให้เกิดความเสียหาย จะมีแนวทางจัดการหรือแก้ปัญหาอย่างไรบ้าง	การไฟฟ้าส่วนภูมิภาคซึ่งเป็นผู้รับผิดชอบดำเนินการ จะมีการประสานงานเพื่อหรือแนวทางการดำเนินการก่อสร้างที่เหมาะสม เช่น ให้ชาวบ้านเก็บเกี่ยวผลผลิตให้เรียบร้อย หรือในกรณีสุดท้าย จะมุ่งเน้นการเจรจาสร้างความเข้าใจ ให้ข้อมูลความเป็นในการก่อสร้าง หรือหาแนวทางเพื่อช่วยเหลือเยียวยาตามความเหมาะสม ตามหลักมนุษยธรรม	

ลงชื่อ ..... ผู้บันทึกรายการ  
ลงชื่อ ..... ผู้รับรองรายการ



# **Appendix 6F**

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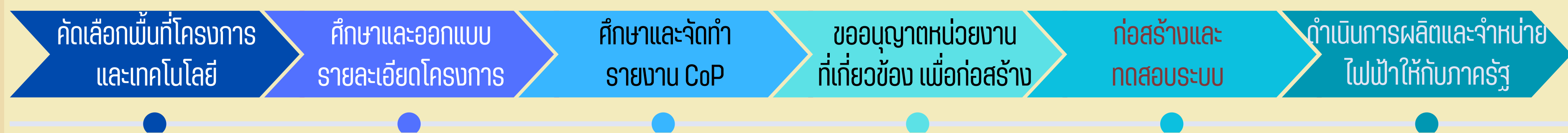
**Brochure for disseminate Transmission Line**



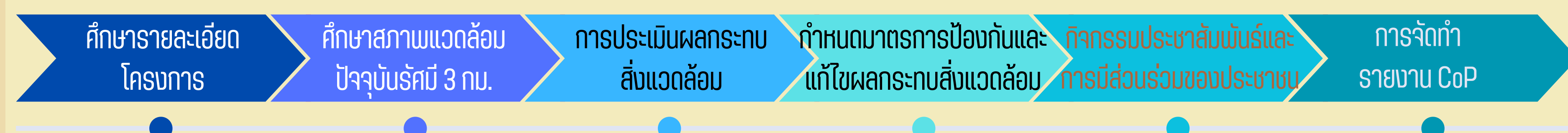
## 10 ระยะเวลาการก่อสร้าง

ระยะเวลาการก่อสร้าง : ตั้งแต่ดำเนินการก่อสร้าง จนถึงจ่ายไฟฟ้าเข้าระบบใช้ระยะเวลา 12 เดือน (1 มกราคม - 31 ธันวาคม 2567)

## 11 วิธีการดำเนินงานของโครงการ



## 12 ขอบเขตการศึกษาและจัดทำรายงาน



## 13 การดำเนินกิจกรรมด้านการประชาสัมพันธ์ และการมีส่วนร่วมของประชาชน

### กลุ่มผู้มีส่วนได้เสียของโครงการ

กลุ่มที่ 1 : ผู้ได้รับผลกระทบหรือผู้มีส่วนได้เสีย

- ประชาชนในพื้นที่ศึกษา
- ผู้นำชุมชนในพื้นที่ศึกษา
- กลุ่มเปราะบาง เช่น กลุ่มสตรี เด็ก คนพิการ เป็นต้น
- กลุ่มชาติพันธุ์ (ถ้ามี)

กลุ่มที่ 2 : หน่วยงานราชการในระดับต่างๆ ที่เกี่ยวข้อง

กลุ่มที่ 3 : ประชาชน และผู้สนใจทั่วไป

### การเผยแพร่และประชาสัมพันธ์โครงการ

โครงการได้ดำเนินการเผยแพร่ข้อมูลโครงการ ตามสถานที่ดังต่อไปนี้

- ๑ บริเวณพื้นที่ที่จะดำเนินการก่อสร้างโครงการ
- ๑ สำนักงานคณะกรรมการกำกับกิจการพลังงานประจำเขต 9 กาญจนบุรี
- ๑ สำนักงานอุตสาหกรรมจังหวัดกาญจนบุรี
- ๑ สำนักงานพลังงานจังหวัดกาญจนบุรี
- ๑ สำนักงานทรัพยากรธรรมชาติและสิ่งแวดล้อมจังหวัดกาญจนบุรี
- ๑ ที่ว่าการอำเภอในพื้นที่ศึกษา
- ๑ องค์กรปกครองส่วนท้องถิ่นในพื้นที่ศึกษา
- ๑ ที่ทำการกำนัน / ผู้ใหญ่บ้านในพื้นที่ศึกษา
- ๑ สถานพยาบาล / โรงเรียน / ศาสนสถาน ในพื้นที่ศึกษา



### ช่องทางติดต่อสื่อสาร



### เจ้าของโครงการ

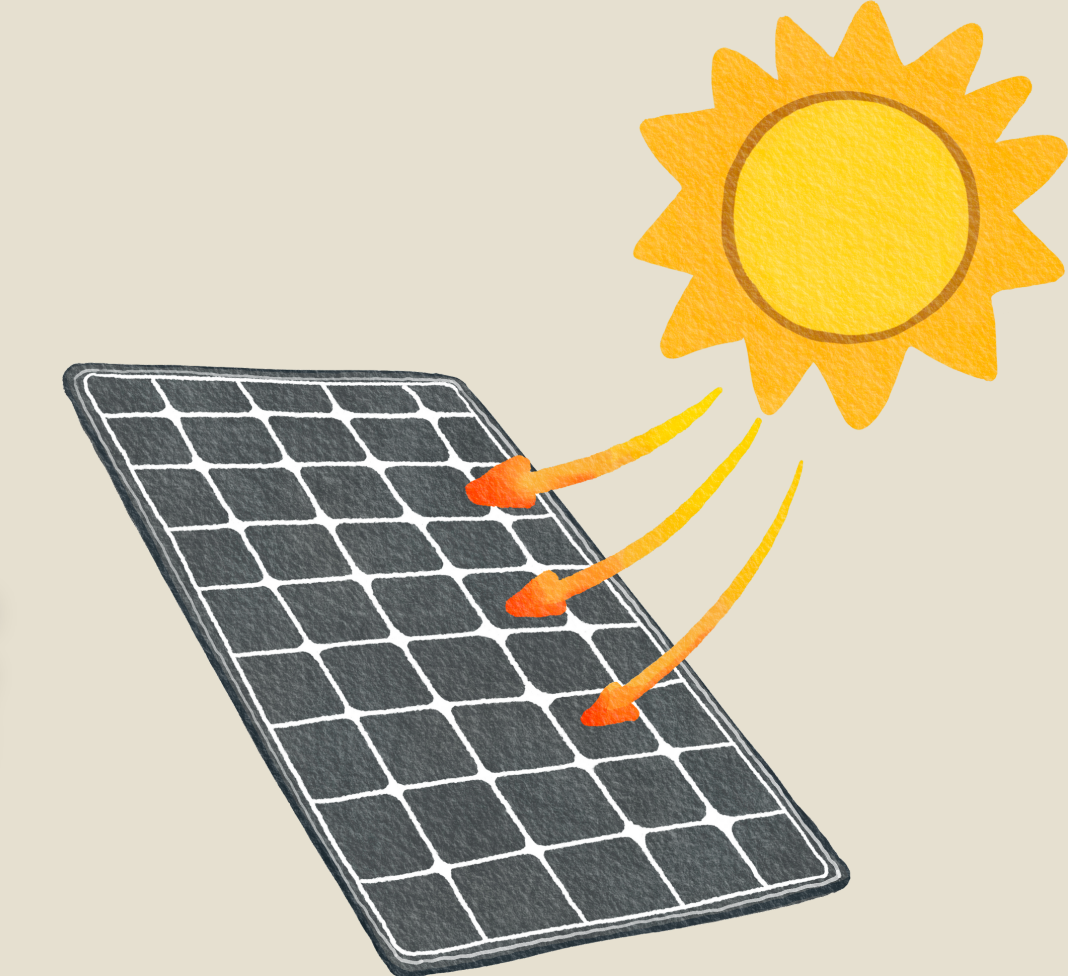
[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]

### บริษัทที่ปรึกษาด้านสิ่งแวดล้อม

[This information has been removed as it falls within the exceptions to disclose specified in paragraph 17(2) of ADB's Access to Information Policy.]



# โครงการโรงไฟฟ้า พัฒนาโซลาร์ ของบริษัท พัฒนาโซลาร์ จำกัด ตำบลสระสูงเรือ อำเภอห้วยกระเจา จังหวัดกาญจนบุรี



## 1 เหตุผล ความจำเป็นโครงการ

บริษัท พัฒนาโซลาร์ จำกัด มีแนวคิดที่จะพัฒนาโครงการโรงไฟฟ้า พัฒนาโซลาร์ ซึ่งเป็นโครงการผลิตไฟฟ้าจากพลังงานแสงอาทิตย์ ด้วยเทคโนโลยีแผงโพลีโวลเทอิกหรือโซลาร์เซลล์ แบบติดตั้งบนพื้นดินร่วมกับระบบกักเก็บพลังงาน เพื่อจำหน่ายไฟฟ้าให้แก่ภาครัฐ ตามนโยบายให้การสนับสนุนการผลิตไฟฟ้าจากพลังงานทดแทนหรือพลังงานสะอาด โดยพลังงานแสงอาทิตย์เป็นหนึ่งในพลังงานสะอาดที่สามารถนำมาใช้งานได้โดยไม่จำกัด ไม่ก่อให้เกิดมลภาวะทางสิ่งแวดล้อม และช่วยเสริมสร้างความมั่นคงด้านพลังงานในระยะยาว ทั้งนี้ การพัฒนาดังกล่าวเข้าข่ายต้องจัดทำรายงานประเมินผลกระทบการปฏิบัติ (CoP) สำหรับโรงไฟฟ้าประเภทไม่เผาไหม้เชื้อเพลิง

## 2 วัตถุประสงค์ของโครงการ

- ๑ เพื่อส่งเสริมการผลิตไฟฟ้าจากพลังงานหมุนเวียน ตามแผนการเพิ่มการผลิตไฟฟ้าจากพลังงานสะอาดภายใต้แผนพัฒนากำลังผลิตไฟฟ้าของประเทศไทย พ.ศ. 2561-2580 ฉบับปรับปรุงครั้งที่ 1 (PDP2018 Rev.1) ในช่วงปี พ.ศ. 2564-2573
- ๑ เพื่อสนับสนุนให้ประเทศไทยสามารถมุ่งสู่พลังงานสะอาดและลดการปล่อยคาร์บอนไดออกไซด์สุทธิเป็นศูนย์ภายในปี พ.ศ. 2608 โดยการเพิ่มสัดส่วนการผลิตไฟฟ้าจากพลังงานทดแทน

## 3 ประโยชน์ที่ชุมชนหรือประชาชนจะได้รับ

- 1 การพัฒนาโครงการพลังงานแสงอาทิตย์เป็นการใช้ทรัพยากรธรรมชาติที่มีอยู่เป็นวัตถุดิบพลังงาน จึงส่งผลกระทบต่อชุมชนรอบพื้นที่โครงการค่อนข้างต่ำ
- 2 เจ็บกองทุนพัฒนาไฟฟ้า ตามระเบียบสำนักงานคณะกรรมการกำกับกิจการพลังงาน
- 3 การสนับสนุนงบประมาณในการพัฒนาชุมชน
- 4 เพิ่มสัดส่วนกำลังผลิตไฟฟ้าจากพลังงานหมุนเวียนภายในประเทศ และช่วยลดการผลิตไฟฟ้าจากเชื้อเพลิงฟอสซิลที่เป็นต้นเหตุของการปล่อยก๊าซเรือนกระจก ตามนโยบายภาครัฐ
- 5 การจ้างแรงงาน
- 6 ภาษีโรงเรือนและที่ดิน และภาษีป้าย





## 4 รายละเอียดโครงการ

**เจ้าของโครงการ :** บริษัท พัฒนาโซลาร์ จำกัด

**พื้นที่ตั้งโครงการ :** ต.สระลงเรือ อ.ห้วยกระเจา จ.กาญจนบุรี

(อ้างอิงตามเอกสารสิทธิ์ของโครงการ)

**ขนาดพื้นที่โครงการ :** 813 ไร่ 2 งาน 3.5 ตารางวา

**ประเภทโครงการ :** ผลิตไฟฟ้าจากพลังงานแสงอาทิตย์แบบติดตั้งบนพื้นดิน

ร่วมกับระบบกักเก็บพลังงาน (โรงไฟฟ้าประเภทไม่เผาไหม้เชื้อเพลิง)

**กำลังการผลิตติดตั้ง :** 115.800 MWac (162.129 MWp)

**พลังงานไฟฟ้าที่ผลิตได้ต่อปี :** 264.377 จิกะวัตต์-ชั่วโมงต่อปี

**เครื่องจักรหลักที่มีการติดตั้ง :**

- **แผงเซลล์แสงอาทิตย์ :** ขนาด 605 วัตต์ต่อแผง หรือเทียบเท่า ประมาณ 267,982 แผง
- **เครื่องแปลงกระแสไฟฟ้า :** ขนาด 300 กิโลวัตต์ต่อตัว จำนวน 386 ตัว หรือเทียบเท่า

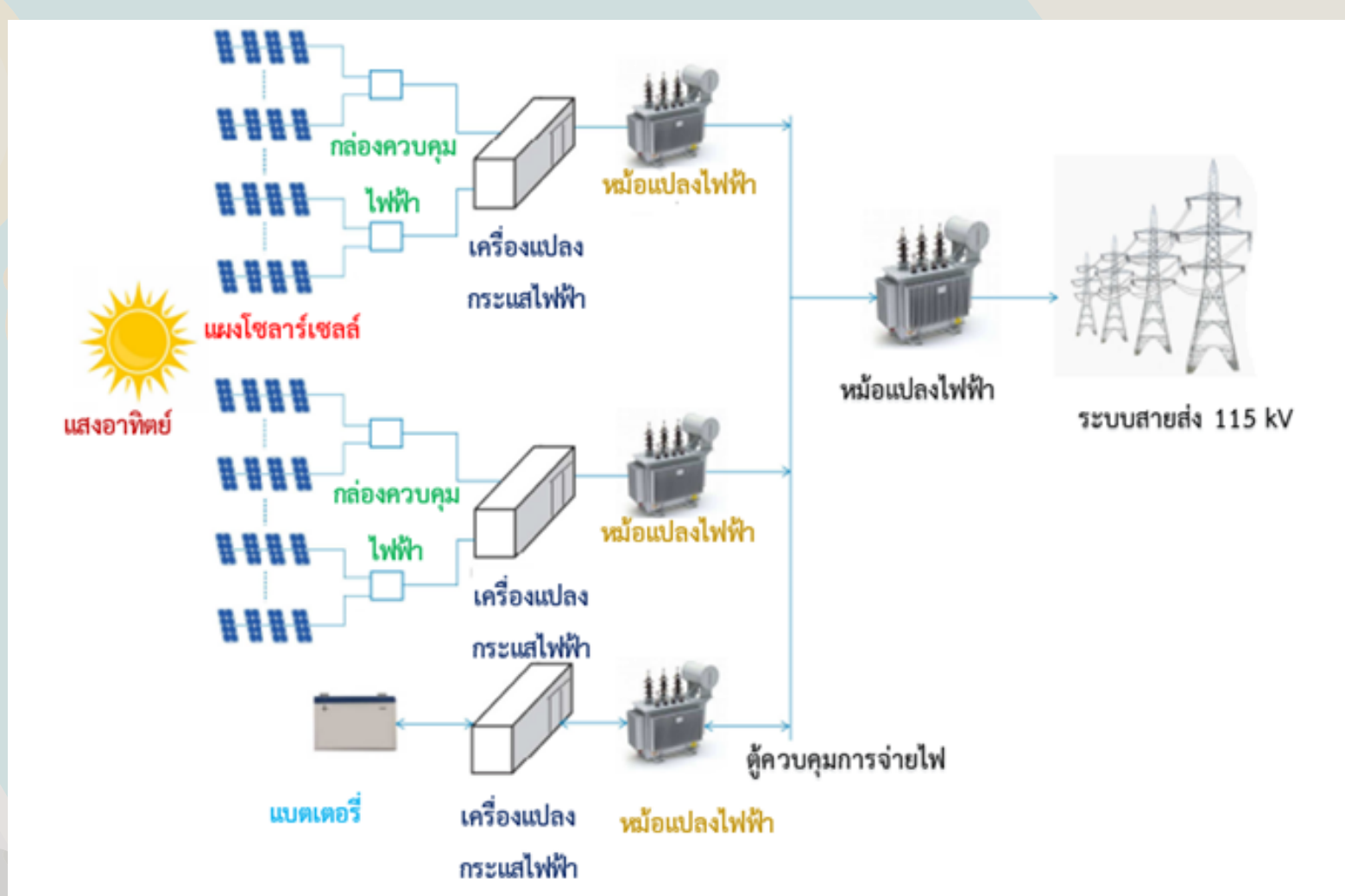
- **หม้อแปลงไฟฟ้า :** ขนาด 70 เมกะโวลต์แอมแปร์ จำนวน 1 ตัว
- **ระบบกักเก็บพลังงาน :** ขนาด 2,752 กิโลวัตต์ชั่วโมง จำนวน 34 ตัว



## 5 กระบวนการผลิตกระแสไฟฟ้า :

เริ่มจากแสงอาทิตย์ซึ่งเป็นคลื่นแม่เหล็กไฟฟ้ามากระทบที่แผงเซลล์แสงอาทิตย์ที่มีสารกึ่งตัวนำ จะเกิดอนุภาคที่มีประจุไฟฟ้าบวกและลบ เคลื่อนที่ไปในทิศทางที่ตรงข้ามกัน ทำให้เกิดไฟฟ้ากระแสตรงขึ้นและส่งเข้าสู่อุปกรณ์ที่เรียกว่า “เครื่องแปลงกระแสไฟฟ้า (Inverter)” เพื่อแปลงไฟฟ้ากระแสตรงให้เป็นไฟฟ้ากระแสสลับ แล้วส่งเข้าสู่หม้อแปลงไฟฟ้าเพื่อแปลงเป็นไฟฟ้าแรงดันสูง โดยไฟฟ้าส่วนหนึ่งจะส่งเข้าสู่ระบบสายส่งเพื่อจำหน่ายไฟฟ้าให้แก่ กฟผ. ส่วนไฟฟ้าส่วนเกินที่ผลิตได้จะถูกจัดเก็บในระบบกักเก็บพลังงาน (BESS) เพื่อนำมาจ่ายให้กับ กฟผ. ในช่วงเวลาที่ผลิตไฟฟ้าจากแสงอาทิตย์ไม่ได้ เช่น ในตอนกลางคืนหรือช่วงไฟฟ้าดับ เป็นต้น

ทั้งนี้ โครงการจะจ่ายไฟฟ้าให้การไฟฟ้าส่วนภูมิภาค (กฟภ.) ผ่านสายส่งจากสถานีไฟฟ้าย่อย (Sub-station) ของโรงไฟฟ้าพัฒนาโซลาร์ ไปทำการเชื่อมต่อสายส่งระหว่างสถานีไฟฟ้าย่อยและสถานีไฟฟ้าอุโมงค์ของ กฟภ. ซึ่ง กฟภ. มีแผนดำเนินการก่อสร้างวางแนวสายส่ง ระหว่างวันที่ 1 มกราคม -31 ตุลาคม 2567 โดยจะอ้างอิงตามแนวสายส่งปัจจุบัน และอยู่ในเขตทางเดิม (Right-of-Way)



**6 พื้นที่ศึกษา :** รัศมี 3 กิโลเมตร จากขอบเขตพื้นที่โครงการครอบคลุมพื้นที่บางส่วนของ ต.หนองปรือ อ.เลาขวัญ และ ต.สระลงเรือ อ.ห้วยกระเจา จ.กาญจนบุรี

อำเภอ	ตำบล	หมู่บ้าน
เลาขวัญ	หนองปรือ	หมู่ที่ 3, 4, 5, 7 และ 9
ห้วยกระเจา	สระลงเรือ	หมู่ที่ 4, 5, 6, 9, 12 และ 16

## 7 การคัดเลือกพื้นที่ และเทคโนโลยี (ต่อ)

**พื้นที่ :** กำหนดให้พื้นที่โครงการต้องไม่ขัดต่อกฎหมายใดๆ เกี่ยวกับเรื่องทำเลที่ตั้งที่มีผลบังคับใช้ในปัจจุบัน

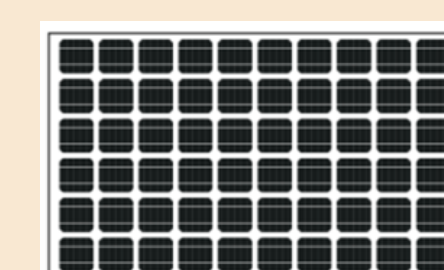
- ไม่ขัดกฎหมายผังเมือง
- ไม่ขัดกฎหมายส่งเสริมและรักษาคุณภาพสิ่งแวดล้อมแห่งชาติ
- ไม่ขัดกฎหมายโบราณสถานและโบราณวัตถุ
- ไม่ขัดต่อมติคณะรัฐมนตรี

**โครงการตั้งอยู่ที่ ต.สระลงเรือ อ.ห้วยกระเจา จ.กาญจนบุรี ไม่ขัดต่อกฎหมายใดๆ ที่มีผลบังคับใช้ในปัจจุบัน**

## 7 การคัดเลือกพื้นที่ และเทคโนโลยี (ต่อ)

**เทคโนโลยี :** เลือกใช้แผงซิลิคอน ชนิดโมโนคริสตัลไลน์ เนื่องจากเป็นเทคโนโลยีที่มีประสิทธิภาพการผลิตไฟฟ้าที่ดีที่สุด

**แผงซิลิคอนชนิดโมโนคริสตัลไลน์**



- ผลิตไฟฟ้าได้ดีที่สุด
- ใช้พื้นที่น้อย
- ใช้งาน >25 ปี
- ผลิตไฟฟ้าในอากาศร้อนดีกว่าเมื่อเทียบกับเทคโนโลยีอื่น

**แผงซิลิคอนชนิดโพลีคริสตัลไลน์**



- ผลิตไฟฟ้าน้อยกว่าโพลีคริสตัลไลน์
- ราคาถูกกว่าโพลีคริสตัลไลน์
- ใช้งาน >25 ปี

**แผงชนิดอะมอฟิส**

- อลูมิเนียมและเบา
- มีผลต่อการผลิตไฟฟ้าน้อย

## 8 ผลกระทบด้านสิ่งแวดล้อมและการจัดการ

	ปัจจัย	กิจกรรมที่ก่อให้เกิดผลกระทบ	การจัดการ
ระยะก่อสร้าง	<b>คุณภาพอากาศ</b>	การปรับพื้นที่	ฉีดพรมน้ำในบริเวณพื้นที่ที่มีการเปิดหน้าดิน
	<b>เสียง</b>	การปรับพื้นที่ การก่อสร้างโครงสร้างหรืออาคาร	ดำเนินการเฉพาะในช่วงเวลากลางวัน ยกเว้นกิจกรรมที่ต้องดำเนินการต่อเนื่อง ต้องแจ้งให้ผู้นำชุมชนก่อนดำเนินการอย่างน้อย 7 วัน
	<b>การใช้น้ำ/น้ำทิ้ง</b>	การก่อสร้าง การอุปโภคและบริโภคของคนงาน	ติดตั้งระบบบำบัดน้ำเสียสำเร็จรูปจากห้องน้ำห้องส้วม จัดทำรางระบายน้ำชั่วคราวและบ่อตกตะกอน และตรวจสอบประสิทธิภาพรางระบายน้ำชั่วคราวเป็นประจำ
	<b>คมนาคมขนส่ง</b>	การขนส่งอุปกรณ์ก่อสร้างเครื่องจักร / อุปกรณ์ การรับส่งคนงาน	จัดให้มีป้ายหรือสัญญาณเตือนที่เห็นได้ชัดเจนตลอดเวลากลางวัน และกลางคืนจนถึงพื้นที่ก่อสร้างอย่างน้อย 100 เมตร
	<b>มูลฝอยและกากของเสีย</b>	การก่อสร้าง การอุปโภคและบริโภคของคนงาน	จัดเตรียมวัสดุอุปกรณ์รองรับขยะไว้ตามบริเวณพื้นที่ปฏิบัติงานให้พอเพียงและประสานกับหน่วยงานท้องถิ่นเพื่อดำเนินการกำจัดขยะ
ระยะดำเนินการ	<b>การใช้น้ำ/น้ำทิ้ง</b>	การอุปโภคและบริโภคของคนงาน การสร้างแผงเซลล์แสงอาทิตย์	บำรุงรักษาระบบบำบัดน้ำเสียให้มีประสิทธิภาพในการบำบัด ให้เป็นไปตามเกณฑ์มาตรฐานก่อนระบายออกนอกพื้นที่โครงการหรือนำมาใช้ประโยชน์ภายในพื้นที่โครงการ
	<b>มูลฝอยและกากของเสีย</b>	การอุปโภคและบริโภคของคนงาน อุปกรณ์ในการผลิตไฟฟ้า แผงเซลล์แสงอาทิตย์ที่ชำรุด	จัดเตรียมวัสดุอุปกรณ์รองรับขยะไว้ตามบริเวณพื้นที่ปฏิบัติงานให้พอเพียงและประสานกับหน่วยงานท้องถิ่นเพื่อดำเนินการกำจัดขยะ

## 9 การศึกษาสภาพแวดล้อมปัจจุบัน

ศึกษารัศมี 3 กม. จากขอบเขตพื้นที่โครงการ โดยดำเนินการตรวจวัดภาคสนาม ดังนี้

**คุณภาพอากาศ** ตรวจวัด 5 วันต่อเนื่อง จำนวน 2 สถานี ได้แก่ (A1) วัดใหม่ศรีณรงค์ (วัดเขาพ่อปู้) และ (A2) วัดห้วยลึกสามัคคีธรรม

**เสียง 2 สถานี** ตรวจวัด 5 วันต่อเนื่อง จำนวน 2 สถานี ได้แก่ (N1) บ้านด้านทิศตะวันออกของโครงการ และ (N2) บ้านด้านทิศตะวันตกของโครงการ

**คุณภาพน้ำผิวดิน และนิเวศวิทยาทางน้ำ 3 สถานี** ได้แก่ (SW1) คลองปลาสร้อยก่อนไหลเข้าใกล้พื้นที่โครงการ (SW2) คลองปลาสร้อยไหลเข้าใกล้พื้นที่โครงการ และ (SW3) คลองปลาสร้อยหลังไหลเข้าใกล้พื้นที่โครงการ

