Environmental Management Plan

March 2021

Cambodia: Second Urban Environmental Management in the Tonle Sap Basin Project

Wastewater Treatment Plant and Drainage System Subproject, Serei Saophoan Town, Banteay Meanchey Province

Prepared by the Ministry of Public Works and Housing for the Asian Development Bank. This is an updated version of the draft originally posted in May 2018 available on https://www.adb.org/projects/documents/cam-50102-002-emp-0.

CURRENCY EQUIVALENTS

(as of March 2020)

Currency unit	–	riel (KR)
KR 1.00	=	$ 0.00025
$1.00	=	KR 4,000

ABBREVIATIONS

ADB	-	Asian Development Bank
BOD	-	Biochemical Oxygen Demand
CDIA	-	Cities Development Initiative for Asia
CEMP	-	Construction Environmental Management Plan
C-EHS	-	Contractor Environmental Health and Safety Officer
CMAC	-	Cambodia Maine Action Center
COD	-	Chemical Oxygen Demand
CRVA	-	Climate Risk Vulnerability Assessment
DDPP	-	Detailed Design and Project Preparation
EA	-	Executing Agency
EIA	-	Environmental Impact Assessment
EMP	-	Environmental Management Plan
FGD	-	Focus Group Discussion
GHG	-	Greenhouse Gas
GRM	-	Grievance Redress Mechanism
IA	-	Implementing Agency
IEE	-	Initial Environmental Examination
IEIA	-	Initial Environmental Impact Assessment
MAFF	-	Ministry of Agriculture, Forest, and Fishery
MoE	-	Ministry of Environment
MOWRAM	-	Ministry of Water Resources and Meteorology
MPWT	-	Ministry of Public Works and Transport
PDoE	-	Provincial Department of Environment
PMC-I/NES	-	PMC-International and National Environmental Specialists
PIU	-	Project Implementation Unit
PIU-SFP	-	PIU Safeguards Focal Point
PMC	-	Project Management Consultant
PMU	-	Project Management Unit
PMU-ESO	-	PMU Environmental Safeguards Officer
PSC	-	Project Steering Committee
RCP	-	Representative Concentration Pathway
SHC	-	Sewer Household Connection
SPS	-	Safeguards Policy Statement
TS-1	-	Tonle Sap Urban Environmental Improvement Project
TSBR	-	Tonle Sap Biosphere Reserve
TSS	-	Total Suspended Solid
UXO	-	Unexploded Ordnance
WHO	-	World Health Organization
WWTP	-	Wastewater Treatment Plant

WEIGHTS AND MEASURES

dBA	-	A-weighted Decibel
km	-	Kilometre
km^2	-	Square kilometre
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
^oC	-	Degree Celsius
PM10	-	Particulate Matter 10 micrometres or less
PM2.5	-	Particulate Matter 2.5 micrometres or less
$\mu g/m^3$	-	Microgram per cubic meter

NOTE

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

CONTENTS

List of Tables

List of Figures

List of Annexes

1. INTRODUCTION

1.1. Purpose

1. This document is the environmental management plan (EMP) for the Wastewater Treatment and drainage system in Serei Saophoan Town, Banteay Meanchey Province subproject for the Second Urban Environmental Management in The Tonle Sap Basin Project (TS-2 project). The EMP for the WWTP subproject defines the mitigation and monitoring measures and describes the institutions, responsibilities and mechanisms to monitor and ensure compliance. Such institutions and mechanisms will seek to ensure continuous improvement of environmental protection activities during pre-construction, construction, and operation of the subproject in order to prevent, reduce, or mitigate adverse impacts.

2. The TS-2 Project also includes infrastructure components in the subproject locations of Battambang city, Battambang Province, and Stueng Saen Town, Kampong Thom Province. The Initial Environmental Examination (IEE) prepared for this subproject is found under separate cover dated March 2021.

1.2. Outline of Sub-Project Technical Approach

3. The design period for the project components is 20 years up to Year 2040. The main subproject components include:

- Construction of an urban drainage collection network for stormwater management;
- Construction of a primary and secondary wastewater collection network (46.6 km);
- Construction of tertiary sewer network, including service connections for households, commercial and institutional buildings (63.3 km);
- Construction of four (4) sewer pump stations and associated pumping mains;
- Construction of a 3,500 m^3/day Wastewater Treatment Plant (WWTP) above flood levels;
- Construction of administration, workshop, electrical and security buildings at WWTP;
- Upgrade and raise 3.0 km of access road to the WWTP site to be above flood levels;
- Construction of a dike about 2.5-3.0 m high around the WWTP for flood protection;
- Provision of Operations & Maintenance Equipment.
- Provision of necessary supporting facilities for construction of sub-project component including campsite, borrow area.

1.2.1. Wastewater Treatment Plant Outline

4. The technology is based on a pond system. Each step of treatment represents a progressively more advanced technology which leads to enhance pollutant removal efficiency and includes:

- Inlet screening – An automatic fine screen.
- Anaerobic ponds, 5 m deep - A first stage for treatment of high strength wastewaters, including mixtures of industrial/domestic wastewaters and septage with high organic loading
- Facultative ponds 2.5-3 m deep - Designed to be naturally aerated to maintain the biological activity of the bacteria
- Maturation ponds 1.5 m deep - aerobic lagoons used as UV disinfection for bacteriological pollutant removal and tertiary or “effluent polishing” treatment
- Sludge stabilization/drying ponds - sludge will need to be removed after 3-5 years.

1.3. Objective of EMP

5. The EMP describes how the impact mitigation measures and measures to enhance the benefits of environmental protection will be implemented. It explains how the measures will be managed, who (agency) will implement them, when and where they will be implemented. The following elements are described in the EMP: (i) implementation of mitigation measures during project design; (ii) implementation of mitigation measures during construction by contractors; (iii) implementation of mitigation measures during subproject operation; (iv) emergency response plan for natural or other disasters; (v) environmental monitoring plans; and (vi) allocation of costs for the implementation of the EMP.

2. SUMMARY OF POTENTIAL RECEPTORS & IMPACTS

6. The impacts of the project are influenced by the presence of receptors in the sub-project area. Without receptors, there will not be any impacts. The key receptors are shown in Table 1. In addition to these facility specific receptors, there are housing, business, access requirements, and utilities in the town that are also considered impact receptors at all locations where any excavations for pipe networks associated with the WWTP and drainage sub-project sites.

Table 1: Summary of Receptors in Sub-Project Area

City/Town	Sub-Project	Surface Water Receptors	Socio-Economic & Cultural Receptors	Land Cover/ Ecological Receptors	Protected Area Status
Serei Saophoan Town	Wastewater Treatment Plant	About 1 km from Saophoan River	- About 0.5km from residents (Kantout village). - About 4km from National Road 6 - About 5km from Serei Saophoan Town,	Lowland wet rice fields (flooded in wet season)	None
Serei Saophoan Town	Drainage system	Near the Saophoan River	- Within Serei Saophoan town - On the roadside and ROW - Locations are near the pagodas - Near the houses, business, and town utilities services	None	None
Serei Saophoan Town	Sewer line	Certain section Near the Saophoan River	- Within Serei Saophoan town - On the roadside and ROW - Locations are near the pagodas - Near the houses, business, and town utilities services	None	None
Serei Saophoan Town	Pumping Station	PS2 close to the Saophoan River, PS in town	- Within Serei Saophoan town	None	None

City/Town	Sub-Project	Surface Water Receptors	Socio-Economic & Cultural Receptors	Land Cover/ Ecological Receptors	Protected Area Status
Serei Saophoan Town	Pressurized sewer or forced main	None	- Within Serei Saophoan town and outside urban area up to WWTP - Along the road and within ROW	None	None
Serei Saophoan Town	Access road	Canal along the road	- None	None	None
Serei Saophoan Town	Borrow area	Not identified during IEE/EMP preparation	-	-	-
Serei Saophoan Town	Treated Effluent Discharge point	Irrigation canal	- None	None	None

7. Summary of adverse impacts to the receptors is presented below:

- **Air Quality.** Moderate temporary air quality impacts during the construction stage of the project are anticipated because of fugitive dust generation associated with all construction works, earth works and waste movements. Odour could be an impact during WWTP and pump operation, if those facilities are not operated properly.
- During the operation of the WWTP generation of nuisance odour may occur. The most likely sources of odour are the inlet chamber, the anaerobic ponds and the septage receiving facility. The WWTP will be in an open paddy field area with a buffer of about 500 m to the nearest houses ensuring that any release of nuisance odour from the WWTP will not impact the local residents. Monitoring of generation of offensive odour at the WWTP is included in the EMP.
- At the pumping stations (during operation), with proper operation and maintenance nuisance odours are not likely; however, this will be closely monitored, and the stations will be made ready for installation of odour control measures should this be warranted.
- **Noise.** 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 and unloading of equipment and materials.
- **Surface Water.** Construction will take place in areas close to network of irrigation canals which has been used for both household water requirements such as laundry and bathing as well as for fishing. Short term construction impacts may be seen in terms of increased turbidity during access roads improvement or other construction taking place adjacent to the canals. In addition, some construction activities will be carried out at the riverbank including outfalls for drainage. Effluent discharges will impact to water quality and water users, if the design discharge standards are not complied.
- No significant impacts on surface water are expected during the operation of the sewer and drainage networks, pumping stations and the WWTP. The WWTP effluent will be discharged to an irrigation canal next to it that is connected to Saophoan River as indicated in Figure 1. The WWTP is designed to comply with effluent standards for public water area and sewer (see Annex 4) and simple mass balance calculations based on a conservative dry season low flow in the Saophoan River of 2 m^3/s and the design treatment capacity of 3,500 m^3/d or approx. 0.04 m3/s indicate that the resulting concentrations of key water

quality parameters in the river after mixing with the effluent are well within the Cambodian ambient water quality standards. In addition, during the dry season, it is likely that most of the effluent will be used for irrigation; and in the rainy season with high flows in Saophoan River, the effect of the effluent discharge on the river water quality will be negligible.

- In terms of using the treated effluents for irrigation, as a general rule, a waste stabilization pond system comprising anaerobic, facultative and maturation ponds produces an effluent suitable for unrestricted irrigation. The microbiological quality guidelines for wastewater use in agriculture recommended by FAO also indicate that the treated effluents can be used for irrigation of cereal crops, industrial crops, fodder crops, pasture and trees. Specific microbiological analyses will be undertaken upon start of operations based on the actual strength of the raw wastewater and the performance of the treatment system to determine if the effluent can be used for unrestricted irrigation and aquaculture.
- **Flora and fauna** Baseline data indicates that the WWTP site is located in highly disturbed environment dominated by agricultural land (paddy field) with scattered tree of common species while sewerage system, drainage system and pumping stations are located in town with intense economic activities. The sub-project area is excluded from protected areas or habitat of particular biodiversity value. Therefore, the impact on flora and fauna will be minimal.
- **Soil and Land**. Soil erosion is not anticipated given the nature of the sub-projects and their locations. However, borrow sites will cause local impacts to the land. The sub-projects are in fertile agricultural locations and fertile topsoil is a valuable resource which requires protection, particularly for construction areas which are located in and around rice fields where encroachment from inappropriate spoil disposal could have detrimental impacts.
- **Community and Occupational Health and Safety.** Construction work at site and improvement of access roads will necessarily mean health and safety risks not only to construction workers, but also to people living and working around the sites. Community risks come from unauthorized access to construction sites and construction traffic i.e. use of heavy vehicles on the roads around the site. Occupational risks come from a range of activities including the use of heavy machinery, earth moving, and use of chemicals. The drainage construction activities will disturb local business and decrease their income.
- **Socio-Economic Impacts (accessibility).** The installation of sewer pipe network will require the excavation of parts of the road network. This will be in urban areas where businesses and other activities take place. The community in and around these areas will be disrupted by the noise and dust, as described above, and also by potentially impaired access (for themselves and their customers) to their properties and businesses. The drainage construction will affect local utilities: water supply, electric poles/lines, telecommunication, and other local services.

8. The Wastewater Treatment Plant (WWTP) subproject is located in Kantout Village, Phneach Commune, Serei Saophoan Town. It is about 5 km from the town centre. The wastewater system network and drainage system are within Serei Saophoan Town. Wastewater from the town area will be transported through a wastewater network system to the WWTP. The subproject locations are shown in Figure 2 and Figure 3.

Figure 1: Location of Serei Saophoan Wastewater Treatment Plant

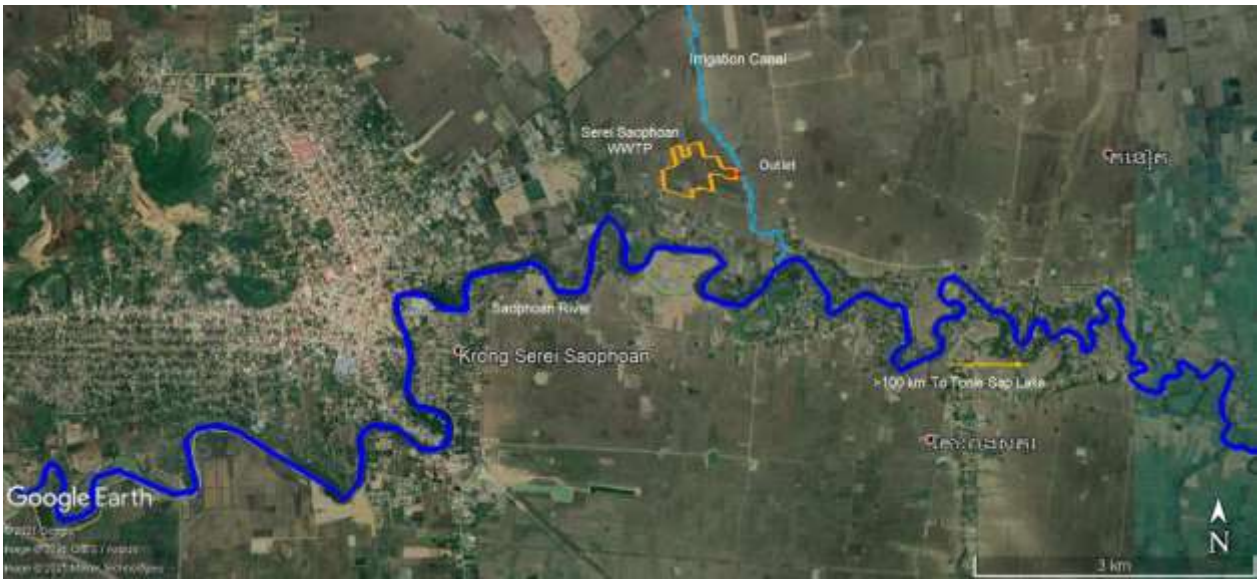
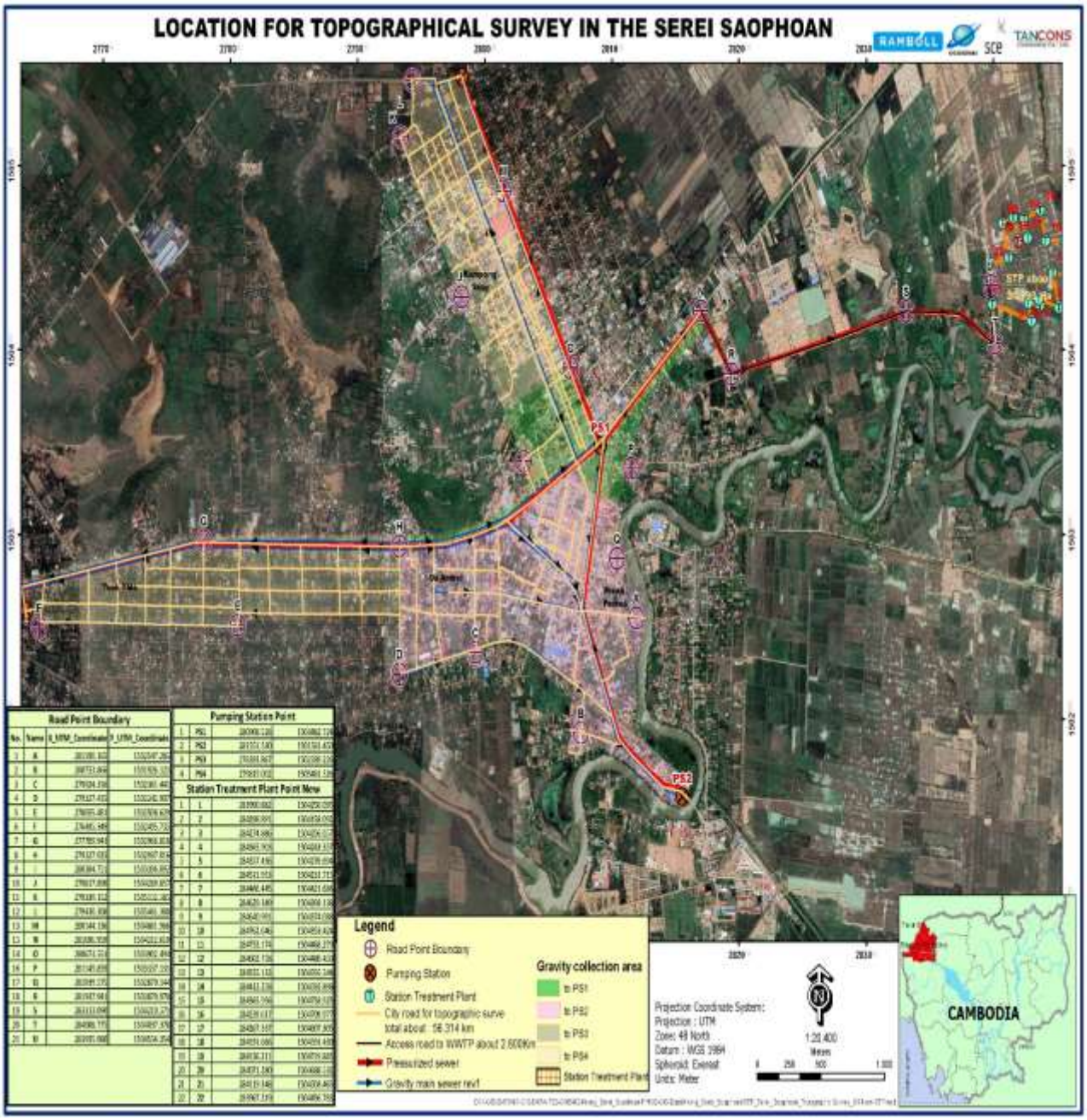
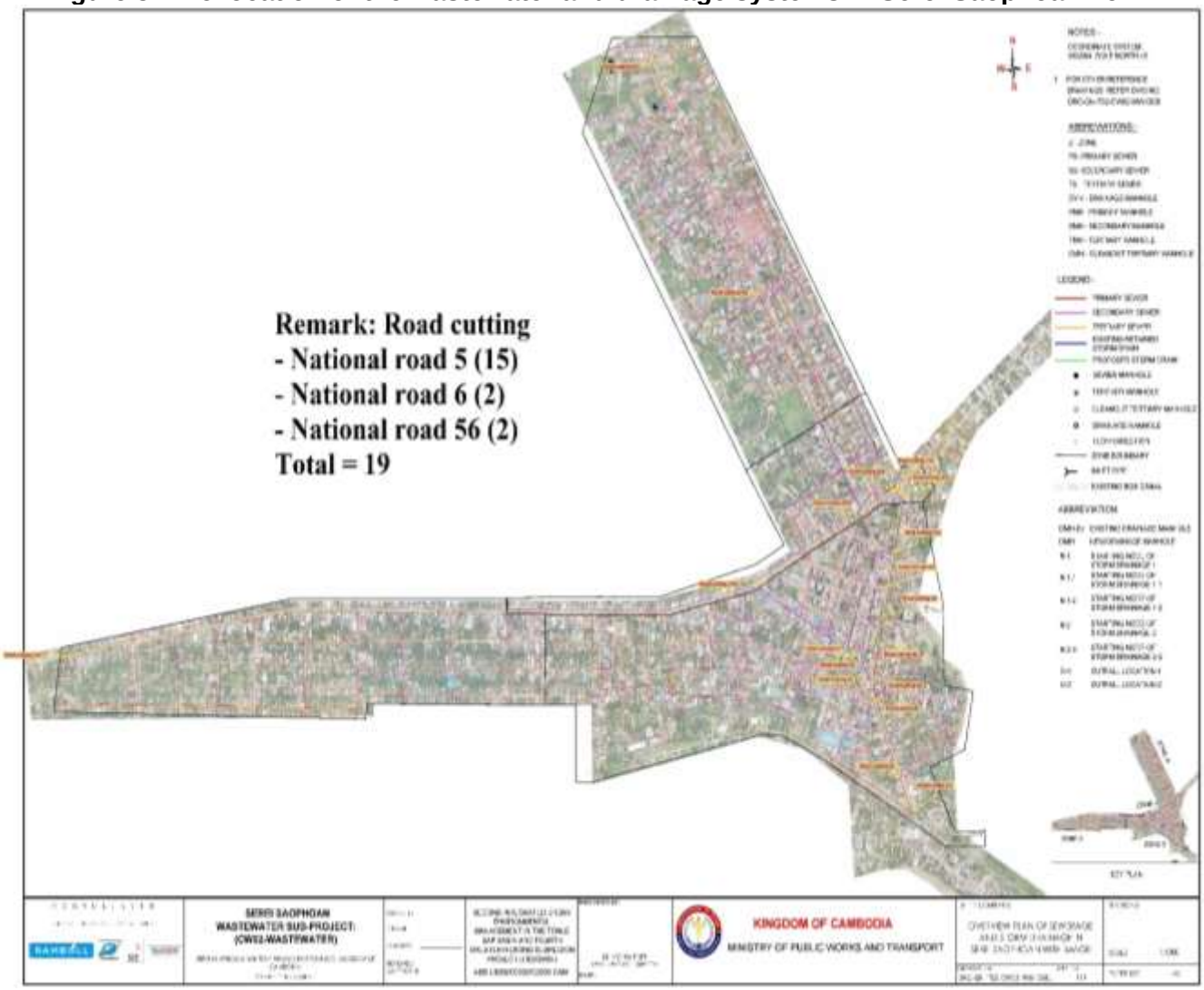


Figure 2: The Location of WWTP and Service Areas in Serei Saophoan Town



Source: Consultant Team, March 2020

Figure 3: The location of the wastewater and drainage systems in Serei Saophoan Town



Source: Consultant Team, March 2020

3. INSTITUTIONAL ARRANGEMENTS & RESPONSIBILITIES

9. The framework for implementation of the environmental management plan (EMP) for the subproject is described in this section. The key institutions, organizations and stakeholders relevant to environmental safeguards are set out below.

10. The overall responsibility for EMP implementation and compliance with loan assurances lies with the Executing Agency (EA), 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) of Banteay Meanchey Province. The PDPWT will establish a Project Implementation Unit (PIU) comprising relevant provincial government representatives including the Provincial Department of the Environment.

11. A summary of the key functions for project implementation and environmental safeguards is presented in Table 2 for ease of reference:

Table 2: Key Roles 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 (funded through CTDP4 Loan)	PMU-ESO	Phnom Penh within PMU	EMP compliance across the sub-projects for environmental safeguards - Full Time
Project Implementation Unit	PIU	Provinces within PDPWT	Responsible for sub-project implementation
PIU Safeguards Focal Point	PIU-SFP	Provinces within PIU	Responsible for sub-project environmental and social safeguard monitoring - Full Time
Contractor Environmental Compliance Officer	C-EHS	Construction Site	Mitigation measure implementation and reporting
Project Management Consultants	PMC	Phnom Penh	Project final design and implementation, support and capacity development. Engineering supervision for all construction and reporting
International and National Environment Specialists	PMC-I/NES	Phnom Penh within PMC 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
Ministry of Environment (MOE)/ Provincial Department of Environment (PDoE)	MoE/PDoE	Phnom Penh province	Collaborate with project to provide policies or environmental standards and advise. Observer and conduct environmental monitoring of the project activities based on the mandate.

Source: IEE Preparation Team.

12. A Project Steering Committee (PSC) has been established to provide policy and technical guidance for subproject implementation. The PSC is chaired by the EA and comprises relevant ministry of provincial departments representatives including the Ministry of Environment, General Department of Resettlement (GDR) and Ministry of Labour as a minimum.

13. External support to the IA/PIU for EMP implementation during the project implementation phase will be provided by the International and National Environment Specialists (I/NES) of the Project Management Consultants (PMC). An external Environmental Monitoring Institute (EMI) will be engaged to conduct the field sampling and laboratory analyses of environmental quality (e.g., water quality, air quality) that cannot be performed by other functions within the project. In Cambodia, this can be performed by qualified staffs from the Ministry of Environment (MoE).

14. ADB is responsible for reviewing project progress reports and quarterly-semi-annual environmental safeguards monitoring reports and undertaking review missions to ensure the project is implemented in line with project environmental safeguard requirements, SPS (2009) and Royal Government of Cambodia regulations and guidelines.

15. The EA will be accountable for project implementation and operation on behalf of the Royal Government of Cambodia. The responsibilities of the EA in relation to environmental safeguards requirements are summarized below:

    (i) Overall responsibility for subproject implementation and management of the Project Management Unit (PMU);
    (i) Recruit and manage qualified ESO for PMU;
    (ii) Recruit and manage Project Management Consultants
    (iii) Ensure compliance with Loan Covenants;
    (iv) Approve procurement plans, bidding documents, bid evaluation and contract awards including EMP;
    (v) Submit regular quarterly and annual subproject reports to ADB including summary on EMP and GRM implementation;
    (vi) Ensure compliance of subproject/component implementation with ADB and Government social and environmental policies, guidelines and plans;
    (vii) Approve proposed corrective actions in the event of identified impacts or non-compliance issues identified in monitoring and evaluation reports.

16. The responsibilities of the IA in relation to environmental safeguards requirements are summarized below:

    (i) Coordinate and monitor subproject implementation activities including all environmental safeguards activities;
    (ii) Coordinate capacity development program for PIU;
    (iii) Obtain necessary approvals from respective departments and other institutions prior to awarding of civil works contracts;
    (iv) Support PMU-ESO in the implementation of EMP;
    (v) Coordinate regular reporting of PMU to EA on EMP implementation;
    (vi) Undertake regular quality control inspection of subproject facilities;
    (vii) Manage the handover of subproject facilities to agencies responsible for operation and maintenance; and
    (viii) Ensure PIU engage with and follow the Grievance Redress Mechanism GRM.

17. Specific environmental safeguard responsibilities are set out for each project phase as shown in Table 3

Table 3: EMP Responsibilities

<table>
<tr><th>Responsible Entity</th><th>Engineering Detailed Design</th><th>Tendering & Pre-construction</th><th>Construction</th><th>Operation</th></tr>
<tr><td>Executing Agency</td><td colspan="4">The Ministry of Public Works and Transport is responsible for ensuring the implementation of the mitigation measures in the EMP and for ensuring compliance with loan covenants</td></tr>
<tr><td rowspan="6">PMU / PMU-ESO</td><td>Update IEE/EMP</td><td>Engage PMC & PMU-ESO</td><td>Ensure EMP is implemented, and that the contractor(s) abide by the EMP</td><td rowspan="6"></td></tr>
<tr><td>Review updated EMP</td><td>Coordinating the tendering process including overseeing incorporation of EMP clauses into the bidding documents</td><td>Supervising project construction (with support of PMC engineers)</td></tr>
<tr><td rowspan="4">Confirm that mitigation measures have been included in engineering detail design</td><td>Ensuring the procurement of environmentally responsible contractors and approve CEMP</td><td rowspan="2">Prepare and submit quarterly and annual reports including environmental safeguard reporting to ADB</td></tr>
<tr><td>Ensuring that domestic EIA approvals by MoE have been secured prior to the awarding of civil works contracts</td></tr>
<tr><td rowspan="2">Dissemination and coordination of Grievance Redress Mechanism</td><td>Ensure EMP implementation and submit regular monitoring reports to IA and EA</td></tr>
<tr><td>ensure PIU-SFPs undertake regular site inspections as part of progress reporting</td></tr>
<tr><td rowspan="4">PIU-SFP</td><td rowspan="4"></td><td rowspan="4">Attend all pre-construction training courses regarding EMP implementation</td><td>Working closely with the contractors to ensure EMP implementation</td><td rowspan="4"></td></tr>
<tr><td>Support GRM</td></tr>
<tr><td>Support Progress Monitoring and Reporting requirements working with PMU-ESO</td></tr>
<tr><td>Conduct consultation interviews with affected people</td></tr>
<tr><td>Project Management</td><td>Engage appropriate engineer and safeguards staff</td><td>See PMC-I/NES</td><td>See PMC-I/NES</td><td>Operator training and support as per ToR in PAM</td></tr>
</table>

<table>
<tr><th>Responsible Entity</th><th>Engineering Detailed Design</th><th>Tendering & Pre-construction</th><th>Construction</th><th>Operation</th></tr>
<tr><td>Consultants PMC</td><td>Finalise Detailed Engineering Design in accordance with Environmental Safeguard principles</td><td></td><td></td><td></td></tr>
<tr><td rowspan="8">Project Management Consultants PMC (PMC-I/NES)]</td><td rowspan="8">Update IEE/EMP if needed</td><td>Provide training on EMP supervision and GRM to PMU, PIU and contractors</td><td>coordinate public consultation with PMU/ ESO/ PIU-SFP</td><td rowspan="6">Organize, prior to project completion report (PCR) mission, a survey to assess community satisfaction with project implementation and EMP implementation performance. Draft environment sections of the PCR.</td></tr>
<tr><td>setting up environmental management and internal monitoring systems at PUSO and civil works contracts level</td><td>preparing annual EMP progress reports</td></tr>
<tr><td>review tender and contractor documents</td><td>identifying environment-related implementation issues and necessary corrective actions</td></tr>
<tr><td>review the Construction EMP</td><td rowspan="4">Training of PMU, PIU and other stakeholders GRM and EMP implementation</td></tr>
<tr><td>Ensure grievance redress mechanism established</td></tr>
<tr><td>regular EMP and implementation monitoring</td></tr>
<tr><td rowspan="2">Coordinate public consultation</td></tr>
<tr><td colspan="2">Organize, prior to project completion report (PCR) mission, a survey to assess community satisfaction with project implementation and EMP implementation performance. Draft environment sections of the PCR.</td></tr>
<tr><td>Contractor</td><td></td><td>Provision of Construction EMP and environmental track record in bid response</td><td>Ensure sufficient funding and human resources for proper and timely implementation of required mitigation and monitoring measures in the EMP throughout the construction phase</td><td>Ensure handover of sites is in accordance with EMP and any corrective actions identified in Project Completion Report are completed.</td></tr>
</table>

Responsible Entity	Engineering Detailed Design	Tendering & Pre-construction	Construction	Operation
			Appoint an Environment, Health and Safety (EHS) officer to oversee EMP implementation related to environment, occupational health and safety on construction site	
			Ensure health and safety	
			Implement mitigation measures	
			Act as a local entry point for the project GRM and collaborate with PMU on all GRM issues	
External Monitoring Institute		Undertake specialised environmental monitoring as contracted by PMU	Undertake specialised environmental monitoring as contracted by PMU	Undertake specialised environmental monitoring as contracted by Operator
Operator			Testing prior to commissioning to ensure discharge standards applicable to the WWTP can be met	Ensure proper operation of project facilities according to design standards & monitoring
				Allocation of budget for O&M

3.1. Institutional Capacity Review and Needs

18. Currently there is little experience of monitoring and implementing environmental mitigation measures particularly at a provincial level. There is little enforcement of environmental or health and safety legislation and routine environmental monitoring is not undertaken apart from in major urban centres (air quality) or major rivers (water quality).

19. During the preparation of the IEE, the team checked the capacity and experience at MPWT and found that there are a number of people who have fulfilled the role of 'focal point' for safeguards on a project-by-project basis, and there is an established Safeguards team within the ministry of six people. This team has experience of working on highway projects but have not to date been involved in urban development projects and are willing to be involved in any training and site visits required during project implementation. They will be provided with copies of relevant monitoring reports, the EMP and other relevant safeguard documents.

20. In addition, through understanding existing operations for the wastewater treatment in Phnom Penh, it is clear that there is still limited ability for operation and maintenance. 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; and (ii) insufficient budget.

21. A training program is set out in Table 4 which addresses the safeguard reporting and implementation requirements during construction, and the environmental and social risks from operations.

22. The engagement of a National Environmental Specialist for 10 months spread throughout implementation will be critical to ensuring the capacity of the PIU staff and to ensuring monitoring and reporting are managed effectively during implementation. This person will also work closely with the PMU Environment Safeguards Officer (PMU-ESO) in order to ensure safeguards are implemented and monitored.

23. **Training for EMP implementation**. The proposed training required for project implementation is set out in Table 4. For budgeting purposes, refer to Feasibility Report Volume 5, Institutional Strengthening and Capacity Building. Specifically, the training requirements for the project set out in the relevant Terms of Reference include:

    - Train PIUs, contractors, municipalities, and other relevant stakeholders on the implementation of the EMP;

24. **Training for investment sustainability**. The importance of training in wastewater treatment operations and management should be emphasized if the investment in wastewater treatment plant is to be sustainable and adequate operations are maintained as per the design. This is also relevant to WWTP operations. Therefore, the Feasibility Study for the WWTP includes details on operator training. For budgeting purposes, refer to Feasibility Report Volume 5, Institutional Strengthening and Capacity Building. Specifically, the training requirements for the project set out in the relevant Terms of Reference include:

    - Develop an operation and maintenance manual for each wastewater plant and collection system, and a training program on the operations manual provisions;

- Train operators on plant equipment at the wastewater treatment plant sites;
- Train operators on achievement of, and compliance with, regulatory standards and monitoring of the performance of the facilities;
- Train WWTP operators and maintenance on management of the wastewater system, odour control discharging of effluent, sludge disposal and other environmental controls related to the WWTP.

Table 4: Capacity Building and Training Requirements

Subject / Content	Participants	Trainer/ Organization	When/ Frequency	Duration (days / event)	# of participants	Cost ($) USD
EMP adjustment and implementation - Development and adjustment of the EMP, roles and responsibilities, monitoring, supervision and reporting	PMU, PIU, contractors	I/NES of Project Management Consultant	Twice - Once prior to, and once after 6 months of construction	2	10	For costs and details see: Feasibility Report Volume 5, Institutional Strengthening and Capacity Building
Grievance Redress Mechanism (GRM)-roles and responsibilities	PMU, PIU, contractors, Commune Councils	I/NES of Project Management Consultant	Twice - Once prior to, and once after 6 months of construction	1	10	
Environmental protection Pollution control on construction sites (air, noise, wastewater, solid waste)	PMU, PIU, contractors	I/NES of Project Management Consultant	Once (during project implementation)	2	10	
Environmental monitoring - Monitoring methods, data collection and processing, reporting systems	PMU, PIU, contractors, Operators of WWTP,	I/NES of Project Management Consultant & MoE (environmental analyst)	Once (at beginning of project construction)	**2**	**10**	
WWTP Management	Included as part of the WWTP investment management training budget					

Source: IEE Preparation Team.

4. MITIGATION MEASURES PLAN

25. Comprehensive mitigation measures for project are summarized in **Table 5.** In addition, the mitigation measures are also included the environmental monitoring plan.

26. **Construction Environmental Management Plans**. The Contractor is required to develop a specific Construction Environmental Management Plan (CEMP) to set out the contractor's approach to mitigate the highest risks, as identified in the environmental Impacts section of the IEE report.

Table 5: EMP Mitigation Measures for the WWTP and Drainage Subproject

Sub-Project Activity	Environmental Impact / Issue	Mitigation measures or response	Implemented by	Supervised by	Cost ($)
Pre-Construction Phase					
National IEIA Approval	All	1. The IEIA has been approved by MoE on 11 February 2021. Conditions in the approval including baseline environmental surveys shall be met	PMU-PMC Local Firm	MoE	Included in project cost
Design	Effluent Discharge	2. Final design ensures that the absorptive capacity of the receiving waterway is not exceeded and health risks to users of the waterways are minimized.	PMC-NIES	PMU	Part of Contract Cost
Disclosure and engagement of community through consultation	No community impacts	3. Initiate Information Disclosure and the Grievance Redress Mechanism 4. Consultation of community based on the final detailed design	PMU-ESO/ PIU-SFP	EA	Included in PMC cost package
Unexploded Ordnance (UXO) survey, & removal	Injured worker or public	5. Ensure national military is consulted to confirm all relevant areas are clear from UXO. This includes: a) All land to which is used for resettlement purposes (for people/businesses/ farmland) b) All construction sites including 50 m either side of any access roads c) All associated areas including borrow sites. 6. Cambodian Mine Action Centre (CMAC) to clear areas where necessary and provide evidence of clearance to PMU in advance of construction. As evidence, please submit a certificate of UXO clearance and attach it as annex to the subsequent monitoring report to ADB once the certificate of clearance has been awarded.	CMAC-PIU	PMU	To be confirmed as required
Final Design	Flooding/ Climate Change	7. Final design incorporates adequate cross drains on all facility access roads ensuring that any roads raised above natural flood level do not cause ponding or further flooding elsewhere.	PMC	EA	Included in consultancy contract price
Final Design	Emergency Response Plan	8. Ensure the operational and maintenance plan for each facility includes an emergency response plan including consideration of flooding.	PMC	EA	Included in consultancy contract price
IEE and EMP Updated	All	9. The IEE and EMP have been updated reflecting the final detailed engineering design and incorporate appropriate mitigation measures.	I/NES	PMU	Included in project cost

Sub-Project Activity	Environmental Impact / Issue	Mitigation measures or response	Implemented by	Supervised by	Cost ($)
Construction EMP (CEMP) Approvals	All	10. Prepare and develop CEMP by contractor and Approval of CEMP by consultant and PMU, including site maps as required by CEMP.	Contractor	PMC, PMU / EA	Included in project cost
GRM	Dissemination	11. Erect sign boards with project details and GRM procedures/contact details at the entrance to each construction site/camp or at strategic locations. 12. PMU to provide contractor with GRM contact details which the contractor will use to print 'GRM Contact Cards' for its staff to hand to complainants and will keep cards with all vehicles, machinery and site managers/foremen. 13. 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'.	Contractor	PMU/ PIU/ PMC	Included in bid price
Construction Phase					
Civil works	Air quality	1. Concrete batching facilities will be located at least 500 m downwind from the nearest dwellings in order to reduce the impact of fumes on humans and to be fitted with necessary emission control equipment such as bag house filters to reduce fugitive dust emissions. 2. Water will be sprayed at construction sites, material handling areas, and borrow pits where fugitive dust is generated. 3. Trucks carrying dry and loose construction materials such as earth will be covered with tarpaulins or other suitable cover. 4. Construction vehicles and machinery will be maintained to a high standard to minimize emissions.	Contractor	PMU/PMC	Included in bid price
Civil Works	Noise	5. Maintain all exhaust systems which generate noise in good working order; undertake regular equipment maintenance; 6. Restrict construction activities using heavy machinery to be between 8 am - 6 pm; 7. 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 such as periods of worship for pagodas	Contractor	PIU/PMU/ PMC	Included in bid price

Sub-Project Activity	Environmental Impact / Issue	Mitigation measures or response	Implemented by	Supervised by	Cost ($)
		8. Public notification of construction operations will incorporate noise considerations; information procedure of handling complaints through the Grievance Redress Mechanism will be disseminated. 9. Ensure noise monitoring is undertaken near sensitive receptors, particularly dwellings when construction machinery is operational; 10. All construction workers will use appropriate Personal Protective Equipment (PPE) including ear defenders when operating machinery; 11. Ensure that mobile noise barriers are available for use in populated areas where excavations are taking place			
Civil Works	Flora or vegetation	12. All trees over 3 m in construction sites to be protected from construction activities if they are not required to be removed. The cutting of trees shall be informed to DPWT and local authority to obtain permission. 13. Where possible, material from existing licensed borrow and quarry sites will be used. If new sites are needed, they will be subject to due diligence and approval by ADB and the relevant PDoE to ensure that sensitive habitats are avoided and that an appropriate restoration plan using native species is agreed following re-contouring	Contractor	PIU/PMU/ PMC	Included in bid price
Civil Works	Water Quality and Access	14. Provision of adequate short-term drainage away from construction sites to prevent contaminated run off entering water bodies including canals. 15. Installation of temporary storm drains or ditches for construction sites to manage and control the flow and direction of surface water run off 16. Stockpiles and materials will be stored at least 50m from surface waters with drainage directed away from the irrigation canals or drainage channels 17. All construction fluids such as oils, and fuels should be stored and handled within a bunded and impermeable surface; a bund will be provided around any above ground fuel storage tanks with a capacity of 110% of the largest single tank. 18. No washing or repair of machinery within 50m of surface waters including irrigation canals. 19. Pit latrines (for worker camps if required) to be located at least 200m from surface waters, and in areas of	Contractor	PIU/PMU/ PMC	Included in bid price

Sub-Project Activity	Environmental Impact / Issue	Mitigation measures or response	Implemented by	Supervised by	Cost ($)
		suitable soil profiles and above the groundwater levels. 20. Refuelling only in designated areas which are to be 50m from a water course and drip trays to be used when refuelling or topping up / changing machinery fluids. 21. Maintenance of irrigation water supplies for agriculture during dry season works within or around irrigation canals. Seek suggestions from water users if supply may be affected.			
Civil Works	Power, Water Supply and any utilities Interruption	Based on the pre-construction assessment of power and water supply locations, if the contractor identifies a risk to supplies from construction activities, the contractor will: 22. Liaise with power or water supplier to identify an approach to minimise inconvenience to residents 23. Provide advance warning to residents (minimum 2 weeks in advance) that power/water supplies will be interrupted 24. Provide alternatives for residents if the supply interruption exceeds 2 days for water	Contractor	PMU/PMC	Included in bid price
Implementation of Materials Spoil and Borrow Site Management	Soil and land resources	Site specific materials, spoil and borrow site management plan will be developed and approved by the relevant Municipal authority. The plans will include as a minimum: 25. Assess source and impacts of all materials proposed for construction. 26. A map of all borrow sites and top soil piles will be developed and maintained with copies held by the Contractor and PIU; 27. Define & schedule how materials are extracted from borrow pits, transported, and handled & stored at sites. 28. Measures to rehabilitate the borrow sites include contouring of the slopes within each site and replanting sites with native species. 29. Retention of topsoil - top soil present on construction sites will be removed and stockpiled in a labelled area for use on rehabilitation of the site post-construction or rehabilitation of borrow sites. 30. Criteria for spoil disposal including levels of contamination and location for spoil disposal (to be approved by municipal authorities).	Contractor	PMU/ PMC	Included in bid price

Sub-Project Activity	Environmental Impact / Issue	Mitigation measures or response	Implemented by	Supervised by	Cost ($)
		31. No disposal of spoil or dredged material on agriculturally productive land or within 50 m of a water course.			
Implementation of Solid and Liquid Waste Management	Resource use and natural resource contamination	Measures to be included in the management subplan will include measure to explain how the contractor will: 32. Follow the waste hierarchy and demonstrate how waste will be prevented and recycled and will show effective management of materials on site through good housekeeping and work planning 33. Clear arrangements for storage and transportation of all hazardous and non-hazardous waste to an authorised and approved disposal point (approved by Provincial Department of Environment). 34. Recyclables to be separated at source and given/sold to recycler (plastic, metal, card, paper as a minimum) 35. No waste will be stored within 20 m of a water course including irrigation channels and all solid waste to be stored in containers cover with lids. 36. Prohibit burning of waste (anytime and anywhere) and dumping in public areas or water bodies. 37. Provide all vehicles/drivers with plastic bags for waste collection and prevent any unauthorized waste disposal with particular attention paid to prevention of waste entering water ways including irrigation canals.	Contractor	PIU/PMU/ PMC	Included in bid price
Implementation of Community and Occupational Health and Safety and Emergency Response	Human health and safety	38. Community H&S measures to be included in the management sub-plan will include: • Details of appropriate fencing, protective barriers, and buffer zones which will be provided around all construction sites including barriers where needed on access roads and populated areas. • Details of Safety measures, if required, to prevent access by members of the public and livestock to any borrow site excavations • Details 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. • Details of signage and speed controls if public roads are to be affected by construction traffic. • Details of sufficient signage giving community dangers / warnings and information disclosure	Contractor	PIU/PMU/ PMC	Included in bid price

Sub-Project Activity	Environmental Impact / Issue	Mitigation measures or response	Implemented by	Supervised by	Cost ($)
		outside all construction sites, include example warnings. 39. Occupational H&S measures to be included in the management sub-plan will include: • Assurance that all workers are equipped with and use Personal Protective Equipment (PPE). • Specifications for the PPE to be used on site and the contractors' approach to enforcement of its use by workers • Sufficient signage giving occupational health and safety warnings and information disclosure within all construction sites – sub-plan to include example warnings. • 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. • Details of daily toolbox meetings (safety briefings) • Details of the site accident record book which will be maintained where all major or minor accidents and incidents are recorded with actions taken. • An Environment Health and Safety qualified engineer will be engaged for the contract and adequate first aid equipment made available on site. • Warning signs 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 • Provision will be made for safety precautions when using 220 to 240V Electric Power tools if the workers are likely to be working within wet or flooded environments. 40. COVID-19 prevention measures: • Dissemination about COVID-19 prevention and mitigation measures to staff and workers through orientation or distributing leaflet/poster at information/safety board at each construction and camp site; • Daily checking temperature of staff and workers prior starting the works;			

Sub-Project Activity	Environmental Impact / Issue	Mitigation measures or response	Implemented by	Supervised by	Cost ($)
		• Staff and workers have to wear masks all the time and properly; • Do not share personal items or supplies such as phones, pens, notebooks, tools, etc.; • Avoid common physical greetings, such as handshakes; • Maintain a minimum physical distance of one metre from others if possible; • Wash hands often with soap and water for at least 20 seconds after using the washroom, before handling food, after blowing nose, coughing, or sneezing, and before smoking. If hands are not visibly soiled, and soap and water are unavailable, alcohol-based hand sanitizer can be used; • All offices and jobsites implement additional cleaning measures of common areas. All door handles, railings, ladders, switches, controls, eating surfaces, shared tools and equipment, taps, toilets, and personal workstation areas are wiped down at least twice a day with a disinfectant, such as disinfectant wipes. Individuals are responsible for cleaning and disinfecting their workstations; • Commonly touched surfaces on vehicles and equipment are thoroughly cleaned and disinfected at the end of shifts and between users; • Coughing or sneezing into a tissue or the bend of your arm, not your hand; And dispose of any tissues you have used as soon as possible in a lined waste basket and wash your hands afterwards; • Complying with any instructions announced by Ministry of Health accordingly; 41. Responding measures if there is a COVID-19 case: • Individuals who have been potentially exposed to the virus, or who are exhibiting flu-like symptoms such as fever, tiredness, coughing, or congestion are instructed to: Not come to work; Contact their supervisor and/or human resources department; Stay at home and self-isolate; and Contact local health authorities for further direction. • Such individuals are required to follow the directions of the local health authority and may not			

Sub-Project Activity	Environmental Impact / Issue	Mitigation measures or response	Implemented by	Supervised by	Cost ($)
		return to work until given approval by the proper health authorities; • Individuals who begin to display flu-like symptoms on site are instructed to avoid touching anything, take extra care to contain coughs and sneezes, and return home immediately to undergo self-isolation as directed by the local health authority; • All areas on site potentially infected by a confirmed or probable case are barricaded to keep individuals two meters away until the area is properly cleaned and disinfected; 42. The Emergency Response Plan will set out detailed Preventative Measures for all types of incidents covered in the Emergency Plan. This will include: • Prevention of Injury and Accidents – to include Personal Protective Equipment requirements for construction workers, training requirements • 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 refuelling and maintaining vehicles. • Prevention of Fire – to include measures for Ignition Sources including prevention of smoking on construction site, management of flammable materials and liquid. • Other Incidents – prevention measures relevant to other issues considered relevant by the contractor 43. The Contractor will develop Emergency Response Procedures prior to construction. The procedures will cover actions to be taken in case of: • Worker injury (e.g. construction or traffic accident) • Spillage (e.g. fuel spillage) • Fire (e.g. fuel or chemicals storage area); and • Any other incidents anticipated by the contractor.			
Implementation of Construction Workers Camp Management	Contamination of water, soil, waste production and social issues	44. [if required] If a camp for construction workers is required the contractor will set out a management plan which includes: • A map showing camp lay out, welfare facilities, and first aid kit locations.	Contractor	PIU/PMU/ PMC	Included in bid price

Sub-Project Activity	Environmental Impact / Issue	Mitigation measures or response	Implemented by	Supervised by	Cost ($)
		• Accommodation facilities including pit latrines for male and female workers, adequate drainage to prevent flooding, security including a no weapons policy and waste disposal areas. • Schedule of HIV Aids education awareness to be given to workers. • Training on relevant laws for foreign labour (including hunting, fishing and traffic rules); • Plan of how camp areas will be restored to original condition after construction completed. 45. If a construction camp is not required, the contractor will not require a Management Plan but will: • Provide adequate waste disposal facilities including garbage bins for workers. • Provide welfare facilities including water for washing, drinking and include facilities for male and female workers • Provide toilets for male and female construction workers with a cleaning schedule 46. The contractor will give priority to local labour force and retain evidence of how local labour recruitment efforts were undertaken			
Operations Discharge Permits	Legal Compliance	47. Owner of WWTP to start process of obtaining permit for discharge of effluent.	MPWT/ PMC	MoE	Included in bid price
Pipe Network Installation		48. Warning given to residents 4 weeks in advance of any excavations for sewer pipes	PDPWT	PMU/ PMC	Included in bid price
Pipe Network Installation	Socio-Economic (Accessibility)	49. Adequate pedestrian access to enter buildings across any open trenches 50. Adequate vehicular access to enter properties across any open trenches 51. Restoration of any damage at expense of contractor 52. Consideration and management of potential localised flood impacts.	Contractor	PIU/PMU, PMC	Included in bid price
Pipe Network Installation	Community Health and Safety (Traffic)	53. The contractor will develop a traffic management plan in conjunction with the DPWT in order to ensure routes for vehicles are not blocked and signage is provided to reduce speeds and show drivers in advance of any changes to road surface or traffic direction	Contractor	PIU/PMU, PMC	Included in bid price

Sub-Project Activity	Environmental Impact / Issue	Mitigation measures or response	Implemented by	Supervised by	Cost ($)
		54. Where risks occur given changes to traffic lanes or road closures, additional lighting will be provided to allow visibility of the changes at night.			
PMC-I/NES	Project Completion	55. Site visit in order to develop Project Completion Report to assess community views on project and EMP implementation in overall and state of project at contractor' handover	PMC-NIES	PMU	Part of Contract Cost
Operation Phase					
Operation of WWTP	All	1. Final design ensures that the effluent will meet the standards in Sub-decree, No. 27 ANRK.BK on Water Pollution Control, MoE, 1999 (public water area and sewer). 2. Final design considers climate change and provides dike around the WWTP site to protect the WWTP against flooding. 3. Always comply with the required operation and maintenance standards (i.e. Surface Water Quality Standard Referring to Sub-Decree No. 27 ANRK.BK) to ensure effluents are treated effectively prior to discharge. 4. Provision of adequate budget for O&M of WWTP 5. Regularly inspect the wastewater system structures and provide maintenance or corrective actions 6. Conduct monitoring and reporting on water quality of receiving water after discharge from WWTP. The discharge of wastewater quality from WWTP shall always comply with effluent standards specified in Sub-Decree No. 27 ANRK.BK). Inform downstream uses of the risks to their health of using water for consumption.	Operator Team	MPWT MoE	Included in operational costs
Operation of WWTP	Occupational health and safety,	7. The operator will develop and implement a Health and Safety Manual as part of the Operation & Maintenance (O&M) which will include the following: 8. A signed commitment from the Operator to a) Understand and b) comply with IFC Environmental Health and Safety guidelines (2007) 9. Training Programme for workers in workplace on safety of WWTP operation	Operator Team	MPWT Mo	Included in operational costs – O&M Budget

Sub-Project Activity	Environmental Impact / Issue	Mitigation measures or response	Implemented by	Supervised by	Cost ($)
		10. Provide all operational staff with appropriate personal protective equipment 11. Prevent public access to the WWTP and pumping stations with fencing and appropriate signage. 12. Conduct safety orientation trainings including regular safety drills for workers. 13. Provision of appropriate and adequate PPE for workers (including regular training and drills on the use of PPE and other emergency equipment). 14. Plan and execute work in compliance with country-specific COVID-19 risk management regulations and directives including directions of the General Department of Labour, MoLVT. 15. Conduct workplace risk assessment to identify low, medium or high exposure risk to COVID-19. Prepare an action plan for prevention and mitigation of the spreading of COVID-19. 16. Conduct Risk communication, training, and education. Training of workers in infection prevention and control practices 17. Provide clear and visible guidelines on how to prevent infection at the construction site and initiatives taken. 18. Regularly clean and disinfect toilet and bathrooms 19. Promote personal hygiene (including hand and respiratory hygiene), make wash basins and sanitizers available 20. Screen on entry the temperature of each person entering the work site and record their contact details to facilitate tracking of infected persons should there be a need			
Operation of WWTP	Community health and safety	21. Coordinate with local public health officials to monitor incidence of water and air-borne sickness or disease in the local community and worker that could be caused by the operation of WWTP 22. Cover as much standing water as possible and regularly treat for mosquitoes breeding during seasons of high incidence of mosquito borne diseases such as dengue fever 23. Monitor the pumping stations for possible release of offensive odour, and if necessary, install ventilation	Operator Team	MPWT/ MoE	Included in operational costs – O&M Budget

Sub-Project Activity	Environmental Impact / Issue	Mitigation measures or response	Implemented by	Supervised by	Cost ($)
		stacks with odour filter treatment (carbon filters, biofilter). 24. Conduct routine hosing and debris removal at the pumping station wet wells to remove accumulated solids.			
Operation of WWTP	land and surface water pollution, occupational health and safety	25. As part of O&M manual provide clear methods and procedures for all aspects of the WWTP operation, including the following key issues: • Safe handling and storage of treatment chemicals including spills action plan • Sludge management including treatment, disposal and emergency situations • Monitoring/ testing procedures and schedule for effluent and sludge, with approval by MoE • Odour Monitoring procedures and schedule including monthly boundary monitoring and procedures for recording and managing complaints from the public • Emergency Procedures including schedule for testing and upgrading procedures • Procedures for storing, transporting and disposing of solid waste generated by operations	Operator Team	MPWT/ MoE	Included in operational costs – O&M Budget
Operation of WWTP	Odour	26. Quarterly meetings with residents and / or their representatives to identify odour or nuisance issues; 27. Movement of any sludge materials off site on days of low wind speed. 28. Provide trees planting and green place around and in the WWTP. 29. Removing screenings and grit from the inlet and outlet works; 30. Cutting grasses on the embankment, and removing it so that it does not fall in the ponds; 31. Removing floating scum and floating macrophytes from the surface of the maturation and facultative ponds. This will be done to maximise the light energy reaching the pond algae, increase surface re-aeration, and prevent fly and mosquito breeding; 32. Spraying scum on the surface of the anaerobic ponds and not removing it, since this will help the treatment processes;	Operator Team	MPWT/ MoE	Included in operational costs-O&M Budget

Sub-Project Activity	Environmental Impact / Issue	Mitigation measures or response	Implemented by	Supervised by	Cost ($)
		33. Removing any accumulated solids in the inlet and outlet works; 34. Repairing any damaged embankment as soon as possible; and 35. Repairing any damage of the fences or gates. 36. Use quick-disconnect fittings between septage pumper truck and receiving station to minimize exposure of septage to the atmosphere 37. Wash-down septage facilities to clean up any spills, with drainage into the septage chamber 38. Avoid free fall of septage by extending receiving pipes below the water surface 39. Introduce septage at slow controlled rates to avoid turbulence or agitation 40. Ventilate the air from the septage chamber to an odour biofilter 41. Clean tanks, trucks and equipment daily			
Effluent Discharge	Agricultural Yield Impact	42. Provision of effluent and receiving water body monitoring data to Provincial Department of Agriculture. 43. In collaboration with the Provincial Department of Agriculture carry out microbiological analyses of effluents to determine if the effluent can be used for unrestricted irrigation and aquaculture.	Operator	PDAFF/ MoE.	Included in operational costs-O&M Budget

5. MONITORING PLAN

27. The project monitoring is conducted under the EMP includes:

(ix) **Project readiness monitoring**. Monitoring to follow up progress on project readiness and close gaps through corrective actions.

(x) **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.

(xi) **EMP compliance monitoring**. To be conducted by the PMC-NES (contracted via the Project Management Consultants) to verify EMP compliance during project implementation.

(xii) **Affected People monitoring (consultation).** This is to be conducted by the PIU-SFP via consulting affected people on the impacts during construction.

(xiii) **Operational monitoring**. This is required as part of the operations of the sub-project and will be undertaken by the relevant government department or a nominated private sector operator.

28. The engagement of a National Environmental Specialist for 10 months will be critical to ensuring the capacity of the PIU staff and to ensuring monitoring is effective and that corrective actions are promptly identified and implemented.

5.1. Project Readiness Monitoring for Sub-Project

29. Before construction, the Project Management Consultant (PMC) will monitor the project's readiness on environmental management based on a set of indicators as shown in Table 6 and report it to ADB and PMU. 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 detailed design & approved by ADB	Y/N		
2. Compliance with loan covenants	The borrower complies with loan covenants related to project design and environmental management	Y/N		
3.Completion of CEMP including associated sub-plans*	Required preparation of CEMP including associated sub-plans by Contractor as indicated in Table 5 have been completed and get approval from the PMU and PMC	Y/N		

Indicator	Criteria	Are the Criteria met? Yes/No	If No, What Corrective action is needed?	Date for Corrective Action Completion
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 external staff as set out in the Institutional Arrangements for this EMP	Y/N		
	Nomination of government staff for PMU and PIU roles as set out in the Institutional Arrangements for this EMP	Y/N		
5. Bidding documents and contracts with environmental safeguards	Bidding documents and contracts incorporate the environmental activities and mitigation measures required by this EMP	Y/N		
	Bidding documents and contracts incorporate the Particular Conditions for bidding (see Annex 3)	Y/N		
6. EMP financial support	The required funds have been set aside for EMP implementation including training and capacity building	Y/N		

Note: * CEMP includes i.e. waste management plan, traffic management plan, material spoils and borrow pit management plan, emergency response plan, occupational, health and safety plan, campsite management plan.

5.2. Environmental Quality Monitoring

30. During construction, the impact on the sensitive environmental receptors will be monitored and compared against the relevant national or international recognized environmental standards.
31. During operation, the PIU and relevant operators will be expected to allocate an adequate budget to ensure environmental monitoring can be undertaken as specified in Table 7.

Table 7: Environmental Quality Monitoring for WWTP Sub-Project

Environmental Indicators	Location	Method & Frequency	Responsibility		Estimated Costs (USD)	
			Supervision	Implementation	Per Sample	Total per site/yr
Construction Phase – WWTP						
Air Quality -including PM10, NO_2, SO_x	Nearest residential receptor (2 locations) (Monitor only when construction activities occur within 250 m)	1 day (24-hr) per 3 months Means in accordance with national standard	CSC/PIU	Contractor	$1000	$8000
Noise	Nearest residential receptor (2 locations) (Monitor only when construction activities occur within 250 m)	1 day (daytime only) per 3 months Means in accordance with national standard	CSC/PIU	Contractor	$300	$3600
Water Quality	Downstream at nearest water body (canal or river) to construction sites - two samples (Monitor when construction is active)	Every 3 months during construction periods Means in accordance with national standard	CSC/PIU	Contractor	$100	$800
Operations Phase – WWTP						
Treatment monitoring: Inlet and outlet flow rates, pH, DO, BOD5, COD, total N, total P, TSS, TDS, faecal coliform bacteria	Each step in the treatment process	Weekly during the first 6 months of operations, thereafter monthly or more often in case of performance problems	PIU	Operator	Included in operational costs – O&M Budget	
Effluent Quality: Parameters: pH, DO, Colour, Odour, TSS, BOD5, COD, total P, total N, Fe, Cu, Pb, Cd, Zn, Oil and Grease, E.coli, Coliform	Effluent outfall	Twice per year or in case of complaints	MoE MPWT	Operator	Included in operational costs – O&M Budget	
Effluent Quality: Parameters: pH, DO, BOD5, COD, NH_3-N,	Effluent outfall	Monthly	MoE MPWT	Operator	Included in operational costs – O&M Budget	

Environmental Indicators	Location	Method & Frequency	Responsibility		Estimated Costs (USD)	
			Supervision	Implementation	Per Sample	Total per site/yr
TSS, TDS, faecal coliform bacteria						
Microbiological irrigation water quality parameters	Effluent outfall	Prior to determining if effluents are allowed for unrestricted use in irrigation and aquaculture. Thereafter as required by the competent authority	Ministry of Agriculture and Forestry	Operator	Included in operational costs – O&M Budget	
Odour	Site boundary (downwind)	Odour boundary monitoring method to be established within Operational Plan	MoE MPWT	Operator	Included in operational costs – O&M Budget	
Receiving Water Body	Upstream and downstream	Quarterly and every time effluent quality failure is recorded	MoE MPWT	Operator	Included in operational costs – O&M Budget	
Worker & public injury associated with WWTP operations	On property of WWTP	Regular record keeping	MPWT Ministry of Labour and Vocational Training (MLVT)	Operator	Included in operational costs – O&M Budget	

5.3. EMP Compliance Monitoring

32. In order for the EMP to be effective, all its mitigation measures must be monitored to ensure they are implemented. Note this applies to construction only; during operation, it is the responsibility of the appropriate ministries or its line departments to ensure monitoring of operational facilities is incorporated in the operations and maintenance manual and carried out routinely. Compliance monitoring requirements are summarized in Table 8.

Table 8: EMP Compliance Monitoring

Environmental Indicators	Location	Method & Frequency	Responsibility		Estimated Costs (USD)
			Verification	Implementation	
Construction Phase – WWTP Sub-Project					

Environmental Indicators	Location	Method & Frequency	Responsibility		Estimated Costs (USD)
			Verification	Implementation	
Air Quality	Civil works sites	Monthly checking against mitigation measures specified in this EMP	PMC-NES	CSC	Included in CSC contract
Noise	Civil works sites	Monthly checking against mitigation measures specified in this EMP	PMC-NES	CSC	Included in CSC contract
Flora	Civil works sites	Monthly checking against mitigation measures specified in this EMP	PMC-NES	CSC	Included in CSC contract
Water Quality	Civil works sites	Monthly checking against mitigation measures specified in this EMP	PMC-NES	CSC	Included in CSC contract
Soil and land resources	Quarries, Borrow and Spoil Disposal Sites	Monthly checking against mitigation measures specified in this EMP	PMC-NES	CSC	Included in CSC contract
Resource use and natural resource contamination	Implementation site of Solid and Liquid Waste Management Sub-Plan B	Monthly checking against mitigation measures specified in this EMP	PMC-NES	CSC	Included in CSC contract
Human health and safety	Implementation of Community and Occupational Health and Safety and Emergency Response Sub-Plan C	Monthly checking against mitigation measures specified in this EMP	PMC-NES	CSC/Contractor H&S engineer	Included in CSC contract
Contamination of water, soil, waste production and social issues	Implementation of Construction Workers Management Sub-Plan D	Monthly checking against mitigation measures specified in this EMP	PMC-NES	CSC	Included in CSC contract
Community Issues • Environmental impacts of civil works (e.g., solid & liquid waste, erosion, local flooding, pollution).	At all construction locations	Consultation interview with Affected People Using the form in Annex **1**1 4-6 weeks after construction starts	PMU-ESO	PIU-SFP	Included in PIU staff/travel budget

Environmental Indicators	Location	Method & Frequency	Responsibility		Estimated Costs (USD)
			Verification	Implementation	
• Any unforeseen impacts caused by accidentally e.g. through spillages • Civil nuisance (e.g., noise, disrupted business & farming activity, social issues, community health and safety). • Impaired use of access roads (e.g. traffic issues and access). • GRM and its procedures & key contacts		Every 2 months until end of construction			
Socio-Economic (accessibility)	All sites of pipe excavations in urban areas	Visual inspection and record. 4-6 weeks after construction starts Every 2 months until end of construction	PMU-ESO	PIU-SFP	Included in PIU staff/travel budget

5.4. Environmental Policy and Standards

33. The construction and operation phases of the projects shall follow relevant environmental quality standards. These are presented in Annex 44 for reference. These quality standards relate to i) air quality, ii) ambient surface water quality, iii) groundwater quality, vi) soil quality and v) effluent quality.

6. PUBLIC CONSULTATIONS

34. The IEE for this subproject contains details of the consultations undertaken during preparation of the subproject. In addition, consultations will take place during implementation. The PIU Safeguard Focal Point (PIU-SFP) will undertake consultations after the detailed design has been completed and will conduct consultation interviews within 4-6 weeks of construction starting and then again, every 3 months until the end of construction. This is set out in the Environmental Monitoring Plan which is provided in the Environmental Management Plan.

35. Informal monitoring interviews with affected people will focus on complaints about community disturbance from construction activities, such as construction noise, dust, solid waste and wastewater, as well as public concerns about ecological protection, soil / land concerns and access issues. A sample Environmental Monitoring Interview Form is given in Annex 11 which will contribute to project monitoring.

36. The IEE for these sub-projects also includes information on consultation undertaken during preparation of this EMP and can be consulted or discussed for reference.

7. GRIEVANCE REDRESS MECHANISM

7.1. GRM Objective

37. A grievance redress mechanism (GRM), consistent with the requirements of the ADB Safeguard Policy Statement (2009) will be established to prevent and address community concerns, reduce risks, and assist the project to maximize environmental and social benefits. In addition to serving as a platform to resolve grievances, the GRM has been designed to help achieve the following objectives: (i) open channels for effective communication, including the identification of new environmental issues of concern arising from the project; (ii) demonstrate concerns about community members and their environmental well-being; and (iii) prevent and mitigate any adverse environmental impacts on communities caused by project implementation and operations. The GRM is accessible to all members of the community.

7.2. Proposed GRM System

38. In Cambodia, there is currently no existing legally established system to resolve environmental concerns and complaints. The MPWT, as the EA of the Tonle Sap II will establish the GRM. The establishment shall be made before commencement of site works and have members from the PMU, district authority and commune councils. Grievances can be filed in writing or verbally with any entry point of the GRM. The committee will have

15 days to respond with a resolution. The PMU's Environment Safeguards Officer (PMU-ESO) will oversee/manage the implementation/observance of the mechanism and will be responsible for keeping the PMU informed. The PIU Safeguards Focal Point (PIU-SFP) will be responsible for ensuring GRM implementation at the sub-project level.

39. The GRM will accommodate both informally and formally lodged eligible, grievances. Informally lodged grievances are those received by the contractor during construction. Formally lodged grievances are those received at District and Commune Council offices or direct to the PIU. Commune Councils evaluate complaints for eligibility and then report to PDPWT. The PDPWT and PMU maintain record of all grievances, informally and formally lodged, eligible and ineligible. The PMU will inform the MPWT, as necessary, and report on the observance/implementation of the GRM in the monthly progress reports and in the periodic Environmental Monitoring Report that will be submitted to the MPWT.

7.2.1. Access to the Mechanism

40. Any person who has environmental issues pertaining to the subproject during detailed design, construction and operation phases will have access to the mechanism free of charge. The PMU, through its Environment Safeguards Officer (PMU-ESO) and staff in the MPWT, will ensure that:

    (i) The public and all stakeholders are aware of their rights to access, and will have access to, the GRM free of administrative and legal charges; and

    (ii) The GRM is fully disclosed prior to construction: (a) in public consultations, (b) through posters displayed in the commune office (posters to include names and contact details of the PIU-SFP)

41. The Access Points to the GRM are critical for ensuring it is useable for affected persons. The GRM Access points for this project, as set out in this GRM Mechanism will be:

- The Contractors
- District and Commune Councils
- The PIU office
- The Provincial Department of Public Works and Transport (PDWT).

7.2.2. GRM Steps and Timeframe

42. Grievances raised on environmental impacts are critical to the health and safety of affected persons. Hence, the proposed mechanism intends to be easily accessible and promptly responsive to complaints from affected persons.

7.2.2.1. Informal Approach

43. Informally, affected persons can lodge complaints directly to the contractor during construction. PMU to provide contractor with GRM contact details which the contractor will use to print 'GRM Contact Cards' for its staff to hand to complainants and will keep cards with all vehicles, machinery and site managers/foremen.

44. Contractor to raise awareness of all workers on how to respond when an AP or member of the public has a complaint i.e. direct the person to the most senior site manager present at the time and/or Contractor GRM focal point and prepare a 'GRM Contact Card'.

45. The contractor shall document and assess the complaint immediately. If assessment validates the complaint as within the scope of the GRM/eligible, the contractor shall act on the complaint within three days from receipt of complaint. MPWT shall obtain a written confirmation of satisfaction from the AP after 7 days from completion of resolution by the contractor

46. If assessment invalidates the complaint (i.e., reveals the complaint as ineligible or not associated with the project's environmental performance), the contractor shall direct the AP to the Commune Council and shall report the complaint to MPWT within 2 days from receipt of complaint, stating reasons for ineligibility.

7.2.2.2. Formal Approach

47. If complaint is eligible but is not acted on within three days from receipt of complaint, or if AP is not satisfied with the resolution undertaken by the contractor, he/she can access the formal mechanism, as shown in Table 9:

Table 9: GRM Steps

Step	Action
Step 1: Lodging a Complaint (Day 1)	AP lodges complaint, by him/herself or with assistance from the village chief or district council, at the access point with the Commune Council. The complaint may also be lodged with the PIU or PDPWT,
Step 2: Documentation & Registration of Complaint (Day 1)	Commune Council, PIU/PMU or PDPWT documents/registers lodged complaint, makes sure these are referenced and provides AP with a copy of referenced complaint. The commune forwards complaint document to the MPWT. A copy of a proposed GRM Complaint Form is in Annex 2
Step 3: Assessment and Discussion (Day 1 to 3)	AP shall be informed if the grievance is eligible or ineligible. If it is ineligible, AP shall be directed to the district. If complaint is eligible, AP shall be informed of the expected action timelines as set out in the established mechanism
	If both of the AP and contractor/operator are available, the complaint shall be immediately reviewed, investigated and discussed. If not, both parties should agree to undertake the review, investigation and discussion within 3 days. The discussion will centre on the cause and action/measure to implement and will engage the PIU/PMU. After review and investigation, agreement on actions and measures and time involved shall be made with the AP. Agreement shall be properly documented and filed; MPWT, PIU/PMU, Commune Council and AP shall have copies
Step 4: Implementing the Agreed Resolution	(Day 3 to Day 4) If complaint is minor, i.e., not requiring further investigation and would be easy to resolve, the contractor/operator shall immediately implement agreed on action/resolution. (To be implemented by Day 8)
	If further investigation and/or procurement of supplies/parts would be necessary, the contractor/operator shall: (i) immediately provide the most suitable interim measure to reduce the magnitude of the impact; and (ii) start work on the final measure within **15 days** from the day the complaint is lodged.
Step 5: **Acceptance of Resolution (1 week after completion of action/measure taken)**	If, according to the AP, the impact has been resolved satisfactorily, MPWT shall obtain a written confirmation of satisfaction from the AP. This confirmation will signify closure of grievance and will form part of the grievance documentation. The PIU, Commune Council and AP shall retain their copies of the confirmation.
Step 6: **Monitoring and Evaluation (for 1 week**	The MPWT shall monitor the effectiveness of the resolution for at least a week after closure of grievance (that is, when action implemented has been satisfactorily confirmed in writing by the complainant).

Step	Action
after closure of grievance)	Monitoring and evaluation shall be properly documented and included in the Environmental Monitoring Report
Step 7: **Appeal for Dissatisfied AP**	When dissatisfied (or, in the event the issue/impact persists despite actions undertaken), AP can appeal for assistance from the district in the elevation of his/her complaint to the provincial authority. The provincial authority shall call all parties concerned to review the history of the grievance and resolution process taken and assess the validity of the appeal.

Source: IEE Report 2018

48. **Appeals**. If appeal is found not valid, the provincial authority shall write the AP and declare the grievance closed. In the event of an appeal, the MPWT shall immediately report to the PMU. The PMU shall ensure that the ADB is immediately informed.

49. If appeal is assessed to be valid, provincial authority and the parties discuss and agree on the quick resolution of the issue. The PMU requires the contractor and operator to implement the agreed resolution. Should the issue continue to persist despite the second action, or the AP remain dissatisfied, the following steps will be taken:

50. **Special Mission or Judicial System**. If the complainant is still unsatisfied, the PMU/EA will inform ADB to convene a special mission to attempt a resolution prior to use of the Cambodian judicial system.

51. **Accountability Mechanism of the ADB**. In addition, affected people may always contact the Complaints Receiving Officer of the ADB via the following addresses which will be included in the sub-project signboard:

    Complaints Receiving Officer, Accountability Mechanism
    Asian Development Bank
    ADB Headquarters, 6 ADB Avenue, Mandaluyong City 1550, Metro Manila, Philippines
    (+632) 632-4444 loc. 70309
    (+632) 636 2086
    amcro@adb.org

52. Instructions available here: http://www.adb.org/site/accountability-mechanism/how-file-complaint.

53. Sufficient communication on the GRM including signs containing contact details of the GRM access points will be displayed at strategic locations to sustain the effective implementation of the mechanism.

8. REPORTING

54. Environmental monitoring reports (using ADB's integrated safeguards monitoring report format) will be prepared semi-annually for the EA by the Project Management Consultants in collaboration with PMU-ESO and sent to the MoE and ADB. The reports will table all indicators measured with the monitoring plan of EMP including performance monitoring indicators and will include relevant national environmental quality standards. The reporting requirements are indicated in Table 10.

Table 10: Reporting Requirements

Report	Frequency	Purpose	From	To
Contractors' Progress Report	Monthly	EMP Implementation Progress and Monitoring Results	Contractor	PMU
EMP Progress and Compliance Report	Monthly	Confirm Mitigation Measures	International National Env Specialists with PIU-SFP	PMU
Environmental Monitoring	Quarterly	Relevant environmental parameters	PMU-ESO	EA
Environmental Safeguards Monitoring Report	Semi-Annual	Full EMP Implementation and Adherence to Environmental Covenants/Conditions	PMU	ADB
WWTP Operation	Quarterly	Surface and groundwater Quality. Effluent quality, sludge disposal, health and safety	Operator	EA

8.1. Mechanisms for Feedback and Adjustment

55. 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.

9. ESTIMATED COST OF EMP

56. The total cost for EMP implementation for the WWTP comprises the following:

- Mitigation measures (Table 5) Costs to be included in construction contract and operations budget
- Environmental quality monitoring (Table 7) $12,400 per year
- EMP Compliance Monitoring (including public consultation) (Table 8) No additional cost

57. Excluded from the EMP budget as separate items are

- Measures required as part of good construction practice. This includes measures such as PPE for workers, machinery maintenance and mobile noise barriers.
- Remuneration and associated costs for Project management consultants and staff within PMU and PIU as this is covered elsewhere in the project budget.
- Cost for Project Management Consultant which includes a National and International Environmental Safeguards specialist.
- Training covered elsewhere including WWTP operator training which is covered under the feasibility study for each specific sub-project.

58. 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.

59. The selected operators, private sector or government, will bear all environmental monitoring and reporting costs during the operational stage. EMP operational environmental mitigation and monitoring measures will be incorporated in the operations and maintenance manual.

10. CONCLUSION

60. 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 WWTP operators. The implementation of this EMP will be closely monitored and reported on by the relevant stakeholders in the project.

61. The most significant impacts from the project will arise from facility operation, for both the WWTP more concerning during operation and the sewerage system more consider during construction the sewers in the town. As a result, there is a comprehensive training and capacity building component to the project which is essential for ensuring the investment is both financially and environmentally sustainable and beneficial.

62. A robust Grievance Redress Mechanism will be established, as outlined in this EMP. It will ensure that all unplanned impacts which cause grievances for affected people are managed swiftly and a satisfactory outcome brought about.

63. Overall, the project is anticipated to bring environmental benefits to the populations of the project cities. It will serve to improve the current wastewater management situation and will provide long term environmental improvements.

Annex 1: Affected Person Monitoring Form

Consultation / Interview Form

Date of Interview		**Interviewer Name**	
Interview Site: *Where is the interview held? In school, on the road, in shop*		**Stakeholder Name & Status:** *Full name, status is business owner, school teacher, religious leader, resident*	
Construction Site & Date Construction Started *Which road, GPS location if available*		**Has this stakeholder been interviewed before?** *Yes (when were they interviewed) No*	

Interview Discussion Points:

1. NOISE	**Record of Discussion**
Before the project started, was the person disturbed by noise? If yes, explain how and when. Where did the noise come from? E.g. traffic, machinery, people, music When did it disturb the person? E.g. all day, at night, intermittently	
During the construction, is the person disturbed by noise from the project? If yes, explain how and when. What type of noise and where did the noise come from? All day, at night, intermittently?	
If noise from construction is a problem, what changes does the person suggest are made?	
2. AIR QUALITY	**Record of Discussion**
Before the project started, was the person affected by air pollution or dust? If yes, explain how and when. Where did the pollution or dust come from? E.g. traffic, machinery, construction, burning garbage, cooking stoves When was the dust or pollution a problem? E.g. all day, at night, intermittently	
During the project, is the person disturbed by dust or pollution? If yes, explain how and when. What type of noise and where did the noise come from? E.g. increased traffic congestion, construction machinery, construction workers, burning construction garbage etc When did it disturb the person? E.g. all day, at night, intermittently	
3. VEGETATION AND LAND USE	**Record of Discussion**
Before the project started, what was the vegetation like in the project area?	

E.g. pasture land, trees, shrubs, rice fields.	
During the project, has the person found the vegetation situation has changed? If yes, explain how and when.	
If impact on vegetation is unacceptable, what changes does the person suggest are made?	
4 COMMUNITY SAFETY	**Record of Discussion**
Before the project started, can you describe the community safety situation in the project area? E.g. no problems, some accidents, difficulty crossing the roads	
During the project, has the person found the community safety situation has changed? If yes, explain how and when. Slower traffic so easier to cross the roads, construction vehicles are making a crossing harder / easier, more accidents / less accidents, construction site dangers	
If change in road safety is unacceptable, what changes does the person suggest are made?	
5. WATER QUALITY	**Record of Discussion**
Before the project started, was the person affected by poor water quality? If yes, explain how and when. Ground water? Surface Water? which Water source? How was it polluted?	
During the project, is the person affected by water pollution? If yes, explain how and when. Ground water? Surface Water? which Water source? How is quality being affected?	
If water quality from the construction is a problem, what changes does the person suggest are made?	
6. ACCESS	**Record of Discussion**
During the project, is the person affected by reduced access to their business, home or land? Access to what is limted, and how?	
If access limitations are not acceptable, please suggest changes which can be made?	
7. OTHER ISSUES	**Record of Discussion**
Any other issues about the construction sites that the person wants to discuss? E.g. wastewater concerns, waste disposal, Other concerns, labour force,	

Annex 2: GRM – Complaint Recording Form

PIU Staff Responsible: (name and role)	
Date: (of this record)	

Date of Complaint:	
Date Resolution Required by (15 days from initial complaint):	
Complaint Made by: (Name & Contact Details)	
Method of Complaint: (direct to PMU, via Contractor, Via Commune People's Council)	
Details of Complaint: (issues, actions taken so far, when did it start – all details needed)	
PMU Actions: (Next steps for PMU to resolve the issue or to move complaint to next level)	
Follow Up Actions Needed and Date: (PMU to follow up on resolution if needed, e.g. check contractor actions)	

Annex 3: Particular Conditions (For Bidding Documents)

64. The following clauses shall be added to the Bidding Document, Section 8 Particular Conditions in relation to the Environmental Safeguards for the Project:

65. The contractor will undertake to develop and submit to the PMU/CSC for approval, a site-specific Construction Environmental Management Plan with the following management sub-plans:
    A. Spoil and Borrow Site Management;
    B. Solid and Liquid Waste Management;
    C. Community and Occupational Health and Safety and Emergency Response;
    D. Construction Workers' Camp Management (if required).

66. The management sub-plans will be sufficiently detailed as to allow a clear understanding of the approach the contractor will take to mitigate environmental impacts during construction. The contractor will adhere to the management sub-plans at all times unless prior agreement has been given by the PMU under extenuating circumstances.

67. The Contractor will commit to ensuring a full time environmental health and safety officer on site who is competent, nominated to manage health and safety risks, and who can implement the EMP requirements for occupational health and safety and ensure relevant health and safety legislation is followed.

68. The Contractor will commit to enabling the project staff or consultants tasked with monitoring, full access to all information and data required in order that the Environmental Management Plan can be fully monitored.

Annex 4: Environmental Quality Standards

(1) Ambient Air Quality Standards

Source: Sub-decree **No. 42 ANRK.BK** on Air Pollution Control and Noise Disturbance, MoE 2000 and WHO. Ambient Air Quality Guidelines (2005).

Parameter	Averaging Period	No. 42 ANRK.BK		WHO Ambient Air Quality Guidelines (2005)	
		Unit	Value	Averaging Period	Value / Unit
Nitrogen Dioxide (NO2)	24 hours	mg /m^3	0.1	1 hour	200 µg/m^3
Sulfur Dioxide (SO2)	24 hours	mg /m^3	0.3	1 hour	20 µg/m^3
Carbon Monoxide (CO)	24 hours	mg /m^3	20		
PM 2.5	24 hours	-	-	24 h	25 µg/m^3
PM 10	24 hours	-	-	24 h	50 µg/m^3

(2) Ambient Noise Standards

Source: Sub-decree **No. 42 ANRK.BK** on Air Pollution Control and Noise Disturbance, MoE , 2000 and WHO Community Noise Guidelines (1999).

Time Period (24 hours)	No. 42 ANRK.BK	Areas Specified for WHO Guidance	WHO Community Noise Guidelines (1999)
	Value / Unit		Value / Unit
Day time (from 6:00am to 6:00pm)	70.0 dB(A)	Outdoor Living Area - serious annoyance - moderate annoyance	 55 dB(A) 50 dB(A)
Evening Time (from 6:00pm to 11:00pm)	65.0 dB(A)	Inside dwellings - moderate annoyance	35 dB(A)
Night time (from 11:00pm to 6:00am)	50.0 dB(A)	Inside dwellings - sleep disturbance	30 dB(A)

(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 wastewater 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	< 60	< 120
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

No	Parameters	Unit	Allowable limits for pollutant substance discharging to	
			Protected public water area	Public water area and sewer
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 in public water areas for public health protection

- The CNDWQS Standard is National Standard of the Ministry Industry and Handicraft.

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

No	Parameter	Unit	Standard Value
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

No	Parameter	Standard	
		Unit	Value (CNDWQS Standard)
1	pH	-	6.5-8.5
2	Turbidity	NTU	5.0
3	Dissolved Oxygen (DO)	mg/l	NV
4	Total Suspended Solid (TSS)	mg/l	NV
5	Chloride (Cl-)	mg/l	250
6	Nitrate (NO3)	mg/l	50
7	Phosphate (PO4)	mg/l	NV
8	Sulphate (SO4)	mg/l	250
9	(BOD)5	mg/l	NV
10	(COD) Mn	mg/l	NV
11	Aluminum (Al)	mg/l	0.2
12	Arsenic (As)	mg/l	0.05
13	Copper (Cu)	mg/l	1.0
14	Iron (Fe)	mg/l	0.3
15	Lead (Pb)	mg/l	0.01
16	Manganese (Mn)	mg/l	0.1
17	Mercury (Hg)	mg/l	0.001
18	Zinc (Zn)	mg/l	3.0
19	Total Coli form	MPN/100mlml	0

(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

No	Parameter	Standard (Allowable limits for pollutant substance discharging) to		
		Unit	Value (Protected public water area)	Value (Public water area and sewer)
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, (c29-c36) (mg/L)	mg/kg	-
BTEX		

Parameter	Standard	
	Unit	Value
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