Draft Initial Environmental Examination

Project Number: 52287-001
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CAM: Cambodian National Solar Park IPP Project

Prepared by Prime Road Alternative (Cambodia) Co. Ltd.

Social and Environmental Impact Assessment (SEIA)

For 60WM Solar Plant Project

26 November 2020

CURRENCY EQUIVALENTS
(as of 20 October 2020)

Currency unit	–	riel (KHR)
KHR1.00	=	$0.00024
$1.00	=	KHR4,097.87

ABBREVIATIONS

ADB	Asian Development Bank
CEMP	Construction Environmental Management Plan
CCOF	Climate Change Operational Framework, ADB
CRVA	Climate Risk and Vulnerability Analysis
ECU	Egineering and Construction Unit of PRAC
EDC	Electricite du Cambodge
EHS	Environment, Health and Safety
EIA	Environmental Impact Assessment
EMF	Electric and Magnetic Fields
ESMP	Environmental And Social Management Plan
EMOP	Environmental Monitoring Plan
ERP	Emergency Response Plan
GHG	greenhouse gas
GRC	Grievance Redress Committee
GRM	Grievance Redress Mechanism
IBAT	Integrated Biodiversity Assessment Tool
IPP	Independent Power Producer
ICNIRP	International Commission on Non-Ionizing Radiation Protection
IFC	International Finance Corporation
ILO	International Labor Organization
IUCN	International Union for Conservation of Nature
MAFF	Ministry of Agriculture, Forestry and Fisheries
MOE	Ministry of Environment
MOWRAM	Ministry of Water Resources and Meteorology
MRC	Mekong River Commission
PAM	Project Administration Manual
PCR	Physical Cultural Resources
PIC	Project Implementation Consultant
PPA	Power Purchase Agreement
PRAC	Prime Road Alternative Cambodia
PDoE	Provincial Department of Environment
PMO	Project Management Office
PPE	Personnel Protective Equipment
PV	photovoltaic
REA	Rapid Environmental Assessment
ESIA	Environmental and Social Impact Assessment
SECU	Social and Environmental Compliance Unit of PRAC

SCADA	Supervisory Control and Data Acquisition
SPS	Safeguard Policy Statement
STD	Sexually Transmitted Disease
TA	technical assistance
TAS	Transaction Advisory Services
TOR	Terms of Reference
UNFCCC	United Nations Framework Convention on Climate Change
USD	United States Dollar
UXO	Unexploded ordinance
WHO	World Health Organization

WEIGHTS AND MEASURES

dBA	–	A-weighted decibel
km	–	kilometer
km2	–	square kilometer
ha	–	Hectare (10,000 square kilometer or 2.47105 Acre
LAeq	–	Equivalent Continuous Level 'A weighting' - 'A'-weighting = correction by factors that weight sound to correlate with the sensitivity of the human ear to sounds at different frequencies
m	–	Meter
^{o}C	–	Degree Celsius
PM10	–	Particulate Matter 10 micrometers or less
PM2.5	–	Particulate Matter 2.5 micrometers or less
µg/m3	–	Microgram per cubic meter
kV	–	Kilovolt (1,000 volts)
kW	–	Kilowatt (1,000 watt)
MW	–	Megawatt (1000 kilowatt)
GWh	–	Gigawatt-hour
MVA	–	Megavolt Amperes

GLOSSARY

District	–	Sub-divisions of the 24 provinces in Cambodia
Commune	–	Sub-divisions of districts

NOTE

In this report, "$" refers to United States dollars.

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EXECUTIVE SUMMARY

Introduction

1. The National Solar Park Project involves the contruction of two phases totaling 100-megawatt (MW) capacity in Kampong Chhnang province and connect to the Phnom Penh demand center to supply power to the national grid. This impact assessment is for the design, construction and operation of the first phase involving 60 MW power plant "Project" for the National Solar Park (NSP) by a private contractor Prime Road Alternative (Cambodia) Co. Ltd. (later known as PRAC).

2. The project is the first of its kind in Cambodia and builds on lessons learnt from ADB Private Sector Operations Department's financing of a 10 MW solar power plant at Bavet, Svay Rieng Province in 2016. Building on the Bavet project, this project aims to demonstrate the ability of large-scale solar parks to produce solar energy at a competitive price while also providing technical benefits to the national grid[1] and substitute for planned fossil fuel and hydropower generation in the future. This project will build appreciation for the costs, operational requirements and actual performance of solar PV plants.

3. The government's Rectangular Strategy, Phase IV (2018–2023), highlights increased investment in solar energy to reduce electricity costs and ensure long-term energy security.[2] The government has also prioritized the development of renewable energy in its National Strategic Development Plan 2014–2018 in order to meet the growing demand for electricity in Phnom Penh and address the country's electrification target of 100% of villages by 2020.[3] In addition, the government's Industrial Development Policy 2015–2025 [4] identifies the historically high power tariffs in the country as a major impediment to the competitiveness of the country's manufacturing sector, and calls for alternate sources of energy to be developed. Furthermore, Cambodia's Nationally Determined Contribution, enshrined in the 2015 Paris Agreement[5], commits to a 16% reduction in greenhouse gas (GHG) emissions from a business as usual scenario by 2030 from the energy sector.[6] Ideally, alternate, clean sources of energy would complement installed and planned hydropower-based generation, which is often inadequate during the dry season, as well as help provide ancillary benefits to the grid around the key demand centers.

Project Organizational Structure

4. PRAC will be responsible for project implementation and compliance with loan for the 60 MW solar plant. The Project Management Office (PMO) of the PRAC Cambodia will be responsible for the day-to-day coordination specifically for 60MW plant. PRAC's PMO will be

[1] Technical or ancillary benefits include: (i) voltage support during peak loading periods, (ii) reduction of loading levels on transformers, (iii) and reduction of the amount of power that needs to be generated from distant sources (hydro and coal, in particular) and therefore reduction of losses in the transmission system.

[2] Government of Cambodia. 2018. *Rectangular Strategy for Growth, Employment, Equity and Efficiency: Building the Foundation Toward Realizing the Cambodia Vision 2050, Phase IV of the Royal Government of Cambodia of the Sixth Legislature of the National Assembly*. Phnom Penh.

[3] Government of Cambodia, Ministry of Planning. 2014. *National Strategic Development Plan, 2014–2018*. Phnom Penh, Government of Cambodia. 2013. *Rectangular Strategy for Growth, Employment, Equity and Efficiency, Phase III of the Royal Government of Cambodia of the Fifth Legislature of the National Assembly.* Phnom Penh.

[4] Government of Cambodia. 2015. *Cambodia Industrial Development Policy 2015–2025: Market Orientation and Enabling Environment for Industrial Development*. Phnom Penh.

[5] The Paris Agreement entered into force on 4 November 2016.

[6] Government of Cambodia. 2015. *Cambodia's Intended Nationally Determined Contribution*. Phnom Penh.

supported by the Consultant Team to be engaged to handle social and environmental issues under its PMO's Social and Environmental Compliance Unit (SECU). The SECU will be responsible for the overall supervision and coordination during project implementation and ensure consistency of all safeguards documents with government policy, legal and administrative framework.

5. PRAC will own, operate and maintain the 60MW portion of the NSP and all infrastructure installed under the project, as an Independent Power Producer (IPP) with a long-term power purchase agreements (PPAs) with Electricity du Cambodge (EDC). EDC and its PIC will be responsible for the whole NSP's shared infrastructure (access road, sub-stations, transmission line) to ensure compliance with lenders.

Project Location

6. The 60MW solar plant covers an area of 97 ha within the planned 250 ha national solar park and is located in Tuek Phos district of Kampong Chhnang province.

Project Impacts, Outcome and Outputs

7. The project is aligned with the Government's stated impact of lower electricity cost in Cambodia.[7] The project outcome will be increased private sector investments in solar PV in Cambodia.

8. Climate Resilience – A climate risk and vulnerability analysis (CRVA) has been carried out for the project and the project is classified as being at medium risk from future climate change impacts. The study indicates that the key climate change impacts in the region would be extreme rainfall events causing flooding and precipitation induced landslides. While climate change impacts are not anticipated to be significant over the design life of the solar park (+20 years), the preliminary design integrates flood resilience measures such as ensuring solar park are raised above the highest flood level, strengthening existing drainage canals and building a storm water retention pond. Regular maintenance of drainage canals, storm water retention pond and access roads will be carried out to ensure their ongoing effective operation. The key climate vulnerable components will be subject to further analysis during the project detailed engineering design. Flood resilience measures that will permanently become part of the solar park will be included within the main civil work contract costs.

9. Land purchase –the PRAC will lease 97 ha for 60MW PV plant from EDC who purchased land based on negotiation and willing to buy and willing to sell principle.[8]

Lender (ADB and IFC) and Domestic Environmental Requirements

10. The 60MW solar plant requires social and environmetal impact assessment (SEIA) and environmental and social management plan (ESMP). The SEIA and ESMP cover environmental impacts and risks in the project area of influence[9] of project outputs, including the solar PV

[7] Government of Cambodia. 2015. *Cambodia Industrial Development Policy 2015–2025: Market Orientation and Enabling Environment for Industrial Development*. Phnom Penh.

[8] One MW requires 1.5 to 2.5 ha of land; Source: Cambodia Solar Park Feasibility Study, 2018. The land requirements for each phase are not scaled by MW; however, the total requirement for 100 MW will be met with 250 ha.

[9] For the purposes of establishing the environmental baseline and assessing the potential environmental impacts, the area of influence for impacts from the proposed solar plant is taken as 1-3km radius and this area is primarly assessed.

plants[10], as per the definitions in ADB Safeguard Policy Statement (2009) and World Bank Environmentla and Health Safety (EHS), IFC Performance Standards (2012). The SEIA and ESMP have been prepared based on the detail design of the 60MW plant.

11. The project will also comply with the Government Sub-decree No.72 on Environmental Impact Assessment (EIA) issued on 11 August 1999. Full EIAs (FEIAs) are required for the solar plant common infrastructure, substation and transmission interconnection system ("solar park infrastructure") and for each of the solar PV plants.

Project Benefits

12. This project is expected to have significant environmental benefits. A transition to clean energy sources (i.e. solar energy generation) will limit import dependence on coal and other fossil fuels, delay or defer construction of new coal-fired plants and reduce reliance on hydropower generation[11]. This would contribute to national emission reduction targets[12] and reduce pollution impacts.

13. The operation of a 60 MW solar PV plant will avoid approximately 84,000 tons of carbon dioxide-equivalent (tCO2e) annually. For a lifetime, the project will contribute to the reduction of emssions upto 1,760,000 tCO_2e.

Anticipated Adverse Environmental and Social Impacts and Mitigation Measures

14. Environmental impacts were assessed for the project area of influence across all stages of project implementation, i.e. (i) design and pre-construction stage, (ii) construction stage, and (iii) operation stage. Direct impacts will result from acquisition of land for the solar park.

15. Impacts during Design and Pre-Construction. The potential adverse environment impacts associated with the project have been avoided or minimized through careful site and route selection of the solar park. The migitation measures are included in the detailed engineering design. Measures include: (i) ensuring final site and route selection avoids sensitive receptors including protected areas, habitats and species of conservation value, hospitals/clinics/schools and physical cultural resources (PCRs) as well as minimizing impacts on human health, households and crops and trees of economic value, (ii) an efficient project implementation and grievances redress mechanism (GRM) set up, (iii) training and capacity building for the PMO, PRAC and contractors; (iv) timely land acquisition, (v) permits and clearances, (vi) integration of design features for climate risks and effective environmental management, (vii) conducting meaningful consultations, environmental baseline and seasonal surveys, and (viii) unexploded ordinances (UXO) clearance prior to civil works.

16. Impacts during Construction Stage: There will be temporary localized impacts during peak construction such as increased noise and dust levels, vibration, traffic congestion, potential interruption to existing utilities (e.g. power outages), waste generation, disrupted

[10] ADB SPS 2009 requires that assessment encompasses *associated facilities* that are not funded as part of the project (funding may be provided separately by the borrower or by third parties), and whose viability and existence depend exclusively on the project and whose goods or services are essential for successful operation of the project.

[11] Cambodia now has a surplus of power generation in some hours in wet periods and at nighttime. Yet the national grid is unable to meet daytime peak demand in high population areas such as Phnom Penh and experiences shortages during the dry season when storage in hydropower reservoirs is limited.

[12] https://unfccc.int/resource/docs/natc/khmnc2.pdf

access to properties and agricultural land, presence of workers at construction camps and work sites as well as loss of vegetation, trees, plantations, orchards and/or crop damage. A biodiversity assessment was carried out for the project; no habitats of significant conversation value or protected species have been identified within the project area of influence.

17. Impacts during Operation Stage: There will be minor impacts during operation such as due to use of transformer oil at the substation, visual impacts (industrial park in rural setting), risks to occupational and community health and safety (working at height, electrocution), water usage for PV panel cleaning, waste generation and impacts from the site.

18. Mitigation Measures: The identified potential adverse environmental impacts can be managed through effective implementation of the ESMP. However, the main project risks include the low institutional capacity of the PMO and contractors and their failure to implement the ESMP effectively during construction and operation stages. These risks will be mitigated by: (i) project output 2 that includes provisions for providing training and capacity building on environmental and social safeguards to the PMO, Social/Environmental Complaince Unit (SECU) and contractors, (ii) developing and implementing site specific construction EMPs and Performance Standard (PS) manuals, (iii) following appropriate project implementation mitigation, monitoring and reporting arrangements, and (iv) adequate site supervision including audits of contractor's environmental, health and safety (EHS) performance. Monitoring parameters have been identified in the environmental and social monitoring plan (ESMP) to check the effectiveness of ESMP measures and to ensure any unidentified impacts can be readily addressed. The project risks will also be mitigated through inclusion of environmental specifications in construction contracts, such as recycling and/or disposal of component parts of solar PV plants and restoring and maintaining landscape, hedges and field margins at the solar park site.

Information Disclosure, Consultation and Participation

19. Public participation as part of this SEIA preparation included information disclosure via distribution of project information booklets (PIB) in affected communes during consultations, public meetings at district, and village level and focus group discussions (FGDs) with both women and men of the affected communes. All of participants supported the project. Main environmental concerns expressed by the participants were related to increases in dust in the dry season, interrupted access to agricultural/grazing land, construction debris dumping and damage to existing roads during construction and safety concerns due to presence of transmission towers during the operation stage. Other general environmental concerns were periodic drought episodes, soil erosion and low water quality in the communes. Measures to address these concerns have been integrated in the design and ESMP.

Grievance Redress Mechanism

20. PRAC will set up a project grievance redress mechanism (GRM) under its SECU to document and resolve complaints from affected persons for 60MW solar plant. The GRM will be coordinated by the PMO of PRAC. GRM will address concerns and complaints promptly via a transparent process. Complaints and their resolution will be documented and reported in quarterly project progress reports and semi-annual safeguard reports.

Key SEIA and ESMP implementation Responsibilities

21. The key institutions involved in the SEIA and ESMP implementation will be the SECU under PMO of PRAC. For 60MW solar plant, the PMO will have the responsibility to supervise and oversee compliance with environmental, health, and safety guideline, coordinate the project GRM and report to IFC/ADB. The PMO will be assisted by social specialist, environmental spectialist, and health and safety specialist of SECU.

22. PRAC will be responsible only for the overall supervision and coordination of the 60MW solar plant project implementation; it will ensure consistency of all safeguards documents with government policy, legal and administrative framework across all jurisdictions as well as assist with project GRM and meaningful consultation.

23. The SECU will be responsible for social and environmental monitoring. The SECU will coordinate and interact with the PRAC's PMO on compliance to ADB's Safegaurd Policies and IFC Performance Standard requirements and with relevant government agencies and local authorities on permits and clearances and update and finalize the SEIA and ESMP as needed.

24. The SECU will submit monthly and quarterly progress reports to PMO on CEMP/EMP implementation to Project Implementation Consultant (PIC) of EDC's National Solar Park, which will inform the project and semi-annual safeguard monitoring reports, .

Conclusion

25. This SEIA confirmed that potential social and environmental impacts can be reduced to acceptable levels with effective implementation of mitigation measures. Impacts for instance land acquisition, traffic/noise disturbance, water quality, loss of income, or incoming worker are well identified and management measures are proposed to keep impacts under control. The ESMP has specified mitigation measures to address identified impacts, responsible parties, and monitoring during construction and operation. The project is expected to improve electricity supply and increase access to clean and reliable energy that will encourage additional investment and economic growth. A transition to cleaner energy sources will avoid thermal generation and imports as well as the construction of new coal-fired plants. This would have significant environmental benefits, contributing to national emission reduction targets and reduced pollution impacts.

CHAPTER 1: INTRODUCTION

1.2 Project Scope and Location

26. Within the planed National Solar Park, PRAC will construct a 60-megawatt (MW) capacity solar plant and connect to the Phnom Penh demand center to supply power to the national grid[13]. The project is located in Kbal Toeuk commune, Toeuk Phos district, Kampong Chhnang province and covers an area of 100ha. Electricitė du Cambodge (EDC), with ADB support, is developing the National Solar Park (NSP) facility in Kampong Chhnang Province approximately 60 kilometers from Phnom Penh. The NSP will accommodate up to 100 MW of solar photovoltaic (PV) power generation capacity.[14] The NSP facility includes land, access road, substation, and transmission lines to connect to the grid. PRAC Alternative (Cambodia) Company Limited was selected by EDC for the design, construction and operation of the NSP's first 60 MW of power plant within the NSP. The Prime plant will supply electricity to the grid through an on-site connection to facilities designed and built by EDC.

1.2 Lenders and Domestic Environmental Due Diligence

IFC/ADB and MoE require SEIA

27. IFC PS 2012 and Domestic Requirements – IFC PS 2012 sets out the environmental and social requirements that apply to all IFC-financed projects. The due diligence was carried out during project preparation and confirms that the project requires a Social and Environmental Impact Assessment (SEIA) and Environmental and Social Management Plan (ESMP). Additionally, as per the requirements of the national Ministry of Environment (MOE), full SEIA is required for the solar plant.

28. Site Visits. As part of the environmental due diligence for the National Solar Park, site visits were conducted during preparation of the Pre-Feasibility Study[15] in July 2017 and January 2018 prior to the project preparatory technical assistance inception 16 in February 2018 (by EDC and Assisted by ADB's Technical Asssistance). The ground survey for biodiversity assessment was conducted in March and July 2018. In Sept-Nov 2020, environmental and socio-economic surveys, and site investigation were conducted to form ESIA and ESMP for the 60MW solar plant. MoE also conducted site inspection on 18 November 2020 to check and validate the solar plant's SEIA/ESMP.

29. Public Consultations and Focus Group Discussions – Public consultations and Focus Group Discussions (FGDs) with project affected persons and other relevant stakeholders were conducted in Sept and Oct 2020. Records of consultations are discussed in Chapter 6 of this SEIA.

1.3 Structure of this Report

30. This SEIA report follows the format prescribed in IFC PS 2012 and ADB. The other 40MW will be subjected for further assessment For the purposes of this project, this SEIA contains the following:

- Chapter 1 – Introduction

[13] The project is included in ADB. 2017. *Country Operations Business Plan: Cambodia, 2018–2020*. Manila
[14] See https://www.adb.org/projects/51182-001/main for sovereign project documentation.
[15]National Solar Park Project for Cambodia: Pre-Feasibility Study, August 2017
[16]Project Inception Report, February 2018

- Chapter 2 – Policy, Legal and Administrative Framework
- Chapter 3 – Description of the Project
- Chapter 4 – Description of the Baseline Environment
- Chapter 5 – Public Consultation and Participation
- Chapter 6 – Anticipated Environmental Impacts and Mitigation Measures (including cumulative impact assessment and mitigation management)
- Chapter 7 – Environmental and Social Management Plan
- Chapter 8 – Conclusions and Recommendations

31. Attached within, this SEIA contains the Environmental and Social Management Plan (ESMP), the Environmental Monitoring Plan (EMOP) and safeguards requirements for IPPs that are designed to aid the contractors and facility operators in management of environmental impacts. The ESMP includes:

- Mitigation and monitoring measures
- Institutional arrangements and project responsibilities
- Public consultations and information disclosure
- Project GRM
- Training and capacity building requirements
- ESMP budget of environmental safeguards and mitigation measures

CHAPTER 2: POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

2.1 ADB/IFC Environmental Assessment Requirements

2.1.1 Environmental Requirements ADB Safeguard Policy Statement (SPS 2009)

32. Safeguard requirements for all projects funded by ADB are defined in SPS 2009 which establishes an environmental review process to ensure that projects undertaken as part of programs funded through ADB loans are environmentally sound, are designed to operate in compliance with applicable regulatory requirements and are not likely to cause significant environmental, health, or safety hazards. The SPS 2009 is underpinned by the ADB Operations Manual, Bank Policy (OM Section F1/BP, October 2013). The policy also promotes adoption of international good practices as reflected in the IFC's (World Bank Group) Environmental, Health and Safety (EHS) Guidelines. This SEIA and EMP are intended to meet SPS 2009 requirements.

33. SPS 2009 environmental assessment requirements specify that:

- At an early stage of project preparation, the borrower/client will identify potential direct, indirect, cumulative, and induced environmental impacts on and risks to physical, biological, socioeconomic and cultural resources and determine their significance and scope, in consultation with stakeholders, including affected persons and concerned non-government organizations (NGOs). If potentially adverse environmental impacts and risks are identified, the borrower/client will undertake an environmental assessment as early as possible in the project cycle.
- The assessment process will be based on current information, including an accurate project description and appropriate environmental and social baseline data.
- Impacts and risks will be analyzed in the context of the project's area of influence.
- Environmental impacts and risks will be analyzed for all relevant stages of the project cycle, including preconstruction, construction, operations, decommissioning, and post-closure activities such as rehabilitation or restoration.
- The assessment will identify potential transboundary effects as well as global impacts.
- Assessment encompasses associated facilities that are not funded as part of the project (funding may be provided separately by the borrower or by third parties), and whose viability and existence depend exclusively on the project and whose goods or services are essential for successful operation of the project.
- Assessment encompasses existing facilities and/or business activities that already exist (for which) the borrower will undertake an environment and/or social compliance audit, including on-site assessment to identify past or present concerns related to impacts on the environment, involuntary assessment and indigenous peoples. The objective of the audit is to determine if actions were in accordance with SPS and to identify and address outstanding compliance issues.

34. Other requirements of SPS 2009 included in the SEIA include:

- Analysis of Alternatives. There is a requirement to examine alternatives to the project's location, design, technology, components and their potential environmental and social impacts and consider the no project alternative. SPS 2009 states that this is only for projects which have ''significant adverse environmental impacts that are irreversible, diverse, or unprecedented'' i.e., category A projects. This does not apply to this category B projects but is included for completion.
- Consultation and participation. The borrower/client will carry out meaningful consultation with affected persons and other concerned stakeholders, including civil society and facilitate their informed participation. This SEIA includes a Stakeholder Analysis and Communication Strategy and a consultation plan to ensure that the project affected persons, other concerned stakeholders and the civil society can provide meaningful consultations into the project detailed design and implementation.
- Information disclosure. Environmental information on the project will be translated into Khmer and made available in accessible locations (e.g. project construction field offices, commune councils local government offices, etc.) in accordance with ADB's Public Communications Policy (2011) and SPS (2009). The SEIA will be disclosed on ADB's project website (www.adb.org) prior to Board approval, the final SEIA after detailed engineering design and safeguards monitoring reports during implementation.
- Grievance redress mechanism. The borrower/client will establish a mechanism to receive and facilitate resolution of project affected persons' concerns, complaints, and grievances about the project's environmental (and social) performance.
- Monitoring and Reporting. The borrower/client will monitor, measure the progress of implementation of the EMP, EMOP and safeguards tender requirements for IPPs and report as mandated by the SPS 2009.

2.1.2 The World Bank's Environmental, Health and Safety Guideline (EHS) (2007)

35. The EHS Guidelines[17] contain the performance levels and measures that are generally considered to be achievable in new facilities byexisting technology at reasonable costs. Application of the EHS Guidelines to existing facilities may involve the establishment of site-specific targets, with an appropriate timetable for achieving them. The applicability of the EHS Guidelines should be tailored to the hazards and risks established for each project on the basis of the results of an environmental assessment in which site-specific variables, such as host country context, assimilative capacity of the environment, and other project factors, are taken into account.

36. The Environmental, Health, and Safety (EHS) Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP). When one or more members of the World Bank Group are involved in a project, these EHS Guidelines are applied as required by their respective policies and standards.

37. This EHS contains key guidelines on (1) Environment, (2) Occupational Health and

[17] WGB General EHS Guidelines (2007) https://www.ifc.org/wps/wcm/connect/29f5137d-6e17-4660-b1f9-02bf561935e5/Final%2B-%2BGeneral%2BEHS%2BGuidelines.pdf?MOD=AJPERES&CVID=jOWim3p

Safety, (3) Community Health and Safety, and (4) Construction and Decommissioning.

2.1.3 IFC's Performance Standards on Environmental and Social Sustainability (2012)

38. Performance Standard requirements for all projects funded by IFC are defined in IFC's Performance Standards on Environmental and Social Sustainability (2012) which establishes an environmental review process to ensure that projects undertaken as part of programs funded through IFC loans are environmentally sound, are designed to operate in compliance with applicable regulatory requirements and are not likely to cause significant environmental, health, or safety hazards. The IFC's PS 2012 is underpinned by the IFC's Policies and Standards. The policy also promotes adoption of international good practices as reflected in the IFC's (World Bank Group) Environmental, Health and Safety (EHS) Guidelines. This SEIA and ESMP are intended to meet IFC's PS 2012 requirements.

39. The IFC's Environmental and Social Performance Standards in 2012 define IFC clients' responsibilities for managing their environmental and social risks. The 2012 edition of IFC's Sustainability Framework, which includes the Performance Standards, applies to all investment and advisory clients whose projects go through IFC's initial credit review process after January 1, 2012.

40. The Sustainability Framework comprises IFC's Policy and Performance Standards on Environmental and Social Sustainability and IFC's Access to Information Policy. These policies describe IFC's commitments, roles, and responsibilities related to environmental and social sustainability. IFC's Access to Information Policy reflects IFC's commitment to transparency and good governance on its operations, and outlines the Corporation's Institutional Disclosure obligations regarding its investment and advisory services.

41. The Performance Standards are directed to towards clients, providing guidance on how to identify risks and impacts, and are designed to help avoid, mitigate, and manage risks and impacts as a way of doing business in a sustainable way, including stakeholder engagement and disclosure obligations of the client in relation to project-level activities.

42. In case of its direct investments (including project and corporate finance provided through financial intermediaries), IFC requires its clients to apply the Performance Standards to manage environmental and social risks and impacts so that development opportunities are enhanced. IFC uses the Sustainability Framework along with other strategies, policies, and initiatives to direct the business activities of the Corporation in order to achieve its overall development objectives.

43. IFC's clients are to comply with the eight Performance Standards throughout the life of the investment.

- Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts
- Performance Standard 2: Labor and Working Conditions
- Performance Standard 3: Resource Efficiency and Pollution Prevention
- Performance Standard 4: Community Health, Safety, and Security
- Performance Standard 5: Land Acquisition and Involuntary Resettlement

- Performance Standard 6: Biodiversity Conservation and Sustainable Development of Living Natural Resources
- Performance Standard 7: Indigenous Peoples
- Performance Standard 8: Cultural Heritage

44. Performance Standard 1 applies to all projects that have environmental and social risks and impacts. Depending on project circumstances, other Performance Standards may apply as well. Performance Standard 1 establishes the importance of (i) integrated assessment to identify the environmental and social impacts, risks, and opportunities of projects; (ii) effective community engagement through disclosure of project-related information and consultation with local communities on matters that directly affect them; and (iii) the clients' management of environmental and social performance throughout the life of the project.

45. Performance Standards 2 through 8 establish objectives and requirements to avoid, minimize, and where residual impacts remain, to compensate/offset for risks and impacts to workers, affected communities, and the environment. While all relevant environmental and social risks and potential impacts should be considered as part of the assessment, Performance Standards 2 through 8 describe potential environmental and social risks and impacts that require particular attention. Where environmental and social risks and impacts are identified, the client is required to manage them through its Environmental and Social Management System (ESMS) consistent with Performance Standard 1.

46. The Performance Standards should be read together and cross-referenced as needed. The requirements section of each Performance Standard applies to all activities financed under the project, unless otherwise noted in the specific limitations described in each paragraph. Clients are encouraged to apply ESMS developed under Performance Standard 1 to all their project activities, regardless of financing sources.

47. This SEIA/ESMP cover the solar park infrastructure and the solar plants within the 100-ha immediate area. Other shared facilities including transmission line, access road, and the GS6 substation are NOT covered by this impact assessment.

48. International Best Practices. Performance Standard 2012 requires that during the design, construction, and operation of the project, the Borrower/Client will apply pollution prevention and control technologies and practices consistent with International Best Practice, as reflected in internationally recognized standards of the International Finance Corporation's (World Bank Group) Environmental, Health and Safety Guidelines ("EHS Guidelines") and World Health Organization (WHO). 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 Borrower/Client will provide full and detailed justification for any proposed alternatives that are consistent with the requirements presented in this document. These EHS Guidelines are adopted in the ESMP for the project such as IFC (WBG) Industry Sector EHS Guidelines for Electric Power Transmission and Distribution (2007)[18]; and Environmental Guidelines on Air

[18] IFC (WBG) Industry Sector Guidelines for Electric Power Transmission and Distribution

Emissions and Ambient Air Quality, Noise Management, Wastewater and Ambient Water Quality, Hazardous Material Management and Waste Management as well as Occupational Health and Safety and Community Health and Safety (2007).

49. The project owner is committed to due consideration of Core Labor Standards (CLS) in the design and implementation of investment projects. A CLS handbook has been developed by ADB with cooperation of International Labor Organization (ILO). EDC will also ensure compliance to applicable CLS of ADB-ILO during project implementation including[19]:

- Freedom of association and the effective recognition of the right to collective bargaining
- Elimination of all forms of forced or compulsory labor
- Effective abolition of child labor
- Elimination of discrimination in respect of employment and occupation

50. The project will comply with IFC Prohibited Exclusion List (2007) as listed in Appendix II of this SEIA.

2.1.4 ADB Climate Change Commitments

51. In 2015, ADB committed itself to increasing climate financing from its own resources to $6 billion yearly by 2020—$4 billion for mitigation in sectors such as renewable energy, energy efficiency, sustainable transport, and urban development, and $2 billion for adaptation in areas such as urban resilience and agriculture and land use. The $6 billion target corresponds to around 30% of ADB's projected corporate pipeline by 2020. In 2017, ADB reached a record high of $4.5 billion in climate investments, a 21% increase from the $3.7 billion reached in 2016. From 2011 to 2017, ADB approved more than $25 billion for climate financing—$21.7 billion from ADB's own resources while leveraging over $3.4 billion from external resources.

52. With a view to deliver stronger, better, and faster support to its Developing Member Countries (DMCs), ADB has established its Climate Change Operational Framework, 2017–2030 (CCOF 2030), which positions ADB to facilitate, collaboratively and proactively, a regional shift toward a low GHG emissions and climate-resilient development path. It further provides a framework for supporting DMCs in translating their NDC aspirations into climate change action investment plans and implementing those plans.

2.2 **Cambodian EIA requirements**

53. The following regulations and guidelines manage and require environmental impact assessment in Cambodia:

- Law on Natural Resource Management and Environmental Protection (1996) highlights the requirement for environmental impact assessment for both state and private projects (Article 6 & 7, Chapter 3).
- Sub-decree on Environmental Impact Assessment (EIA) process No. 72 (1999) provides

[19]Asian Development Bank and International Labour Organization. Core Labour Standards, October 2006.

the detailed guidelines for implementation of the EIA process and specifically that power plants that generate more than 5 MW require an IEIA or EIA.

- Declaration on Guideline for Conducting IEIA and EIA Reports No. 376 (2009) specifies the basic contents of IEIA/EIA Reports, which should include: (i) introduction, (ii) legal framework, (iii) project description, (iv) description of the existing environment, (v) public participation, (vi) assessment of and mitigation measures for significant environmental impacts, (vii) environmental management plan, (viii) cost-benefit analysis, and (ix) conclusion and recommendations.

54. The MoE through its EIA Department regulates and monitors the EIA process. The MOE is responsible for: (i) review and approval of IEIA/EIA reports in collaboration with other relevant ministries and (ii) monitoring the ESMP implementation of Project Proponents/Owners throughout the different project stages. The MOE operates at the municipal and provincial levels through its Provincial Departments of Environment (PDOE).

55. The Project Proponents/Owner (public or private) is required to submit the necessary project document (IEIA/EIA Reports) to the MOE for review and approval. After submission of IEIA/EIA report, it will take a maximum of 30 working days for a decision.

56. The MoE's Prokas on Classifying Development Projects for SEIA in 2018 has indicated that any power project producing more that 10MW required SEIA for MoE to review and approve prior to any construction and operation. Therefore, SEIA is required for the 100-ha Solar Plant Project and Terms of Reference (ToR) was submitted and approved in September 2020.

2.2.1 National Environmental Legislations

57. The Environment Law has the following objectives:

- Protect and upgrade environmental quality and reduce pollution
- Assess the impacts of proposed projects before approval
- Ensure rational and sustainable use of the Kingdom’s resources
- Encourage public participation in environmental protection and natural resource management
- Reduce activities that impact negatively on the environment

58. Specific regulations and standards for environmental quality are contained in three Sub-decrees:

- Sub-decree on Solid Waste Management (1999)
- Sub-decree on Water Pollution Control (2009)
- Sub-decree on Air Pollution Control and Noise Disturbance (2000)

59. A summary of legislative and policy instruments relevant to the project is presented in Table 1.

Table 1: Relevant Laws, Regulations and Guidelines

Law/Regulation/Guideline	Year	Summary
Royal Decree on the Protection of Natural Areas	1993	Classifies 23 protected areas in Cambodia into four categories: (i) natural parks; (ii) wildlife sanctuaries; (iii) protected landscapes; and (iv) multiple-use areas.
Law on the Protection of Cultural Heritage (NS/RKM/0196/26)	1996	▪ Regulates the protection of national cultural heritage and cultural property in general against illegal destruction, modification, alteration, excavation, alienation, exportation or importation. ▪ Article 37 stipulates that in case of chance find of a cultural property during construction, work should be stopped and the person who found the property should immediately make a declaration to the local police, who shall, in turn, transmit the property to the Provincial Governor without delay.
Labor Law (1997) Decree No. CS/RKM/0397/01	1997	Governs relations between employers and workers resulting from employment contracts to be performed within Cambodia. The key sections relevant to this project include: ▪ Chapter VIII Health and Safety of Worker. The key provisions relate to the quality of the premises; cleaning and hygiene; lodging of personnel, if applicable (such as workers camp); ventilation and sanitation; individual protective instruments and work clothes; lighting and noise levels in the workplace. ▪ Article 230: Work places must guarantee the safety of workers. ▪ Chapter IX Work-Related Accidents Article 248: All occupational illness, as defined by law, shall be considered a work-related accident. The law sets out how accidents should be managed in terms of compensation.
Sub-decree on Solid Waste Management (Sub-decree No. 36 ANK/BK),	1999	▪ Article 1: Regulates solid waste management to ensure the protection of human health and the conservation of biodiversity through using appropriate technical approaches. ▪ Article 2: This Sub-decree applies to all activities related to disposal, storage and collection, transport, recycling, dumping of garbage and hazardous waste. ▪ Article 4: The Ministry of Environment (MOE) shall establish guidelines on disposal, collection, transport, storage, recycling, minimizing, and dumping of household waste in provinces and cities in order to ensure the safe management of household waste.

Law/Regulation/Guideline	Year	Summary
		▪ The authorities of the provinces and cities shall establish the waste management plan in their province and city for short, medium and long-term.
Sub-decree on Control of Air Pollution and Noise Disturbance (Sub-decree No. 42 ANK/BK	2000	▪ Regulates air and noise pollution from mobile and fixed sources through monitoring, curb and mitigation activities to protect the environmental quality and public health. It contains the following relevant standards: (i)) ambient air quality standard (Annex 1 of the Sub-decree); and (ii) maximum allowable noise level in public and residential areas (Annex 6 of the Sub-decree). ▪ Article 3 A. "Source of pollution" is defined and separates mobile sources (including transport) and fixed sources such as factories and construction sites. ▪ Article 3 B. "Pollutant" is defined as smoke, dust, ash particle substance, gas, vapor, fog, odor, radio-active substance
Law on Land (NS/RKM/0801/14)	2001	Provides that: (i) unless it is in the public interest, no person may be deprived of ownership of his immovable property; and (ii) ownership deprivation shall be carried out according to legal forms and procedures and after an advanced payment of fair and just compensation. (Article 5)
Law on Forestry	2002	Provides general jurisdiction and enforcement activities for all forest related offences that occur within the Protected Areas; supervised by the Ministry of Agriculture, Forestry, and Fisheries in coordination with the MOE.
Law on Water Resources Management (NS/RKM/0607/016)	2007	▪ Requires license/permit/written authorization for the: (i) abstraction and use of water resources other than for domestic purposes, watering for animal husbandry, fishing & irrigation of domestic gardens and orchards; (ii) extraction of sand, soil and gravel from the beds and banks of water courses, lakes, canals and reservoirs; (iii) filling of river, tributary, stream, natural lakes, canal and reservoir; and (iv) discharge, disposal or deposit of polluting substances that are likely to deteriorate water quality and to endanger human, animal and plant health (Articles 12 & 22) ▪ Article 24 stipulates that Ministry of Water Resources and Meteorology (MOWRAM), in collaboration with other concerned agencies, may designate a floodplain area as flood retention area.

Law/Regulation/Guideline	Year	Summary
Royal Decree on Protected Areas (Royal Decree No. NS/RKM/0208/007)	2008	▪ Defines the framework of management, conservation and development of protected areas to ensure the conservation of biodiversity and sustainable use of natural resources in protected areas. ▪ Article 11 divides the protected area into 4 zones namely, core zone, conservation zone, sustainable use zone and community zone. ▪ Article 36 strictly prohibits all types of public infrastructure in the core zone and conservation zone; allows development of public infrastructures in the sustainable use zone and community zone with approval from the Royal Government at MOE's request. ▪ Article 41 provides for the protection of each protected area against destructive/harmful practices such as destroying water quality in all forms, poisoning, using of chemical substances, disposing of solid and liquid wastes into water or on land. ▪ Article 44 requires all proposals and investments within or adjacent to protected area boundary an Environmental and Social Impact Assessment. ▪ Each protected area shall be divided into four (4) management zoning systems: ▪ 1. Core zone: management area(s) of high conservation values containing threatened and critically endangered species, and fragile ecosystems. Access to the zone is prohibited except the Nature Conservation and Protection Administration's officials and researchers who, with prior permission from the MOE, conduct nature and scientific studies for the purpose of preservation and protection of biological resources and natural environment with the exception of national security and defense sectors. ▪ 2. Conservation zone: management area(s) of high conservation values containing natural resources, ecosystems, watershed areas and natural landscape located adjacent to the core zone. Access to the zone is allowed only with prior consent of the Nature Conservation and Protection Administration at the area with the exception of national security and defense sectors. Small-scale community uses of Non-Timber Forest Products to

Law/Regulation/Guideline	Year	Summary
		support local ethnic minorities' livelihood may be allowed under strict control, provided that they do not present serious adverse impacts on biodiversity within the zone. ▪ 3. Sustainable use zone: management area(s) of high economic values for national economic development and management, and conservation of the protected area(s) itself thus contributing to the local community, and indigenous ethnic minorities' livelihood improvement. ▪ After consulting with relevant ministries and institutions, local authorities, and local communities in accordance with relevant laws and procedures, the Royal Government of Cambodia may permit development and investment activities in this zone in accordance with the request from the MOE. ▪ 4. Community zone: management area(s) for socio-economic development of the local communities and indigenous ethnic minorities and may contain existing residential lands, paddy field and field garden or swidden (Chamkar).
Sub-decree on Water Pollution Control (Sub-decree No. 27 ANRK/BK)	2009	▪ Regulates activities that cause pollution in public water areas in order to sustain good water quality so that the protection of human health and the conservation of biodiversity are ensured. ▪ Annexes 2, 4 and 5 provide the industrial effluent standards, including effluent from wastewater stabilization ponds, water quality standards for public waters for the purpose of biodiversity conservation, and water quality standards for public waters and health, respectively.
Expropriation Law	2010	Defines the principles, mechanisms, and procedures of expropriation, and defining fair and just compensation for any construction, rehabilitation, and public physical infrastructure expansion project for the public and national interests and development of Cambodia.

Table 2: Key National and International Environmental Standards

Environmental Parameter	National Standard	International Standard
Ambient air quality	Declaration on Uses of Term of Reference for Establishment of Factory and Handicraft (2018),	▪ IFC (WBG) EHS Guidelines, Air Emissions and Ambient Air Quality, 200720 ▪ WHO Air Quality Guidelines, Global Update 2005[21]
Noise	Declaration on Uses of Term of Reference for Establishment of Factory and Handicraft (2018)	▪ IFC (WBG) EHS Guidelines, Noise management, 2007 ▪ WHO Guidelines for Community Noise, 1999[22]
Ground water quality	Declaration on Uses of Term of Reference for Establishment of Factory and Handicraft (2018)	WHO Guidelines for Drinking-water Quality, Fourth Edition, 2011[23]
Surface water quality	Declaration on Uses of Term of Reference for Establishment of Factory and Handicraft (2018)	▪ US EPA National Recommended Water Quality Criteria[24] ▪ IFC (WBG) EHS Guidelines, Wastewater and ambient water quality, 2007 ▪ MRC Technical Guidelines for the Protection of Aquatic Life[25] ▪ MRC Technical Guidelines for the Protection of Human Health

Note: EHS = environmental, health and safety; IFC = International Finance Corporation; MRC = Mekong River Commission; US EPA = United States Environment Protection Agency; WBG = World Bank Group; WHO = World Health Organization

2.2.2 International and Regional Agreements

60. International Agreements. Cambodia is party to the following international environmental agreements in general and as relevant to the Project: (i) United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage Convention, 1991; (ii) Convention on Biodiversity, 1995; (iii) United Nations Framework Convention on Climate Change (UNFCCC), 1995; (iv) Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), 1997; (v) UNESCO Network of Biosphere Reserves in 1997; (vi) Ramsar Convention on Wetlands of International Importance, especially as Waterfowl Habitat, 1999; (vii) Basel Convention on the Control of Trans-boundary Movements of the Hazardous Wastes and Their Disposal, 2001; (viii) Vienna Convention for the Protection of the Ozone Layer and its Montreal Protocol on Substances that Deplete the Ozone Layer, 2001, and all Amendments, 2007; (ix) Climate Change Kyoto Protocol, 2002; (x) International Tropical Timber Agreement, 2006; and (xi) Paris Agreement, 2016.

[20] IFC (WBG) EHS Guidelines 2007
[21] WHO Air Quality Guidelines Global Update 2005
[22] WHO Guidelines for Community Noise 1999
[23] WHO Guidelines for Drinking - Water Quality
[24] https://www.epa.gov/wqc/national-recommended-water-quality-criteria
[25] http://www.mrcmekong.org/about-mrc/mandate/procedures-for-water-quality/

61. Cambodia Climate Change Commitments. The First and Second National Communication was submitted to UNFCCC in October 2002 [26] and November 2015 [27], respectively. The Second National Communication contained information on the country's major source of GHG emissions and sinks, vulnerability, adaptation options and mitigation measures that Cambodia has implemented or intends to implement to further contribute to global efforts to reduce GHG emissions. Furthermore, Cambodia's Nationally Determined Contribution (NDC) enshrined in the 2016 Paris Agreement[28], commits to a 16% reduction in GHG emissions from a business as usual scenario by 2030 from the energy sector.[29] The National Strategic Development Plan (2014-2018) states the importance of implementing Cambodia's Climate Change Strategic Plan (2014-2023) and contains indicators to track implementation of climate change actions. In alignment to the Climate Change Strategic Plan of Cambodia, Sectoral Climate Change Strategic Plans and Action Plans have also been developed.

62. Regional Agreements. At the regional level, Cambodia has ratified the following Association of Southeast Asian Nations (ASEAN) agreements: (i) on Trans-boundary Haze Pollution in 2006; and (ii) on Disaster Management and Emergency Response, entered into force in 2009.

63. Sub-Regional Agreements. At the sub-regional level, Cambodia, along with the Lao People's Democratic Republic, Thailand and Viet Nam, signed the "Agreement on the Cooperation for the Sustainable Development of the Mekong River Basin" (or the Mekong Agreement) in April 1995.

[26] https://unfccc.int/resource/docs/natc/khmnc1.pdf (accessed May 2018)
[27] https://unfccc.int/resource/docs/natc/khmnc2.pdf (accessed May 2018)
[28] The Paris Agreement entered into force on 4 November 2016.
[29] Government of Cambodia. 2015. *Cambodia's Intended Nationally Determined Contribution*. Phnom Penh.

CHAPTER 3: DESCRIPTION OF THE PROJECT

3.1 Rationale

64. Country Background. Cambodia's economy has grown quickly over the past decade, averaging annual growth of 7.0% from 2006 to 2016 and poverty has fallen substantially, from 47.8% in 2007 to 13.5% in 2014.[30] Nonetheless, gross domestic product (GDP) per capita, estimated at $1,427 in 2017, remains among the lowest in Asia. An underdeveloped energy sector is a key constraint to the further improvement of Cambodia's economic competitiveness and the welfare of its people. Cambodia's energy sector is faced with several strategic challenges. Access to reliable energy is the most pressing one in the short and medium term while broader and longer-term issues of energy security, affordability and environmental sustainability also need to be addressed. Nearly 5 million Cambodians do not have access to electricity and are reliant on batteries, wood and other traditional fuels for energy. Historically, the high cost of power, dependence on conventional energy sources and limited transmission and distribution networks, coupled with intermittent power supply, have hindered economic competitiveness and discouraged private sector investments. Annual electricity demand growth in Cambodia averaged 16% from 2011 to 2017. In 2017, Cambodia's energy consumption was 8,073 gigawatt-hour (GWh), of which 44% was coal, 34% hydro, 4% diesel, less than 1% renewables and 18% power imports from neighboring countries. The hydropower and coal-fired plants are owned by the private sector and operated under long-term Power Purchase Agreements (PPAs) with take-or-pay arrangements. The current Power Development Plan (PDP), revised in 2015, projects demand growth to average about 7% through 2030.

65. The government's Rectangular Strategy, Phase IV (2018–2023), highlights increased investment in solar energy to reduce electricity costs and ensure long-term energy security.[31] The government also prioritized the development of renewable energy in its National Strategic Development Plan, 2014–2018 to meet growing demand for electricity in Phnom Penh and address the country's electrification target of 100% of villages by 2020.[32] In addition, the Government's Industrial Development Policy 2015–2025[33] identifies the historically high power tariffs in the country as a major impediment to the competitiveness of the country's manufacturing sector and calls for alternate sources of energy to be developed. Furthermore, Cambodia's Nationally Determined Contribution, enshrined in the 2016 Paris Agreement[34] commits to a 16% reduction in GHG emissions from a business as usual scenario by 2030 from the energy sector.[35] Ideally, alternate, clean sources of energy would complement installed and planned hydropower-based generation, which is often inadequate during the dry season as well as help provide ancillary benefits to the grid around the key demand centers.

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[30] ADB. 2016. *Country Economic Indicators 2016*. Manila.

[31] Government of Cambodia. 2018. *Rectangular Strategy for Growth, Employment, Equity and Efficiency: Building the Foundation Toward Realizing the Cambodia Vision 2050, Phase IV of the Royal Government of Cambodia of the Sixth Legislature of the National Assembly*. Phnom Penh.

[32] Government of Cambodia, Ministry of Planning. 2014. *National Strategic Development Plan, 2014–2018*. Phnom Penh.

[33] Government of Cambodia. 2015. *Cambodia Industrial Development Policy 2015–2025: Market Orientation and Enabling Environment for Industrial Development*. Phnom Penh.

[34] The Paris Agreement entered into force on 4 November 2016.

[35] Government of Cambodia. 2015. *Cambodia's Intended Nationally Determined Contribution*. Phnom Penh.

66. The Project. This project will support the construction of solar PV plants in Cambodia and address the country's need to: (i) expand low-cost power generation, (ii) diversify the power generation mix with an increase in the percentage of clean energy in line with the national GHG emissions reductions targets, and (iii) expand the use of competitive tenders and other global best practices in the sector.

67. PRAC will construct a 60-MW capacity solar plant as part of EDC's National Solar Park in Kampong Chhnang province and connect to the Phnom Penh, demand center to supply power to the national grid via the transmission line built by EDC.[36]

68. The National Solar Park project is the first of its kind in Cambodia and builds on lessons learnt from ADB Private Sector Operations Department's financing of a 10 MW solar PV plant at Bavet, Svay Rieng province in 2016. The project aims to demonstrate the ability of large-scale solar parks to produce solar energy at a competitive price while also providing technical benefits to the national grid[37] and substitute for planned fossil fuel and hydropower generation in the future. This project will build appreciation for the costs, operational requirements and actual performance of solar PV plants.

3.2 National Solar Park Project Structure

69. National Solar Park project combines the five components under the oversight of EDC. According to the Power Purchase Agreement (PPA), PRAC's responsibility is to develop, construct and operate the 60 MW solar plant (component 1) whereas EDC will provide the so-called shared facilities. These shared facilities include:

1. **Access road:** Existing road from National road No. 1 up to EDC substation in the project's land will be upgraded and constructed in order to ensure that the mobilization of heavy equipment and manpower to be used for construction and operation phase.
2. **EDC substation:** 22kV/115 kV substation to be located within the area of 5 ha inside the total 102 hectare of National solar park phase 1. The Interconnection point which is the end of Prime Road's IPP scope will be located in the EDC substation.
3. **Transmission line:** 230 kV transmission line (double circuit, 40 km in length,) that will be initially operated at 115 kV voltage to connect the National solar park at EDC substation with the GS6 substation in Phnom Penh
4. **Upgrading of GS6 substation:** Upgrade to Grid Substation 6 ("GS6") to facilitate solar-generated electricity from the National Solar Park;

70. The environmental and social impacts the shared facilities are assessed by a separate study conducted by EDC.

71. As indicated in Figure 1, infrastructures highlighted in red are under the responsibility of PRAC as an IPP. The blue highlights are those of EDC

[36] The project is included in ADB. 2017. *Country Operations Business Plan: Cambodia, 2018–2020*. Manila.

[37] Technical or ancillary benefits include: (i) voltage support during peak loading periods, (ii) reduction of loading levels on transformers, (iii) and reduction of the amount of power that needs to be generated from distant sources (hydro and coal, in particular), and therefore reduction of losses in the transmission system.

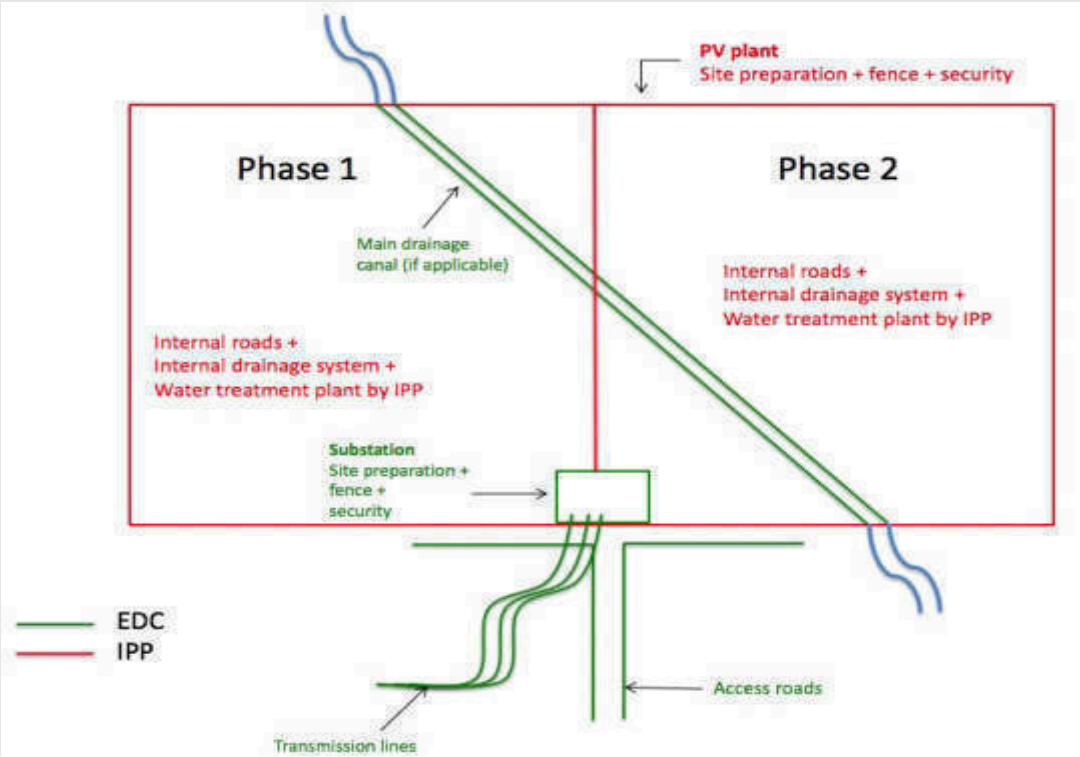


Figure 1: Solar PV park subsections and responsibilities

3.3 National Solar Park and Land for 60MW solar plant

72. The National Solar Park is located in Thnal Keng Village, Kbal Toeuk Commune, Touek Phos District of Kampong Chhnang province. The 60 MW solar plant project will be constructed within the area of National Solar Park.

73. The Project's land for the development, construction and operation of 60 MW solar project covers 100 hectares and is located in Cambodia's Kampong Chhnang province at a linear distance of about 60 km from the capital Phnom Penh and approximately 5 km from Thpong District (reference coordinates for the solar resource assessment, 11.7916° North, 104.4047° East). This 100-hectare of land includes the land area of 5 hectares for the construction of EDC's substation and Access road which is under responsibility of EDC. The road distance from the capital and thereby the closest international airport and the largest inland port to Thpong District is about 80 km. The detial UTM coordinates of the project is listed in Table 3 below:

Table 3: Project UTM coordinates for 60WM Solar Plant

Point	UTM Coordinates		Point	UMT Coordinates	
	X	Y		X	Y
A	434646	1304160	AA	433610	1303245
B	434023	1303981	AB	433612	1303217
C	433952	1303826	AC	433818	1303122
D	434003	1303813	AD	433829	1303227
E	433934	1303973	AE	434042	1303114
F	433461	1303953	AF	434093	1303103
G	433432	1303882	AG	434092	1302822

H	433390	1303886	AH	433974	1302665
I	433401	1303838	AI	434237	1302423
J	433429	1303823	AJ	434252	1302549
K	433442	1303784	AK	434340	1302667
L	433438	1303727	AL	434362	1302802
M	433411	1303662	AM	434347	1302901
N	433362	1303652	AN	434369	1303042
O	433347	1303614	AO	434407	1303148
P	433341	1303551	AP	434418	1303251
Q	433312	1303515	AQ	434091	1303286
R	433309	1303491	AR	434092	1303412
S	433322	1303474	AS	434436	1303351
T	433405	1303443	AT	434578	1303683
U	433411	1303391			
V	433462	1303351			
W	433467	1303322			
X	433489	1303274			
Y	433570	1303241			
Z	433586	1303250			

3.4 Project Impact, Outcomes and Outputs

74. The implementation of the National Solar Park is aligned with the Government's stated impact of lower electricity cost in Cambodia.[38] The National Solar Park (NSP) phase 1 will be implemented based on 102 ha of project's land according to the Letter of Authorization issued by EDC to the Borrower on 27 August 2020. PRAC will construct a 60 MW solar plant in Kampong Chhnang Province. Under the PPA, PRAC will construct the solar plant on 97 ha of the phase 1 project land. The remaining 5 ha of land will be allocated for the construction of EDC's substation.

75. The Commercial operation date of the 60 MW solar plant is anticipated to be occurred in June 2022. The solar-generated electricity can then produce and evacuated to supply electricity demand in EDC's grid. The impact of the project is aligned with the direction from Ministry of Mines and Energy which is to encourage exploration and development of environmentally and socially acceptable energy resources needed to supply all sectors of Cambodian economy39. In addition, the 60 MW solar project will also create employment during the construction and operation.

3.5 Project Design

3.5.1 Design and Site Selection for 60MW solar plan and National Solar Park

76. During the Bidding stage, the Site selection was conducted by consultant, ADB-OPPP and EDC as a Project Owner. A total of seven sites were assessed for the National solar park location in the Pre-feasibility Study out of which three were identified as preferred sites for

[38] Government of Cambodia. 2015. *Cambodia Industrial Development Policy 2015–2025: Market Orientation and Enabling Environment for Industrial Development*. Phnom Penh.

[39] Government of Cambodia, Ministry of Mines and Energy. 2019. *Operationalizing National Expert SDG Tool for Energy Planning (NEXSTEP) at National Level–Cambodia*. Presented at the Workshop on SDG7 Implementation in Asia and Pacific. Bangkok. 19–21 November.

further assessment during the project preparatory technical assistance phase. All of the sites are located between Kampong Chhnang and Kampong Speu provinces. Out of the three preferred sites, two were dropped from further study mainly due to potential socio-economic impacts and ease and cost of land acquisition. For details refer to Section 7 of this SEIA. EDC further determined that the optimal point of connection of the proposed solar park site (initially referred to as site 6) to the national grid is at GS6. GS6 is located close to the major load center of Phnom Penh. Connecting the new substation at the proposed solar park site to GS6 will minimize the need for new infrastructure while enabling the project component to provide voltage support and reduce network losses.

77. Two natural streams, the only surface water bodies that run across the proposed solar park site, will be conserved in current natural condition during site design. The proposed 60MW solar plant site is also situated outside the historical flood zone. Detailed engineering design integrate measures based on recommendations from the ongoing hydrological study to maximize flood resilience and minimize impacts on local drainage patterns. Details on hydrology and flood risks are provided in Chapter 5 of this SEIA.

78. Common infrastructure of 60MW solar plant include perimeter fencing with adequate ground clearance (for passage of animals/ wild species), drainage design and/or building storm water retention pond. There is an existing unpaved road up to the start of the solar park site (width 30 m) that has been built by the local Army; this approach road connects Road No. 132/136.

79. Shared access roads to the site (length 3-4 km, width 5.5 m) will be constructed and maintained for transportation of the equipment, materials and machinery and further maintained during operation of the National solar park by EDC.

3.5.2 Project basic layout and solar power plant design

(A) Project system summary as of October 2020

80. As conceptual design, the solar plant is planned to equip with 535 Watt-peak monocrystalline bifacial photovoltaic module (PV module) for the generation of electricity from sunlight. The total DC installed capacity is envisaged to be 78 MW-peak comprising of 164,248 PV modules. The PV modules will be installed on the East-West single-axis tracking system which mounted on foundation which designed accordingly to the geotechnical properties of the project's land, taking into account the loads from PV modules, mounting structures and wind loads. The plant is composed of (i) 20 subsystems, each subsystem has a 3150k VA Box – Transformer; (ii) 175kW string inverter total 343 sets; (iii) 475Wp monocrystallin photovoltaic module, the PV module size is 2119 x 1038 x 35MM. The plant will use a total number of PV modules is 164,248 PCS, and the total capacity of 78.0178Wp. Total 3 weather stations will be constructed.

81. As conceptual design, the solar plant is planned to equip with 530 Watt-peak monocrystalline bifacial photovoltaic modules (PV module) for the generation of electricity from sunlight. The total DC installed capacity is envisaged to be 78 MW-peak comprising of 147,252 PV modules. The PV modules will be installed on the East-West single-axis tracking system which mounted on foundation which designed accordingly to the geotechnical

properties of the project's land, taking into account the loads from PV modules, mounting structures and also wind loads.

82. The PV modules will be connected to increase it voltages and forms PV strings which will be connected to 175 kW String inverter in order to convert direct current electricity generated from solar power to alternate current electricity. The output from each string inverter is then connect to the box transformer station in order to increase its output voltage from low voltage to medium voltage at 22 kV for the distribution to the Interconnection point. The box transformer comprises of low voltage input collection part, 22 kV step-up transformer and 22 kV switchgear. There will be 20 box transformer installed to collect output from the string inverter installed at the different part of the project lands. The output from each of the box transformer will be connected to each other, forming the so-called 22 kV ring main system. The four (4) output of 22 kV ring main system (each comprise 20 MW output) will be connecting to Interconnection point at EDC's substation via underground cable (Only from the nearest box transformer to the Interconnection point). The Interconnection Point which is at four (4) of 22 kV incoming feeders of EDC substation. The revenue meter also installed at the Interconnection Point. This is the end of PRIME ROAD's scope of work as IPP.

83. Weather station system to be installed on-site is important for the verification of system performance during commissioning, testing and also operational period. In addition, weather data such as wind speed is also crucial for the safety operation of single-axis tracking as well. The sensors to be installed at the solar plant includes pyranometer to measure solar resource on front and rear side of PV module, Temperature sensors to measure ambient and PV module temperature, Wind speed, Rainfall and humidity sensors.

84. Lighting Protection System. This project will use Early Stream Emission (ESE) system to prevent the damages due to lighting strike. Considering the maximum elevation of PV module is 3 meters, the ESE for the PV installation area which lighting rod is designed to be 8 meters height which will cover radius of 89 meters. The 50 lightning rods will be installed in the PV installation area. The Lighting Protection System (LPS) will also be provided for the main components of the solar plant. All metal parts of the solar plant equipment shall be earthed to provide equipotential bonding, Surge Protection Device (SPD) will be installed in the important circuit of the electrical equipment.

85. String inverter. String inverters are installed near to the solar module support structure, metal shell will be connected to the earthing grid via grounding cable, the inverter is form an equipotential object with the earthing system. Consider the inverter as the major power generation device, every circuit of the DC and AC side has installed one SPD to protection internal component from the indirect lightning damage.

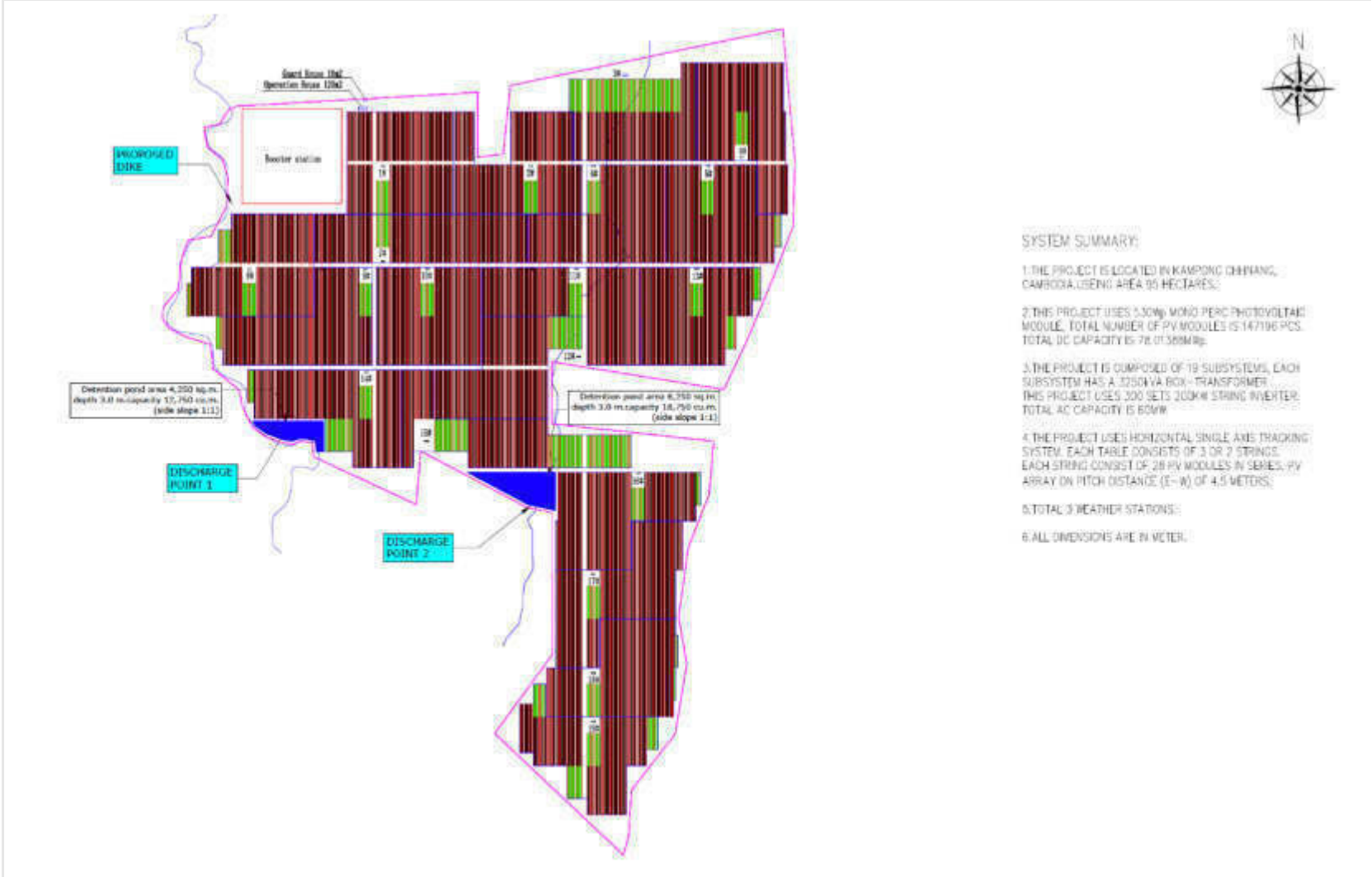
86. Box transformer. The MV transformer, 22 kV switchgear and Low Voltage LV cabinet are installed in one prefabricated container, and the container is provided with at least two grounding points. The grounding points are reliably connected to the main earthing grid via grounding cable and used for guiding lightning energy into the ground. In addition, lightning arresters are also arranged in the 22 kV switchgear of box transformer, while the LV side is arranged SPD to protect against the indirect lightning damage.

87. Solar module and support structure. The solar module frame is used as the natural air-termination and connected to the support structure via grounding cable as the natural down-

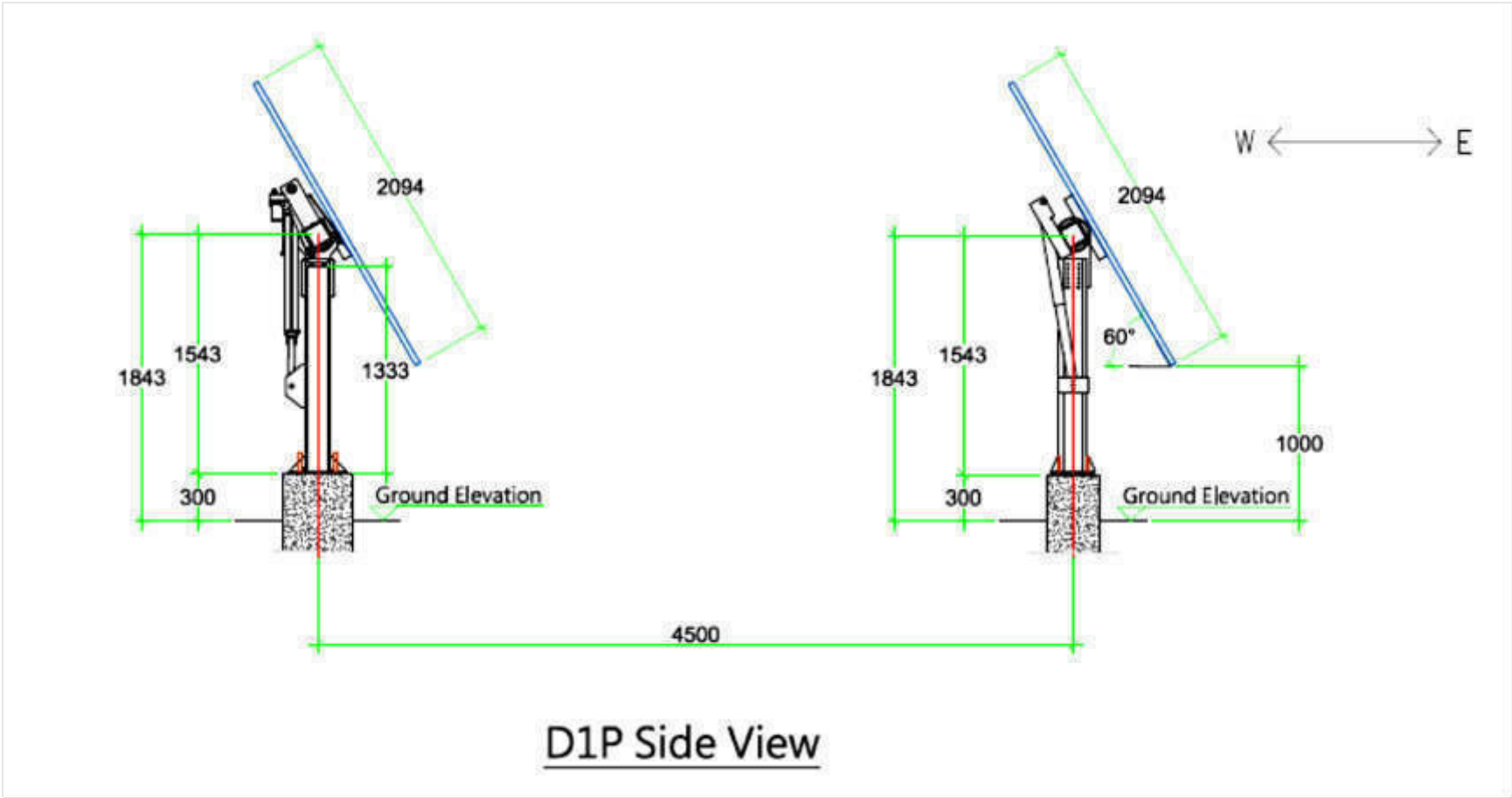
conductor. The support structure is connected to the main earthing grid via grounding cable to form a complete grounding system. Meanwhile the internal part of single axis tracker has been connected via grounding cable, including the connection between slew and post, slew and damper, control box and post, all the tracker are connected as an equipotential object, refer to the following figure

88. The detail design layout of 60MW solar plant is illustrated in the following pages. All dimensions are meter.

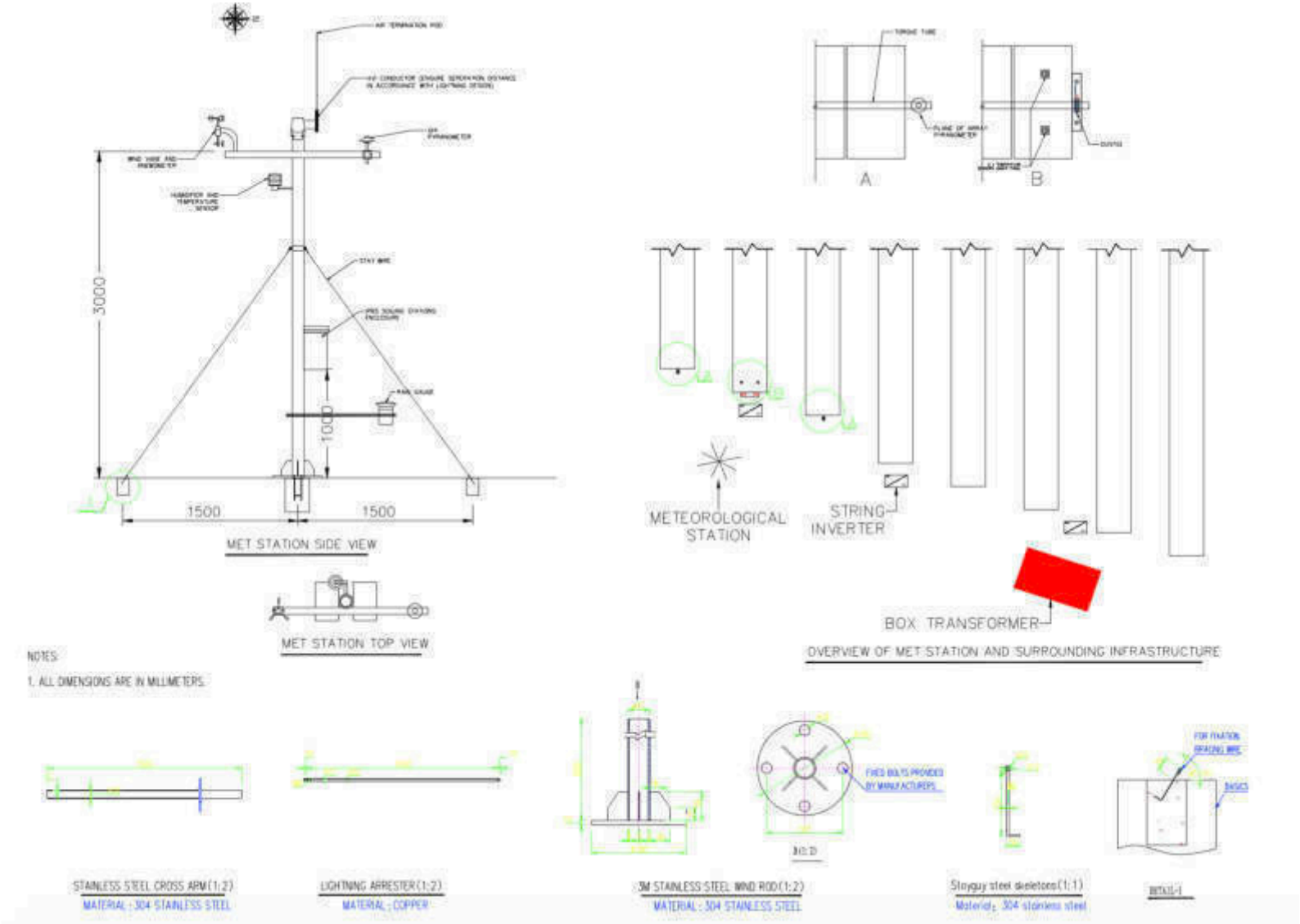
(A) Overall conceptual solar plat layout



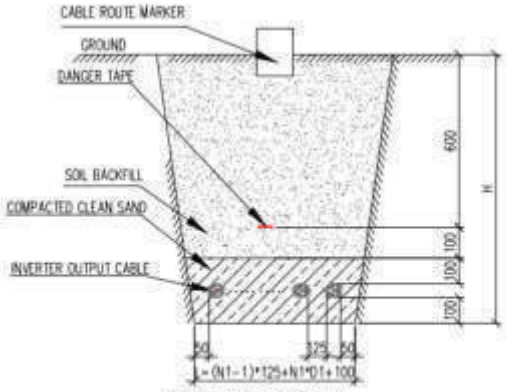
(B) Single Axis Tracking

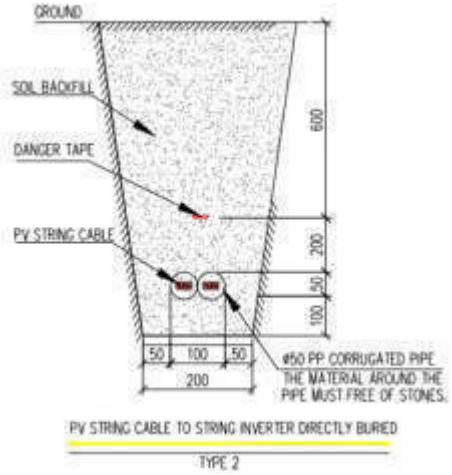


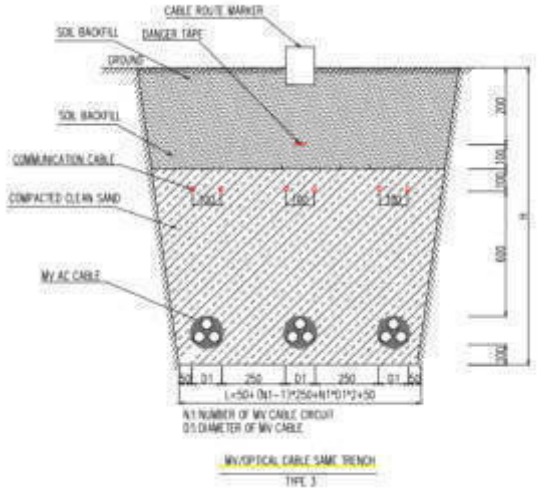
(C) Meteorological station

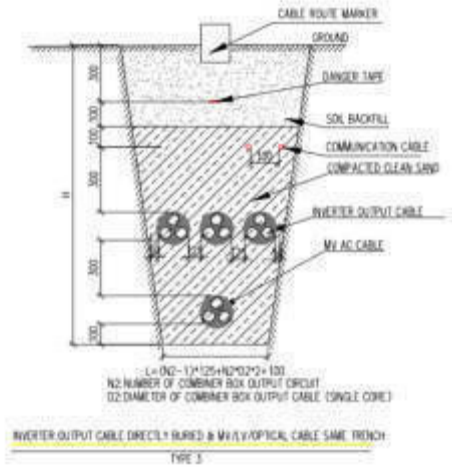


(D) Inverter Output

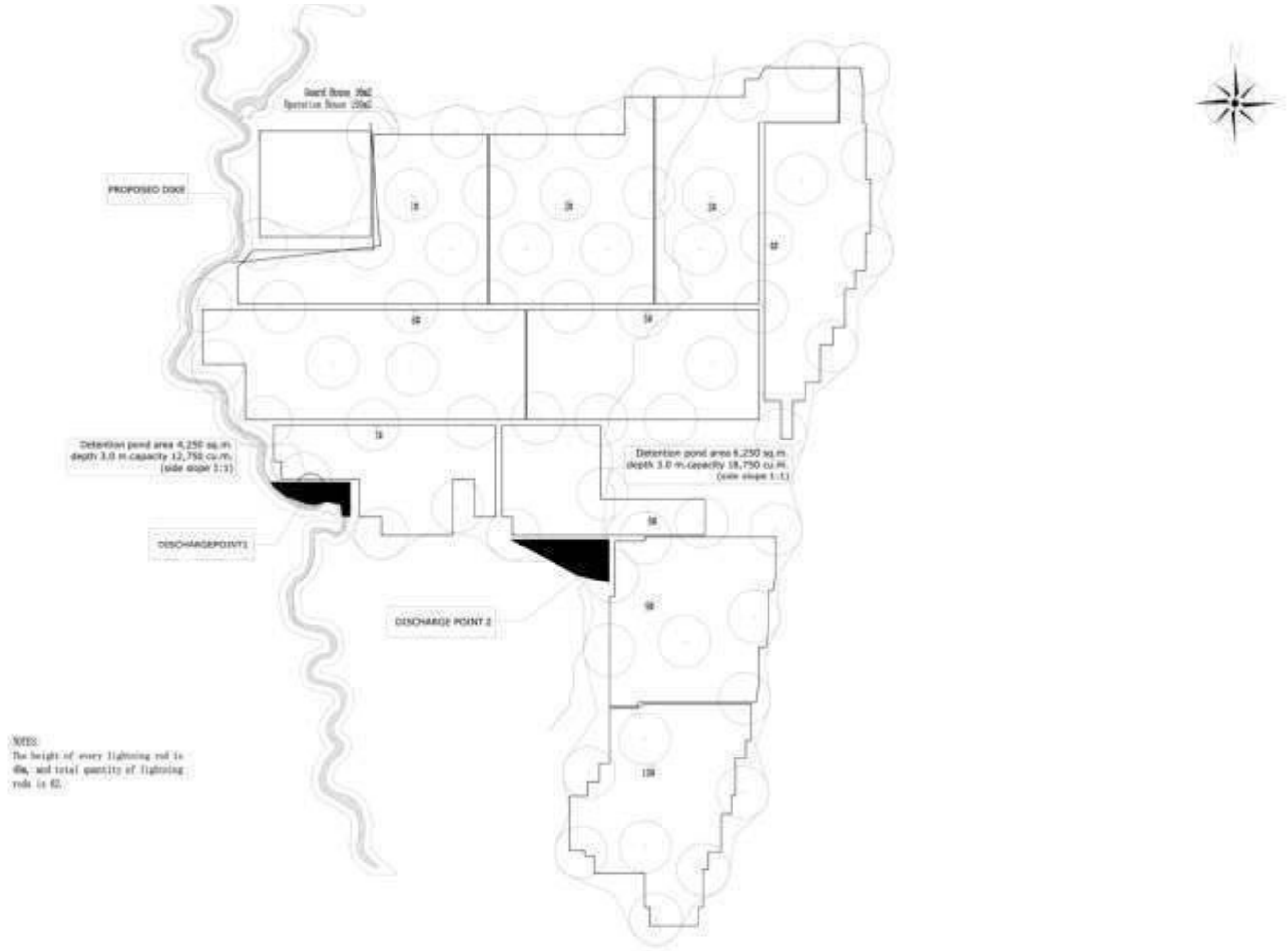




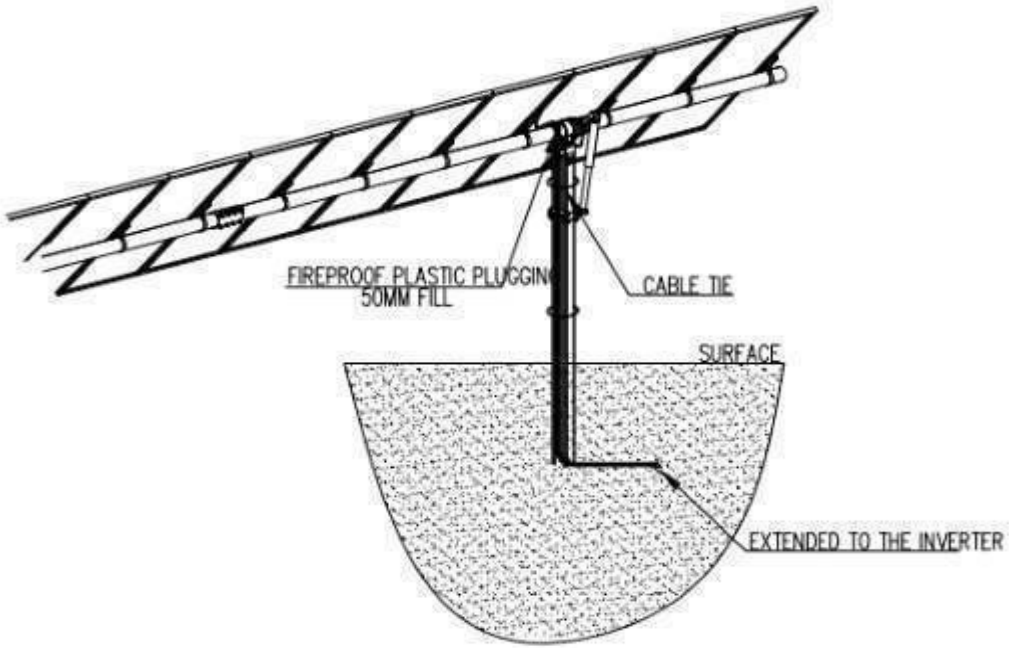




(E) Lighting Protection System

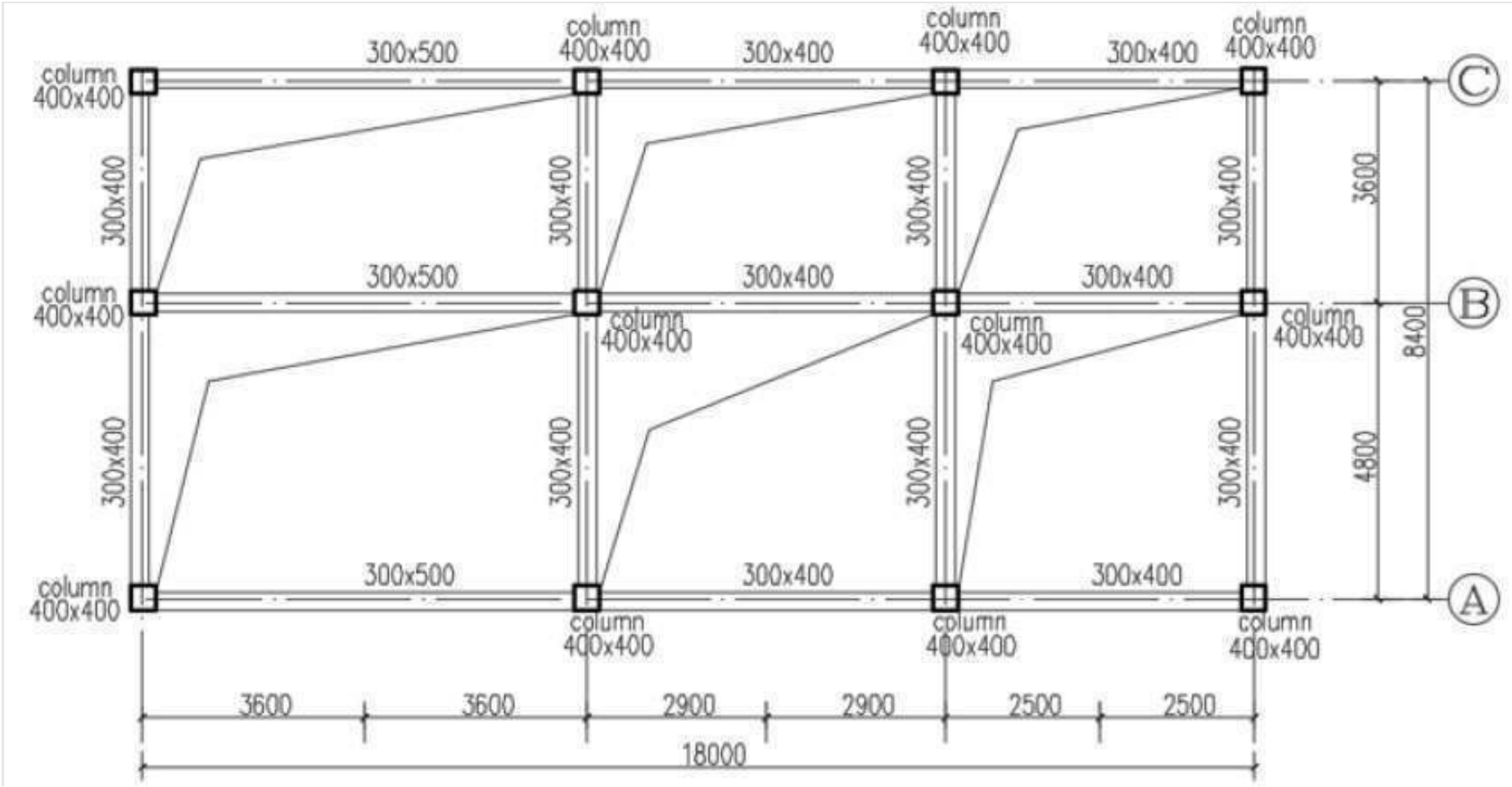


(F) PV Pole

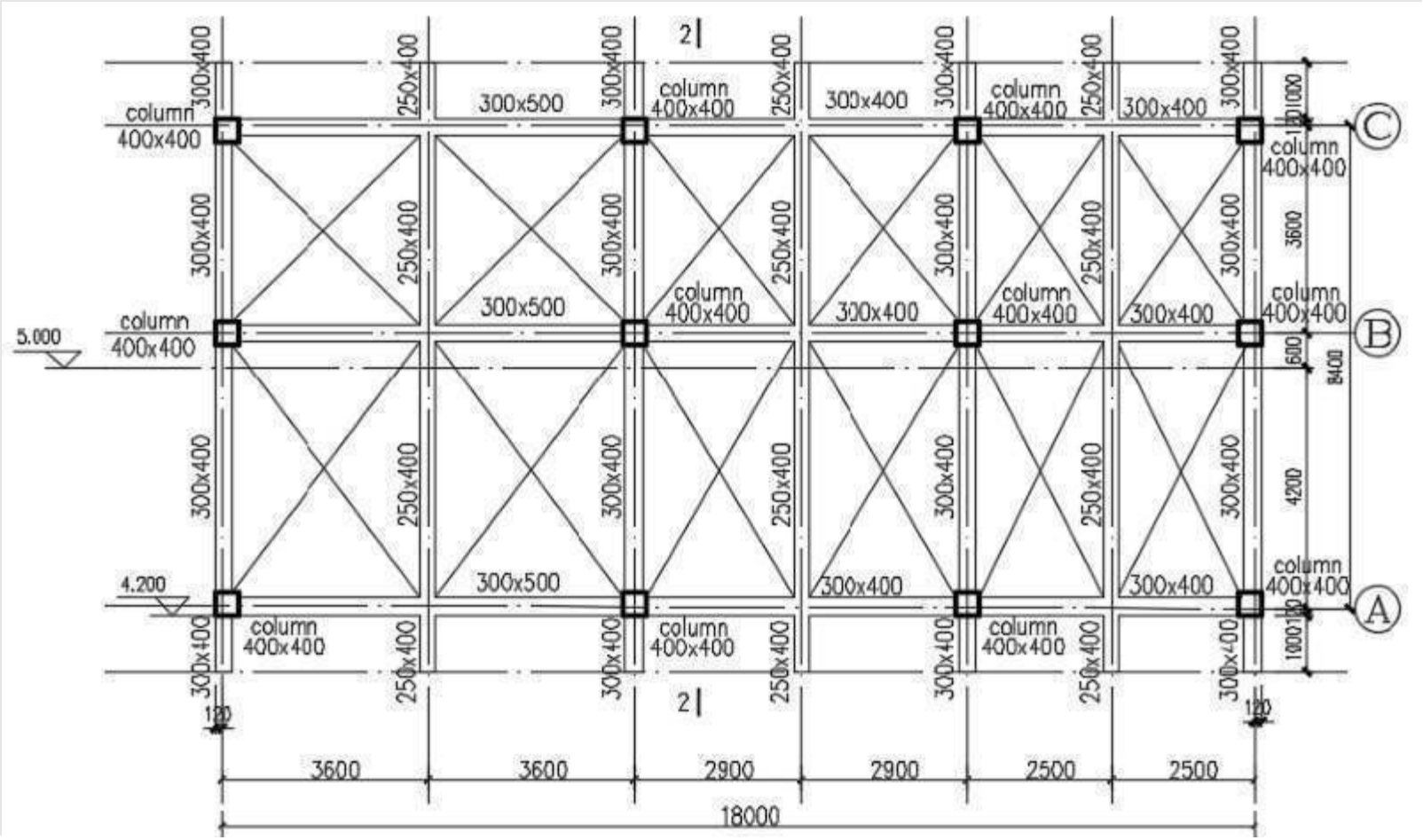


DETAIL 1

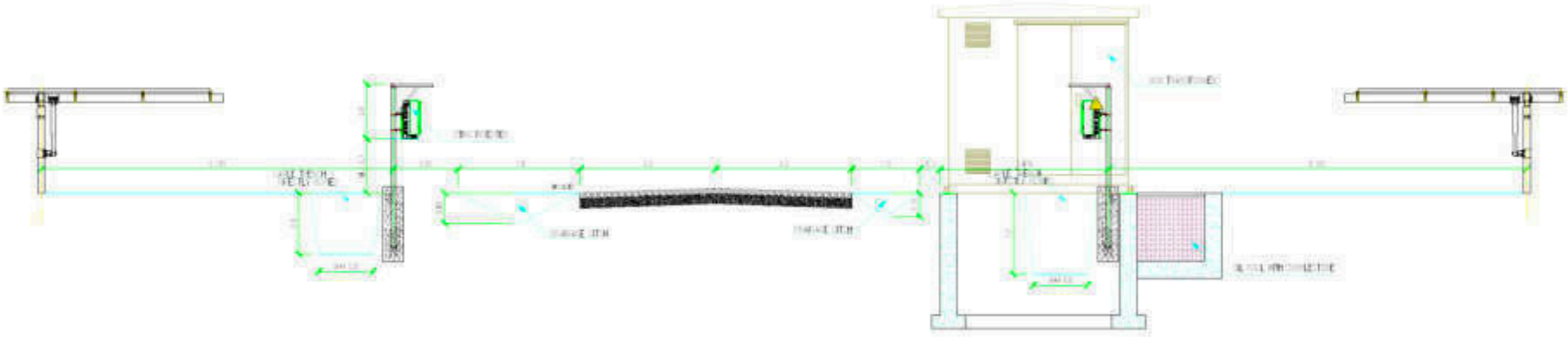
(G) Plan of columns and beams at EL-0.05



(H) Plan of columns and beams at EL-4.20

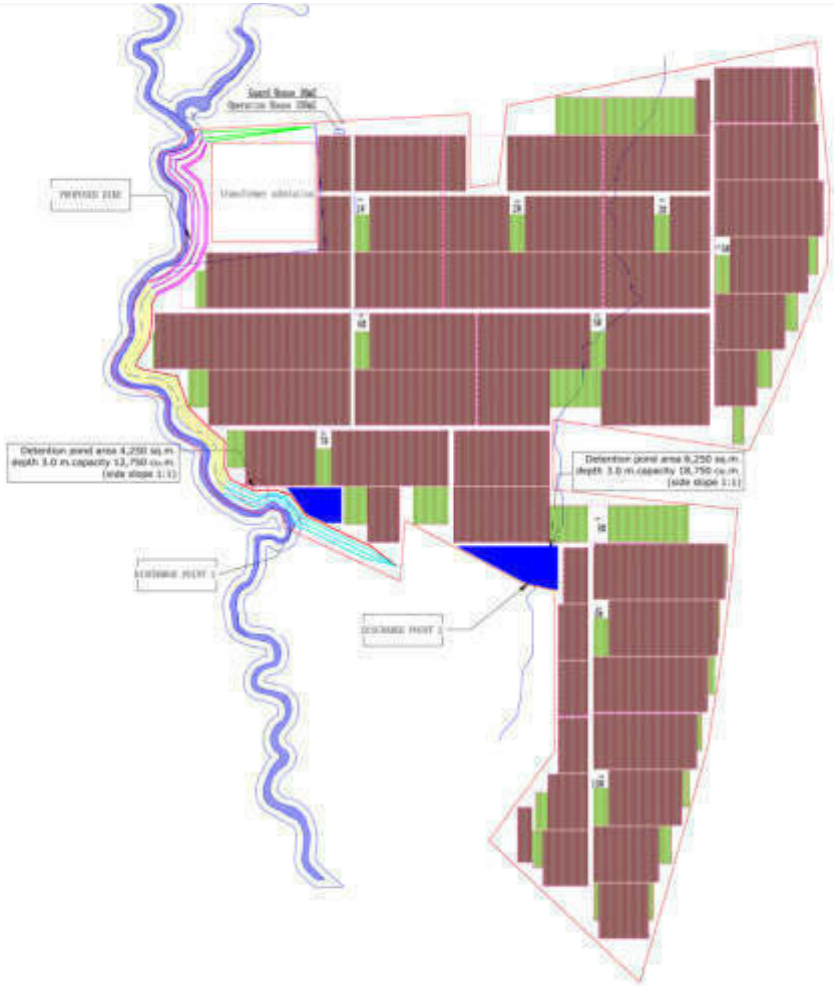


(I) Equipemnt Location



TYPICAL DRAWINGS

(J) Solar PV installed on the park



SYSTEM SUMMARY:

1. THE PROJECT IS LOCATED IN KAMPONG CHHNANG, CHAMKOL ESTATE, AREA 80 HECTARES.

2. THIS PROJECT USES 330Wp MONO PERC PHOTOVOLTAIC MODULE, TOTAL NUMBER OF PV MODULES IS 147252 PCS. TOTAL DC CAPACITY IS 76.843560Wp.

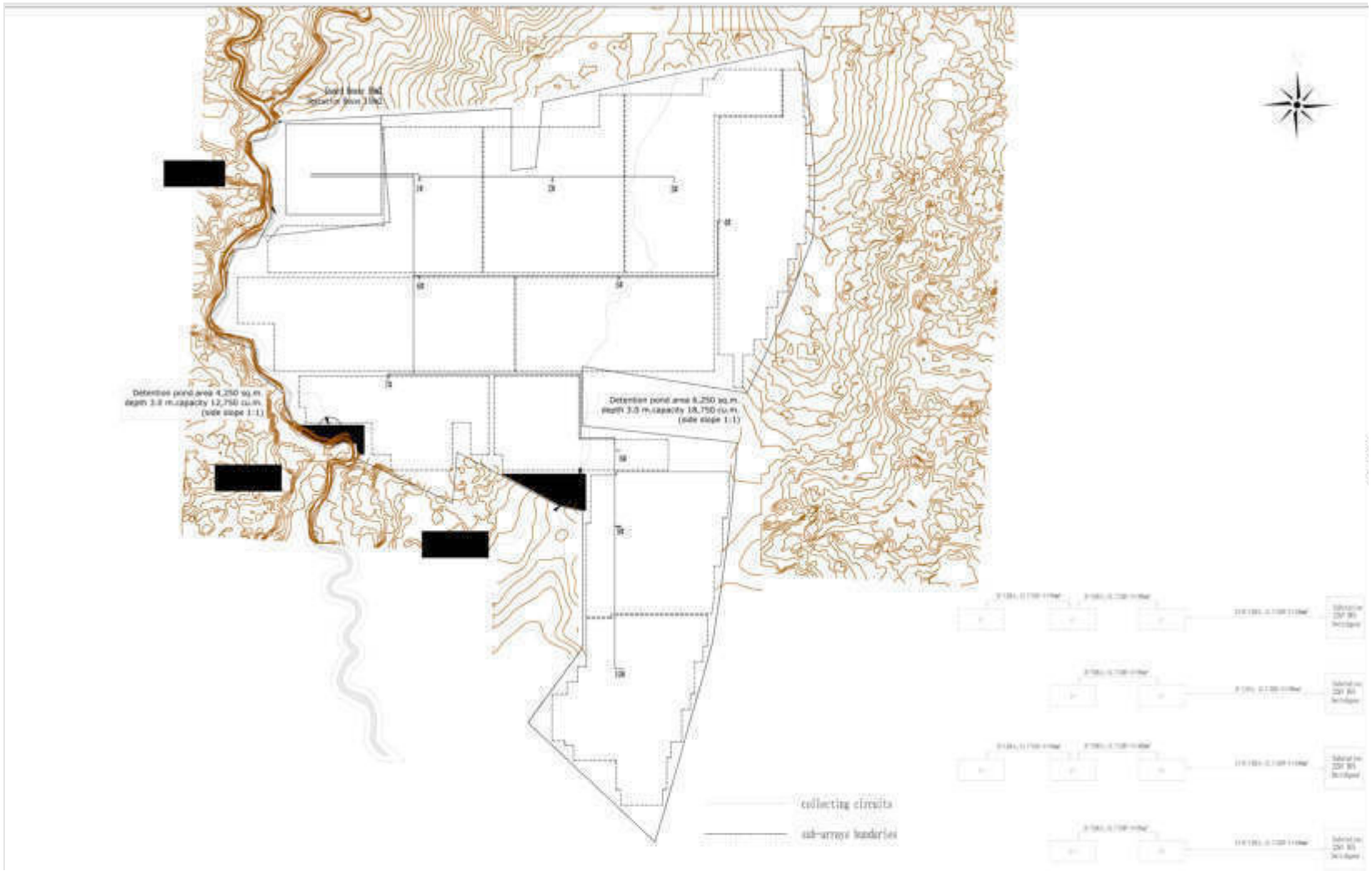
3. THE PROJECT IS COMPOSED OF 10 SUBSYSTEMS, 9 OF THE SUBSYSTEMS HAVE A 6500KVA DOS+TRANSFORMER AND THE OTHER HAS A 3250KVA DOS+TRANSFORMER.
THIS PROJECT USES ABOUT 300 SETS 200KW STRING INVERTER, TOTAL AC CAPACITY IS ABOUT 60MW.

4. THE PROJECT USES HORIZONTAL SINGLE AXIS TRACKING SYSTEM. EACH TABLE CONSISTS OF 2 OR 1 STRINGS.
EACH STRING CONSIST OF 28 PV MODULES IN SERIES. PV ARRAY ON FIXED INCLINACE IS 0° OF 4.5 METERS.

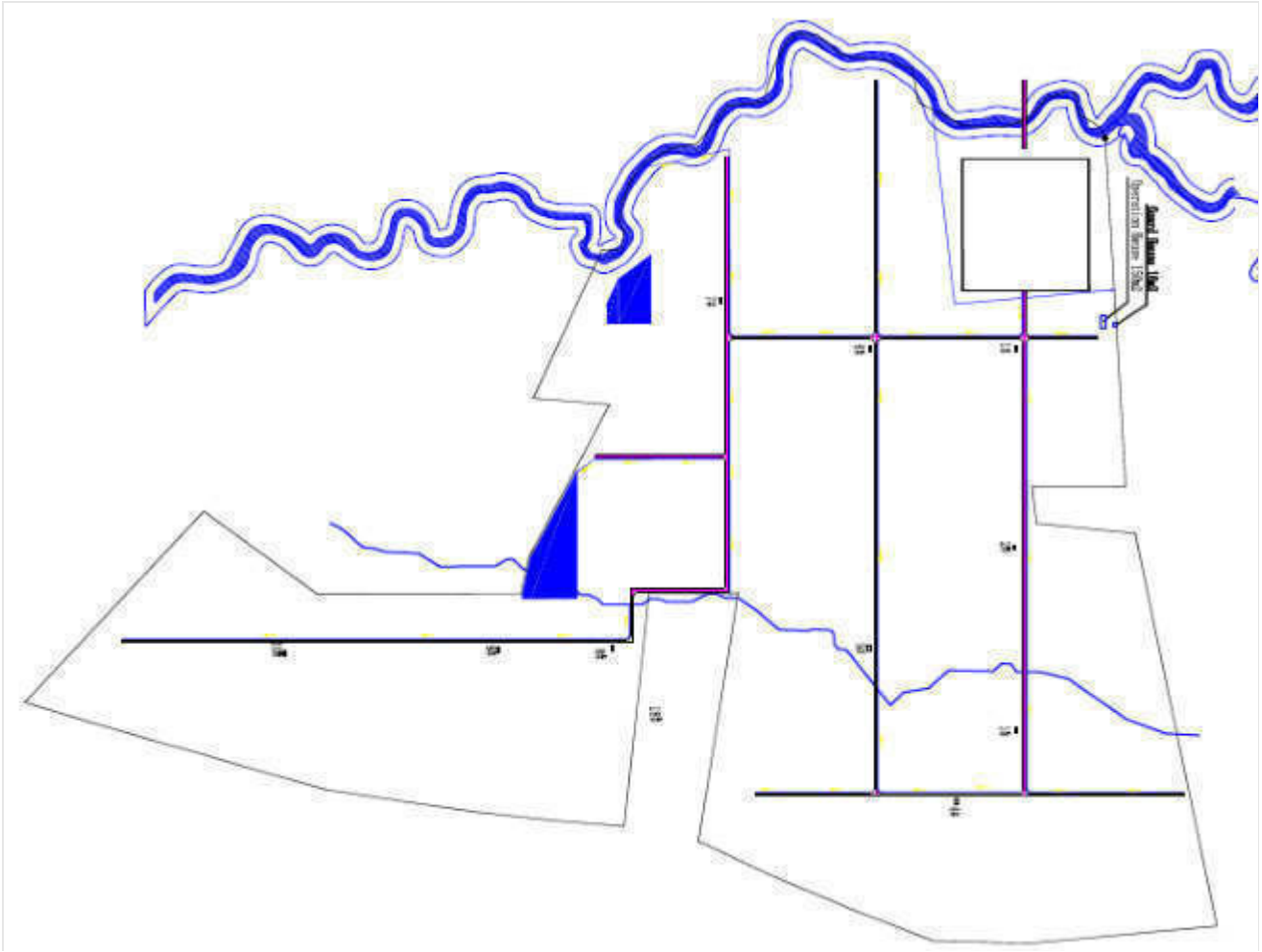
5. TOTALLY 2 WEATHER STATIONS.

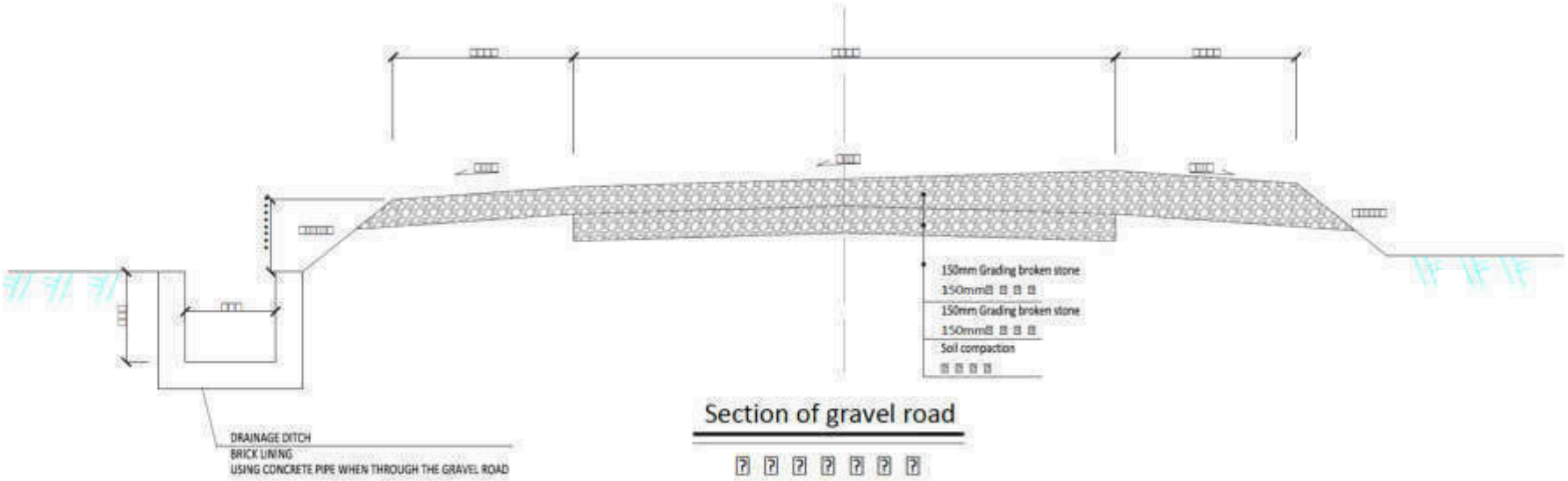
6. ALL DIMENSIONS ARE IN METER.

(K) Cable routing of PV area



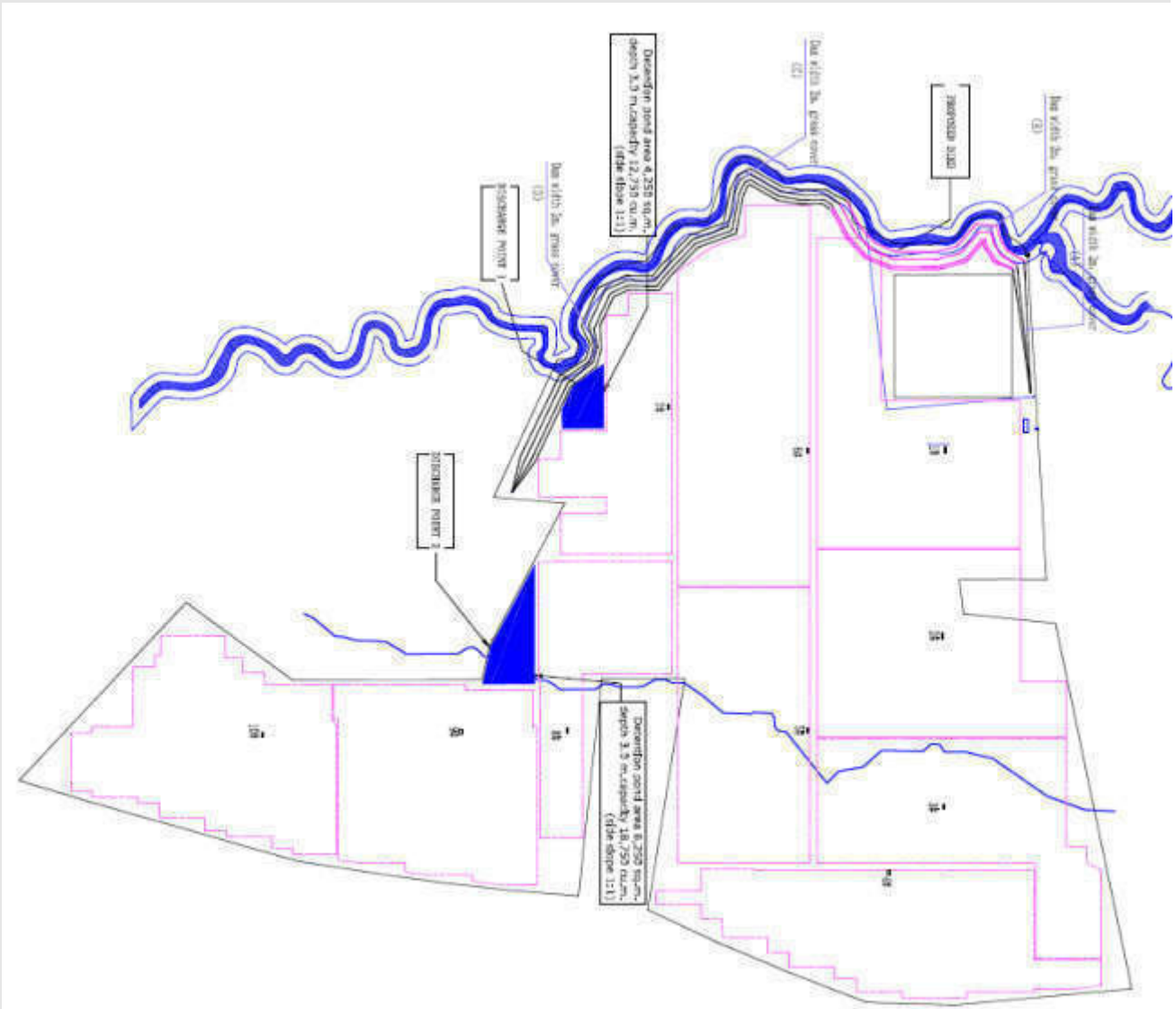
(L) Road system and drainage ditch on site

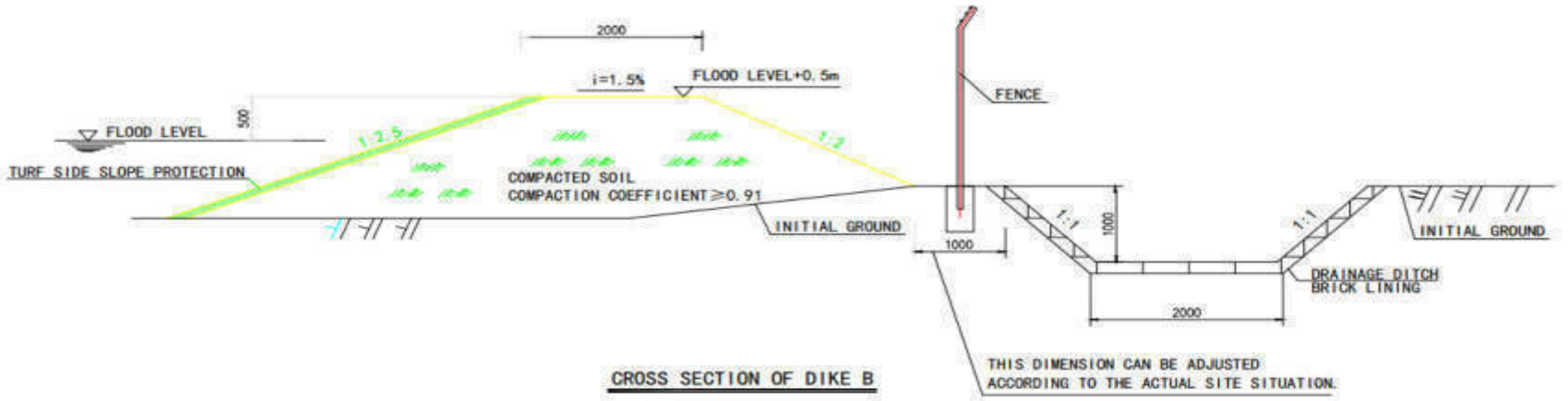




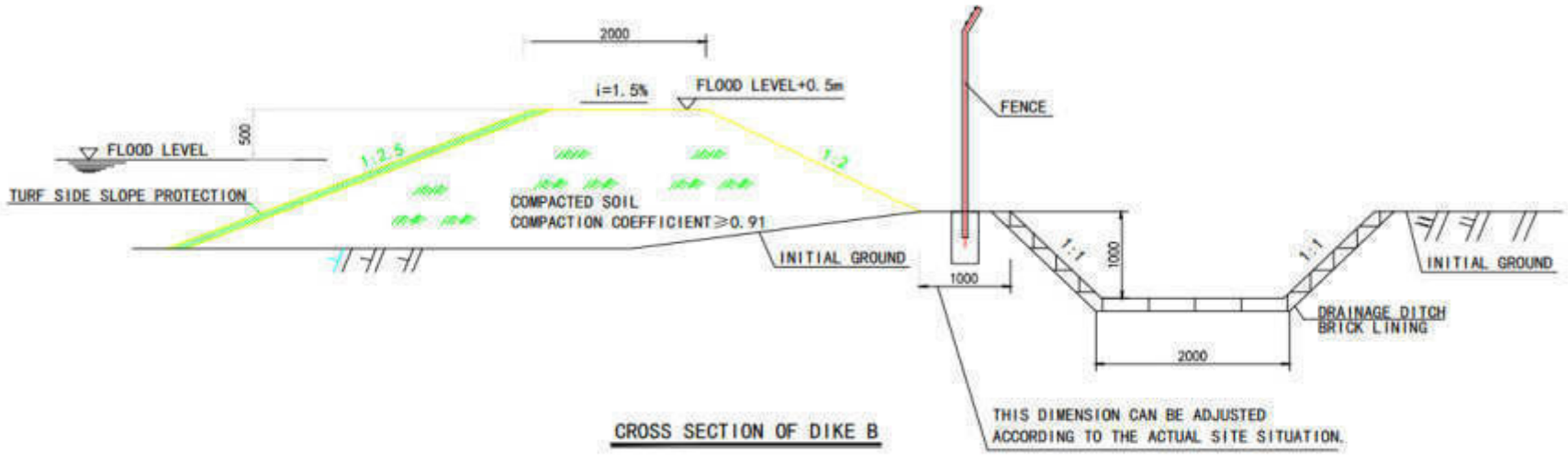
Section of gravel road

(M) Dyke layout



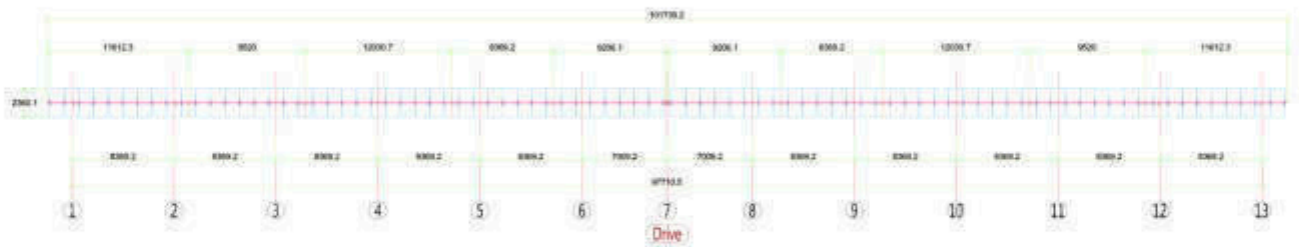


CROSS SECTION OF DIKE B

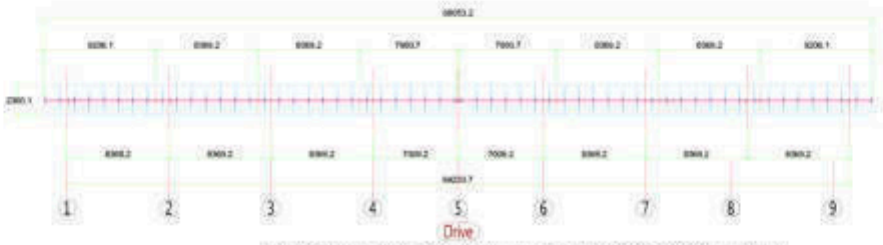


CROSS SECTION OF DIKE B

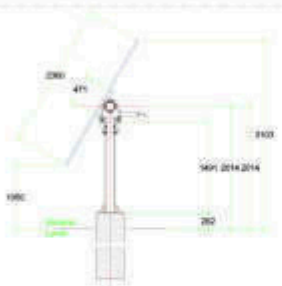
(N) Single Axis Tracker



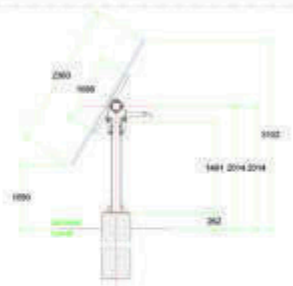
PLAN of EzTracker D1P84 (PV Module: Longi LR5-72HBD-530M 2256*1133*35mm 530Wp)



PLAN of EzTracker D1P56 (PV Module: Longi LR5-72HBD-530M 2256*1133*35mm 530Wp)



SIDE VIEW of EzTracker D1P84
(PV Module: Longi LR5-72HBD-530M 2256*1133*35mm 530Wp)



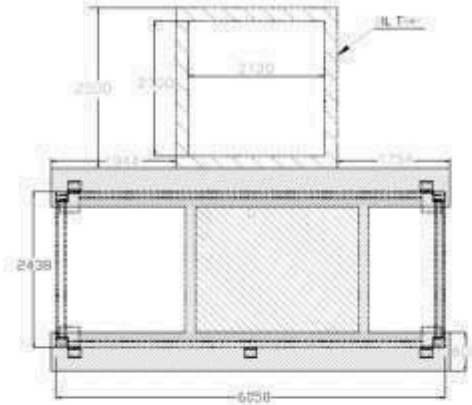
SIDE VIEW of EzTracker D1P56
(PV Module: Longi LR5-72HBD-530M 2256*1133*35mm 530Wp)

NOTES:

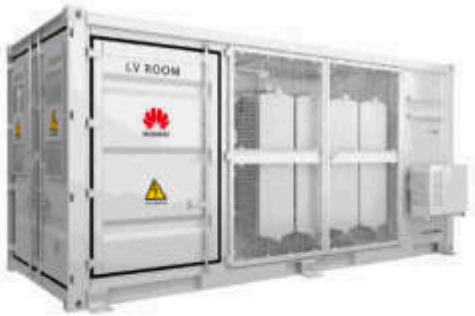
-ORIENTATION:	PORTRAIT
-MODULE ARRANGEMENT:	(1P*84) * 1,643 TABLES (1P*56) * 164 TABLES
-TOTALLY QTY. OF MODULES:	147,196PCS
-TRACKING RANGE:	±60°
-PITCH:	4.5 M
-TOTAL STRINGS:	5,257 STRINGS X 28 PCS/STRING
-DC POWER:	78.013888MWP

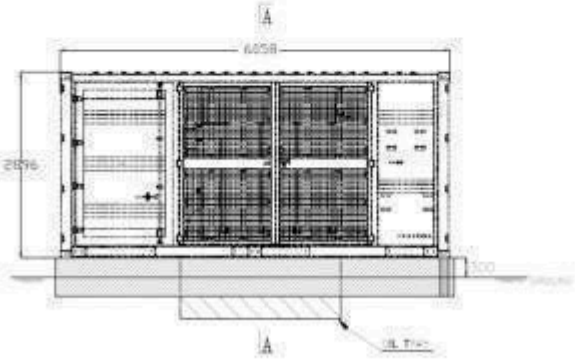
Project design information	
Design criteria	ASCE 7-05
Design wind pressure	30m/s 3s gust, MRI=50Y
Design snow pressure	
Anti corrosion grade	C4

(O) Power station

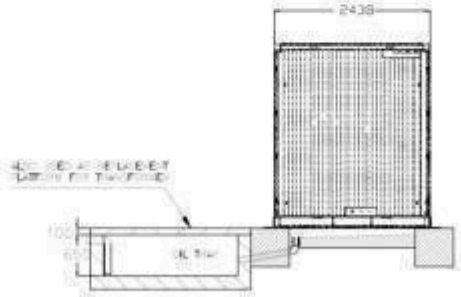


FOUNDATION PLAN OF POWER STATION



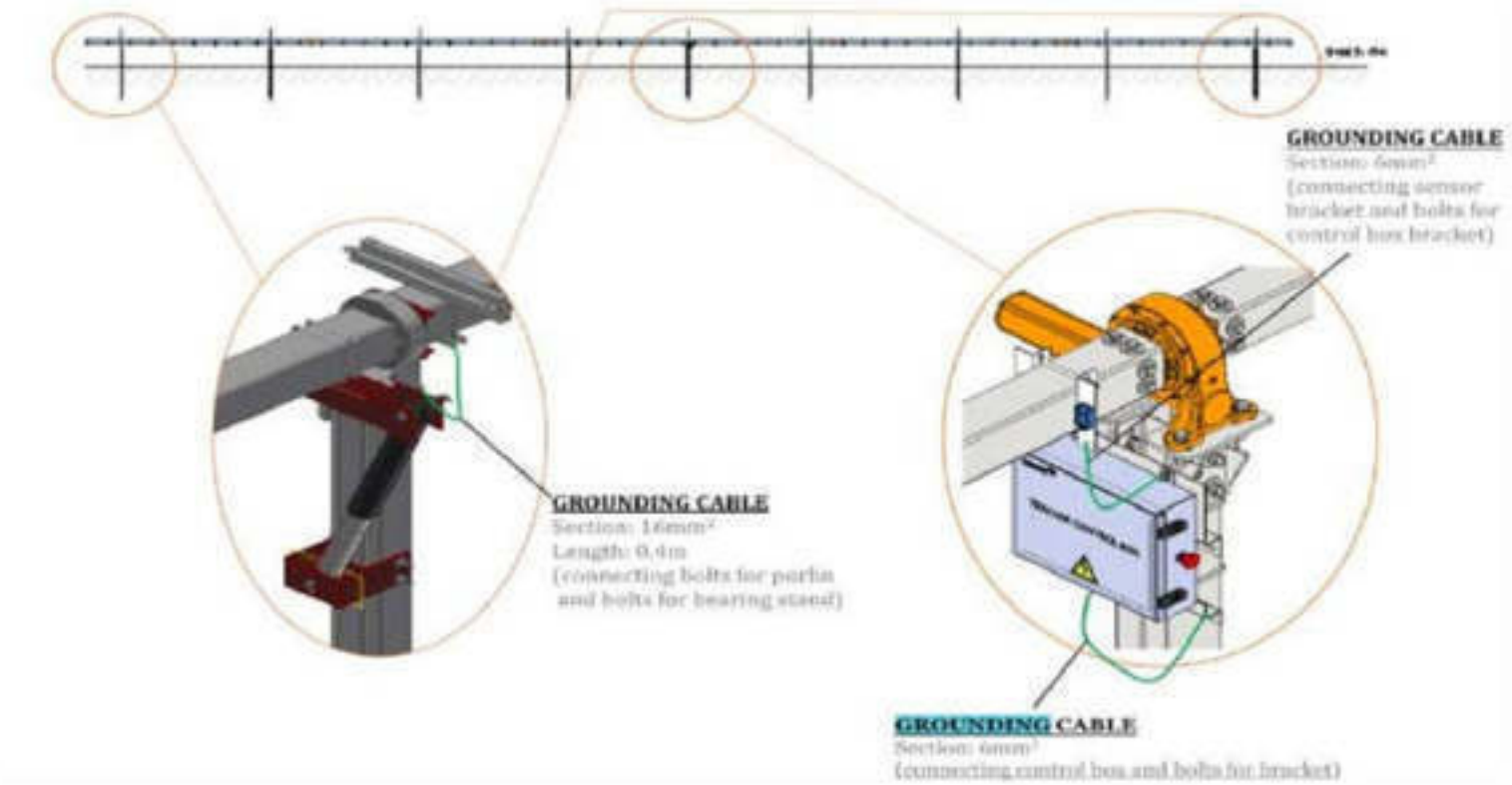


SIDE VIEW OF POWER STATION

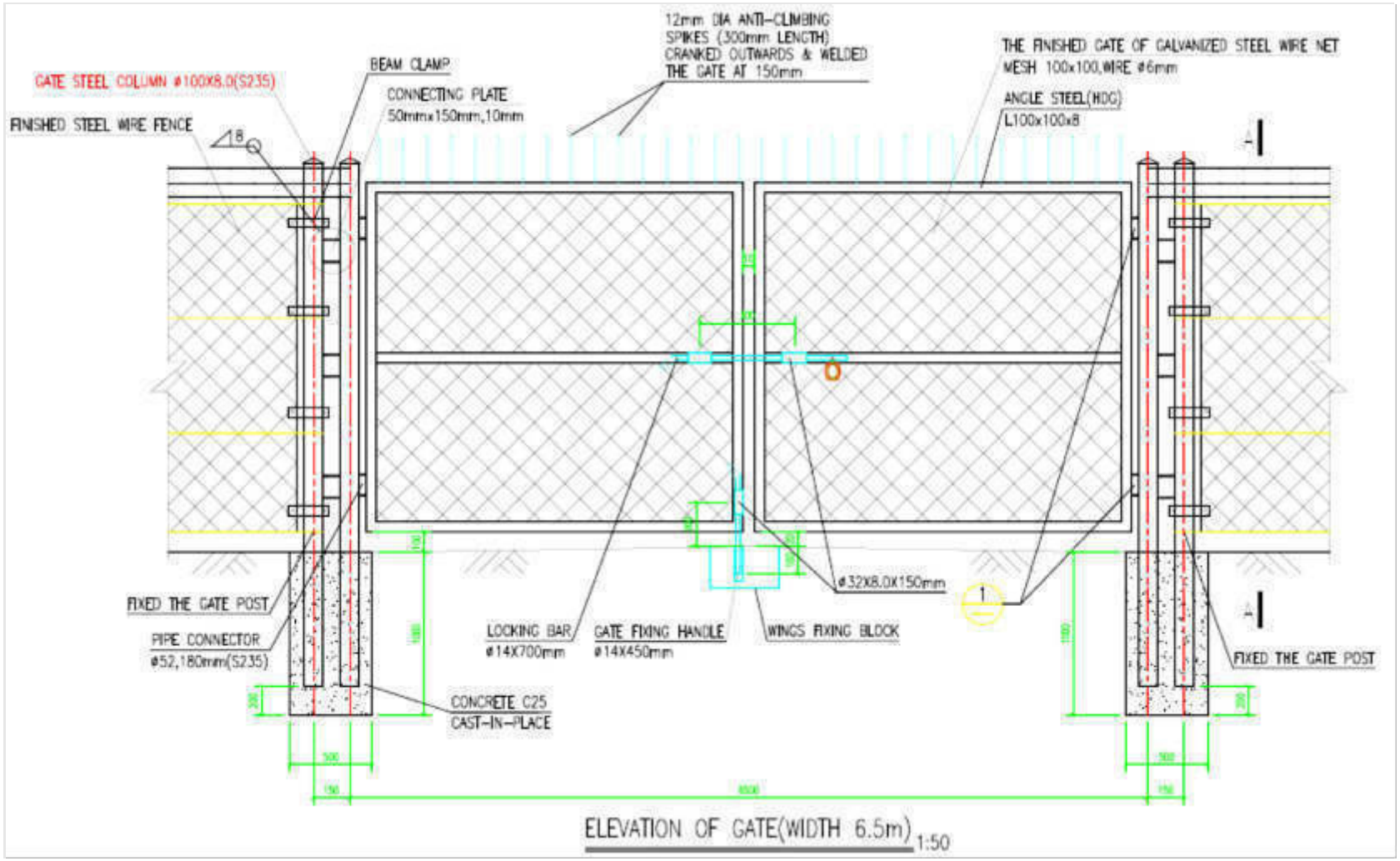


CROSS-SECTION OF POWER STATION

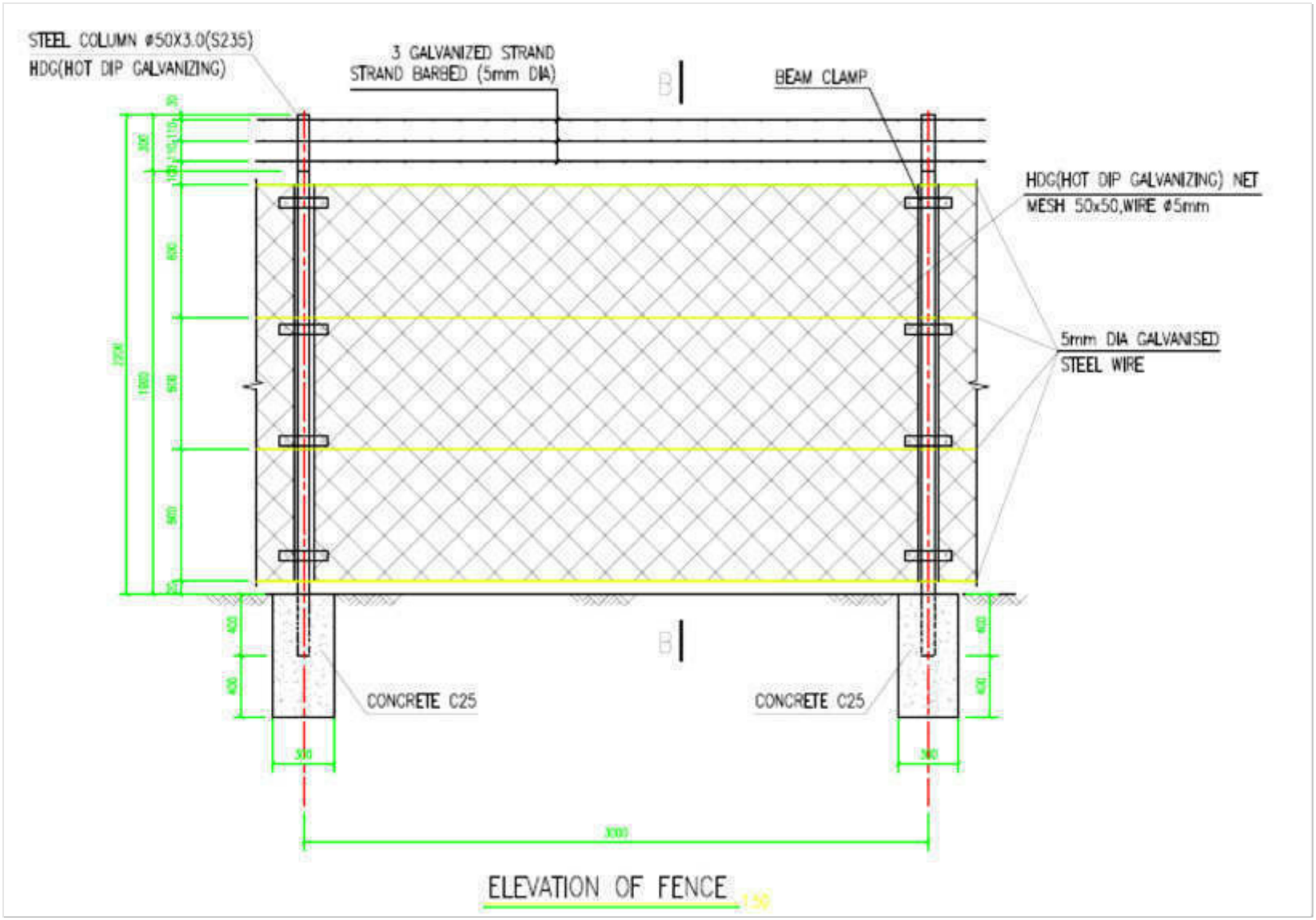
(P) Tracking slewing drive



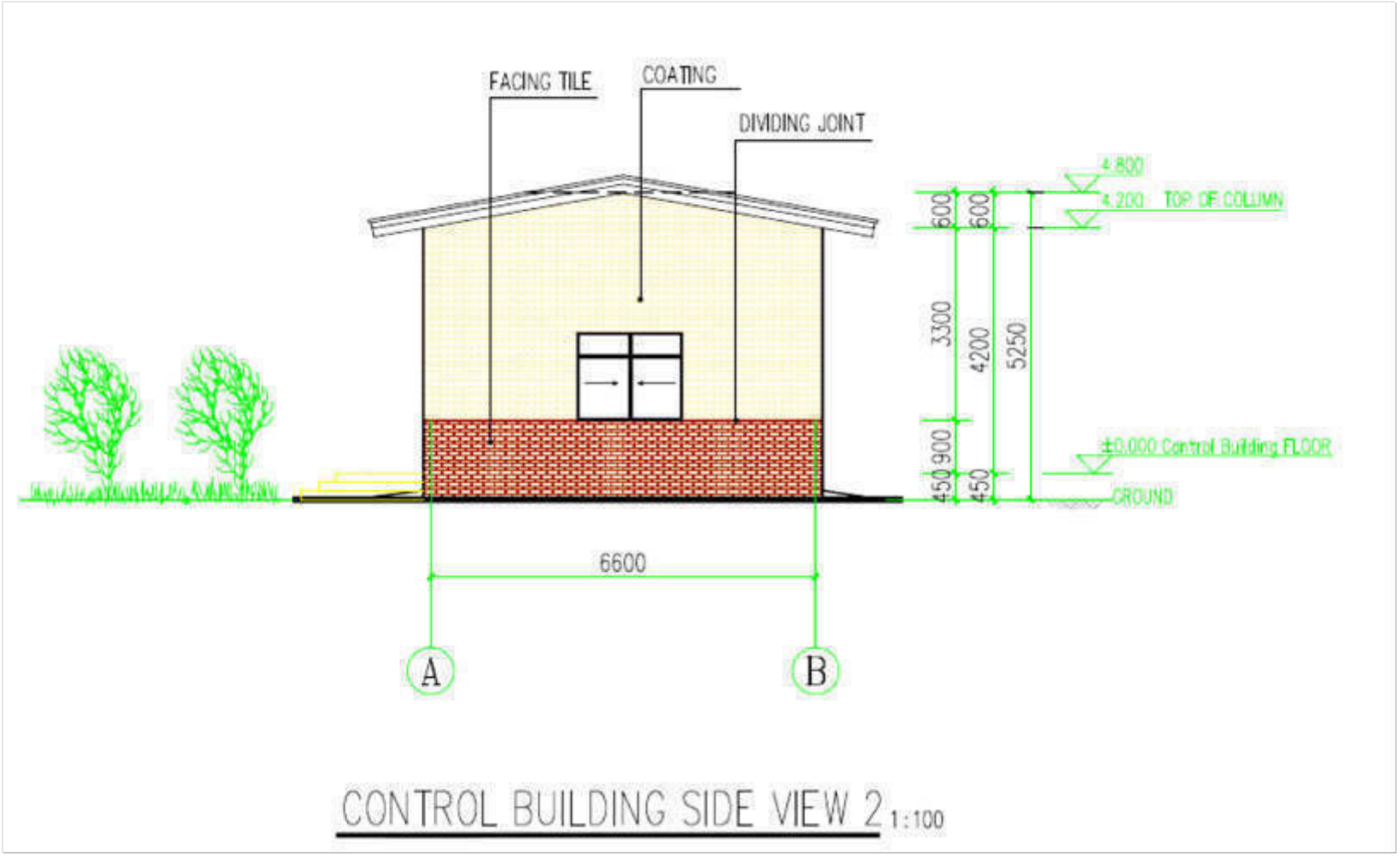
(Q) Entrance Gate



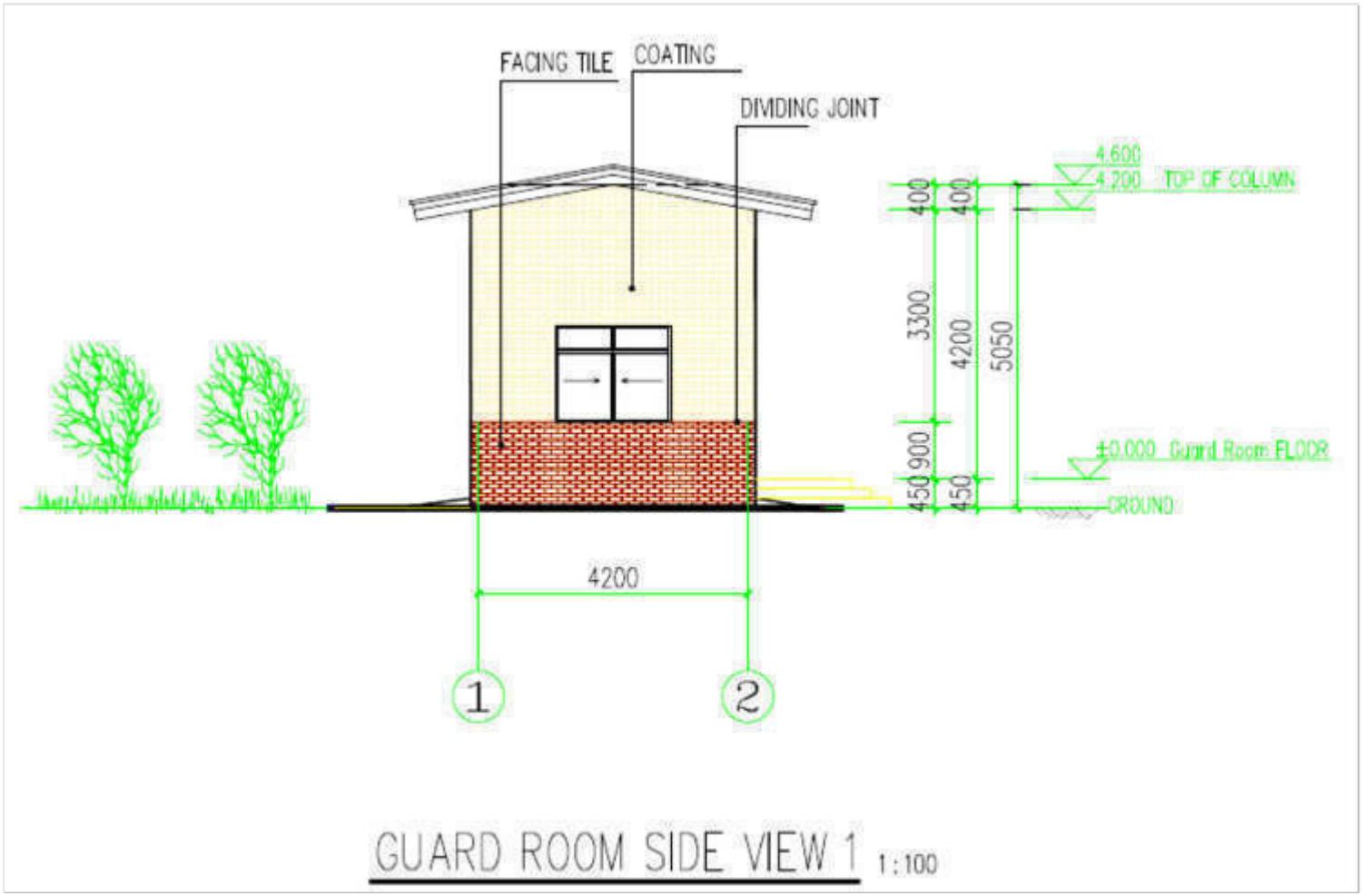
(R) Fence


STEEL COLUMN ø50X3.0(S235)
HDG(HOT DIP GALVANIZING)
3 GALVANIZED STRAND
STRAND BARBED (5mm DIA)
BEAM CLAMP
HDG(HOT DIP GALVANIZING) NET
MESH 50x50,WIRE ø5mm
5mm DIA GALVANISED
STEEL WIRE
CONCRETE C25
CONCRETE C25
ELEVATION OF FENCE

(S) Control Room



(T) Guard Room



GUARD ROOM SIDE VIEW 1 1:100

3.5.3 Plots sizing and capacity options

89. The land requirements have been defined to provide the PRAC with sufficient land to optimize the potential plant configurations for the cheapest energy price possible. The following plant parameters were used to define land size:

- DC/AC ratio between nominal output power of solar modules (DC) and solar inverters (AC)
- Distance between the rows and tilt (for fixed-tilt mounting systems)
- Ground Cover Ratio (GCR) for single-axis tracked systems
- Module wattage

90. In consideration of the above, the area requirements have been defined. They have been conservatively determined to provide enough room to PRAC for optimizing the above listed parameters.

3.5.4 Stormwater management and drainage

91. Topographic, hydrological and geotechnical reports are included as appendices.

92. Utilizing the abovementioned studies, the 60 MW solar project will be equipped with the:

1. Flood protection system to prevent overflowing water from the stream at the western side of the 60 MW solar plant project.
2. Internal drainage system for the internal water catchment, collection from all areas and conveying into the retention pond.
3. Retention pond and discharge channel, the collected water is retained until the water reach certain limit and therefore safely discharge to the external water channel can be done through the discharge channel.

93. One main drainage canal will be constructed as part of the whole solar park infrastructure to provide an adequate drainage system for the PV site. It will be heading southwards through the centre of the site. The length of this canal depicted in the canal layout (see Figure above (K, L)). The PRAC will construct internal drainage system to mitigate flood hazards, using the main canal for water evacuation. Retention ponds to retain the water collect internally inside the 60 MW solar plant project before safely release to the discharge point which leads to the reservoir located south of the National Solar Park. The water collected in the retention pond also can be filtered and purified for the cleaning the solar panels if it is required.

3.5.5 Amenities and facilities

94. For water sourcing, PRAC will have to find their way to source water for solar panel´s cleaning. There is already a water reservoir at site which can be reinforced and used to store water for panels cleaning. PRAC will dig bore holes in solar plant and will extract water for 6-8m3/day for construction and 13m3/day for workers' consumption. During the operation, 170-200m3/month will be required for panel cleaning and 0.5 m3/day for domestic uses. In combination with the ponds, water sources are plenty for the project.

95. Underground water and river water quality have been analysed to design and build

any water catchment and treatment system necessary for providing water suitable for the module cleaning process.

3.6.5 Proposed land use and preparation

96. The break-down of the indicative land use below is calculated for a 60 MW fixed-tilt (with 1.2 ha/MW, 1.3 DC/AC ratio) and a 60 MW single-axis tracked system (with 2 ha/MW, 1.3 DC/AC ratio) of non-rectangular shape. For a fixed-tilt system, the numbers are different as the mounting structure can be adapted more cost-efficiently to irregular shapes.[40]

97. Within the 97 hectares of land for the implementation of 60 MW solar plant under National Solar park which EDC will lease to the PRAC during the entire of Power purchase agreement period, project's land will be utilized accordingly to below table.

Table 4: Break-down of proposed land use for a fixed-tilt system (60 MW solar plant)

Description	Area in hectares	Area in percentage (%)
Buildings and fencing (fence and space between boundary and plant components)	5 ha	5 %
Internal roads and parking area	3 ha	3 %
PV plant components (inverters, transformers, modules, mounting structures, space between tracking tables)	88 ha	91 %
Drainage systems and Retention pond	1 ha	1 %
Total area of 60 MW solar plant under National solar park	97 ha	100 %

98. PRAC will only be responsible for land preparation for the proposed solar plant. Site clearance works are not expected to be intensive.

99. As part of the Scope of Work, PRAC will provide the fencing and security systems for the 60 MW solar plant project according to the conceptual engineering design above.

3.6.6 Construction and logistics for PV power plants

100. The construction of the PV power plant will require access for heavy-duty transport for the equipment, infrastructure and housing for the construction workers and engineers as well as access to electricity and water, as elaborated in following table.

Table 5: Construction and logistics

Category	Description
Access road(s) to 60MW solar plant (impact study is being conducted by a separate package)	Access roads (a shared facility) to 60MW solar plant must provide an uninterrupted connection from the nearest logistical hub (international port or major inland port) with a height and width required for the

[40] The reason is that motors for tracked systems are dimensioned for specific table lengths. Adapting too many tracker tables to the irregular shape of the power plant area will lead to over-dimensioning of overall motor capacity installed and hence higher relative costs.

	largest plant components - typically heavy-duty transport for the substation transformers. If required, a transportation study will have to be conducted.
Water, electricity and fuel(s)	The civil works require water of a certain quality and amount for the foundations of mounting structures, inverter and transformer stations and substations. Equally, access to electricity and/or fuel(s) for construction vehicles and generators is required. Under ground water will be extracted for construction and for cleaning solar PV during the operation phases.
Human resources during construction and operation phase	Locally sourced staff (197 personnel in Construction Phase) is required for construction, security, cleaning and regular maintenance activities. Local legal experts are required for the contracting and permitting processes. Specialized staff e.g. for detailed design, procurement, legal work packages, construction supervision, inspections, remote plant operation and asset management to be sourced nationally (if possible) or internationally. There will be 57 personnel in Operation phase.
Housing, sanitation and offices a) provisional facilities during construction period b) permanent facilities during operation phase	Housing for construction site workers and for engineering staff for construction supervision is required depending on available local accommodation options. Temporary accommodation for specialized staff for site visits, commissioning, testing and inspection missions and temporary offices in addition to accommodation. On-site temporary housing which is 400m from waterways
Communication	Access to communication infrastructure (internet, network connection for cell phones)

3.6 Climate Risks Adaptation

101. The project is classified as being at medium risk from future climate change impacts. The project design includes climate change adaptation measures for the solar plant infrastructure. Measures include: site level drainage provisions, constructing a storm water retention pond, road pavement and raising embankment height of access roads to the solar plant site. These key climate vulnerable components are analysed based on the detailed engineering design to adapt to climate.

3.7 Project Implementation

3.7.1 Land purchase

102. Land purchase. At the time of preparation of this SEIA, PRAC has leased 97 ha of land that EDC's purchased from the land owners in the area. All transactions related to land purchase for the National Solar Park were undertaken by EDC with landowners based on willing buyer willing seller procedures at market rates. A separate due diligence on purchasing land was conducted by a third party and report was submitted to lenders for review. The land

leased to PRAC was not compulsorily acquired by EDC (see chapter 6).

3.7.2 Project Labor

Table 6: Project's labor required

Type of Work	Number of worker	Type of Jobs	Work Hours	Days of work per year
Construction Phase				
Civil Jobs	72	fulltime	8	90
Installation Jobs	74	fulltime	8	100
Electrical Jobs	51	fulltime	8	40
Operation Phase				
Management	15	fulltime	8	365
Cleaning	12	fulltime	8	60
Grass Cutting	30	fulltime	8	40

3.7.3 Implementation Schedule

103. The project is scheduled for completion within 30 months from the loan effective date. The overall project implementation schedule for design and construction is presented in Figure 10. And the detail work plan is presented in Table 13.

Figure 2: Overall schedule for 60MW solar plant construction

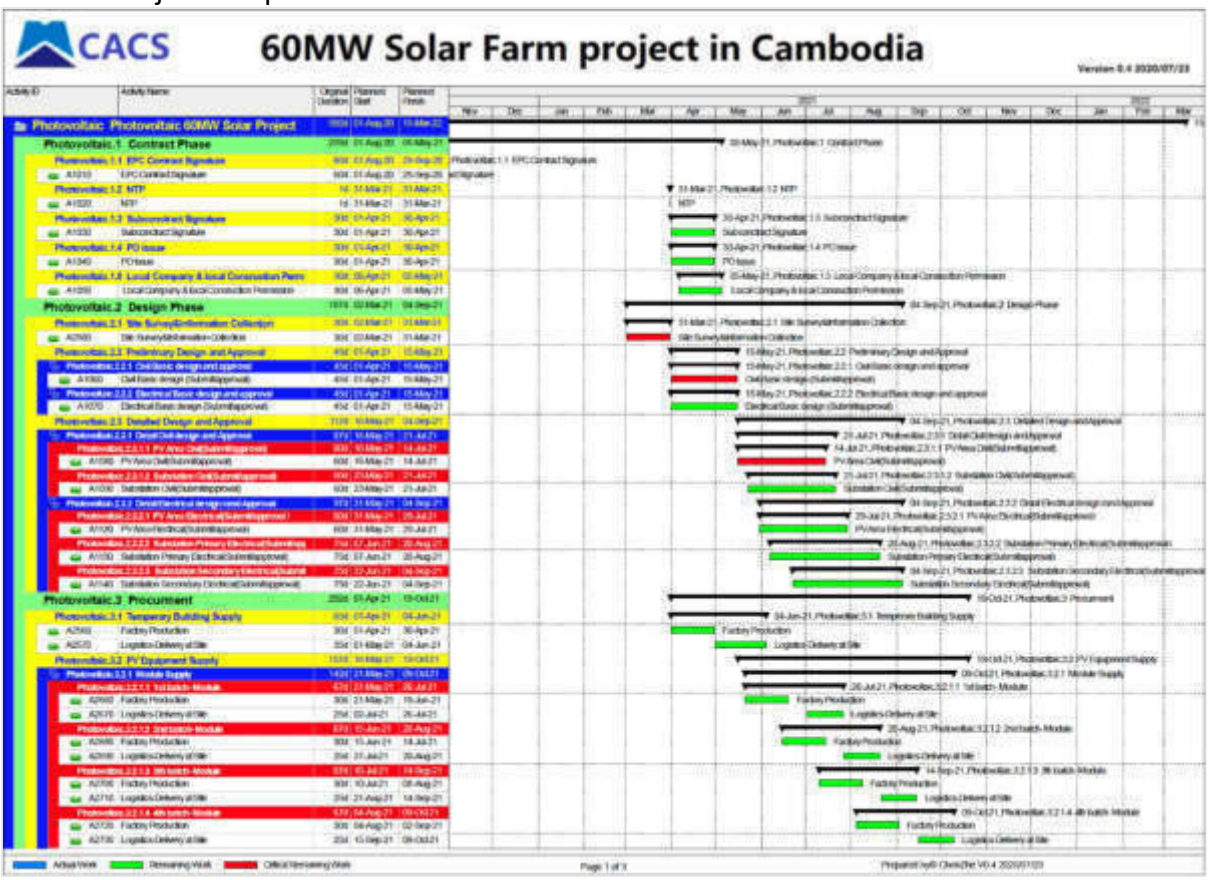
104. The implementation of 60 MW solar plant can be categorized in 3 distinctive phases including Development, Construction and Operation.

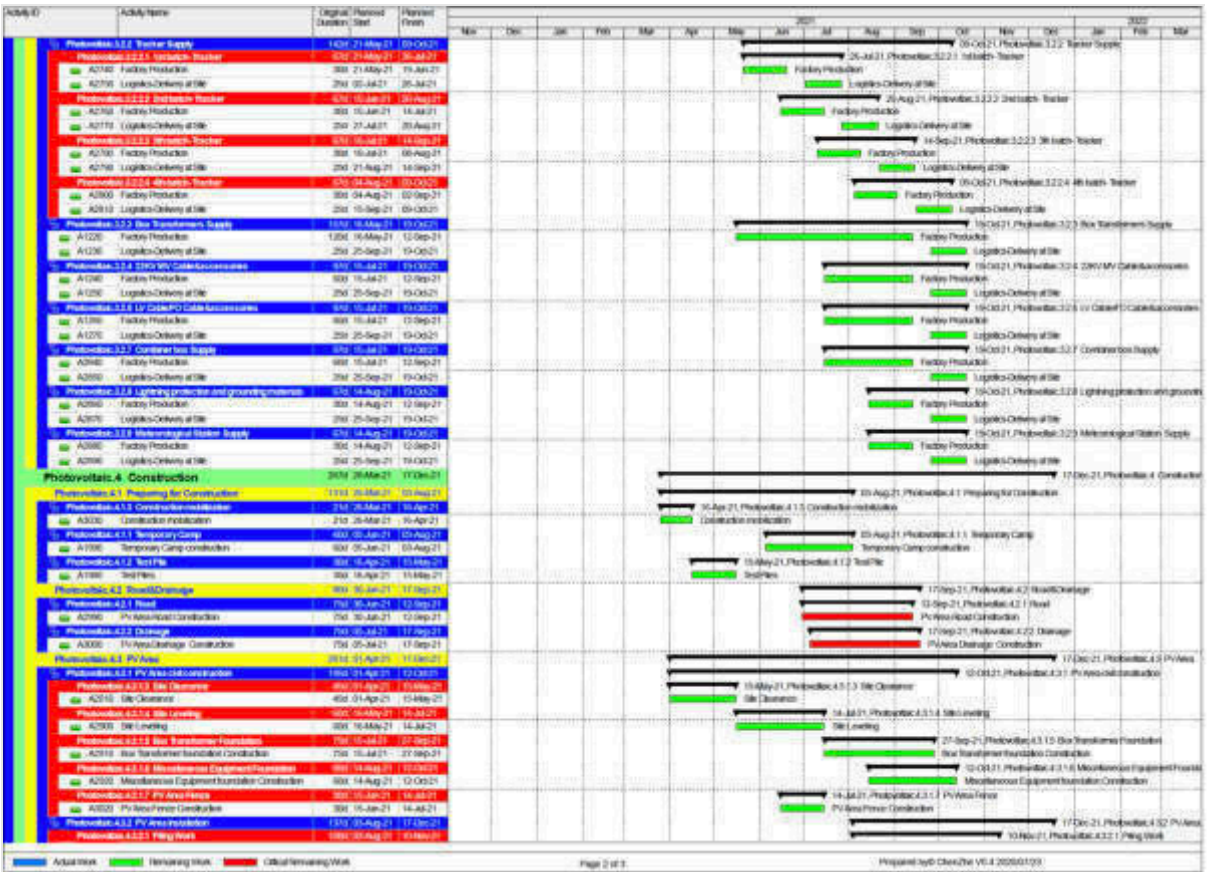
- Development phase starts right after the signing of Power purchase agreement (PPA) until the Schedule Effective date of PPA. During this period, Borrower acquires permits and licenses, securing financing and preparation on various aspects such as engineering design and relevant project agreements including Engineering, Procurement and Construction contract.
- Construction phase commences after the conditions for Schedule Effective Date are fulfilled and EDC has provided an approval on the construction plan submitted by the Borrower. The Construction is currently expected to start in March 2021 and finish in

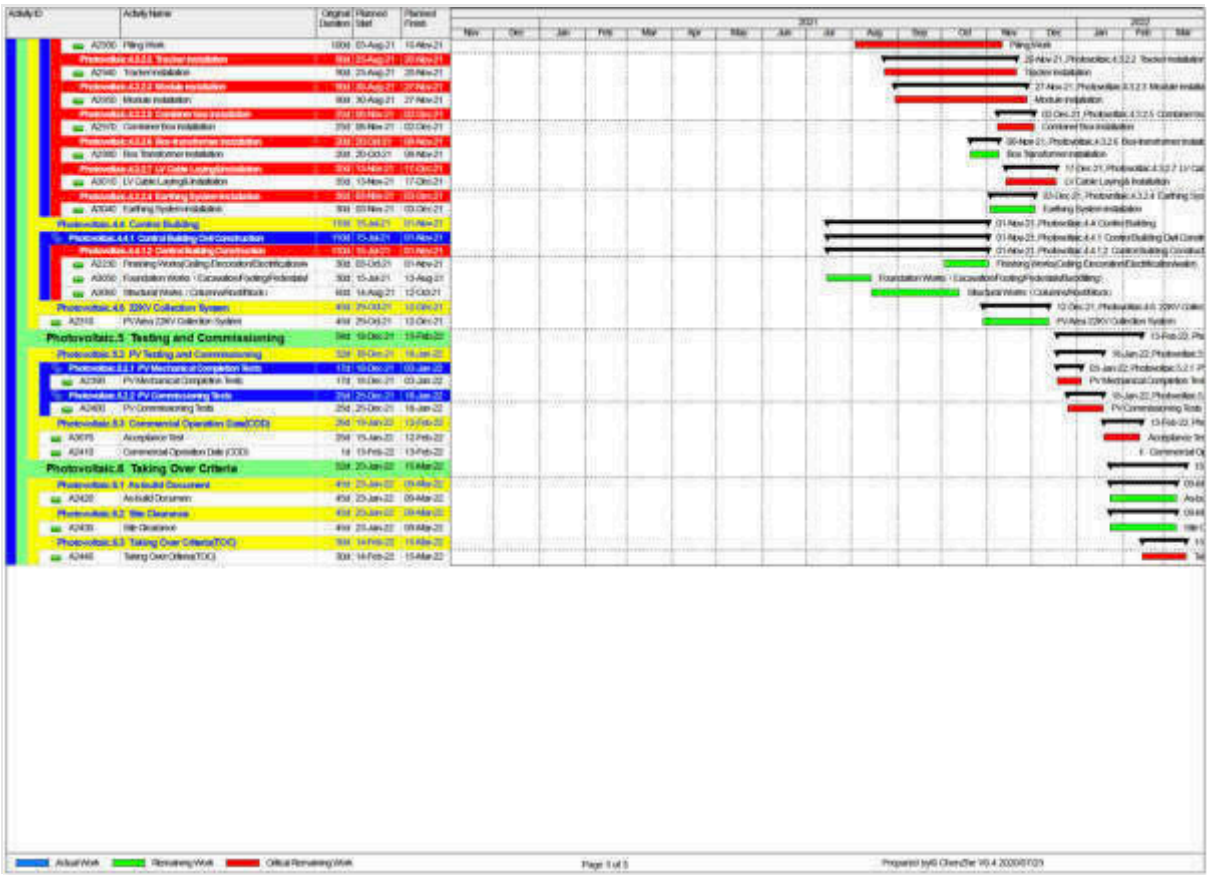
May 2022 before starting of commercial operation date which has the deadline on June 2022.

- The Operational period starts right after the completion of commercial operation date until following 20 years when decommission is required according to the detail in the current draft of land lease agreement

Table 7: Project's implementation timeline







3.7.4 Project Organizational Structure

105. PRAC will be the responsible for project implementation and compliance of 60MW with lenders through EDC's Project Implementation Consultant (PIC). In so doing, PRAC, as an IPP in phase 1 of NSP, will establish its own Project Management Office (PMO) to handle day-to-day coordination with EDC's PIC. The PRAC's PMO will consist of Social and Environmental Compliance Unit (SECU), Engineering and Construction Unit (ECU), and Operation and Maintenance Unit (OMU). Under the leadership of PRAC's PMO, SECU will coordinate with EDC's PIC to ensure 60MW solar plant comply with social and environmental safeguards of lenders (ADB/IFC) and with ensure consistency of all safeguards documents with government policy, legal and administrative framework. SECU will monitoring the implementation of the 60MW solar plant's ESMP. The organization structure of PRAC, as an IPP, is presented in Figure 11.

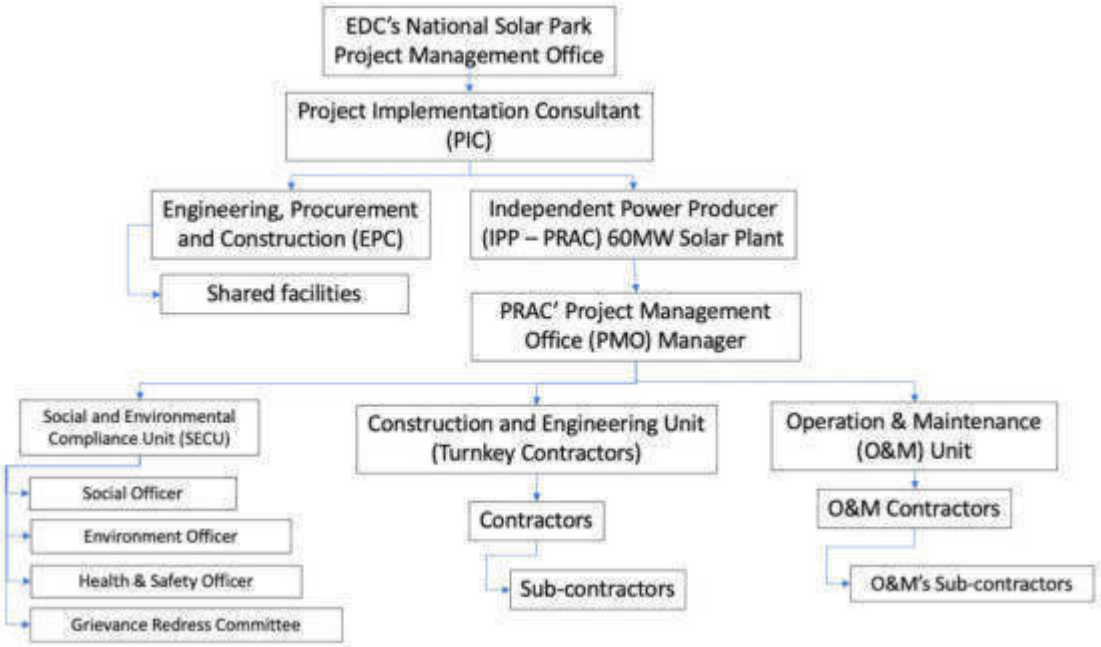


Figure 3: Organizational structure to implement 60MW solar plant, and monitoring its ESMP

106. PRAC will own, operate and maintain its 60 MW solar plant within EDC's National Solar Park. The following staff and positions will be employed

Table 8: Staff arrangement

No	Positions	Qauntity	Recruitment
1	Station Manager	1	To be sent from China
2	Operations Team Leader	1	To be sent from China or locally recruited
3	Operator	1	Locally recruited
4	Maintenance Team Leader	1	To be sent from China or locally recruited
5	Repairer	1	Locally recruited
6	Security guard	2	Locally recruited
7	Driver	1	Locally recruited
8	Chef & Cleaner	1	Locally recruited
	Total	9	

3.8 Project maintenance and monitoring

107. The operation analysis mainly focus on conducting monthly, quarterly and annual operation analysis and reporting of the photo-voltaic power station within a specified time for the actual operation situation of photovoltaic power station modules and electric transmission and transformation equipment as well as the completion situation of the production task. The report shall analyze and compare the equipment's operation situation, power grid situation, sunlight exposure change situation and production task completion situation in combination with reports of previous years and corresponding data, to find the change rule of matter and timely detect the problems existed in the production. Feasible study shall be conducted to find the weak link, prepare and take targeted measures to prevent accidents and formulate contingency plan of photovoltaic power station accident.

108. Comprehensive analysis: analyze the safety operation, economic operation and operational management of the equipment once a quarter, identify the factors that may affect the safety and economic operation of the equipment and possible problems etc., propose safety measures and economic measures to for its weak links. Special analysis shall be conducted once month under general circumstances.

109. Special analysis shall be conducted in case of following circumstances: equipment and power grids accident; abnormality or fault of the equipment; special operation mode that may cause damage to the relay protection and automatic device or could not meet the operation mode requirements and affect the reliable power generation; the identified major equipment defect shall also be subject to analysis.

1) General

110. Being committed to learning procedures and periodic safety and skill training system. The team leaders shall persist in carrying out the training of O&M personnel in accordance with the actual situation, and have a special person being responsible for implementation. By complying with the principle of combining theory with actual situation for the training work, the annual, quarterly, monthly and weekly feasible training plan shall be formulated according to the quality of the personnel and equipment conditions, personal training file shall also be established.

2) Training standards

- O&M personnel must undergo three levels of safety education: namely, the team level; operational management department level; regional company level and make records, it is also required for personal signature and preservation;
- O&M personnel shall familiarize with operating situation of equipment.
- O&M personnel shall correctly implement regulations and systems and familiarize with field operating regulations of the station.
- In order to guarantee safety in power supply and consumption and according to related regulations of GB26860-2012 Working Regulations on Power Safety (electrical part of power plant and substation), the personnel on duty shall possess electrician certificate for high voltage special operation (the electrician certificate issued by power supply bureau for permission of high voltage power distribution operation) and power grid access permit for electricians (the effective certificate representing qualification of electrician for power grid access operation).

3) Regular training system

111. O&M personnel at photovoltaic power station must obtain electrician certificate for high tension special operation and power grid access permit for electricians in strict accordance with GB26860-2011 Power Safety Work Procedure (electrical part of power plant and substation) and related national regulations as regulated by the company and shall participate in regular rechecking on schedule to ensure the validity of certificate. The safety technical personnel shall file and spot-check qualification certificate of O&M personnel periodically and also be responsible for reminding of rechecking.

- An examination around Power Safety Work Procedure (electrical part of power plant and substation), local Dispatch Operation Regulations and Field Operation Regulations at Photovoltaic Power Station must be held annually at the photovoltaic power station. Contents of examination and comments saved for reference.
- An examination on professional skills shall be held annually at the whole station, the contents of examination and results shall be filed and the results shall be referred in performance appraisal.
- The group leader at photovoltaic power station shall organize a lecture on techniques monthly. The contents of technical lecture shall be in close relation to equipment at the station.
- Once monthly for on-site questioning and technical Q&A;
- Once on-duty prediction failure monthly;
- Once anti-accident exercise quarterly at the whole station;
- Special training records shall be made timely for various training.
- On-site questioning to on-duty O&M personnel shall be held when competent departments at all levels organize operation and maintenance checking and appraisal at the station, the questioning results shall be recorded in training record book. All training recordings and examination results shall be kept in personal training files.

4) Training management

112. Corresponding training management methods shall be prepared according to related requirements of the superior, and training planning and annual training plans shall be prepared in combination with the actual production and operation of the current photovoltaic power station.

- Personal training file for O&M personnel shall be established, with designated special management personnel, all training contents of operation and maintenance personnel shall be recorded, and the result card and related materials shall be kept in personal training file, to gradually realize management by microcomputer.
- The file on basic information and training appraisal of O&M personnel shall be established, to gradually realize management by microcomputer.
- Training to O&M personnel subcontracted in the integrated construction engineering on operation and maintenance regulations before the project is put into operation officially, to reach operation and maintenance standards as required, and is then filed for confirmation.

3.9 Analysis of alternatives

3.9.1 Site Selection

113. Based on the IEE (2018-19), preliminary site evaluation was based on assessment of seven individual sites identified by EDC[41], and followed by field visits in May and July 2017. Site 6 was identified as the preferred site for the solar park.

114. Some sites were excluded due to potential socio-economic impacts and ease and cost of land acquisition followed by other criteria such a unsuitable terrain and vulnerability to flooding (a key concern in Cambodia given the seasonal flood pattern). For example:

- Site 1 is close to a cemetery and urban areas. Land acquisition costs will be high and the potential social impacts more significant than at other sites. The site is also small, limiting scope for future potential expansion of the initial park (the initial 100 MW solar park requires a land area of 150-250 hectares, assuming 1.5-2 hectares per 1 MW of installed capacity). Therefore, it was dropped from further evaluation.
- Site 2 is located about 10km from GS6 where the land price is also very expensive. In addition, EDC noted that it would make little sense to build a new substation and transmission line from the site to GS-6 for such a short distance and that, if a site close to GS6 is to be used, it would be more economic to select Site 1 which is adjacent to GS6 and would avoid these infrastructure investment costs. Therefore, it was dropped from further evaluation.
- Site 3 is opposite a primary school and next to a reservoir. It is located along national road 44, about 35-40km from GS6 (straight line distance) where the land price is considered medium to high. The site size of 205 hectares may also be too small and constrain possible future expansion of the solar park. The land may be suitable for an agro-plantation and land preparation appears to already have taken place on parts of an Economic Land Concession (ELC) within the site, which will further raise the cost and complexity of land acquisition. Therefore, it was dropped from further evaluation.
- Sites 4, 5 and 7 are mostly occupied by scrubland with scattered grown trees and palm trees. Land values are assessed as being much lower than for Sites 1, 2 and 3. The number of landowners with land-based livelihoods is also expected to be low, minimizing social impacts. However, EDC recommended dropping site 4 while further preliminary technical and socio-economic assessment[42] resulted in dropping site 7 from evaluation and keeping site 5 as back up.

3.9.2 Technology Selection

115. PV Module Technologies: A number of PV module technologies were assessed for use in the project, and selection was based on minimum environmental impacts and disposal method and procedures as follows:

- Crystalline Modules: Most manufacturers of crystalline modules have a performance guarantee of 25 years however; these panels can have a longer lifetime if maintained

[41]National Solar Park Project for Cambodia: Pre-Feasibility Study, August 2017
[42]Inception Report, February 2018

properly. Crystalline modules pose little to no risk to the environment in terms of toxicity since most of the module is made of common construction materials such as tempered glass and aluminum. Furthermore, the PV cell is made from silicon, which is a common earth element. Some panels contain a small amount of lead however; it is sealed in a panel to reduce the risk of environmental release[43]. Even though these modules do not pose a significant environmental risk, they should be recycled. PV Cycle is an organization of PV module manufacturers that collects and recycles PV modules within the EU with the costs of these services included in the selling price of the modules[44]. In 2016, PV Cycle extended its collection and recycling service to include Japan[45]. The waste management solution is also offered to other countries outside of the EU however; an additional fee may be required for services. Recycle Solar is another option for PV recycling. The company recycles damaged or defect PV modules of all types in the UK and Ireland[46].

- CdTe Thin Film Modules: CdTe modules also have a warranty of 25 years.[47] The modules contain small amounts of cadmium, which is a toxic heavy metal. Tests have shown that in the event that these panels are damaged, only a negligible amount will be leached from the panel. Also, in the event of a catastrophic event such as a fire, the release of cadmium is below human health evaluation levels.[48] Recycling of CdTe modules is the best option after decommissioning due to the potential release of cadmium into the environment. First Solar, a leading CdTe module manufacturer, has a take-back policy to pay for collecting and recycling modules at the end of their life cycle.[49]
- CIGS Thin Film Modules: CIGS modules typically have a shorter lifetime than other PV module technologies. These cells consist of copper, indium, gallium and selenium, which are all not considered to be very toxic elements. However, the potential formation of hydrogen selenide from selenium is a concern because it is a carcinogen. Also, some cells contain a thin layer of cadmium, which is toxic to the environment. The release of these compounds into the environment is not a significant risk when the panels are in normal use however; special disposal is required at the end of the product life. For recycling, CIGS modules can be collected through programs such as PV Cycle.
- For the purpose of this 60 MW solar plant project, bifacial monocrystalline modules will be utilized in the solar PV plants. For end of life/failure or at decommissioning, provision in tender agreements with suppliers/vendors will ensure proper and safe collection, recycling and/or disposal, as needed.

116. With And Without Project Scenario

Table 15 presents a comparison of a “with project” and a “without project” scenario.

[43] NC Clean Energy Technology Center (n.d.). Health and Safety Impacts of Solar Photo-Voltaics
[44] http://www.pvcycle.org/services/european-union/
[45] http://www.pvcycle.org/press/pv-cycle-launches-take-back-and-recycling-service-in-japan/
[46] https://recyclesolar.co.uk/
[47] http://www.firstsolar.com/Modules/Our-Technology
[48] Centre for Renewable and Sustainable Energy Studies (2015). First Solar’s CdTe Module Technology –Performance, Life Cycle, Health and Safety Impact Assessment.
[49] Environment Canada (2012). Assessment of the Environmental Performance of Solar Photovoltaic Technologies

Table 9: “With” and “Without” Project Scenario

No.	Parameter	With Project Scenario	Without Project Scenario
1	Electricity	Major effect, improve the electricity supply and stability of the national grid, diversity the power generation mix, increase the percentage of clean energy	Negative Effect, increase in greenhouse gas (GHG) emissions due to continued reliance on fossil fuel based energy
Environment			
2	Effect on protected, sensitive, or	No effect, avoids National Protected Areas, environmentally sensitive and forest areas	No effect
3	Effect on endangered species	No effect identified to date. Solar plant avoids valuable habitats, forest areas	No effect
4	Tree cutting, looping and trimming	Minor effect, shall comply with the Environmental and. Social Management Plan (ESMP), environmental safeguards provision of the ADB Safeguard Policy Statement (SPS) 2009 and relevant national regulatory	No effect
5	Air emissions	Minor effect during construction: Increase in air emissions because of construction activities / trenching, dust generation; temporary impact Major effect during operation: Decrease in GHG emission	Negative effect, Increase in GHG emissions due to continued reliance on fossil fuel based energy generation
9	Water supply	Minor effect during operation: Increase in groundwater withdrawal compared to without project, shall comply with ESMP and withdrawal limits as prescribed in permits and clearances obtained from relevant authorities. Major effect, improved water accessibility for agriculture purposes due to available power.	No effect
Social			

No.	Parameter	With Project Scenario	Without Project Scenario
10	Disturbances of people/ communities	During construction phase; temporary impact	No issue
11	Effect of business	Construction activities may employ local populace generating economic and livelihood generation opportunities.	No issue
12	Status of living	Improve access to electricity, reduce domestic load for persons such as women involved in cooking activities, accessing water	No change
Economic			
13	Economic development	Greater rate of economic development expected	Slow development

CHAPTER 4: DESCRIPTION OF THE BASELINE ENVIRONMENT

4.1 Assessment Methodologies

117. World Bank/IFC[50] advises baseline data in ESIA to include relevant physical, biological, and socio-economic conditions; which are similar to what is stated in the 2009 IEIA/EIA preparation guideline by Cambdoain MOE, mentioning that a Full SEIA shall describe physical -resources, biological environment and socio-economic resources, based on both primary and secondary data available within and around project area to determine, predict and analyze possible environmental and social impacts caused by project activities in order to take measures to minimize negative impacts and maximize positive impacts. The scope of the study is defined as follow:

118. Spatial: The study covers a total land area of 100ha. The study will cover areas outside the project boundary, but not farther than 3 km radius from the palnt site. Certain issues like wildlife migration, water quality, and impacts on health at downstream village and natural resource-based livelihood will be assessed.

119. Temporal: The SEIA report is prepared to cover different phases of the project, which include: (i) design phase and preparation/construction phases, (ii) operation phase, and (iii) decommissioning phase. Baseline information was collected only one time; however, existing available data and information, especially from the initial examination (any relevant studies conducted for the solar park), were collected and documented in the report.

4.2 Geographical Location

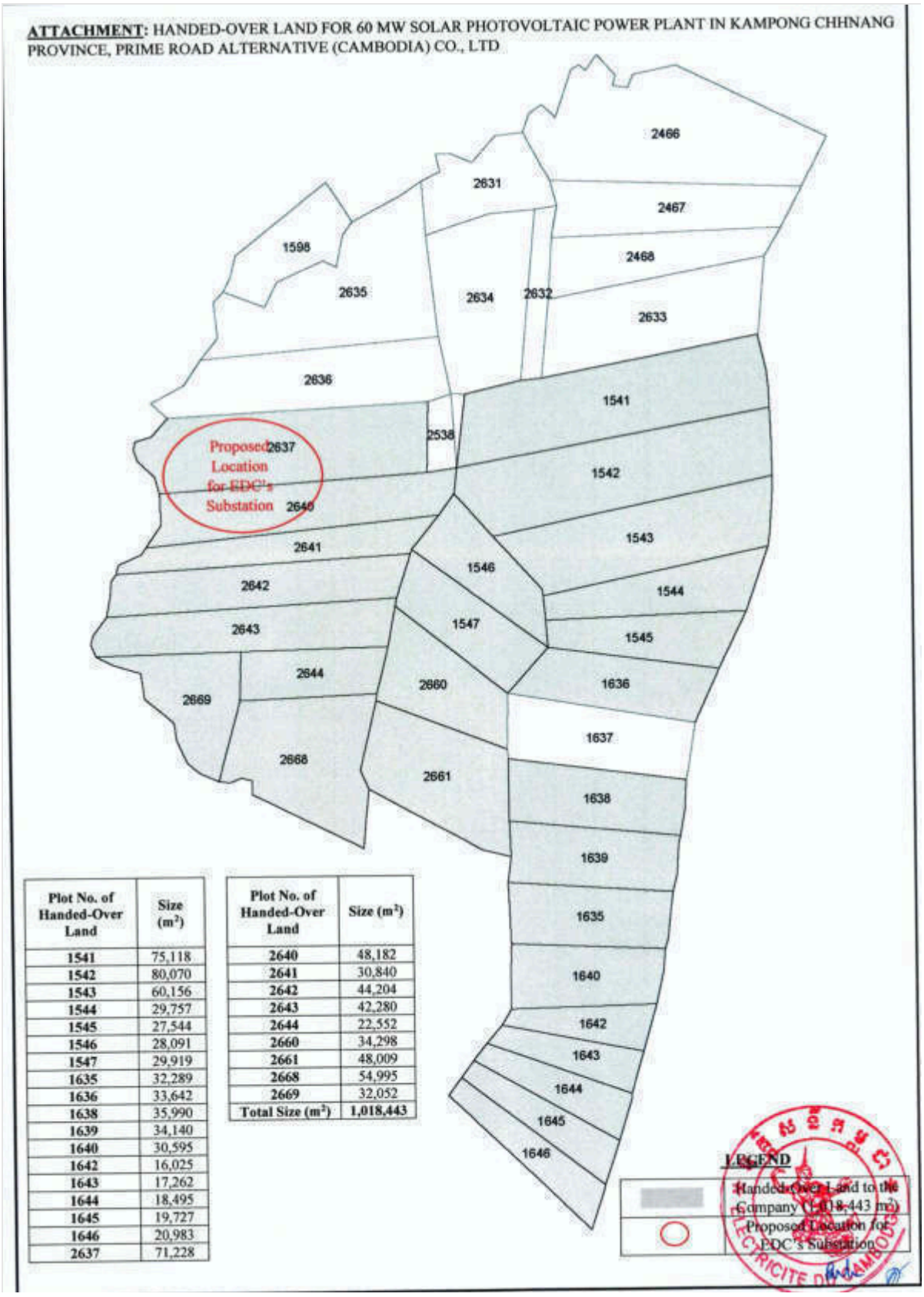
120. Overall, EDC has already aquired the 100 ha for the 60MW solar plant and all land titles have been being coverted into one single tenure and will be expected to complete prior to March 2021 (see Figure 10 below).

121. The proposed project site is geographically situated between 11.669518° and 11.804790° north latitudes and 104.334288° and 104.699287° east longitudes in the provinces of Kampong Chhnang and Kampong Speu in Cambodia, located northwest and west of capital Phnom Penh, respectively. The north border of Kampong Chhnang lies on the banks of the Tonle Sap Lake. Kampong Chhnang province is connected to the capital by National Road No. 5 at a distance of 91 km. Kampong Chhnang province has a population of over 504,234 persons and a population density of 86 persons per square km. The project locates only in Tuek Phos district in Kampong Chhnang province and closely to Thpong and Odongk districts in Kampong Speu province. There is only one project affected commune – Kbal Tuek in Kampong Chhnang province.

122. The site is located at a distance of between 3 – 6 km to the closest upgraded road. There are no tarmac or gravel roads leading to the site. Existing bumpy roads/trails might need to be broadened, cleared and reinforced to allow for heavy-duty transport. It is likely that the

[50] World Bank (2017). *Environmental and Social Framework*. The International Bank for Reconstruction and Development. Washington, DC.

construction of a completely new all-weather access road is required.



Plot No. of Handed-Over Land	Size (m²)
1541	75,118
1542	80,070
1543	60,156
1544	29,757
1545	27,544
1546	28,091
1547	29,919
1635	32,289
1636	33,642
1638	35,990
1639	34,140
1640	30,595
1642	16,025
1643	17,262
1644	18,495
1645	19,727
1646	20,983
2637	71,228

Plot No. of Handed-Over Land	Size (m²)
2640	48,182
2641	30,840
2642	44,204
2643	42,280
2644	22,552
2660	34,298
2661	48,009
2668	54,995
2669	32,052
Total Size (m²)	1,018,443

Figure 4: Predefined and extended land map

4.3 Project area of influence

123. The project area of influence includes localized impacts arising from noise, vibration and dust and trans-boundary impacts with wider geographical impacts, such as GHG emissions associated with material transport and PV panel production[51] and disturbance to bird/bats flyways due to the operation of the solar plant.

124. For the purposes of establishing the environmental baseline and assessing the potential environmental impacts, the area of influence for impacts on 60 MW solar plant ecology is taken as 3 km radius. Particular attention was paid to identify:

- Sensitive natural environmental receptors such as water bodies, biodiversity and wildlife habitats
- Sensitive human receptors such as households, schools
- Cultural and heritage sites (such as temples and animism sites)
- Potential health and safety issues

125. According to IFC-PS1 2012 -, the area of influence encompasses:

- (i) The project[52] and the client's activities and facilities that are directly owned, operated or managed (including by contractors) and that are a component of the project[53]
- (ii) impacts from unplanned but predictable developments caused by the project that may occur later or at a different location
- (iii) indirect project impacts on biodiversity or on ecosystem services upon which Affected Communities' livelihoods are dependent

126. Cumulative impacts[54] that result from the incremental impact, on areas and resources used or directly impacted by the project, from other existing, planned or reasonably defined developments at the time the risks and impacts identification process is conducted. GS6 is an existing facility for this project.

4.4 Baseline Receptor Summary

127. The following section of the SEIA provides the description of the baseline environment for the solar plant. Key receptors information was obtained and collated based on-site visits, stakeholder consultations, socio-economic survey, biodiversity assessment, discussions and interviews with local authorities during this SEIA prepration. A summary table for key receptors is provided in Table 17 while Figure 11 &12 presents the project location with receptor information.

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[51] PV panel production is energy intensive and causes depletion of some natural resources, because bulk semiconductor material is needed in high quantities (Tsoutsos et al. 2005)

[52] Examples include the project's sites, the immediate airshed and watershed, or transport corridors.

[53] Examples include power transmission corridors, pipelines, canals, tunnels, relocation and access roads, borrow and disposal areas, construction camps, and contaminated land (e.g. soil, groundwater, surface water, and sediments).

54 Cumulative impacts are limited to those impacts generally recognized as important on the basis of scientific concerns and/or concerns from Affected Communities. Examples of cumulative impacts include: incremental contribution of gaseous emissions to an airshed; reduction of water flows in a watershed due to multiple withdrawals; increases in sediment loads to a watershed; interference with migratory routes or wildlife movement; or more traffic congestion and accidents due to increases in vehicular traffic on community roadways.

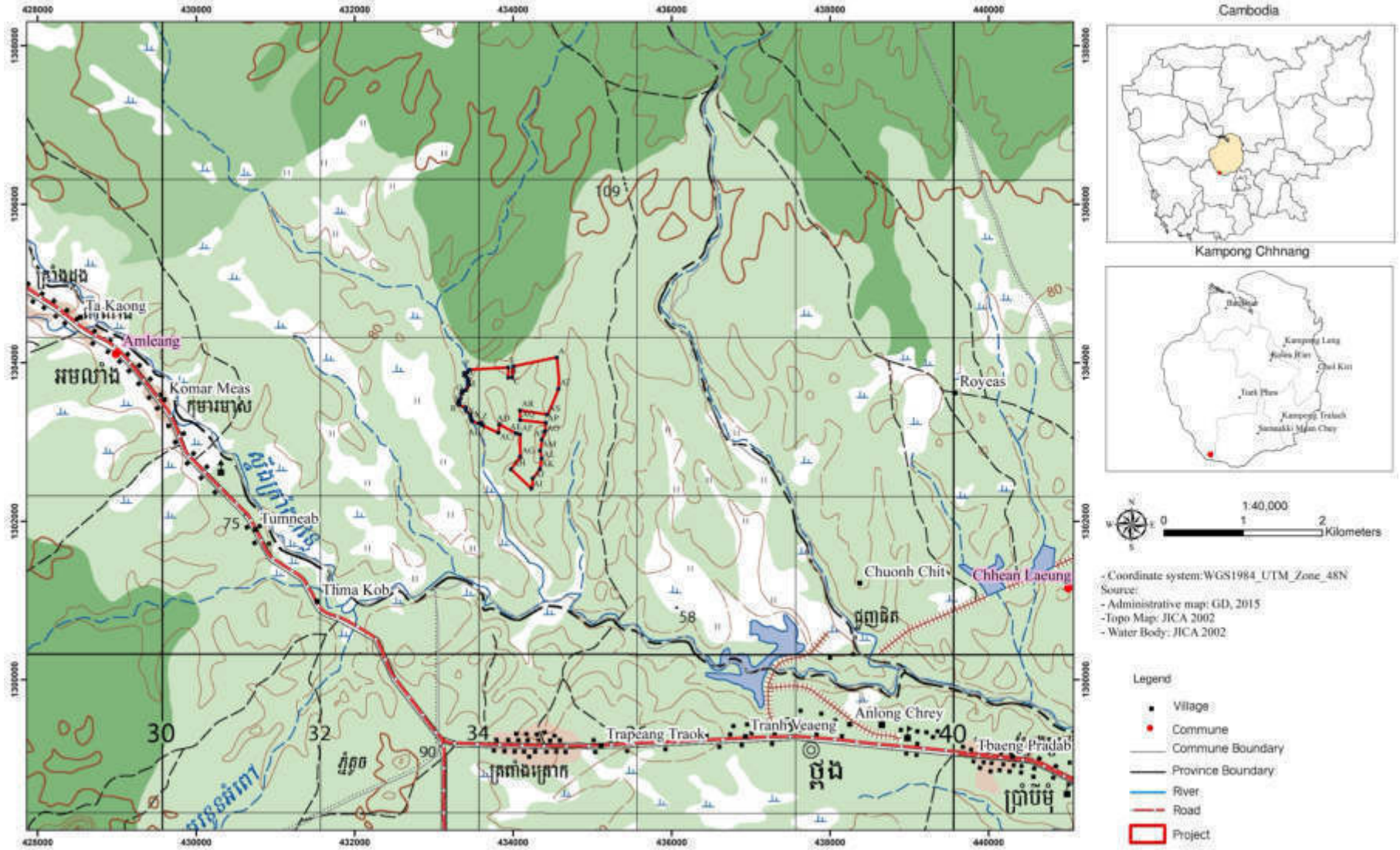
Table 10: Summary of Environmentally and Socially Sensitive Receptors for 60WM Solar Plant

Province / District	Project Component	Communes Affected	Surface Water Receptors	Socio-Economic and Cultural Receptors	Land Cover/ Ecological Receptors	Existing Utilities Affected	Protected Area
Tuek Phos District, Kampong Chhnang Province	60MW Solar Plant	Kbal Tuek	Two natural streams transecting across the length of the proposed solar plant site with inflow coming from Upper Catchment Aural and feeding into "An Long Chrey" reservoir located downstream at a distance of approximately 4-5 km; the reservoir may function as a stop off point for migratory birds	No habitations / settlements within the proposed solar plant site private ownership with formal land titles or traditional land holding; police owned farmland in close vicinity	Scrubland (293 ha) and paddy fields (116 ha); small plantations such as cassava, mango, cashew, eucalyptus and bamboo are also present	None	None in close proximity to the proposed site; Phnom Aural National Protected Area located within 20 km of site; 300 ha Community forest in Chean Laeung located 5-7 km from proposed solar plant in the northeast direction[55].
Samaki Meanchey District, Kampong Chhnang Province	Existing access road	Chhean Loeung	The existing access road runs through two villages: Royas and Chhoun Chhet in Chhean Loeung commune.	There are local residents living along the access road. There are also primary school, church and buddhist temples that may be	There are (1) Taing Por river/bridge, and (2) community forestry.	This existing access road is about 7km from the national road no. 136 with a	There is also a Tbeng Srorng community forestry located right close to this

[55] Tbeng Srorng community forest

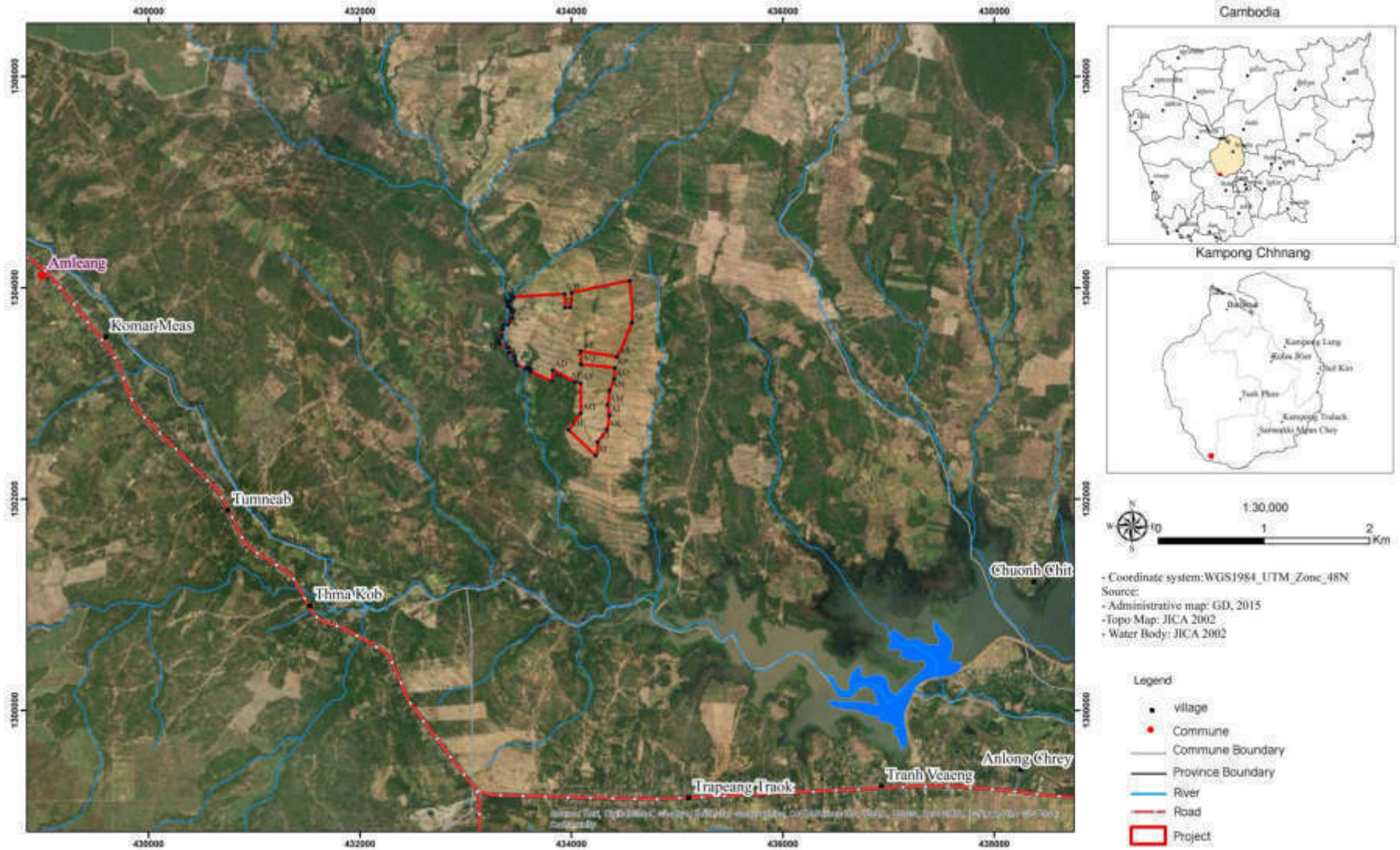
Province / District	Project Component	Communes Affected	Surface Water Receptors	Socio-Economic and Cultural Receptors	Land Cover/ Ecological Receptors	Existing Utilities Affected	Protected Area
				disturbed from transportation schedule of the proejct.		mix of laterite and BTS.	exiting access road.

Figure 5: Project location (topographical map)



Sources: Assessment & Solution (2020)

Figure 6: Solar Plant Site (Satellite Map)



Sources: Assessment & Solution (2020)

4.5 Physical Resources

4.5.1 Topography

128. The objectives of the study are to:

- Collect data on elevation of the project site where there are low/high elevation and slopes
- Collect current positions including coordinates of all important topographical featuresin and around the project site
- Study the catchment area of the project site

129. Methodology – The ESIA assessment team uses ASTER GDEM data available at the Ministry of Economics, Commerce, and Industry, Japan, and at NASA, USA, in 2011. Moreover, A&S utilizes ArcMap10 to investigate slopes with the ASTER GDEM data gathered within a 1-kilometer radius around the proposed facilities.

130. The topography of the project site consists of gentle hills. To the south of the site topographic relief decreases as the border with Kampong Speu province is approached. The project area itself is dominated by gently undulating terrain at elevations ranging from 80 m to 200 m above sea level, with some isolate d scattered hills rising to around 400 m. The area is dissected by numerous ephemeral drainages that flow into the perennial An Long Chrey Reservoir. There are no large lakes or major rivers in and around the project site. Residents generally establish settlements near streams or irrigation channels and along the existing access road running through the Royas and Chhoun Chet villages in Chhean Loeung commune.

131. The Project area is covered with degraded scrubland due to heavy agricultural practices and clearing associated with local settlements. The area is mostly covered by the grass and small shrubs.

4.5.2 Soil quality

132. Methodology: The ESIA team collected the soil data i.e. types, quality, and uses for different purposes in and around the project site The project activities will not pose significant risks to soil quality and uses, A&S depends very much on the existing data and document and collects one soil sample (X=433651, Y=1303521) (Figure 18) for laboratory test. Soil quality parameters are listed in the table below. The following soil parameters were referred to the suggested list by the Ministry of Agriculture, Fishery, and Forestry (MAFF) (Table 18) for any soil quality study in Cambodia. A quick soil survey of the anticipated project footprint is conducted to characterize soil types within the project area to understand how eroded it is based on the current state (i.e. erosion potential, storm water run-off quality and rehabilitation efforts) and land use practices.

133. To collect the soil sample, the local soil auger was used to drill deep straight into the ground, up to 50cm to get the best estimate of soil nutrient levels. Multiple soil cores were taken to reduce the chance of pulling one from a 'bad spot'. The collected cores were kept in clean, and labeled plastic pail with a total weight of 0.5kg. Sample was submitted to the MAFF's laboratory on the same day of smapling. Photograps were taken to record the existing conditions of the sampling location.

Photo 1: Soil sampling activities

134. Soils in Kampong Chhnang and Kampong Speu provinces are typically clayey and physically inferior, with relatively low soil fertility. Coarse grained granite rocks of Oral Mountain located in the west of Kampong Chhnang province and some hilly outcrops in the province. Despite the poor soil quality, arable farming is common. The predominant soil types in the project site are Grey hydromorphics (82 ha) and red-yellow podzols (18 ha) (Figure 14).

135. The results show that all parameters are below MAFF's soil fertility guideline levels for healthy soil. Nutrient levels are relatively high indicating good fertility. Total nitrogen in the project site is only 0.22% that is in the medium range if compared with the soil fertility level. There is a very high organic matter (4.35%) in the project site. But the test result shows that total phosphorus has only 0.02% in the project site which is low. From an environmental health perspective, it can be concluded that soil quality within and around the project is in relatively good condition and not significantly degraded. A detail of each soil parameters is described below the table.

Table 11: Soil parameters and test results

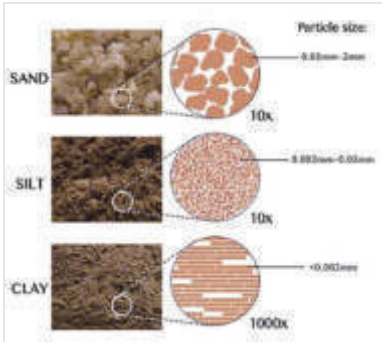
Parameters		**Test Result**	**MAFF**
Particle Size	(< 0.002mm), Clay %	48.50	-
	(0.002-0.02 mm), Fine Silt, %	22.75	-
	(0.02-0.05mm), Coarse Silt, %	8.24	-
	(0.05-0.2mm), Fine Sand, %	10.79	-
	(0.02-2mm), Coarse Sand, %	10.16	-
Moisture % (Moisture, %/105 °C)		4.35	-
Total Carbon, C ‰ (Black Method)		2.53	>2.0 Very High
Total Nitrogen; N, % (Kjeldal SulfuricMethod)		0.22	0.15-0.25 Medium
C/N Ratio (Unit)		12	8.0-13 Good Decompost
Organic Matter (OM) %		4.35	>4.0 Very High
Total Phosphorus, P2O5 ‰ (Nitric Digestion)		0.02	0.01-0.025 Low
Available Phosphorus P2O5 ppm (Pray II)		24	20-40 Medium
Cation Exchange Capacity C.E.C m.e/100g Soil (1M Ammonium Acetate at pH=7 & Leach with %10 NaCl Method)		14.50	12-25 Medium
Exchangeable Cation (m.e/100g, Organic Matter (OM % Soil)	Calcium Ca	7.60	5.0-10 Medium
	Magnesium Mg	2.20	1.0-3.0 Medium
	Sodium Na	2.89	>2.0 Very High

	Potasium K	0.64	0.5-0.8 Medium
Total Exchangeable Bases (m.e/100g soil)		13.33	7.0-15 Medium
Bass Saturation (%)		92	80-100 Very High
Exchange Acidity, (m.e/100g Soil)		13.30	5.0-15 Low
Exchange Al, (m.e/100g Soil)		0.22	0.1-0.5 Low
Electrode Conductivity µS/cm, (1:5 Soil: water)		191.00	<400 Very Low
pH H2O 1:5 (Soil: water)		9.02	>9.0 Very High
pH KCL 1:5 (Soil: 1N KCL)		8.12	8.20

Source: Test results are generated from laboratory of the Ministry of Agriculture, Fishery and Forestry (2020)

- The particle size has five types – clay, fine silt, coarse silt, fine sand, and coarse sand. The result from the laboratory test shows that the project site has a mixed composition that consists of 48.50% of clay, 22.75% of fine silt, 8.24% of coarse silt, 10.79% of fine sand, and 10.16% of coarse sand. The result is analyzed based on the soil texture triangular and it indicated that clay covers most of the area and followed by coarse sand and fine silt.

Table 12: Soil texture

No.	Soil Taxonomy (USDA)		Soil particle size
1	Clay	Argile	
2	Silty Clay	Argile Limoneuse	
3	Sandy Clay	Argile Sableuse	
4	Clay Loam	Laom Argileux	
5	Silty Clay Loam	Loam Argilo-Limoneux	
6	Sandy Clay Loam	Loam Argilo-Sableux	
7	Loam	Loam	
8	Silt Loam	Loam Limoneux	
9	Silt	Limon	
10	Sandy Loam	Loam Sableux	
11	Loamy Sand	Sable Loameux	
12	Sand	Sable	

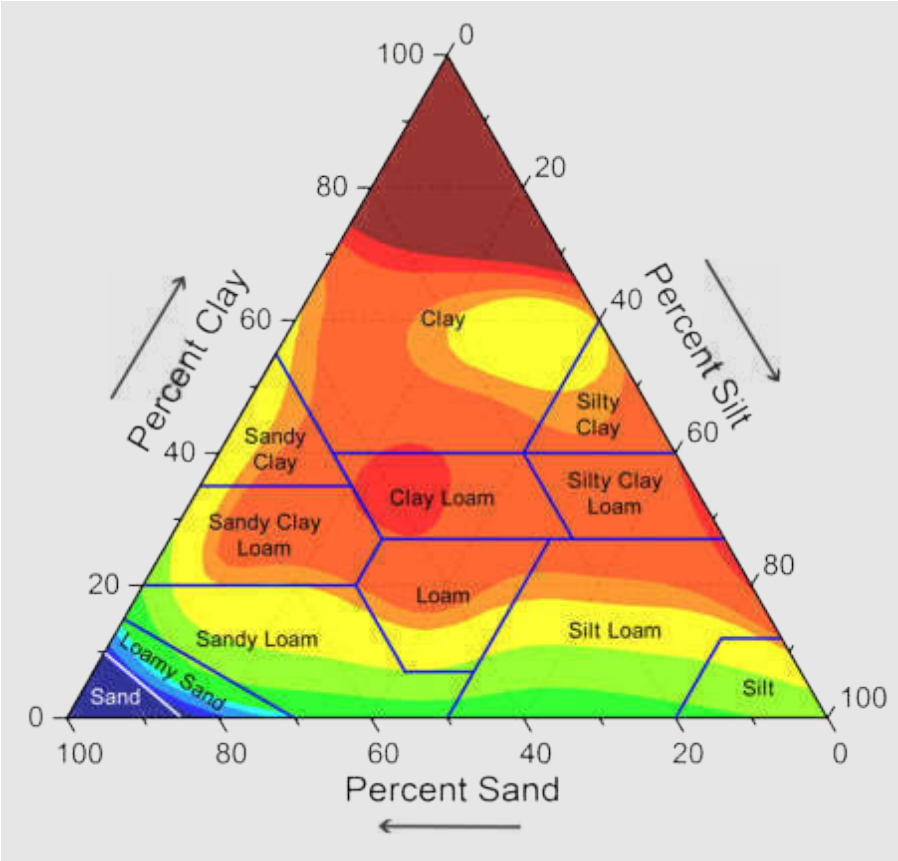


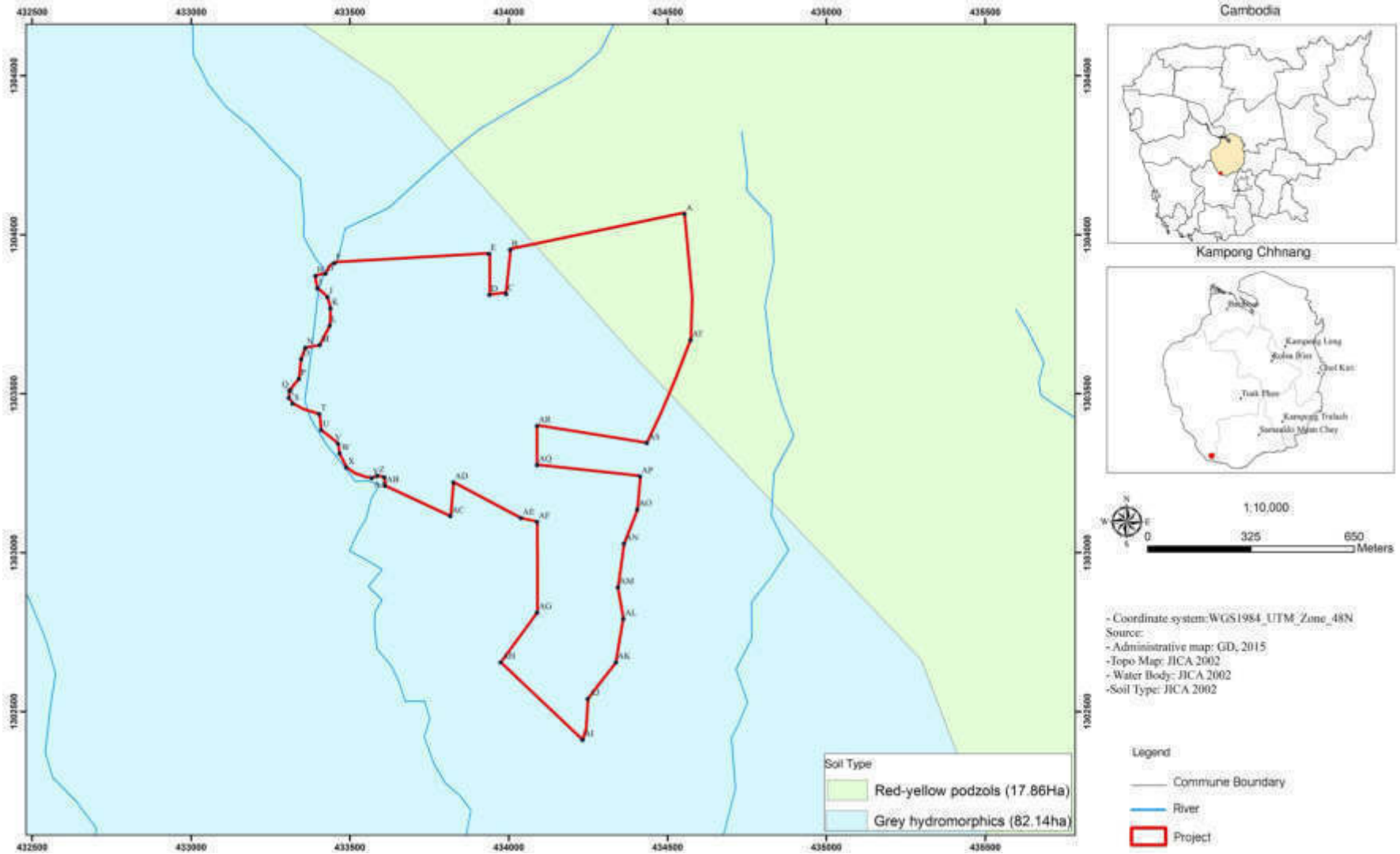
Figure 7: Soil texture: sand, silt and clay

- Moisture is the level of moisture in between the soil particles that is essential for the growth of the plants. Moisture plays a role of accelerating the decomposition process of organic matters in the soil, i.e. it keeps soil fertile and increases in the growth of crops. The laboratory result indicates that soil moisture in the project site is in range of 1.26% to 1.82% that is known to be low.
- Based on the standard of Directorate of Agriculture Department (2015), total carbon has five levels in soil – 1. very high (>2.0%), 2. high (1.7%-2.0%), 3. medium (0.8%-1.7%), 4. low (0.4%-0.7%), 5. very low (<0.4%). The test result shows that total carbon in the project site has 2.53% that is very high.
- Total nitrogen is important for agricultural crops especially supporting the growth of the crops. The laboratory result shows that total nitrogen in the project site is only 0.22% that is in the medium range if compared with the soil fertility level determined by the Ministry of Agriculture, Fishery and Forestry (MAFF).
- CN (C/N Ratio) is a factor of soil decomposition that determined the ways and levels of decomposing the organic matter in soil by the bacteria. The result indicates that the project site has such ratio of 12 meaning that there is a good decomposition for agricultural crops (based on MAFF's soil fertility is from 8.0-13).
- Organic matter helps us understand the nutrient and organic levels of each soil layers in supporting the growth of the crops. The laboratory test result shows that there is a very high organic matter (4.35%) in the project site.
- Total phosphorus (P205) is a nutrient needed by the organisms for their living process. Such nutrient is found in rocks, soil, and organic matter. Total phosphorus is essential for planting crops and consists in every cell of lives including plant and animal. Phosphorus

attaches strongly to soil particles and is used by the plants. The test result shows that total phosphorus has only 0.02% in the project site which is low.

- Available phosphorus Bray II in the project site has 24ppm. This result indicates that this phosphorus in the soil is in the medium level.
- Cation exchange capacity is used to measure the soil fertility, to determine the nutrient maintenance, and to prevent groundwater from being contaminated by other pollutants. The result shows that the cation exchange capacity is 14.50 me/100g soil – meaning that it is the medium capacity.
- The cation exchange has key components such as Ca, Mg, Na, and K. This group has a high capacity to absorb the soil nutrient and helps accelerate the growth of plan and crop. The result indicates that soil in the project site has 7.60 me/100g of Calcium (Ca), that is low; 2.20 me/100g of Magnesium (Mg) is found to be medium; and 2.89 me/100g of Sodium (Na) is known to be low; and 0.64 me/100g of Potasium (K) is medium.
- The total exchangeable bases refer to the sum of other components such as calcium, magnesium, sodium, and potasium. Based on the test result, this exchangeable base is only 13.33 me/100g soil – indicating that the total exchangeable base is low.
- The bass saturation has a relation with the cation exchange capacity (Ca, Mg, Na, K). If bass saturation is high, it means that the acidity level in soil is more neutralized for a short time, than the soil with low saturation. The result shows that the bass saturation is 92% which indicates the very high saturation.
- The exchange AL is an important factor affecting the productivity of the agricultural crop in the tropical climate. This exchange AL is related with the soil fertility and if it is high, then it means that soil quality is low. The test result shows this AL has only 0.22 me/100g soil that means it is low. Moreover, the electrode conductivity result is only 191 which is very low.
- The pH H_20 is essential to measure the potentiality of nutrient and polluted components for the plants. Plants grow well when the pH is between 5.7 and 7. The result shows that pH is 9.02 which it is more alkaline. While the pH KCL in the soil in the project site is 8.12 – indicating that there is a high acidity.

Figure 8: Soil types in the solar plant



Source: Assessment & Solution (2020)

4.5.3 Climate

136. The objectives of the climate and meteorology baseline studies are to:

- Identify and describe meteorological data sources relevant to the project
- Characterize the existing and historical meteorological conditions in the project region
- Characterize the meteorological conditions of the project area

137. Methodology – Baseline climate and meteorological conditions of the Project area are determined and climatic variability is assessed based on available on site data and long-term records from regional sites. This includes the assessment of:

- Rainfall, including assessment of extreme rainfall events
- Temperature
- Evaporation
- Humidity

138. Cambodia is situated in a tropical zone between 10 and 14 degrees latitude north of the equator. The climate is dominated by the monsoon cycle with a distinct dry season and wet season. The northeast monsoon brings in the dry season from November to April. The dry season is cooler from November to January when cool air from Siberia flows in and is dry and hot from February to April. The wet season is from May to October, as southwest monsoon brings in moisture and rains from the Indian Ocean. Most provinces experience an average wind speed of less than 3 m/s. The maximum wind speed in the rainy season is over 20 m/s while it is lower during the dry season.

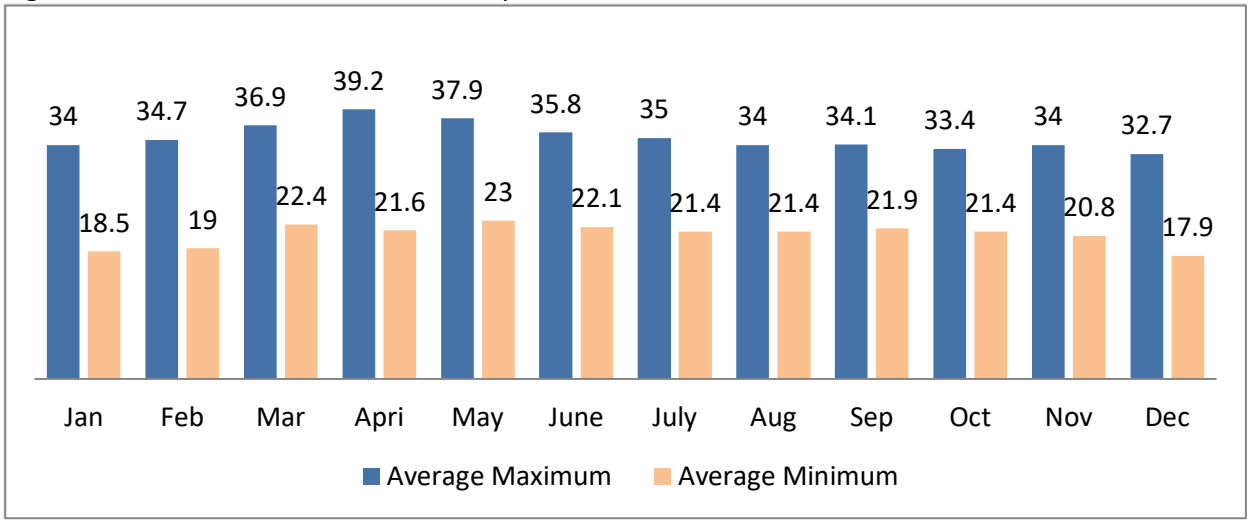
(A) Temperature

139. Data recorded by the meteorological station in Kampong Chhnang province indicates mean monthly maximum temperatures of 32.7–39.2°C, with a minimum in December and maximum in April. The annual average temperature from 2016-2018 is only 35.2°C, in which 2017 has the lowest average. At the same time, the mean monthly average minimum temperature is from 17.9-22.4°C, where the lowest is in December and highest is in March. 21°C is the annual average temperature among the three years, and 2018 has the lowest annual average (19°C) .

Table 13: Temperature data in Kampong Chhnang province from 2016-2018

Month / Year	Jan	Feb	Mar	Apri	May	June	July	Aug	Sep	Oct	Nov	Dec	Annual Average
Maximum													
2016	36.0	36.2	39.5	41.5	40.3	37.5	35.0	34.5	35.5	33.0	35.0	32.5	36.4
2017	33.5	34.0	36.0	38.1	37.5	35.0	34.6	33.5	33.4	33.3	32.5	31.1	34.4
2018	32.6	34.0	35.1	38.0	36.0	35.0	35.5	34.0	33.5	34.0	34.5	34.5	34.7
Averg	34.0	34.7	36.9	39.2	37.9	35.8	35.0	34.0	34.1	33.4	34.0	32.7	35.2
Minimum													
2016	20.0	18.5	24.5	22.5	25.5	23.7	22.0	23.0	23.0	23.0	23.5	20.5	22.5
2017	18.5	19.5	21.5	23.3	23.5	23.0	22.7	22.6	23.2	22.2	20.5	15.8	21.4
2018	17.1	19.0	21.2	19.0	20.0	19.5	19.5	18.5	19.5	19.0	18.5	17.5	19.0
Averg	18.5	19.0	22.4	21.6	23.0	22.1	21.4	21.4	21.9	21.4	20.8	17.9	21.0

Figure 9: Maximum and minimum temperature from 2016-2018



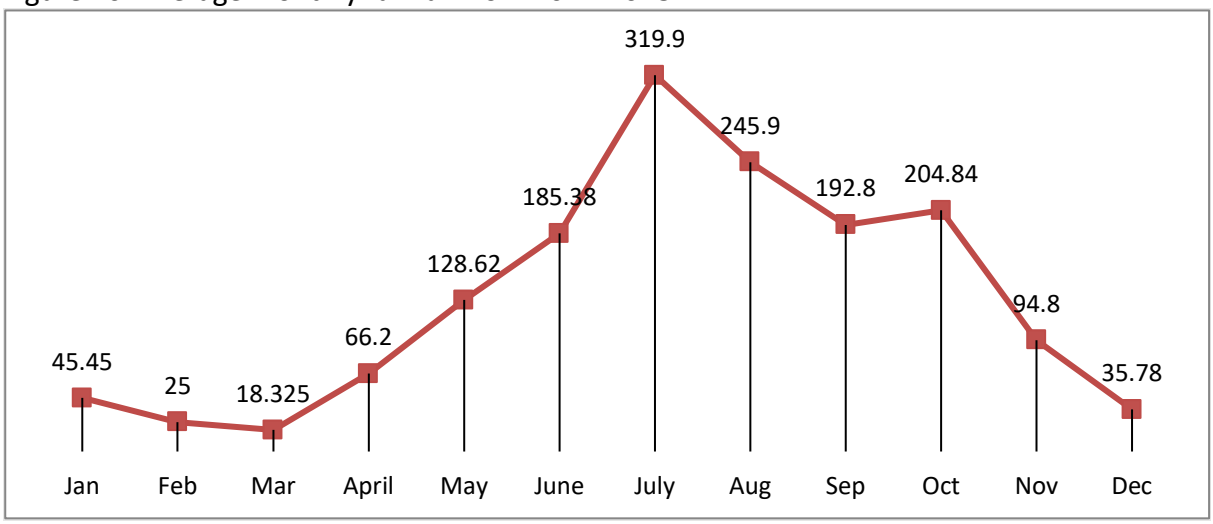
(B) Rainfall

140. Historical daily rainfall records exist in Kampong Chhnang province from 2014-2018. The monthly average of rainfall is between 18-320mm, where March has the lowest and July has the highest. Mean annual rainfall across years in Kampong Chhnang province varies from 1,210 mm to 1,939.5 mm. Moreover, the annual average rainfall in Kampong Chhnang province is 1,517mm.

Table 14: Annual rainfall from 2014-2018

Year	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec	Annual Average
2014	-	-	2	64.7	148	207.6	288.6	177	190.6	288.2	44.04	25	**1435.7**
2015	-	-	0.7	102.5	32.2	201.8	91	357.7	168.5	138.4	107.7	9.5	**1210.0**
2016	-	-	-	33	75.5	176.2	215.1	151.7	309.7	204.1	103.9	113.6	**1382.8**
2017	51.4	23.6	9.6	34.8	240.9	200.6	321.1	229.1	105.5	205.1	176.4	19.2	**1617.3**
2018	39.5	26.4	61	96	146.5	140.7	683.7	314	189.7	188.4	42	11.6	**1939.5**
Averg	45.45	25	18.32	66.2	128.6	185.3	319.9	245.9	192.8	204.8	94.80	35.78	1517.1

Figure 10: Average monthly rainfall from 2014-2018



5.4.4 Air quality

141. The objectives of the air quality assessment are to:

- Review the available baseline air quality monitoring data, and collect any further data required to ensure that there is a sufficient baseline for the project area;
- Identify appropriate noise, vibration and air quality assessment criteria, where available;
- Characterise the existing air quality and noise/vibration in the project area
- Estimate the potential sources for vibration, air and noise emissions from the project, and identify any potential impacts on sensitive receptors
- Identify suitable management and mitigation measures that will minimise any direct adverse effects from vibration, noise and air emissions associated with the Project.

142. Methodology

- An air quality baseline is established for the project area through the field sampling with MoE laboratory team in September 2020. Any available air quality monitoring data will be reviewed. Fieldwork was conducted where further air quality baseline data is required.

- The potential impacts of any air emissions from the project are assessed, and management measures to prevent or minimize any identified impact are recommended. The primary air quality issue requiring assessment is likely to be the generation of dust from transportation mostly. Additionally, greenhouse gas emissions, for example those associated with energy usage, were considered during the assessment.

- The assessment of potential air quality impacts was undertaken by analysing the exploration plan and using relevant emission factors to estimate the quantity of total suspended particulate matter (TSP), sub-2.5 and sub-10 micron particles (PM10, PM2.5) that would be emitted from each operation. In addition, there are more parameters will be analysed namely NO2, SO2, CO, Pb, and O3 as listed below. The site meteorological data relevant to air quality issues was reviewed – in particular, rainfall and temperature.

- The current study collected two samples– (1) within the project site ANV01 (X=434264, Y=1303047) and (2) near the existing access road ANV02 (X=439465, Y=1303928) (Figure 11).

- Potential impacts of all significant air emissions from the project are assessed with respect to the relevant Cambodian standards (MoE's Declaration in 2018), and appropriate management measures to prevent or minimize identified impacts were recommended. This includes a framework for ongoing monitoring, including recommendations for monitoring locations and frequency.

- The assessment and management of potential dust impacts were based upon the following criteria: (a) Declaration on Uses of Terms of Reference for Establishing Factory and Handicraft (2018), and (b) IFC EH&S Guidelines (2007)

Table 15: MoE's parameters for air quality test

Parameters	Analytical Methods	Unit	Standard*	IFC	Time
Total Suspended Particles	*OCEANUS OC-9500, Dust Monitor System*	mg/m^3	0.33	-	24h
Sulfur Dioxide (SO_2)	*GRI-IAT (Real-time Monitor)*	mg/m^3	0.3	0.12	24h
Carbon Monoxide (CO)	*GRI-IAT (Real-time Monitor)*	mg/m^3	20	-	8h
Nitrogen Dioxide (NO_2)	*GRI-IAT (Real-time Monitor)*	mg/m^3	0.1	0.2	24h
Particulate Matter (PM10)	*OCEANUS OC-9500, Dust Monitor System*	mg/m^3	0.05	0.15	24h
Particulate Mater (PM2.5)	*OCEANUS OC-9500, Dust Monitor System*	mg/m^3	0.025	0.075	24h
Ozone (O_3)	*GRI-IAT (Real-time Monitor)*	mg/m^3	0.2	0.1	1h
Lead (Pb)	*CPSC-CH-E1002-08.3, (HNO_3 Digestion)*	mg/m^3	0.005	0.005(1yr)	24h

Note: *Declaration on Uses of Terms of Reference for Establishing Factory and Handicraft (2018)

Photo 2: Air, noise and vibration sampling activities

Sampling activities in Location 1 (within the project site)

Sampling activities in Location 2 (near the existing access road)

143. Field visits indicated that air quality in the project site was good as the project areas are located in rural areas without significant industrial/commercial zones to cause air quality degradation or high noise levels. Typically, in Cambodia, outside Phnom Penh or town centers there are few industrial pollution sources and the volume of vehicular traffic is low. There was no available air quality data or noise level measurement for the project provinces. Air quality and noise monitoring were taken to inform the environmental baseline in this SEIA for this solar plant.

144. The baseline for air quality within and around the project site is carefully studied to capture the current situation and how it is already influenced by the surrounding projects. The study collects the field air parameters in two different locations as indicated above (Figure 17) based on the selected parameters (i.e. TSP, O_3, PM_{10}, $PM_{2.5}$, SO_2, NO_2, CO and Lead) as agreed in the terms of reference. Test was conducted for 24 hours on site, starting from 10am till 10am in the next day. Assessment of the baseline air quality is based on Cambodian quality standards and the result is listed in the Table 23 below.

Table 16: Air quality result

No.	Parameters	Unit	Result (1)	Result (2)	MoE Standard	IFC Standard	Analytical Method
1	CO	mg/m^3	0.41	0.93	<20 (8 hours)	NA	GRI-IAT (Real-time Monitor)
2	NO_2	mg/m^3	0.022	0.015	<0.10 (24 hours)	<0.2 mg/m^3 (1 hour)	GRI-IAT (Real-time Monitor)
3	SO_2	mg/m^3	0.028	0.034	<0.30 (24 hours)	<0.02 mg/m^3 (24 hour)	GRI-IAT (Real-time Monitor)
4	O_3	mg/m^3	0.031	0.02	<0.20 (1 hour)	<0.1 mg/m^3 (8 hours)	GRI-IAT (Real-time Monitor)
5	Pb	mg/m^3	ND	ND	0.005 (24 hours)	NA	CPSC-CH-E1002-08.3, (HNO3 Digestion)
6	TSP	mg/m^3	0.011	0.018	<0.33 (24 hours)	NA	OCEANUS OC-9500, Dust Monitor System
7	PM10	mg/m^3	0.007	0.013	<0.05 (24 hours)	<0.05 mg/m^3 (24 hours)	OCEANUS OC-9500, Dust Monitor System
8	PM2.5	mg/m^3	0.006	0.009	<0.025 (24 hours)	<0.025 mg/m^3 (24 hours)	OCEANUS OC-9500, Dust Monitor System

Note: ND= Not Detected, NA= Not Available

Source: Test result is generated by the Department of Air and Noise Quality Control (2020)

145. The IFC ambient air quality guideline in 2007 (based on WHO Air Quality Guideline in 2005) does not regulate the standard for CO, TSP and Pb, but covers the rest. Unlike the Ministry of Environment, the eight critical parameters are determined as illustrated in the above table. Values of the parameters in the second location (near the existing access road) seem a little bit higher than those in the project site. This is because of more traffic and commuting activities of the local people on and around the road. However, the results from the two sampling sites are below the MoE's standards. When compared with the IFC, also they are all under the determined threshold values, except the SO_2 which is slightly above the limit due to the frequent traffic specially in testing location #2 (near the main road). It means that ambient air quality of the two sites is currently clean, fresh, and inhalable that could well support the lives and ecosystem in the areas.

4.5.5 Noise

146. Methodology

- Available noise monitoring data was reviewed. Further fieldwork was required to ensure that a sufficient baseline for noise levels is available.
- Potential noise sources and sensitive receptors (e.g. local villages) were identified. The project construction and operation plans are analysed to determine the locations of equipment including trucks, bulldozers, drills and other fixed and mobile equipment required for construction works.
- The study collected two samples to build the baseline of noise for the project. Locations selected are (1) within the project site ANV01 (X=434264, Y=1303047) and (2) near the existing access road ANV02 (X=439465, Y=1303928) (Figure 11 below).
- The potential impacts of noise generating activities on sensitive receptors such as local villages were assessed based on Cambodian and international standards that are referenced where appropriate. Potential noise impacts on sensitive receptors located along the likely transportation and access routes are assessed.
- Management and mitigation measures were developed that helps minimise any

direct adverse effects associated with noise from the project. This includes a framework for ongoing noise monitoring, including recommendations for monitoring locations and frequency.

- The assessment and management of potential noise impacts were based upon the (a) Declaration on Uses of Terms of Reference for Establishing Factory and Handicraft (2018), and (b) IFC EH&S Guidelines (2007)

Table 17: MoE's noise standards

Noise by time	Standard*	IFC (2007)**
Day Time (6:00-18:00)	75 dB(A)	55 dB(A)
Evening Time (18:00-22:00)	70 dB(A)	
Night Time (22:00-6:00)	50 dB(A)	45 dB(A)

Note: *Declaration on Uses of Term of Reference for Establishment of Factory and Handicraft (2018), ** IFC (2007). Environmental, Health, and Safety (EHS) Guideline: Noise Management (for Residential, institutional, educational)

147. Table 25 below lists the result of the observed noise level for 24 hours in two locations – (1) within the project site, and (2) near the existing access road (Figure 11). Hourly LAeg noise at the two sampling sites was found to be below the standard of Cambodia standard. Result from location 2 (near the access road) recorded the slightly higher value than the location 1 and this is due to high mobility of the local villagers. Noise is observed to increase from 11:00-12:00 am and 19:00-20:00 at night. The average 24-hour noise level of location 1 is recorded at 47.20 dBA and 54.84 dBA is for location 2. When compared with the IFC's residential standard for both day and night times, the results from the two locations can be inferred a little bit higher the guideline values in the day-time but critically sensitive at night from 22:00 to 6:00 in the morning. The frequent transportation of the products from factory (Mountain Rock Manufacturing) which is about 3-4km away from project site and access road is doubtful to be causing such disturbing noise.

Table 18: Noise level observed in and around the project site

Observed Time		Noise Level [dB(A)]			
		Result (1) (Average)	Result (2) (Average)	MoE's Standard	IFC's Standard
Day	6:00-7:00	44.30	58.50	70	Residential (Day-Time) – 55
	7:00-8:00	45.40	53.90		
	8:00-9:00	54.20	53.00		
	9:00-10:00	40.80	56.50		
	10:00-11:00	46.10	46.10		
	11:00-12:00	46.80	67.90		
	12:00-13:00	51.10	53.10		
	13:00-14:00	49.40	52.20		
	14:00-15:00	42.70	52.60		
	15:00-16:00	42.30	56.50		
	16:00-17:00	33.20	57.60		
	17:00-18:00	34.10	54.20		
Evening	18:00-19:00	43.70	53.80	65	
	19:00-20:00	49.00	60.60		
	20:00-21:00	49.60	59.00		

	21:00-22:00	52.00	60.40		
Night	22:00-23:00	52.40	58.70	50	Residential (Night-Time) - 45
	23:00-00:00	52.80	52.80		
	00:00-1:00	47.40	53.00		
	1:00-2:00	49.30	51.70		
	2:00-3:00	53.30	52.60		
	3:00-4:00	53.70	49.90		
	4:00-5:00	53.60	50.00		
	5:00-6:00	45.60	51.50		
24 Hours		47.20	54.84		

Source: Test result is generated by the Department of Air and Noise Quality Control (2020)

4.5.6 Vibration

148. Methodology

- Available vibration monitoring data was reviewed. Further fieldwork was required to ensure that a sufficient baseline for vibration levels is available.
- Potential vibration sources and sensitive receptors (e.g. local villages) were identified. The project construction and operation plans are analysed to determine the locations of equipment including trucks, bulldozers, drills and other fixed and mobile equipment required for construction works.
- The study collected two samples to build the baseline of virbation for the project. Locations selected are (1) within the project site ANV01 (X=434264, Y=1303047) and (2) near the existing access road ANV02 (X=439465, Y=1303928) (Figure 11).
- The potential impacts of vibration generating activities on sensitive receptors such as local villages were assessed based on Cambodian and international standards that are referenced where appropriate. Potential vibration impacts on sensitive receptors located along the likely transportation and access routes are assessed.
- Management and mitigation measures were developed that helps minimise any direct adverse effects associated with vibration from the project. This includes a framework for ongoing vibration monitoring, including recommendations for monitoring locations and frequency.
- The assessment and management of potential virbation impacts were based upon the Declaration on Uses of Terms of Reference for Establishing Factory and Handicraft (2018). There is no specific standard for IFC EH&S Guidelines on vibration.

Table 19: MoE's vibration standards

Vibration by time	Standard*
Day Time (6:00-18:00)	65 dB
Night Time (18:00-6:00)	60 dB

Note: *Declaration on Uses of Term of Reference for Establishment of Factory and Handicraft (2018)

149. Ground vibration was measured at the two locations – (1) in the project site, and (2) near the existing access road for 10 minutes every 1-3 hours. The vibration results are similar with the results of the noise level in a way that they are all below the MoE's standard across the 24 hours, and the location 2 has higher values than those in location 1. Same reason for such bigger values is due to the more frequent travels of trucks transporting factory products to Phnom Penh. The average 24-hour vibration level is 19.06 dB for location 1 and 23.16 dB

for location 2, which these values are far below the standards – 65 dB for day and 60 dB for night.

Table 20: Vibration level observed in and around the project site

Observed Time		Vibration Level dB		
		Result (1) (Average)	Result (2) (Average)	MoE's Standard
Day	6:00-7:00	20.40	26.90	65
	7:00-8:00	19.20	26.70	
	8:00-9:00	24.70	26.70	
	9:00-10:00	20.30	29.80	
	10:00-11:00	23.20	25.50	
	11:00-12:00	22.60	23.70	
	12:00-13:00	24.30	23.30	
	13:00-14:00	20.50	27.10	
	14:00-15:00	20.30	27.40	
	15:00-16:00	18.00	30.50	
	16:00-17:00	20.90	27.20	
	17:00-18:00	18.60	24.50	
Night	18:00-19:00	20.30	24.40	60
	19:00-20:00	17.70	17.30	
	20:00-21:00	17.50	17.30	
	21:00-22:00	16.40	18.00	
	22:00-23:00	15.80	17.60	
	23:00-00:00	22.10	17.20	
	00:00-1:00	15.60	17.30	
	1:00-2:00	15.40	16.60	
	2:00-3:00	15.70	18.50	
	3:00-4:00	16.10	17.30	
	4:00-5:00	15.80	17.00	
	5:00-6:00	16.00	28.50	
24 Hours		19.06	23.16	

Source: Test result is generated by the Department of Air and Noise Quality Control (2020)

4.5.7 Surface and groundwater quality

(A) Surface Water Quality

150. There are two important Ou (streams) in the project site that drains into the An Long Chrey Reservoir. These waterways run through and are close to the project site (Figure 17). These two streams run at full capacity during the rainy season when water usually floods their edges, banks and other riparian plants and trees, but less in dry season. These two streams are essential habitats for aquatic biodiversity. Any physical change, flow and water quality may pose critical concerns over their resources.

151. The objectives of the water quality are to:

- Characterize the current baseline surface water quality of major streams within/near the project area, upstream and downstream of the project
- Characterize the current baseline hydrology of major streams within / near the

project area, upstream and downstream of the project
- Compare the baseline water quality data to relevant national and international standards
- Assess potential impacts on water quality, and hydrology associated with the project during the project phases
- Identify suitable management measures for minimizing potential impacts on water quality, and hydrology associated with the project

152. Methodology – Baseline water quality data were collected in the project area on 22 September 2020. Additional data was collected throughout the SEIA process to ensure that an extensive pre-project baseline was available. Water quality data was compared to appropriate national and international water quality guidelines, such as those listed below. Cambodian water quality standards were used for comparison with baseline surface quality data, wherever possible. When Cambodian standards did not exist for certain parameters, relevant international standards were used.

153. For surface water sampling, the study documented the current condition of water quality in one stream by testing water sample from 2 locations (Figure 11) – (1) in Preak Mkak closed to the project boundary [SW01 (X= 433561, Y=1303122)] and (2) in the small canal within the project boundary [SW02 (X=434129, Y=1303449)]. Parameters for water testing are described below.

Cambodian water quality legislation and standards
- Sub-decree on Water Pollution Control (1999)
- Law on Water Resources Management in Cambodia (2007)
- Drinking Water Quality Standards (2004)

International water quality standards
- World Bank/IFC Environmental Health and Safety Guidelines (2007); and
- WHO Guidelines for Drinking Water Quality, fourth edition (2011)

154. The general procedure for surface water sampling was as follows:
- Bottles were labelled with site ID and date
- Gloves were used to prevent sample contamination
- Bottles (500 mL) were filled with sample water without headspace
- Bottles were sealed carefully
- Bottles samples were chilled

155. Surface Water. The proposed 60 MW solar plant is located upstream of a reservoir that serves a 170 kW micro-hydro An Long Chrey project. The reservoir gathers the interflow from three main streams[56] (source - upper catchment Aural) with major inflow from Stung Chreav stream. Two of these streams transect the project site while Stung Chreav stream bypasses the proposed project site by a distance of 1.6 km (Figure 13). These two streams are the only surface water bodies within the proposed solar plant site and will be conserved in its current natural condition.[57] Preliminary findings from the hydrological study suggests that the An Long Chrey reservoir experiences overflow during operation on recurring basis; in February 2012 the overflow extended up to 1.5 km from the proposed solar plant site. The reservoir is located

[56] They are (1) Stueng Kraing Ponley, (2) Stueng Chreav, and (3) Preak Mkak.

[57] The important habitat within the proposed solar park are the natural streams and it is necessary to conserve these streams in its natural state and establish a buffer of 400 m on both sides, Source: Project Biodiversity Assessment, July 2018.

approximately 4 to 5 km from the proposed solar plant site, therefore overflow will not be an issue. As seen in the area, there are no protected surface water bodies within the project area of influence, except the An Long Chrey.

156. The surface water test results are presented in the table below. The surface water quality test results show that parameters of the water quality are all under the allowable standards permitted by the Ministry of Environment (see Table 21 below) for public water protection. DO is very good in both locations which mean that the water supports the ecosystems very well. Heavy metal in water is relatively low; for instance, Hg, As, Fe are very less presented in water – posing no serious concern for domestic uses, except for drinking. Similarly, the Total Coliform is high for both locations, which alert the public health issue. Oil and grease is high in location two due to there are some clearing activities from the nearby farms. In general, the water quality at the two sampled locations is relatively good with respect to ecosystem health, but is not suitable for intake.

Table 21: MoE's parameters for surface water quality standards

No.	Surface water quality parameters	Unit	Standard*	#1**	#2**
1	Temperature	^oC	<45	25	25
2	pH	-	6-9	6.83	7.5
3	Total Suspended Solid (TSS)	mg/l	<120	29	32
4	Dissolved Oxygen (DO)	mg/l	>1	5.4	6.4
5	Biochemical Oxygen Demand (BOD_5)	mg/l	<80	1.29	1.4
6	Chemical Oxygen Demand (COD)	mg/l	<100	3.98	4.81
7	Total Nitrogen (TN)	mg/l	<6	0.64	0.68
8	Total Phosphorus (TP)	mg/l	<5	0.05	0.08
9	Total Dissolved Solid (TDS)	mg/l	<2000	34	47
10	Oil or Grease	mg/l	<15	11	21.2
11	Detergent	mg/l	<15	0.14	0.18
12	Sulfate (SO_4)	mg/l	<500	6	5
13	Asenic (As)	mg/l	<1	0.007	0.008
14	Iron (Fe)	mg/l	<20	0.55	0.63
15	Mercury (Hg)	mg/l	<0.05	ND	0.0003
16	Total Coliform	mg/l	<1000	$1.5x10^3$	$9.3x10^3$

Note: *Declaration on Uses of Term of Reference for Establishment of Factory and Handicraft, Ministry of Environment (2018), **#1&#2 are the sampled locations

(B) Groundwater Quality

157. For groundwater sampling, one sample was collected in a village closed to the project site since there is no bore hole located within the 60MW solar plant site.This well located 2 kilometers, north of the project plant and has been used for one year for mainly domestic use i.e. washing and cleaning.The depth of the well is around 40 meters. The sampling location is GW (X=433492, Y=1306328) (Figure 11). Selected parameters for the groundwater are listed in the table below.

158. Sample collection and analysis methodology: Sample was collected during rainy season. Field parameters are monitored using multi-parameter water quality probes. Sample was also collected in bottles containing the appropriate preservatives for analysis at an

accredited analytical laboratory (i.e. MoE's laboratory). Consistent with Cambodian and internationally recognized guidelines, the following laboratory parameters for surface water are sampled. The depth to groundwater varies from location to location. The depth is in between 40-60 meters as the areas closed to solar plant is relatively high with average elevitation from 80-200 meters above sea level rise (see section 4.5.1). The groundwater is mainly used for agriculture, grazing, and domestic use, but not for drinking. People use rainwater and buy bottled water for their intakes. As reported from the villagers, well runs a little bit dry during the dry season.

159. The groundwater quality is tested and the result shows that parameters of water quality are well below the thresholds determined by the Ministry of Environment. Heavy metal is all below the allowable permit for domestic uses, but it is not recommended for any intake. Iron and Al were slightly above the permittable standard. Hg and C6H6 could not be detected during the analysis which means that there is no or very less Hg and C6H6 in the groundwater.

Table 22: MoE's parameters for groundwater quality

No.	Parameter	Unit	Standards*	Result
1	pH	-	6.5-8.5	5.8
2	Turbidity	NTU	<5	4
3	Electrode Conductivity (EC)	NTU	500-1500	994
4	Total Dissolved Solid (TDS)	mg/l	<800	437
5	Total Hardness ($CaCO_3$)	mg/l	<300	130
6	Chloride (Cl)	mg/l	<250	100
7	Fluoride (F)	mg/l	<1.5	0.24
8	Nitrate (NO_3)	mg/l	<50	2
9	Sulfate (SO_4)	mg/l	<250	3.4
10	Iron (Fe)	mg/l	<0.3	**0.35**
11	Arsenic (As)	mg/l	<0.05	0.009
12	Mercury (Hg)	mg/l	<0.001	ND[58]
13	Chromium (Cr)	mg/l	<0.05	0.0008
14	Manganese (Mn)	mg/l	<0.1	0.04
15	Alumimium (Al)	mg/l	<0.2	**0.29**
16	Benzene (C_6H_6)	mg/l	<0.01	ND
17	Cadmium (Cd)	mg/l	<0.003	0.0004
18	Total Coliform	MPN/100ml	0	0
19	E-Coli	MPN/100ml	0	0

Note: *Declaration on Uses of Term of Reference for Establishment of Factory and Handicraft (2018), ND= Not Detected

160. Water Usage and Sources. Information on water usage and source by households in the project-affected communes are included under the Socio-Economic Profile of this section. Public consultations confirmed that the water usage is mainly for household use, feeding animals and irrigation. Water is sourced from local ponds, streams, and river or groundwater wells.

[58] The testing faciltities cannot detect it, an it means there is less Hg or absence of Hg in the water.

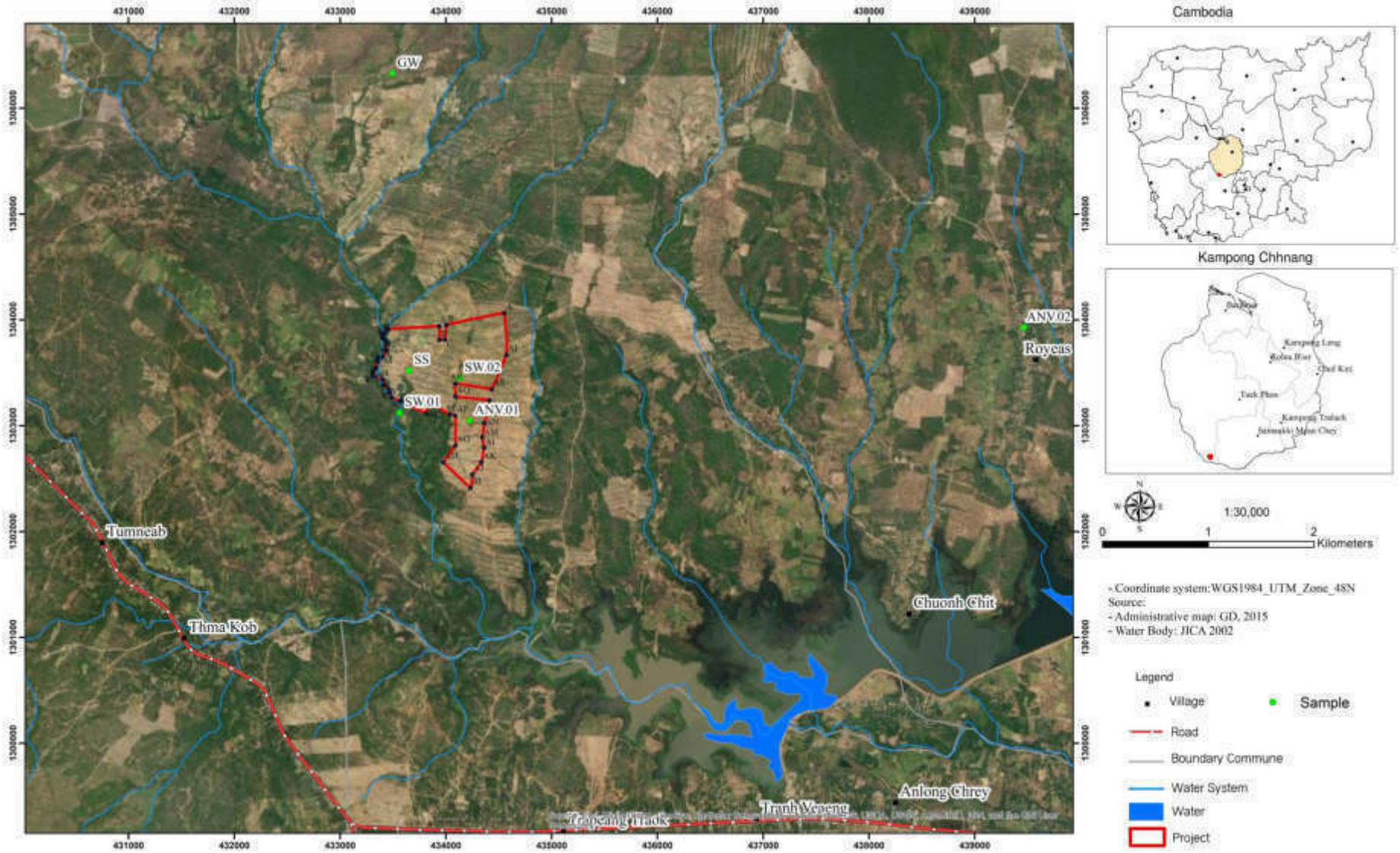
Photo 3: Surface water sampling activities


Surface water sampling (Location 1 in Preak Mkak)


Surface water sampling (Location 2 in small canal within the project site)


Groundwater sampling activity

Figure 11: Test locations



Source: Assessmand & Solution (2020)

5.4.8 Hydrology

161. The objectives of the hydrology study are to:

- Characterize the current baseline hydrology within/near the project area, upstream and downstream of the project
- Assess potential impacts on hydrology associated with the project during the project phases
- Identify suitable management measures for minimizing potential impacts on hydrology associated with the project

162. Methodology – A field visit to document the hydrology baseline in the project area was conducted on 22 September 2020. Existing baseline hydrology was reviewed and additional data was collected throughout the SEIA process to ensure that an extensive pre-project baseline was available.

163. An hydrological study assesses the entire catchment area of the selected site for the solar plant and immediately associated areas. Assessment takes account of peak rainfall season (September 2020) and anticipated increases in frequent and/or intense extreme weather events. Preliminary assessment shows the proposed project site is outside the flood boundary. Figure 18 presents the site contour generated by Google Earth and ArcGIS while Figure 19 shows stream inflow at the proposed project site.

164. In the closed vicinity of the project site, there is a big irrigation reservoir known as An Long Chrey, developed by the Ministry of Water Resources and Meteorology, under the Krang Ponley Water Resources Development Project from November 2009 to February 2012 with the financial support from Republic of Korea. This reservoir locates 48 km from Kampong Speu province. There are three main streams discharging water into this reservoir, namely Stueng Krang Ponley, Stueng Chreav, and Preak Mkak. This reservoir has a total catchment area of 479km2, and with 6.2km length. The normal height of the water is 69.5m and there are 10 associated structures. The reservoir can generate 170kW of electricity. This reservoir is beneficial for agriculture, fishing and domestic consumption. Moreover, there are other six associated canals diverting water to other users.

Photo 4: Existing hydrological systems in and around the project site

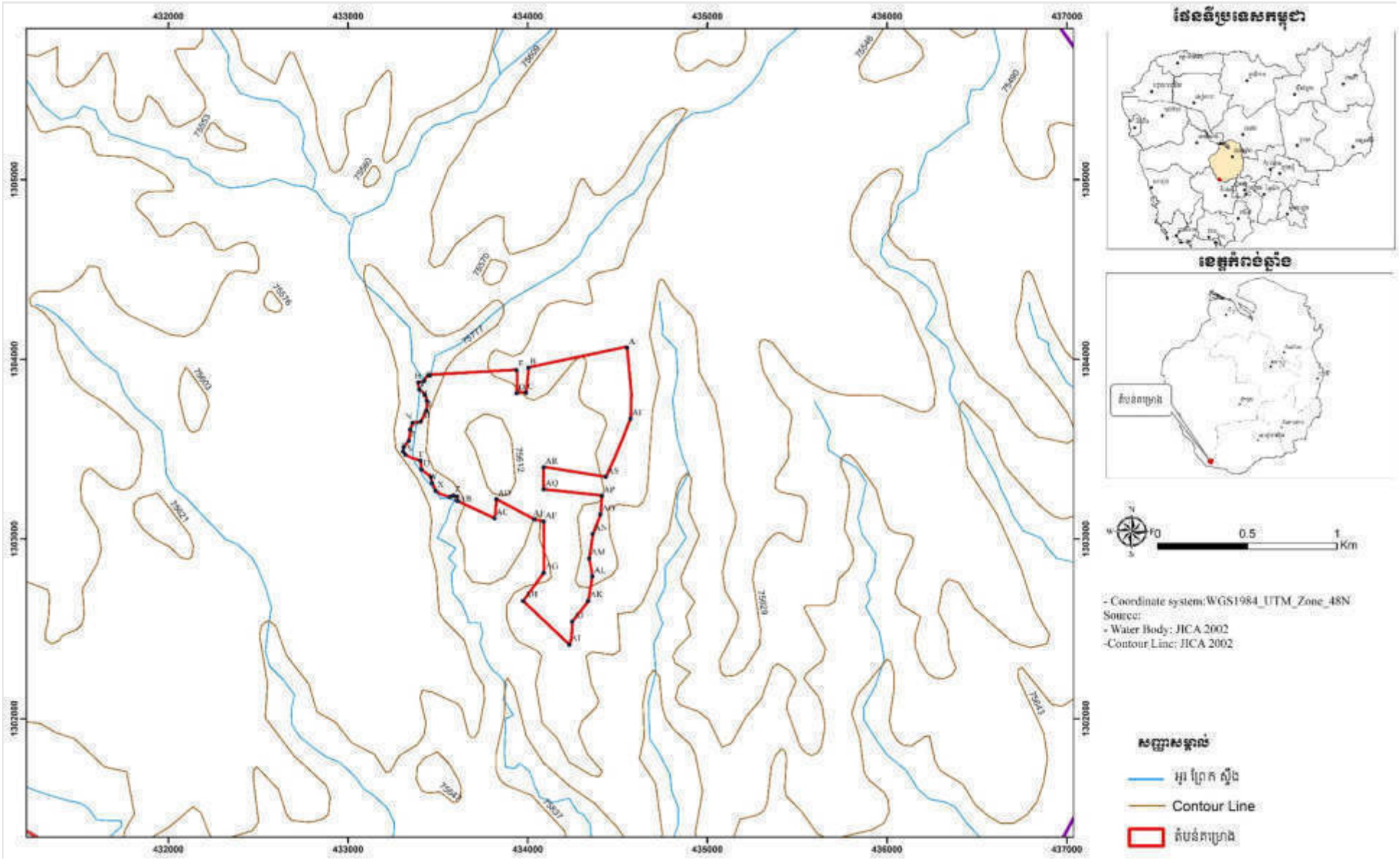
Kraing Ponley (An Long Chrey) Reservoir (September 2020)


Praek Mkak (western of the project site) (September 2020)



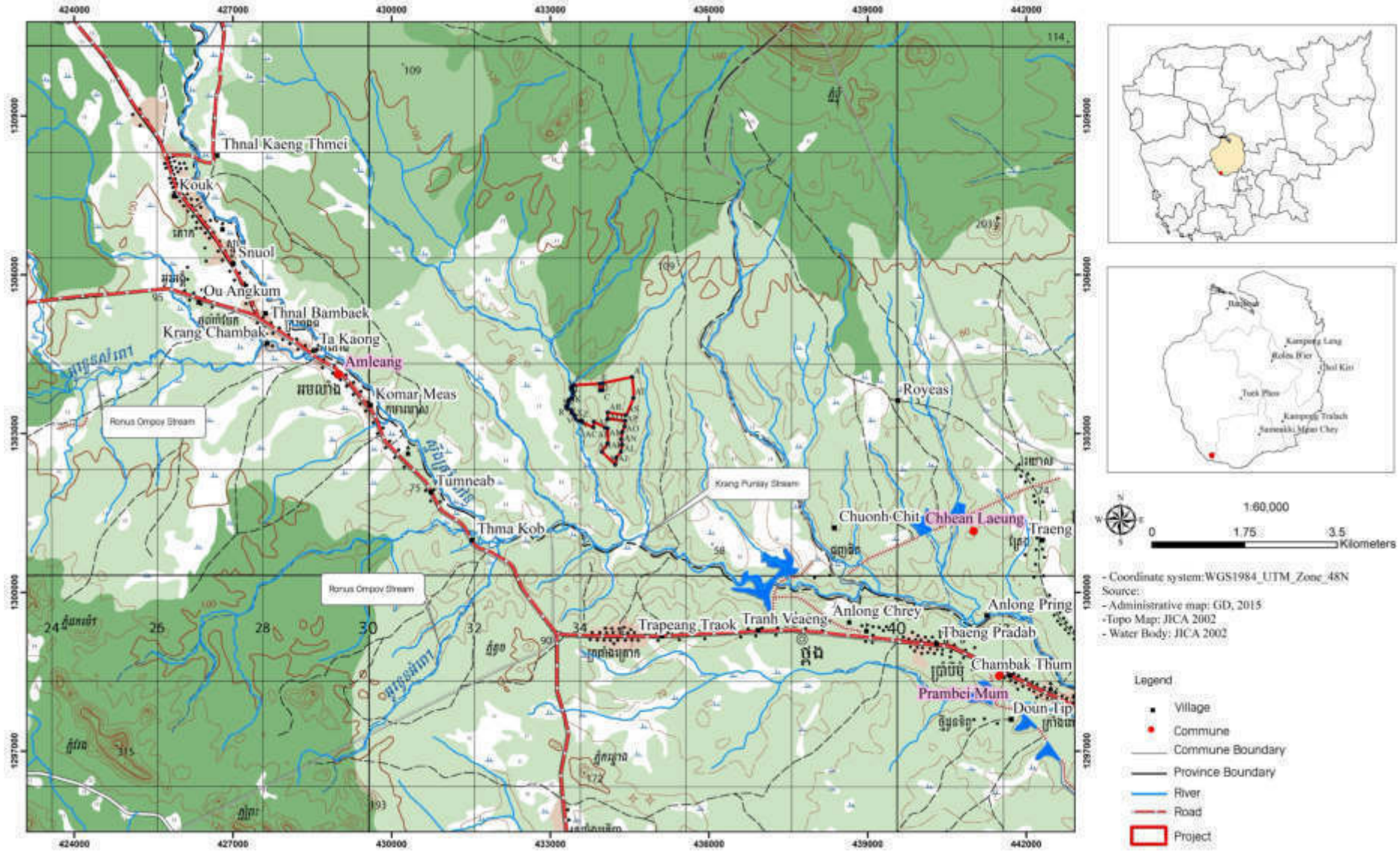
Small creek running in the middle of the project site (September 2020)

Figure 12: Site Contour in the Area of Influence



Source: YDRC (2020)

Figure 13: Stream Inflow in the Area of Influence



Source: YDRC (2020)

4.5.8 Natural Hazards

165. Climate Risks. The project has been screened for climate risks using the AWARE climate risk-screening tool[59] as part of the 60MW solar plant EIA and the overall risk level is Medium. The screening noted that the proposed project site is located in a region that may be potentially at a High-Level Risk from recurring major flood events and precipitation induced landslides and as such mitigation measures in the design are required. The screening also noted that the proposed project site is at a Medium Level Risk for increase in temperature and precipitation, change in water availability and solar radiation. Following the screening results, a Climate Risks and Vulnerability Analysis (CRVA) has been undertaken for the project. Project components sensitive to climate change were identified as listed in Table 23 below. These potential impacts are managed through design mitigation measures, where appropriate in accordance with the Guidelines for Climate Proofing Investments in the Energy Sector.

Table 23: Climate Change Impact on 60MW Solar Plant Infrastructure[60]

Climate Change Factor	Risk Level	Potential Impacts
▪ More frequent and/or intense extreme weather events ▪ Recurring flood events ▪ Precipitation induced landslides	High	▪ Increased risk of direct flood damage to solar photovoltaic (PV) plants, substation, drainage canals ▪ Increased risk of accelerated surface run-off, soil erosion and sedimentation load at site affecting land and drainage ▪ Access/approach roads could be damaged or washed out or segments could be eroded. ▪ Affected life span of solar plant infrastructure
▪ Increase in temperature ▪ Increase in precipitation ▪ Change in solar radiation ▪ Change in water availability	Medium	▪ Increased operating challenges to solar PV plants such as lower cell efficiency and energy output ▪ Heat waves stress on roads, buildings and other infrastructure ▪ Increased losses within the substation and transformers ▪ Increased risk of corrosion of steel infrastructure (lattice towers) with a corresponding increase in humidity ▪ Increased risk of drought episodes and dust damage to solar PV plants

[59] The screening is based on the Aware™ geographic data set, compiled from the latest scientific information on current geological, climate and related hazards together with projected changes for the future where available. These data are combined with the project's sensitivities to hazard variables, returning information on the current and potential future risks that could influence its design and planning.

[60] Data sources utilized: (i) GMS CEP SEA START RC Climate Change Adaptation Platform, web-link - http://climatechangeadaptation.gms-eoc.org/home/country; (ii) World Bank's Climate Change Knowledge Portal; (iii) Preliminary findings of the project Hydrological Study; (iv) Think Hazard, web-link: http://thinkhazard.org/en/report/44-cambodia/LS; (v) EM-DAT | The international disasters database, web-link: https://www.emdat.be/; (Vi) Guidelines for Climate Proofing Investments in the Energy Sector (ADB, 2013).

Climate Change Factor	Risk Level	Potential Impacts
		▪ Less water availability for PV panel cleaning and maintenance of vegetation within the solar plant

166. Extreme Weather Events. Storms and typhoons are not considered a major problem in Cambodia as surrounding mountain ranges protect the country. However, some storms do occasionally affect the country with most storm-related damage caused by localized floods associated with heavy rain. Tropical storms can also affect the level of Mekong River flooding and cause flash floods[61] as well as increase the risk of precipitation-induced landslides.

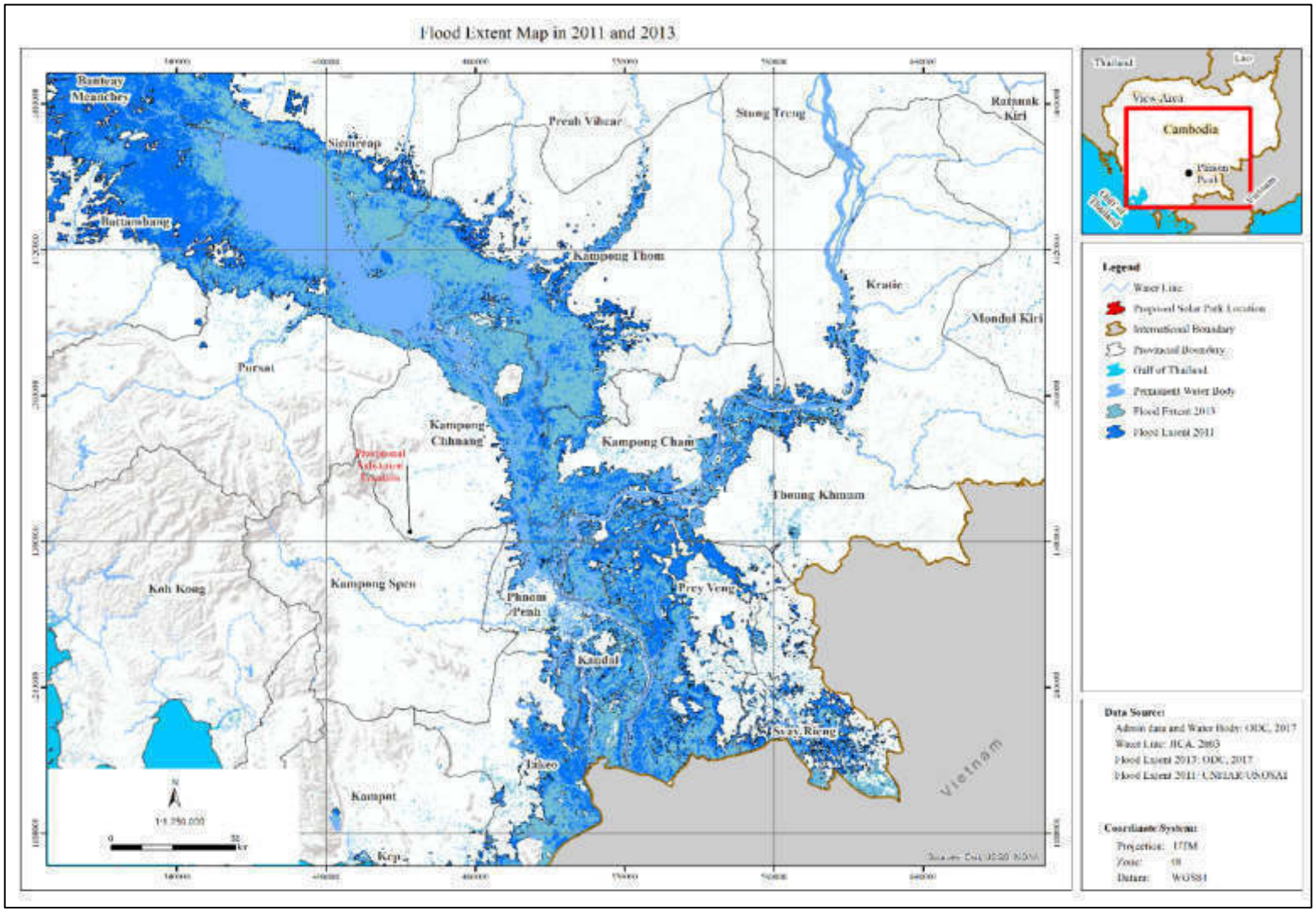
167. Some parts of Kampong Chhnang province were affected by flash floods in the recent past. The maximum flood extent in 2000[62] by the Mekong River flood and the maximum flash flood extent in 2011 and 2013 are presented in Figure 23. As seen in the figure, the proposed project site was out of the flood boundary during these events. The project area communes report heavy precipitation and corresponding floods that affected large areas of rice paddy fields in 2015. Kampong Chhnang province was affected by drought in January 2002 considered as the worst in two decades by the National Committee of Disaster Management and lasted until the onset of rains in mid-August. The project area communes report droughts as recurring phenomena during the dry season.

168. The project region is at low risk for geological hazards such as earthquake, seismic landslide, volcano and tsunami as well as potential decrease in incidences of precipitation. Therefore, these were not further elaborated for the purpose of discussion.

[61] The Mekong river floods are a result of the cumulative rainfall in the upper catchment of the Mekong throughout the rainy season. Mekong river floods are common in the provinces of Stung Treng, Kratie, Kampong Cham, Prey Veng, SvayRieng, Kandal, and Takeo. Flash floods are a result of repeated heavy rainfall in mountainous areas that flow to streams and tributaries of the Mekong River. Flash floods are swift, last only a few days but often cause severe damage to crops and infrastructure especially in tributaries around the Tonle Sap Lake.

[62] The year 2000 is considered as the worst flood in the recent history of Cambodia

Figure 14: Flood Extent for Year 2000, 2011 and 2013[63]

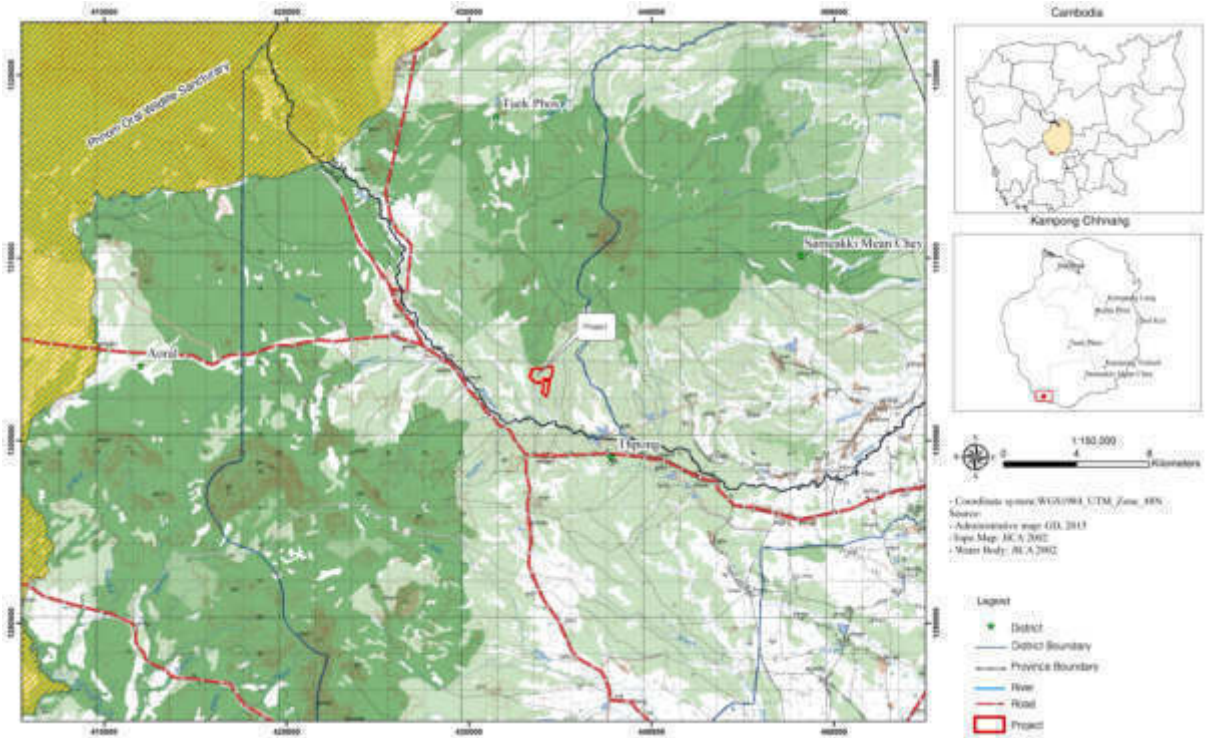


[63]Source: KCC Consultants for CAM NSPP May 2018

4.5.9 Protected Areas

169. Of the 49 Protected Areas in Cambodia, the closest is the Phnom Aural Wildlife Sanctuary located within 20 km from the proposed project site in Aural district of Kampong Speu province. The sanctuary was designated as a National Protected Area (NPA) as per the Royal Decree on Protected Area, 1993. The NPA covers an area of 253,750 ha and contains a variety of landforms, elevations and geology and is considered as an important bird and biodiversity area. Tonle Sap Lake, a Protected Area is located northwest of the proposed project site at a distance of about 60 – 65 km. The Protected Area is not within the project area of influence and will not be impacted by the project. The biodiversity assessment conducted for this project documents the migratory birds flying over the project site to these protected areas. The Phnom Aural National Protected Area and the proposed project site are shown in Figure 15.

Figure 15: Project site and near-by protected area



Source: YDRC (2020)

4.6 Ecological Resources

4.6.1 Flora/plant survey

170. This was to record the exisitng species presented in the plant site to alert the construction and management plans of the project in order to avoid disruption or design better response to keep them as much as possible. Since there was no commercial and large plants onsite, the survey was to record the report of the local people who used to get in around the plant site and knowledged the local species. Primary methods were:

- Interview with relevant local people and relevant technical departments in the Kampong Chhnang province
- Certain locations on the water body were visited if necessary to review potential habitats (i.e. An Long Chrey Reservoir). For forest, site review was needed since

there was no recent forest cover available.

171. Quick forest survey and resource uses – The objectives of the forest survey and forest resource use studies are to:

- Describe the status of flora in the project area and identify any high value habitat or rare and endangered species
- Describe any local community use of flora collected in the project area
- Record locations and conservation values of nearby protected areas
- Assess the potential impacts of the project on forest resources in the vicinity of the project area
- Develop avoidance, management and mitigation measures for the project, including proposed measures to offset any unavoidable impacts from the project.

172. Scope of work and methodology – Given the location of the proposed project closed to the Aural Wildlife Sanctuary and An Long Chrey Reservoir, the current status of terrestrial flora in the area and potential impacts are needed to be rapidly assessed. Important habitats and the presence of any species of conservation significance were determined. Furthermore, the importance of vegetation resources for subsistence and livelihood uses were also assessed. Indigenous knowledge survey was used as well as field surveys where required. The baseline study presented available information in order to:

- Describe key forest species, distribution, density, and their conservation significance
- Document the current forest status including their degradation and conservation
- Describe the current uses of these forest resources

173. There are no protected areas or habitats of particular biodiversity value within the project area of influence. The proposed 60WM solar plant site is located in modified environment (disturbed by human activity) dominated by scrubland with scattered trees and paddy fields (see Table 30), however it contains two natural streams that transect across the site and these are important for conversation since these serve the local habitat (also refer to discussion in Physical Resources above).

174. The survey on flora through visiting the site and interviewing local villagers about the presences of existing species records 26 plants and small trees. Shorea Obtusa (*Shorea tumbuggaia*) is found and rated by IUCN as Endangered, but the trees are small in diameters which have no economic values. Siam Tulip (*Curcuma alismatifola*) is very common on the ground in the project site, but this plant is categorized as nearly threatened. The rest cannot be identified in the Red List, but seems to be least concerned.

Table 24: Plants and small trees present in the project site

No.	Khmer Name	Scientific Names	IUCN Red List
1	Knai Maon (Dalbergia)	*Var.glabrescens*	NA
2	Rom Chong	*Nymphaca nouchali*	NA
3	Doem Kanhchet (Water Mimosa)	*Neptunia oleracea*	LC
4	Doem Thmenh Trei	*Bridelia ovate*	NA
5	Doem Banla Soet	*Mimo sa Pisdica*	NA
6	Doem Prolet Dong	*NA*	NA
7	Doem Chhoeng Kral	*NA*	NA
8	Doem Russey Prey	*Bambusa arundinacea (Retz) Willd*	NA
9	Doem Vor Kleng Por	*Bauhinia pulla crabi*	NA
10	Doem Vor Chhuy (Asclepiadacea)	*Steptocaulon juventas*	NA
11	Doem Thlok (Rosaceae)	*Parinarium annamensis*	NA
12	Doem Sromor (Combretaceae)	*Terminlia chebula*	NA
13	Doem Por Plea (Tiliaceae)	*Microcos tomentosa*	NA
14	Doem Plong Toek (Melastomaceae)	*Memecylon edule*	NA
15	Doem Tror Saek (Caesalpiniaceae)	*Peltophorum dasyrrhachis Kurz, var*	NA
16	Doem Por Pol (Verbenaceae)	*Vitex Pinnata*	NA
17	Doem Brong (Cycadeceae)	*Cycas inermis lour*	NA
18	Doem Phka Chahouy (Siam tulip)	*Curcuma alismatifola*	NT
19	Doem Lourng Reach (Golden Shower Tree)	*Cassia fistula*	LC
20	Doem Chhlick (Arjun Tree)	*Terminalia arjuna*	NA
21	Doem Pcheck (Shorea Obtusa)	*Shorea tumbuggaia*	EN
22	Doem Thnong (Padauk)	*Pterocarpus pedatus, Pierre*	NA
23	Doem Kroeul	*Melanorrhea laccifera, Pierre*	NA
24	Doem Hai San (Chansor)	*Cassia garretiana, Craib*	NA
25	Doem Kandaul	*Careya sphaerica, Pierre*	NA
26	Doem Khvao (Haldu)	*Adina cordifolia, Hook.f.*	NA

Source: LC=Least Concerned, EN= Endangered, NT= Nearly Threatened, NA=Not Available

Photo 5: Some plant species identified on site

Golden Shower Tree (Cessia fistula)

Siam tulip (Curcuma alismatifola)

Cessia garrentiana, Craib

Peltophorum dasyrrhachis

Arjun Tree (terminalia arjuna)

Sermor (local name)

Poplea (local name)

Cycadeceae (Cycas inermislour)

Leea macrophylla Roxb-hornm

Phlobat (local name)

Careya sphaerica, Pierre

Shorea Obtuca (Shorea tumbuggaia)

Alouk (local name)

Antreang Khet (local name)

175. Community forests. The Tbeng Srorng (or Andong Breng) protected community forest (located approximately 5-7 km away from the proposed 60MW solar plant site) covers an area of 254,56 ha and has a mix of diverse tree species that are grown and/or regenerated. The habitats located within this community forest can be considered as new regenerating natural habitat and a good ecosystem for wildlife. This community forest will not be affected by this project.

Photo 6: Tbeng Srorng Community forest

4.6.2 Fauna survey and resource uses

176. The objectives of the wildlife survey and resource use studies are to:

- Describe the status of fauna in the project area and identify any high value habitat or rare and endangered species
- Describe any local community use of wildlife collected in the project area
- Assess the potential impacts of the project on wildlife biodiversity in the vicinity of

the project area
- Develop avoidance, management and mitigation measures for the project, including proposed measures to offset any unavoidable impacts from the project.

177. Scope of work and methodology – Given the location of the proposed project closed to the Aural Wildlife Sanctuary and An Long Chrey Reservoir, the current status of terrestrial fauna in the area and potential impacts is needed to be rapidly assessed. Important habitats and the presence of any species of conservation significance were determined. Furthermore, the importance of wildlife resources for subsistence and livelihood uses were also assessed. Indigenous knowledge surveys were used as well as field surveys where required. The baseline study presents available information in order to:
- Describe key wildlife species, distribution, density, and their conservation significance
- Document the current wildlife status including their uses, threatening factors and conservation
- The survey is based on the guide Alan Rabinowiz (2000) and Carl Traeholt (2003).

178. Management measures for any impacts are developed, and suitable wildlife and rehabilitation methods for the project area were identified as part of the SEIA process. Proposed measures were also developed to offset any unavoidable impacts on biodiversity from the project.

179. There were no endemic, rare, threatened or globally endangered species or species of particular conservation value observed during the site visit or identified from consultations and historic records at the proposed solar plant site. All bird species recorded or tallied during the ground surveys that were conducted in dry season and wet season[64] are classified by IUCN as being of Least Concern category, these include regional migratory, local migratory and ground birds.

180. An Long Chrey reservoir. The reservoir is located downstream of the solar plant site at a distance of about 4-5 km. Based on its ecological condition coupled with frequent increases in elevation of stored water especially during rainy season, this site can attract some migrant bird species such as Lesser Whistling Duck, Cotton Pygmy Goose, Barn Swallow, Asian Palm Swift, House Swift, etc as winter visitors (all IUCN Least Concern classification). These migrants have their own specific flyway that is included in East Asian – Australasian Flyway of migratory water birds.

181. 60MW Solar Plant Site. When considering the habitats within the proposed 60MW solar plantsite and the wider surrounding area comprising of scrubland, agricultural farms, streams as well as the downstream reservoir, these are modified habitats. Within 60MW solar plant area, the presence of two natural streams may support bird species as well as wild pig, muntjac, Burmese hare and other rabbit species (all Least Concern IUCN classification).

[64] Dry season survey was conducted in March 2018 and covered the proposed solar park site, alternative site. Wet season survey was conducted in July 2018 and covered the proposed solar park site (close to the solar park site), An Long Chrey Reservoir[64] and Tbeng Srorng community forest (300 ha) located northeast of proposed solar park in Chean Leung commune at a distance of approximately 4-5 km.

182. Comparison between Survey Results conducted during dry and wet season. Dry season and wet season surveys tallied and recorded a total of 78 and 24 bird species, respectively at the proposed solar plantsite. All bird species were of “Least Concern” category as per IUCN. Only 16 bird species were common between dry and wet season surveys. The difference in number of species recorded during the two surveys may be attributed to seasonal migration. The dry season survey was conducted in March, which is a prime time for bird migration at global, regional and local level while the wet season survey was conducted in July, which is when most of the bird species move away to their breeding or to other foraging grounds. The wet season survey indicates that that there is an ecological connection between stream habitats, reservoir, dipterocarpaceae forest and scrubland. The natural streams within the proposed 60MW solar plant site serve as the feeding ground for Green Peafowl (Least Concern IUCN classification) while the Dipterocarpaceae forest in Tbeng Srorng community forest serves as its breeding ground. Other bird species may migrate to other nearby areas for feeding and breeding including the Phnom Aural Wildlife NPA, the Tonle Sap Biosphere Reserve of the reservoir, for instance, the migration of egret and heron species from the natural stream to the reservoir. In addition, the habitat of Dipterocarpaceae forest and scrubland is also favorable for local migratory species such as the eagle.

183. Community Forests. Tbeng Srorng community forest containing the Dipterocarpaceae forest (300 ha) is suitable for wildlife such as Green Peafowl, Red jungle fowl, Wild pig, etc. Most of red jungle fowl can breed within this habitat. This forest, located approximately 5-7 km northeast of the proposed 60MW solar plant site, will not be affected by the proposed project. The local interviews at Royeas village in Chhaen Laeung commune reported possible presence of endangered and vulnerable mammals and reptiles within Tbeng Srong community forest as seen or heard within the last five years. Species included Dhole, Fishing Cat (both classified as IUCN Endangered), Asiatic Jackal, and Burmese Python (both classified as IUCN Vulnerable). However, these species and/or suitable habitats for these species were not identified in the field survey (September 2020). The interviews also confirmed that bird species found are typical of forested areas, wetlands and rural areas.

184. *Mammals:* 10 common mammal species were recorded during the field observation and in-depth interviews with the local villagers living closed to the project site or having wandered around in the project site. These are IUCN Least Concerned mammals and their population has decreased remarkably in the last five years.

Table 25: Mammal species recently reported (September 2020)

No.	English Name	Scientific Name	Family	MAFF	IUCN
1	Wild Boar	Sus scrofa	Suidae	C	LC
2	Red Muntjac	Muntiacus muntjak	Cervidae	C	LC
3	Burmese Hare	Lepus peguensis	Leporidae	C	LC
4	Malayan Porcupine	Hystrix brachyura	Hystricidae	C	LC
5	White-tailed deer	Odocoileus virginianus	Cervidae	C	LC
6	Common Palm Civet	Paradoxurus hermaphroditus	Viverridae	C	LC
7	Berdmore's Squirrel	Menetes berdmorei	Sciuridae	C	LC
8	Variable Squirrel	Callosciurus finlaysonii	Callosciurus finlaysonii	C	LC
9	Javan Mongoose	Herpestes javanicus	Herpestidae	C	LC
10	Crab-eating Mongoose	Herpestes urva	Herpestidae	C	LC

Note: C=Common, LC= Least Concerned

Photo 7: Wildlife footprints

Footprint of Wild Boar

Footprint of Red Muntjac

185. *Bird species:* 20 bird species were recorded during the interviews with local villagers and field observation. Three IUCN nearly-threatened parakeet species were reported to be present in the area, but their habitats could not be found. They were seen flying across the area. The rest was classified as Least Concerned by IUCN and as common by Cambodian Ministry of Agriculture, Fishery and Forestry.

Table 26: Bird species recently reported (September 2020)

No.	English Name	Scientific Name	Family	MAFF	IUCN
1	Red- rumped Swallow	*Hirundo daurica*	Hirundinidae	C	LC
2	White-vented Myna	*Acridotheres grandis*	Sturnidae	C	LC
3	Yellow-vented Bulbul	*Pycnonotus goiavier*	Pycnonotidae	C	LC
4	Slaty-backed Forktail	*Nectarinia jugularis*	Nectariniidae	C	LC
5	Plain-backed Sparrow	*Passer flaveolus*	Passeridae	C	LC
6	Red Junglefowl	*Gallus gallus*	Phasianidae	C	LC
7	Barn owl	*Tyto alba*	Tytonidae	C	LC
8	Greater Coucal	*Centropus sinensis*	Cuculidae	C	LC
9	Red-whiskered bulbul	*Pycnonotus jocosus*	Pycnonotidae	C	LC
10	Brown Boobook	*Ninox scutulata*	Strigidae	C	LC
11	Asian Barred Owlet	*Glaucidium cuculodies*	Strigidae	C	LC
12	Grey-headed Parakeet	*Psittacula finschii*	Psittacidae	C	NT
13	Red-breasted Parakeet	*Psittacula alexandri*	Psittacidae	C	NT
14	Blossom-headed parakeet	*Psittacula roseata*	Psittacidae	C	NT
15	Velnal Hanging Parrot	*Loriculus vernalis*	Psittacidae	C	LC
16	Grey-capped Woodpeeker	*Dendrocopos canicapillus*	Picidae	C	LC
17	Lesser Yellownape	*Picus chlorolophus*	Picidae	C	LC
18	Common Hoopoe	*Upupa epops*	Upupidae	C	LC
19	Orange-breasted Green Pigeon	*Treron bicincta*	Columbidae	C	LC
20	Sri Lanka Green Pigeon	*Treron pompadora*	Columbidae	C	LC

Note: C= Common, LC= Least Concerned

186. A bird survey assessment was commissioned[65] in July 2019 and the result confirmed that there were a total of 124 species identified including four Near-Threatened Species (Blossom-headed Parakeet, Cambodian Tailorbird, Oriental Darter and Red-breasted Parakeet) and one Endangered Species (Green Peafowl). The other 119 species are classified as Least Concern. The development of the 60MW solar plant will have minimal impact on national populations of the near threatened Blossom-headed Parakeet and Red-breasted Parakeet as their primary habitats are in Northern Cambodia, whilst Oriental Darter is only a non-breeding visitor to the site.

187. Baseline Bat Assessment was conducted in October 2019 during the wet season. The assessment confirmed the following results:

- Acoustic sampling yielded a total of 3,194 discrete bat passes, 92% of which were recorded in the Kampong Speu portion of the subproject area (SP-12 to SP-23). Mean

[65] Sam Veasna Center for Wildlife Conservation was commissioned to conduct the bird assessment during the dry season under the sub-contractor no. 52096-001. Field surveys in and outside the command area were conducted from 29 April 2018 to 10 May 2019. 24 Village interviews were conducted within these dates.

nightly activity was 139 bat passes (SD ± 180), with a maximum of 539 passes at SP-13 and SP-21 and a minimum of 4 bat passes apiece at SP-6, SP-7, SP-10 and SP-11.

- Direct observations and interviews with residents did not reveal any significant (e.g., >100 individuals) natural roosts for bats. No caves were detected and residents consistently suggested that none occur in the vicinity of the subproject area. The same was true of insectivorous bat farms and flying fox colonies, although occasional sightings of flying foxes were reported at SP-4, SP-12, SP-19 and SP-20 which are presumed to originate from outside of the subproject area.
- With the exception of *Hipposideros* cf. *griffini* (which has been proposed as Near-Threatened), all bat species directly recorded during the survey are currently recognised as Least Concern by the IUCN (2019). The sightings of flying foxes reported by residents are presumed to represent *Pteropus vampyrus* (Near-Threatened) or *P. lylei* (Vulnerable), because the only other flying fox in Cambodia (*P. hypomelanus*) primarily occurs in coastal areas and on marine islands.
- Regarding its conservation significance, current data suggest that the subproject area does not qualify for bats under criterion 1 (Habitat of Critically Endangered +/or Endangered species), criterion 2 (Habitat of significant importance to endemic and/or restricted-range species) or criterion 3 (Habitat supporting globally significant concentrations of migratory species and/or congregatory species) of IFC Performance Standard 6 (IFC 2012a,b)[66&67].

188. *Reptile species:* Indochinese Spitting Cobra and King Cobra have been reported as present in the area. They are IUCN vulnerable species. The area is good for small reptiles but not critically-conservative species. They are common in Cambodia rural area for instance the rate snake.

Table 27: Reptile species reported (September 2020)

No.	English Name	Scientific Name	Family	MAFF	IUCN
1	Striped Keelback	*Amphiesma stolata*	Natricidae	NA	LC
2	Indochinese Ratsnake	*Pytas korros*	NA	NA	NA
3	Chequered Keelback	*Xenochrophis piscator*	Natricidae	NA	NA
4	Common Blind Snake	*Ramphotyphlops braminus*	Typhlopidae	NA	NA
5	Indochinese Spitting Cobra	*Naja siamensis*	Elapidae	II	VU
6	Monocled Cobra	*Naja kaouthia*	Elapidae	II	LC
7	King Cobra	*Ophiophagus hannanh*	Elapidae	II	VU

Note: LC= Least Concerned, VU= Vulnerable, NA= Not Available

189. *Amphibian Species:* 17 species are recorded during the field survey. They are the common species in rural Cambodia. All of them is classified as common or least concerned species.

[66] IFC (2012a) Performance standard 6: Biodiversity conservation and sustainable management of living resources. International Finance Corporation, World Bank Group, Washington DC, USA.

[67] IFC (2012b) Guidance note 6: Biodiversity conservation and sustainable management of living resources. International Finance Corporation, World Bank Group, Washington DC, USA.

Table 28: Amphibian species (September 2020)

No.	English Name	Scientific Name	MAFF	IUCN
1	Paddy frog	*Fejervarya limnocharis*	NA	LC
2	Rugulose frog	*Rana mortensenic*	NA	NA
3	Common Asian toad	*Bufo melenostictus*	NA	LC
4	Common Asia Bull frog	*Palypedates leucomystax*	NA	LC
5	Counsilimani	*Johora tiomanensis*	NA	NT
6	Black rice crab	*Somaniathelpusa sp.*	NA	NA
7	Common Butterfly Lizard	*Leiolepis belliana*	NA	LC
8	Eastern Butterfly Lizard	*Leiopelis reevesil*	NA	NA
9	Striped Tree Skink	*Lygosoma vittlgera*	NA	NA
10	Short-limbed Supple Skink	*Lygosoma quadrupes*	NA	NA
11	Streamside Skink	*Sphenomorphus maculatus*	NA	NA
12	Indian Forest Skink	*Sphenmorphus indicus*	NA	NA
13	Long-tailed Sun Skink	*Mabuya multifasciata*	NA	NA
14	Small-scaled Water Skink	*Tropidophorus microlepts*	NA	LC
15	Northern Forest Creasted Lizard	*Calotes emma alticristatus*	NA	LC
16	Malayan Krait	*Bungarus candiduus*	NA	LC
17	Banded Krait	*Bungarus fasciatus*	NA	LC

Note: LC= Least Concerned, NA= Not Available

4.6.3 Fishery

190. 38 fish species were reported to be important for food for the local people. Almost all of them could not be identified in the IUCN Red List and were commonly known in Cambodia. There was IUCN Endangered species – Thickliped Barb - *Probarbus labeamajor* reportedly present in the An Long Chrey reservoir. Since this reservoir is a protected water body, the Prime Minister of Cambodia once releases hundreds of critical species into this reservoir.

Table 29: Fish species reported (September 2020)

No.	English Name	Scientific Name	Family	IUCN
1	Myer's silver rasbora	*Rasbora myersi*	Cyprinidae	NA
2	Lesser double-lipped carp	*Lobocheilos melanotaenia*	Cyprinidae	LC
3	Chhben	*Hypsibarbus suvattii*	Cyprinidae	NA
4	Snail eating barb	*Puntioplites proctozysron*	Cyprinidae	NA
5	Asiatic minnow	*Paralaubuca typus*	Cyprinidae	NA

6	Three spot gourami	*Trichogaster trichopterus*	Osphronemidae	NA
7	Moonlight gourami	*Trichogaster microlepis*	Osphronemidae	NA
8	Kantouy Kraham	*Discherodontus ashmeadi*	Cyprinidae	NA
9	Flying minnow	*Esomus metallicus*	Cyprinidae	NA
10	Knong Benla	*Poropuntius normani*	Cyprinidae	NA
11	Ronong Chhnot	*Onychostoma gerlachi*	Cyprinidae	NA
12	Talking gourami	*Trichopsis pumila*	Osphronemidae	NA
13	Freshwater garfish	*Xenentodon cancila*	Belonidae	NA
14	Kam Pleav	*Kryptopterus hexapterus*	Siluridae	NA
15	Kam Pleav Kranh	*Kryptopterus cryptopterus*	Siluridae	NA
16	Kam Pleav Brak	*Kryptopterus limpok*	Siluridae	NA
17	Eel walking catfish	*Clarias nieuhofii*	Clariidae	NA
18	Kanchos Bay	*Mystus singaringan*	Bagridae	NA
19	Kam Poes	*Macrobrachium nipponese*	NA	NA
20	Swamp eel	*Monopterus albus*	Synbranchidae	NA
21	Striped snakehead	*Channa striata*	Channidae	NA
22	Chhlonh	*Macrognathus siamensis*	Mastacembelidae	NA
23	Siamese long fin carp	*Labiobarbus siamensis*	Mastacembelidae	NA
24	Thickliped barb	*Probarbus labeamajor*	Cyprinidae	EN
25	Mekong giant barb	*Catlocarpio siamensis*	NA	LC
26	Yellow Eyed silver barb	*Hypsibarbus pierre*	Cyprinidae	DD
27	Goldfin tinfoil barb	*Hampala macrolepidota*	Cyprinidae	LC
28	Trei Snek Russey	*Paralaubuca barroni*	Cyprinidae	LC
29	Snail eating barb	*Puntioplites proctozysron*	Cyprinidae	LC
30	Trei Kes	*Kryptopterus micronemus*	Siluridae	LC
31	Nile tilapia	*Oreochromis niloticus*	Cichlidae	LC
32	Trei Kanchos	*Mystus wolffi*	Bagridae	LC
33	Catopra	*Pristolepis fasciata*	Pristolepidae	LC
34	Three spot gourami	*Trichohodus trichopterus*	Osphronemidae	LC
35	Moonlight gourami	*Trichohodus microlepis*	Osphronemidae	LC
36	Red cheek barb	*Puntinus orphoides*	Cyprinidae	
37	Lesser silver mud carp	*Cirrhinus lobstus*	Cyprinidae	LC
38	Siamese mud carp	*Cirrhinus siamensis*	Cyprinidae	LC

Note: LC= Least Concerned, DD= Data Deficiency, EN= Endangered, NA= Not Available

Photo 8: Some fish species found during the field observation

Fish species found in An Long Chrey Reservoir

4.7 Socio-Economic Profile

(A) Socio-economic study

191. The objectives of the socio-economic assessment for the Project are to:

- Establish a socio-economic baseline for the project region
- Identify possible social impacts of project activities on the communities in the vicinity of the project area. These may include issues related to land loss, increased migration, women, education, migration, health, economic status and employment
- Identify suitable avoidance, management and mitigation measures that help minimise any adverse effects of the project on local villagers and help maximise socio-economic benefits for the region

192. Methodology – To establish a detailed socio-economic baseline for the project area, socio-economic surveys cover possibly impacted village, as well as key indirectly impacted villages such as those along the transportation route. The survey was based on a standard best practice questionnaire that had been modified by the survey team to reflect the specific socio-economic context of the project.

193. The study covered three communes – Kbal Toeuk commune in Toeuk Phos district, and Chhean Loerng commune in Samaki Meanchey district, Kampong Chhnang province and Prambei Mom commune in Kampong Speu province. Only key informant interviews with commune chiefs and village leaders were scheduled and conducted in Chhean Loerng and Prambei Mom communes, but the 78-individual household survey was conducted in Chhean Loerng commune where the local residents were living quite closed to the Solar Plant and also along the existing access road. The project locates in Prey Chrov village in Kbal Toeuk commune but the no physical residents are identified closed to the Solar Plant than the villagers in Chhuon Chet village in Chean Loerng commune. Therefore the socio-economic survey selected some samples in this village. There are 236 families and 236 people in this Chhoun Chet village (commune database 2017). Sample size was determined based on the current population data using the calculation formula of Yamane Taro (1967) as followed with e=10% and 90% of confidentiality.

n = N/1+Ne2
(n=sample, N=total population, e=sampling error)

Thus, sample for Knal Keng village is 78 families.

194. Survey collects information required to:

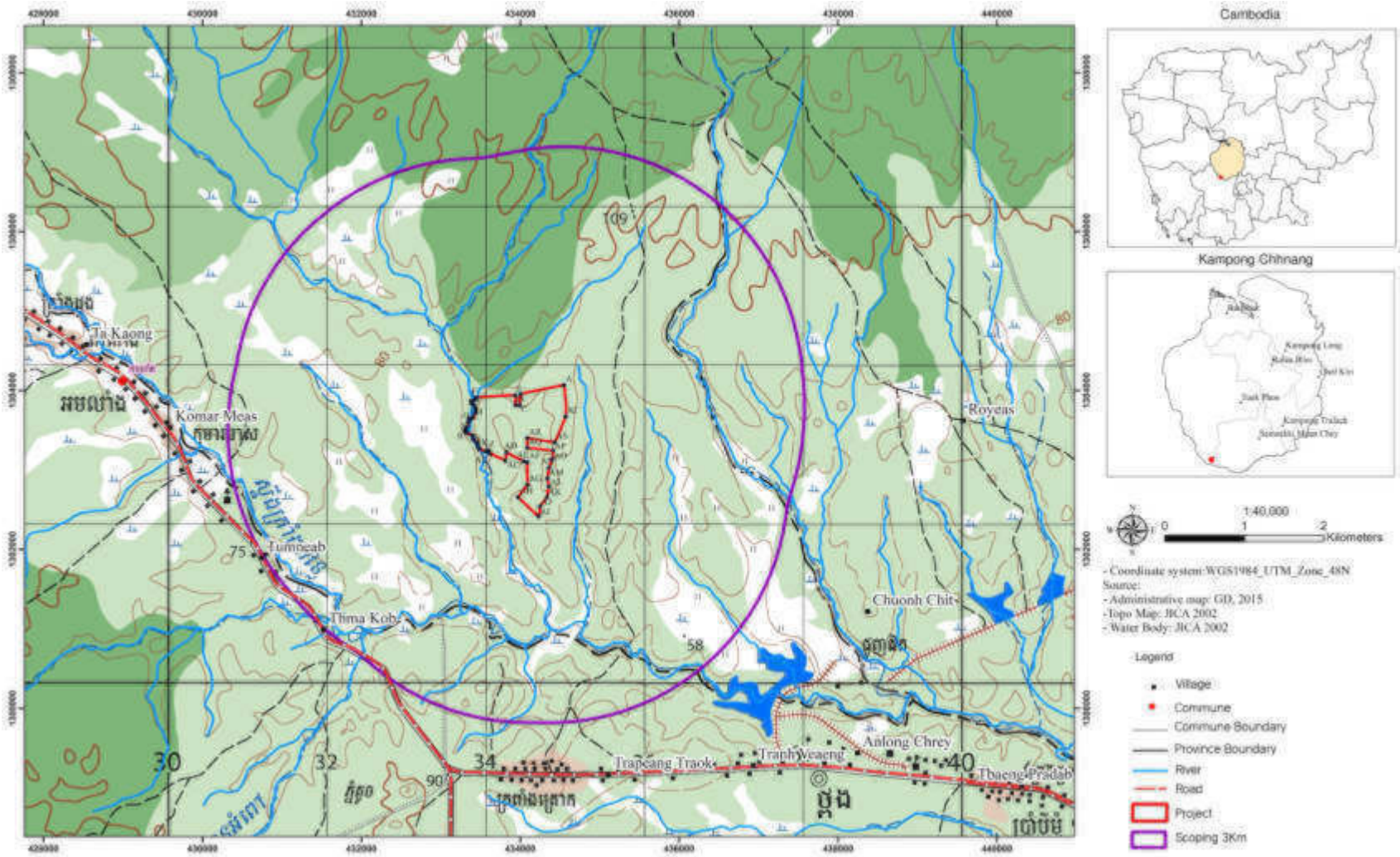
- Determine the age structure, sex ratio and any other relevant demographic characteristics of the communities within the study area (i.e. mortality rates, marriages, migration and ethnic composition)
- Determine the number of residences, the range and average household size (area and number of persons) within the study area
- Describe the level of education and skill of people living in communities within the study area
- Determine the number of presently employed and unemployed people according to gender from each of the villages in the following categories:
    - Education level
    - Skilled
    - Unskilled
- Determine the average and range in household incomes and the proportion of effort expended on subsistence versus cash economy activities within the study area
- Determine the principal sources of cash income for local people
- Determine the use of and dependence on terrestrial and aquatic resources
- Identify baseline public utilities and services available to local villages
- Identify relevant safety and security issues and risks, such as those associated with UXOs

195. Following completion of the baseline socio-economic study, the ESIA team then assessed the potential socio-economic impacts and benefits of the proposed project. Potential socio-economic issues were assessed including:

- Impacts on socio-economic, cultural and livelihood activities in the region
- Impacts on migration and future economic growth
- Impacts on land use and land allocation
- Impacts on community social frameworks and local political mechanisms
- Impacts on vulnerable groups, including women, ethnic minorities (if any),
- Impacts on poverty and development
- Cumulative socio-economic impacts

Photo 9: Socio-economic survey

Figure 16: Map of socio-economic survey



Source: YDRC (2020)

(B) Socio-economic Profile

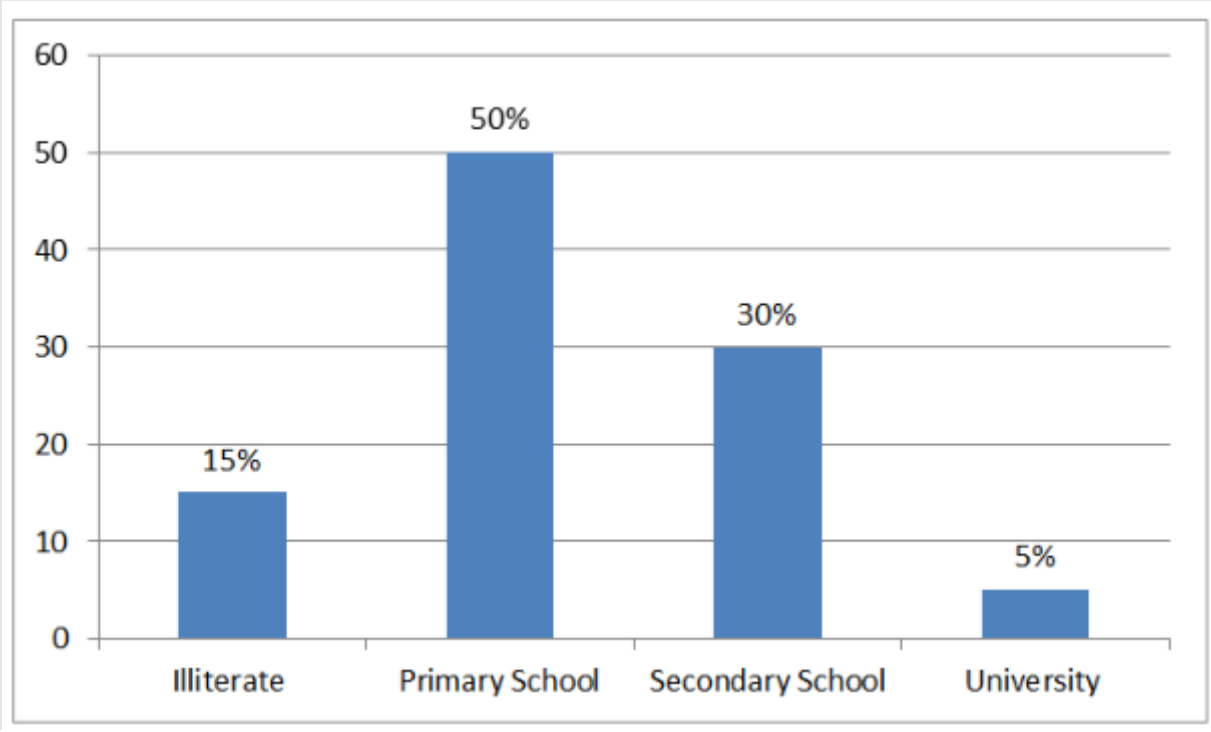
196. *Demographics:* The socio-economic survey was conducted in Prambei Mom commune, Thbong District, Kampong Speu province and in Kbal Toeuk Commune, Toek Phos District, Kampong Chhnang province but only household survey was carried out in Chhean Loerng commune and the key informant interviews with commune/village chiefs in other communes. The recent population data (2019) shows that there are 2,745 families in Prambei Mom with a total of 11,992 people including 5,941 females. There are 329 female-headed families. For Kbal Toek, there are 1,485 families with a total of 9,560 people including 3,177 females and 374 female-headed families. The average household size for both locations is 4-5 persons. There are no other ethnic groups than Khmer in the selected samples.

197. *Education:* The survey concluded that 30% of the residents completed secondary school and only 5% goes to university. Illiteracy is prevalent among a certain age group due to schooling limitations during and immediately after the Khmer Rouge period which resulted in 15% remained illiterate (Figure 23). Each Commune has several primary schools and one lower secondary school while upper secondary schools are located in only Khsem Khsant and Prambei Mom communes. There is one high school in Prambei Mom – Hun Sen An Long Chrey. Also, three secondary schools exist in the areas – Chrok Tnout Primary-Secondary School, Taing Por Primary School, Prambei Mom Primary School, and Trapaing Troak Primary School. The 2017 Statistics[68] from Ministry of Education, Youth and Sports prove that Kampong Chhnang province has grown remarkably both in education quality and quantity. The gross enrollment rate remains high up to 104.6%, 60.3%, and 26.7% in primary, lower secondary and upper secondary level. There are 454 educational entities (105 pre-schools, 273 primary schools, 60 lower secondary schools, and 16 upper secondary schools) with a total student of 115,302 and 3,510 teachers.

Photo 10: Primary, Secondary and High Schools around the solar plant

[68] Ministry of Education, Youth and Sport (2017). Education Statistics and Indicators 2016-2017. Department of Education Management Information System, Phnom Penh, Cambodia

Figure 17: Education of the interviewed residents



198. *Occupation and income*: During the field survey in both locations, there were diverse economic activities that generated income for the local residents. Majority of the households in the project area practice farming while some households run small businesses. Some household members also earn their livelihood working in nearby factories/industries, at construction sites and/or hold government staff positions. Livelihood generation and employment on plantations was reported as temporary and seasonal. Agriculture is a main occupation for both areas, with large proportions of respondents (55%) involved in farming and cropping. The rest combined as a secondary income generating activities, including livestock, fishery, and worker in factories. Regarding the income, 15% of the interviewed households earns less than 500,000 riel (US$125) annually; while the other 15% earns the most, more than 3,000,000 riel (US$750). Still poverty is a concern in the survey area due to limited job opportunities. The poverty rate in Kampong Chhnang province in 2010 is only 30.4% and this percentage falls gradually till 2020. Based on the current survey in September 2020, the current household poverty rate is around 28% among the interviewed households which was reported by the commune chief. This rate is higher than the national poverty line – 12.9%

in 2020 [69] in Cambodia.

Figure 18: Occupation and income (Cambodian Riel) of the surveyed households

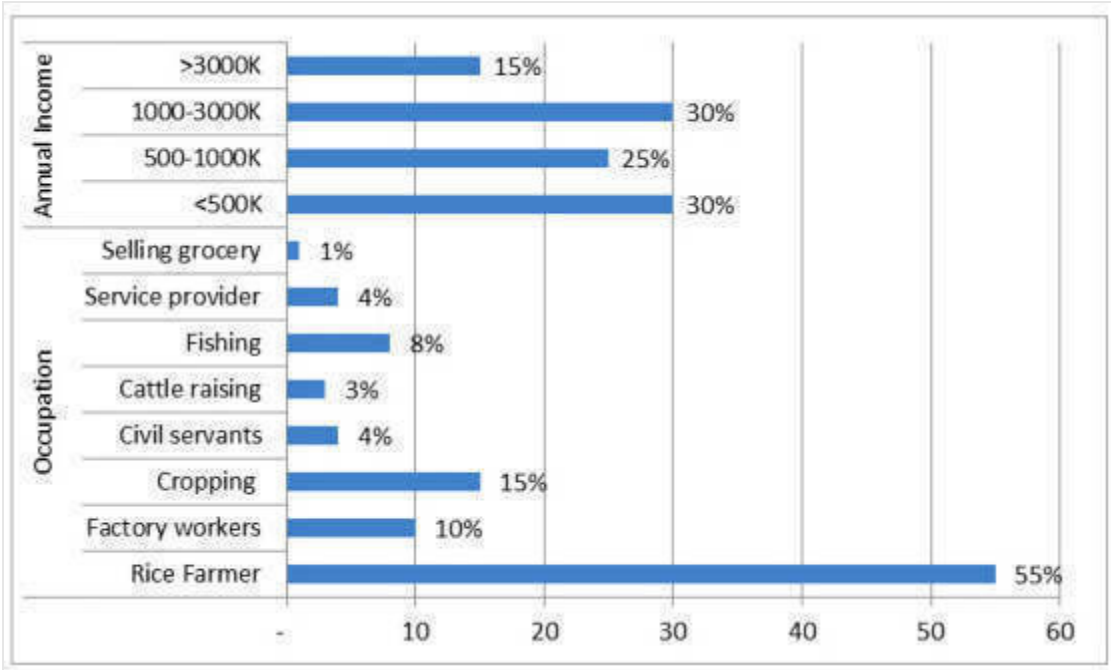


Photo 11: Livelihood activities of the local villagers around the project site

Animal raising

Service provision

Fishing

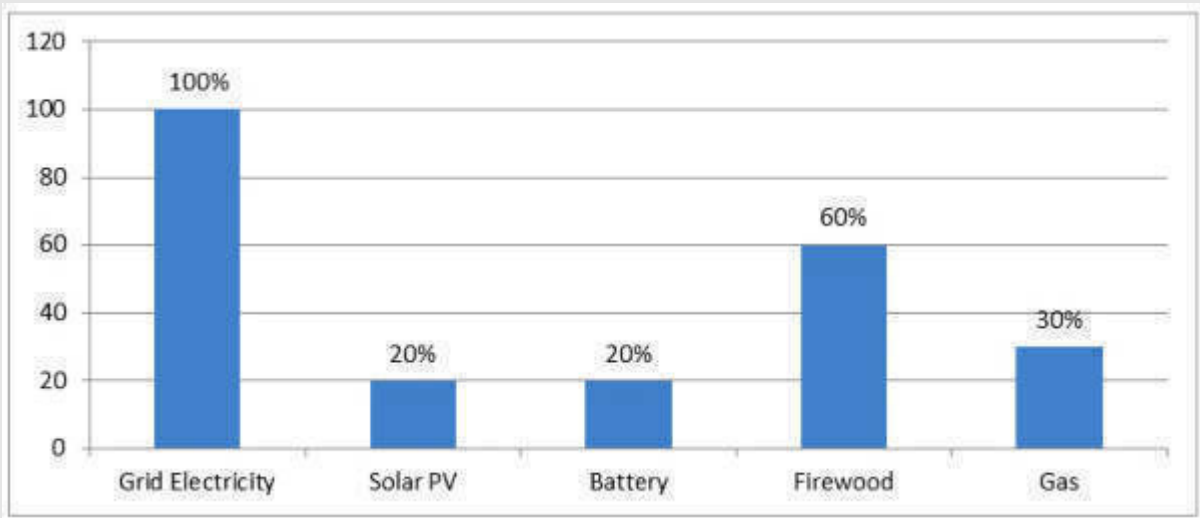
Farming and plantation

[69] According to ADB Basic Statistics 2020, the proportion of Cambodians living below the 2018 national poverty line is 12.9% (https://www.adb.org/mobile/basic-statistics-2020/).

199. Energy. In terms of electricity, all interviewed persons reported that they could access to electricity at households in the project area. This supply is provided by the Electricity du Cambodia in Kampong Chhnang province. There is a grid connection around villages. In addition, some households could access to private solar panel and batteries for additional uses for lighting and household consumption.

200. For source of energy for cooking, firewood is the most common energy source for cooking followed by electricity and liquid petroleum gas. Since the area is plenty of small shrubs and re-generated small trees that were good to collecting the firewood. Gas is commonly seen used for cooking in rural Cambodia in combination with firewood.

Figure 19: Energy Uses



201. *Water use.* There are varieties of water sources within the communes. More than half of the interviewed persons collected rainwater for general household uses. It is observed that rainwater harvesting materials are built up as an attachment to house structures. Water from stream and well and open reservoir are of common uses after rainwater. The Figure below shows similar number of access to these sources. Piped water is also accessible but with a small percentage if compared with other sources. Local people use water in different ways. For drinking, rainwater and well are boiled before drinking. For washing, cleaning, bathing, all sources are interchangeably used depending on their seasonal availabilities. Regarding sanitation, conditions vary between households. Approximately half the families have improved toilets (i.e. flush connected to sewerage or septic tank, or pit latrine with slab).

Figure 20: Water sources and uses

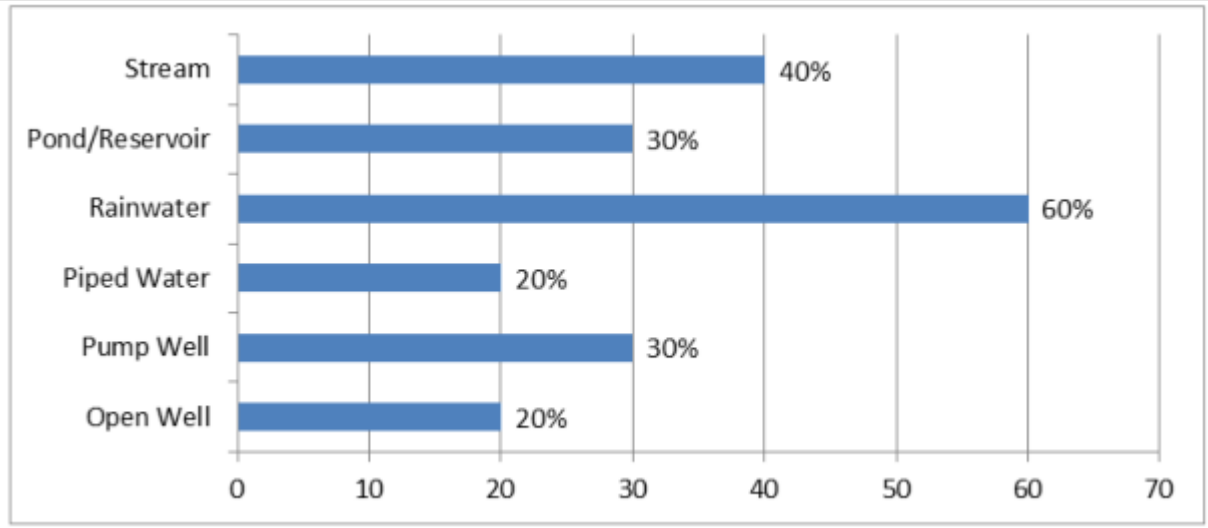


Photo 12: Water source and sanitation types

202. Health. The health facilities in the project area are limited. There is one health center in Prambei Mom (i.e. An Long Chrey Health Center) and there is none in Kbal Toeuk. Local villagers have to travel to Kampong Speu province, Kampong Chhnang province, or Phnom Penh for serious illnesses.

203. Land use: The proposed 60MW solar plant requires 100 ha of land and the site is on a

contiguous piece of land in Kbal Tuek upstream of the An Long Chrey Reservoir.[70] There are no habitations/settlements within the proposed site. This site is previously used for cassava plantations and later is abandoned. The site assessment conducted for 100 ha identified the site as mainly scrubland and paddy fields. The site is now a grass-field and a grazing area for local villagers. This is a kind of opportunistic grazing by villagers since the land is open and there is no fence to limit their access. There is no permission required to graze in the area unless the cattle does not enter into any privately owned areas (usually it is fenced). Aound the Solar Plant, there are more open areas where grazing can be flexible. There is some farmland with sugar cane along the access road to the proposed site from Road No. 51.

204. Local traffic: The national road no. 136 is a main route leading from Odong district to the project site. The traffic pressure on this road is medium since it connects from Odong, Samaki Meanchey, Toeuk Phos, and Thbong districts to Kampong Speu province and vice-versa. The road is in good condition and both light and heavy vehicles are commuting around. The traffic survey considered the traffic pressure on the existing road that accesses to the project site, and also impacts from project's transportation during the construction especially on the settlements located along the route. Potential accidents or spills of materials were also included. The primary result showed that the transportation need of the project was minimal since the total planned construction was only 18 months and the needs of transporting materials in and out of the project site were not a regular basis. The project would require certain schedules to bring in materials and also not for a 24-hour routine. The number of trucks used was limited to around 4-5 trucks per day to avoid the large volume that could cause disturbance and accidents over the uses of route of the local villagers. The current traffic flow was normal and light since there were no large industrial zones around the project site, except the Marble Manufacturing Factory that shared the same existing road.

Table 30: Passenger Car Equivalent (PCE)

No.	Transportation Mode	Passenger Car Equivalent (PCE)
1	Private car or taxi car	1
2	12-seat bus	1.5
3	24-seat bus	1.5
4	44-seat bus	3
5	Light transporting truck	3
6	6-10 wheel transporting truck	3
7	Horse-drawn vehicles	4.5
8	3-wheel motorbicycle	1.5
9	Motobicycle	0.5

205. The survey showed that road in around the project site had one lane per side and there were only two lanes per road. The suggested carrying-capacity of the road per lane was 2,000 PCU/h (passenger car units per hour per lane) with a minimum speed of 100km/h. Thus the current carrying-capacity of the existing access road around the project site was 4,000 PCU/h. According to Puopong (1997)[71], the traffic low of the road could be described based on the traffic ratios as below:

[70] The reservoir serves the micro-hyrdo An Long Chrey project and managed by the Ministry of Water Resources and Meteorology (MoWRAM).

[71] Puongpong, N. (1997). Highway Engineering. Department of Civil Engineer, Faculty of Engineer. Rachamongkol Technology Institute.

Table 31: Traffic Ratio

No.	Traffic Ratio	Traffic Flow
1	0.88-1.00	Very congested traffic
2	0.67-0.88	Congested traffic
3	0.52-067	Medium traffic
4	0.36-0.52	Light (good) traffic
5	0.20-0.36	Very light (very good) traffic

206. The traffic flow was determined through V/C Ration = Traffic Volume/Carrying Capacity of Road. Then the survey result for 12 hours (7am-7pm) for the road diverting from national road 136 to the project site showed that the traffic ratio was only 0.002 meaning that there was a very good traffic in the area for both working days and weekend. For national road 136, the traffic ratio recorded only 0.40 due to more vehicles present. Still the traffic flow remained good, with no congestion in general.

Photo 13: Traffic flow on road around the project site

Traffic flow on road diverting from national road no. 136

Traffic flow on national road no. 136

207. *Physical cultural resources (PCRs):* There are no PCRs (places of worship and animist sites) in the proposed 60MW solar plant site. There are several Buddhist Temples and one Church in the survey area. The PCRs nearby 60MW solar plant is presented in Table 40.

Table 32: Physical Cultural Resources in the Project Area of Influence

Commune	Cultural and worship sites in the village	Distance to 60MW solar plant (approximate)
Kbal Tuek	Chuonh Chit Village Neak Ta Thmor Kombour Prey Chhrao Village Thmor Roung Kla	This place is approximately 5 km in the south-east the proposed 60MW solar plant area. Approximately 8 km from the 60MW solar plant at the Northeast.
Chean Laeung	Royeas Village Trapeang K'chao pagoda Neak Ta Doun Roath and Neak Ta Chrork Nghor	6 km from the study site 1 km at the East the proposed area
	Church – no name	4 km from the 60MW solar plant on the existing access road
Prambei Mom	Chrok Tnout Temple	6 km from the 60MW solar plant on the existing access road
	Por Thivorn (Taing Por) Temple	7 km from the 60MW solar plant on the existing access road
	Sovan Kiri Bopha Ta Ba Li Lay (Phnom Bat) Temple	10 km from the 60MW solar plant on national road 136
	Kiri Mony Kosei Temple	16 km from the 60MW solar plant on national road 136

km = kilometer; m = meter

Photo 14: Religious sites

CHAPTER 5: PUBLIC CONSULTATION AND PARTICIPATION

5.1 Consultation and Participation

208. Initial consultations[72] with relevant stakeholders potentially affected by the National Solar Park project were conducted by EDC's consultants in May and July 2018 to inform them of the proposed project, potential temporary impacts and project benefits. During the preparation of this ESIA report for 60MW solar plant, two public consultations at village level were organized on 27 September 2020 to disseminate the 60WM solar plant information and discuss the concerns and suggestions of the potentially affected peoples.

209. Appendix I of this SEIA includes:

- The agenda for the public consultation meetings
- The Guide Questionnaires for FGDs with women and with men
- The 60MW solar plant's Project Information Booklet (PIB) in Khmer that distributed to participants in the meetings
- Photo documentation of the consultations
- Attendance sheets with signatures

5.2 Consultations – 60MW Solar Plant

210. The second set of consultations covered participants (villagers) from a total of 3 villages in 2 communes in the vicinity of the proposed 60MW solar plant in Kampong Chhnang province. Total of 26 persons (11 females) participated in the FGDs at the village level. The first consultation was organized on 27 September 2020 in Royas village with local residents from Royas and Chhoun Chet villages. The second village consultation was held in Trapaing Troak village, Prambei Mom commune, Thbong district, Kampong Speu province, where the future access road to be built by EDC is planned. The COVID-19 precautionary measures were strictly applied with all participants during the consultation. Temperature-checking, face masks, and hand-cleaning gel or alcohol spray were set up and required for every participant prior to the discussion.

211. Consultations with the affected persons includes information on the project environmental impacts (positive and negative), safeguards measures including community health and safety, training in emergency response, project implementation schedule and process, results from environmental baseline surveys, and acquisition and compensation process, affected households, affected persons' right to complain and Project GRM. Consultations with affected persons provides a two-way information sharing channel, ensuring that the concerns, questions and ideas of the affected persons were discussed and responded to in an appropriate and gender inclusive way.

(A) Village consultation in Royas Village, Chhean Loueng Commune, Samaki Meanchey

[72] Consultations for the solar park were held as follows – 4 at village level. Out of 4 villages, only one village called Trapeang Troak was covered twice for consultations (i.e. solar park).

District, Kampong Chhnang Province

212. The consultative meeting started at 8:30am with the primary introduction of the team and the project. The project size is 100 ha and locates in Kbal Toeuk village, Chhean Loueng Commune, but the existing access route is from Tbong District, Kampong Speu province. The project will be under the construction and operation of the PRAC that is granted the rights to develop the project the period of 20 years in the scheme of BOT. The construction will take up to 18 months and there will be 60MW solar plant, sub-station, access route, water ponds, guard post, and fence.

213. The predicted social and environmental impacts are listed in the table in the booklet given to individual participants. The impacts range from soil erosion to social culture disturbance. The significance of the impacts is averagely low in all project phases (pre-construction, construction, operation). Mitigations to these impacts are given for some examples to let participants clear with what will happen and how it will be managed.

214. The project is under the safeguard conditions of ADB and IFC and the environmental legitimacies of Cambodia. Impact assessment is required to keep the project well prepare with the anticipated impacts and ready to cope with certain effects from the project. The presentation also highlighted the grievance mechanism that participants could exercise in case they were not happy with the project's treatment or if they wanted to complaint for any unprecedented impacts.

215. Participants were allowed to provide comments and feedback on the presentation. Few people turned in with some concerns and suggestions.

- Participant 1: Since the project will use this road for the transportation, please drive the vehicles safely, and avoid certain time (sleeping or school times) to not disturb the people and their local economic activities.
- Participant 2: If the project needs some labor, please consider selecting us in the local village so that we can get a job and some little income.
- Participant 3: The project must consult with villagers in advance if they place the transmission poles and pay a proper compensation.
- Participant 4: The project has no big concern for us. We do not own any land there.

216. In response, the consultant team confirmed that the impacts were associated with the project activities of the solar plant only. Transimssion line is an associated facility but not included in the scope of impact assessment for the solar plant. There is a separated assessment for such facility and the concerns raised in this discussion will be transferred to another assessment for their information.

Photo 15: Village consultation in Royes Village, Chhean Loeung Commune

(B) Village consultation in Trapaing Trok Village, PramBei Mom Commune, Thbong District, Kampong Speu Province

217. The consultative meeting started at 3:30pm with the primary introduction of the project. The project size is 100 ha and locates in Kbal Toeuk village, Chhean Loueng Commune, but the existing access route is from Tbong District, Kampong Speu province. The project will be under the construction and operation of the PRAC that is granted the rights to develop the project the period of 20 years in the scheme of BOT. The construction will take up to 18 months and there will be 60MW solar plant, sub-station, access route, water ponds, guard post, and fence.

Participants were given the same project information as did in the consultation with the villagers in Chhean Loerng commune.

218. Participants were allowed to provide comments and feedback on the presentation. Few people turned in with some concerns and suggestions.

- Participant 1: We do not concern much about the project impacts since it is Toeuk Phos district. What I concern is the placing the transmission poles to GS6. Just inform us and pay us the compensation before the project starts.
- Participant 2: The access road is cutting through the private land and plantation. The project must consult with the owners and address the land prices prior to building the route.
- Participant 3: We are happy to see the project and expect of job employment for our local villagers.

219. In response, the consultation confirmed that the impacts were associated with the project activities of the solar plant only. Transimssion line is a shared facility but not included in the scope of impact assessment for the solar plant. There is a separated assessment for such facility and the concerns raised in this discussion will be transferred to another assessment for their information. Usually, prior to placing the transmission poles, the project will complete the compensation with informed consent from affected households. Similar treatment will be conducted for the access road. Any associated impacts will be recorded and addressed prior to any road construction. For employment, the project will require local labor to help construct the project and this will give the opportunity to local villagers to be employed.

Photo 16: Village consultation in Trapaing Troak Village, Prambei Mum commune


Village consultation in Trapaing Troak village, PramBei Mom commune, Thbong district

(C) Consultative meeting with PramBei Mom Commune Chief, Thpong District, Kampong Speu Province

- Because the project locates in Toeuk Phos district, there is no land conflict on the local people in the commune, but I would like to request for appropriate resolutions if there are conflicts occurred.
- I would also request for a proper caution in regard of traffic and public safety, especially traffic accidents resulting from transporting materials and workers during the project development phases.
- I suggest that prior to placing the transmission poles from the project, the project owner must consult with local authorities and the affected villagers to avoid or minimize land conflicts on private properties of the local villagers.
- I support the project.

220. In response, the assessment team informed that the PRAC built only the solar plant, and other associated or shared facilities were under separated contracts with other developers. The assessment conducted this time was to capture concerns and suggestions of the relevant peoples and stakeholders about the Solar Plant – constructing and installing the PV panel only.

(D) Consultative meeting with Chhean Loueng Commune Chief, Toeuk Phos District, Kampong Chhnang Province

- Since the past this area belongs to private individuals and then they sold them to Mother Barang (local nickname) who bought all land in the area for cassava plantation and later the area is abandoned due to low productivity.
- The project site locates further away from the villages (Royas, Chhoun Chet) and the areas are privately owned. As EDC already purchased the land from owners, then there will be no serious land conflicts.
- I think the project activities will not cause any risks or damages on forest and wildlife resources because there are less of such resources and it is the former farmland.
- I suggest the project owner (1) comply with regulations especially the regulations on transporting materials and staff in and out of the site that would disturb or affect the local villagers living along the road; and (2) cooperate with local authorities for every activity.

(E) Consultative meeting with Mr. Soth Sang, Deputy-District Governor of Toeuk Phos (22

September 2020)

- The project owner must consult with local authorities and villagers in advance before the start of the project work and must ensure that there will be no conflicts on the right of way in front of their houses.
- The project owner must show the master plan and design of the project facilities and locations so that people are aware of the project and are ready to cooperate in case of there are conflicts or impacts from the project.
- I am very much happy with the development project because there is no sufficient power in Cambodia yet.
- I request for a safe transportation of materials and staff in and out of the project site that would cause traffic accidents unintentionally. Drivers must be trained and driving must be monitored regularly to minimize the impacts.
- The project must not fill the cracks, canals, or streams within and closed to the project site to avoid flood in the raining season. The project must prepare the drainage system to avoid flood and drain the wastewater from the project site.
- I think this project has no severe concerns on the environmental and social resources and the local villagers.

(F) Provincial consultation

The consultant team organized a consultative meeting on 19 October 2020 with relevant departments in Kampong Chhnang province. Mr. Khem Channorn, deputy-director of provincial administration chaired the consultation since the deputy-governor was busy accompanying the provincial governor for the flooding relief work. The consultation meeting followed the agenda: (1) introduction to all participants, (2) remark by the chair, (3) project and SEIA presentation, (4) questions and answers (including feedback), and (5) wrap up and closure. There were 20 participants from provincial departments and local NGO (Build Community Voice) (list of attendence is attached in the Appendix VI).

Mr. Khem Channorn – Deputy-Director

- It is a great pleasure to welcome the project since Kampong Chhnang province was very attractive to many development projects.
- This is not the only one solar plant. In this province there are some others including the one in Taing Krasaing commune.
- The solar plant is good to produce more energy and this energy is renewable. This means that we can generate electricity for a long time since the sun never runs out of its energy. This project can produce up to 60 MW and hope that this energy will help reduce our power scarcity and reliance on fuel source.
- We meet to today to welcome the project and learn about it and provide our inputs or comments to assure that the project minimizes the risks as predicted and brings more benefits than losses to our communities and Cambodia as a whole.
- I would like to invite all of you to look through the presentation and materials provided in this meeting and bring about the concerns and suggestions so that we develop the project in a manner that is environmentally friendly and sound.

The consultant team presents the project information and the ESIA findings to all participants.

Mr. Van Rady, inter-sectoral officer of provincial office

- I fully support the project. I would request that if all land plots are not yet properly purchased, please procedure with the buying-and-selling principles to assure it legality.
- I suggest having all plots combined into one single tenure and registered with Land Department in the province. Then change its use status from agriculture to residential use in stead.

Mr. Saing Sokhern – Deputy-governor of Toeuk Phos district

- There is no route from Toeuk Phos to the project site. Thus the project has to go through the national road no. 136 in Chhean Loeung commune. As far as I know, this project closes to Kiri Aphivat village, which is a newly-established village in that area, which borders with Toeuk Phos and Samaki Meanchey districts, and also closed to the Tbeng Srorng community forestry. Most disturbed people are from this new village I think. Therefore the project may need to build new road through Samaki Meanchey district. My request is to help build such road in this district for not only the benefit of the project, but also local people enjoy traveling around too. This road is about 4 kilometers.
- Because it is a government supported project, I totally support it.

Mr. Bong Bonny – Deputy-Director of Cults Department

- There is no impact on any sacred site as there is none of these in and around the project site.
- I fully support the project.

Ms. Phin Phalla – Deputy-Director of Women Affairs Department

- Transportation of materials and staff or workers must lower the risks of dust and minimizes the traffic accidents. Please water the road regularly to keep dust down where dust is potentially generated.
- Local people are not using the road properly. Please ask your driver to be more moderate and professional in driving i.e. with speed limits. Also the project shall inform the local authority and people of the transportation schedule so that they could manage themselves to avoid any road challenges.

Mr. Nou Sokhon – Deputy-Director of MLV Department

- What is the labor required for this project during the construction phase? How many Cambodians and foreigners?
- I would suggest the project implement the safety measures for all workers and staff in this project. Also please prepare the workbook of all staff and workers and inform the MLV department prior to your groundwork.

Mr. Ouk Sophea – Deputy-Chief of Office of Transport and Public Work Department

- I support the project and the project is just aware of heavy transport to avoid road pressure and damages.
- In case of heavy transport, please consult with the Department prior to any work.

Mr. Saing Sokhern – Deputy-Cheif of Toeuk Phos District

- I suggest the project inform us as local authority at least one week prior to any

groundwork so that I can arrange local guard and people to accompany to avoid any unplanned conflicts.
- Also please keep the local authorities alerted and informed of any work of the project

Mr. Khem Channorn – Deputy-Director of Administration
- I would also request all participants here bring up your concerns and suggestions based on your individual areas of work and expertises. Or you can mention if it is not much relevant with you. Here is my summary of the meeting:
- (1) I support the suggestions from Agriculture Department, as to combine all land plots into one and register with Land Department. Also please alert the local authorities when the project starts working on the ground to avoid any unprecended conflicts with the local people.
- (2) I support the comments from Land Department to change the land use status from agriculture to residential/industrial and request the project to get the application approved for site boundary.
- (3) I support the feedback from Women Affairs Department to water the road where there is a potential dust generation, and to inform the local authority of the transportation schedule.
- (4) Toeuk Phos deputy-governor requests for a new road (4km in length) as a contribution to the communities, and the project .
- (5) The project employs the local residents for the project to increase economic activities and incomes of the local people to reduce the out-migration of the people.
- (6) Department of Planning agrees with project as there is no resident on site.
- (7) On behalf of the provincial authority, I confidentially support this project and request the project inform the authority of every development stages of the project. I request all relevant departments provide support as needed to keep the project going smoothly and effectively.

221. Overall responses: PRAC will build the 60MW Solar Plant within the EDC's National Solar Park Project. The project information was already given in 60MW's PIB and presented in Slide and drafted SEIA report to everyone in the meeting today. PRAC builds, operates and transfers the project after 20 years. Other associated and shared facilities are not assigned for PRAC. Assessments and studies will be separately conducted for other facilities. The consultation today is to inform you all about the Solar Plant and its plans/schedules to complete it development plan.

Photo 17: Provincial consultation

5.3 Information disclosure

222. Project Information Books (PIB) for 60MW Solar Plant provides meaningful information sharing, consultations and active participation of concerned stakeholders. The intention of this PIB is to prevent misconceptions on project impacts, project implementation process and doubts or misconceptions on the project that may cause delays in project implementation.

223. As above, the consultant team has recorded all information dissemination and consultation activities and the results from consultations with the affected persons, including how concerns raised and recommendations made are addressed in the SEIA and ESMP for the 60MW Solar Plant.

224. Consultations with concerned stakeholders will continue throughout project implementation and will be open and gender inclusive.

225. The SEIA for 60MW Solar Plant will be disclosed on ADB website (www.adb.org) as required by the ADB SPS 2009 and Public Communication Policy 2011. An updated PIB/FAQ in Khmer were made available for the affected communities in public consultation meetings, project construction field offices and commune offices.

5.4 Grievance redress mechanism
5.4.1 Awareness of Stakeholders

226. Initial consultations with relevant stakeholders potentially affected by the project were conducted in May and July 2018 before the commencement of any project activity to inform them of the proposed project, potential temporary impacts and project benefits. Two village consultations were organized on 27 September 2020 to disseminate the project information and discuss the concerns and suggestions of the potentially affected peoples.

227. PIB containing preliminary information on GRM for 60MW solar plant was made available at the time of the initial consultations. Along with EDC's communication plan and grivevance redress mechanism, 60MW's PIBs will be updated and made them available to grievance redress committees (GRC) at village and commune, district, and provincial levels set up by PRAC's SECU.

5.4.2 Need For Grievance Redress Mechanism

228. Since this project is funded by ADB and IFC and requires PRAC to establish a project specific GRM for 60WM Solar Plant to provide an accessible platform for receiving and facilitating resolution of complaints from affected persons on project implementation. GRM will cover issues that may be raised on environmental issues such as temporary increase in dust, noise or traffic causing inconvenience to local people, access to adjacent properties/agricultural land or other relevant issues.

5.4.3 Current Scenario

229. The SECU of PMO (PRAC) is aware of the procedures of handling complaints/grievance attributed to social or environmental issues based on several discussions and meetings with ADB/IFC[73]. SECU (PRAC) will proactively engage with affected persons and other relevant stakeholders via a project community awareness program prior to start of civil works. The program will cover the scope of the project, schedule of construction activities, identified impacts and mitigation measures, health and safety issues and GRM. There will be ongoing public consultation during project implementation as described in the ESMP.

5.4.4 Project GRM

230. Composition. PRAC will set up a Grievance Redress Committee (GRC) as soon as the project commences. GRC will function from construction to operation phase. As practiced, the GRC will include the relevant local commune and/or village chiefs. It will be headed by the PMO of PRAC through the duration of the project life. Other members may include Provincial Officer or their nominee, District Officer from the Cadastral office or their nominee, Contractor and a witness of the affected person; at least one person in the GRC will be female.

231. Responsibilities. The GRC is expected to: (i) resolve issues on land acquisition (if any), compensation to temporary damages to crops, orchards, trees and other use of land such as temporary/permanent areas for 60MW solar plant; (ii) resolve issues on dust, noise, vibration, construction related nuisances to public, etc.; (iii) convene once a month to review complaints lodged (if any); (iv) record the grievances and resolve the issues within 30 days from the date

[73] **LOAN 2979 - CAMBODIA: MEDIUM-VOLTAGE SUB-TRANSMISSION EXPANSION SECTOR PROJECT.**

the grievance was filed with the SECU; and (v) report to the complainant(s)/affected persons the status of grievance resolution and the decisions made or action taken.

232. Area of Jurisdiction. GRC will be established at provincial level ("Provincial GRC") with representation from commune councils across the project area of influence where the project components will be implemented.

233. Procedures. The key contacts for the GRC will be posted at construction sites, construction camps and public notice boards in affected communes in Khmer language. The GRM will consist of the following steps of conflict resolution:

- *Step 1* – Any complaints by an affected person/complainant can be presented to the commune council via village or commune chief, either verbally in person or in writing.[74] The village or commune chief will be obliged to provide immediate written receipt of the complaint and take it forward in a written format and shared with the SECU of PRAC.[75] The SECU will resolve the issue within one week through negotiation. The SECU will maintain records of complaint received and/or resolutions and submit it to PMO as part of their monthly progress reports.
- *Step 2* – If or when the affected person/complainant is not satisfied with the action or decision of the contractor, an affected person/complainant will take the issue to PMO/PRAC via the commune council. In all cases, the grievances will be recorded in writing and then forwarded to the SECU of PRAC. PRAC will have 15 days to resolve the complaint through negotiation. If the issue is not handled within 15 days, or if the complainant is not satisfied with the result, he/she can bring the issue to the District office.
- *Step 3* – The District office has 15 days to negotiate the complaint and bring it into a resolution. If the complaint cannot be resolved in a way that is satisfactory to all parties, the District office will bring the issue to the provincial GRC.
- Step 4 – The Provincial GRC will meet the affected person/complainant and try to resolve the issue. Within 30 days of the submission of the complaint to the GRC, it has to take a decision and inform in written both the affected person/complainant and SECU/PRAC of the decision.
- Step 5 – If the affected person/complainant gets no response from the Provincial GRC or is not satisfied with the result, he/she can bring the case to the Provincial Court. The Court will make a written decision and submit copies to the executing and implementing agencies. If any party is still unsatisfied with the Provincial Court judgment, he/she can bring the case to a higher-level court.
- Step 6 – If efforts to resolve disputes using the grievance procedures remain

[74] If affected persons do not have sufficient writing skills or are unable to express their grievances verbally, it is a common practice that they are allowed to seek assistance from any recognized local NGO or other family members, village heads or community chiefs to have their complaints or grievances written for them. affected persons will be allowed to have access to the Detail measurement survey or contract document to ensure that all the details have been recorded accurately enabling all parties to be treated fairly. Throughout the grievance redress process, the responsible committee will ensure that the concerned affected persons are provided with copies of complaints and decisions or resolutions reached.

[75] Each contractor will designate a contractor GRM focal person (C-GRM)

unresolved or unsatisfactory, affected persons have the right to directly discuss their concerns or problems with the ADB's Energy Division, Southeast Asia Department or through the ADB Cambodia Resident Mission (CARM) and IFC's ombudsman office. If affected persons are still not satisfied with the responses of the Division and/or CARM, they can directly contact the ADB Office of the Special Project Facilitator through the accountability mechanism[76].

234. Recordkeeping and Reporting. SECU of PRAC will keep a record of all the grievances received, including contact details of complainant, date the complaint was received, nature of grievance, agreed corrective actions and the date these were affected, and final outcome. Documentation of the grievances filed and resolved will be summarized and reported in quarterly project progress reports and semi-annual safeguard reports.

235. Disclosure of Information. Under the direction of the PMO, the SECU will inform the affected persons/complainants on grievance redress procedure, who to contact and when, where and how to file a grievance, time likely to be taken for redressal of minor and major grievances, etc. Grievances received and responses provided will be documented and provided to the affected persons during the process. The number of grievances recorded and resolved and the outcomes will be displayed/disclosed in the project field offices and Commune council offices and Provisional Office (if required).

236. Review of the Process. The SECU of PRAC will periodically review the implementation of the GRM and record information on the effectiveness of the mechanism, especially on the project's ability to prevent and address grievances.

237. Cost of Implementation. Costs involved in resolving the complaints (meetings, consultations, communication and reporting/information dissemination) will be borne by PRAC.

[76] https://www.adb.org/site/accountability-mechanism/main

CHAPTER 6: ANTICIPATED ENVIRONMENTAL AND SOCIAL IMPACTS AND MITIGATION MEASURES

6.1 Impact Assessment

6.1.1 Impact identification

238. The study identified the impacts using three distinct methods: (i) checklist as required by the Ministry of Environment as endorsed in 2009, (ii) matrix table assessing impacts against project activities that potentially affect natural and socio-economic resources, and (iii) overlaying method using ArcGIS. The information for overlaying was needed from existing and fieldwork data (project and facility locations, residential/household locations, main infrastructures on site, and critical sensitive receptors).

6.1.2 Impact significance assessment

(A) Impact significance

239. This is done based on three levels of significance (a) Low, (b) Moderate, (c) High in according to each parameter in quantity and quality formats (if quantification is possible). The analysis of the level of impact significance is discussed based on four main criteria as illustrated below:

- Spatial scale examines how much or far the impacts cover
- Temporal scale identifies the duration of the impacts that can stay in the environment
- Magnitude of change/effect scale identifies the measures of scale of benefit/dis-benefit of an impact or a condition
- Reversibility scale defines whether the condition can be changed and is a measure of the control over the effect of the condition

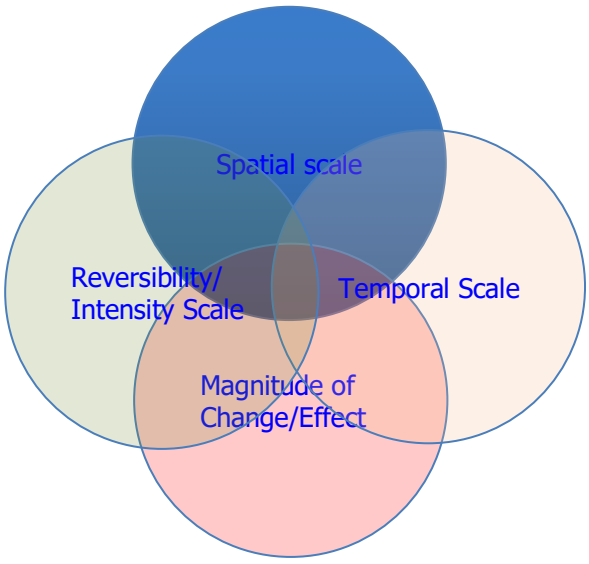


Figure 21: Four criteria for assessing the significance of the impact

(B) Procedures for assessing the impacts

240. Assessing the impacts considers the “livelihood” and possibility of negative and positive impacts and their consequences from project implementation. Waste risks were determined and mitigations were proposed to minimize and manage them. Key impact

assessment procedures follow the following steps:

- Step 1: Through consultation with experts and local communities, impacts could be identified and assessed based on the four criteria above. These criteria ensured the appropriateness and accuracy of the assessment methods. Score was given 1, 2, or 3 for each impact based on the information and data collected from the fieldwork and the project information, and the field parameter testing (i.e. from certified laboratories in Cambodia).
- Step 2: Estimate and calculate the scores given to identify the level of key impact significance, i.e. low, moderate or high.
- Step 3: Impact significance were further assessed against the "Livelihood" criteria which includes four levels – not likely happen, possibly happen, surely happen, and will happen. Form this step, impact is finally rated as low, moderate or high again.
- Step 4: Impact significance of the whole project was assessed in form of percentage to assure how much impact significance is foreseen as low, moderate or high. Through these steps, impacts are carefully screened and assessed with proven evidence and discussions.

(C) Determining the mitigation measures

- Avoidance: Avoiding impacts by modifying the design, process, location, footprint of the project through an iterative process in order to prevent or limit a possible impact.
- Minimization: Minimizing impacts by implementing decisions or activities that are designed to reduce the undesirable impacts of a proposed activity on the surrounding environment, including measures such as reducing the activity footprint, implementing emissions reduction technology, etc.
- Rectification: Continued monitoring to ensure measures continue to be effective at preventing impact and progressively rehabilitating/restoring affected environment. This would include attempts at habitat re-creation, to restore the original pre-mining land uses and biodiversity values.
- Compensation: Compensating for the impact by replacing or providing substitute resources or environment

(D) Environmental and Social Management Plan (ESMP) for 60WM Solar Plant

241. The ESMP covers both the construction, operations and decommission phase of the project. For all the environmental and social risks and potential impacts identified in the SEIA, management measures are recommended in the ESMP to prevent, minimize or offset these impacts.

242. A preliminary budget and work plan for the management and monitoring activities are included in the ESMP. PRAC agrees with the Royal Government of Cambodia regarding the final budget for the ESMP implementation, and the Social and Environmental Fund.

(E) Contents of ESMP

243. As per Annex 1 of the MoE's Declaration on General Guideline for Developing IEIA/EIA Report (2009) the contents of the ESMP covers the following:

- Summary of negative impacts and reduction measures;
- Training program

- Environmental Monitoring Program for project construction phase, project operation phase and project decommission phase, in which the project owner must state:
- Monitoring agency for the project monitoring
- Define monitoring parameters
- Methodology for monitoring
- Environmental standards and guideline used for monitoring
- Program and cycle for monitoring
- Assessment of result of monitoring by project owner
- Quarterly reports to submit to Ministry of Environment and ADB/IFC.

(F) Social and environmental fund

244. The project allocates some fund as required by the 1999 Sub-decree on IEIA/EIA for the sake of protecting and rehabilitating the associated damages the project will cause. The project with the contracted consultants studies the actual cost and available allocation for such fund.

6.2 Project Environmental Benefits

245. This project is expected to have significant environmental benefits. A transition to clean solar energy generation will limit import dependence on coal and other fossil fuels, delay or defer construction of new coal-fired plants and reduce reliance on hydropower generation[77]. This would contribute to national emission reduction targets[78] and reduced pollution impacts. A 60 MW project will avoid approximately 84,000 tons of carbon dioxide-equivalent (tCO2e) annually over a 20-year project lifetime.

6.3 Environmental Impact Screening

246. This section discusses potential environmental in the context of the following factors:
- "Receptor": the resource (human/natural environment/economic/social) that is potentially going to receive and have to cope with an impact.
- "Sensitivity": ability to cope with an impact and/or its importance to Cambodia. It is generally accepted that human health is always a high sensitivity receptor, however in terms of environmental/natural resources, the sensitivity varies according to the receptor e.g. scrubland with no significant biodiversity is considered less sensitive than a water body which may support aquatic ecosystems or the local biodiversity or livelihoods through fishing and/or tourism.
- "Magnitude": the size of the potential impact. Impacts may be short term and considered low magnitude (e.g. noise, dust or vibration) or high magnitude and long term (e.g. global and regional flyways of migratory birds).

247. Where an impact may occur, if there is no receptor to potentially receive the impact, then mitigating actions are not required. This follows the source-pathway-receptor model, whereby in order for there to be an impact, the pollutant or issue (source) needs to be present,

[77] Cambodia now has a surplus of power generation in some hours in wet periods and at nighttime. Yet the national grid is unable to meet daytime peak demand in high population areas such as Phnom Penh and experiences shortages during the dry season when storage in hydropower reservoirs is limited.

[78] https://unfccc.int/resource/docs/natc/khmnc2.pdf

the pathway to a receptor is needed (such as water for human consumption) and a receptor must be present to receive the impact, such as humans, flora or fauna.

248. Environmental impacts were assessed across all stages of project implementation i.e. (i) design and pre-construction stage, (ii) construction stage, and (iii) operation stage. Direct impacts result from acquisition of land for the 60MW solar plant. Potential cumulative and induced impacts from further planned development of the project and other sources of similar impacts were also considered.

6.4 Pre-Construction Stage

249. The potential adverse environmental impacts associated with the project are avoided or minimized by: (i) careful site selection and route alignment; (ii) integrating key measures that will permanently become part of the infrastructure and will be included in the project detailed engineering design; (iii) implementation of environmental mitigation measures for identified impacts; and (iv) ensuring project environment management readiness.[79] These are as follows:

6.4.1 Site and Route Selection.

250. A critical issue for the management of impacts on identified receptors, particularly: a) households areas/structures, b) surface water sources, c) groundwater wells, d) road and railway crossings, e) global and regional flyways of migratory birds, f) protected areas, habitats and species of conservation value, and g) physical cultural resources (PCRs).

251. EDC and ADB undertook a Pre-Feasibility Study[80] to assess site and route options for the project. The preferred site and route were selected to avoid sensitive receptors such as protected areas, habitats and species of conservation value, hospitals/clinics/schools, PCRs as well as to minimize impacts on human health, households, crops and trees of economic value.

6.4.2 Land Requirements

252. Land purchase. The PRAC's 60MW solar plant will be constructed on 97 ha of land leased from EDC who has purchased the land from owners based on willing to sell and willing to buy principles. EDC has informed Council for Development of Cambodia (CDC) about the progress of the land aquisition in a letter dated on 27 October 2020. The 27 land plots (combining together to get 102 ha) have been alrealdy purchased and being procedured to transfer ownership rights from buyers (i.e. villagers) to EDC. The purchase has been conducted with the villagers on a willing-to-sell-buy basis with contracts and agreements prior to the payment.

253. In September 2020, EDC commissioned an external independent expert (a local law firm) to undertake a review of the procurement process for the park land, which determined that negotiations were free, fair, transparent and did not cause involuntary displacement impacts. The independent expert confirmed that expropriation was not to be used by EDC

[79] Project design is discussed in detail in the project Feasibility Study while Climate Risks and Vulnerability Analysis is enclosed as Appendix IV.

[80] National Solar Park Project for Cambodia: Pre-Feasibility Study, August 2017

should the negotiations have failed.

254. Fieldwork and informal discussion with villagers around the solar plant confirm that the land being bought by a few brokers on behalf and or to sell to EDC. Based on the conversation it sounds like the purchase was based on a proper negoation and on the current land price market.

255. There is no temporary land aquisition associated with the solar plant; all civil works will be undertaken within the solar plant acquired area.

6.4.3 Training and Capacity Building

256. Training and Capacity Building[81]. The capacity of PMO of PRAC and its contractors responsible for ESMP implementation, GRM and supervision will be strengthened. The capacities of PMO of PRAC and contractors to coordinate environmental management will be strengthened through a set of measures:

- Appointment of at least one environment focal person and one social focal person within the PMO to be in charge of ESMP coordination, implementation and site inspections including project GRM
- Appointment of at least one environment, health and safety officer ("C-EHS") within the contractor staff to be in charge of ESMP coordination, implementation, site inspections and information disclosure and consultations
- Appointment of at least one GRM focal person ("C-GRM") to be in charge of project GRM coordination, handling complaints, dispute resolution, site visits and information disclosure and consultations

257. PMO of PRAC will provided training on ESMP implementation, supervision, monitoring and reporting, project GRM, conducting meaningful consultations and relevant environmental rules and regulation. In addition, orientation and briefing of project staff, all contractors/sub-contractors, hired workers will be conducted prior to mobilization on site during construction and operation stages.

258. Mitigation measures defined in this SEIA and ESMP are based on final detailed engineering design. Site-specific checklists are developed in ESMP to use in monitoring environmental compliance during construction and operation.

6.5 Construction Stage

(A) Orientation for Project Staff, Contractors, Workers

259. Prior to mobilizing on site, the SECU and PMO of PRAC will conduct briefing and orientation for all project staff and turneky contractors/sub-contractors. Egineering, Procurement, and construction (EPC), and Project Implementation Consultant (PIC) of EDC's National Solar Park will invited to observe the orientation. The following information will be disseminated :

[81] Also see Section 9, Environmental Management Plan.

- ESMP, GRM, Information disclosure and meaningful consultation, environmental monitoring and reporting requirements
- ADB/IFC and Cambodia labor standards
- Responsibilities of the contractors in developing and implementing the site-specific CEMPs, SOPs and monitoring environmental compliance with the ESMP [82]/CEMP;
- Responsibility of the contractors in engaging with affected persons for project GRM
- Create awareness of sexually-transmitted diseases (HIV/AIDs), child labor, bonded labor or forced labor
- Record and maintain briefing and orientation events log with duration and list of attendees
- Under the supervision of the PIC and prior to mobilizing on site, contractors will conduct training and drills for workers on:
    - CEMP sub-plans implementation
    - Environmental, health and safety and hygiene at work sites as well as sexually transmitted disease such as HIV/AIDS to prevent potential incidences
    - Record and maintain briefing and orientation events log with duration and list of attendees

(B)Hiring Of Project Staff and Workers

260. Project implementation will bring opportunities for local employment. While this is beneficial, it may also be a cause of conflict over transparency of hiring particularly if migrant workers are recruited over local people. The contractors will be required to use local labor for manual work and eligible local workforce for technical and administrative jobs. The PIC will monitor the compliance to priority of local hiring.

(C)Presence of Workers at Construction Sites

261. The presence of workers and staff at the project sites may increase demand for services such as food and beverages. The localized demand of services may result in an opportunity for local communities to set up temporary small-scale business in providing food and beverages outside 60MW solar plant. This will be a beneficial impact to local economy.

(D) Preparation of Construction Environmental Management Plans/Standard Operating Procedures for 60MW solar plant

262. The CEMP of 60MW solar plant will help to avoid unplanned activities of PRAC's contractors and will guide the smooth implementation of all project activities. Prior to mobilizing on site, the PRAC will develop site-specific 60MW's CEMP for the key activities; appropriate maps showing where activities will take place and corresponding implementation schedule. 60MW's CEMP will follow the advice of National Solar Park's PIC who will prepare the Standard Operating Procedures (SOPs) for the whole National Solar Park in line with the

[82] PIC will develop checklists for use in monitoring environmental compliance during construction stage.

environmental component likely to be affected.[83] The 60MW's CEMPs will include the sub-plans listed in Table 39 and will be submitted to PMO for approval.

Table 33: List of Construction Environmental Management Plans (CEMP Sub-plans) for 60MW solar plant

Environmental Component Likely to be Affected	60MW's CEMPs
Land and Vegetation	Spoils Disposal Plan Hazardous Material Control Plan Site Rehabilitation and Clean up Plan
Air	Noise and Dust Control Plan
Water	Drainage and Storm-water Management Plan
Waste	Materials Management Plan (including warehouse / storage) Waste Management Plan
Humans (Communities / Workers)	Community Health and Safety Plan Occupational Health and Safety Plan (including worker's facilities and work areas) Emergency Response Plan (ERP) Traffic and Road Management Plan
Physical Cultural Resources	Chance Find Procedures

6.5.1 Physical Landscape

263. 60MW solar plant will involve vegetation clearance and soil compaction for instance. Due to the topographical location of the project and the surrounding forest cover, the changes to physical landscape in the project development area will not be visible or have an impact beyond the project's immediate vicinity.

264. This is because the 60MW solar plant site has long ago modified as cassava plantations. The 60MW solar plant has been designed to minimize adverse physical impacts to the surrounding landscape by minimizing the Project Footprint and blending major project components with the surrounds to the extent practicable.

6.5.2 Topography

265. Land leveling and grading works may alter drainage patterns at the solar plant site that may result in surface erosion, generation of spoil and localized flooding. Impacts will also result from installation of equipment, installation of cable routes (above ground and/or underground) and commissioning of new equipment. These impacts will be temporary and localized at the construction sites within 60MW solar plant.

266. Management measures

[83] SOPs / O&M manuals will be developed taking reference from the CEMP sub-plans except for Spoils Disposal Plan which will not be required during the Operation Stage.

- Clear demarcation of work sites, no encroachment outside the demarcated zone
- Access to adjacent properties and agricultural land will be maintained, as necessary
- Construction camp/ workers accommodation set up at least 400 m from natural streams or any other water source at site including drainage/irrigation canals and dykes. Workers' accommodation: processes and standards—a guidance will be referrered at the time of construction[84].
- Use of herbicides/pesticides will be prohibited for vegetation clearing to prevent soil contamination
- Implement engineering and biological measures to prevent surface erosion such as provision of silt traps or sowing soil-binding grass, as needed.
- Restore loose soil from foundations through ramming, if required
- Implement the following CEMP sub-plans
- Spoils Disposal plan[85]
- Drainage and Storm-water Management Plan

267. Site Rehabilitation and Clean up Plan after completion of civil works to restore works site to pre-construction conditions including landscaping along the fenced perimeter, maintain hedges and field margins to reduce visual and dust impact, re-seeding most or all of the site with native plant species (soil binding grass) to stabilize the soil and restore habitat

6.5.3 Air Quality

268. Potential air quality impacts during construction include dust emissions associated with earthworks and gaseous emissions from construction activities and heavy vehicles used to support the construction works. Some concerning activities are wind-borne dust emissions from cleared areas, stockpiles, and unpaved site roads; truck-derived dust emissions from traffic on haulage routes and dumping; and dozer- and excavator-derived dust emissions from clearing operations and earthworks.

269. Moderate temporary air quality impacts during peak construction phase of the project are anticipated because of construction activities scheduled in the dry season and due to fugitive dust generation associated with construction works and transport (of materials, equipment and machinery), loading, unloading and haulage of materials and corresponding increase in vehicular emissions. Use of construction machinery and equipment and movement of transport vehicles may also levels of nitrogen oxides (NOx) and sulfur oxides (SOx), affecting air quality. Building access roads to project site (asphalt road pavement) will produce fumes containing small quantities of toxic and hazardous chemicals such as volatile organic compounds (VOC) and poly-aromatic hydrocarbons (PAH).

270. Management measures

- Particulate dust generation will be minimized by restricting land clearing to the areas flagged for immediate use, progressively rehabilitating exposed soils as soon as practicable, avoiding clearing and earthworks activities during dry, windy conditions,

[84] The guideline can be retrieved from https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/publications/publications_gpn_workersaccommodation

[85] Excess spoil will be backfilled onsite or temporary / permanently disposed as per the clearly identified disposal sites on site specific map, with corresponding distance and number of trips made will be maintained (this will help avoid disposal of spoil on farm land or within 400 m of any water source).

and applying water to all cleared, road and stockpile areas whenever weather conditions have the potential to mobilize fugitive dust. Open burning (e.g. of vegetation, waste, hydrocarbons) will be avoided.

- A detailed management and monitoring plan for air quality is provided in the Environmental and Social Management Plan (ESMP) for the Project, which will monitor emissions generated during construction.
- General air quality management and mitigation measures are as follows.
    - Conduct awareness training on dust emissions for project employees and workforce
    - Restrict speed limit on unsealed roads to minimize dust generation
    - Conduct topsoil stripping when soil is moist to the extent practical
    - Monitor for air quality impacts near sensitive receptors identified near construction areas and along the access roads
    - Use low-sulphur fuels where practical
    - Source low-emission diesel equipment (e.g. Tier 2 or better) where practical
- The contractors will conduct air quality monitoring at the solar plant site once before start of the civil works to establish the baseline, bi-monthly during the civil works and once after completion of the civil works to monitor and mitigate exceedances (if any) with respect to the Ambient Air Quality Standards (see Table below).

Table 34: MoE's air quality standards

Parameters	Analytical Methods	Unite	Standard*	Time
Total Suspended Particles	*Weight Concentrate Measuring*	mg/m^3	0.33	24h
Sulfur Dioxide (SO_2)	*Pararosaniline*	mg/m^3	0.3	24h
Carbon Monoxide (CO)	*Detection Tube*	mg/m^3	20	8h
Nitrogen Dioxide (NO_2)	*Saltzman Method*	mg/m^3	0.1	24h
Particulate Matter (PM10)	*Weight Concentrate Measuring*	mg/m^3	0.05	24h
Particulate Mater (PM2.5)	*Weight Concentrate Measuring*	mg/m^3	0.025	24h
Ozone (O3)	*Potassium iodide (KI)*	mg/m^3	0.5	1h
Lead (Pb)	*ICP-MS*	mg/m^3	0.005	24h

Note: *Declaration on Uses of Term of Reference for Establishment of Factory and Handicraft (2018)

- Air monitoring will be conducted utilizing hand held air monitoring devices at select locations identified on site map
- Open and exposed land areas at 60MW solar plant will be sprayed with water to suppress dust levels particularly during the dry season.
- Use of chemical dust suppressants will be prohibited.
- Aside from this, works sites will be temporarily barricaded to enclose to control dust levels
- Storage areas/warehouse for materials required for construction and civil works will be provided onsite (construction camps at the solar plant) to reduce construction vehicle trips of transporting materials and minimize stockpiling
- Vehicles transporting materials that generate dusts will be covered with tarps. Construction vehicles and machinery will be maintained to a high standard to minimize vehicular emissions and noise.

- Log of monitoring/incidences of non-compliance and rectification will be recorded and maintained.

6.5.4 Noise and vibration

271. Noise impacts will be temporary and localized at all construction sites as construction machinery and vehicles generate noise as they operate. Other noise sources include loading, unloading and haulage of equipment and materials. Significant noise impacts will be experienced by construction site workers/operators; construction machinery may produce noise levels up to 90 A-weighted decibels (dBA). For 60MW solar plant site, only construction workers will be this close to the machinery for extended periods of time. Measurement of noise levels at 60MW solar plant was conducted once prior to start of the civil works to establish the baseline, bi-monthly during the civil works and once after completion of the civil works (the latter will be conducted at 60MW solar plant only/upon commissioning of the substation) to monitor and mitigate exceedances (if any), with respect to the Ambient Noise Standards. The potential impacts due to noise and vibration will be mitigated by the following measures as set out in the ESMP.

272. Potential vibration and noise impacts include those associated with vehicle movements, heavy machinery and construction activities. Since there are no nearby residents within 3km around the project, potential noise and vibration impacts are primarily issues for workers onsite. Sources of noise and vibration associated with project construction include:

- Light vehicle movements associated with personnel arrival/departure and onsite activities;
- Earthworks in the Project area using heavy machinery (clearing, grubbing and cutting);
- Earthworks associated with upgrade of the project internal roads;
- Concrete foundation works;
- Building and facility construction;
- Heavy vehicle movements associated with delivery of equipment, building materials, and infrastructure; and

273. Management measures

- Noise and vibration associated with vehicles will be minimized by imposing a speed limit on site roads, by scheduling the majority of vehicle movements to daylight hours, minimizing air/exhaust braking where this would cause disturbance, and establishing soil berms or vegetation along roads to reduce the impact of traffic noise.
- Equipment with lower noise levels will be selected where practical, vibration isolation and acoustic enclosures will be installed for mechanical equipment as needed, and the operation of noisy equipment will be limited to daylight hours where practical.
- Install soil berms or vegetation along roads as needed to reduce the impact of traffic noise.
- Schedule project supply deliveries to daylight hours
- Maintain road surface to reduce rumble
- Conduct periodic auditing of noise and vibration levels to ensure minimal impact on the nearest authorized communities

Table 35: MoE's noise and vibration quality standards

Noise by time	Standard*	Vibration by time	Standard*
Day Time (6:00-18:00)	65 dB(A)	Day Time (6:00-18:00)	65 dB
Evening Time (18:00-22:00)	50 dB(A)	Night Time (18:00-6:00)	60 dB
Night Time (22:00-6:00)	45 dB(A)		

Note: *Declaration on Uses of Term of Reference for Establishment of Factory and Handicraft (2018)

- Noise monitoring will be conducted utilizing hand held noise monitors at select locations identified on site map
- Log of monitoring/incidences of non-compliance and rectification will be recorded and maintained
- Drivers will be required to observe low speed wherever necessary and no blowing of horns.
- Construction activities utilizing heavy machinery work will be restricted between 8 AM – 6 PM.
- Advance warning to communities will be provided with respect to the timing of noisy activities.
- Construction vehicles and machinery will be maintained to a high standard to minimize emissions and noise.
- All construction workers / operators will use appropriate PPE including ear defenders when operating machinery.
- Implement CEMP Sub-plans:
  - The Noise and Dust Control Plan
  - Traffic and Road Management Plan

6.5.5 Surface Water Quality

274. During construction, sediment management will be critical to prevent water quality impacts due to erosion and suspended sediment transport impacts associated with land clearance and major earthworks. The removal of vegetation on site and along watercourses could increase erosion and impact local aquatic biodiversity. Surface and near-surface waters near the project area are contaminated and will require management and/or treatment.

275. Any accidental spills of fuel, grey water or septic systems could potentially contaminate receiving waters. Wastes from construction activities have minimal potential to affect the water quality in the Praek Mkak and other water bodies if unmanaged. Significant generation of construction waste is expected during this phase from land clearance, construction activity, and workforce activities. The potential surface water quality impacts associated with the Project construction phase and which are to be managed by the project include:

- Erosion and sedimentation as a result of earthworks and land clearing
- Release of oil, grease and hydrocarbon pollution associated with vehicles and heavy machinery
- Release of pathogen and nutrient pollution associated with human activity, accommodation, sewage treatment and putrescible waste

276. Management measures

- To the extent practical, earthworks will be avoided during the wet season and periods of heavy rain, unless earthworks are needed to prevent erosion;
- Clearance of vegetation from water courses will be avoided wherever practical, leaving a minimum 100m of undisturbed riparian/forest cover on both sides of watercourses within the project area
- All waste from land clearing, building activities, and accommodation will be collected, stored and disposed of safely in a manner that prevents any release of leachate into the Praek Mkak
- All chemicals and hydrocarbons will be handled and stored appropriately according to the ESMP and associated standard operation procedures, with adequate bunding, inspection, auditing and contingency measures
- Mandatory personnel inductions will include awareness of water pollution issues and management, and project regulations will be enacted to prevent polluting activities that may pose a threat to the Praek Mkak
- Furthermore, surface water quality testing will be conducted at 60MW solar plant site and the downstream An Long Chrey reservoir by a Cambodia MOE recognized local laboratory once prior to start of the civil works to establish the baseline, once during the civil works and once after completion of civil works to ascertain if any changes have occurred with respect to MoE's Surface Water Quality Standards.

Table 36: MoE's surface water quality standards

No.	Surface water quality parameters	Unit	Standard*
1	Temperature	^{o}C	<45
2	pH	-	6-9
3	Total Suspended Solid (TSS)	mg/l	<120
4	Dissolved Oxygen (DO)	mg/l	>1
5	Biochemical Oxygen Demand (BOD_5)	mg/l	<80
6	Chemical Oxygen Demand (COD)	mg/l	<100
7	Total Nitrogen (TN)	mg/l	<6
8	Total Phosphorus (TP)	mg/l	<5
9	Total Dissolved Solid (TDS)	mg/l	<2000
10	Oil or Grease	mg/l	<15
11	Detergent	mg/l	<15
12	Sulfate (SO_4)	mg/l	<500
13	Asenic (As)	mg/l	<1
14	Iron (Fe)	mg/l	<20
15	Mecury (Hg)	mg/l	<0.05
16	(Total Coliform)	mg/l	<1000

Note: *Declaration on Uses of Term of Reference for Establishment of Factory and Handicraft (2018)

- Compliance with Sub-decree No. 27 ANRK.BK on Water Pollution Control, MOE, 1999
- Construction camps to be established at least 400 m from any water source
- No washing or repair of equipment/machinery will take within 400 meters of

any water source.

- Provision for a temporary secured hazardous materials handling and waste storage area will be provided across all work sites including site for broken and redundant solar panels.
- Provision for a temporary secured hazardous materials handling and waste storage area will be provided across all work sites including site for broken and redundant solar panels
- Provide temporary sanitary facilities (e.g. pit latrines/portable toilets) to workers and safe drinking water
- Groundwater abstraction will be avoided
- Contractors to include in the construction schedule estimates of anticipated annual water usage and sources of water for construction
- Implement CEMP Sub-plan
- Drainage and Storm-water Management Plan

277. All activities will be supervised by PMO's HS officer, Environment Officer, Social Officer and monitored by PMO of PRAC.

6.5.6 Groundwater Quality

278. There are some potential effluences for groundwater contamination, i.e. contamination of soil and groundwater with oil, grease and hydrocarbon pollution associated with vehicles and heavy machinery; and with pathogen and nutrient pollution associated with human activity, accommodation, sewage treatment and putrescible waste.

279. Management measures

- All chemicals and hydrocarbons will be handled and stored appropriately according to the ESMP and associated standard operation procedures, with adequate bunding, hardstand preparation including lining, concreting or compaction, as well as inspection, auditing and contingency measures.
- Septic tank will be installed to keep wastewater from toilet and kitchen to prevent pollution to groundwater.
- Groundwater quality is to be monitored using groundwater monitoring bores installed up and down gradient of potential contamination zones. Important quality parameters to be monitored are EC, Turbidity, TDS, Total Hardness, Flouride, NO3, SO4, CL, E-Coli, Al, As, Cd, Cr, Fe, Hg, and Mn.

6.5.7 Hydrology

280. The predicted impacts on hydrology associated with the Project construction phase and which are to be managed by the Project include:

- Increased surface runoff from the developed areas of the catchment
- Slightly altered flow regime in ephemeral waterways downstream of Praek Mkak
- Water abstraction from the Praek Mkak may be required to support construction activities

281. Management measures

- The project has been designed to minimize long-term negative impacts to

surface water drainage, flood risk levels, and local hydrology within and downstream of the project area.

- Surface runoff from developed areas of the project is to be controlled by the installation of drainage channels, and contained by the construction of (sedimentation) ponds in order to minimize erosion and flood risk.

6.5.8 Soil Quality

282. 100 ha of vegetation will be cleared in preparation for the construction of project components. Measures are therefore required to minimize soil erosion (by rain and wind) and prevent sediment release to the Praek Mkak. Soil compaction within active construction areas is likely due to heavy traffic passage and construction activities. Soil contamination from accidental leaks/spills of hydrocarbons, oil, grease, chemicals and sewage/wastewater effluent is also possible and will require management.

283. Management measures

- The project has been designed to minimize long-term negative impacts to soil function in the project site by recovering topsoil stripped from clearing and construction activities and subsequently for progressive and final rehabilitation.
- Land clearing is to be limited to the immediate project site required for development to the extent practical
- Activities involving chemicals or hydrocarbons (including storage of broken and redundant solar panels) are to be restricted to designated areas that have been prepared with appropriate bunding, a concrete or compacted earth base, and fully contained by drainage controls
- An appropriate sanitation system is to be provided to collect all waste and sewage for proper storage and disposal;
- Strict controls on the use of sanitation facilities will be implemented through education and enforcement.

6.5.9 Waste Generation

284. Impacts due to waste generation during construction stage have been assessed for all infrastructure types under 60MW solar plant and discussed as follows. Impacts on resource use and impacts associated with disposal will arise from waste generated during site preparation and civil works. This includes generation of inert wastes e.g. spoil, biodegradable wastes e.g. cleared vegetation, construction debris, packaging waste, metal scrap, domestic waste. Impacts of disposal and wind-blown litter will be seen at the construction areas whereas the impacts of resource use are national and global.

285. Management measure

- Compliance with Sub-decree No. 36 ANRK.BK on Solid Waste Management, MOE, 1999
- Establish a covered onsite sorting and recycling area away from existing water sources, drainage /irrigation canals or water sources
- Transport of recyclables, scrap, discarded equipment to PRAC depots, dedicated storage yards for resale or auction to authorized dealers. The broken or damaged solar parnels will be sold to a solar planel specializing panel recycling.
- For other type of wastes, licensed companies will be hired to collect, transport and

dispose of wastes at licensed dump facilities

- Biodegradable waste such as cleared vegetation may be provided to local communities for use
- Provide multiple waste containers at construction camps
- Waste burning will be prohibited
- No final waste disposal on site

6.5.10 Biological Impacts

286. A biodiversity assessment has been carried out for the project; the flora and fauna recorded during the data search, ground surveys and consultations did not reveal the presence of species or habitats of particular conservation value within the project area of influence.

287. There are no protected areas or community forests in or around the solar plant site. The Phnom Aural NPA is located within 20 km of the solar plant site and 300 ha Tbeng Srong community forest in Chhean Laeung commune is located approximately 5-7 km from the solar plant site in the northeast direction. Local interviews with villagers in the Chaen Laeung commune, which borders the Tbeng Srong community forest have suggested the possible presence of endangered and vulnerable species of mammals and reptiles in the forest such as Dhole, Fishing Cat, Asiatic Jackal, and Burmese Python. The interviewed locals also suggested possible presence of rich bird species diversity (species found typically in forested areas, wetlands and rural areas).[86] While there may be avifauna migration from one habitat to another habitat over close distances, for instance, the migration of egret and heron species from the natural stream within the solar plant to the downstream reservoir, such coverage is not anticipated for ground mammals or reptiles due to existing habitat fragmentation and sustained human activity. No direct or indirect adverse impacts are anticipated on the NPA or the community forest as a result of construction activities at the solar plant site. Construction impacts on terrestrial flora and fauna within the solar plant site will be negligible because the site is located in areas of modified habitat consisting of paddy fields and scrubland[87] disturbed by human activity.

6.5.11 Vegetation impacts

288. The most significant impact to terrestrial habitats and flora associated with the project is expected to occur during the Construction Phase when habitats within the project footprint will be cleared. The project site is located further away (16km) on the south-eastern part of the Phnom Aural Wildlife Sanctuary (PAWS), therefore habitat clearance will not result in the loss of natural and modified habitats from within the PAWS or even within the project site since the area has been long modified and no critical habitats are found.

289. Management measures

- Construction camps to be set up at least 400 m from any water source, drainage/irrigation canals or dykes
- Access to adjacent properties and agricultural land will be maintained, as

[86] The interviewee said the observations were in the last five years and there has been a decline in sightings due to change in land use and hunting.

[87] Solar park site is mainly scrubland (293 ha) and paddy fields (116 ha); small plantations such as cassava, mango, cashew, eucalyptus and bamboo.

necessary
- Vegetation clearances will be strictly restricted to work sites
- Use of herbicides/pesticides will be prohibited for vegetation clearing to prevent soil contamination
- Excess spoil will be backfilled onsite or spread out in a manner that causes no disturbance to existing drainage/irrigation canals, dykes or local drainage pattern
- Implement the following CEMP sub-plans
- Strictly implement the Spoils Disposal plan[88]
- Drainage and Storm-water Management Plan
- Site Rehabilitation and Clean-up Plan after completion of civil works to pre-construction conditions including vegetation planting to stabilize soil where it does not compromise the intended function.

6.5.12 Fauna Impacts

290. The significant impact to priority fauna will be the loss of a proportion of their habitat during construction. This impact will largely be localized and restricted to the approximately 100 ha of modified habitat to be removed for project. As preparatory works begin, the on-site species will move into other parts of their range. Other priority birds, reptiles and small mammals have a wide habitat tolerance and are likely to move into similar habitat elsewhere.

291. Management measures
- The project will design a plant layout to avoid most sensitive habitats including maintaining the buffer zone for instance to keep habitats as possible.
- The project will avoid direct and indirect impacts to areas of biodiversity sensitivity (e.g. Praek Mkak).
- Habitat clearance will be undertaken in a progressive and sensitive manner to enable priority fauna to move away from the area of works and to avoid isolating fauna in fragmented areas of habitat.
- Adverse impact to habitats, flora and fauna arising from fugitive dust will be minimized through the regular application of water to reduce dust levels in areas of biodiversity sensitivity (particularly during the dry season), the stabilization of landforms, and the implementation of erosion prevention measures.
- Raise awareness with workforce and local villagers about importance of protecting forest resources and conservation important species and their habitats.

6.5.13 Fishery and other aquatic biodiversity

292. The Praek Mkak is a closed tributary of the An Long Chrey reservoir and provides significant aquatic habitat and ecosystem services. Several minor ephemeral creeks in and around the project site will be slightly modified for the construction of associated components. Vegetated areas occurring within the Project Footprint will also be cleared. Potential impacts

[88] Excess spoil will be backfilled onsite or temporary / permanently disposed as per the clearly identified disposal sites on site specific map, with corresponding distance and number of trips made will be maintained (this will help avoid disposal of spoil on farm land or within 400 m of any water source).

therefore include:

- Release of suspended sediment from construction activities
- Clearing or modification of watercourses in the project site
- Accidental spills of diesel fuel

293. Management measures

- The project design minimizes potential impacts to aquatic habitat by minimizing the construction footprint, which avoids local wetlands and waterways to the extent possible and primarily drains into a single catchment – Praek Mkak.
- Riparian habitats will be retained where possible to maintain a degree of functionality, including a 100 m buffer zone around watercourses
- Proper transport, storage, handling and disposal procedures for hazardous substances will be developed and implemented to prevent spills and leaks entering the Praek Mkak and tributaries.
- Personnel and contractors will be prohibited, as a condition of employment, from fishing and trading in aquatic natural resources.

294. The potential impacts on ecological resources will be mitigated by the following measures as set out in the ESMP:

- Minimize vegetation clearing confined to the footprint of 60MW solar plant area
- No use of chemicals (pesticides/herbicides)
- Maintain hedges and field margins along 60MW solar plant perimeter
- After completion of civil works, implement Site Rehabilitation and Clean Up Plan including landscaping along the fenced perimeter of 60MW solar plant, re-seeding most or all of the site with native species of plants
- Provision for adequate ground clearance under fencing for allowing passage of animals/wild species to prevent habitat fragmentation
- Restoring temporarily disturbed areas to pre-construction conditions
- Trees below 3 m will not be cut or felled, minimum lopping and pruning will be undertaken as necessary
- Any identified bat roosting sites will not be disturbed
- Restoring temporary land use (used for material storage) to pre-construction conditions

6.5.14 Local Economic Development

- Despite the generally positive impacts the Project will have on economic development and employment, there is a risk of inequitable employment, training and procurement opportunities or inadequate communication leading to community dissatisfaction.
- The project will implement the preferential local recruitment and procurement policies in place. Implementation of social management and monitoring as per the ESMP and sub-plans: Stakeholder Engagement Plan, and Grievance Mechanism.
- Provide a grievance mechanism for the Project.

6.5.15 Agricultural Land Use

- There will no risk to agricultural land.

6.5.16 Forest Resource Use

295. Project construction will result in the removal of small bushes in the project footprint, exclusion of the public from the project site and its resources, and the potential for increased pressure on forest resources from local villagers.

296. Management measure

- The project will demarcate the project boundary and avoid the key community forest collection areas when siting infrastructure in the Project design.
- The project will ban on unauthorized collection of forest resources, including plants, and firewood within and around the project areas.
- The project will set up a grievance mechanism.
- The project will monitor the vegetation clearance to avoid any vast and unnecessary clearance.

6.5.17 Water Uses

297. There is a slight risk to downstream water users related to the possibility of impacts on water quality associated with project construction activities including contamination of water resources with sediment and chemicals such as diesel, grease and oil. Other impacts may arise from modifications to local creeks/drainages. Groundwater is not a significant source of water for the project, and no significant impacts on groundwater quality or availability are expected during the construction phase.

298. Management measures

- All hydrocarbons, oils and greases will be handled, stored and used in designated areas according to standard operation procedures with adequate bunding, hardstand preparation (e.g. lining, concreting or compaction), inspection, auditing and contingency measure
- Mandatory personnel inductions will include awareness of water pollution issues and management.

6.5.18 Occupational Health and Safety

299. During the construction phase, more workers will be employed to support project construction, to be housed on site in the Project accommodation village. The key factors that will pose risks to worker health and safety are movement of heavy machinery and high volumes of traffic on site. The main risks to worker health and safety and other risks such as fire.

300. Management measures:

- The project will demarcate exclusion and safety zones around high risk area.
- The project will strictly require all workers wear personal protective equipment appropriate to their duties with signage at designated sites.
- Clinical assistance will be available to project personnel and medical emergency evacuation procedures will be developed.

- Fatigue will be monitored and managed during travel and during on site operations.
- Standard Operating Procedures (SOPs) for the safe handling, storage and transportation of associated facilities and materials.
- The project will strictly implement the management and monitoring measures as per ESMP for water quality, waste management, air, health and safety, noise and vibration and transport measures.
- Implement CEMP sub-plan on Occupational Health and Safety (OHS) Plan
- Establish and implement ERPs as required
- Compliance with Cambodia Occupational Safety and Health laws and regulations, Department of Safety and Health, Ministry of Labour and Vocational Training (MLVT), 2011[89]
- Provide sanitary facilities and wash areas, safe drinking water and garbage bins
- Provide health assessments (health and fitness to workers once every two months)
- Periodic training will be provided to workers in all aspects of the ERP and OHS
- Coordinate with nearest hospital for arrangements in case of accidents
- provide first aid treatment for construction sites and camp
- Assess safety risks and safety protocols (such as for electrical works, working at heights, etc.), and implement
- Workers will be equipped with PPE including proper safety clothes and protection gear/equipment to avoid accidents
- Provide communication devices to designated site officers / engineers
- Electrical safety risks will be assessed and safety protocols will be developed and implemented such as for electrical works, working at heights, etc.
- All works at height will be prohibited during night time, periods off fog and strong wind on the Beaurfort Wind Scale[90]
- All workers climbing towers will have a Safety Certificate of Class 391 or above
- All towers, steel structures and equipment will be properly earthed and equipped with lightening protection
- When testing electrical equipment, all unrelated works in the flagged zone – marked as danger zone- will be stopped and unrelated workers will leave the zone
- Records of health assessments/incidents/accidents/near-miss/fatalities will be maintained

6.5.19 Community Health and Safety

301. Site preparation and civil works, movement of vehicles bringing equipment, materials,

[89] MLVT- Ministry of Labor and Vocational Training

[90] The Beaufort Wind Scale is an empirical measure with 12 wind speed classes. Winds above Class V are higher than 10.8 m/sec.

[91] Electric Safety Classification is regulated in Circular 31/2014/TT-BCT (2014). The Circular stipulates five Safety Classifications (1 to 5), with 5 being the highest. A Class 3 Safety Certificate designates a worker capable of working in the field, and is given to workers/technicians who: 1) pass 80% of the training; 2) have knowledge of the proper use of PPE; 3) master the method to extract an electrocuted victim from the power source; 4) can provide first aid to an electrocuted victim; 5) is able to determine unsafe practices; and 6) is able to supervise electric workers working at height and near electric equipment.

supplies and machinery may interfere with road crossings, flow of traffic and may cause an increase in traffic congestion. These activities may pose safety risks to the communities residing in close proximity to the work sites and general public. In addition, construction camps and an influx of workers may cause social conflict or even lead to the spread of any comunicable diseases. Contractors will obtain permissions from relevant authorities before commencement of activities. A code of conduct will be developed for all relevant stakeholder and workers to keep the work organized and safe.

302. The Project may also generate (fugitive) dust mainly from upgrading the access road, clearing the forestland for infrastructure, and transportation of materials and equipment. Noise from these activities may also disturb nearby residents at night as well as impact on daily economic/business activities. Also, during the Construction Phase, the project may lead to a number of key risks for community health, food security and safety, including:

- Safety impacts will be primarily associated with accidents involving company vehicles along the project access road. During construction in particular there will be a significant increase in project traffic.
- Potential psycho-social and health impacts among Project personnel associated with air quality, noise, and vibration effects.

303. Management measures

- Security fencing and patrols to prevent safety impacts from any construction activities undertaken during construction.
- Potential noise impacts will be reduced to acceptable levels through scheduled daytime construction, while dust generation will be managed through regular water spraying on major dust sources associated with the project.
- The project will strictly implement the management and monitoring measures as per ESMP for water quality, waste management, air, health and safety, noise and vibration, and transportation; and sub-plans including Emergency Preparedness and Response Plan, Community Health and Safety Plan, Stakeholder Engagement Plan, Traffic and Transport Management Plan, and Waste Management Plan.
- Provide healthcare services for project employees with an appropriately staffed site clinic
- Effectively control the risks associated with accidents involving multiple vehicles, interactions between different types of vehicles with consideration for the volume and speed of traffic, and vehicle and person interactions.
- Obeying speed limits and apply additional caution by considering environmental conditions such as time of day, visibility, precipitation.
- Implement an effective site waste management strategy and surface water drainage to prevent the incidence of vector-borne and water-related diseases
- Develop a management strategy for worker accommodation in line with international/national standards to minimize spread of infectious disease and food-related illnesses.
- Adhere to strict schedule for completion of civil works and avoid prolonged construction and disturbance
- Implement CEMP Sub-plans
- Community Health and Safety Plan

- Traffic and Road Management Plan
- Provide perimeter fencing to mitigate trespassing (fencing will be constructed with adequate ground clearance for passing of wild animals/other species at the 60MW solar plant site)
- Provide barricade to temporarily enclose open excavated tower foundations
- Provide sufficient lights, clear warning signs and danger signals
- Assign security personnel to prevent accidents, trespassing and pilferage
- Warning signs and cones will be installed in and around the transmission tower site and along roads, with clearly marked danger zones
- Safety flags and flag persons will be used, as needed
- Record of incidents/accidents/near-miss/fatalities associated with the project will be maintained
- Records of issues raised will be maintained in accordance with GRMs
- Outreach to local communities to disseminate knowledge about safety and ERPs at or near 60MW solar plant will be provided via information disclosure and consultation activities, project information booklet (PIB) / frequently asked questions (FAQ) flyers.

6.5.20 Physical Cultural Resources (PCRs)

304. There are no known PCRs within 60MW solar plant site. During the construction stage, there may be moderate temporary air quality impacts due to fugitive dust generation and noise to these existing PCRs. These will be mitigated as per the steps detailed under Impacts on Air Quality, Noise and Vibration and by conducting consultations to avoid sensitive religious and spiritual functions/periods. In addition site preparation and civil works during the construction stage have the potential to disturb as yet unknown PCRs. A Chance Find Procedures will be implemented as necessary. All activities will be supervised by SECU's HS officer, Social Officer, Environment Officer and monitored by the PMO of PRAC.

6.5.21 Interruption to Existing Utilities

305. To reduce impacts on existing utilities (such as power outages), 60MW solar plant construction works and upgrade works will be scheduled in a phased manner. All activities will be supervised by PMO's HS officer, Social Officer, Environment Officer, and monitored by the PRAC's PMO.

306. Use of Existing Access Roads. Delivery of equipment, materials and machinery to work sites at 60MW solar plant may lead to increase in traffic and road congestion. It may cause interference with road crossings during stringing of conductors. Movement of transport vehicles will also result in moderate air quality impacts (dust and increase in vehicular emissions) as well as an increase in noise (due to operation of transport vehicles) during peak construction period (these are discussed under Impact on Air Quality, Noise and Vibration). The potential impacts due to increase in traffic and road congestion will be mitigated through the following measures as set out in the ESMP:

- Implement Traffic and Road Management Plan
- Follow planned transportation routes and delivery schedule
- Any traffic detours to have danger and clearly visible warning signs as well as flag persons
- Compliance with local speed limits vehicle load carrying capacity and other

road regulations
- Any damage to roads to be borne by Contractor(s)
- Record of incidents/accidents/near-miss/fatalities/road damage will be maintained

6.5.22 Other Risks

307. Forest fire in the dry season and flooding of the Praek Mkak during the wet season are risks that need to be accounted for in the planning, design and management of the Project.

308. Management and Mitigation
- The project will construct a fire path break around the project boundary to prevent forest fires from reaching 60MW solar plant and other facilities.
- The project will maintain equipment ready for fire-fighting (e.g. water trucks with water cannons) and train personnel to respond to forest fires in the Project area.
- A flood-preventing dam is set up at the west of the project to stop rising water level from flooding 60MW solar plant.
- Implement and provide inductions to all staff on the Emergency Preparedness and Response Procedures and measures described in the ESMP.
- Ongoing engagement with government authorities and consultation with local communities will form part of a proactive approach to prevent or reduce risk of natural hazards to project activities and communities.

6.6 Operation Stage

6.6.1 Workforce Organization And Orientation

309. The SECU (PMO) of PRAC will conduct briefing and orientation for all project staff, workers, and its turnkey contractor/sub-contractors (facility operators).:

- ESMP, GRM, Information disclosure and meaningful consultation, environmental monitoring and reporting requirements
- ADB and Cambodia labor standards
- Responsibilities of the contractors in implementing SOPs and monitoring environmental compliance with environmental performance indicators and ESMP 92
- Responsibility of the contractors in engaging with affected persons for project GRM
- Create awareness of sexually-transmitted diseases (HIV/AIDs), child labor, bonded labor or forced labor
- Searching for an assessing, monitoring and recording keeping of carcass searches (birds/bats)
- Record and maintain briefing and orientation events log with duration and list of attendees
- Project Operation

[92] PIC will develop checklists for use in monitoring environmental compliance during construction stage.

6.6.2 Topography

310. The landscape changes associated with the development will be limited in duration (life of project), with original landscape values restored at closure.

311. Maintaining and assuring the structural integrity of these project components is critical to prevent health, safety and environmental impacts. Due to the topographical location of the project and the surrounding forest cover, the changes to physical landscape in the project development area will not be visible or have an impact beyond the project's immediate vicinity.

312. Operation stage impacts on land and vegetation are assessed for all infrastructure types under project output 1 and discussed as follows.

313. Vegetation Management. Periodic vegetation maintenance will be undertaken solar plant site. The potential impacts during operation will be mitigated through the following measures as set out in the ESMP:

- Maintain landscaping along the fenced perimeter of 60MW solar plant
- Maintain hedges and trees at field margins
- Employ manual vegetation maintenance methods such as grazing by local cattle or manual trimming of grasses and plants within 60MW solar plant site and employ local labor
- Maintain the re-seeded site
- No chemicals (herbicides/pesticides) will be used
- To avoid buildups of trimmed vegetation and branches, these will be allowed for collection by local people for firewood or facility operator will contact the relevant local authorities for collection, transport and disposal.

6.6.3 Landscape Impact

314. The 60MW solar plant will create a visual impact and may result in induced access to the area. The site is not surrounded by habitation or permanent structures. Steps to reduce visual impacts e.g. maintenance of hedges and field margins around the fenced perimeter will be incorporated after completion of civil works and during the start of operation. This project will showcase green development of the power sector in Cambodia as well as preserve the local biodiversity. Solar panel glare issues are not anticipated for solar PV plants[93].

6.6.4 Air Quality, Noise and Vibration

315. Operation of 60MW solar PV plants will not impact the air quality except for some fugitive dust generation due to movement of transport vehicles. Noise-generating equipment (such as inverters/transformers) at pooling substation will be enclosed and periodic maintenance of equipment will be conducted to minimize disturbance.

6.6.5 Water Quality

Operation impacts on water quality and resources at 60MW solar plant may result due to excess usage, potential contamination to water sources due to accidental spills and leakage as

[93] Current glint / glare studies for solar systems at airports have proved that these are not an issue. Source: FS CAM NSPP Technical Team.

well as due to accidental discharge of wastewater. Contractors within 60 days of each contract year after the commercial operations date, will be required to provide to the PMO reasonable estimates of water usage for purposes of operating and maintaining the solar PV plant for the applicable contract year.

316. The potential impacts on water quality and resources will be mitigated by the following measures as set out in the ESMP.

- Maintain storm water retention pond for use for PV cleaning
- Periodic cleaning of storm water retention pond to remove debris
- No use of chemicals/detergents for cleaning purposes
- Provide and maintain permanent sanitary facilities to workers and safe drinking water
- Provide and maintain a septic system for wastewater collection and disposal; tank system will be located at least 400 m from any water sources, to avoid contamination.
- Maintain permanent secured ('bunded') areas on impermeable surfaces and dykes capable of carrying 110% volume of materials for accidental spills or leakage

6.6.6 Waste Generation

317. While it is not expected that solar PV panels of 60MW solar plant will require replacement since their life span is 25+ years; however some may fail due to rain, humidity or heat. Inverters at the substation will likely be rebuilt as opposed to replaced. Small amounts of domestic solid waste will also be generated at 60MW solar plant site during operation. Lack of proper handling, storage and disposal of domestic waste and/or broken PV panels may result in adverse impacts. The potential impacts due to waste generation will be mitigated by following the measures as set out in the ESMP:

- Compliance with Sub-decree No. 36 Solid Waste Management, MoE 1999
- Utilize licensed vendors/suppliers for collection, transportation and disposal of broken/unused PV panels
- Also store broken/redundant panels in covered bunded areas
- Implement SOP for Materials Management and Waste Management

6.6.7 Ecological Impacts

318. The large area of PV panels in the solar plant may create a 'lake effect' which could attract birds that mistake the solar panels for a water body and the hot panels could kill or seriously injure birds, which attempt to land on them especially the young inexperienced ones. Visual deterrents and flight diverters will be provided at the solar plant, particularly close to the storm water retention pond.

6.6.8 Occupational Health and Safety

319. Contractors will comply with the relevant safety measures required by law and as per International Best Practices. The potential impacts to workers will be mitigated through the following measures as set out in the ESMP:

- Implement SOP for Occupational Health and Safety
- Compliance to Cambodia Occupational Safety and Health laws and regulations, MLVT, 2011

- Compliance to relevant national electrical safety standards
- Provide and maintain signage as per Institute of Electrical and Electronics Engineers standards at dangerous places for warning of electrical hazards
- Provide and maintain health assessment by a competent medical practitioner for all workers
- Provide periodic training to all workers with access to electrical and hazardous conditions and workers will be certified to work on site
- Provide and maintain workers appropriate PPE
- Equipment and tools will be inspected before use to ensure proper and safe operation
- Appropriate grounding and deactivation of live power equipment during maintenance work or if working in close proximity to the equipment; provision of lightning arrestors as appropriate
- Record of health assessments, incidents, accidents, near-miss, fatalities will be maintained
- EMF levels expected to be below the limits set by International Commission on Non-Ionizing Radiation Protection which is 4.17 kV/m for electric field and 833 miliGauss for magnetic field; periodic EMF monitoring using hand held devices as required

6.6.9 Community Health and Safety

320. The presence of a solar plant and its operation may pose potential hazards such as electrocution, lighting strike due to accidental failure of power transmission and exposure to EMF. Information and consultation with local residents (community awareness program) and authorities will be conducted intermittently during operation stage. These activities will be conducted in and around the villages situated close to 60MW solar plant.

321. The potential impacts will be mitigated by the following measures as set out in the ESMP:

- Distribute PIB/FAQ and make it publicly available during consultations
- Communicate with communities on potential health and safety risks and mitigation measures including ERPs
- Record of consultations will be maintained in accordance with Stakeholder Analysis and Communication Plan
- Record of incidents, accidents, near-miss, fatalities associated with the project will be maintained
- Records of issues raised will be maintained in accordance with project GRM

6.7 Decommissioning Phase

322. The solar plant facility lifespan is expected to be >20 years, at which point it might be decommissioned. Typical activities during the decommissioning and site reclamation phase include facility removal, breaking up of concrete pads and foundations, removal of access roads that are not maintained for other uses, re-contouring the surface (if required), and land re-vegetation and replantation of trees. Associated impacts include erosion, noise, dust and vehicle exhaust, and the need to properly manage large amounts of debris, solar panels, wire and cabling, electronics, etc. Solar plant and its power production may have a much longer

lifespan that the solar PV plants (order of 45 to 60 years), which may be further extended through maintenance and periodic equipment replacement.

323. The ESMP plan provides a preliminary assessment of potential mitigation measures/safeguards that may be implemented at a minimum of six months prior to plant closure at that time. This will be followed by a detailed decommissioning and site reclamation plan to be developed at that time. The preliminary assessment will include measures for avoiding and/or minimizing surface erosion, impact to air and water quality, noise and vibration, flow alteration, waste generation, impact to flora and fauna, traffic related issues as well as health and safety of workers and communities.

6.8 Cumulative and Induced Impacts

324. In 2016, ADB conducted a preliminary grid-integration study on solar PV prospects for Cambodia.[94] The study report, issued in February 2017, demonstrates the technical feasibility of rapid uptake of solar power to boost generation capacity, diversify the country's energy mix, increase energy security, improve system stability and avoid GHGs. The grid integration study lays out three scenarios of PV penetration (low, medium and high), the corresponding levels of electricity generation and emissions as well as impacts on the grid and recommended mitigation measures. The study suggests that with currently available technologies, up to 150 MW of solar can be added to the grid by 2020 with no major impact on the grid and no additional transmission investment.[95] The study also suggests a staged solar PV capacity development plan to 2030 that would allow new systems to be added as demand grows and transmission capacity expands in Cambodia.

325. Given the above scenario, cumulative impacts could arise from other similar solar PV projects in the vicinity that are being constructed concurrently with the construction stage of this project. There are no existing commercial solar PV plants in operation in close proximity to the proposed project except the 60 MW Solar developed by Schnetic in Taing Krasaing Commune, Toeuk Phos District and is about 40km to the proposed 60MW solar plant in Kbal Toeuk commune. The 10 MW Bavet solar plant project in Svay Rieng province is approximately 200 km from the proposed site. Given the constraints in availability of information, it is only possible to qualitatively assess cumulative impacts.

326. **Topography and land-use:** Field visits suggest that 500 ha in and around 60MW solar plant site are heavily disturbed by human activities; impacts resulting from land use change and future solar PV plants at the site are expected to be medium. However, all solar PV power plants will have negative impact on land use.

327. **Soils, Surface and Groundwater:** When preparing sites for PV panels, some developers clear the entire site of vegetation, often leveling and grading the whole extent of the site. This may result in soil compaction, soil disturbance and erosion and increase the sedimentation of canals and/or any water bodies in the area. As solar PV plants occupy large areas, potential cumulative impacts could be significant if not managed properly especially if more solar PV

[94] ADB. (14 February 2017) Towards a National Solar Program in Cambodia: Pre-feasibility Study Findings. Confidential Draft. Manila.

[95] The report studies the addition of 100 MW added to the Phnom Penh region and 50 MW elsewhere throughout Cambodia.

plants were to be constructed and operated in the future in the surrounding wider area. During operation, PV panels require water for panel cleaning. Some facility operators may undertake groundwater extraction that may affect the groundwater table, excess usage and shortage in water availability for other users in the area. With stipulated mitigation measures to avoid disturbance to the soils as well as surface and groundwater usage, the cumulative impacts associated with future solar PV plants in this regard are expected to be minor.

328. **Air, Noise and Vibration**: Most solar PV plants will have negative impacts on air, noise and vibration during peak construction stage, which are temporary and localized in nature, the cumulative impacts in this regard are expected to be minor. There will be no air quality issues during operation except for fugitive dust emissions arising from movement of transport vehicles on access roads. There will be some noise generation due to movement of vehicles and operation of substation. However, cumulative impacts during operation in this regard are expected to be minor.

329. **Ecology:** The biodiversity assessment confirmed that the proposed site does not support any species or habitat of conservation value. However, given the considerable space requirements of commercially viable solar PV plants (100 ha) and corresponding site/vegetation clearances, the effect on ecology could be significant and should be informed by detailed ecological assessment of the area under consideration.

330. **Human Environment**: Resettlement and rehabilitation of affected persons may have higher relevance for solar PV plants in cases of land acquisition of paddy fields (that also serve as a livelihood source for most rural communities) and associated power evacuation. However, with implementation of safeguard measures such as careful site selection that avoids agriculturally productive lands and appropriate and timely compensation, the cumulative impacts associated with solar PV plants in this regard are expected to be minor.

331. **Waste:** All solar PV plant development will need to effectively manage their wastes such as biodegradable waste (vegetation clearances), construction debris, presence of workers and hazardous materials, leaks and spills. In case solar PV plants utilize lithium ion batteries for energy storage, then certified vendors will need to be identified for collection and disposal of batteries at the end of its life span. The cumulative impacts associated with solar PV plants in this regard are expected to be minor if managed effectively.

332. **Visual and Aesthetics**: Within the wider surrounding area, there are no sensitive human receptors, no sites of particular importance, visual or scenic features, environmental reserves or parks that will be affected by the current or future development. The nearest community forest is approximately 5-7 km away. Another issue is the potential for glare caused by sunlight reflected off the PV panels from the future developments in the wider project area. PV panels work on the concept of absorbing sunlight rather than reflecting it. While minimal reflections from the panels are inevitable, this is not anticipated as a major issue. Thus, impacts in this regard are expected to be minor.

333. Induced impacts would include more frequent use of major roads and access roads for the transportation of workers, equipment and machinery to 60MW solar plant site. This will result in traffic nuisance to nearby communes and increase in dust due to movement of

vehicles and increase in vehicular emissions affecting air quality. However, with mitigation measures, the impacts are expected to be minor.

CHAPTER 7: ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

334. The 60WM Solar Plant's Environmental and Social Management Plan (ESMP) identifies the potential project environmental impacts and defines mitigation measures and monitoring requirements for the design and pre-construction, construction, and operation stages of the project. It also defines the institutional arrangements, roles and responsibilities of institutions involved and cost estimates for implementation of the ESMP. The ESMP will ensure environmental protection activities during all stages in order to prevent, reduce, or mitigate adverse environmental impacts and risks. The ESMP draws on the findings of the project ESIA report and discussions and agreements with ADB, IFC and EDC.

335. The 60MW solar plant's ESMP is based on inputs from the Feasibility Study team for the project as of June–July 2018, and field assessment in Sept-Nov 2020. Detailed engineering designs are referred by this ESMP. With the oversigh of PIC and EPC of EDC's National Solar Park, PRAC's SECU will inform the obligation of its turnkey contractors/subcontractor to implement the ESMP.

7.1 Institutional Arrangements And Implementation Responsibilities

336. Implementing Agency. The SECU of PMO (PRAC) will be responsible for overall supervision and monitoring of project implementation and compliance with loan/grant assurances of ADB SPS 2009 and IFC PS 1-8, and regulations of the Government of Cambodia (MoE) for 60MW solar plant. SECU of PRAC will work closely with PIC and EPC of EDC's National Solar Park to ensure the construction and operation of 60MW solar plant comply with ADB/IFC and MoE social and environmental standard requirement

337. PRAC has established its own Project Management Office (PMO) comprising of a Social and Environmental Complaince Unit (SECU) (to engage external consultant team), Engineering and Construction Unit [ECU] (where PRAC's turnkey contracts/sub-contractors), and Operation and Maintenance Unit (OMU). The PMO is assigned responsibility on behalf of PRAC, for the day-to-day management of the project. With the oversighs of PIC and EPC of EDC's National Solar Park, the PMO will have the responsibility to supervise and oversee the 60MW solar plant's compliance with (i) loan and grant covenants, (ii) environmental safeguards requirements, (iii) coordinate the project GRM, (iv) coordinate with line ministries to ensure smooth implementation of the project, (v) supervise the procurement process and (vi) report to ADB/IFC. Within PMO, PRAC will appoint a team of external consultants consisting of environment officer, social officer, and HS officer (under SECU) to carry out ESMP and to ensure compliance with the requirement of relevant regulations. See organizational structure in chapter 3.

338. PRAC's tuneky contractors for 60MW solar plant. All contractors and sub-contractors will be responsible for implementing the mitigation measures during construction and operation under the supervision of the SECU of PRAC. To ensure that the contractors comply with the ESMP provisions, the SECU will ensure that the safeguards requirements are met. SECU will work with contractors/sub-contractors and their staff to regularly co-ordinate with affected persons), village chiefs and commune councils to provide up to date information on project activities and to address any issues that arise during project implementation.

339. SECU of PRAC will be responsible for overall supervision and coordination during project implementation; in particular it will ensure consistency of safeguards documents with government policy, legal and administrative framework across all jurisdictions – national, state and local level as well as assist with project GRM and meaningful consultations.

7.2 Reporting And Monitoring

340. The SECU will be responsible for environmental reporting, and ensure compliance checks and environmental monitoring and prepare the project Quarterly Progress Reports (QPR) of 60MW solar plant for submission to EDC's PIC and the MoE/ADB/IFC till the project completion report is issued. Together with the National Solar Park, the environmental monitoring reports of 60MW solar plant will be publicly disclosed on the ADB/IFC website. Reporting to ADB/IFC will continue until project completion report is prepared, one year after physical completion.

341. The SECU of PRAC will be responsible for environmental monitoring specifically the 60MW solar plant. Three types of project monitoring will be conducted under the 60MW ESMP.

- Project readiness monitoring. To be conducted by the SECU (see Project Readiness Checklist)
- Environmental monitoring. To be conducted across all stages of project implementation as described in the EMOP and assessing compliance with applicable Cambodia environmental quality standards
- Compliance monitoring. To be conducted by the PIC to verify ESMP and EMOP compliance during project implementation

342. ADB/IFC will oversee project compliance on the basis of the annual environmental monitoring reports provided by SECU/PMO and site visits (generally one to two times per year).

7.3 Training and Capacity Building

343. PRAC will engage suitably qualified and experienced employees and contractors possessing relevant qualifications, certifications and/or licenses to ensure project duties and requirements are carried out properly. External specialists who are suitably qualified to support site employees will be engaged where there is a need for additional expertise. PRAC will ensure that these consultants are suitably qualified and experienced for the Project.

344. In line with local regulatory requirements and labour laws, PRAC will employ Cambodian nationals to the extent possible. Locally available management and technically skilled personnel will be given preferential employment opportunities. There will be international professionals employed who will be expected to train and mentor local professionals in the long- term.

345. SECU of PRAC will provide training and orientation to contractors/sub-contract staff and hired workers. Such training will be conducted prior to mobilization on site during

construction and operation stages. All parties involved in constructing and operating 60MW solar plant of PRAC must have an understanding of the goals, methods, and practices of project environmental management.

7.4 Cost Estimates

346. There are three types of mitigation measures and corresponding costs:

- Measures that will permanently become part of the infrastructure such as landscaping, re-seeding of sites, hedge planting, maintenance of field margins, perimeter fencing with adequate ground clearance for passage of wild species/animals, road signage, permanent access roads to 60MW solar plant, detailed engineering measures for preventing soil erosion and localized flooding (storm water retention pond, strengthening of drainage canals), will be included within the main civil work contract costs and not double-counted as part of the ESMP costs, estimated as XXX million or 4.4% of the total base cost.[96]
- Measures such as conducting environmental baseline surveys for surface water and groundwater and seasonal surveys can be counted as part of the ESMP costs. Cost estimates related to environmental and social impact mitigation are estimated as $0.20 million or 0.75% of total project base cost.
- Measures during the construction stage (e.g. dust suppression by watering, use of hand held portable air and noise monitoring devices, EMF measuring devices, quiet/low noise machinery and equipment, PPE, etc.) as well as measures to mitigate unforeseen impacts due to construction activities will need to be included in the tender documents to ensure that all contractors budget these items in their bids. Contractors will also bear all environmental monitoring costs during the operational stage.

7.5 Project Reporting

347. PRAC will undertake the following environmental and social reporting for the Project in accordance with the Cambodian Sub-decree on Environmental Impact Assessment Process (1999), and internal reporting requirements:

- Quarterly reporting
- Bi-annual reporting
- Annual reporting

348. Significant findings from the environmental and social monitoring programs and reportable incidents and complaints logged by the incident reporting system will need to be reported and discussed at regular (e.g. weekly and monthly) management meetings as necessary.

7.6 Summary of 60MW solar plant's Environmental and Social Management and Monitoring Measures

[96] Source: Project Administration Manual, July 2018. The total project base cost is USD 26.50 million; subject to change.

349. Mitigation measures are proposed for the PRAC in attempt to achieve the highest standards of operation and management for the environmental and social protection of 60MW solar plant.

350. Table below summarizes the key environmental and social monitoring measures to be implemented for each phase of the project. Further details of the proposed monitoring program are provided in the ESMP.

Table 37: Summary of environmental and social monitoring program for 60MW solar plant

Aspect	Project Phases	Parameters	Actions	Location	Frequency	Responsible Agency	Monitoring Agency
Physical Resources							
Landscape	Pre-Construction	Maintain the existing landscape (shrub, stream)	The project design is to minimize the impacts on the landscape through limiting the clearing where it is not necessary.	Project site (100ha)	One time before construction	PRAC's Engineering and Construction Unit (ECU) including turnkey contracts/sub-contractors	PRAC (SECU)
	Construction		▪ The project minimizes its footprint and blending major project components with the surrounds to the extent practicable. ▪ The project undertakes required clearing of forested areas in the dry season, where possible, to prevent exposure of ground to erosion by rainfall.		Annually	PRAC (SECU)	MoE EDC's PIC (on behald of ADB/IFC)

Aspect	Project Phases	Parameters	Actions	Location	Frequency	Responsible Agency	Monitoring Agency
	Decommission	Trees planted on site and existing landscape is improved	The project restores the landscape through planting trees and habitats.		One time before completion	PRAC (SECU)	MoE EDC's PIC (on behald of ADB/IFC)
Topography	Pre-Construction	Maintain the existing topography	The project design is to minimize the impacts on existing topography of the site.	Project site (100ha)	One time before the civil work begins	PRAC (ECU)	PRAC (SECU) with oversight of EDC's PIC
	Construction		▪ Clear demarcation of work sites, no encroachment outside the demarcated zone ▪ Construction camp set up at least 400 m from natural streams or any other water source at site including drainage/irrigation canals and dykes ▪ Use of herbicides/pesticides will be prohibited for vegetation clearing to prevent soil		Annually	PRAC (SECU)	MoE EDC's PIC (on behalf of ADB/IFC)

Aspect	Project Phases	Parameters	Actions	Location	Frequency	Responsible Agency	Monitoring Agency
			contamination ▪ Implement engineering and biological measures to prevent surface erosion such as provision of silt traps or sowing soil-binding grass, as needed.				
	Operation		▪ Maintaining and assuring the structural integrity of these project components		Annually	PRAC (SECU)	MoE EDC's PIC (on behalf of ADB/IFC)
Land Take	Pre-Construction	Land purchase take for the 60MW solar plant	Negotiated settlements with landowners for the 60MW solar plant site will be completed prior to any civil works.	Project site (100ha)	One time before the civil work begins	Land owner: PRAC to confirm with EDC	EDC's PIC (on behalf of ADB/IFC)
		Temporary land take	All the temporary sites will be vacated and restored or vegetated upon completion of civil works.	Around the project site	One time before the civil work begins	PRAC (ECU)	PRAC (SECU) with oversight of EDC's PIC
Air Quality	Construction	Air quality parameters	▪ Restricting land clearance	Project site	Every 6 months	PRAC (ECU)	PRAC

Aspect	Project Phases	Parameters	Actions	Location	Frequency	Responsible Agency	Monitoring Agency
		are CO, NO2, SO2, O3, TSP, PM10, PM2.5, Pb	▪ Regulating transporting practices ▪ Regularly monitoring the air quality	Access road			(SECU) with oversight of EDC's PIC
	Operation		Operation of 60MW solar plant, substation, and solar PV plants will not impact the air quality except for some fugitive dust generation due to movement of transport vehicles.	Project site Access road	Annually	PRAC (SECU)	MoE EDC's PIC (on behalf of ADB/IFC)
Noise/Virbation	Construction	Noise 6-18 – 65 dB(A) 18-22 – 55 dB(A) 22-6 – 45 dB(A) Vibration 6-18 – 65dB 18-6 – 60 dB	▪ Imposing a speed limit on site roads, by scheduling the majority of vehicle movements to daylight hours ▪ Maintain road surface to reduce rumble	Project site Access road	Every 6 months	PRAC (ECU)	PRAC (SECU) with oversight of EDC's PIC
	Operation		Operation of 60MW solar plant will not	Project site	Annually	PRAC (SECU)	MoE EDC's PIC (on behalf of ADB/IFC)

Aspect	Project Phases	Parameters	Actions	Location	Frequency	Responsible Agency	Monitoring Agency
			pose any noise and vibration risks.	Access road			
Topography	Construction	▪ Limited clearance of vegetation ▪ Minimize the impacts on water and land	▪ Clear demarcation of work sites, no encroachment outside the demarcated zone ▪ Access to adjacent properties and agricultural land will be maintained, as necessary ▪ Construction camp set up at least 400 m from natural streams or any other water source at site including drainage /irrigation canals and dykes ▪ Vegetation clearances will be strictly restricted to the works site and for permanent access roads, hedges and field margins will be retained	Project site (100ha)	Every 6 months	PRAC (ECU)	PRAC (SECU) with oversight of EDC's PIC

Aspect	Project Phases	Parameters	Actions	Location	Frequency	Responsible Agency	Monitoring Agency
	Operation	Maintained existing landscape	▪ Maintain landscaping along the fenced perimeter of 60MW solar plant ▪ Maintain hedges and trees at field margins ▪ Employ manual vegetation maintenance methods such as grazing by local cattle or manual trimming of grasses and plants within 60MW solar plant site and employ local labor ▪ Maintain the re-seeded site ▪ Maintenance of vegetation along permanent access roads to 60MW solar plant	Project site (100ha)	Every 6 months	PRAC (SECU)	MoE EDC's PIC (on behalf of ADB/IFC)
Soil Quality	Construction	Soil quality parameters are Moisture, TC, TN, OM, P, Ca, Mg,	▪ Land clearing is to be limited to the immediate project site required for development to the	Project site (100ha)	Every 6 months	PRAC (ECU)	PRAC (SECU) with oversight of EDC's PIC

Aspect	Project Phases	Parameters	Actions	Location	Frequency	Responsible Agency	Monitoring Agency
		Na, K, H2O, KCL	extent practical ▪ Activities involving chemicals or hydrocarbons are to be restricted to designated areas that have been prepared with appropriate bunding, a concrete or compacted earth base, and fully contained by drainage controls ▪ An appropriate sanitation system is to be provided to collect all waste and sewage for proper storage and disposal; ▪ Strict controls on the use of sanitation facilities will be implemented through education and enforcement.				
	Operation	Project operation will no pose any significant impacts on soil quality.					

Aspect	Project Phases	Parameters	Actions	Location	Frequency	Responsible Agency	Monitoring Agency
Hydrology	Pre-Construction	Physical properties of the existing cannals and drainages	Construction of drainages will be conducted during the dry season to prevent associated impacts such as sediment release into the nearby streams.	▪ Praek Mkak ▪ Small cannal on project site	Every 6 months	Contractor	PRAC (SECU) with oversight of EDC's PIC
	Construction		Surface runoff from developed areas of the project is to be controlled by the installation of drainage channels, and contained by the construction of (sedimentation) ponds in order to minimize erosion and flood risk.		Annually	PRAC (SECU)	MoE EDC's PIC (on behalf of ADB/IFC)
Surface water quality	Pre-Construction	▪ Water quality parameters are TSD, TSS, DO,BOD, COD, Oil & Grease, Detergent,	All project components will be designed to minimize potential impacts on water quality.	Praek Mkak	Every 6 months	PRAC (SECU)	MoE EDC's PIC (on behalf of ADB/IFC)
	Construction		A buffer zone of 100 m along the Praek Mkak and 30 m along ephemeral tributaries				

Aspect	Project Phases	Parameters	Actions	Location	Frequency	Responsible Agency	Monitoring Agency
		TN, TP, SO4, As, Fe, Hg, Coli Form ▪ Buffer zone to protect water quality	will be maintained to mitigate potential water quality impacts				
Groundwater Quality	Pre-Construction	Water quality parameters to be monitored are pH, EC, Turbidity, TDS, Total Hardness, F, NO3, SO4, CL, Total Coliform, E-Coli, Al, As, Cd, Cr, Fe, Hg, and Mn.	The project design is to avoid impacts on groundwater quality or to maintain the forest cover as much as possible.	Bore hole in the project site	Every 6 months	Contractor	PRAC (SECU) with oversight of EDC's PIC
	Construction		▪ All chemicals and hydrocarbons will be handled and stored appropriately according to the ESMP and associated standard operation procedures, with adequate bunding, hardstand preparation including lining, concreting or compaction, as well		Annually	PRAC (SECU)	MoE EDC's PIC (on behalf of ADB/IFC)

Aspect	Project Phases	Parameters	Actions	Location	Frequency	Responsible Agency	Monitoring Agency
			as inspection, auditing and contingency measures ▪ The project maintain the existing shrub or buffer zone as design in the layout. ▪ The project avoids extracting too much water especially in the dry season and looks for water sources.				
Unexploded Ordinance Clearance	Pre-Construction	UXOs are removed prior to civil works.	The PIC will coordinate with the Cambodia Mine Action Centre to undertake UXO clearance in the project area of influence prior to civil works	Project site (100ha)	Once before the civil work	PRAC (ECU)	PRAC (SECU) with oversight of EDC's PIC
Groundwater quality	Construction	Water quality parameters are EC, Turbidity, TDS, Total	▪ All chemicals and hydrocarbons will be handled and stored appropriately ▪ Groundwater quality	Project site (100ha)	Every 6 months	PRAC (SECU)	MoE EDC's PIC (on behalf of ADB/IFC)

Aspect	Project Phases	Parameters	Actions	Location	Frequency	Responsible Agency	Monitoring Agency
		Hardness, Flouride, NO3, SO4, CL, E-Coli, Al, As, Cd, Cr, Fe, Hg, Mn	is to be monitored using groundwater monitoring bores installed up and down gradient of potential contamination zones.				
	Operation		▪ Maintain storm water retention pond for use for PV cleaning ▪ Periodic cleaning of storm water retention pond to remove debris ▪ No use of chemicals/detergents for cleaning purposes ▪ Provide and maintain permanent sanitary facilities to workers	Project site (100ha)	Every 6 months	PRAC (SECU)	MoE EDC's PIC (on behalf of ADB/IFC)
Biological Resources							
Vegetation Impacts	Construction	Maintain the existing vegetation as much as possible	▪ Construction camps to be set up at least 400 m from any water source, drainage/irrigation	Project site (100ha)	Every 6 months	PRAC (ECU)	PRAC (SECU) with oversight of EDC's PIC

Aspect	Project Phases	Parameters	Actions	Location	Frequency	Responsible Agency	Monitoring Agency
			canals or dyke ▪ Vegetation clearances will be strictly restricted to work sites ▪ Use of herbicides / pesticides will be prohibited for vegetation clearing to prevent soil contamination				
	Operation		Planting trees where possible within 60MW solar plant to keep the space greener	Project site (100ha)	Annually	PRAC (SECU)	MoE EDC's PIC (on behalf of ADB/IFC)
Fauna Impacts	Construction	Maintain the existing habitats on site as much as possible	▪ The project will avoid direct and indirect impacts to areas of biodiversity sensitivity (e.g. Praek Mkak). ▪ Habitat clearance will be undertaken in a progressive and sensitive manner to enable priority fauna to move away from the area of works	Project site (100ha)	Every 6 months	PRAC (ECU)	PRAC (SECU) with oversight of EDC's PIC

Aspect	Project Phases	Parameters	Actions	Location	Frequency	Responsible Agency	Monitoring Agency
			and to avoid isolating fauna in fragmented areas of habitat. ▪ Raise awareness with workforce and local villagers about importance of protecting forest resources and conservation important species and their habitats.				
	Operation	Maintain the existing habitats	Planting trees where possible within 60MW solar plant to keep the space greener and extend more habitats	Project site (100ha)	Annually	PRAC (SECU)	MoE EDC's PIC (on behalf of ADB/IFC)
Fishery Impacts	Construction	Maintain the existing Praek Mkak and other waterways	▪ Riparian habitats will be retained where possible to maintain a degree of functionality, including a 100 m buffer zone around watercourses ▪ Proper transport, storage, handling and disposal procedures	Praek Mkak	Every 6 months	PRAC (ECU)	PRAC (SECU) with oversight of EDC's PIC

Aspect	Project Phases	Parameters	Actions	Location	Frequency	Responsible Agency	Monitoring Agency
			for hazardous substances will be developed and implemented to prevent spills and leaks entering the Praek Mkak and tributaries. ▪ Personnel and contractors will be prohibited, as a condition of employment, from fishing and trading in aquatic natural resources				
	Operation	Project operation will no pose any significant impacts on fishery resources.					
Forest resource use	Construction	Maintain the existing shrub	▪ The project will demarcate the project boundary and avoid the key community forest collection areas when siting infrastructure in the Project design. ▪ The project will ban on unauthorized	Project site (100ha)	Every 6 months	PRAC (ECU)	PRAC (SECU) with oversight of EDC's PIC

Aspect	Project Phases	Parameters	Actions	Location	Frequency	Responsible Agency	Monitoring Agency
			collection of forest resources, including plants, and firewood within and around the project areas.				
	Operation	Maintain the existing shrub and plant new trees where possible (not to block the sunlight)	The project will ban on unauthorized collection of forest resources, including plants, and firewood within and around the project areas.	Project site (100ha)	Annually	PRAC (SECU)	MoE EDC's PIC (on behalf of ADB/IFC)
Socio-Economic Resources							
Occupational Health and Safety	Construction	Minimized work risks on workers	▪ The project will strictly require all workers wear personal protective equipment appropriate to their duties with signage at designated sites. ▪ Clinical assistance will be available to project personnel and medical emergency evacuation	Project site (100ha)	Every 6 months	PRAC (ECU)	PRAC (SECU) with oversight of EDC's PIC

Aspect	Project Phases	Parameters	Actions	Location	Frequency	Responsible Agency	Monitoring Agency
			procedures will be developed. ▪ Standard Operating Procedures (SOPs) for the safe handling, storage and transportation of associated facilities and materials.				
	Operation	Minimized work risks on workers or staff	▪ Compliance to Cambodia Occupational Safety and Health laws and regulations, MLVT, 2011 ▪ Compliance to relevant national electrical safety standards ▪ Provide periodic training to all workers with access to electrical and hazardous conditions and workers will be certified to work on site ▪ Provide and maintain	Project site (100ha) and Power house	Annually	PRAC (SECU)	MoE EDC's PIC (on behalf of ADB/IFC)

Aspect	Project Phases	Parameters	Actions	Location	Frequency	Responsible Agency	Monitoring Agency
			workers appropriate PPE				
Community Health and Safety	Construcion	Minimized work risks on related communities	▪ Security fencing and patrols to prevent safety impacts from any construction activities undertaken during construction. ▪ Potential noise impacts will be reduced to acceptable levels through scheduled daytime construction, while dust generation will be managed through regular water spraying on major dust sources associated with the project. ▪ Provide healthcare services for project employees with an appropriately staffed site clinic ▪ Effectively control	Along the existing access road	Every 6 months	PRAC (ECU)	PRAC (SECU) with oversight of EDC's PIC

Aspect	Project Phases	Parameters	Actions	Location	Frequency	Responsible Agency	Monitoring Agency
			the risks associated with accidents involving multiple vehicles, interactions between different types of vehicles with consideration for the volume and speed of traffic, and vehicle and person interactions.				
	Operation	Minimized work risks on related communities	▪ Record of incidents, accidents, near-miss, fatalities associated with the project will be maintained ▪ Records of issues raised will be maintained in accordance with project GRM	Along the access road	Annually	PRAC (SECU)	MoE EDC's PIC (on behalf of ADB/IFC)

7.7 Environmental and Social Fund

351. As required by Cambodian regulation, PRAC will contribute toward the following fund

- Endowment Fund = $500 per year
- Environmental Fund = $500 per year
- Social Fund = $500 per year

352. The toal fund from the project for the next 20 years is $30,000.

CHAPTER 8: CONCLUSION AND RECOMMENDATIONS

353. The project is confirmed as environment category B as per ADB SPS 2009 and IFC category; SEIA and ESMP have been prepared. The project will comply with the Government Sub-decree No.72 on Environmental Impact Assessment (EIA) issued on 11 August 1999, in accordance with these requirements, full EIAs are required for the 60MW solar plant's common infrastructure.

354. This project is expected to have significant environmental benefits. A transition to clean energy sources (i.e. solar energy generation) will limit import dependence on coal and other fossil fuels, delay or defer construction of new coal-fired plants and reduce reliance on hydropower generation. This would contribute to national emission reduction targets and reduced pollution impacts.

355. The total land conversion for a 60 MW solar plant and associated infrastructure is 100 ha, of which is permanent. Some vegetation on site will be maintained for safety reasons.

356. The potential adverse environment impacts associated with the project have been avoided or minimized through careful site selection of the National Solar Park site (including 60MW solar plant). A biodiversity assessment conducted for the project confirms that there are no habitats or species of conservation value in the project area of influence. Further seasonal surveys of birds and bats will be conducted to inform the project detail design in relation to the potential impacts on flyways.

357. While climate change impacts are not anticipated to be significant over the design life of 60MW solar plant (+20 years), the preliminary design integrates flood resilience measures such as elevating 60MW solar plant, strengthening existing drainage canals and building a storm water retention pond. Regular maintenance of drainage canals, storm water retention pond will be carried out to ensure their ongoing effective operation. The key climate vulnerable components will be subject to further analysis during the detailed engineering design.

358. The project is not expected to cause significant adverse impacts, the identified impacts can be managed through effective implementation of the mitigation measures specified in the ESMP. Monitoring parameters have been identified to check the effectiveness of ESMP measures and to ensure any unidentified impacts can be readily addressed.

359. The SECU/PMO of PRAC will set up a GRM and GRC as soon as the project commences to deal with environmental and social issues that may be raised by affected persons and other relevant stakeholders during project implementation. The GRM will be coordinated by the SECU/PMO. GRM will address concerns and complaints promptly via transparent process.

360. Public consultations and FGDs with project affected persons and other relevant stakeholders were conducted in May and July 2018. Measures to address concerns raised during the consultations have been integrated in the design and ESMP. Overall, all stakeholders were made aware of the proposed project and were supportive due to expected benefits such as local employment. Consultations with project-affected stakeholders will

continue during detailed design and project implementation.

361. The Project has been designed to minimize impacts and risk on key environmental values and social values, particularly the Praek Mkak. The Project will result in a short-term and spatially confined impact on the project site. Habitat (and flora) loss for project development is necessary and cannot be avoided. However, the loss will be partially restored by rehabilitation.

362. The project will provide a significant benefit to the Kampong Chhnang and Kampong Speu provinces and Cambodian economy. The project will be the largest investment in the province, and the flow on effect to the economy of this province is likely to be considerable. Revenues from taxes, royalties and investment will make a substantive contribution to the development of the Cambodian economy. With careful implementation of the proposed management, mitigation and offset/compensation measures, the project should bring a net socio-economic benefit to Kampong Chhnang and Kampong Speu provinces and Cambodia without compromising the integrity of the hydrology, and other socio-economic resources.

363. It is recommended that PRAC:

- Strictly implement the ESMP, Emergency Preparedness and Response Plan and approved mitigations and monitoring measures in this ESIA at all phases of the project development.
- Cooperate with the Ministry of Environment, line ministries and local authorities to ensure that the mitigation/monitoring measures are enforced and are participatory.
- Establish the Environmental and Social Fund to contribute to the further and wider conservation, restoration and management of the social and environmental resources around the project site and in Cambodia.
- Commit to the environmental contract and other agreements prescribed by the Ministry of Environment.

364. Based on the results of the ESIA, public consultation, and the commitment of the project proponent, associated losses and impacts from the project can be managed, mitigated and monitored to prevent, reduce and avoid the majority of impacts at all phases of the project development. It is clear that the project has the full capacity and resources to protect the environmental and social assets associated with implementation of the project. In addition, there will be economic benefits and a lasting positive legacy from the project.

365. In conclusion, we request that the Ministry of Environment grants the agreement letter for this ESIA report to fulfill a requirement for the approval for the development of the 60 MW Solar Plant Project in Kampong Chhnang Province. Such agreement will encourage the project proponent to commit to the investment of project development and the protection of the environmental and social resources, while contributing to the long-term and sustainable development of Cambodia.

APPENDIXES

Appendix I: Project Information Booklet for 60MW Solar Plant

គម្រោងបង្កើតស្ថានីយផលិតអគ្គិសនីដើរដោយថាមពលពន្លឺព្រះអាទិត្យកំលាំង ៦០ មេហ្គាវ៉ាត់របស់ក្រុមហ៊ុន PRIME ROAD ALTERNATIVE (CAMBODIA) CO., LTD.

ព័ត៌មានអំពីគម្រោង

១. សេចក្តីផ្តើម

គោលនយោបាយ និងក្របខណ្ឌគតិយុត្តរបស់ប្រទេសកម្ពុជាបានលើកទឹកចិត្ត និងការជំរុញការវិនិយោគលើថាមពលជាពិសេសថាមពលកកើតឡើងវិញ។ អគ្គិសនីកម្ពុជាបានសិក្សាអំពីលទ្ធភាពក្នុងការវិនិយោគលើការសាងសង់និងបង្កើតរោងចក្រថាមពលពន្លឺព្រះអាទិត្យនៅក្នុងប្រទេសកម្ពុជា។ *" ប្រទេសកម្ពុជាមានអំណោយផលថាមពលពន្លឺព្រះអាទិត្យយ៉ាងខ្លាំង។ ជាការពិត កម្ពុជាគួរតែចាប់យក កាលនុវត្តភាពដ៏ប្រសើរនេះសម្រាប់បំពេញតម្រូវការអគ្គិសនីដែលកំពុងតែកើនឡើង ដើម្បីមាគ៌ាមួយដែលសន្សំសំចៃសេដ្ឋកិច្ច នាពេលអនាគត និងចីរភាព។ "*- ប្រសាសន៍ឯកឧត្តម សាយ សំអាល់ ប្រធានក្រុមប្រឹក្សាជាតិអភិវឌ្ឍន៍ដោយចីរភាព និងជារដ្ឋមន្ត្រីក្រសួងបរិស្ថាន។ នៅក្នុងបរិយាការណ៍នៃការគ្រប់គ្រងបរិស្ថាន និងការកាត់បន្ថយហេតុប៉ះពាល់ទៅលើបរិស្ថាននិងសង្គមពីគម្រោងអភិវឌ្ឍន៍ គម្រោងនេះតម្រូវឱ្យធ្វើការសិក្សាវាយតម្លៃហេតុប៉ះពាល់បរិស្ថាននិងសង្គមពេញលេញ និងត្រូវធ្វើការត្រួតពិនិត្យរបាយការណ៍ឱ្យបានល្អិតល្អន់ និងត្រឹមត្រូវមុនពេលដែលរាជរដ្ឋាភិបាលអាចអនុញ្ញាតឱ្យគម្រោងមានសកម្មភាព និងផែនការអនុវត្តបន្តក្នុងការសម្រេចផែនការផលិតថាមពលអគ្គិសនី។

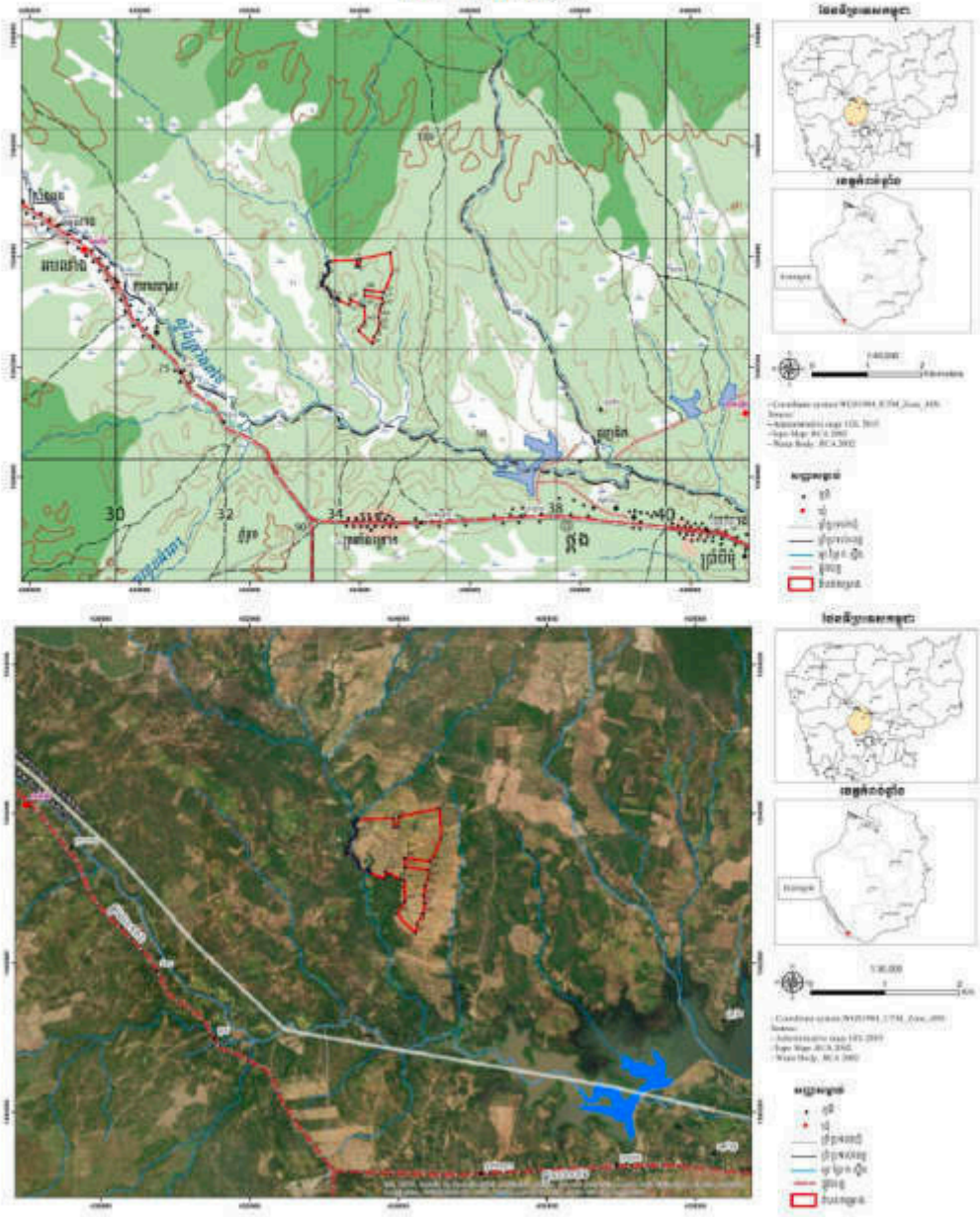
អគ្គិសនីកម្ពុជា បានអនុវត្តន៍ដោយជោគជ័យនូវគម្រោងផលិតថាមពលអគ្គិសនីដោយពន្លឺព្រះអាទិត្យក្នុង សមត្ថភាព ១០មេហ្គាវ៉ាត់នៅក្នុងក្រុងបាវិត ខេត្តស្វាយ រៀងកាលពីចុងឆ្នាំ២០១៧ ។ គម្រោងនេះបានជាក់បញ្ជូលនូវថាមពលស្អាតចំនួន ១០មេហ្គាវ៉ាត់ទៅក្នុងប្រព័ន្ធខ្សែបញ្ជូនថាមពលរបស់ជាតិ។ បន្ទាប់ពីនោះមក ក្រសួងរ៉ែនិងថាមពល និងអគ្គិសនីកម្ពុជាបានអនុម័តនូវគម្រោងបន្ទាប់ទៀតនៅក្នុងខេត្តកំពង់ស្ពឺដែលមានអនុភាពផលិតបាន ៦០មេហ្គាវ៉ាត់ និង ២ ទីតាំងទៀតក្នុងខេត្តកំពង់ឆ្នាំង និងពោធិសាត់ដែលមានសមត្ថភាពផលិតលើសពី ១០០មេហ្គាវ៉ាត់។ ជាមួយនឹងភាពជោគជ័យក្នុងការអភិវឌ្ឍគម្រោងកន្លងមក អគ្គិសនីកម្ពុជាមានបទពិសោធន៍គ្រប់គ្រាន់ និងមានសុទិដ្ឋិនិយម និងចាប់អារម្មណ៍ច្រើនក្នុងការវិនិយោគទៅលើគម្រោងផលិតថាមពលកកើតឡើងវិញនៅទូទាំងប្រទេសកម្ពុជា។ បច្ចុប្បន្ននេះ អគ្គិសនីកម្ពុជាជាមួយនឹងក្រុមហ៊ុន PRIME ROAD ALTERNATIVE (CAMBODIA) CO., LTD. បានត្រៀមខ្លួនរួចជាស្រេចក្នុងការអភិវឌ្ឍគម្រោងផលិតថាមពលអគ្គិសនីដោយពន្លឺ ព្រះអាទិត្យដែលមានសមត្ថភាព ៦០មេហ្គាវ៉ាត់នៅក្នុងខេត្តកំពង់ឆ្នាំងនេះ។

២. ទីតាំងគម្រោង

គម្រោងបង្កើតស្ថានីយផលិតអគ្គិសនីដើរដោយថាមពលពន្លឺព្រះអាទិត្យនេះមានទីតាំងស្ថិតនៅលើផ្ទៃដី ១០០ ហិកតា ស្ថិតនៅក្នុងភូមិថ្នល់កែង ឃុំក្បាលទឹក ស្រុកទឹកផុស ខេត្តកំពង់ឆ្នាំង។ តំបន់គម្រោងមានព្រំប្រទល់ជាប់ជាមួយឃុំឈានឡើង ស្រុកទឹកផុស និងឃុំប្រាំបីមុម ស្រុកថ្ពង។ បើយោងតាមស្ថានភាពគម្រោងនាពេលបច្ចុប្បន្ននេះ ផ្ទៃដីក្នុងតំបន់គម្រោងនឹងត្រូវបានឈូសឆាយ (គាស់គល់ឈើចេញ ពង្រាបដី និងសម្អាតកម្ទេចកម្ទី) និងត្រូវរៀបចំរបងព័ទ្ធជុំ

ក្បែរដើម្បីកំណត់ត្រាំប្រទល់គម្រោង និងការពារការចេញចូលរបស់មនុស្ស និងសត្វពាហនៈដែលអាចរំខានដល់សកម្ម
ភាពគម្រោងនៅពេលក្រោយ។ នៅក្នុងតំបន់គម្រោង មាននៅសេសសល់កូនរុក្ខជាតិតូចៗដែលមានមុខកាត់ត្រឹម ៥-
១០សង់ទីម៉ែត្រ, ជាអតីតតំបន់ស្រែនិងចម្ការ (ម្រុំ) និងវាលស្មៅសុទ្ធសាធ។

ផែនទីទីតាំងគម្រោង



៣. ក្រុមហ៊ុន PRIME ROAD ALTERNATIVE (CAMBODIA) CO., LTD. (PRIME ROAD)

ក្រុមហ៊ុន PRIME ROAD មានគម្រោងអភិវឌ្ឍថាមពលពន្លឺព្រះអាទិត្យជាច្រើនគម្រោងនៅក្នុងតំបន់ និងអន្តរជាតិជាពិសេសនៅក្នុងប្រទេសថៃ។ ក្រុមហ៊ុន PRIME ROAD មានគម្រោងចំនួន ០៩ នៅក្នុងប្រទេសថៃ, ០៥ គម្រោងនៅក្នុងប្រទេសជប៉ុន, និង ០១គម្រោងនៅក្នុងប្រទេសតៃវ៉ាន់។ គម្រោងទាំងនេះជាបទពិសោធន៍ដោគជ័យរបស់ក្រុមហ៊ុន PRIME ROAD ក្នុងការលើកកម្ពស់ការអភិវឌ្ឍថាមពលកកើតឡើងវិញដើម្បីរួមចំណែកដល់ការអភិវឌ្ឍប្រកបដោយចីរភាពនៅក្នុងតំបន់។

បទបពិសោធន៍អនុវត្តគម្រោងរបស់ក្រុមហ៊ុន PRIME ROAD

Remark : All installed capacity of the projects above are represented in MWdc

៤. ហេដ្ឋារចនាសម្ព័ន្ធរបស់គម្រោង

ហេដ្ឋារចនាសម្ព័ន្ធមូលដ្ឋានរបស់គម្រោងមានដូចជា៖

- ទីតាំងតម្លើងផ្ទាំងបន្ទះពន្លឺព្រះអាទិត្យ
- អនុស្ថានីយអគ្គិសនី
- ខ្សែបញ្ជូនថាមពលអគ្គិសនី
- របងព័ទ្ធជុំវិញតំបន់គម្រោងដែលមានកម្ពស់ ២,២ម៉ែត្រ
- ប៉ុស្តិ៍យាមរបស់សន្តិសុខ
- ប្រព័ន្ធផ្លូវ និងប្រឡាយបង្ហូរទឹក
- ស្ថានីយឧតុនិយម
- បង្គោលការពារផ្លេះ
- ស្រះទឹក
- ទំនប់ការពារទឹកជន់ពីអូរព្រែកម្ពាក់

៥. កាលបរិច្ឆេទរបស់គម្រោង

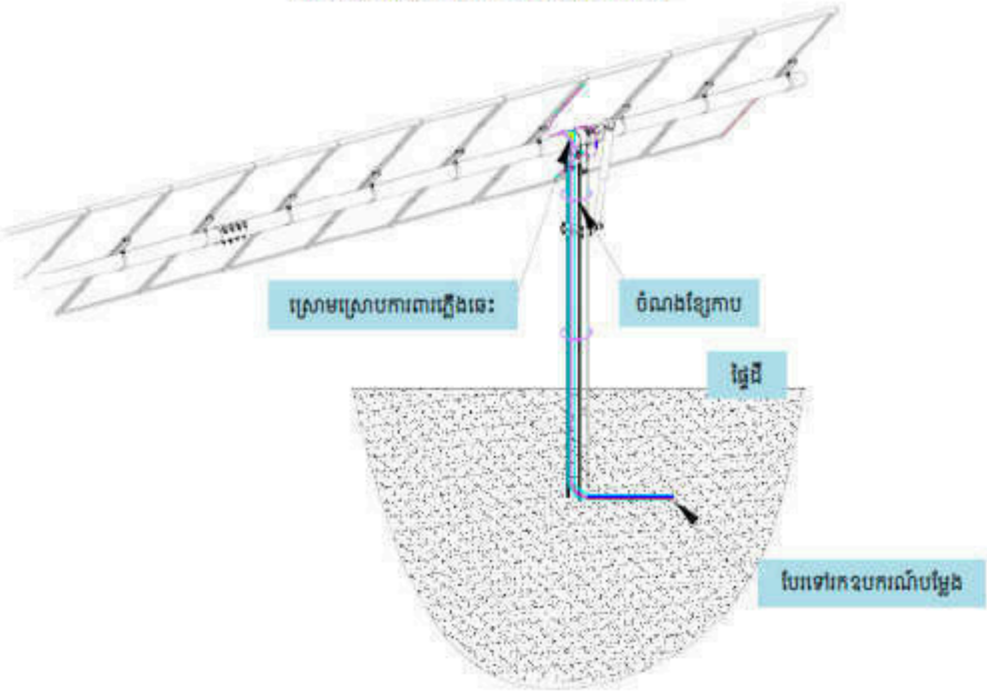
ក្រុមហ៊ុន PRIME ROAD នឹងធ្វើការសាងសង់ហេដ្ឋារចនាសម្ព័ន្ធគម្រោងនេះក្នុងរយៈពេល ១៨ខែដោយចាប់ផ្តើមពីត្រីមាសទី១ ក្នុងឆ្នាំ២០២១ និងត្រោងបញ្ចប់នៅត្រីមាសទី១ ក្នុងឆ្នាំ២០២២។ ដំណាក់កាលសាងសង់សំខាន់ៗ មានសង្ខេបដូចខាងក្រោម៖

ល.រ	ដំណាក់កាល	កាលបរិច្ឆេទ
១	ដំណាក់កាលរៀបចំកិច្ចសន្យាគម្រោង	សីហា ២០២០ - ឧសភា ២០២១
២	ដំណាក់ការសិក្សារចនាគម្រោង	មីនា - កញ្ញា ២០២១
៣	ដំណាក់កាលរៀបចំលទ្ធកម្មគម្រោង	មេសា - តុលា ២០២១
៤	ដំណាក់កាលសាងសង់គម្រោង	មីនា - ធ្នូ ២០២១
៥	ដំណាក់កាលសាកល្បង និងប្រតិបត្តិការគម្រោង	ធ្នូ ២០២១ - កុម្ភៈ ២០២២
៦	ដំណាក់កាលត្រួតពិនិត្យ	មករា - មីនា ២០២២

ការសាងសង់គម្រោងនេះនឹងត្រូវបែងចែកចេញជា ៤ផ្នែកសំខាន់ៗដើម្បីធានាបាននូវការអនុវត្តដោយរលូននូវដំណើរការលទ្ធកម្ម និងដំណើរការសាងសង់ហេដ្ឋារចនាសម្ព័ន្ធចាំបាច់នានា។ ផ្នែកទាំង៤នោះរួមមាន ការសិក្សាទីតាំងគម្រោងនិងការរចនារៀបចំគម្រោង, ការងារសម្អាតផ្ទៃដីសម្រាប់រៀបចំតម្លើងផ្នាំងពន្លឺព្រះអាទិត្យ, ការងារបម្លែងនិងបញ្ជូនថាមពលចេញពីតំបន់គម្រោង, និងស្ថានីយផ្នាំងពន្លឺព្រះអាទិត្យ។

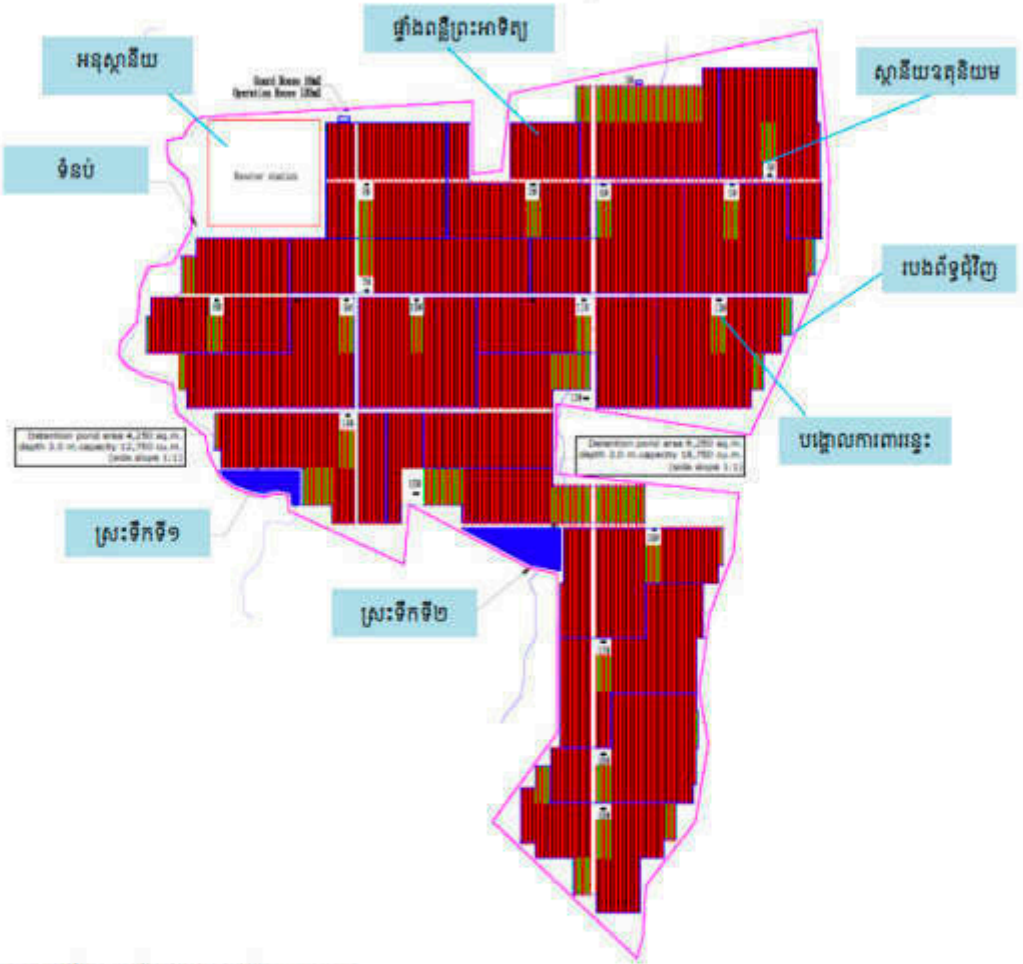
- (ក) ដំណាក់ការរចនាគម្រោង៖ ម្ចាស់គម្រោងបានសិក្សាអំពីសណ្ឋានដី និងបរិស្ថានជុំវិញ ហើយបានសិក្សារៀបចំរចនាទីតាំងជាក់ហេដ្ឋារចនាសម្ព័ន្ធមូលដ្ឋាននានាដូចជាដើងទម្រ, របង, ប៉ុស្តិ៍យាមជាដើម។
- (ខ) ការសម្អាតផ្ទៃដីសម្រាប់រៀបចំតម្លើងផ្នាំងពន្លឺព្រះអាទិត្យ៖ សកម្មភាពការងារនេះមានការសិក្សាវិស្វកម្មមូលដ្ឋានដែលស្ថិតនៅក្រោមការទទួលខុសត្រូវរបស់អគ្គិសនីកម្ពុជានិងក្រុមហ៊ុនម៉ៅការ ហើយកិច្ចការនេះក៏រួមបញ្ចូលនូវការរៀបចំនិងស្តារផ្លូវចេញចូលឡើងវិញ, ការរៀបចំនូវប្រព័ន្ធប្រឡាយនិងលូទឹក, ការសម្អាតផ្ទៃដីសម្រាប់ការសាងសង់ទូទៅនិងអនុស្ថានីយ, និងការរៀបចំសាងសង់នូវរបងព័ទ្ធជុំវិញដើម្បីធានាសន្តិសុខជាដើម។
- (គ) ការងារបម្លែងនិងបញ្ជូនថាមពល៖ សកម្មភាពការងារនេះរួមមានការរៀបចំអនុស្ថានីយ, ការរៀបចំតម្បៀបណ្តាញបញ្ជូនថាមពលពីអនុស្ថានីយនៅក្នុងតំបន់គម្រោងទៅកាន់អនុស្ថានីយ GS6 របស់អគ្គិសនីកម្ពុជា, និងការងារសំណង់ស៊ីវិល និងអេឡិចត្រូនិកមួយចំនួនទៀត។
- (ឃ) ស្ថានីយផ្នាំងពន្លឺព្រះអាទិត្យ៖ សកម្មភាពការងារសាងសង់និងតម្លើងផ្នាំងពន្លឺព្រះអាទិត្យ និងការងារអេឡិចត្រូនិកនានាដែលពាក់ព័ន្ធ។

គំនូសប្លង់តម្លើងបង្គោលបន្ទះពន្លឺព្រះអាទិត្យ



គំរូសួនផ្ទាំងពន្លឺព្រះអាទិត្យ

តំនុសបង្ហាញហេដ្ឋារចនាសម្ព័ន្ធមូលដ្ឋាននៅក្នុងតំបន់គម្រោង



៦. ផលប៉ះពាល់ផ្សេងៗពីគម្រោង

ការសិក្សាវាយតម្លៃហេតុប៉ះពាល់បរិស្ថាន និងសង្គមនេះបានកំណត់រកឃើញនូវហេតុប៉ះពាល់ចំនួនដែលមានកម្រិតមាប។ មិនមានហេតុប៉ះពាល់ណាមួយដែលត្រូវបានកំណត់ថាមានកម្រិតខ្លាំងទេ។ ហេតុប៉ះពាល់ទាំងនេះភាគច្រើនមានកម្រិតតិចតួចនៅក្នុងដំណាក់កាលមុនប្រតិបត្តិ និងប្រតិបត្តិគម្រោង ដោយសារគម្រោងមិនមានសកម្មភាពច្រើន។ នៅក្នុងដំណាក់កាលសាងសង់ គម្រោងមានសកម្មភាពមួយចំនួនដែលអាចបង្កជាហេតុប៉ះពាល់ដល់បរិស្ថានដែលជុំវិញ តែកម្រិតនិងវិសាលភាពនៃហេតុប៉ះពាល់ទាំងនោះមានរយៈពេលខ្លី (ដោយសារការសាងសង់មានរយៈពេល ១៨ ខែ) ។ វិធានការកាត់បន្ថយត្រូវបានលើកឡើងសម្រាប់ហេតុប៉ះពាល់នីមួយៗ។

ADB Asian Development Bank PRIME PRIME ROAD POWER

ហេតុប៉ះពាល់បរិស្ថាន និងសង្គមមួយចំនួនមានដូចជា៖

ហេតុប៉ះពាល់បរិស្ថាន-សង្គម	កម្រិតប៉ះពាល់		
	ដំណាក់កាលមុនប្រតិបត្តិ	ដំណាក់កាលប្រតិបត្តិគម្រោង	ដំណាក់កាលបញ្ចប់គម្រោង
• សណ្ឋានដីនិងការហូរច្រោះដី	ទាប	ទាប	ទាប
• គុណភាពខ្យល់	ទាប	ទាប	ទាប
• កម្រិតសំឡេង និងរំញ័រ	ទាប	ទាប	ទាប
• គុណភាពដី	ទាប	ទាប	ទាប
• គុណភាពទឹកលើដី	ទាប	ទាប	ទាប
• គុណភាពទឹកក្រោមដី	ទាប	ទាប	ទាប
• ប្រព័ន្ធជលសាស្ត្រ	ទាប	ទាប	ទាប
• តំបន់ទេសភាព	ទាប	ទាប	ទាប
• ធនធានជីវសាស្ត្រ	ទាប	ទាប	ទាប
• មុខរបរនិងប្រាក់ចំណូល	ទាប	ទាប	ទាប
• ការប្រើប្រាស់ដី	ទាប	ទាប	ទាប
• ការប្រើប្រាស់ទឹក	ទាប	ទាប	ទាប
• ការប្រើប្រាស់អគ្គិសនី	ទាប	ទាប	ទាប
• ការប្រើប្រាស់ហេដ្ឋារចនាសម្ព័ន្ធផ្សេងៗ	ទាប	ទាប	ទាប
• ការធ្វើចរាចរណ៍	ទាប	ទាប	ទាប
• ជំនឿ វប្បធម៌ និងទំនៀមទំលាប់	ទាប	ទាប	ទាប
• សុវត្ថិភាពនិងសុខុមាលភាពបុគ្គលិក	ទាប	ទាប	ទាប
• សុវត្ថិភាពនិងសុខុមាលភាពសាធារណៈ	ទាប	ទាប	ទាប

៧. គោលនយោបាយបរិស្ថានរបស់ប្រទេសកម្ពុជា

- ច្បាប់ស្តីពីកិច្ចការពារបរិស្ថាន និងការគ្រប់គ្រងធនធានធម្មជាតិ ឆ្នាំ១៩៩៦
- អនុក្រឹត្យស្តីពីកិច្ចដំណើរការវាយតម្លៃហេតុប៉ះពាល់បរិស្ថាន ឆ្នាំ១៩៩៩
- អនុក្រឹត្យស្តីពីការត្រួតពិនិត្យការបំពុលទឹក ឆ្នាំ១៩៩៩
- អនុក្រឹត្យស្តីពីការត្រួតពិនិត្យការបំពុលខ្យល់ និងការរំខានដោយសំឡេង ឆ្នាំ២០០០
- អនុក្រឹត្យស្តីពីការគ្រប់គ្រងប្រព័ន្ធលូ និងប្រព័ន្ធប្រព្រឹត្តិកម្មទឹកកខ្វក់ ឆ្នាំ២០១៧
- អនុក្រឹត្យស្តីពីការគ្រប់គ្រងសំរាម និងសំណល់រឹងទីប្រជុំជន ឆ្នាំ២០១៥
- ប្រកាសស្តីពីចំណាត់ថ្នាក់នៃការវាយតម្លៃហេតុប៉ះពាល់បរិស្ថានសម្រាប់គម្រោងអភិវឌ្ឍន៍ ឆ្នាំ២០២០

YOUNG

៨. គោលនយោបាយការពាររបស់ធនាគារអភិវឌ្ឍន៍អាស៊ី

រដ្ឋាភិបាលកម្ពុជា បានស្នើសុំជំនួយការពីធនាគារអភិវឌ្ឍន៍អាស៊ី ដើម្បីផ្តល់មូលនិធិដល់គម្រោងនេះតាមរយៈប្រាក់កម្ចីសម្បទាន។ យោងទៅតាមគោលនយោបាយការពាររបស់ធនាគារអភិវឌ្ឍន៍អាស៊ី (ADB) ព័ត៌មានអំពីគម្រោងដែលគាំទ្រដោយធនាគារ ADB ត្រូវផ្តល់ជូនដល់ប្រជាជនដែលត្រូវបានរំពឹងថានឹងទទួលរងផលប៉ះពាល់ដោយការសាងសង់ និងប្រតិបត្តិការគម្រោង ហើយពួកគេត្រូវបានពិគ្រោះយោបល់នៅដំណាក់កាលដំបូងក្នុងអំឡុងពេលគម្រោងផែនការ។ យោងទៅតាមគោលនយោបាយការពាររបស់ធនាគារ ADB ផលប៉ះពាល់អវិជ្ជមានលើមនុស្ស និងបរិស្ថានត្រូវតែជៀសវាងក្នុងកម្រិតអតិបរមាដែលអាចធ្វើទៅបាន ហើយនៅពេលមិនអាចជៀសវាងបានផលប៉ះពាល់អវិជ្ជមានត្រូវតែសម្របសម្រួលឱ្យបានត្រឹមត្រូវ តាមរបៀបដែលប្រជាជនដែលទទួលរងផលប៉ះពាល់អាចទទួលយកបានដោយសមមូលនិងពេញចិត្ត។ ផលប៉ះពាល់ទាំងអស់របស់គម្រោង និងការខូចខាតទាំងអស់ដែលកើតឡើងដោយសារគម្រោងដែលប៉ះពាល់ដល់ប្រជាជនដែលកំពុងរស់នៅ និងធ្វើការក្នុងតំបន់គម្រោងត្រូវតែត្រូវបានវាយតម្លៃក្នុងដំណាក់កាលផែនការគម្រោង។ អ្នកដែលទទួលរងផលប៉ះពាល់ដោយគម្រោង តាមរយៈការបាត់បង់ដីដំណាំ ដើមឈើផ្ទះសំណង់ ឬទ្រព្យសម្បត្តិផ្សេងទៀតនឹងត្រូវបានផ្តល់សំណងតាមរបៀបសមរម្យ។

យោងទៅតាមគោលនយោបាយការពារសុវត្ថិភាពរបស់ធនាគារ ADB ប្រសិនបើប្រជាជនដែលមិនមានការពេញចិត្តនឹងសំណងដែលទទួលបាន ឬប្រសិនបើមានប្រជាជនៅក្នុងតំបន់គម្រោងទទួលរងផលប៉ះពាល់ធ្ងន់ធ្ងរពីគម្រោងនោះពួកគេមានសិទ្ធិប្តឹងតវ៉ាដើម្បីឱ្យមានការត្រួតពិនិត្យត្រឹមត្រូវ។ គម្រោងនឹងមានយន្តការដោះស្រាយបណ្តោះអាសន្នដែលបានដាក់ក្នុងកំឡុងពេលរៀបចំគម្រោង ហើយប្រជាជននៅក្នុងតំបន់គម្រោងនឹងត្រូវបានជូនដំណឹងអំពីនីតិវិធីបណ្តឹងនានា។

ដើម្បីជំរុញឱ្យគោលនយោបាយទាំងនេះអាចអនុវត្តទៅបាន ធនាគារអភិវឌ្ឍន៍អាស៊ីបានកំណត់នូវតម្រូវការជាកំលាក់សម្រាប់អនុវត្តគោលនយោបាយដែលអ្នកខ្វី ឬអតិថិជនត្រូវគោរពតាមលក្ខខណ្ឌតម្រូវទាំងឡាយនៅក្នុងអំឡុងពេលរៀបចំ និងអនុវត្តគម្រោង។ លក្ខខណ្ឌតម្រូវទាំងនោះរួមមាន៖

- លក្ខខណ្ឌតម្រូវសម្រាប់ការពារ ១៖ បរិស្ថាន
- លក្ខខណ្ឌតម្រូវសម្រាប់ការពារ ២៖ ការតាំងទីលំនៅជាថ្មីដោយមិនស្ម័គ្រចិត្ត
- លក្ខខណ្ឌតម្រូវសម្រាប់ការពារ ៣៖ ក្រុមជនជាតិដើមភាគតិច
- លក្ខខណ្ឌតម្រូវសម្រាប់ការពារ ៤៖ លក្ខខណ្ឌតម្រូវពិសេសសម្រាប់ទម្រង់ហិរញ្ញវត្ថុផ្សេងៗ

ធនាគារអភិវឌ្ឍន៍អាស៊ីនឹងមិនផ្តល់ហិរញ្ញប្បទានដល់គម្រោងដែលមិនគោរពតាមសេចក្តីថ្លែងការណ៍គោលនយោបាយការពាររបស់ខ្លួនឡើយ ហើយក៏មិនផ្តល់ហិរញ្ញប្បទានដល់គម្រោងដែលមិនគោរពច្បាប់ និងបទបញ្ជាពាក់ព័ន្ធនឹងបរិស្ថាន-សង្គមរបស់ប្រទេសម្ចាស់ផ្ទះឡើយ រួមទាំងច្បាប់ដែលតម្រូវឱ្យប្រទេសម្ចាស់ផ្ទះបំពេញកាតព្វកិច្ចដែលមានចែងក្នុងច្បាប់អន្តរជាតិផង។

៩. គោលនយោបាយស្តង់ដារប្រតិបត្តិរបស់សាជីវកម្មហិរញ្ញវត្ថុអន្តរជាតិ (IFC)

នៅឆ្នាំ២០០៦ សាជីវកម្មហិរញ្ញវត្ថុអន្តរជាតិ ដែលជាសមាជិករបស់ក្រុមធនាគារពិភពលោក បានអនុម័តនូវបទដ្ឋានស្តង់ដារប្រតិបត្តិ (Performance Standard - PS) ស្តីពីនិរន្តភាពបរិស្ថាន និងសង្គម សម្រាប់វិស័យ

Asian Development Bank

ឯកជនដែលបានទទួលថវិកាពីសាជីវកម្មហិរញ្ញវត្ថុអន្តរជាតិ។ ទោះយ៉ាងណាក៏ដោយ នៅក្នុងបរិបទដែលសាជីវកម្មហិរញ្ញវត្ថុអន្តរជាតិបានក្លាយទៅជាអ្នកផ្តល់ប្រាក់កម្ចីមួយ បទដ្ឋាននេះនឹងក្លាយគោលអន្តរជាតិសម្រាប់ការអនុវត្តឱ្យបានល្អប្រសើរ ដែលជាបទដ្ឋានចាំបាច់ត្រូវតែអនុវត្តន៍តាម ហើយឥលូវវាបានក្លាយទៅប្រតិបត្តិជាឧបករណ៍គ្រប់គ្រងហានិភ័យសម្រាប់គម្រោងដែលផ្តល់មូលនិធិដោយ IFC។

ស្តង់ដាប្រតិបត្តិស្តីពីបរិស្ថាននិងសង្គមរបស់ IFC កំណត់នូវការទទួលខុសត្រូវរបស់អតិថិជនក្នុងការគ្រប់គ្រងហានិភ័យនានាទៅលើធនធានបរិស្ថាន និងសង្គម។ ស្តង់ដាសំខាន់ៗដែលចាំបាច់ត្រូវអនុវត្តរួមមាន៖

- ស្តង់ដាប្រតិបត្តិ ១៖ ការវាយតម្លៃ និងការគ្រប់គ្រងហានិភ័យ និងផលប៉ះពាល់ទៅលើបរិស្ថាន និងសង្គម
- ស្តង់ដាប្រតិបត្តិ ២៖ លក្ខខណ្ឌការងារ និងពលកម្ម
- ស្តង់ដាប្រតិបត្តិ ៣៖ ប្រសិទ្ធភាពធនធាន និងការការពារការបំពុល
- ស្តង់ដាប្រតិបត្តិ ៤៖ សន្តិសុខ សុវត្ថិភាព និងសុខភាពរបស់សហគមន៍
- ស្តង់ដាប្រតិបត្តិ ៥៖ ការធ្វើលទ្ធកម្មដី និងការតាំងទីលំនៅដោយមិនស្ម័គ្រចិត្ត
- ស្តង់ដាប្រតិបត្តិ ៦៖ ការអភិរក្សជីវៈចម្រុះ និងការអភិវឌ្ឍប្រកបដោយចីរភាពនៃធនធានបរិស្ថានមានជីវិត
- ស្តង់ដាប្រតិបត្តិ ៧៖ ជនជាតិដើមភាគតិច
- ស្តង់ដាប្រតិបត្តិ ៨៖ បេតិកភណ្ឌវប្បធម៌

១០. យន្តការបណ្តឹងតវ៉ា

គម្រោងបង្កើតស្ថានីយផលិតដើរដោយថាមពលព្រះអាទិត្យកំលាំង ៦០មេហ្គាវ៉ាត់នេះ បានរៀបឱ្យមាននូវយន្តការដោះស្រាយបណ្តឹងតវ៉ាដែលជាយន្តការមួយចិត្តទុកដាក់ពិនិត្យលើការព្រួយបារម្ភ ការតវ៉ា និងបណ្តឹងផ្សេងៗរបស់ប្រជាពលរដ្ឋរងនូវផលប៉ះពាល់។ គម្រោងធានាដោះស្រាយនូវរាល់បណ្តឹងតវ៉ាទាំងអស់ឱ្យប្រកបដោយតម្លាភាព និងយុត្តិធម៌ពិតប្រាកដ។ គោលបំណងសំខាន់នៃយន្តការដោះស្រាយបណ្តឹងតវ៉ា គឺដើម្បីដោះស្រាយនូវពាក្យបណ្តឹងឱ្យបានលឿនតាមដែលអាចធ្វើបាននៅថ្នាក់មូលដ្ឋាន តាមរយៈដំណើរការនៃការផ្សះផ្សាមួយ, និងដើម្បីផ្តល់នូវនីតិវិធីច្បាស់លាស់និងតម្លាភាពសម្រាប់បណ្តឹងឧទ្ធរណ៍ ក្នុងករណីមិនមានការដោះស្រាយបញ្ហានោះឱ្យបានត្រឹមត្រូវ។ ប្រជាពលរដ្ឋ និងគ្រួសារដែលមានផ្ទះសម្បែងដែលទទួលរងផលប៉ះពាល់ មានសិទ្ធិដាក់ពាក្យប្តឹងទាក់ទងនឹងទិដ្ឋភាពណាមួយនៃសកម្មភាពរបស់គម្រោងវិនិយោគមួយនេះ។ ប្រជាពលរដ្ឋដែលរងផលប៉ះពាល់អាចធ្វើការទាក់ទងតាមលេខទូរស័ព្ទខាងក្រោមដើម្បីទទួលនូវការណែនាំលម្អិតអំពីនីតិវិធីនៃយន្តការបណ្តឹងតវ៉ា។

១១. ព័ត៌មានទំនាក់ទំនងគម្រោង សូមទាក់ទង៖

ក្រុមហ៊ុន PRIME ROAD ALTERNATIVE (CAMBODIA) CO., LTD

លោក យ៉េង ឡុងឌី

០៨៦ ៩៤៩ ៤០៩

Appendix II: Soil Test Result

ព្រះរាជាណាចក្រកម្ពុជា

ជាតិ សាសនា ព្រះមហាក្សត្រ

ក្រសួងកសិកម្ម រុក្ខាប្រមាញ់ និងនេសាទ

អគ្គនាយកដ្ឋានកសិកម្ម

លេខ ១០៥៥ អ.ន.ក

ថ្ងៃ... ព.ស.២៥៦៤

រាជធានីភ្នំពេញ ថ្ងៃទី ២៤ ខែ កញ្ញា ឆ្នាំ២០២០

លទ្ធផលវិភាគដី

Soil Analysis Results

ឈ្មោះក្រុមហ៊ុន(Company Name): **ASSESMENT & SOLUTION Co.,Ltd**

អាសយដ្ឋានAddress: **Prime Road Alternative (Cambodia) Co.,Ltd (Solar Park 60 MW)**

ថ្ងៃខែទទួលសំណាក: 23/09/20 , NAL : 281 180 / S93 20

Lab. ID: 93/20	LabNo. :	1
Description Parameter	Field ID: ភូមិថ្នល់ទឹក ឃុំក្បាលទឹក ស្រុកទឹកផុសខេត្តកំពង់ឆ្នាំង	Soil Sample X= 433651, Y= 1303521
Particle Size	(< 0.002mm)ឥដ្ឋ, Clay %	48.50
	(0.002-0.02 mm)ល្បាប់ ម៉ដ្ឋ, Fine Silt , %	22.75
	(0.02- 0.05mm)ល្បាប់ គ្រើម, Coase Silt , %	8.24
	(0.05- 0.2mm) ខ្សាច់ម៉ដ្ឋ, Fine Sand,%	10.79
(Pipette Method)	(0.02 - 2mm) ខ្សាច់គ្រើម, Coase Sand,%	10.16
សំណើម Moisture % , (Oven dry at 105 °C and 24 hours)		4.35
កាបូន Total Carbon (Black & Walkey Method) , C %		2.53
អាសូត Total Nitrogen (Kjeldal Sulfuric Method) ,N %		0.22
អនុបាត C/N Ratio (Unit)		12
សារធាតុសរីរាង្គ Organic Matter (OM) %		4.35
ផូស្វ័រសរុប Total Phosphorus (Nitric Digestion) P %		0.02
ផូស្វ័ររលាយ Available Phosphorus (Bray II) , P ppm		24
សមត្ថភាពដោះដូរកាចុង Cation Exchange Capacity C.E.C m.e/100g Soil (Method ,1M Ammonium Acetate at pH = 7 & Leach with 10 % NaCl)		14.50

ចំណាំ: លទ្ធផលទទួលខុសត្រូវតែលើសំណាកដែលបានវិភាគ(Note: This report only valid for sample examined)

1

អាសយដ្ឋានលេខ: ៥៤ប/៤៩អេហ្វ ផ្លូវលេខ ៣៩៥-៦៥៦ សង្កាត់ទឹកល្អក់៣ ខណ្ឌទួលគោក រាជធានីភ្នំពេញ ទូរស័ព្ទលេខ:(០២៣) ៨៨៣ ៤២៧ ទូរសារលេខ:(០២៣) ៨៨៣ ៤២៧
Address# 54B/49F, Street 395-656, Sangkat Toeuk Laak3, Khan Tuol Kok, Phnom Penh. Cambodia, Phone : (023) 883 427, Fax : (023) 883 427

Lab. ID: 93/20	LabNo. :	1
Description Parameter	Field ID:	X= 433651, Y= 1303521
កាចុងដោះដូរ ,Exchangeable Cation	កាល់ស្យូម, Calcium Ca	7.60
(m.e/100g Soil),	ម៉ាញ៉េស្យូម,Magnesium Mg	2.20
(Method 1M Ammonium Acetateat pH = 7)	សូដ្យូម,Sodium Na	2.89
	ប៉ូតាស្យូម,Potasium K	0.64
កាចុងដោះដូរសរុប , Total Exchangeable Bases (m.e/100g soil)		13.33
អត្រាឆ្អែតនៃកាចុង, Bass Saturation %		92
អាស៊ីតដោះដូរ Exchange Acidity m.e/100g Soil , (1 M KCl Method)		13.30
អាលុយមីញ៉ូមដោះដូរ Exchange Al m.e/100g Soil , (1 M KCl Method)		0.22
បញ្ជូន.អ.នីមើលជាតិប្រៃ Electrode Conductivity µS/cm , (1:5 Soil: water)		191.00
ប៉េហាស់ទឹក pH H2O , (1:5 Soil: water)		9.02
ប៉េហាស់អំបិល pH KCL , (1:5 (Soil : 1N KCL)		8.12

ចំណាំ: លទ្ធផលទទួលខុសត្រូវតែចំពោះសំណាកដែលបានវិភាគ(Note: This report only valid for sample examined)

ប្រធានមន្ទីរពិសោធន៍ជាតិកសិកម្ម

N. Rīn

បានឃើញ និងឯកភាព
ប្រតិភូរាជរដ្ឋាភិបាលកម្ពុជាទទួលបន្ទុកជាអគ្គនាយក
នៃអគ្គនាយកដ្ឋានកសិកម្ម ។
អគ្គនាយករង

សាម៉េន កែវមុនីន

Appendix III: Air/Noise/Vibration Test Result (Location 1)

(A) Air Quality

ព្រះរាជាណាចក្រកម្ពុជា

ជាតិ សាសនា ព្រះមហាក្សត្រ

#1

អគ្គនាយកដ្ឋានគាំពារបរិស្ថាន

នាយកដ្ឋានគ្រប់គ្រងគុណភាពខ្យល់ និងសំឡេង

លេខ: ......១៦៣.......គខស អគព.បស្ថ

របាយការណ៍ពិនិត្យគុណភាពខ្យល់

Air Quality Monitoring Report

ឈ្មោះក្រុមហ៊ុន៖ ក្រុមហ៊ុន PRIME ROAD ALTERNATIVE (CAMBODIA) CO., LTD

អាសយដ្ឋាន៖ នៅភូមិឈៀនឡើង ឃុំក្បាលទឹក ស្រុកទឹកផុស ខេត្តកំពង់ឆ្នាំង

ទីតាំងត្រួតពិនិត្យ៖ ដាក់នៅក្នុងតំបន់គម្រោង, UTM: 48P 0434264 & 1303047

ប្រភេទគម្រោង៖ គម្រោងសាងសង់រោងចក្រផលិតអគ្គិសនីដើរដោយថាមពលពន្លឺព្រះអាទិត្យ៦០មេហ្គាវ៉ាត់

ប៉ារ៉ាម៉ែត្រ **Parameter**	ខ្នាត **Unit**	លទ្ធផល **Result**	ស្តង់ដា **Standard**	វិធីសាស្ត្រវិភាគ **Method**
Carbon Monoxide (CO)	mg/m^3	0.410	20	GRI-IAT (Real-time Monitor)
Nitrogen Dioxide (NO_2)	mg/m^3	0.022	0.1	GRI-IAT (Real-time Monitor)
Sulphur Dioxide (SO_2)	mg/m^3	0.028	0.3	GRI-IAT (Real-time Monitor)
Ozone (O_3)	mg/m^3	0.031	0.2	GRI-IAT (Real-time Monitor)
Dust (TSP)	mg/m^3	0.011	0.33	OCEANUS OC-9500, Dust Monitor System
Dust (PM10) **	mg/m^3	0.007	0.05	OCEANUS OC-9500, Dust Monitor System
Dust (PM2.5) **	mg/m^3	0.006	0.025	OCEANUS OC-9500, Dust Monitor System
Lead (Pb)	mg/m^3	ND	0.005	CPSC-CH-E1002-08.3, (HNO_3 Digestion)

សម្គាល់៖ - យោងអនុក្រឹត្យលេខ ៤២ អនក្រ.បក ចុះថ្ងៃទី១០ ខែកក្កដា ឆ្នាំ២០០០ ស្តីពីការត្រួតពិនិត្យការបំពុលខ្យល់ និងការរំខានដោយសំឡេង

*- ** យោងប្រកាសលេខ ១១៦ ប្រក.បស្ថ ចុះថ្ងៃទី១១ ខែមេសា ឆ្នាំ២០១៨ ស្តីពីការដាក់ឱ្យប្រើប្រាស់លក្ខខណ្ឌការងារសម្រាប់គម្រោងបង្កើតរោងចក្រ និងសិប្បកម្ម*

ថ្ងៃពុធ ១៣កើត ខែអស្សុជ ឆ្នាំជូត ទោស័ក ព.ស.២៥៦៤

រាជធានីភ្នំពេញ ថ្ងៃទី៣០ ខែកញ្ញា ឆ្នាំ២០២០

ប្រធាននាយកដ្ឋាន

Director of Department

ជា ណារ៉ា

បានឃើញ និងឯកភាព

រាជធានីភ្នំពេញ ថ្ងៃទី ៣០ ខែកញ្ញា ឆ្នាំ២០២០

អគ្គនាយក

Director Genaral

ជា_ស៊ីណា

អគារមេតេកតេជោ ផ្លូវគីឡូលេខ៥០៣ ផ្លូវមេមាត់ទន្លេបាសាក់ សង្កាត់ទន្លេបាសាក់ ខណ្ឌចំការមន រាជធានីភ្នំពេញ ទូរស័ព្ទលេខ: ០២៣-២១៣ ៥០៨

(B) Noise Result

ព្រះរាជាណាចក្រកម្ពុជា
ជាតិ សាសនា ព្រះមហាក្សត្រ

#1

អគ្គនាយកដ្ឋានគាំពារបរិស្ថាន
នាយកដ្ឋានគ្រប់គ្រងគុណភាពខ្យល់ និងសំឡេង
លេខ: ....១[illegible]........តខស អគព.បស្ថ

របាយការណ៍ពិនិត្យសំឡេង
Noise Control Report

ឈ្មោះក្រុមហ៊ុន៖ ក្រុមហ៊ុន PRIME ROAD ALTERNATIVE (CAMBODIA) CO., LTD
អាសយដ្ឋាន៖ នៅភូមិឈើទាលទៀង ឃុំក្បាលទឹក ស្រុកទឹកផុស ខេត្តកំពង់ឆ្នាំង
ទីតាំងត្រួតពិនិត្យ៖ ដាក់នៅក្នុងតំបន់គម្រោង, UTM: 48P 0434264 & 1303047
ប្រភេទគម្រោង៖ គម្រោងសាងសង់រោងចក្រផលិតអគ្គិសនីដើរដោយថាមពលពន្លឺព្រះអាទិត្យ៦០មេហ្គាវ៉ាត់

No	Survey Period	Noise Level dB(A)				Remarks
		LAeq	Standard	Lmax	Lmin	
1	6:00 - 7:00	44.30	70	63.90	34.70	
2	7:00 - 8:00	45.40		72.00	32.70	
3	8:00 - 9:00	54.20		72.70	31.40	
4	9:00 - 10:00	40.80		58.20	32.10	
5	10:00 - 11:00	46.10		63.30	33.80	
6	11:00 - 12:00	46.80		67.90	32.00	
7	12:00 - 13:00	51.10		70.80	32.10	
8	13:00 - 14:00	49.40		62.20	35.30	
9	14:00 - 15:00	42.70		56.30	37.00	
10	15:00 - 16:00	42.30		49.50	34.90	
11	16:00 - 17:00	33.20		38.80	30.50	
12	17:00 - 18:00	34.10		45.40	30.50	
13	18:00 - 19:00	43.70	65	69.10	32.00	
14	19:00 - 20:00	49.00		55.50	33.70	
15	20:00 - 21:00	49.60		55.60	39.00	
16	21:00 - 22:00	52.00		56.00	35.70	
17	22:00 - 23:00	52.40	50	55.90	35.60	
18	23:00 - 00:00	52.80		59.00	39.40	
19	00:00 - 1:00	47.40		59.70	36.60	
20	1:00 - 2:00	49.30		54.80	36.50	
21	2:00 - 3:00	53.30		55.60	44.70	
22	3:00 - 4:00	53.70		56.80	44.90	
23	4:00 - 5:00	53.60		56.30	45.30	
24	5:00 - 6:00	45.60		59.50	37.40	
24 hours Average		47.20		58.95	35.74	

សម្គាល់៖ - យោងអនុក្រឹត្យលេខ ៤២ អនក្រ.បក ចុះថ្ងៃទី១០ ខែកក្កដា ឆ្នាំ២០០០ ស្តីពីការត្រួតពិនិត្យការបំពុលខ្យល់ និងការរំខានដោយសំឡេង
- ឧបករណ៍វាស់កម្រិតសំឡេងប្រភេទ RION NL-42EX

ថ្ងៃ[illegible] ខែ[illegible] ឆ្នាំជូត ទោស័ក ព.ស.២៥៦៤
រាជធានីភ្នំពេញ ថ្ងៃទី៣០ ខែកញ្ញា ឆ្នាំ២០២០
ប្រធាននាយកដ្ឋាន
Director of Department
ជា ណារ៉ា

បានឃើញ និងឯកភាព
រាជធានីភ្នំពេញ ថ្ងៃទី៣០ ខែកញ្ញា ឆ្នាំ២០២០
អគ្គនាយក
Director Genaral
ជា-ស៊ីណា

(C) Vibration Result

ព្រះរាជាណាចក្រកម្ពុជា
ជាតិ សាសនា ព្រះមហាក្សត្រ

#1

អគ្គនាយកដ្ឋានគាំពារបរិស្ថាន
នាយកដ្ឋានគ្រប់គ្រងគុណភាពខ្យល់ និងសំឡេង
លេខ: ...១២៤............គខស អគព.បស្ព

របាយការណ៍ពិនិត្យរំញ័រ
Vibration Control Report

ឈ្មោះក្រុមហ៊ុន៖ ក្រុមហ៊ុន PRIME ROAD ALTERNATIVE (CAMBODIA) CO., LTD
អាសយដ្ឋាន៖ នៅភូមិឈៀនឡើង ឃុំក្បាលទឹក ស្រុកទឹកផុស ខេត្តកំពង់ឆ្នាំង
ទីតាំងត្រួតពិនិត្យ៖ ដាក់នៅក្នុងតំបន់គម្រោង, UTM: 48P 0434264 & 1303047
ប្រភេទគម្រោង៖ គម្រោងសាងសង់រោងចក្រផលិតអគ្គិសនីដើរដោយថាមពលពន្លឺព្រះអាទិត្យ៦០មេហ្គាវ៉ាត់

No	Survey Period	Vibration Level dB				Remarks
		LAeq	Standard	Lmax	Lmin	
1	6:00 - 7:00	20.40	65	42.70	14.20	
2	7:00 - 8:00	19.20		39.00	14.00	
3	8:00 - 9:00	24.70		41.40	14.40	
4	9:00 - 10:00	20.30		32.60	14.60	
5	10:00 - 11:00	23.20		39.80	14.80	
6	11:00 - 12:00	22.60		45.50	14.40	
7	12:00 - 13:00	24.30		46.40	14.20	
8	13:00 - 14:00	20.50		40.80	15.40	
9	14:00 - 15:00	20.30		41.60	15.30	
10	15:00 - 16:00	18.00		31.20	14.50	
11	16:00 - 17:00	20.90		49.10	14.20	
12	17:00 - 18:00	18.60		40.10	14.10	
13	18:00 - 19:00	20.30	60	48.80	15.50	
14	19:00 - 20:00	17.70		43.40	15.70	
15	20:00 - 21:00	17.50		26.50	15.60	
16	21:00 - 22:00	16.40		29.80	13.70	
17	22:00 - 23:00	15.80		29.90	13.70	
18	23:00 - 00:00	22.10		58.10	13.30	
19	00:00 - 1:00	15.60		23.00	13.60	
20	1:00 - 2:00	15.40		25.30	13.40	
21	2:00 - 3:00	15.70		22.60	13.60	
22	3:00 - 4:00	16.10		22.50	13.90	
23	4:00 - 5:00	15.80		25.30	13.80	
24	5:00 - 6:00	16.00		23.10	13.40	
24 hours Average		19.06		36.19	14.30	

សម្គាល់៖ - យោងអនុក្រឹត្យលេខ ៤២ អនក្រ.បក ចុះថ្ងៃទី១០ ខែកក្កដា ឆ្នាំ២០០០ ស្តីពីការត្រួតពិនិត្យការបំពុលខ្យល់ និងការរំខានដោយសំឡេង
- ឧបករណ៍វាស់កម្រិតរំញ័រប្រភេទ RION VM-55EX

ថ្ងៃ៣៖ ១៣កើតខែអស្សុជ ឆ្នាំជូត ទោស័ក ព.ស.២៥៦៤
រាជធានីភ្នំពេញ ថ្ងៃទី៣០ ខែកញ្ញា ឆ្នាំ២០២០
ប្រធាននាយកដ្ឋាន
Director of Department
ជា ណារ៉ុង

បានឃើញ និងឯកភាព
រាជធានីភ្នំពេញ ថ្ងៃទី៣០ ខែកញ្ញា ឆ្នាំ២០២០
អគ្គនាយក
Director Genaral
ជា-ស៊ីណា

អគារមរតកតេជោ [illegible] សង្កាត់ទន្លេបាសាក់ ខណ្ឌចំការមន រាជធានីភ្នំពេញ ទូរស័ព្ទលេខ: ០២៣-២១៣ ៩០៨

Appendix IV: Air/Noise/Vibration Test Result (Location 2)

(A) Air Quality

ព្រះរាជាណាចក្រកម្ពុជា
ជាតិ សាសនា ព្រះមហាក្សត្រ

#2

អគ្គនាយកដ្ឋានគាំពារបរិស្ថាន
នាយកដ្ឋានគ្រប់គ្រងគុណភាពខ្យល់ និងសំឡេង
លេខ: ១៤៤ គនស.អគព.បស្ត

របាយការណ៍ពិនិត្យគុណភាពខ្យល់
Air Quality Monitoring Report

ឈ្មោះក្រុមហ៊ុន៖ ក្រុមហ៊ុន PRIME ROAD ALTERNATIVE (CAMBODIA) CO., LTD
អាសយដ្ឋាន៖ នៅភូមិអណ្តូងប្រេង ឃុំក្បាលទឹក ស្រុកទឹកផុស ខេត្តកំពង់ឆ្នាំង
ទីតាំងត្រួតពិនិត្យ៖ ដាក់នៅក្នុងភូមិប្រជាពលរដ្ឋ, UTM: 48P 0439465 & 1303928
ប្រភេទគម្រោង៖ គម្រោងសាងសង់រោងចក្រផលិតអគ្គិសនីដើរដោយថាមពលពន្លឺព្រះអាទិត្យ៦០មេហ្គាវ៉ាត់

ប៉ារ៉ាម៉ែត្រ Parameter	ឯកតា Unit	លទ្ធផល Result	ស្តង់ដា Standard	វិធីសាស្ត្រវិភាគ Method
Carbon Monoxide (CO)	mg/m^3	0.930	20	GRI-IAT (Real-time Monitor)
Nitrogen Dioxide (NO_2)	mg/m^3	0.015	0.1	GRI-IAT (Real-time Monitor)
Sulphur Dioxide (SO_2)	mg/m^3	0.034	0.3	GRI-IAT (Real-time Monitor)
Ozone (O_3)	mg/m^3	0.02	0.2	GRI-IAT (Real-time Monitor)
Dust (TSP)	mg/m^3	0.018	0.33	OCEANUS OC-9500, Dust Monitor System
Dust (PM10) **	mg/m^3	0.013	0.05	OCEANUS OC-9500, Dust Monitor System
Dust (PM2.5) **	mg/m^3	0.009	0.025	OCEANUS OC-9500, Dust Monitor System
Lead (Pb)	mg/m^3	ND	0.005	CPSC-CH-E1002-08.3, (HNO_3 Digestion)

សម្គាល់៖ - យោងអនុក្រឹត្យលេខ ៤២ អនក្រ.បក ចុះថ្ងៃទី១០ ខែកក្កដា ឆ្នាំ២០០០ ស្តីពីការត្រួតពិនិត្យការបំពុលខ្យល់ និងការរំខានដោយសំឡេង
*- ** យោងប្រកាសលេខ ១១៦ ប្រក.បស្ត ចុះថ្ងៃទី១១ ខែមេសា ឆ្នាំ២០១៨ ស្តីពីការដាក់ឱ្យប្រើប្រាស់លក្ខខណ្ឌការងារសម្រាប់គម្រោងបង្កើតរោងចក្រ និងសិប្បកម្ម*

ថ្ងៃ ៧ ១៣កើត ខែអស្សុជ ឆ្នាំជូត ទោស័ក ព.ស.២៥៦៤
រាជធានីភ្នំពេញ ថ្ងៃទី ៣០ ខែកញ្ញា ឆ្នាំ២០២០
ប្រធាននាយកដ្ឋាន
Director of Department

ជា សារ៉ា

បានឃើញ និងឯកភាព
រាជធានីភ្នំពេញ ថ្ងៃទី ៣០ ខែកញ្ញា ឆ្នាំ២០២០
អគ្គនាយក
Director Genaral

ជា ស៊ីណា

អគារលេខ៥០៣ ផ្លូវកោះពេជ្រ ... ទូរស័ព្ទលេខ: ០២៣-២១៣ ៩០៨

(B) Noise Result

ព្រះរាជាណាចក្រកម្ពុជា
ជាតិ សាសនា ព្រះមហាក្សត្រ

#2

អគ្គនាយកដ្ឋានគាំពារបរិស្ថាន
នាយកដ្ឋានគ្រប់គ្រងគុណភាពខ្យល់ និងសំឡេង
លេខ: ......១៤៣..........គខស អគព.បស្ក

របាយការណ៍ពិនិត្យសំឡេង

Noise Control Report

ឈ្មោះក្រុមហ៊ុន៖ ក្រុមហ៊ុន PRIME ROAD ALTERNATIVE (CAMBODIA) CO., LTD
អាសយដ្ឋាន៖ នៅភូមិអណ្តូងប្រេង ឃុំក្បាលទឹក ស្រុកទឹកផុស ខេត្តកំពង់ឆ្នាំង
ទីតាំងត្រួតពិនិត្យ៖ ដាក់នៅក្នុងភូមិប្រជាពលរដ្ឋ, UTM: 48P 0439465 & 1303928
ប្រភេទគម្រោង៖ គម្រោងសាងសង់រោងចក្រផលិតអគ្គិសនីដើរដោយថាមពលពន្លឺព្រះអាទិត្យ៦០មេហ្គាវ៉ាត់

No	Survey Period	Noise Level dB(A)				Remarks
		LAeq	Standard	Lmax	Lmin	
1	6:00 - 7:00	58.50	70	77.90	34.40	
2	7:00 - 8:00	53.90		75.70	36.90	
3	8:00 - 9:00	53.00		86.20	36.00	
4	9:00 - 10:00	56.50		78.90	35.40	
5	10:00 - 11:00	46.10		63.30	33.80	
6	11:00 - 12:00	67.90		91.30	30.30	
7	12:00 - 13:00	53.10		78.40	27.10	
8	13:00 - 14:00	52.20		76.20	26.50	
9	14:00 - 15:00	52.60		75.20	27.20	
10	15:00 - 16:00	56.50		80.90	27.90	
11	16:00 - 17:00	57.60		75.40	33.80	
12	17:00 - 18:00	54.20		76.80	33.70	
13	18:00 - 19:00	53.80	65	75.20	32.60	
14	19:00 - 20:00	60.60		76.10	46.30	
15	20:00 - 21:00	59.00		77.70	41.60	
16	21:00 - 22:00	60.40		68.20	48.50	
17	22:00 - 23:00	58.70	50	66.20	44.60	
18	23:00 - 00:00	52.80		74.60	45.30	
19	00:00 - 1:00	53.00		69.20	42.90	
20	1:00 - 2:00	51.70		66.60	45.50	
21	2:00 - 3:00	52.60		58.60	43.60	
22	3:00 - 4:00	49.90		69.30	41.30	
23	4:00 - 5:00	50.00		72.00	42.60	
24	5:00 - 6:00	51.50		67.90	45.00	
24 hours Average		54.84		74.08	37.62	

សម្គាល់៖ - យោងអនុក្រឹត្យលេខ ៤២ អនក្រ.បក ចុះថ្ងៃទី១០ ខែកក្កដា ឆ្នាំ២០០០ ស្តីពីការត្រួតពិនិត្យការបំពុលខ្យល់ និងការរំខានដោយសំឡេង
- ឧបករណ៍វាស់កម្រិតសំឡេងប្រភេទ RION NL-42EX

ថ្ងៃ៣៩ ១៣កើត ខែភទ្របទ ឆ្នាំជូត ទោស័ក ព.ស.២៥៦៤
រាជធានីភ្នំពេញ ថ្ងៃទី៣០ ខែកញ្ញា ឆ្នាំ២០២០
ប្រធាននាយកដ្ឋាន
Director of Department

ជា ណារ៉ា

បានឃើញ និងឯកភាព
រាជធានីភ្នំពេញ ថ្ងៃទី៣០ ខែកញ្ញា ឆ្នាំ២០២០
អគ្គនាយក
Director Genaral

ឆា ស៊ីណា

អគារមរតកតេជោ ដីឡូតិ៍លេខ ៥០៣ ... សង្កាត់ទន្លេបាសាក់ ខណ្ឌចំការមន រាជធានីភ្នំពេញ ទូរស័ព្ទលេខ: ០២៣-២១៣ ៩០៨

(C) Vibration Result

ព្រះរាជាណាចក្រកម្ពុជា
ជាតិ សាសនា ព្រះមហាក្សត្រ

#2

អគ្គនាយកដ្ឋានគាំពារបរិស្ថាន
នាយកដ្ឋានគ្រប់គ្រងគុណភាពខ្យល់ និងសំឡេង
លេខ: ......១៤៤..........គខស អគព.បស្ក

របាយការណ៍ពិនិត្យរំញ័រ
Vibration Control Report

ឈ្មោះក្រុមហ៊ុន៖ ក្រុមហ៊ុន PRIME ROAD ALTERNATIVE (CAMBODIA) CO., LTD
អាសយដ្ឋាន៖ នៅភូមិអណ្តូងប្រេង ឃុំក្បាលទឹក ស្រុកទឹកផុស ខេត្តកំពង់ឆ្នាំង
ទីតាំងត្រួតពិនិត្យ៖ ដាក់នៅក្នុងភូមិប្រជាពលរដ្ឋ, UTM: 48P 0439465 & 1303928
ប្រភេទគម្រោង៖ គម្រោងសាងសង់រោងចក្រផលិតអគ្គិសនីដើរដោយថាមពលពន្លឺព្រះអាទិត្យ៦០មេហ្គាវ៉ាត់

No	Survey Period	Vibration Level dB				Remarks
		LAeq	Standard	Lmax	Lmin	
1	6:00 - 7:00	26.90	65	54.10	14.50	
2	7:00 - 8:00	26.70		56.00	14.30	
3	8:00 - 9:00	26.70		54.00	14.10	
4	9:00 - 10:00	26.90		54.20	14.50	
5	10:00 - 11:00	29.80		54.90	14.20	
6	11:00 - 12:00	25.50		54.00	14.20	
7	12:00 - 13:00	23.70		43.10	14.00	
8	13:00 - 14:00	23.30		48.90	14.10	
9	14:00 - 15:00	27.10		52.10	14.00	
10	15:00 - 16:00	27.40		50.10	14.80	
11	16:00 - 17:00	30.50		55.40	14.80	
12	17:00 - 18:00	27.20		54.20	14.70	
13	18:00 - 19:00	24.50	60	51.90	14.40	
14	19:00 - 20:00	24.40		51.30	14.60	
15	20:00 - 21:00	17.30		31.40	14.60	
16	21:00 - 22:00	18.00		34.00	13.80	
17	22:00 - 23:00	17.60		36.40	14.80	
18	23:00 - 00:00	17.20		40.60	14.50	
19	00:00 - 1:00	17.30		41.10	14.50	
20	1:00 - 2:00	16.60		28.10	14.60	
21	2:00 - 3:00	18.50		38.10	14.90	
22	3:00 - 4:00	17.30		25.90	14.40	
23	4:00 - 5:00	17.00		27.80	14.50	
24	5:00 - 6:00	28.50		55.00	14.40	
24 hours Average		**23.16**		**45.53**	**14.43**	

សម្គាល់៖ - យោងអនុក្រឹត្យលេខ ៤២ អនក្រ.បក ចុះថ្ងៃទី១០ ខែកក្កដា ឆ្នាំ២០០០ ស្តីពីការត្រួតពិនិត្យការបំពុលខ្យល់ និងការរំខានដោយសំឡេង
- ឧបករណ៍វាស់កម្រិតរំញ័រប្រភេទ RION VM-55EX

ថ្ងៃពុធ ១៣កើត ខែ ភទ្របទ ឆ្នាំជូត ទោស័ក ព.ស.២៥៦៤
រាជធានីភ្នំពេញ ថ្ងៃទី ៣០ ខែ កញ្ញា ឆ្នាំ២០២០
ប្រធាននាយកដ្ឋាន
Director of Department

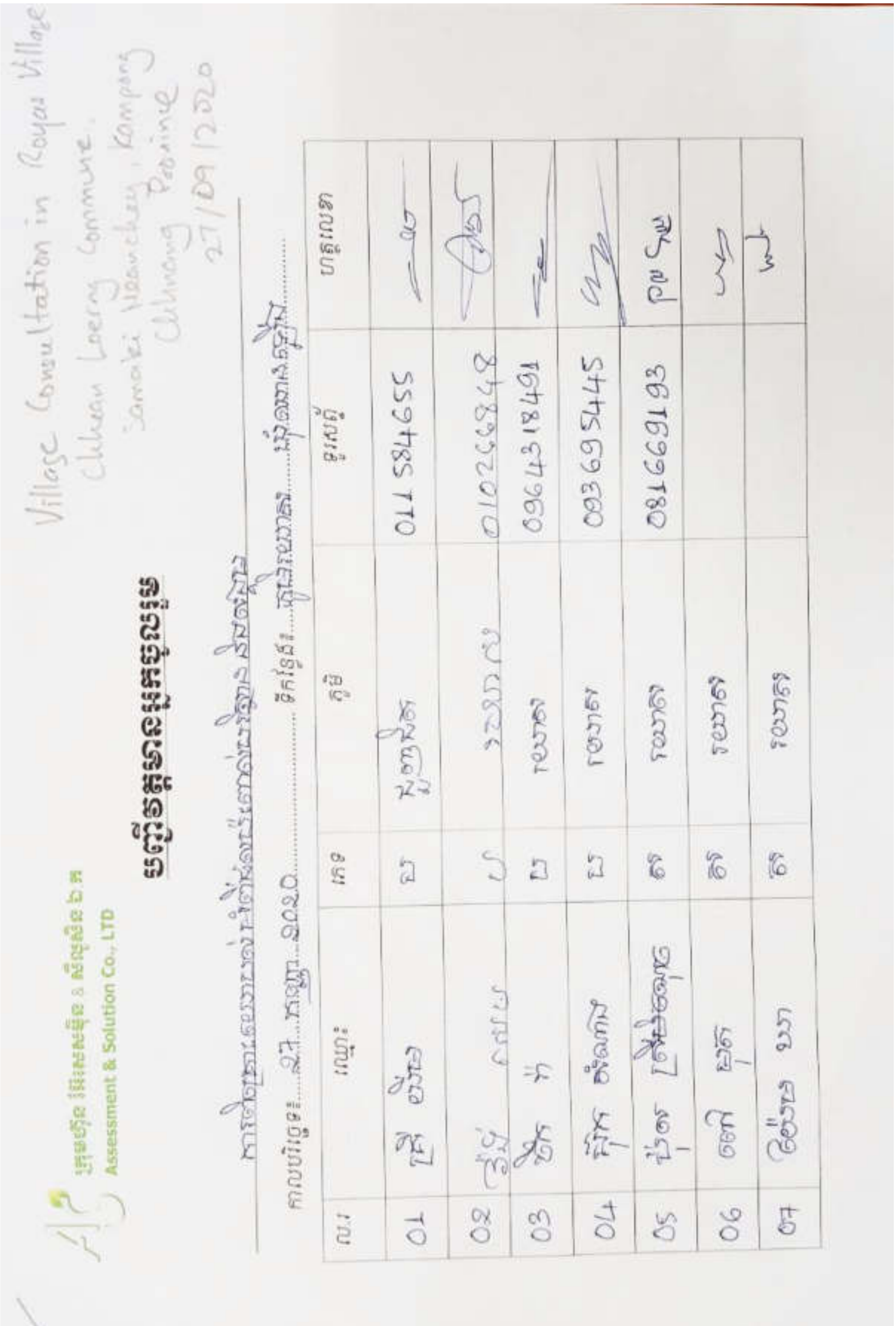
ជា ណារ៉ា

បានឃើញ និងឯកភាព
រាជធានីភ្នំពេញ ថ្ងៃទី ៣០ ខែ កញ្ញា ឆ្នាំ២០២០
អគ្គនាយក
Director Genaral

ជា_ស៊ីណា

អគារមរតកតេជោ ផ្លូវ... សង្កាត់ទន្លេបាសាក់ សង្កាត់ទន្លេបាសាក់ ខណ្ឌចំការមន រាជធានីភ្នំពេញ ទូរស័ព្ទលេខ: ០២៣-២១៣ ៩០៨

Appendix V: List of Attendees in the Village Consultation (27 September 2020)



Assessment & Solution Co., LTD

បញ្ជីវត្តមានអ្នកចូលរួម

Village Consultation in Royas Village
Chhean Loeng Commune,
Samaki Meanchey, Kampong
Chhnang Province
27/09/2020

កាលបរិច្ឆេទ: 27 កញ្ញា 2020 ទីកន្លែង: [illegible]

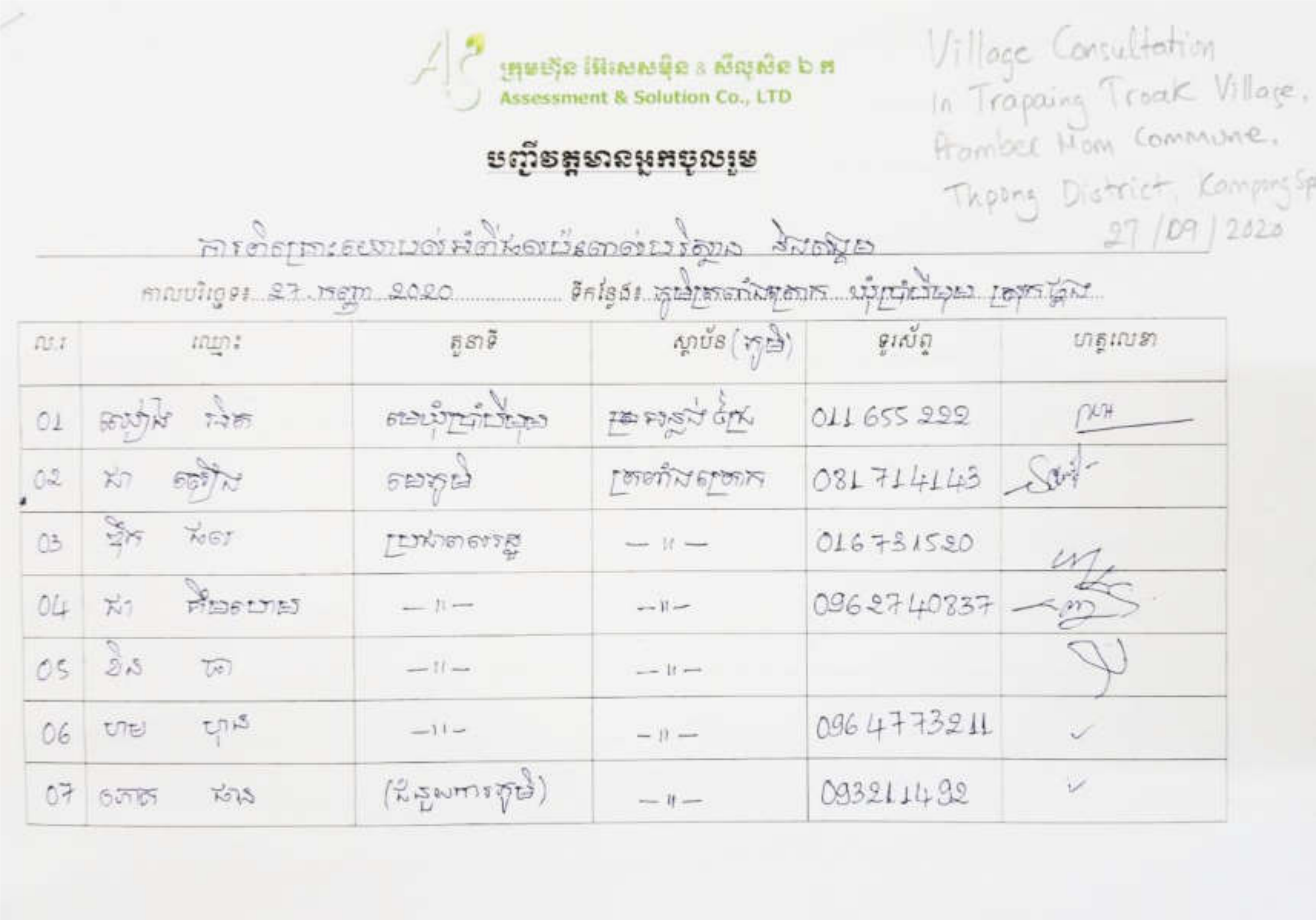
ល.រ	ឈ្មោះ	ភេទ	ភូមិ	ទូរស័ព្ទ	ហត្ថលេខា
01	[illegible]	ប	[illegible]	011 584655	[signature]
02	[illegible]	ប	[illegible]	010266848	[signature]
03	[illegible]	ប	[illegible]	096 4318491	[signature]
04	[illegible]	ប	[illegible]	093 695445	[signature]
05	[illegible]	ស	[illegible]	081669193	[signature]
06	[illegible]	ស	[illegible]		[signature]
07	[illegible]	ស	[illegible]		[signature]

ក្រុមហ៊ុន អាសេសម៉ិន & សឹលូស្យិន ឯ.ក
Assessment & Solution Co., LTD

ល.រ	ឈ្មោះ	ភេទ	ភូមិ	ទូរស័ព្ទ	ហត្ថលេខា
08	តៅ ឡូរ	ស	រលាត		
09	ប៊ុន សៀវ	ប	រលាត	096 71 50 922	
10	ប៊ិច ញ៉ិល	ប	រលាត		
11	លឹម យឿង	ប	ស្លាញដែក	085 206303	
12	ឌិន យឿន	ប	ស្លាញដែក	016334237	
13	ភិន សម្បត្តិ	ប	ស្លាញដែក		
14	ងិម ដែក	ប	ស្លាញដែក		
15	ណា សេលាម	ស	ស្លាញដែក		
16	ម៉ុត ចឿន	ស	រលាត		
17	រី លាភ	ស	រលាត	098238316	

ក្រុមហ៊ុន អេសេសមិន & សឺលូសិន ខ.ត
Assessment & Solution Co., LTD

ល.រ	ឈ្មោះ	ភេទ	ភូមិ	ទូរស័ព្ទ	ហត្ថលេខា
១៨	ហ៊ុំ ចន្ធី	ស	រលាង	0964374377	
១៩	ហាង្សា ខេម	ស	រលាង		
២០	ម៉ុន ប៊ុនធឿ	ប	រលាង(គណការប៉ុស្ត)	015236278	



Assessment & Solution Co., LTD

បញ្ជីវត្តមានអ្នកចូលរួម

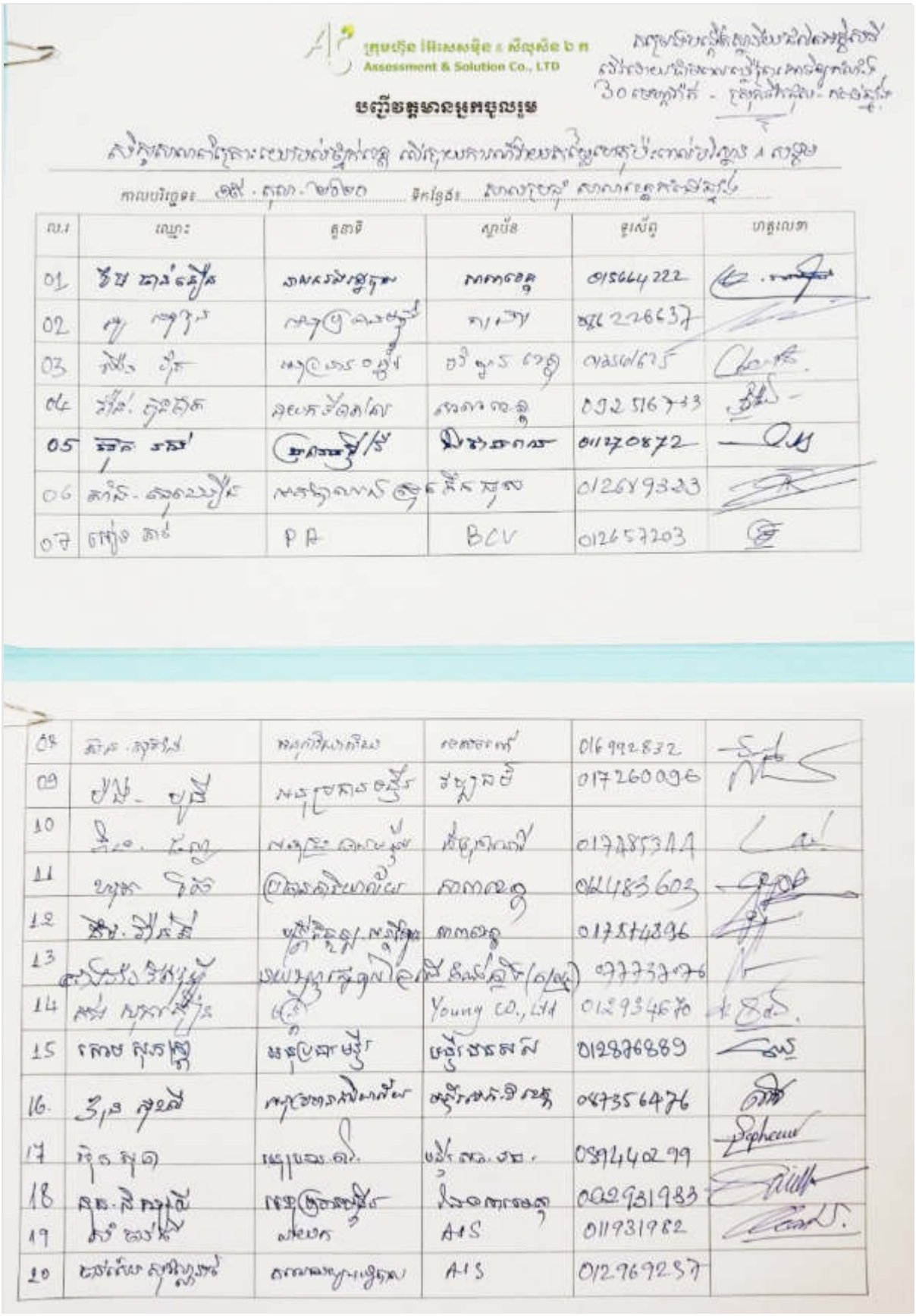
Village Consultation
In Trapaing Troak Village,
Pramber Mom Commune,
Thpong District, Kampong Sp[eu]
27/09/2020

[illegible]

កាលបរិច្ឆេទ៖ 27 កញ្ញា 2020 ទីកន្លែង៖ ភូមិត្រពាំងត្រាក [illegible] ស្រុកថ្ពង

ល.រ	ឈ្មោះ	តួនាទី	ស្ថាប័ន (ក្រសួង)	ទូរស័ព្ទ	ហត្ថលេខា
01	[illegible]	[illegible]	[illegible]	011 655 222	[signature]
02	[illegible]	មេភូមិ	[illegible]	081 714143	[signature]
03	[illegible]	[illegible]	— ॥ —	016 781520	[signature]
04	[illegible]	— ॥ —	— ॥ —	096 2740837	[signature]
05	[illegible]	— ॥ —	— ॥ —		[signature]
06	[illegible]	— ॥ —	— ॥ —	096 4773211	✓
07	[illegible]	[illegible]	— ॥ —	09321 1492	✓

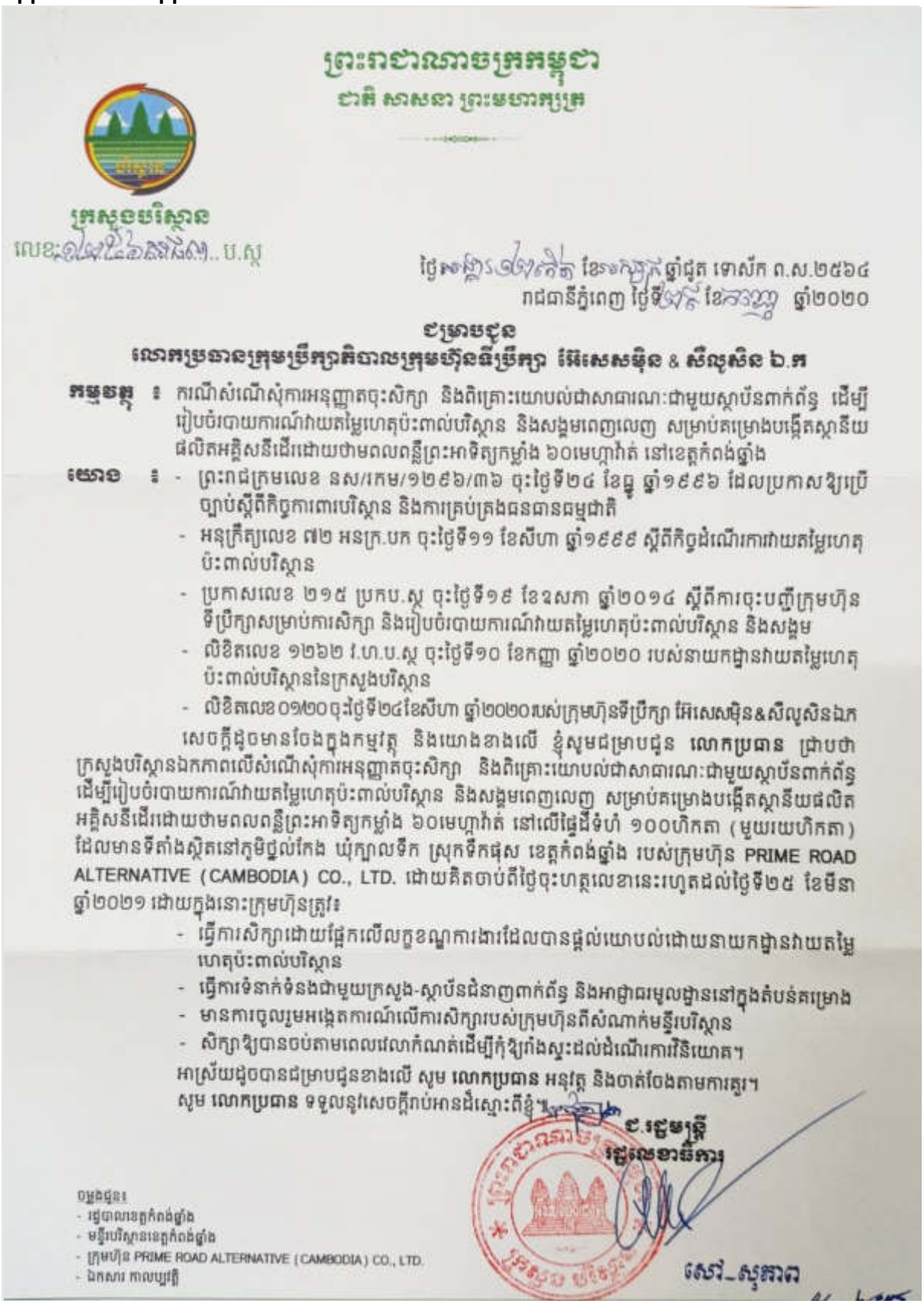
Appendix VI: List of Attendees in Provincial Consultation (19 October 2020)



បញ្ជីចូលរួមកិច្ចប្រជុំ

ល.រ	ឈ្មោះ	តួនាទី	ស្ថាប័ន	ទូរស័ព្ទ	ហត្ថលេខា
01				015664222	
02				012226637	
03					
04				092516733	
05				011708872	
06				012693323	
07		PA	BCV	012657203	
08				016992832	
09				017260096	
10				017485314	
11				064483603	
12				017544896	
13				077737476	
14			Young CO., LTD	012934670	
15				012876889	
16.				087356476	
17				089446299	
18				092931983	
19			A+S	011931982	
20			A+S	012769257	

Appendix VII: Approval Letter for TOR



ព្រះរាជាណាចក្រកម្ពុជា
ជាតិ សាសនា ព្រះមហាក្សត្រ

ក្រសួងបរិស្ថាន
លេខ:...ប.ស

ថ្ងៃ...ខែ...ឆ្នាំជូត ទោស័ក ព.ស.២៥៦៤
រាជធានីភ្នំពេញ ថ្ងៃទី...ខែ...ឆ្នាំ២០២០

ជម្រាបជូន
លោកប្រធានក្រុមប្រឹក្សាតិចាលក្រុមហ៊ុនទីប្រឹក្សា អ៊ែសេសម៉ិន & សីលូសិន ឯ.ក

កម្មវត្ថុ ៖ ការណើសំណើសុំការអនុញ្ញាតចុះសិក្សា និងពិគ្រោះយោបល់ជាសាធារណៈជាមួយស្ថាប័នពាក់ព័ន្ធ ដើម្បីរៀបចំរបាយការណ៍វាយតម្លៃហេតុប៉ះពាល់បរិស្ថាន និងសង្គមពេញលេញ សម្រាប់គម្រោងបង្កើតស្ថានីយផលិតអគ្គិសនីដើរដោយថាមពលពន្លឺព្រះអាទិត្យកម្លាំង ៦០មេហ្គាវ៉ាត់ នៅខេត្តកំពង់ឆ្នាំង

យោង ៖
- ព្រះរាជក្រមលេខ នស/រកម/១២៩៦/៣៦ ចុះថ្ងៃទី២៤ ខែធ្នូ ឆ្នាំ១៩៩៦ ដែលប្រកាសឱ្យប្រើច្បាប់ស្តីពីកិច្ចការពារបរិស្ថាន និងការគ្រប់គ្រងធនធានធម្មជាតិ
- អនុក្រឹត្យលេខ ៨២ អនក្រ.បក ចុះថ្ងៃទី១១ ខែសីហា ឆ្នាំ១៩៩៩ ស្តីពីកិច្ចដំណើរការវាយតម្លៃហេតុប៉ះពាល់បរិស្ថាន
- ប្រកាសលេខ ២១៥ ប្រក.ប.ស ចុះថ្ងៃទី១៩ ខែឧសភា ឆ្នាំ២០១៤ ស្តីពីការចុះបញ្ជីក្រុមហ៊ុនទីប្រឹក្សាសម្រាប់ការសិក្សា និងរៀបចំរបាយការណ៍វាយតម្លៃហេតុប៉ះពាល់បរិស្ថាន និងសង្គម
- លិខិតលេខ ១២៦២ វ.ហ.ប.ស្ត ចុះថ្ងៃទី១០ ខែកញ្ញា ឆ្នាំ២០២០ របស់នាយកដ្ឋានវាយតម្លៃហេតុប៉ះពាល់បរិស្ថាននៃក្រសួងបរិស្ថាន
- លិខិតលេខ ០១២០ចុះថ្ងៃទី២៤ខែសីហា ឆ្នាំ២០២០របស់ក្រុមហ៊ុនទីប្រឹក្សា អ៊ែសេសម៉ិន&សីលូសិនឯក

សេចក្តីដូចមានចែងក្នុងកម្មវត្ថុ និងយោងខាងលើ ខ្ញុំសូមជម្រាបជូន **លោកប្រធាន** ជ្រាបថា ក្រសួងបរិស្ថានឯកភាពលើសំណើសុំការអនុញ្ញាតចុះសិក្សា និងពិគ្រោះយោបល់ជាសាធារណៈជាមួយស្ថាប័នពាក់ព័ន្ធ ដើម្បីរៀបចំរបាយការណ៍វាយតម្លៃហេតុប៉ះពាល់បរិស្ថាន និងសង្គមពេញលេញ សម្រាប់គម្រោងបង្កើតស្ថានីយផលិតអគ្គិសនីដើរដោយថាមពលពន្លឺព្រះអាទិត្យកម្លាំង ៦០មេហ្គាវ៉ាត់ នៅលើផ្ទៃដីចំហំ ១០០ហិកតា (មួយរយហិកតា) ដែលមានទីតាំងស្ថិតនៅភូមិថ្នល់កែង ឃុំក្បាលទឹក ស្រុកទឹកផុស ខេត្តកំពង់ឆ្នាំង របស់ក្រុមហ៊ុន PRIME ROAD ALTERNATIVE (CAMBODIA) CO., LTD. ដោយគិតចាប់ពីថ្ងៃចុះហត្ថលេខានេះរហូតដល់ថ្ងៃទី២៥ ខែមីនា ឆ្នាំ២០២១ ដោយក្នុងនោះក្រុមហ៊ុនត្រូវ៖

- ធ្វើការសិក្សាដោយផ្អែកលើលក្ខខណ្ឌការងារដែលបានផ្តល់យោបល់ដោយនាយកដ្ឋានវាយតម្លៃហេតុប៉ះពាល់បរិស្ថាន
- ធ្វើការទំនាក់ទំនងជាមួយក្រសួង-ស្ថាប័នជំនាញពាក់ព័ន្ធ និងអាជ្ញាធរមូលដ្ឋាននៅក្នុងតំបន់គម្រោង
- មានការចូលរួមអង្កេតការណ៍លើការសិក្សារបស់ក្រុមហ៊ុនពីសំណាក់មន្ទីរបរិស្ថាន
- សិក្សាឱ្យបានចប់តាមពេលវេលាកំណត់ដើម្បីកុំឱ្យក៏ងស្ទះដល់ដំណើរការវិនិយោគ។

អាស្រ័យដូចបានជម្រាបជូនខាងលើ សូម **លោកប្រធាន** អនុវត្ត និងចាត់ចែងតាមការគួរ។
សូម **លោកប្រធាន** ទទួលនូវសេចក្តីរាប់អានដ៏ស្មោះពីខ្ញុំ។

ឧ.រដ្ឋមន្ត្រី
រដ្ឋលេខាធិការ

សៅ_សុភាព

ចម្លងជូន៖
- រដ្ឋបាលខេត្តកំពង់ឆ្នាំង
- មន្ទីរបរិស្ថានខេត្តកំពង់ឆ្នាំង
- ក្រុមហ៊ុន PRIME ROAD ALTERNATIVE (CAMBODIA) CO., LTD.
- ឯកសារ កាលប្បវត្តិ

Appendix VIII: Detail Socio-Economic Data (see separate file attached)