Environmental Management Plan

December 2021

Cambodia: Integrated Urban Environmental Management in the Tonle Sap Basin Project - Kampong Chhnang Sewerage, Flood Protection and Wastewater Treatment Subproject

Prepared by the Ministry of Public Works and Transport for the Asian Development Bank. This is an updated version of the draft originally posted in July 2021 available on https://www.adb.org/projects/documents/cam-42285-013-emp-2.

ABBREVIATIONS

ADB	–	Asian Development Bank
AOI	–	Area of Influence
AP	–	affected person
CEMP	–	Construction Environmental Management Plan
EA	–	Executive Agency
EMP	–	environmental management plan
EMR	–	Environmental Monitoring Report
EHS	–	Environment, Health and Safety
EHSO	–	Environmental, Health and Safety Officer
ESO	–	Environmental Safeguard Office
GRM	–	Grievance Redress Mechanism
GRC	–	Grievance Redress Committee
H&S	–	Health and Safety
IEE	–	initial environmental examination
IESIA	–	initial environmental and social impact assessment
IFC	–	International Finance Corporation
ILO		International Labor Organization
MoE	–	Ministry of Environment
MPWT	–	Ministry of Public Works and Transport
O&M	–	operation and maintenance
PDoE	–	Provincial Department of Environment
PDPWT	–	Provincial Department of Public Works and Transport
PMIS	–	project management and implementation support
PIU	–	project implementation unit
PMU	–	project management unit
PSC	–	project steering committee
PPTA	–	Project Preparation Technical Assistance
SEMR	–	Semi-Annual Environmental Monitoring Report
SPS	–	Safeguard Policy Statement
UXO	–	Unexploded Ordnance
WHO	–	World Health Organization
WWTP	–	Waste water treatment plant

WEIGHTS AND MEASURES

^{o}C	–	Degrees centigrade
m	–	meter
m^3	–	cubic meters
mg/l	–	milligram/s per liter

GLOSSARY

Boeung	–	Khmer word for lake
Tonle	–	Khmer word for river

NOTE

In this report, "$" refers to US dollars.

TABLE OF CONTENTS

FIGURES and TABLES

I. ENVIRONMENTAL MANAGEMENT PLAN

A. Objectives

1. This is the EMP for the Kampong Chhnang Sewerage Drainage and Waste water Treatment System subproject. The EMP aims to avoid impacts where possible and mitigate those impacts which cannot be eliminated to an acceptable and minimum level. The EMP includes requirements for:

- Institutional arrangements and project responsibilities;
- Mitigation measures;
- Monitoring and reporting requirements;
- EMP budget for implementation; and
- Capacity building and training requirements.

2. The EMP was updated to reflect the detailed engineering designs (DED) before procurement, and was included in the Bidding Documents supplied to the contractor.

3. The Initial Environmental and Social Impact Assessment (IESIA) is the environmental study required under national law. IESIA approval was given by the Ministry of Environment in September 2021. This latest version of the EMP updated with the IESIA will be provided to the contractor and supersedes any previous version.

II. DESCRIPTION OF THE SUBPROJECT

A. Sewerage System

4. Construction of a new sewerage system and improvement works for the existing drainage system will be undertaken in the center of Kampong Chhnang town covering an area of 247 ha. A total of 16.4 km of main sewer lines will be installed. For the sewer lines RCC pipes are proposed, and the pipes will be of spigot and Socket joint type with rubber rings. Minimum diameter of 300 mm is adopted. The composition of the priority sewer system can be given as follows. The pipes will be installed at depths between 2 to 7 m

Main sewer line pipes (dia in mm)	**m**	**16,436**
300	m	10,468
400	m	202
500	m	2,387
600	m	1,546
700	m	175
800	m	840
900	m	218
1000	m	600

5. RCC manholes are proposed. Depending on the height of the manholes and pipe diameter, various types of manholes are proposed. The number and type of manholes to be installed in the sewer lines is 390 manholes with a diameter of 1500mm at various depths between 3 to 6 m and 89 manholes with a diameter of 1200 mm at various depths between 3 to 7.5 m

6. For every house or building in the service area the possibility will be provided for a connection to the sewer system. The total number of house/building connections is estimated at 1.800. Connections to the existing drainage lines will be modified to separate the sewer flow and storm water drainage flow in these connections. There are however many complications that have to be overcome to achieve this goal depending on the density of buildings and the type of existing waste

water and drainage water disposal

7. A total of 24.9 km of collector lines and lateral will be installed under the sidewalks or road shoulders, the alignments have been fixed in such a manner that all encumbrances in the COI of these lines are avoided. Where possible collector lines and laterals will be installed at the back of the buildings/houses for easy connection of the existing waste water disposal facilities. All the interconnections (collector lines and laterals) of the building/house connection chambers and manholes are proposed to be of uPVC pipes The installation of collector lines behind the buildings will require detailed consultations with all the proprietors. For this purpose, the team for construction supervision will, apart from a resident engineer and site supervisors also include social mobilizers to organize and lead the consultation with the beneficiary/proprietors. Prior to the start of the construction the PMIS consultants will prepare a detailed sanitation inventory of the buildings/house in the service area. This sanitation inventory will include the overall willingness of proprietors to connect to a new sewerage system, the type and location of on-site waste water disposal facilities, existing off-site disposal including connections to the town drainage lines, possibility and willingness of proprietors to cooperate with installation of collector lines at the back of the buildings/houses. This inventory will guide the final alignment and installation of collector lines/laterals and the type of building/house connection The collector lines will comprise of the following pipe lines:

Collector Lines (Dia in mm)	**m**	**24,900**
150	m	5,000
200	m	17,400
250	m	2,500

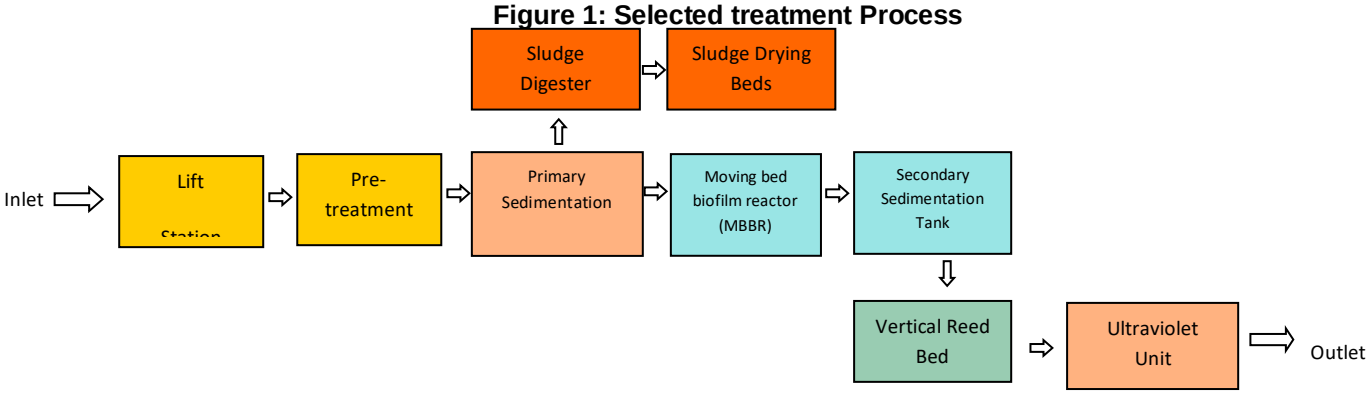
B. Waste Water Treatment Plant

8. A Waste water Treatment Plant (WWTP) will be constructed for the treatment of the sewage flow that originates from the service area of 247 ha. with a design flow is 5.40 Mld and peak flow is 12.76 Mld. The WWTP will be located in the Boeung Alum estuary at a distance of 250 m from the old embankment (see figure 3-4). For the development of the site an area of 6.4 ha. will have to be raised by soil filling from the present levels of 4 to 5 m to a level of 13 m. This level is above the 50-year return period flood level of 11.8

9. Based on the proximity of the WWTP site to the town with the need for odor control and the limited size of the area that can be created for the construction of the WWTP by soil filling in the Boeung Alum estuary it is proposed to utilize combination of mechanical treatment for primary and secondary treatment and a constructed wetland (Reed Bed) for tertiary treatment together with manual sludge drying operation. The combination will have both the benefit of the mechanical treatment with high efficiency and lower operation and maintenance cost for the tertiary treatment.

10. The selected process will meet the Effluent Discharge Standard from Commercial Building, Borey, Satellite City and Resort or Recreation Center Discharges directly to the Public Waterbody or Drainage/Sewerage System as required by sub-decree 235 on the Management of Drainage and Waste water Treatment Systems and will meet the effluent standards for Sub-Decree No. 27 on Water Pollution Control (1999), which was adjusted specifically for this project by MoE's review of the domestic IESIA (a bespoke effluent standard therefore applies, as detailed in the IEE).

Figure 1: Selected treatment Process



C. Improvement of the drainage system

11. The existing drainage system covers the core areas of the town center. However, secondary roads in the priority area have no drainage system and some of the road also have no hard pavement. In order make the separate sewerage system functional, storm water drainage is essential to avoid that storm water will enter the separate sewerage system which will lead to overloaded and overflowing sewer lines and excessive overflow at the WWTP. It is also proposed to pave the dirt roads in the service area to limit the inflow of soil in to the drainage lines

12. A total of 19.1 km of new drainage lines will be installed. The new drainage lines will be integrated with the existing drainage system and complement this system expanding the town drainage to all areas in the priority development area. The new drainage lines will comprise the following:

Installation New Pipes (dia in mm)	**m**	**19,118**
400	m	17,938
450	m	350
500	m	650
600	m	180

13. It is also proposed to provide pavement for unpaved roads in the service area to ensure an effective operation of the drainage system in this area by limiting the inflow of soil during rain storms A total of 5.8 Km of road is proposed for pavement with concrete of 150mm thickness.

Figure 2: Layout of the Sewerage and Drainage Systems

III. INSTITUTIONAL ARRANGEMENTS AND THEIR RESPONSIBILITIES

14. The EMP reflects the institutional arrangements for the Project; this Subproject will become part of the wider Project and therefore will fit into the existing arrangements.

15. The overall responsibility for EMP implementation and compliance with loan assurances lies with the Executing Agency, the Ministry of Public Works and Transport. The EA has established a Project Management Unit (PMU) based in Phnom Penh, responsible for general project implementation. The Implementing Agency is the Provincial Department of Public Works and Transport (PDPWT) in the subproject city. The PDPWT has established a Project Implementation Unit (PIU) in each province, comprising relevant provincial government representatives including the Provincial Department of the Environment.

16. A summary of the key functions for project implementation and environmental safeguards is presented in Table 1 and detail on the responsibilities of each function is in Table 2.

Table 1: Key Functions for Project Implementation

Role	Abbreviation	Location	Summary of Overall Function
Project Steering Committee	PSC	Phnom Penh	Policy and technical guidance for subproject implementation
Project Management Unit	PMU	Phnom Penh within MPWT	Responsible for general project implementation and reporting
PMU Environment Safeguards Officer	PMU-ESO	Phnom Penh within PMU	Existing MPWT staff seconded/assigned to the PMU for the environmental management of the Project EMP compliance across the subprojects for environmental safeguards – Full Time
Project Implementation Unit	PIU	Provinces within PDPWT	Responsible for subproject implementation
PIU Environmental Safeguard Counterpart	PIU-ESC	Provinces within PIU	Nominated person responsible for subproject environmental monitoring and support to PMU-ESO
Contractor Environmental, Health and Safety Officer	C-EHSO	Construction Site	Mitigation measure implementation and reporting
Project Management and Implementation Support Consultants	PMIS	Phnom Penh	Project final design and implementation, support and capacity development Engineering supervision for all construction and reporting including Construction Supervision Consultant (PMIS-CSC)
International and National Environment Specialists	PMIS -I/NES	Phnom Penh within PMIS team	Environmental safeguards and reporting support during design and implementation - Intermittent
Asian Development Bank	ADB	-	Review project progress, compliance with covenants and advise on corrective actions

Table 2: Responsibilities for Environmental Safeguards

Institution	Prior to Construction including Detailed Engineering Design	During Construction	During Operation and Commissioning
Executing Agency	• Ministry of Public Works and Transport responsible for ensuring the implementation of the mitigation in the EMP and for ensuring compliance with loan covenants • Collaborate with the MoE for the Subproject's compliance with the Government's environmental safeguard requirements on IESIA and EMP implementation		
PSC	• Oversee implementation in conformity with the Project's development objectives and scope • Assist in coordination among government agencies involved in Project implementation including MoE • Ensure coordinated and efficient Project implementation activities including EMP implementation		
DPWT	Collaborate with PDoE & relevant provincial agencies on matters concerning the environmental management of the Subproject.		
PMU / PMU-ESO	• Update IEE & EMP • Coordinate with Design Consultant to ensure the incorporation of updated findings & mitigation measures in design & bidding documents. • Ensure EMP is part of the bidding documents, EMP clauses are incorporated in bidding documents, contracts. • Ensure MoE approval of IESIA Report has been secured prior to awarding of civil works. • Review contractor's Construction EMP (CEMP) against ADB and IESIA requirements and issue approval before the contractor mobilizes. • Conduct affected people consultation • Participate in training provided by PMIS • Establish GRM and making affected persons aware of GRM focal points, contacts and procedures'	• Conduct inspections and spot checks to monitor the performance of the Contractor in implementing the CEMP/EMP • Review monthly progress report of Contractor • Review environmental quality monitoring results. • Prepare the Project's Semi-Annual Environmental Monitoring Reports for submission to ADB with support from PMIS. • Implement the GRM for environmental issues • Conduct appropriate consultation and monitoring of effect of construction on affected people • Participate in training provided by PMIS	• Review relevant operator monitoring reports. • Prepare the Project's Semi-Annual Environmental Monitoring Report (SEMR) for submission to ADB, until loan closure or as agreed. • Ensure all GRM complaints are closed out to affect person's satisfaction
PIU-ESC	• Coordinate and collaborate relevant provincial agencies, as necessary • Support PMU-ESO • Conduct affected people consultation • Establish health & safety baseline conditions in affected villages. • Establish GRM for Environmental Issues • Participate in training provided by PMIS	• Collate monthly progress report of Contractor, and submit to the PMU. • Conduct monthly EMP verification checklist and reporting • Oversee the conduct of the environmental effects monitoring to be managed by the contractor and tested to be conducted by MoE Laboratory. • Prepare the draft Semi-Annual Environmental Monitoring Reports and submit • Implement the GRM for environmental issues • Conduct appropriate consultation and monitoring of effect of construction on affected people • Participate in training provided by PMIS • Spot checks to verify EMP implementation	• Review relevant operator monitoring reports • Support reporting requirements of PMU. • Ensure all GRM complaints are closed out to affect person's satisfaction
PMIS-N/IES	• Provide technical advice/assistance, IEE/EMP update • Review bidding documents, review CEMP against the EMP; confirm subproject readiness.	• Provide technical advice/assistance, e.g., preparation of Semi-Annual Environmental Monitoring Reports for ADB, review of results of environmental effects monitoring.	• Organize, prior to project completion report (PCR) mission, a survey to assess community satisfaction with project implementation and

	• Ensure environmental considerations included in Detailed Design • Environmental related training for PMU, PIU, contractors and other stakeholders • Incorporate mitigation measures in design & bidding documents • Incorporate EMP as part of bidding documents, EMP clauses in bidding documents, contracts • Support PMU/PIU with appropriate consultation	• Environmental related training for PMU, PIU, contractors and other stakeholders • Support PMU/PIU with appropriate consultation • Site visits to check on construction, EMP implementation and affected people, in collaboration with PMU	EMP implementation performance. Draft environment sections of the PCR.
PMIS-CSC		• Contribution to EMP and Health and Safety verification	
ADB	• Review and clear updated IEE/EMP and disclose on the ADB Website • Review bidding documents and confirm readiness of subproject.	• Review Project SEMRs and disclose on ADB's website. • Carry out review missions • Review project progress, compliance with covenants and advise on corrective actions	
Contractor-EHSO	• Prepare a CEMP that addresses as minimum the requirements of the EMP.	• Implement mitigation measures • Conduct CEMP implementation monitoring and reporting • Conduct environmental quality monitoring as prescribed in SPS-compliant EMP. (If an independent Licensed Laboratory will not be engaged.) • Prepare Monthly environmental monitoring report (EMRs).	
Operator			• Implement mitigation measures & conduct internal EMP implementation monitoring. • Prepare Monthly and Annual EMRs.
MoE/PDoE	• Review, comment on approve IESIA Report	• Monitor compliance with approved IESIA & EMP.	• Monitor compliance with environmental standards.
Municipality	• Facilitate obtaining the necessary inputs from and/or participation/cooperation of, concerned communes and villages through collaboration with their Commune Councils. • Facilitate (& participate in) GRM dissemination and implementation	• Participate in the monitoring of the performance of Contractor in EMP implementation. • Review EMRs & results of environmental effects monitoring • Facilitate & participate in GRM dissemination and implementation.	
Commune Councils	• Facilitate & participate in GRM dissemination and implementation	• Participate in the monitoring of the performance of Contractor in EMP implementation. • Review EMRs & results of environmental effects monitoring. • Facilitate & participate in GRM dissemination and implementation.	

1. Institutional Capacity Review and Needs

17. The PMU and PIU for Kampong Chhnang are managing the current implementation works under the Project for another subproject. However, in order to build on existing experience, further training and capacity building is incorporated into the EMP for this Subproject.

18. In addition, through understanding existing operations for sewage and drainage system and WWTPs in Kampong Chhnang elsewhere in Cambodia, it is clear that there is limited maintenance and WWTPs do not operate for long at their design standard. The limiting factors affecting the operators' ability to maintain adequate standards are likely to be a function of (i) a lack of technical capacity and experience; (ii) lack of staff and (iii) insufficient budget.

19. A training program is set out Table 3 which addresses the safeguard reporting and implementation requirements during construction. For Operation, the Project is under discussion with MPWT with regards to operational training requirements. The Project consultancy contract has a provisional sum[1] for targeted training allocated for Operation and Maintenance (O&M) training for all infrastructure components under the Project. A Variation Order is planned to increase the budget to allow an additional sum for specific O&M training for this subproject.

20. The PMIS-I/NES will perform key roles in supporting the PMU and PIU-ESO in implementing the EMP and ensuring the pre-construction requirements are in place.

Table 3: Capacity building and training requirement

Subject / Content	Participant (No.)	Trainer	When/ Frequency	Days / event	Cost ($) USD
EMP development and implementation – Refresher EMP function, Roles and responsibilities, CEMP development	PMU, PIU, contractors (10)	PMIS – I/NES	Twice – Once before, and once 6 months after construction starts	2	1892
EMP Monitoring and Reporting (including Consultation) -Refresher Using checklists and reporting requirements	PMU, PIU (6)	PMIS - I/NES	Once before to construction	1	1682
Grievance Redress Mechanism – roles, responsibilities and implementation	PMU, PIU, contractors, Commune Councils Village Chief, Municipality (24)	PMIS - I/NES	Twice - Once before, and once 6 months after construction starts	1	3751
Environmental protection Pollution control on construction sites (air, noise, waste water, solid waste)	PMU, PIU, contractors (5)	PMIS - I/NES	Once (during project implementation)	2	1487
					8,812

[1] $20.000

Urban Drainage and WWTP	The PMIS will prepare an O&M manual and assist the PMU and PIU in the development of specific Standard Operating Procedures and Standard Operating Guidance for various systems within the plant and for the drainage/sewerage network. Combined, the O&M Manual along with Standard Operating Procedures and Guidance should become the reference book for the entire system. Once completed, the O&M Manual may serve to support Asset Management and Emergency Response Plans. Specific training will be provided for the operation of the jetvac equipment for cleaning of the drainage/sewer lines that will be provided by the project.

IV. MITIGATION MEASURES

21. Comprehensive mitigation measures are in Table 4 below which set the minimum standards required by the construction Contractor and indicate operational mitigation measures to be implemented by the Operator. Supplementary mitigation measures are in Tables A and B for Construction Site Working Conditions Including COVID-19, and Work Camp Siting and Management. In addition, the construction Contractor is required to develop specific Construction Environmental Management Plan (CEMP) which sets out the contractor's approach to implementing this EMP and any specific method statements or plans requested. The Contractor's requirements for environmental monitoring and associated costs are in Table 7.

22. The table includes updated measures, which are further requirements of the IESIA (see mitigation measures 43-45 below). All other mitigation measures remain valid.

Table 4: Mitigation Measures

Subproject Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Estimated Cost[2] ($)	Responsibility	
				Implementation	Supervision
PRE-CONSTRUCTION					
Design	Noise and Water quality	1. Finalize design to ensure reduction of noise from pumping station and design for minimal maintenance requirement to support operation to the design standard.	Include in project cost	PMIS	EA
Confirmation of required resettlement, relocations, & compensation	No negative environmental impacts	2. No Affected households	See resettlement plans	Resettlement committees (IRC)	EA/IA
Disclosure, & engagement of community	No community impacts	3. Initiate Information Disclosure and Grievance process of IEE 4. Consultation of community based on final detailed designs	Include in project cost	PIU	PMU

[2] Costs will need to be updated during detailed design phase

Subproject Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Estimated Cost[2] ($)	Responsibility	
				Implementation	Supervision
GRM Dissemination	No community impacts	5. Establish GRM and clarify roles and responsibilities 6. Provide contractor with GRM contact details to be used for: a) GRM sign boards b) GRM Contact Cards for Affected People	Included in Project cost	PMU	PMU
		7. Erect sign boards at the construction site entrance for WWTP and sewer and drainage areas with: 8. A. Project details 9. B. GRM procedures and contact details 10. Print 'GRM Contact Cards' for all workers to give to complainants and keep cards with all vehicles, machinery and site managers/foremen 11. Affected People Training. Contractor to raise awareness of all workers on how to respond when an affected person or member of the public has a complaint i.e. direct the person to the most senior site manager present at the time and provide a 'GRM Contact Card'	Included in Bid Price	Contractor	PMU
National IESIA Approval	All	12. Ensure IESIA approvals are in place and include baseline environmental surveys as required by MoE	Included in Bid Price	PMU	MoE
IEE and EMP Updated	All	13. Update IEE and EMP to include: a) final detailed design b) further necessary environmental protection measures c) approved national IESIA requirements & mitigation measures. d) environmental quality baseline monitoring (water, air, noise) e) IESIA approved by MoE prior to contract award	Included in Project cost	Local licensed Company and PMIS	ADB/ PMU
Construction EMP (CEMP)	All	14. The contractor(s) will develop a Construction EMP (CEMP) that includes the mitigation measures set out in this table as a minimum and will include detailed individual management sub-plans for: a) Solid and Liquid Waste Management; b) Community Health and Safety and Access c) Occupational Health and Safety and Emergency Response; d) Construction Workers and Camp Management (if required). 15. The CEMP will include a map of each construction site, with copies held by the Contractor and PIU, showing as a minimum: a). Access routes, b). storage areas for waste, c). storage area for chemicals such as fuels, d) concrete mixing, e) stockpile storage	Included in Bid price	Contractor (C-EHSO)	PMU/ PMIS

Subproject Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Estimated Cost[2] ($)	Responsibility	
				Implementation	Supervision
		areas (on & off site), f) first aid kit and equipment used in emergency response, g) location of worker camps (if required) and construction staging areas and h) borrow sites. 16. The contractor will submit the CEMP to the PMU for review within 30 of contract award. Mobilization is not prohibited without an approved CEMP.			
Construction EMP (CEMP) Approvals	All	17. Approval of CEMP including site maps as required by CEMP before construction is allowed to start.	Include in Project cost	PMU/ PMIS	EA
Obtain & activate permits and licenses	Compliance obligations	18. Contractors to comply with all statutory requirements set out by Government for use of construction equipment, and operation construction plants. 19. Contractor to ensure all required permits including materials extraction permits are in place prior to construction.	Include in bid price	Contractor	PMU
UXO survey, & removal	-	20. Ensure national military is consulted to confirm all relevant areas are clear from UXO in accordance with national standards / guidance. 21. Ensure any areas used for resettlement (if required) are confirmed clear of UXO. 22. UXO Clearance specialists to clear areas where necessary and provide evidence of clearance to PMU in advance of construction. 23. PMU will share UXO clearances with ADB (requirement prior to ADB being able to issue the NOL for commencement of works).	To be confirmed if required	UXO specialists / military	PMU
Bidding	All	24. Incorporate EMP into the bid and contract requirements, including Particular Conditions for Bidding Documents.	No cost	PMU/ PMIS	EA
CONSTRUCTION PHASE					
Production, Transport and Use of Construction Materials	Air quality Resource use Waste Water Quality	25. A Traffic Management Plan will be developed and submitted to PMU for approval. This will show how a) construction traffic movements scheduled to avoid congested and/or sensitive periods; b) how traffic flows will be maintained safely c) safety measures to reduce risk of accidents including signs and speed controls. d) use of flag men	Included in Bid Price	Contractor	PIU/ PMU

Subproject Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Estimated Cost[2] ($)	Responsibility	
				Implementation	Supervision
		26. Asphalt and concrete batching facilities will be located at least 500m downwind from the nearest dwellings in order to reduce the impact of fumes on humans and to be fitted with necessary equipment such as bag house filters to reduce fugitive dust emissions. 27. Water will be sprayed on material handling areas, and borrow pits where fugitive dust is generated if it will impact on workers or residents. 28. Trucks carrying dry construction materials such as earth will be covered with tarpaulins or other suitable cover. 29. Stockpiles and materials will be stored at least 50m from surface waters with drainage directed away from the irrigation canals or drainage channels 30. Driving on unmade roads, trucks will be limited to 15 km per hour.			
Use of Machinery & Equipment	Air quality Noise and vibration Water Quality Soil Socio-economics	31. Maintain all exhaust systems in good working order; undertake regular equipment maintenance; 32. Restrict construction activities using heavy machinery work between 8am-6pm; 33. Provide advance warning to the community on timing of noisy activities. Seek suggestions from community members to reduce noise annoyance, particularly related to noise sensitive activities at receptors 34. Public notification of construction operations will incorporate noise considerations; information procedure of handling complaints through the Grievance Redress Mechanism will be disseminated. 35. Ensure noise monitoring is undertaken near sensitive receptors, particularly dwellings when construction machinery is operational 36. All construction workers will use appropriate Personal Protective Equipment (PPE) including ear defenders when operating machinery; 37. No washing or repair of machinery within 50m of surface waters including irrigation canals. 38. Use mobile Noise Barriers in populated the urban core	Included in Bid Price	Contractor	PIU/ PMU
Earthworks	Water quality Air quality Cultural heritage/ Chance Finds	39. Provision of adequate short-term drainage away from construction sites and all excavations to prevent contaminated run off entering Boeung Tum, irrigation canals or other water bodies. 40. Installation of temporary storm drains or ditches for construction sites to manage and control the flow and direction of surface water run off	Included in Bid Price	Contractor	PIU/ PMU

Subproject Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Estimated Cost[2] ($)	Responsibility	
				Implementation	Supervision
		41. Spray water on areas being worked if fugitive dust is generated if it will impact on workers or residents. 42. If earthworks reveal cultural chance finds, the contractor will stop work immediately, fence off the area, and notify the PMU. Work will not commence until MPWT approval is given.			
Earthworks	IESIA Requirements	43. Installation of sewer pipes and drainage will be undertaken in sections of 30m in order to avoid dust along the road during dry season and mud during rainy season 44. Back-filling to raise the WWTP above the flood level will be undertaken in dry season before flood levels rise from Tonle Sap lake and river. 45. Soil for back-filling to raise the WWTP above the flood level will be tested to confirm no contamination prior to use at the WWTP site.			
Excavations	Livelihoods access Noise Dust	46. A night time construction schedule (8pm to 4pm) will be required for market areas to minimize impact on livelihoods, the exact location for which will be agreed with PMU. 47. Mobile noise barriers will be used for night time work 48. The community affected by night time working noise will be warned at least two weeks in advance, with start and end dates and construction times.	Included in Bid Price	Contractor	PIU/ PMU
Storage and Use of chemicals and fuels	Air quality Water quality Soil quality	49. Refueling only in designated areas which are to be 200m from a water course and drip trays to be used when refueling or topping up / changing machinery fluids 50. Construction fluids such as oils, and fuels should be stored and handled on a bunded impermeable surface; a bund will be provided around any above ground fuel storage tanks with a capacity of 110% of the largest single tank. 51. All chemicals and fuels will be labeled 52. Spill control measures will be included in emergency response measures	Included in Bid Price	Contractor	PIU/ PMU
Implementation of Spoil, Solid and Liquid Waste Management Sub-Plan A	Soil quality Water quality, Resource use Socio-economics	53. Sub-plan will include measures to explain how the contractor will: a) Follow the waste hierarchy and demonstrate how waste will be prevented, reused and recycled b) Implement effective management of materials on site through good house-keeping and work planning to prevent spoilage (waste).	Included in bid price	Contractor	PIU/ PMU

Subproject Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Estimated Cost[2] ($)	Responsibility	
				Implementation	Supervision
		c) Clear arrangements for storage and transportation of all hazardous and non-hazardous waste to an authorized and approved disposal point (approved by Provincial Department of Environment). d) Recyclables to be separated at source and given/sold to recycler (plastic, metal, card, paper as a minimum) e) All solid waste to be stored in containers with lids. f) Prohibit burning of waste at all times; g) Train all vehicles/drivers to prevent any unauthorized waste disposal from vehicles h) Immediately clear and waste which escapes including waste in water ways including drainage ditches i) Identify criteria for spoil disposal including levels of contamination and location for spoil disposal (to be approved by municipal authorities) j) No disposal of spoil on agriculturally productive land or within 50 m of a water course			
Implementation of Community Health and Safety and Access Sub-plan B	Socio-economics	54. **Community H&S and Access - measures** to be included in the management sub-plan will include: a) Signing, lighting, guarding. Details of signs, lighting, and fencing, , and buffer zones which will be provided around all construction sites including access roads and populated (Kampong Chhnang urban centre). b) Use of Warning signs which will be set up if mud is likely on public roads. Mud will be removed at the end of each day. Other spillages on public roads will be removed immediately. c) Details of how safe access will be maintained for pedestrians and vehicles (motorbikes and cars) to schools, markets, houses, pagodas and commercial establishments during excavations for pipe network and WWTP construction.	Included in bid price	Contractor	PIU/ PMU
Implementation of Occupational Health and Safety and Emergency Response Sub-plan C	Socio-economics (Occupational Health and Safety), Water, Soil.	55. **Occupational H&S measures** to be included in the management sub-plan will include: d) Assurance that all workers are equipped with, and use Personal Protective Equipment (PPE). e) Specifications for the PPE to be used on site and the contractors' approach to enforcement of its use by workers	Included in bid price	Contractor	PIU/ PMU

Subproject Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Estimated Cost[2] ($)	Responsibility	
				Implementation	Supervision
		f) Details of signage giving occupational health and safety warnings and information disclosure within all construction sites – sub-plan to include example warnings. g) Details of worker education and awareness seminars for construction hazards will be given. A construction site safety program will be developed and distributed to workers. h) Details of daily toolbox meetings (safety briefings) i) Details of the site accident record book which will be maintained where all major or minor accidents and incidents are recorded with actions taken. j) Details of safety precautions when using 220 to 240V Electric Power tools if the workers are likely to be working within wet or flooded environments. k) Details of safety precautions taken for working in trenches. 56. **The Emergency Response Plan** will set out detailed Preventative Measures for all types of incidents covered in the Emergency Plan. This will include: l) Prevention of Injury and Accidents – to include Personal Protective Equipment requirements for construction workers, training requirements m) Prevention of Spillage - All construction fluids such as oils, and fuels will be stored on hard standing with sealed drainage with a capacity of 110% of the largest fuel container, will include procedures on refueling and maintaining vehicles. n) Prevention of Fire – to include measures for Ignition Sources including prevention of smoking on construction site, management of flammable materials and liquid. o) Other Incidents – prevention measures relevant to other issues considered relevant by the contractor p) The plan will outline: a. Organization of emergency areas b. Roles and responsibilities c. Training and updating plan			

Subproject Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Estimated Cost[2] ($)	Responsibility	
				Implementation	Supervision
		57. The Contractor will develop **Emergency Response Procedures** prior to construction. The procedures will cover actions to be taken in case of: a) Worker injury (e.g. construction or traffic accident) b) Spillage (e.g. fuel spillage) c) Fire (e.g. fuel or chemicals storage area); and d) Any other incidents anticipated by the contractor. 58. The Contractor will follow **the COVID-19 Mitigation Measures** in the EMP (see separate table) which include a risk assessment relating to COVID-19 prior to any construction works or site preparation to be approved by the Project.			
Implementation of Construction Workers Camp Management Sub-Plan D	Socio-economics Soil quality Water quality	59. [if required] If a camp for construction workers is required the contractor will set out a management plan which will includes: a) A map showing camp lay out, welfare facilities, and first aid kit locations. b) details of security at night for camp workers and a no weapons policy c) A schedule of training for workers including: - HIV Aids education awareness. - Relevant laws for foreign labor (including hunting, fishing and traffic rules); d) An approach to give priority to local labor force and retain evidence of how local labor recruitment efforts were undertaken 60. The contractor will follow the **Camp Siting and Management Mitigation Measures** in the EMP (see separate table) 61. If a construction camp is not required, the contractor will not require a Management Plan but will: a) Provide adequate waste disposal facilities including garbage cans for workers.	Included in bid price	Contractor	PIU/ PMU

Subproject Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Estimated Cost[2] ($)	Responsibility	
				Implementation	Supervision
		b) Provide welfare facilities including water for washing, drinking and include facilities for male and female workers c) Provide toilets for male and female construction workers with a cleaning schedule 62. The contractor will give priority to local labor force and retain evidence of how local labor recruitment efforts were undertaken			
Temporary land take	Soil, water, flora, fauna	63. For all temporary land take, the contractor will : a) Provide a layout map of staging area or other land take and its location which will not be within 200m of any surface water body and not in an area liable to flood b) Report on the condition of the land prior to its use for the Subproject 64. The site will not be at least 50m from a residential property	Included in bid price	Contractor	PIU/ PMU
Restoration and Rehabilitation	Contamination of soil and waste disposal, community health and safety	65. Topsoil from construction areas (WWTP) will be retained and used for landfill landscaping and rehabilitation 66. The contractor will provide a clear plan of how the following sites will be restored to their original condition following the end of construction; a) Worker camp b) Temporary land take c) Borrow site 67. Any damage shall be repaired as per the technical specification in the bidding documents 68. All waste will be removed, and compacted ground restored.	Included in bid price	Contractor	PIU/ PMU
Utilities disruption	Socio-economics	69. Ensure planning and co-ordination with the water supply service provider 70. Early information for residents affected by any interruptions. 71. Significant receptors including healthcare facilities will require specific detailed co-ordination actions and consultation.	Included in Bid Price	Contractor	PIU/PMU
WWTP Landscaping	Flora	72. Follow requirements in Technical Specification regarding tree size, planting and aftercare requirements 73. Native species only to be approved by PDoE	Included in Bid Price	Contractor	PIU/ PMU/ PDOE
POST-CONSTRUCTION					

Subproject Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Estimated Cost[2] ($)	Responsibility	
				Implementation	Supervision
Operation & Maintenance	Water quality, soil quality, socio-economics	74. The operator will ensure adequate ring fenced budget for the operation and maintenance 75. The operator will develop operational plans, building on those provided by PMIS to include: a) clear methods and procedures for all aspects of the WWTP operation; b) a network and WWTP maintenance schedule in accordance with the design and ensure all repairs are completed before the start of each rainy season c) Environmental analysis program for regularly testing effluent and surface water quality and identify beneficial uses for any sludge disposal, ensuring any hazardous or non-hazardous sludge disposal does not pollute the environment or cause harm to human health. d) Procedures for emergency situations including business continuity planning for COVID-19 or similar issues. e) Regular meetings with local representatives such as village chiefs to discuss any arising nuisance issues. 76. The operator will develop: a) Specific health and safety procedures b) A comprehensive H&S training program; c) Undertake risk assessments for the use of calcium hypochlorite and other chemicals used on site and retain the Material Safety Data Sheet for the chemicals on site; d) An approach to ensure the use of appropriate PPE; e) Develop emergency procedures and f) Provide access to first aid	O&M cost	DPWT	MPWT

2. COVID-19:

23. WHO[3] defines '*quarantine'* as the separation of a person who is not ill but who may have been exposed to an infectious person, with the objective of monitoring their symptoms and ensuring the early detection of cases. '*Isolation'* is the separation of a person who is showing symptoms or has confirmed COVID-19 to prevent the spread of infection or contamination.

24. Contractors must ensure the safe quarantine or isolation of workers and that this does not impact on their employment status.

EMP SUPPLEMENTARY TABLE A: Construction site working conditions Mitigation measures for COVID-19	
1. Form a joint team to plan and organize return to work	• Develop or convene a joint occupational safety and health committee with members representing the employer and workers. • Train team members on the basic principles for the formulation and implementation of occupational safety and health preventive and control measures. • Develop and communicate a work plan on safe working for COVID-19.
2. Risk assessment to decide when to work, who works and how	• Undertake a risk assessment to determine the preventive and control measures. • Ensure preventative measures are in place before resuming or beginning construction work.
3. Adopt engineering, organizational and administrative measures	• Avoid physical interaction and remain socially distant. • Ventilate enclosed workplaces including work camps and communal spaces. • Avoid concentration of workers - limit the capacity of common areas such as work camp dining rooms and changing rooms to allow the minimum separation of 2 meters and organize one-way systems. This includes sleeping areas which must be a minimum of 2 meters between beds. • Put in place training and information on COVID-19 and measures required for its management. • The construction site is to be segregated to the extent possible in zones or other methods to keep different crews physically separated at all time. • Stagger break and lunch schedules to minimize the number of people in close proximity to one another.
4. Regularly clean and disinfect	• Increase the frequency of cleaning and disinfection, in particular heavily trafficked areas and common areas, including work camps. • All door handles, railings, ladders, switches, controls, eating surfaces, shared tools and equipment, taps, toilets, and personal areas are wiped down at least twice a day with a disinfectant. • Discourage the sharing of items such as cups, glasses, plates, tools.

[3] WHO (19 March 2020) Considerations for quarantine of individuals in the context of containment for coronavirus disease (COVID-19) https://apps.who.int/iris/bitstream/handle/10665/331497/WHO-2019-nCoV-IHR_Quarantine-2020.2-eng.pdf

5. Promote personal hygiene	• Provide workers with the conditions and means necessary for frequent hand washing (soap, water or alcohol gel) with a posted hand washing protocol at site entries, exits, bathrooms, communal areas, offices, and any other areas with commonly touched surfaces. • Inform workers of the need to avoid physical contact when greeting, and avoid touching eyes, nose and mouth. • Inform workers of the need to cover the mouth and nose with a disposable handkerchief when coughing or sneezing or the crook of their arm. • Dispose of tissues in a lined and covered waste bin and wash hands afterwards.
6. Provide personal protective equipment (PPE) and inform workers of its correct use	• Identify appropriate PPE related to the tasks and health and safety risks faced by workers according to the results of risk assessment and the level of risk, and provide it to workers free of charge and in sufficient number, along with instructions, procedures, training and supervision. • Non-medical face-coverings (such as homemade cloth masks) should be worn as mitigation for catching and transmitting the virus, but are not to be treated as substitutes for proper handwashing.

7. Health surveillance and insurance	• Before entering the site, staff and visitors must confirm that they are not currently exhibiting flu-like symptoms.
	• Monitor the health status of workers, develop protocols for cases of suspected and confirmed COVID-19. The protocol will state that :
	  ○ workers with **symptoms or confirmed cases** must be isolated within the construction camp or stay at home for 7 days after symptoms started.
	  ○ If symptoms persist after 7 days the person must isolate until the symptoms stop.
	  ○ People who have been **in close contact** with the person with confirmed COVID-19 be quarantined for 14 days.
	• All workers in quarantine or isolation must be provided with adequate food, water, medical assistance and sanitation.
	• Identify workers who have had close contact with people infected with COVID-19 and follow national medical guidance.
	• Communicate confirmed cases of COVID-19 infection to the appropriate authorities.
	• All workers should be provided with health insurance that includes COVID-19 treatment

8. Consider other hazards, including psychosocial	• Promote a safe and healthy working environment free from violence and harassment. • Encourage health promotion and wellbeing in the workplace through enough rest, balance of physical and mental activity and adequate work-life balance. • Implement prevention and control measures for the use and storage of chemicals, particularly those used for disinfection during COVID-19.
9. Review emergency preparedness plans	• Develop an emergency plan adapted to COVID-19 and regularly review it.
10. Review and update preventive and control measures as the situation evolves	• Periodically monitor prevention and control measures to determine whether they have been adequate to avoid or minimize risk, and identify and implement corrective actions for continuous improvement. • Establish and maintain records related to work-related injuries, illnesses and incidents, worker exposures, monitoring of the work environment and workers' health.

	• Construction Workers and Camp Management.
Source: Adapted from: ILO, [4] WHO, [5] [6], [7] Canada Construction Association,[8] and UK Government.[9]	

[4] ILO (May 2020) Practical Guidance: Safe Return to Work. Ten Action Points.
[5] WHO (19 March 2020) Getting your workplace ready for COVID-19
[6] WHO (17 March 2020) Home care for patients with COVID-19 presenting with mild symptoms and management of their contacts
[7] WHO (16 April 2020) considerations in adjusting public health and social measures in the context of COVID-19
[8] Canada Construction Association (April 2020, version 4) COVID-19 Standardised protocols for all Canadian construction sites.
[9] www.gov.uk (19 May 2020) Working safely during coronavirus COVID-19: Construction and other outdoor work

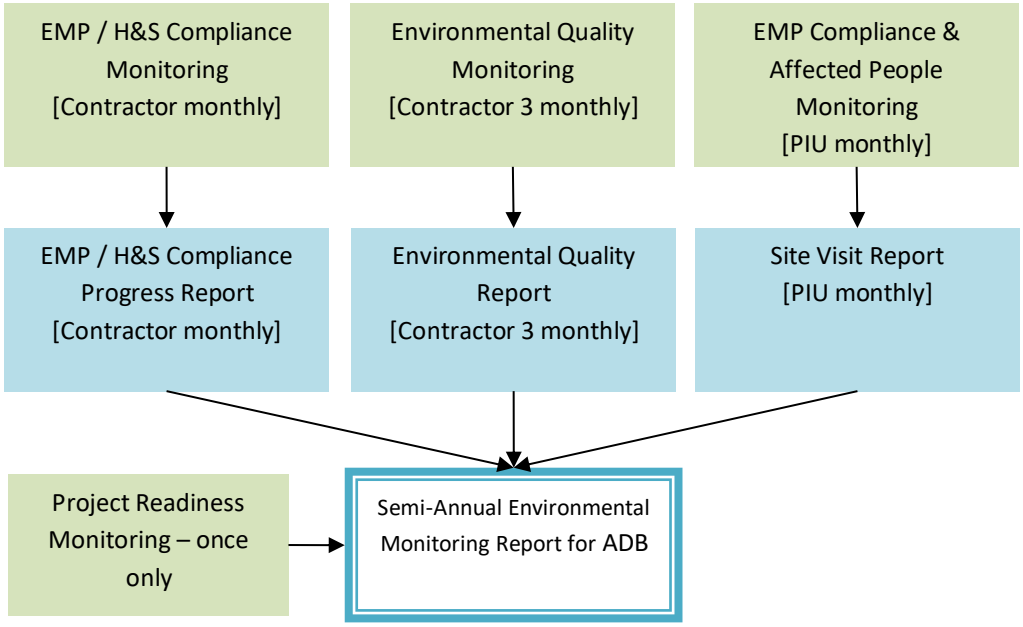
EMP SUPPLEMENTARY TABLE B Worker Camp Siting and Management Mitigation Measures for Health and Safety and COVID-19	
1. Siting	• Not in area liable to flooding, landslide or other natural disaster • Not in area affected by construction dust, noise, sewage or other pollution • Not in a residential area
2. Minimum housing standards	• a separate bed for each worker • beds should not be arranged in tiers of more than two; • separate accommodation of the sexes or to accommodate couples • adequate natural light during the daytime and adequate artificial light • adequate ventilation to ensure sufficient movement of air • adequate supply of safe potable water • adequate sanitary facilities (see below); • adequate drainage • adequate furniture for each worker to secure his or her belongings, such as a locker. • common dining rooms, canteens or mess rooms, located away from the sleeping areas • appropriately situated and furnished laundry facilities • reasonable access to plug sockets for charging telephones and other devices • rest and recreation rooms and health facilities, where not available in the community.
3. Minimum accommodation sizes	Sleeping space • inside dimensions over 198 centimeters by 80 centimeters; Sleeping room: • headroom of over 203 centimeters allowing full free movement • Beds minimum 2m apart for COVID-19 risk management
4. Sanitation Facilities	• One toilet, one tap / basin, one toilet for every 6 people • Convenient location to accommodation • Provision of soap • Separate facilities for men and women • Ventilation to open air • Fresh cold running water • Clean and hygienic • Septic tank / sewage treatment facility, or pit latrines located at least 200m from surface waters, and in areas of suitable soil profiles, downstream of groundwater wells and above the groundwater levels
5. Health and Safety within worker accommodation	• Separate area for sick workers to prevent transmission of disease • Smoke detector in sleeping area • Fire safety throughout accommodation such as fire extinguishers, fire alarms, fire blankets • Worker training in fire prevention and procedures • Fire exit sign, adequate means of escape and clearly maintained exit • Security lighting within camp and for sanitation block and lighting for route from sleeping area to sanitation block.

	• Electrical cables to be in safe condition, elevated and not in areas liable to flood
6. Inspection	• 2 weekly inspection to inspect for cleanliness, state of repair of building, accommodation and fire equipment. • Record inspection results and retain for review
Source: Adapted from ILO Workers' Housing Factsheet No.6.[10]	

V. MONITORING AND REPORTING

25. Monitoring and reporting are linked. All monitoring is reported and supports the development of the semi-annual environmental monitoring report (SEMR) required by ADB, as shown in Figure 3.

Figure 3 Monitoring and reporting outline



26. The project monitoring required by the EMP and its costs is shown in Table 5.

Table 5: Monitoring requirement

Monitoring Type	Purpose	Estimated Cost or Source of Budget
1. Project readiness monitoring	Monitoring to check progress on project readiness and close gaps through corrective actions	No additional cost, part of project activities

[10] ILO (2009) Workers' housing. ILO Helpdesk Factsheet No. 6

2. Project phase environmental quality monitoring	To be conducted by a competent authority or person appointed by the Contractor, involving the collection and analyses of air quality, noise and water quality data at designated monitoring locations for assessing compliance with applicable environmental quality and emission standards during construction See Table 7	$15,800/year from project budget EIA and UXO requires separate budget
3. EMP compliance monitoring	To be conducted by the Contractor's-EHSO and verified by PIU/PMU with support from PMIS- I/NES during project implementation. See Table 8	No additional cost, part of project implementation activities
4. Affected People monitoring	A consultative approach. This is to be conducted by the PIU via consulting affected people on the impacts during construction. See Table 8	No additional cost, part of project implementation activities
5. Operational phase environmental quality monitoring	This is required as part of the operation of the WWTP will be undertaken by the relevant government department See Table 7.	Included in operator O&M costs

27. Contractors will bear the costs for all mitigation measures during construction, including those specified in the tender and contract documents as well as those to mitigate unforeseen impacts due to their construction activities.

28. The selected operators, private sector or government, will bear all environmental monitoring and reporting costs during the operational stage.

A. Project Readiness Monitoring

29. Before construction, the PMIS Consultant will monitor the project's readiness on environmental management based on a set of indicators and report it to ADB and PMU, see Table 6. This assessment will formally demonstrate that environmental commitments are being carried out and environmental management systems are in place before construction starts, or suggest corrective actions to ensure that all requirements are met.

Table 6: Project Readiness Assessment Indicators

Indicator	Criteria	Are the Criteria met? Yes/No	If No, What Corrective action is needed?	Date for Corrective Action Completion
1. EMP update	EMP updated after domestic IESIA approval and detailed design & cleared by ADB/MoE	Y/N		
2. Compliance with loan covenants	The borrower complies with loan covenants related to project design and environmental management	Y/N		
3. Public involvement effectiveness	Meaningful consultation completed	Y/N		
	GRM established with entry points	Y/N		
4. Environmental supervision and monitoring in place	Recruitment of MPWT staff as set out in the Institutional Arrangements for this EMP	Y/N		
	Nomination of government staff for PIU roles as set out in the Institutional Arrangements for this EMP	Y/N		
5. Bidding documents and contracts with	Bidding documents and contracts incorporate the environmental activities and mitigation measures required by this EMP	Y/N		

environmental safeguards	Bidding documents and contracts incorporate any specific particular conditions specified in the appendix to this EMP	Y/N		
6. EMP financial support	The required funds have been set aside for EMP implementation including training and capacity building	Y/N		

B. Environmental Quality Monitoring

30. The monitoring requirements in the approved IESIA report are less stringent than those in the Borrower EMP, with fewer sampling locations and longer intervals in between sampling. Therefore the Borrower EMP monitoring requirements are updated as follows:

- The surface water quality locations are changed to match the IESIA baseline, including the IESIA two locations. Boeung Tum, as the receiving water body for the WWTP effluent and adjacent to the construction site is retained as a sampling location.
- Budget line of $4,800 is removed, which was for MoE/PDoE field observations, because this was not specified by MoE in the IESIA. The budget is reallocated to accommodate the additional water sample as a result of the IESIA and the higher cost of air sampling estimated by the IESIA which is a more up to date price (based on 2021 prices); the total budget per year for monitoring remains the same.

31. During construction, the impact on the sensitive environmental receptors will be monitored and compared against the relevant national standard (Annex 2). During operation, the relevant operator will be expected to maintain an adequate budget to ensure environmental monitoring can be undertaken as specified in Table 7.

Table 7: Environmental quality monitoring requirements

Aspects/Parameters to be Monitored	Location	Means of Monitoring	Frequency	Estimated Cost (USD)*	Responsibility
A. Prior to Construction Phase (INCLUDED IN DOMESTIC IESIA COST)					
1 Ambient air quality CO, NO_2, SO_2, TSP, O_3, Pb, PM 10 &PM 2.5	WWTP site [IESIA did not sample urban air quality]	Analytical methods outlined in the guideline of the MoE, or applied by MoE	Once	3,250	**Implement**: PMU via EIA company **Verify**: PMIS
2 Ambient noise levels Lmax, Lmin, Leq			Once		

3 Surface water quality pH, DO, TSS, Fe, BOD5, COD, Oil and Grease, Detergent, SO_4, NH_3, TN, TP, Pb, AS, Cd, Hg and Total Coliform.	SW1at Sangkat Phsar Chhnang (X: 464969; Y: 1354463); SW2 at Sangkat Kampong Chhnang (X: 465503; Y: 1354111)	Analytical methods outlined in Cambodia's Drinking Water Quality Standards, 2004	Once	750	
4. Mine Clearance and Unexploded ordnance	To be included in Bill of Quantities				
Sub-Total (Prior to construction for baseline data)				4,000	
*Costs include laboratory analysis and associated costs of sampling such as transport and accommodation based on MoE quote					
B. Construction Phase					
5. Ambient air quality CO, NO_2, SO_2, TSP, O_3, Pb, PM 10 &PM 2.5 (Monitor only when construction activities occur within 250 m of nearest residential receptor)	Housing near WWTP site and Urban receptor in town (Market, Wat Kampong Os Leur, Provincial Referral Hospital)	Analytical methods outlined in the guideline of the MoE or applied by. MoE.	Every 3 month	9,000	**Implement**: Contractor **Verify**: PMU / PMIS
6. Ambient noise levels Lmax, Lmin, Leq (Monitor only when construction activities occur within 100 m of nearest residential receptor)					
7. Surface water quality pH, TSS, BOD5, COD, Oil and Grease, TN, TP	SW1at Sangkat Phsar Chhnang (X: 464969; Y: 1354463); SW2 at Sangkat Kampong Chhnang (X: 465503; Y: 1354111) Boeung Tum, open water close to construction site Project location	Analytical methods outlined in Cambodia's Drinking Water Quality Standards, 2004		6,800	
Sub-Total (Construction) PER YEAR				15,800	
C. Operation Phase					

9. Surface water quality pH, TSS, BOD5, COD, TN, TP and Total Coliform.	Boeung Tum, open water within 500m of outfall	Analytical methods outlined in Cambodia's Drinking Water Quality Standards, 2004	As per PMIS O&M Manual	Included in O&M cost of Operator	**Implement**: Operator **Verify**: DPWT/MPWT
10. Effluent quality COD, BOD, TSS, TN, TP, NH3, pH, Oil /Grease as per Annex 2 of Sub-decree 27.	Final effluent from WWTP	Analytical methods outlined in the guideline of the MoE or applied by. MoE.	As per PMIS O&M Manual	Included in O&M cost of Operator	**Implement**: Operator **Verify**: DPWT/MPWT

C. EMP compliance monitoring

32. In order for the EMP to be effective, all its mitigation measures in the EMP must be monitored to ensure they are implemented. Table 8 defines the responsibilities of the Contractor and PIU to support the PMU in monitoring the monthly progress against the EMP during construction. Note this applies to construction only; during operation, it is the responsibility of the appropriate ministry or its line department to ensure monitoring of operational facilities is incorporated in the operations and maintenance manual and carried out routinely. Table 8 also shows the PIU/PMU responsibility for monitoring through consultation with affected people.

Table 8: EMP compliance and affected people monitoring

Environmental Indicators /EMP activity	Location	Method & Frequency	Responsibility		Estimated Costs (USD)
			Implement	Verify	
Construction Phase – All Sub-Projects					
Air Quality & Noise	Civil works sites	Monthly checking against mitigation measures specified in this EMP	Contractor EHSO	PIU-ESC With support from PMIS-N/IES	Included in project budget / contract
Water Quality	Civil works sites	Monthly checking against mitigation measures specified in this EMP			
Traffic Management Plan	Civil works sites	Monthly checking against mitigation measures specified in this EMP			

Environmental Indicators /EMP activity	Location	Method & Frequency	Responsibility		Estimated Costs (USD)
			Implement	Verify	
Implementation of Solid and Liquid Waste Management Sub-Plan	Civil works sites	Monthly checking against mitigation measures specified in this EMP			
Implementation of Community Health and Safety and Access Subplan	Civil works sites	Monthly checking against mitigation measures specified in this EMP			
Implementation of Occupational Health and Safety and Emergency Response Sub-Plan	Civil works sites	Monthly checking against mitigation measures specified in this EMP			
Implementation of Construction Workers and Camp Management Sub-Plan	Civil works sites	Monthly checking against mitigation measures specified in this EMP			
Community Issues - At all construction locations Environmental impacts of civil works (e.g., solid & liquid waste, local flooding, pollution). Any unforeseen impacts caused by accidentally e.g. through spillages Civil nuisance (e.g., noise, disrupted business, social issues, community health and safety). Impaired use of access roads (e.g. traffic issues and access). GRM and its procedures & key contacts		Consultation interview with Affected People Using the form in Appendix 1 4-6 weeks after construction starts Every 2 months until end of construction	PMU-ESO	PIU-ESC	Included in PIU staff/travel budget

D. Reporting requirements

33. Environmental monitoring reports are designed to coincide with monitoring i.e. all monitoring will be reported. The monthly reports will be used to collate the semi-annual environmental monitoring report. This report will be prepared semi-annually for the EA by the Project Management and Implementation Support consultants in collaboration with PMU's Environmental Safeguard Officer and sent to MPWT's Environmental Safeguard Office, MoE and ADB. The reports will table all indicators measured with the monitoring plan of EMP and will include relevant national environmental quality standards. Table 9 gives reporting requirements.

Table 9. Reporting Requirements

	Report	Frequency	Purpose	From	To
1	Contractor EMP / H&S Compliance Progress Report	Monthly	EMP Progress, Environment, Health and Safety Progress	Contractor	PMU
2	Site Visit report	Monthly	Verify EMP implementation Confirm EMP and GRM are working (consultation and observation)	PIU-ESC PMIS support (PMU verify)	PMU/PMIS
3	Environmental quality Monitoring	Varies - as per monitoring table in EMP	Relevant environmental parameters,	Contractor (or laboratory)	PMU (PMU-ESO to send to EA)
4	Environmental (Safeguards) Monitoring Report	Semi-Annual	Full EMP Implementation and Adherence to Environmental Covenants/Conditions	PMU	ADB

3. Mechanisms for Feedback and Adjustment

34. Based on environmental monitoring and reporting systems in place, the PMU shall assess whether further mitigation measures are required as corrective action, or improvement in environmental management practices are required. The effectiveness of mitigation measures and monitoring plans will be evaluated by a feedback reporting system. The PMU will play a critical role in the feedback and adjustment mechanism. If the PMU identifies a substantial deviation from the EMP, or if any changes are made to the project scope that may cause significant adverse environmental impacts or increase the number of affected people, then the PMU shall immediately consult MoE, MPWT and ADB to get approval and identify EMP adjustment requirements or update the IEE.

VI. CONCLUSIONS

A. Conclusions

35. The EMP, if implemented as directed, will mitigate impacts on the natural environment and affected people to an acceptable level. The key parties for mitigation measure implementation are the construction contractors and the operators. The implementation of this EMP will be closely monitored and reported on by the relevant stakeholders in the project.

36. The main project risks related to environment include: (i) low institutional capacity for environmental management and the possibility that the PMU and Implementing Agency or operator inadequately monitor the environmental impact and implement the EMP during the construction and operation of the project; (ii) the PMU and Implementing Agency inadequately implement corrective actions as issues arise during project implementation (iii) inadequate budget is allocated for maintenance of the WWTP.

37. The most significant long-term impacts from the project will arise from WWTP operations. As a result, the PMIS will ensure a comprehensive operation and maintenance manual with guidance is provided to the operator. Short term impacts will arise primarily from street works in a dense urban core. .

38. A robust Grievance Redress Mechanism will be established. It will ensure that all unplanned impacts which cause grievances for affected people are managed swiftly and a satisfactory outcome brought about. The PMU will ensure COVID-19 compliant consultation and awareness raising e.g. for night construction works, will be maintained throughout construction.

39. Overall, the project is anticipated to bring environmental benefits to the subproject towns and its residents. It will serve to improve the current situation and will provide long term environmental improvements.

B. Recommendations

40. The project will require agreements and commitments from the Government that the key risks from the subprojects will be mitigated as set out in the EMP. In particular the provision of adequate operation and maintenance budgets for effective long-term service delivery, in accordance with the designs is required.

ANNEXES

Annex 1 GRM Project Hotline Notice

Project Hotline

Project: Construction of [drainage and sewage network / Waste water Treatment Plant / or access road] in Kampong Chhnang

For suggestions, questions or problems related to the project, please contact any of these phone numbers: Call, SMS or Telegram

Name	Role or Company	Phone Number
	Project Management Office, Ministry of Public Works and Transport, Phnom Penh,	
	Project Implementation Office, Phnom Penh, Department of Public Works and Transport, [Town]	
	Sangkat [town]	
	Village Chief, [village]	
	Construction Contractor, [company name]	
	Construction Site Supervisor, Project Management and Implementation Consultants	

You can also contact ADB directly:

ADB, Phnom Penh Office:

[Name] and [Phone Number] and [email address]

Annex 2 Environmental Quality Standards

(1) Ambient Air Quality Standards

Source: Sub-decree **No. 42 ANRK.BK** on Air Pollution Control and Noise Disturbance, MoE 2000.

Parameter	**Averaging Period**	**Standard**	
		Unit	**Value**
Nitrogen Dioxide (NO2)	24 hours	mg /m3	0.1
Sulfur Dioxide (SO2)	24 hours	mg /m3	0.3
Carbon Monoxide (CO)	8 hours	mg /m3	20
PM 2.5 (use WHO value in Cambodia)	24 hours	mg /m3	0.025
PM 10 (use WHO value in Cambodia)	24 hours	mg /m3	0.05

(2) Ambient Noise Standards

Source: Sub-decree **No. 42 ANRK.BK** on Air Pollution Control and Noise Disturbance, MoE , 2000 and WHO. Bold highlights most stringent standard to be followed.

Areas	**Time Period (24 hours)**	**Standard**	
		National Standard (dB(A))	**WHO Community Noise (dB(A))**
RES: Residential Area MIX: Mixed Residential and Small Industries Area I&C: Industrial and Commercial	Day time (from 6:00am to 6:00pm)	(i) RES: 60 (ii) MIX: 75	RES: 55 (serious annoyance) **RES: 50 (moderate annoyance)** **I&C: 70 (hearing impairment)**
	Evening Time (from 6:00pm to 10:00pm)	(iii) **RES: 50** (iv) MIX: 70	) RES: 55 (moderate annoyance) vi) **I&C: 60 (hearing impairment)**
	Night time (from 10:00pm to 6:00am)	(vii) **RES: 45** (viii) **MIX: 50**	) RES: 45 (moderate annoyance) x) I&C: 60 (hearing impairment)

(3) Surface Water Quality Standard

Referring to Sub-decree **No. 27 ANRK.BK** on Water Pollution Control, MoE, 1999, the standards of water quality are divided as follows:

Annex 2 of Sub-decree on Water Pollution Control

Effluent standard for pollution sources discharging waste water to public water areas or sewer

No	Parameters	Unit	Allowable limits for pollutant substance discharging to	
			Protected public water area	Public water area and sewer
1	Temperature	0C	< 45	< 45
2	pH		6 – 9	5 - 9
3	BOD5 (5 days at 200 C)	mg/l	< 30	< 80
4	COD	mg/l	< 50	< 100
5	Total Suspended Solids	mg/l	< 50	< 80
6	Total Dissolved Solids	mg/l	< 1000	< 2000
7	Grease and Oil	mg/l	< 5.0	< 15
8	Detergents	mg/l	< 5.0	< 15
9	Phenols	mg/l	< 0.1	< 1.2
10	Nitrate (NO3)	mg/l	< 10	< 20
11	Chlorine (free)	mg/l	< 1.0	< 2.0
12	Chloride (ion)	mg/l	< 500	< 700
13	Sulphate (as SO4)	mg/l	< 300	< 500
14	Sulphide (as Sulphur)	mg/l	< 0.2	< 1.0
15	Phosphate (PO4)	mg/l	< 3.0	< 6.0
16	Cyanide (CN)	mg/l	< 0.2	< 1.5
17	Barium (Ba)	mg/l	< 4.0	< 7.0
18	Arsenic (As)	mg/l	< 0.10	< 1.0
19	Tin (Sn)	mg/l	< 2.0	< 8.0
20	Iron (Fe)	mg/l	< 1.0	< 20
21	Boron (B)	mg/l	< 1.0	< 5.0
22	Manganese (Mn)	mg/l	< 1.0	< 5.0
23	Cadmium (Cd)	mg/l	< 0.1	< 0.5
24	Chromium (Cr)+3	mg/l	< 0.2	< 1.0

25	Chromium (Cr)+6	mg/l	< 0.05	< 0.5
26	Copper (Cu)	mg/l	< 0.2	< 1.0
27	Lead (Pb)	mg/l	< 0.1	< 1.0
28	Mercury (Hg)	mg/l	< 0.002	< 0.05
29	Nickel (Ni)	mg/l	< 0.2	< 1.0
30	Selenium (Se)	mg/l	< 0.05	< 0.5
31	Silver (Ag)	mg/l	< 0.1	< 0.5
32	Zinc (Zn)	mg/l	< 1.0	< 3.0
33	Molybdenum (Mo)	mg/l	< 0.1	< 1.0
34	Ammonia (NH3)	mg/l	< 5.0	< 7.0
35	DO	mg/l	>2.0	>1.0
36	Polychlorinated Byphemyl	mg/l	<0.003	<0.003
37	Calcium	mg/l	<150	<200
38	Magnesium	mg/l	<150	<200
39	Carbon tetrachloride	mg/l	<3	<3
40	Hexachloro benzene	mg/l	<2	<2
41	DTT	mg/l	<1.3	<1.3
42	Endrin	mg/l	<0.01	<0.01
43	Dieldrin	mg/l	<0.01	<0.01
44	Aldrin	mg/l	<0.01	<0.01
45	Isodrin	mg/l	<0.01	<0.01
46	Perchloro ethylene	mg/l	<2.5	<2.5
47	Hexachloro butadiene	mg/l	<3	<3
48	Chloroform	mg/l	<1	<1
49	1,2 Dichloro ethylene	mg/l	<2.5	<2.5
50	Trichloro ethylene	mg/l	<1	<1
51	Trichloro benzene	mg/l	<2	<2
52	Hexaxhloro cyclohexene	mg/l	<2	<2

Remark: The Ministry of Environment and the Ministry of Agriculture, Forestry and Fishery shall collaborate to set up the standard of pesticides which discharged from pollution sources.

Annex 4 of Sub-decree on Water Pollution Control

Water Quality Standard in public water areas for bio-diversity conservation

Source: Sub-decree **No. 42 ANRK.BK** on Water Pollution Control, MOE, 1999.

a) River

Parameter	Standard	
	Unit	Value
pH	mg/l	6.5 – 8.5
BOD5	mg/l	1 – 10
Suspended Solid	mg/l	25 – 100
Dissolved Oxygen	mg/l	2.0 - 7.5
Coliform	MPN/100ml	< 5000

b) Lakes and Reservoirs

Parameter	Standard	
	Unit	Value
pH	mg/l	6.5 – 8.5
COD	mg/l	1 – 8
Suspended Solid	mg/l	1 – 15
Dissolved Oxygen	mg/l	2.0 - 7.5
Coliform	MPN/100ml	< 1000
Total Nitrogen	mg/l	1.0 – 0.6
Total Phosphorus	mg/l	0.005 – 0.05

Annex 5 of Sub-decree on Water Pollution Control:

Water Quality Standard (ground and surface water) in public water areas for public health protection (not non-potable water)

No	Parameter	Unit	Standard Value
1	Carbon tetrachloride	µg/l	< 12
2	Hexachloro-benzene	µg/l	< 0.03

3	DDT	µg/l	< 10
4	Endrin	µg/l	< 0.01
5	Diedrin	µg/l	< 0.01
6	Aldrin	µg/l	< 0.005
7	Isodrin	µg/l	< 0.005
8	Perchloroethylene	µg/l	< 10
9	Hexachlorobutadiene	µg/l	< 0.1
10	Chloroform	µg/l	< 12
11	1,2 Trichloroethylene	µg/l	< 10
12	Trichloroethylene	µg/l	< 10
13	Trichlorobenzene	µg/l	< 0.4
14	Hexachloroethylene	µg/l	< 0.05
15	Benzene	µg/l	< 10
16	Tetrachloroethylene	µg/l	< 10
17	Cadmium	µg/l	< 1
18	Total mercury	µg/l	< 0.5
19	Organic mercury	µg/l	0
20	Lead	µg/l	< 10
21	Chromium, valent 6	µg/l	< 50
22	Arsenic	µg/l	< 10
23	Selenium	µg/l	< 10
24	Polychlorobiohenyl	µg/l	0
25	Cyanide	µg/l	< 0.005

(4) Groundwater Quality Standard (for drinking) from Ministry of Handicrafts and Industry

Based on WHO (2003) Standards

Parameter	**Standard**	
	Unit	**Value**
pH	-	6.5-8.5
Turbidity	NTU	5.0

Chloride (Cl-)	mg/l	250
Sulphate (SO4)	mg/l	250
Aluminum (Al)	mg/l	0.2
Copper (Cu)	mg/l	1.0
Iron (Fe)	mg/l	0.3
Manganese (Mn)	mg/l	0.1
Zinc (Zn)	mg/l	3.0
Total Coli form	MPN/100ml	0
Mercury (Hg)	mg/l	0.001
Lead (Pb)	mg/l	0.01
Arsenic (As)	mg/l	0.05
Nitrate (NO3)	mg/l	50
Nitrite (NO2)	mg/l	3

(5) Effluent Quality Standard

(Effluent from WWP and from Leachate Treatment Facility at the controlled disposal facility)

Source: Sub-decree **No. 42 ANRK.BK** on Water Pollution Control, MOE, 1999.

No	**Parameter**	**Standard (Allowable limits for pollutant substance discharging) to**		
		Unit	**Value** **(Protected public water area)**	**Value** **(Public water area and sewer)**
1	Temperature	0C	< 45	< 45
2	pH		6 – 9	5 - 9
3	BOD5 (5 days at 200 C)	mg/l	< 30	< 80
4	COD	mg/l	< 50	< 100
5	Total Suspended Solids	mg/l	< 50	< 80
6	Total Dissolved Solids	mg/l	< 1000	< 2000
7	Grease and Oil	mg/l	< 5.0	< 15
8	Detergents	mg/l	< 5.0	< 15

9	Phenols	mg/l	< 0.1	< 1.2
10	Nitrate (NO3)	mg/l	< 10	< 20
11	Chlorine (free)	mg/l	< 1.0	< 2.0
12	Chloride (ion)	mg/l	< 500	< 700
13	Sulphate (as SO4)	mg/l	< 300	< 500
14	Sulphide (as Sulphur)	mg/l	< 0.2	< 1.0
15	Phosphate (PO4)	mg/l	< 3.0	< 6.0
16	Cyanide (CN)	mg/l	< 0.2	< 1.5
17	Barium (Ba)	mg/l	< 4.0	< 7.0
18	Arsenic (As)	mg/l	< 0.10	< 1.0
19	Tin (Sn)	mg/l	< 2.0	< 8.0
20	Iron (Fe)	mg/l	< 1.0	< 20
21	Boron (B)	mg/l	< 1.0	< 5.0
22	Manganese (Mn)	mg/l	< 1.0	< 5.0
23	Cadmium (Cd)	mg/l	< 0.1	< 0.5
24	Chromium (Cr)+3	mg/l	< 0.2	< 1.0
25	Chromium (Cr)+6	mg/l	< 0.05	< 0.5
26	Copper (Cu)	mg/l	< 0.2	< 1.0
27	Lead (Pb)	mg/l	< 0.1	< 1.0
28	Mercury (Hg)	mg/l	< 0.002	< 0.05
29	Nickel (Ni)	mg/l	< 0.2	< 1.0
30	Selenium (Se)	mg/l	< 0.05	< 0.5
31	Silver (Ag)	mg/l	< 0.1	< 0.5
32	Zinc (Zn)	mg/l	< 1.0	< 3.0
33	Molybdenum (Mo)	mg/l	< 0.1	< 1.0
34	Ammonia (NH3)	mg/l	< 5.0	< 7.0
35	DO	mg/l	>2.0	>1.0
36	Polychlorinated Byphemyl	mg/l	<0.003	<0.003
37	Calcium	mg/l	<150	<200
38	Magnesium	mg/l	<150	<200

39	Carbon tetrachloride	mg/l	<3	<3
40	Hexachloro benzene	mg/l	<2	<2
41	DTT	mg/l	<1.3	<1.3
42	Endrin	mg/l	<0.01	<0.01
43	Dieldrin	mg/l	<0.01	<0.01
44	Aldrin	mg/l	<0.01	<0.01
45	Isodrin	mg/l	<0.01	<0.01
46	Perchloro ethylene	mg/l	<2.5	<2.5
47	Hexachloro butadiene	mg/l	<3	<3
48	Chloroform	mg/l	<1	<1
49	1,2 Dichloro ethylene	mg/l	<2.5	<2.5
50	Trichloro ethylene	mg/l	<1	<1
51	Trichloro benzene	mg/l	<2	<2
52	Hexaxhloro cyclohexene	mg/l	<2	<2

(6) Soil Quality Standard

Source: Cambodia National Quality Standards for agriculture, Ministry of Agriculture, Forest, and Fishery (MAFF).

Parameter	**Standard**	
	Unit	**Value**
pH		
Salinity	ppt	6-8
Oil & Grease	mg/kg	-
Chloride	mg/kg	-
Petroleum Hydrocarbons		
Kerosene hydrocarbons (c10-c14)	mg/kg	-
Diesel hydrocarbons (c15-c28) (mg/L)	mg/kg	-
Heavy oil hydrocarbons	mg/kg	-

(c29-c36) (mg/L)		
BTEX		
Ethylbenzene	mg/kg	0.018
Benzene	mg/kg	0.0068
Toluene	mg/kg	0.08
Xylene	mg/kg	2.4
Metals		
Nickel	mg/kg	50
Copper	mg/kg	63
Zinc	mg/kg	200
Arsenic	mg/kg	12
Cadmium	mg/kg	1.4
Lead	mg/kg	70
Iron	mg/kg	-
Chromium	mg/kg	64
Mercury	mg/kg	6.6