

Initial Environmental Examination

October 2020

CAM: Integrated Urban Environmental Management in the Tonle Sap Basin Project - Kampong Chhnang Sewerage and Wastewater Treatment System

Prepared by the Ministry of Public Works and Transport for the Asian Development Bank.
The originally posted documents in September 2014 for the project are available on
<https://www.adb.org/projects/42285-013/main#project-documents>.

ABBREVIATIONS

ADB	–	Asian Development Bank
AOI	–	Area of Influence
AP	–	affected person
CEMP	–	Contractor's Environmental Management Plan
CITES	–	Convention on International Trade in Endangered Species
CRVA	–	Climate Risk and Vulnerability Assessment
EIA	–	environmental impact assessment
EA	–	Executive Agency
EMP	–	environmental management plan
EHS	–	Environment, Health and Safety
EHSO	–	Environmental, Health and Safety Officer
ESO	–	Environmental Safeguard Office
GRM	–	Grievance Redress Mechanism
GRC	–	Grievance Redress Committee
H&S	–	Health and Safety
IEE	–	initial environmental examination
IEIA	–	initial environmental impact assessment
IFC	–	International Finance Corporation
ILO	–	International Labor Organization
MoE	–	Ministry of Environment
MPWT	–	Ministry of Public Works and Transport
MRC	–	Mekong River Commission
O&M	–	operation and maintenance
PDoe	–	Provincial Department of Environment
PDPWT	–	Provincial Department of Public Works and Transport
PMIS	–	project management and implementation support
PIU	–	project implementation unit
PMU	–	project management unit
PAM	–	Project Administration Manual
PSC	–	project steering committee
PPTA	–	Project Preparation Technical Assistance
RCP	–	Representative Concentration Pathway
SPS	–	Safeguard Policy Statement
SES	–	Socio Economic Survey
SWM	–	Solid Waste Management
UNESCO	–	United Nations Educational, Scientific and Cultural Organization
UXO	–	Unexploded Ordnance
WHO	–	World Health Organization
WWTP	–	wastewater treatment plant

WEIGHTS AND MEASURES

°C	–	Degrees centigrade
ha	–	hectare/s
km	–	kilometer/s
km ²	–	square kilometer/s
m	–	meter
m ³	–	cubic meters
masl	–	meters above sea level
mg/l	–	milligram/s per liter

GLOSSARY

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

NOTE

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

This initial environmental examination is a document of the borrower. The views expressed herein do not necessarily represent those of ADB's Board of Directors, Management, or staff, and may be preliminary in nature. Your attention is directed to the ["terms of use"](#) section on ADB's website.

In preparing any country program or strategy, financing any project, or by making any designation of or reference to a particular territory or geographic area in this document, the Asian Development Bank does not intend to make any judgments as to the legal or other status of any territory or area.

TABLE OF CONTENTS

EXECUTIVE SUMMARY

I.	INTRODUCTION	1
A.	BACKGROUND AND INTRODUCTION	1
B.	ADB AND DOMESTIC ENVIRONMENTAL DUE DILIGENCE	2
C.	STRUCTURE OF THIS REPORT	2
II.	POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK	3
A.	ENVIRONMENTAL ASSESSMENT REQUIREMENTS	3
B.	NATIONAL ENVIRONMENTAL POLICY AND LEGISLATION	4
III.	DESCRIPTION OF THE PROJECT	10
A.	RATIONALE	10
B.	PROJECT IMPACT, OUTCOME AND BENEFITS	10
C.	PROJECT OUTPUTS	10
D.	KAMPONG CHHNANG WASTEWATER AND SEWAGE NETWORK SUBPROJECT	11
IV.	DESCRIPTION OF THE ENVIRONMENT	16
A.	PROJECT AREA OF INFLUENCE	16
B.	SUMMARY OF RECEPTORS	17
C.	PHYSICAL ENVIRONMENT	18
D.	BIOLOGICAL ENVIRONMENT	26
E.	SOCIO-ECONOMIC ENVIRONMENT	28
V.	ANTICIPATED IMPACTS AND MITIGATION MEASURES	31
A.	ENVIRONMENTAL IMPACT SCREENING AND ASSESSMENT METHODOLOGY	31
B.	POSITIVE IMPACT AND ENVIRONMENTAL BENEFITS	32
C.	IMPACTS AND MITIGATION MEASURES RELATIVE TO SITING, DESIGN AND PLANNING	32
D.	ENVIRONMENTAL IMPACT AND MITIGATION MEASURES DURING CONSTRUCTION	33
E.	IMPACTS AND MITIGATION MEASURES DURING OPERATION	42
VI.	INFORMATION DISCLOSURE AND PUBLIC CONSULTATIONS	45
A.	INFORMATION DISCLOSURE	45
B.	PUBLIC CONSULTATIONS DURING PROJECT PREPARATION	45
C.	PUBLIC CONSULTATIONS DURING PROJECT IMPLEMENTATION	46
D.	CONSULTATION DURING OPERATION	46
VII.	GRIEVANCE REDRESS MECHANISM	47
A.	GRM OBJECTIVE	47

VIII.	ENVIRONMENTAL MANAGEMENT PLAN	52
A.	OBJECTIVES	52
B.	INSTITUTIONAL ARRANGEMENTS AND THEIR RESPONSIBILITIES	52
C.	MITIGATION MEASURES	57
D.	MONITORING AND REPORTING	70
IX.	CONCLUSIONS	78
A.	CONCLUSIONS	78
B.	RECOMMENDATIONS	78

ANNEXES

Annex 1 Fauna species in Subproject area	80
Annex 2 GRM Project Hotline Notice	83

FIGURES and TABLES

Figure 1 Proposed Coverage of Separate Sewerage Master Plan and Priority Area.....	11
Figure 2 Kampong Chhnang Sewer and WWTP Location	13
Figure 3 Kampong Chhnang drainage network location	14
Figure 4 Subproject potential receptors	18
Figure 5 Tonle Sap Biosphere Reserve	19
Figure 6 Tonle Sap great lake area zones	20
Figure 7 Soil Map of Tonle Sap Basin	21
Figure 8 Raised road at site of WWTP access road.....	25
Figure 9 Towards Boeung Tum at WWTP proposed site	25
Figure 10 Subproject area flora	27
Figure 11 Example housing construction	30
Figure 12 Material/spoil transport in Kampong Chhnang	35
Figure 13 Subproject public consultation meeting.....	45
Figure 14 Monitoring and reporting outline	70
Table 1 Relevant Laws, Regulations and Guidelines in Cambodia	5
Table 2 Key National and International Standards.....	7
Table 3 National and International Effluent Standards	8
Table 4 Subproject components	12
Table 5 WWTP design parameters.....	15
Table 6 Key Subproject Receptors	17
Table 7 Monthly and Annual Rainfall, Kampong Chhnang, 2008-2012	22
Table 8 Impacts from climate change on wastewater collection and treatment.....	22
Table 9: Natural Hazards in Kampong Chhnang Town (1996-2018).....	26
Table 10 Kampong Chhnang town SES urban infrastructure findings.....	29
Table 11 Positives Impacts and Outcomes	32
Table 12 Consultation response 12 th March 2020.....	46
Table 13: GRM Roles and Responsibilities.....	47
Table 14: Project Hotline Informal Contact with Affected People	48

Table 15: Project Hotline Formal Contact with Affected People	49
Table 16: Key Functions for Project Implementation	52
Table 17: Responsibilities for Environmental Safeguards	54
Table 18: Capacity building and training requirement	56
Table 19: Mitigation Measures	57
Table 20: Monitoring requirement	70
Table 21: Project Readiness Assessment Indicators	71
Table 22: Environmental quality monitoring requirements	73
Table 23: EMP compliance and affected people monitoring	75
Table 24. Reporting Requirements	76
Table 25: Fish species in Kampong Chhnang and Pursat town	80
Table 26: Locally observed bird species, Kampong Chhnang and Pursat town Residents..	80

EXECUTIVE SUMMARY

A. Introduction

1. This Initial Environmental Examination (IEE) covers a change of scope to the Integrated Urban Environmental Management in the Tonle Sap Basin Project (known as 'the Project'). Two original IEEs were disclosed in 2014. A consolidated IEE was developed and updated to accommodate further project scope changes in 2018-2019, during the detailed design and implementation phase. This IEE covers a new Subproject in Kampong Chhnang. This follows a further major scope change to the Project which now includes:

- Wastewater treatment plant (WWTP), sewage collection network and stormwater drainage improvements

2. The Subproject will improve urban services in Kampong Chhnang and enhance climate resilience. The town currently has no sewage treatment; sewage is discharged untreated in storm water outfalls across the town. The WWTP site and its access road will be protected from flooding by land raising to an appropriate level given climate predictions. In the urban core, flooding from rainstorms will be reduced through improvements to the storm drainage network. The improvements will include cutting off sewage inflows to the stormwater network and providing household connections to the sewerage network.

3. The Subproject is classified as category B for environment as confirmed during the project preparation. The Subproject requires an Initial Environmental Impact Assessment (IEIA) under Cambodian law prior to construction.

B. Key Findings and Mitigation Measures

4. The environmental baseline study confirms that the local communities are the most sensitive receptors in the project area. The installation of the sewer network will impact most significantly on people living and working in the area during construction. The impacts will be localized and short term but will include increased levels of dust, noise and traffic in Kampong Chhnang town centre. This may give rise to community health and safety impacts and restricted access to business and residential properties.

5. The mitigation of these impacts in the Environmental Management Plan (EMP) focuses on good construction practice to ensure the communities' health and safety is not put at risk from trench excavations, and to control dust and noise through water spraying and use of mobile noise barriers to protect local residents and businesses. The EMP also requires good communication with the community to inform them in advance of the construction works and associated traffic disruption.

6. The WWTP effluent is discharged into Boeung Tum, a lake adjacent to the site. It is used to a limited extent by residents for household uses and occasional fishing. This lake and the area to the East of the National Road is part of the Tonle Sap Biosphere Reserve. It is in Zone 2, where development activities are allowed, with permission from Tonle Sap Authority. There will be moderate environmental impacts from the operation of the WWTP. The discharge of effluent during operation which does not meet discharge standards due to operational inadequacies offers the most significant potential risk of the project. The operation of the site will be required to meet design standards throughout its operational life in order to mitigate the environmental impacts of point source effluent discharge. In addition, there will be inherent long-term odor impacts from a WWTP.

7. The Subproject also poses occupational health and safety risks to construction workers and operators. In particular for construction work, the EMP includes mitigation measures to ensure the reduction of accidents and incidents, including releases to the environment, are minimized to

acceptable levels. This also requires the contractor to put in place measures to protect workers from any potential risks from COVID-19. Similarly, for the operational phase, the EMP requires the operator to consider and plan for Health and Safety including business continuity during the on-going COVID-19 crisis which may re-emerge when the site is operational.

8. In summary, short term impacts associated with construction and traffic disruption in an urban area are likely to occur, however the most significant long-term environment risks associated with the Subproject are during the operation phase. The WWTP can cause environmental pollution if it is not managed and maintained effectively. A pollution event either acute or over the long term, and can cause risks to water quality from WWTP effluent discharges or improper sludge disposal from maintenance of the WWTP or sewer and drainage networks. The impacts from poor quality effluent may vary considerably depending on the flood state of the surrounding environment.

9. The EMP aims to avoid impacts where possible and mitigate those impacts which cannot be eliminated to an acceptable and minimum level. This IEE and its EMP includes detailed requirements for:

- Mitigation and monitoring measures;
- Institutional arrangements and project responsibilities;
- EMP budget for implementation
- Capacity building and training requirements
- Public consultation and information disclosure
- GRM including clearly defined timescale and responsibilities

10. This IEE recognizes that its scope is for an additional Subproject, within the wider existing on-going Project. As such, the GRM for the Subproject is based on that which is already functioning for the Project's other Subprojects. In addition, the training and capacity building requirements build on that which have already been given and provides for refresher training for project staff, as well as ensuring any new GRM access points are fully trained in their responsibilities.

C. Conclusion

11. The main project risks relate to environment include: (i) low institutional capacity for environmental management and the possibility that the Project Management Unit (PMU) and Implementing Agency or operator will not adequately monitor the environmental impacts and implement the EMP during the construction and operation of the project; (ii) the PMU and Implementing Agency omit to implement corrective actions as issues arise during project implementation (iii) inadequate budget is allocated for maintenance of the sewerage and drainage network, WWTP meaning the environmental benefits are not realized.

12. This IEE was undertaken to determine the environmental issues and concerns associated with the Subproject. As a result of understanding the environmental baseline, receptors and project activities, an EMP is developed which will be updated in the Detailed Design phase. The EMP, if implemented effectively, will mitigate impacts on the natural environment and affected people to an acceptable level.

13. Overall, the project is anticipated to bring environmental benefits to Kampong Chhnang and will provide long term environmental improvements and health benefits for residents and visitors.

INTRODUCTION

A. Background and introduction

1. This Initial Environmental Examination (IEE) covers a change of scope to the Integrated Urban Environmental Management in the Tonle Sap Basin Project (known as 'the Project'). Two original IEEs were disclosed in 2014, and are available at:

- Kampong Chhnang¹
- Pursat²

2. A consolidated IEE was developed and updated to accommodate further project scope changes in 2018-2019 during the detailed design and implementation phase. This consolidated IEE was disclosed in ADB's website in July 2020.³ Changes in the consolidated IEE in 2018-2019 included:

- Changes to approach for Pursat wastewater treatment and network location;
- Removal of landfill closure from project scope;
- Removal of Pursat riverbank erosion protection; and
- Removal of Kampong Chhnang embankment from project scope.

3. This IEE covers a new Subproject in Kampong Chhnang. This follows a further major scope change to the Project which now includes:

- Wastewater treatment plant (WWTP), sewage collection network and stormwater drainage improvements.

4. As set out in the Project Administration Manual (PAM), the Project will contribute to increased economic activities and environmental protection in towns in the Tonle Sap Basin. It responds to the need of municipal governments for integrated urban environmental management in urban areas around Tonle Sap Lake.

5. The Project is located in the two secondary cities of Pursat town, Pursat Province and Kampong Chhnang town, Kampong Chhnang Province. The Project outputs are:

- Output 1: Kampong Chhnang Urban Area Environment Improvements
 - 1a. improved solid waste management (SWM) collection, and disposal by controlled landfill.
 - 1b. wastewater treatment, sewage network and stormwater drainage.
- Output 2: Pursat Urban Area Environment Improvements
 - 2a. improved SWM collection, and disposal by controlled landfill.
 - 2b. wastewater treatment, sewage network and drainage.
- Output 3: Community Mobilization and Environment Improvements.
- Output 4: Strengthened Sector Coordination and Operations.

¹ Kingdom of Cambodia. Ministry of Public Works and Transport. 2014. *Initial Environment Examination: Kampong Chhnang Urban Area Environment Improvements* (prepared by ADB).

² Kingdom of Cambodia. Ministry of Public Works and Transport. 2014. *Initial Environment Examination: Pursat Urban Area Environmental Improvements* (prepared by ADB)

³ Kingdom of Cambodia. Ministry of Public Works and Transport. 2020. *Initial Environment Examination: Pursat and Kampong Chhnang Urban Area Environmental Improvements* (prepared by ADB)

- Output 5: Strengthened Capacity for Project Implementation, Operation and Maintenance.

B. ADB and Domestic Environmental Due Diligence

6. The project classification of environment category B has been confirmed during project preparation. This IEE includes an Environmental Management Plan (EMP) which will be updated during the detailed design phase and will be included in the bidding documents for the Project. The IEE has been undertaken in accordance with ADB Safeguards Policy Statement (SPS) 2009.

7. **Scope of IEE.** This IEE covers Project Outputs 1b only i.e. the new Subproject and its major physical infrastructure interventions.

8. Output 1a and 2 are covered in the consolidated IEE for the Project. Output 3 is covered by an Environmental Assessment and Review Framework which was developed during the project preparation. Outputs 4 and 5 contribute to effective implementation and operation of Outputs 1 and 2, therefore will contribute to environmental performance.

9. An approved company registered with the Ministry of Environment (MoE) will be required to undertake a separate Initial Environmental Impact Assessment (IEIA) for the subproject. The results of the IEIA will be incorporated into this IEE and EMP ensuring that the contractor has one consolidated set of EMP requirements to follow, which meet good international practice standards and national requirements.

C. Structure of This Report

10. This IEE report follows the format prescribed in ADB SPS 2009 including:

- The policy legal and administrative framework;
- A description of the project the subproject;
- The environmental baseline for the subproject locations;
- Information on disclosure and consultation for this IEE;
- A Grievance Redress Mechanism for the subproject; and
- Environmental Management Plan for the subproject which will be updated following the final Detailed Engineering Design (DED) completion.

II. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

A. Environmental Assessment Requirements

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

12. SPS 2009 environmental assessment requirements specify that:

- At an early stage of project preparation, the borrower/client will identify potential direct, indirect, cumulative, and induced environmental impacts on and risks to physical, biological, socioeconomic, and cultural resources and determine their significance and scope, in consultation with stakeholders, including affected people and concerned nongovernment organizations. If potentially adverse environmental impacts and risks are identified, the borrower/client will undertake an environmental assessment as early as possible in the project cycle;
- The assessment process will be based on current information, including an accurate project description, and appropriate environmental and social baseline data;
- Impacts and risks will be analyzed in the context of the project's area of influence;
- Environmental impacts and risks will be analyzed for all relevant stages of the project cycle, including preconstruction, construction, operations, decommissioning, and post-closure activities such as rehabilitation or restoration; and
- The assessment will identify potential transboundary effects as well as global impacts.

13. Other requirements of SPS 2009 include:

- Alternatives analysis. SPS 2009 states that this is only required for projects which have "significant adverse environmental impacts that are irreversible, diverse, or unprecedented" i.e., category A projects. This does not apply to this category B IEE
- Environmental management plan. The borrower/client will prepare an EMP that addresses the potential impacts and risks identified by the environmental assessment.
- Consultation and participation. The borrower/client will carry out meaningful consultation with affected people and other concerned stakeholders, including civil society, and facilitate their informed participation.
- Information disclosure. Environmental information on the project, including the IEE and other safeguards information will be disclosed in accordance with ADB's Public Communications Policy (2011) and SPS (2009). In addition: (i) The EMP will be translated into Khmer language and be made available at each provincial department of public works and transport (PDPWT); (ii) The IEE will be disclosed on ADB's project website (www.adb.org);
- Grievance redress mechanism. The borrower/client will establish a mechanism to receive and facilitate resolution of affected people's concerns, complaints, and grievances about the project's environmental performance.
- Monitoring. The borrower/client will monitor and measure the progress of implementation of the EMP.

14. As stated in the "Guidelines for Climate Proofing Investments in the Water Sector: Water Supply and Sanitation, Climate Impacts", ADB (2016) there may be impacts from climate change on wastewater treatment. Warmer temperatures can mean (i) Increased operating challenges to

biological and chemical processes of treatment facilities (ii) Increased temperatures and increased evaporation in receiving water bodies, changing chemical balances and increased eutrophication (iii) Reduced capacity to meet wastewater treatment requirements and standards. More frequent and/or intense extreme weather events can lead to (i) increased risk of direct flood damage to treatment plant, pumping and conveyance, and outfall and (ii) Increased risk of untreated sewage overflows contaminating water supply sources.

15. These climate change risks are assessed in the project Climate Resilience Vulnerability Assessment for the Project (April 2018) and are reflected where appropriate in this IEE and will be reflected in the final project designs.

16. **Domestic EIA Requirements.** Environmental assessment in Cambodia is governed by the Sub-decree on EIA Process No. 72 (No. 72 ANKR. BK 1999). This law provides the detailed guidelines for implementation of the EIA Process and the types of projects requiring the conduct of IEIA or EIA. The law applies to both private sector and Government projects.

17. This sub-decree was updated in February 2020 by Prakas on Environmental Impact Assessment Classification for Development Projects (No, 021 PRK.BST 2020). The Appendix to Prakas No. 021 specifies the projects which require an EIA, IEIA or a Contract on Environmental Protection. The classification is depending on the scale of the project. Section 6 'Infrastructure Sector' specifies the following, in the MoE English translation:

- #187 Natural/stabilization pond-based sewage water treatment and Drainage System facilities – IEIA required
- #172 Automatic / mechanical sewage water treatment and drainage system facilities – EIA required

18. The project will require an IEIA.

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

20. The Ministry of Environment (MoE) through its EIA Department regulates and monitors the EIA Process. The MoE is responsible for: (i) review and approval of IEIA/EIA reports in collaboration with other relevant ministries and (ii) monitoring the EMP implementation of Project Proponents/Owners throughout the different project phases. MoE operates at the municipal and provincial levels through its Provincial Department of Environment (PDoE).

21. The project owner (public or private) is required to submit the necessary project document (IEIA/EIA report) to MoE for review and approval. After submission of IEIA/EIA report, it should take a maximum of 30 working days for a decision.

B. National Environmental Policy and Legislation

1. Legal Framework for Environmental Management

22. The hierarchy of legislation in Cambodia is:

- Royal Decree signed by the King;
- Sub-decree signed by the Prime Minister;
- Ministerial Decision signed by a Minister; and
- Regulation issued by a Ministry.

23. A Royal Decree ratifies laws passed by parliament. These can be supplemented by

“Prakas” or ministerial decisions. These laws allow sub-decrees and regulations to be passed which can stipulate procedures and standards to be met in order to ensure compliance with the law. Many sub-decrees and standards have been drafted but have not yet been ratified by parliament.

2. Policies and legal instruments

24. Cambodia’s main legal framework for addressing environmental protection, management of natural resources and public consultation is the Law on Environmental Protection and Natural Resource Management (‘the Environment Law’), which was adopted in 1996.

25. The Environment Law has the following objectives:

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

26. Specific regulations and standards for environmental quality are contained in the following sub-decrees:

- Sub-decree on Water Pollution Control (1999); and
- Sub-decree on Air Pollution Control and Noise Disturbance (2000)

27. A summary of legislative and policy instruments relevant to the project is presented in Table 1. The key environmental quality standards applied to the EMP for this IEE are listed in Table 2 and the key effluent standard is presented in detail in Table 3. The most stringent limit (national or international) shall apply.

Table 1 Relevant Laws, Regulations and Guidelines in Cambodia

Law/Regulation/Guideline	Year	Brief Description
Royal Decree on the Protection of Natural Areas	1993	Classifies the 23 protected areas in Cambodia into four categories, namely: (i) natural parks; (ii) wildlife sanctuaries; (iii) protected landscapes; and (iv) multiple-use areas. Designated the Tonle Sap (316,250 ha) as a multiple-use area or area necessary for the stability of the water, forestry, wildlife and fishery resources, for entertainment/ tourism, and for conservation of long-term existing natural resources with a view to assure sustainable economic development.
Royal Decree on the Establishment and Management of Tonle Sap Biosphere Reserve (Royal Decree No. NS/RKT/0401/070)	2001	Establishes the Tonle Sap Biosphere Reserve (TSBR) in accordance with the statutory framework of the World Network of Biosphere Reserves. Divides the TSBR into 3 zones: (i) core areas; (ii) buffer zone and (iii) flexible transition zone.
Protected Areas Law (Royal Decree No. NS/RKM/0208/007)	2008	Defines the framework of management, conservation & development of protected areas to ensure the conservation of biodiversity, & sustainable use of natural resources in protected areas. It divides the protected area into 4 zones namely, core zone, conservation zone, sustainable use zone & community zone.

Law/Regulation/Guideline	Year	Brief Description
		Article 36 strictly prohibits all types of public infrastructure in the Core Zone & Conservation Zone; & allows development of public infrastructures in the Sustainable Use Zone & Community Zone with approval from the Royal Government at MoE's request. Article 41 provides for the protection of each protected area against destructive/harmful practices, e.g., destroying water quality in all forms, poisoning, using chemical substances, disposing of solid and liquid wastes into water or on land.
Law on the Protection of Cultural Heritage (NS/RKM/0196/26)	1996	Regulates the protection of national cultural heritage and cultural property in general against illegal destruction, modification, alteration, excavation, alienation, exportation or importation. Its Article 37 stipulates that in case of chance find of a cultural property during construction, work should be stopped and the person who found the property should immediately make a declaration to the local police, who shall, in turn, transmit the property to the Provincial Governor without delay.
Law on Land	2001	Provides that: (i) unless it is in the public interest, no person may be deprived of ownership of his immovable property; and (ii) ownership deprivation shall be carried out according to legal forms and procedures and after an advanced payment of fair and just compensation. (Article 5)
Law on Water Resources Management	2007	Requires license/permit/written authorization for the: (i) abstraction & use of water resources other than for domestic purposes, watering for animal husbandry, fishing & irrigation of domestic gardens and orchards; (ii) extraction of sand, soil & gravel from the beds & banks of water courses, lakes, canals & reservoirs; (iii) filling of river, tributary, stream, natural lakes, canal & reservoir; and (iv) discharge, disposal or deposit of polluting substances that are likely to deteriorate water quality and to endanger human, animal and plant health. (Articles 12 & 22) Its Article 24 stipulates that MOWRAM, in collaboration with other concerned agencies, may designate a floodplain area as flood retention area.
Expropriation Law	2010	Defines the principles, mechanisms, and procedures of expropriation, and defining fair and just compensation for any construction, rehabilitation, and public physical infrastructure expansion project for the public and national interests and development of Cambodia.
Sub-decree on Sub-Decree No. 235 on the management of drainage system and wastewater treatment system	2017	This sub-decree aims to improve the management of drainage and wastewater treatment system in terms of efficiency, transparency and accountability to ensure safety, public health and biodiversity conservation. Under Article 11, municipal and district administrations are tasked to manage drainage and wastewater treatment systems within their jurisdiction
Sub-Decree on Demarcation of 647,406 Hectare Flooded Forest Domain in Six Provinces adjacent to Tonle Sap Lake (Sub-decree No. 197 ANKR/BK)	2011	Stipulates a zoning system for the area between the national highways and the Tonle Sap Lake system and the nature of agriculture activities that are permitted and banned in each zone.
Sub-decree on Water Pollution Control (Sub-decree No. 27 ANKR/BK)	1999	Regulates activities that cause pollution in public water areas in order to sustain good water quality so that the protection of human health and the conservation of

Law/Regulation/Guideline	Year	Brief Description
		biodiversity are ensured. Its Annexes 2, 4 and 5 provide the industrial effluent standards, including effluent from wastewater stabilization ponds and wastewater treatment plants, water quality standards for public waters for the purpose of biodiversity conservation, and water quality standards for public waters and health, respectively.
Sub-decree on solid waste Management (Sub-decree No. 36 ANKR/BK),	1999	Regulates solid waste management to ensure the protection of human health and the conservation of biodiversity. Annex I of standard classifies sludge waste from WWTPs as hazardous.
Sub-decree on Control of Air Pollution and Noise Disturbance (Sub-decree No. 42 ANKR/BK)	2000	Regulates air and noise pollution from mobile and fixed sources through monitoring, curb and mitigation activities to protect the environmental quality and public health. It contains the following relevant standards: (i) ambient air quality standard (Annex 1 of standard); and (ii) maximum allowable noise level in public and residential areas (Annex 6 of standard).
Sub-decree No. 235 on the management of drainage system and wastewater treatment system	2017	This sub-decree aims to improve the management of drainage system and wastewater systems efficiently, transparently and accountably to ensure the safety of public health and biodiversity.

Table 2 Key National and International Standards

Environmental Issue	National Standard	International Standard
Ambient air quality	Annex 1 of standard, Ambient Air Quality Standard, of Sub-decree on Control of Air Pollution and Noise Disturbance, 2000	WHO Air Quality Guidelines, global update 2005
Noise	Annex 6 of standard, Max. Standard of Noise Level Allowable in the Public and Residential Areas, of Sub-decree on Control of Air Pollution and Noise Disturbance, 2000	WHO Guidelines for Community Noise, 1999
Groundwater quality (for drinking)	Drinking water Quality Standards, 2004	WHO Guidelines for Drinking-water Quality, Fourth Edition, 2011
Groundwater (ambient)	Ministry of Handicrafts and Industry Groundwater Quality Standards	Groundwater Directive (GWD, 2006/118/EC)
Surface water quality	Annex 4 of standard, Water Quality Standards for Public Waters for the Purpose of Biodiversity Conservation, and Annex 5, Water Quality Standards for Public Waters and Health, of Sub-decree on Water Pollution Control, 1999	United States Environmental Protection Agency National Recommended Water Quality Criteria and Quality Criteria for Water (1986) UK Water Framework Directive Standards (Defra 2014) Mekong River Commission (MRC)_ Technical Guidelines for the Protection of Aquatic Life MRC Technical Guidelines for the Protection of Human Health
Effluent quality (including leachate)	Annex 2 of standard, Effluent standard (Discharged wastewater to public water areas or sewers), of Sub-decree No. 27 on Water Pollution Control, 1999	Environment Agency (2019) Waste water treatment works: treatment monitoring and compliance limits IFC (International Finance Corporation) EHS (Environment Health and Safety)

Environmental Issue	National Standard	International Standard
		General Guidelines and Guidelines for Water and Sanitation

28. In accordance with sub-decree No. 27 on Water Pollution Control, the effluent standard required is shown in the second row of Table 3: Sub-decree No.27 (1999) Annex 2, Discharged wastewater to *Public Water Areas or sewers*⁴. The table also compares national standards to IFC guidelines. IFC General EHS Guidelines and IFC EHS Guidelines for Water and Sanitation both specify that compliance with national standards is required, if they exist, or IFC standards if none are available nationally or locally. Note that while the applicable standard is *Public Water Areas or sewers*, it is expected that the WWTP performance will be able to achieve the *Protected Public Water Area* standard, which is comparable to IFC guidelines with key parameters of BOD, COD and nutrients.

Table 3 National and International Effluent Standards

Standard	Parameter*							
	COD	BOD	TSS	NO ₃	PO ₄	NH ₃	PH	Oil /Grease
National Standard Sub-decree No.27 (1999) Annex 2, discharge to <i>Protected Public Water Area</i>	<50mg/l	<30mg/l	<60mg/l	<10mg/l	<3mg/l	<5mg/l	6-9	<5
National Standard Sub-decree No.27 (1999) Annex 2, Discharged wastewater to <i>Public Water Areas or sewers</i>	<100mg/l	<80mg/l	<80mg/l	<20mg/l	<6mg/l	<7mg/l	5-9	<15
IFC ⁵ Indicative Values for Sanitary Sewage Discharges	125	30	50	TN 10	TP 2	-	6-9	10

*COD-Chemical Oxygen Demand, BOD – Biological Oxygen Demand, TSS-Total Suspended Solids, TN-Total Nitrogen, TP-Total Phosphorous, NH₃ –Ammonia, PH-acidity/alkalinity scale, NO₃- Nitrate, PO₄-Phosphate.

29. In terms of SPS 2009 requirements, during the design, construction, and operation of the project the borrower/client will apply pollution prevention and control technologies and practices consistent with international good practice, as reflected in internationally recognized standards such as the World Bank Group's Environment, Health and Safety Guidelines. These standards contain performance levels and measures that are normally acceptable and applicable to projects. When host country regulations differ from these levels and measures, the borrower/client will achieve whichever is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, the borrower/client will provide full and detailed justification for any proposed alternatives that are consistent with the requirements presented in this document. These Environment, Health and Safety Guidelines are considered throughout the Environmental Management Plan for the subproject.

3. International Agreements

30. Cambodia is party to the following relevant international environmental agreements: (i) UNESCO World Heritage Convention, 1991; (ii) Convention on Biodiversity, 1995; (iii) UN Framework Convention on Climate Change, 1995; (iv) Washington Convention on International

⁴ Advice from MPWT in concertation with MoE, 11 December 2020

⁵ IFC General EHS Guidelines: Environmental Wastewater quality and ambient water quality

Trade in Endangered Species of Wild Fauna and Flora (CITES), 1997; (v) Ramsar Convention on Wetlands of International Importance, especially as Waterfowl Habitat, 1999; (vi) Basel Convention on the Control of Transboundary Movements of the Hazardous Wastes and Their Disposal, 2001; (vii) Vienna Convention for the Protection of the Ozone Layer and its Montreal Protocol on Substances that Deplete the Ozone Layer, 2001, and all Amendments, 2007; (viii) Climate Change Kyoto Protocol, 2002; and (ix) International Tropical Timber Agreement, 2006.

31. Cambodia joined the UNESCO Network of Biosphere Reserves in 1997. It committed to the Millennium Development Goals and subsequently endorsed the Sustainable Development Goals at the UN General Assembly in 2015. At the regional level, it ratified the following ASEAN Agreements: (i) on Transboundary Haze Pollution in 2006; and (ii) on Disaster Management and Emergency Response, which entered into force in 2009. At the sub-regional level, Cambodia, along with Lao PDR, Thailand and Viet Nam, signed the “Agreement on the Cooperation for the Sustainable Development of the Mekong River Basin” (or the Mekong Agreement) in April 1995.

III. DESCRIPTION OF THE PROJECT

A. Rationale

32. The rationale is set out in the Project Administration Manual (PAM)⁶, for the Project as a whole, however the PAM did not include the Subproject to which this IEE refers.

33. The PAM identifies that the Project will contribute to increased economic activities and environmental protection in towns in the Tonle Sap Basin. It responds to the need of municipal governments for integrated urban environmental management in urban areas around Tonle Sap Lake. The project will improve urban services and enhance climate change resilience in Kampong Chhnang and Pursat municipalities through urban area environmental improvements; community mobilization and environmental improvements; strengthened sector coordination and operations; and strengthened capacity for project implementation, and operations and maintenance (O&M). The Project follows the Tonle Sap Urban Areas Development Framework and Kampong Chhnang and Pursat municipalities' urban development strategies to 2030.

34. Urbanization in Cambodia is taking place with minimal coordination and regulation, inadequate infrastructure and insufficient regard for the environmental impacts of development. The results include disorganized growth, inefficient land use, damage and loss of natural resources, and inadequate access to urban services. The problems can be attributed to poor urban management, little strategic spatial planning, poor connectivity between urban planning and environmental management, and insufficient investment in infrastructure and community services. Urban planning and investments are needed to (i) accommodate expanding urban populations, (ii) sustain economic growth in medium-sized cities that are moving up the value chain in terms of their production profiles and activities, and (iii) protect the environment.

B. Project Impact, Outcome and Benefits

35. As defined in the PAM, the impact and outcome for the Project are as follows:

- **Impact:** increased economic growth and environmental protection in towns in the Tonle Sap Basin.
- **Outcome:** Improved urban services and climate change resilience in Kampong Chhnang and Pursat municipalities.

36. **Benefits.** The Project will enhance the urban environment, improve public health, and contribute to better quality, coverage and reliability of services to more than 100,000 residents in the two municipalities.

C. Project Outputs

37. Output 1: Kampong Chhnang urban area environmental improvements. Includes construction of a new controlled landfill site at Trapeang Sbov Village (Pongro commune, Rolea Bier district); provision of equipment for solid waste collection, and a new wastewater treatment plant, sewage network and storm drain improvements.

38. Output 2: Pursat urban area environmental improvements. Includes construction of primary and secondary drains in the town center with associated road improvements and improved wastewater treatment and sewage network; development of new controlled landfill at Toul Mkak village (Roleap Sangkat, Pursat town) and associated access road of about 1,500 meters and provision of equipment for solid waste collection.

⁶ Project Administration Manual: Project Number: 42285 Loan and/or Grant Number(s): L3311/L8295/G0454-CAM

39. Output 3: the community mobilization and environmental improvements (CMEI). Includes improved household sanitation for ID Poor 1 and 2 in the current municipality area; climate change and hygiene awareness and action; and community small-scale infrastructure improvements in pre-identified poor and vulnerable areas in each municipality. Small-scale infrastructure improvements will be prioritized by the communities and will be financed by the project, national government, and community.

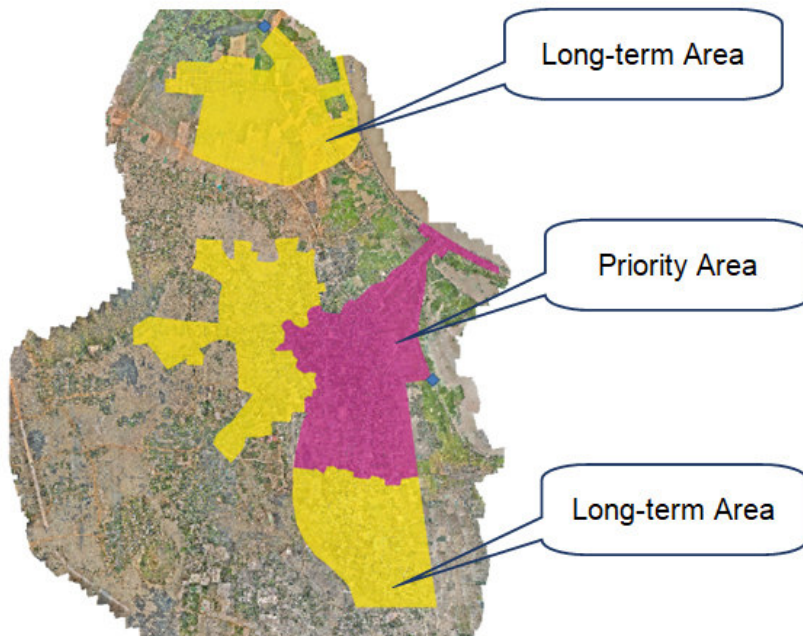
40. Output 4: Strengthened Sector Coordination and Operations. Supports MPWT to convene national urban development task force meetings with other ministries and development partners in the urban sector; strengthen climate change regulations; and support the establishment of urban service units for improved delivery and management of decentralized urban services.

41. Output 5: Strengthened Capacity for Project Implementation and O&M. Includes project implementation support services for the project management (PMU) and project implementation units (PIUs) in design supervision; safeguards implementation; project and climate resilience monitoring; gender mainstreaming; community development; accounting and financial management; procurement; disbursement; review and expansion of existing strategies; and skills enhancement and on-the-job training in urban planning and development, solid waste SWM and O&M.

D. Kampong Chhnang Wastewater and Sewage Network Subproject

42. The Subproject is part of a long term master plan which covers the entire city area including the northern proposed settlement area, see Figure 1. The entire area covers about 1800 ha. A priority area is identified for first phase of construction under the ADB assistance. The total area coverage by the priority area is 559 ha. This Subproject is the Priority Area.

Figure 1 Proposed Coverage of Separate Sewerage Master Plan and Priority Area



Source: Kampong Chhnang Separate Sewerage Master Plan Report (draft May 2020).

43. The Subproject components are shown in Table 4.

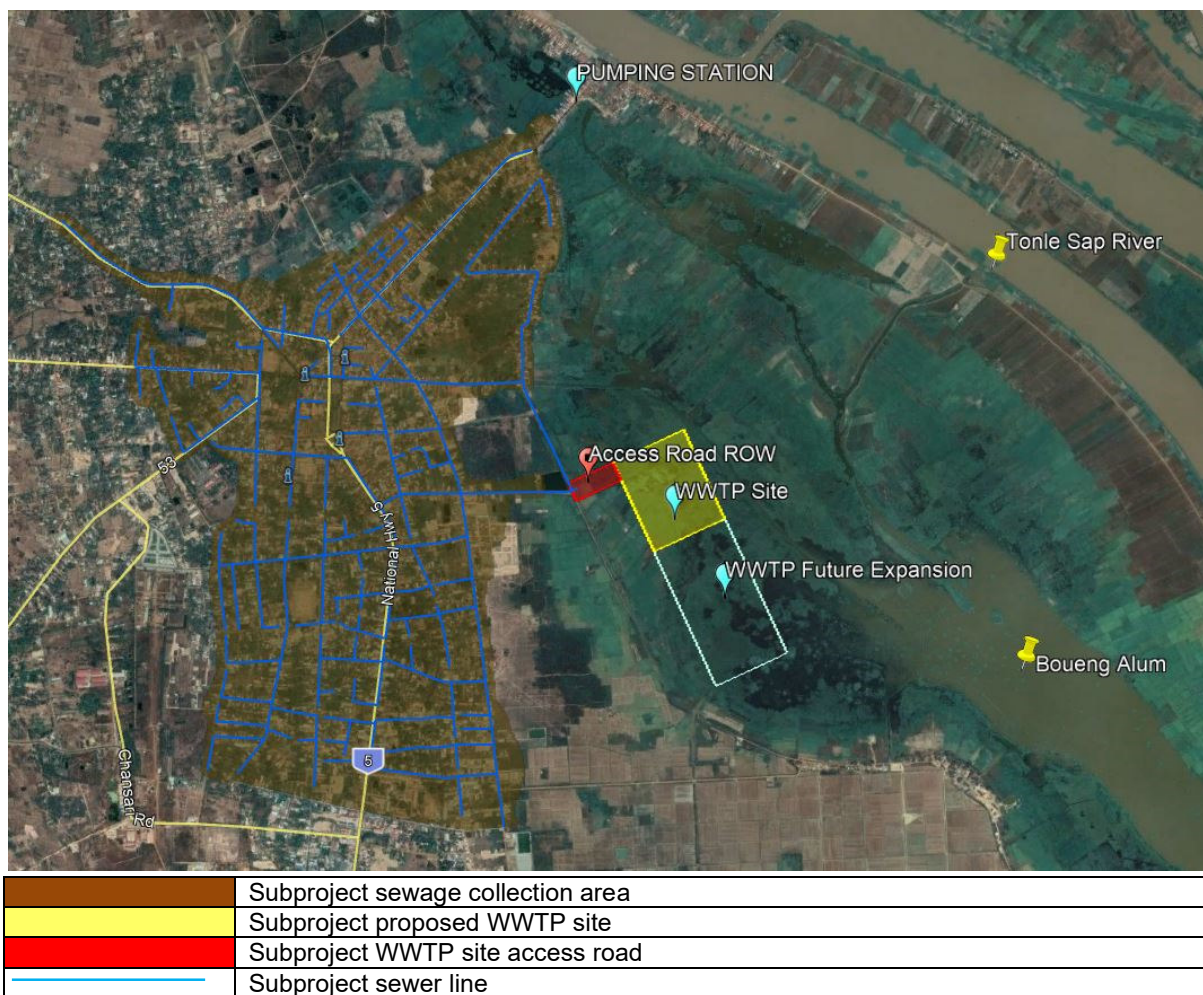
Table 4 Subproject components

No.	Sub-project Components	Descriptions
1	Sewage collection network	Trunk Line diameter 1000 mm, 8 km Main line diameter 600 mm, 30 km Lateral or collector lines diameter 160 mm, 6.6 km Connection for each house Trunk lines and main lines will be installed under the existing roads. The lateral or collector lines will provide for the connection to the individual houses/buildings. They will be installed under the sidewalks or in road shoulders. In sections where other underground utilities are installed under the sidewalk or in narrow roads the lateral lines will have to be installed close to the houses.
2	Wastewater treatment plant (WWTP)	WWTP treatment capacity 4.2 m³/d. Comprising: Anaerobic treatment (closed pond); Sedimentation tank Reed bed The WWTP will include landscaping comprising a double row tree screen at the perimeter of the site.
3	Land raising for the construction of WWTP site	An area of 19.9 ha. located east of the an existing raised road embankment . The site will be raised to the level of 12 masl for the construction of the WWTP.
4	WWTP access road	Within a Right of Way (ROW) area of 2.5 ha and 100m wide, 250m long an access road will be constructed on an embankment raised up to 12 masl
5	Pumping Station	Lifting pump and chamber x 1
6	Storm water drainage improvement	Within the service area of the sewerage system (492 ha.) the storm water drainage will be improved. 8.5 km average 1.0m diameter pipe construction of 425 rain inlets and 2 km open channel improvements. 1215 reinforced cast concrete manholes and heavy duty cast iron covers suitable for street use.

Source: PMIS Team

44. The Subproject location is shown in Figure 2 (Components 1 to 5) and Figure 3 (Component 6). Figure 2 also shows a 30-ha area designated by the Municipality for future expansion of the WWTP site. No sub-project construction will take place in this area under the Project.

Figure 2 Kampong Chhnang Sewer and WWTP Location



Source: PMIS Team in Google Earth

Figure 3 Kampong Chhnang drainage network location



Source: PMIS Team

45. As shown in Figure 3, Japan International Cooperation Agency (JICA) has rehabilitated selected drains and roads in the city center. Under this rehabilitation project 25 km of new pipelines were installed with diameters from 300 mm to 1750 mm and 5.4 km of open drain was constructed.

46. **Subcomponent 1 Sewer network.** Currently sewerage in Kampong Chhnang is discharged to the drainage system, entering the environment at the drainage outfalls shown in Figure 3. The Subproject will close the sewage connections to the drainage system and will connect them to a separate sewer system.

47. **Subcomponent 2: WWTP.** For the WWTP, a basic design has been carried out with the considerations in Table 5:

Table 5 WWTP design parameters

No	Design Parameters	Values
1	Design Population Density	90 pop/ha
2	Per Capita Sewage Flow (120 lpcd x 0.8)	96 lpcd
3	Commercial Factor	20%
4	Ground Water Infiltration	0.1 l/s/ha
5	Rainfall Dependent Infiltration/inflow (RDI/I)	2% of 2 yr 24 - hrs Rainfall
6	Minimum Velocity at ½ full capacity	0.6 m/s

Source: Project Management Implementation Support (PMIS)Team

48. The process design concepts are based on providing a treated effluent to specified quality standards that will be suitable for river discharge. The WWTPs concept design includes sufficient redundancy and robustness to treat peak hour flow of 1.8 times of average daily flows for up to the effluent quality required.

49. Effluent quality is a key design criteria. The Biological Oxygen Demand (BOD) per person ranges from 30 to 70 g/day⁷ and the higher the living standard, the higher the BOD contribution. For this Subproject, 40 g/day BOD contribution from each person is adopted. The average BOD concentration of 378.8 mg/l (say 400 mg/l) assumed. It is proposed to limit the BOD to less than 30 mg/l as per the effluent standard of Cambodia. 65% BOD removal is in the closed anaerobic pond and the reed bed is for further BOD reduction and pathogen removal.

50. **Subcomponent 3 and 4: WWTP flood protection and access road raising.** The protection offered by the Subproject will be for a maximum flood level for a 50-year return period, which is 11.8 m based on an MRC model. Therefore, the access road and WWTP site will be raised to 12 masl. This is anticipated to mean. For the road embankment this means raising the land to approximately 6 m above current levels.

51. **Subcomponent 5: Pumping station.** The pumping station will be constructed at the northern edge of the collection area.

52. **Subcomponent 6: storm water drainage improvements.** Many of the current drainage channels are totally blocked from a lack of maintenance and have manholes which cannot be lifted. The Subproject will improve the drainage through improving outfalls and cleaning the open channels after the outfalls enabling the storm water to flow away from the town. The manholes will be cleaned and covered to ensure they can be maintained in the future.

⁷ Compos & Von Sperling, 1996 cited in Kampong Chhnang Separate Sewerage Master Plan Report (draft May 2020).

IV. DESCRIPTION OF THE ENVIRONMENT

A. Project Area of Influence

53. The subproject site was visited for the preparation of this IEE, with particular attention paid to identifying:

- Sensitive natural environmental receptors such as water bodies, biodiversity and wildlife habitats;
- Sensitive human receptors;
- Cultural and heritage sites; and
- Potential health and safety issues.

54. According to SPS 2009, the area of influence encompasses:

- (i) The primary project site(s) and related facilities that the borrower/client develops or controls. The primary project sites for this Subproject include direct construction sites, pipelines, canals, access roads, borrow pits, disposal areas, and construction camps.
- (ii) Associated facilities that are not funded as part of the project whose viability and existence depends exclusively on the project. No associated facilities are anticipated for this project.
- (iii) Effects from cumulative impacts from further planned development of the project, other sources of similar impacts. Cumulative impacts are considered where appropriate in the baseline and impact sections.
- (iv) Effects from unplanned but predictable developments caused by the project that may occur later or at a different location. As a result of this subproject's raised embankment, it is anticipated that the development of the area protected from flooding by the raised road embankment will continue, leading to further developments around the subproject area.

55. The **Area of Influence (Aoi)** is used to describe the extent over which the Project impacts will be realised. The Aoi to be assessed can vary depending upon the type of impact being considered and the attributes of the potentially affected receptors and may also extend across administrative or national boundaries. In each case, however, the Aoi includes all areas within which **significant** impacts are likely to occur taking into account the:

- physical extent of the proposed works defined by the limits of land to be acquired or used (temporarily or permanently) by the Project; and
- nature of the baseline environment and manner in which impacts are likely to be propagated beyond the project boundary.

56. For the purposes of this IEE, the Project Aoi includes the footprint of all Subproject activities and for the sewage and drainage networks it includes the road corridor in which the works take place. It also includes the areas in which a direct or indirect impact on the physical, biological, social or cultural environment might occur, which can vary by topic. Where different areas are used, this is discussed in the respective baseline and impact sections.

57. Local impacts with a narrow Aoi are those impacts arising from noise, dust and amenity issues. A wider Aoi results from impacts which contribute to global issues such as the embodied carbon associated with the manufacture, supply and use of concrete products, and the carbon emissions associated with material transport. SPS 2009 requires the assessment to identify potential transboundary effects, such as air pollution, and global impacts, such as emission of greenhouse gases. Where these transboundary impacts are assessed as significant, this is discussed in the impact section.

B. Summary of Receptors

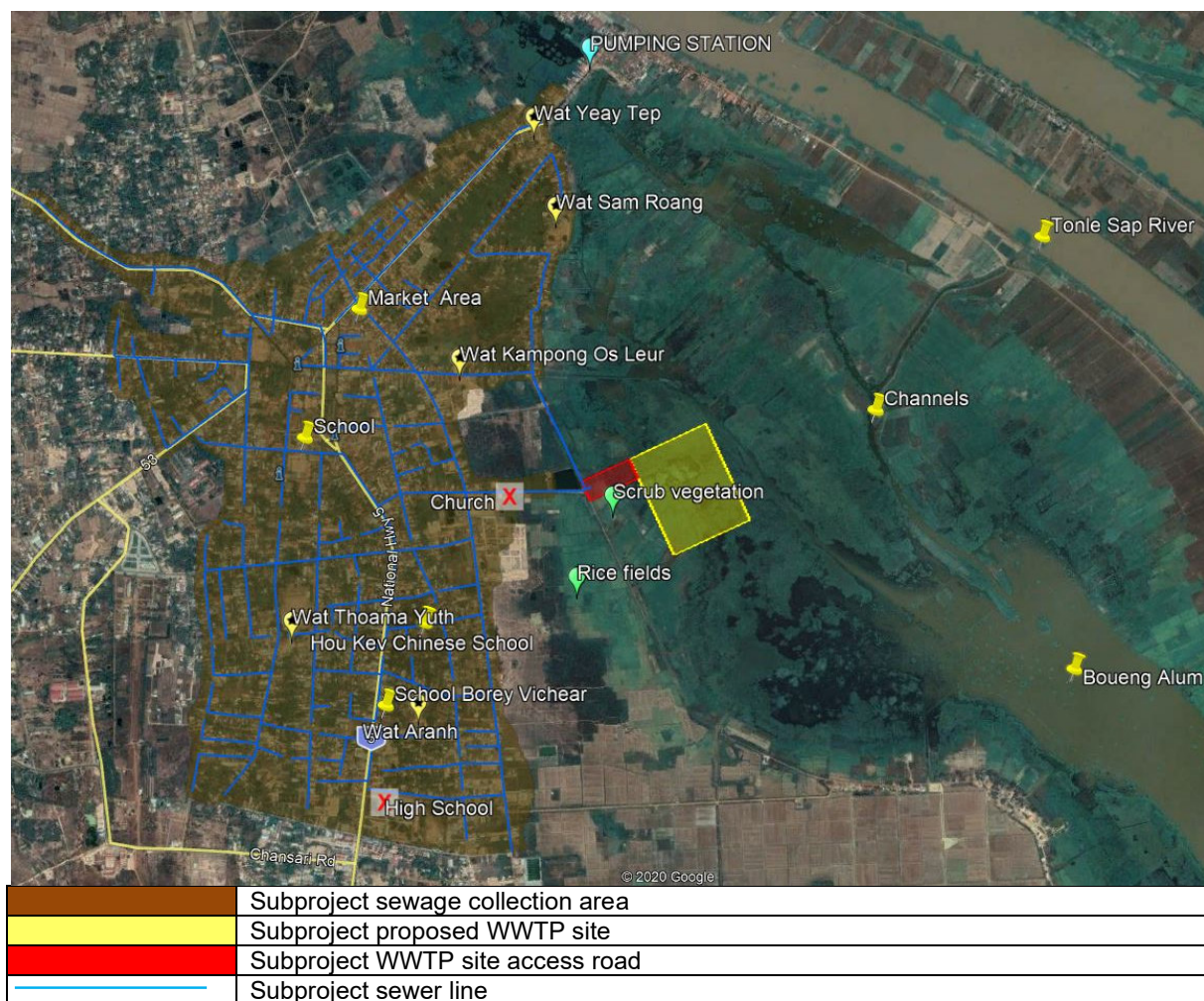
58. A table with GPS locations of receptors for the Subproject is shown in Table 6 which includes the WWTP site, access road, and urban core sewage network construction work. A map of receptors is shown in Figure 4. This is based on field work and mapping however additional receptors e.g. schools and health care facilities not specified in this table, are anticipated within the Subproject construction area.

Table 6 Key Subproject Receptors

Type of Receptor	Description	GPS	Protected Area Status
Surface Water	Boeung Tum ⁸ – wetland and lake to the south east of WWTP site, receiving water body for effluent in dry season	-	None
	Tonle Sap River – receiving water body for effluent in wet season when river naturally floods	-	Within Tonle Sap Biosphere Reserve
	Channels connect the lake and river when the river is not in flood	-	
Socio-Economic	Housing and businesses within Priority Area. Housing area begins 450 west of WWTP site.	-	None
	Market within Priority Area	12.255744°, 104.669593°	None
	Open air restaurant adjacent to access road	12.235031°, 104.682688°	None
Cultural	Multiple places of worship and culture including:		None
	Church 370m west of WWTP site within Priority Area	12.248361°, 104.676300°	None
	Wat Kampong Os Leur- within Priority Area 350 m from raised road construction	12.253303°, 104.674127°	None
	Wat Aranh - within Priority Area	12.238638°, 104.672343°	None
	Wat Yeay Tep - within Priority Area, 450 m from pumping station	12.263547°, 104.677354°	None
	Wat Sam Roang- within Priority Area	12.259776°, 104.678306°	None
	Wat Thoama Yuth- within Priority Area	12.242136°, 104.666850°	None
Education	Multiple schools and education facilities, including:		None
	High School	12.250280°, 104.667241°	
	Borey Vichear School	12.238908°, 104.670753°	
Health Care	Hou Kev Chinese School	12.242421°, 104.672445°	
	Provincial Referral Hospital 1km west of WWTP, within Priority Area	12.250796°, 104.669583°	None

Source: PMIS Team

⁸ Boung Alum on Google Maps, known locally as BoeungTum.

Figure 4 Subproject potential receptors

Source: PMIS

C. Physical Environment

4. Geographic Location and Project Context

59. Kampong Chhnang is located approximately 80 km north of Phnom Penh on National Road No.5. It is situated at the southern end of the Tonle Sap Great Lake basin, 35 km south of the main body of the lake. The town sits on the west bank of one of the main channels in the Tonle Sap river. Of the six main urban centers around the Tonle Sap, Kampong Chhnang is by far the best access to the waterfront.

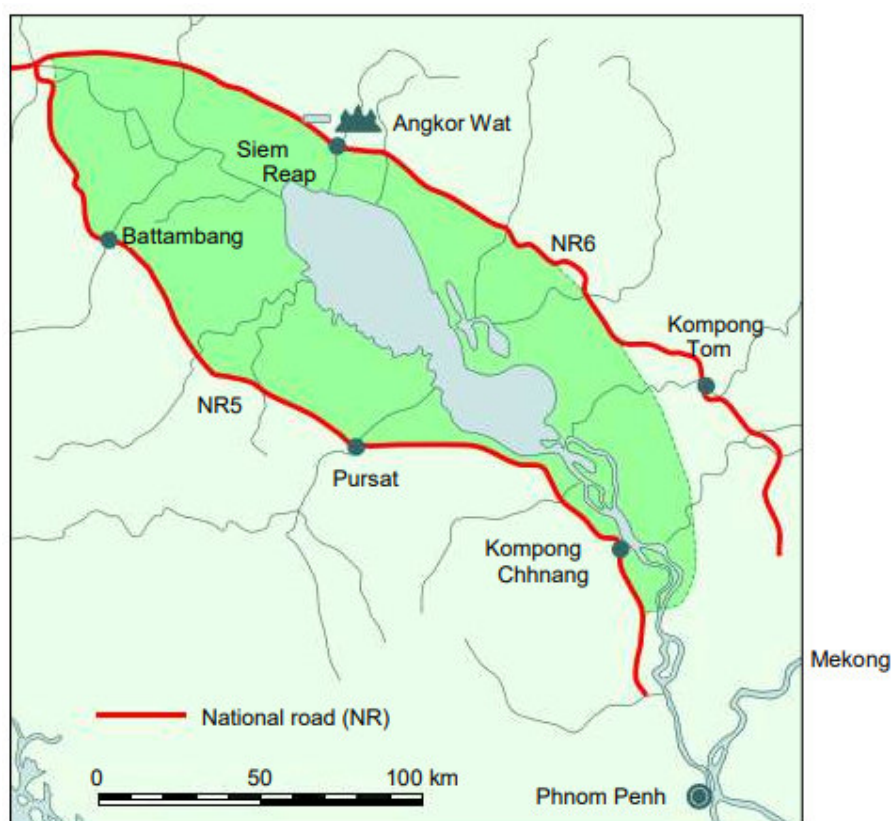
60. The urban area of Kampong Chhnang extends beyond the municipal boundary. The population of the contiguous urban areas is estimated at 47,000. The town has developed along a radial pattern with urban development along radial roads extending from the town center. The population in the urban center of the town is estimated to be about 28,000.

61. The national and provincial roads are all bitumen surfaced, while the municipal roads are a combination of laterite or bitumen surfacing with many unformed roads. The town is in the process of upgrading roads and the Provincial Department of Public Works and Transport (PDPWT) reported that it has introduced cost sharing between the Province and potential road beneficiaries for constructing and surfacing roads with the capital cost split 50:50 between government and beneficiaries.

62. Many of the roads do not have roadside drains, while existing drains are often silted up or blocked with waste. The relatively low traffic on the municipal roads means that in general road conditions are reasonable. The main issue is flooding of the roads during the wet season and also dust and mud on unsurfaced roads during respective dry and wet periods. As part of a program to upgrade the National Highway Five (NH5) between Phnom Penh and the Thai border, JICA is also working on the preparation of a proposed new by-pass road for NH5 around five kilometers to the West of the town.

63. **Tonle Sap Biosphere Reserve.** The part of the Kampong Chhnang town between Road No.5 and the river is situated in the Tonle Sap Biosphere Reserve. The reserve covers the lake itself and its surrounding flooded forests. It has a core zone (708 km²), a buffer zone (5,108 km²), acting as a buffer to the core areas, and a transition zone (8,997 km²) which includes the wider flood plain in which many settlements and socio-economic activities such as agriculture occur. The boundary is largely delineated by National Roads 5 and 6 (see Figure 5).⁹

Figure 5 Tonle Sap Biosphere Reserve



Source: MRC (2013) Learning from the lakes: IWRM implementation in Tonle Sap Lake of Cambodia and Songkhla Lake Basin of Thailand

64. As defined by the Tonle Sap Authority (TSA) the areas surrounding the Tonle Sap Great Lake are divided into three different zones as follows (see Figure 5):

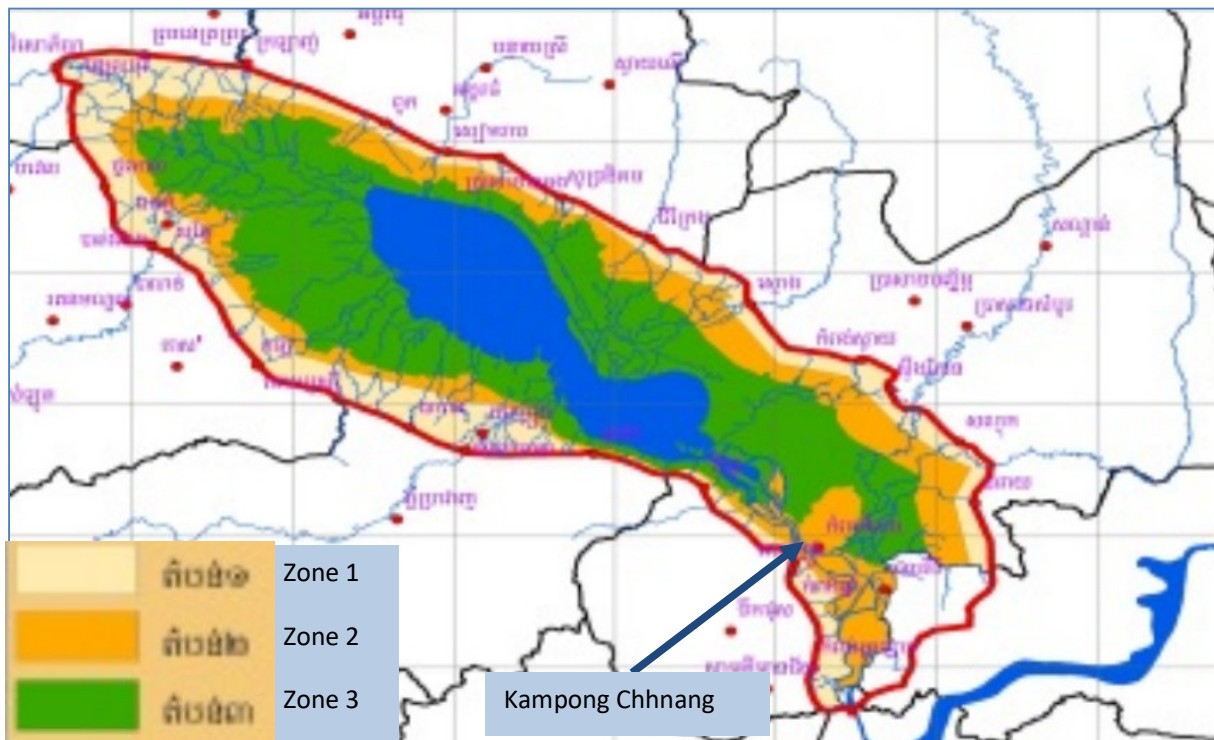
- Zone 1: 395, 587 ha. Generally is a residential area and traditional paddy fields with rain-fed farming.

⁹ Mekong River Commission (August 2013) Learning from the lakes: IWRM implementation in Tonle Sap Lake of Cambodia and Songkhla Lake Basin of Thailand.

- Zone 2: 369, 865 ha. A cultivated area for floating, receding and dry season rice and agriculture.
- Zone 3: 647, 406 ha (Zone 3 was defined via Sub-degree No. 197 GNKR/BK of the Royal Government of Cambodia dated on 29 July 2011). An area of flooded forests, fully protected consisting of inundated forest, spare forest, big and small natural lakes and muddy areas.

65. Subproject is in Zone 2, where activities are allowed, with permission from TSA. TSA is responsible for coordinating the management, conservation and development of the Tonle Sap Region and as such is part of the Project Steering Committee for the Project. TSA has agreed to the project and to date the PMIS team is not aware of any particular requests or mitigation measures submitted to the Project by TSA.

Figure 6 Tonle Sap great lake area zones

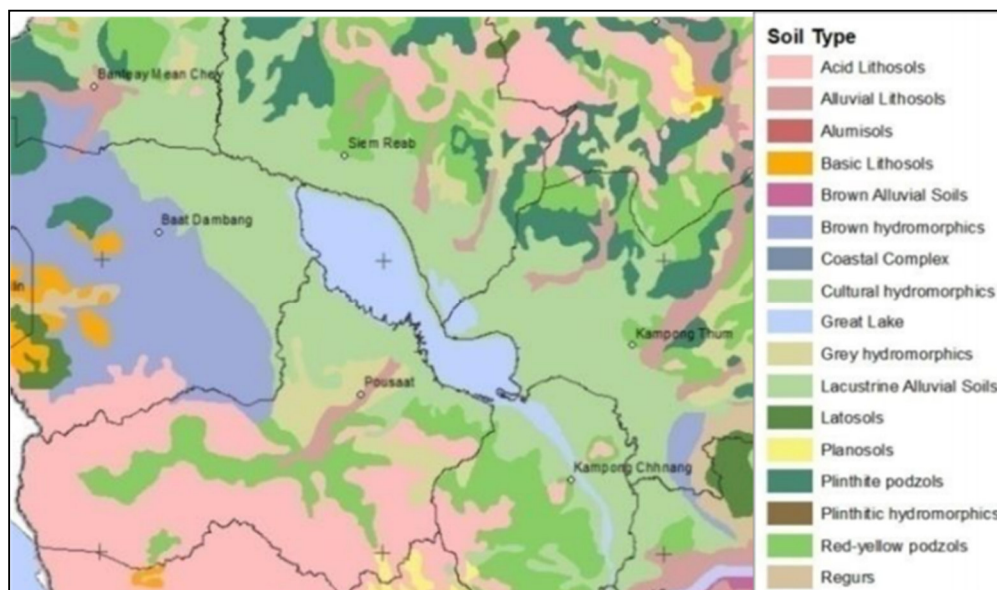


Source: Ministry of Water Resources and Meteorology, Tonle Sap Authority (undated brochure).

5. Geology and Topography

66. Kampong Chhnang is in the Tonle Sap Great Lake basin. The area is dominated by the Tonle Sap lake and this has affected the soil characteristics. As shown in Figure 7 the subproject area are dominated by alluvial soils and lithosols and red-yellow podzols from which minerals such as iron have been leached.

Figure 7 Soil Map of Tonle Sap Basin



Source: Dr Seng Vang Deputy Director, MAFF, presentation 2015, with UN FAO¹⁰

67. The topography of the area is generally flat, forming part of the Tonle Sap floodplain area. As a result, the subproject is in flat low-lying areas with the WWTP site being 5-10 meters above sea level (masl).

6. Climate

68. Cambodia is situated in a tropical zone, between 10 and 14-degree latitude north of the equator. Its climate is influenced by the monsoon cycle and has two distinct seasons, the dry and rainy seasons. The northeast monsoon brings in the dry season from November to April. The dry season is cooler from November to January when cool air from Siberia flows in, and is dry and hot from February to April. The rainy season is generally from May to October, as southwest monsoon brings in moisture and rains from the Indian Ocean. The rainy season accounts for about 80-90% of the annual rainfall, varying between 1,200 and 2,000 mm across the country. October is the wettest month; January/February have the least rainfall.

69. Average temperature has minimal variations regionally and seasonally. Weather is coolest in January and hottest in April. Relative humidity ranges between 65-70% in March and 85-90% in September. Annual evaporation is from 2,000 to 2,200 mm, i.e. highest in March and April at 200 mm to 240 mm and lowest in September-October at 120 mm to 150 mm¹¹.

70. The mean wind speed in Cambodia is low at about 2 m/s. December is known as the month of strong steady wind from the north.

71. Monthly rainfall data for Kampong Chhnang are shown in Table 7. This highest rainfall occurred in 2011 and this coincided with the flooding in the town when the existing embankment was overtopped.¹²

¹⁰ Asian Soil Partnership Consultation Workshop on Sustainable Management and Protection of Soil Resources 13-15 May 2015, Bangkok, Thailand.

¹¹ Cambodia Environment Outlook. Ministry of Environment and UNEP. 2009.

¹² Climate Vulnerability Risk Assessment (Draft version April 2018) for Tonle Sap 1 Project.

Table 7 Monthly and Annual Rainfall, Kampong Chhnang, 2008-2012

Year	Monthly Rainfall (mm)												Total
	Jan	Feb	Mar	Apr	Ma y	Jun	Jul	Au g	Sep	Oct	No v	Dec	
2008	0.0	11.0	2.6	25.0	259.3	97.1	170.6	92.0	326.0	169.2	267.0	0.0	1,419.8
2009	0.0	0.0	64.0	73.5	195.8	164.6	275.6	273.0	299.1	289.0	0.0	0.0	1,634.6
2010	26.2	22.1	148.6	40.5	191.6	80.8	126.5	147.4	147.4	236.8	51.7	0.0	1,219.6
2011	0.0	0.0	73.0	185.0	138.0	249.0	259.7	265.0	301.0	237.0	210.5	11.0	1,929.2
2012	94.0	17.0	24.0	96.0	135.4	187.5	318.1	293.5	180.5	269.5	212.3	3.3	1,831.1
Average													1,606.9
Key	Lowest Monthly mm						Highest Monthly mm						

Source: Provincial Department of Water Resources and Meteorology of Kampong Chhnang Province

7. Climate Change

72. A Climate Risk and Vulnerability Assessment (CRVA) has been undertaken for the Project (April 2018)¹³ based on site visits and climate change projections for the Year 2050 and Representative Concentration Pathway¹⁴ (RCP) 8.5. The CRVA noted that many sites are vulnerable to flooding and as such mitigation measures in the design are required; the most significant climate change risks associated with the subprojects are during operation. WWTPs can be impacted by heavy rain and flooding. Increased temperatures and droughts can reduce potable water supplies which may directly impact the flows into the WWTP. However, if effectively managed, the CRVA notes that new facilities will bring about improvements to the living conditions of the population of the project areas.

73. Table 8 shows the impacts from climate change on the subprojects as identified by the CRVA. These issues are managed through design mitigation measures where appropriate.

Table 8 Impacts from climate change on wastewater collection and treatment

Climate Change Factor	Impact
Warmer Temperatures	Increased operating challenges to biological and chemical processes of treatment facilities. Increased temperatures and increased evaporation in receiving water bodies, changing chemical balances and increased eutrophication. Reduced capacity to meet wastewater treatment requirements and standards
More Frequent and/or Intense Extreme Weather Events	Increased risk of direct flood damage to treatment plant, pumping and conveyance, and outfall. Increased risk of untreated sewage overflows contaminating water supply sources. Changes in quantity and quality of watershed runoff and in the resulting non-point source pollution loads to receiving waters.

Source: CRVA (2018)

¹³ Climate Change Adaptation in Urban Development (Package 2), Integrated Urban Environmental Management in the Tonle Sap Basin Project (Tonle Sap 1) ADB Grant: 0454-CAM. April 2018

¹⁴ RCP = Representative Concentration Pathway. Greenhouse Gas trajectory adopted by IPCC for its 5th Annual Assessment Report which supersedes the Special Report on Emissions Scenarios (2000)

74. The main change in rainfall will occur in the three wettest months of the year, July to September. In low lying areas flooding is generally caused by the rainfall in the wettest months of the year and lasts for several weeks. In such a case, changes in monthly rainfall are of more importance than rain falling over a shorter time period. Projections suggest that there will be little, if any, increase by 2030 but could increase by over 20% by 2070. The CRVA concludes that when comparing predictions under RCP 6.0 and RCP 8.5 there is little difference with regards to changes in future precipitation:

- Annual rainfall may remain unchanged, but rainfall will increase more in the wettest months by being of stronger duration. This will lead to longer dry periods. There may be “mini-droughts” during the wet season.
- Precipitation will increase most in the south-west and decrease in the north-east.
- Both the maximum 5-day and 1-day storms are expected to increase. The projected increases are 10% for 2030, 20% for 2050 and 30% or more for 2070.
- The relative increase in rainfall is heavier for short durations.
- A conservative increase of 20% by 2070 on existing IDF curves will allow for a global temperature increase of 2°C.

75. A Provincial Climate Change Adaptation Strategy around Tonle Sap was issued in December 2019. Similarly, to the CRVA it examines climate related extremes using the RCP of 8.5. The overall conclusion of the Climate Change Adaptation Strategy is that annual precipitation around Tonle Sap will rise slowly, if at all. Changes in monthly rainfall are of more importance than rain falling over a shorter time period. Projections suggest that there will be little, if any, increase by 2030 but could increase by over 20% by 2070, which is the same conclusion as the CRVA.

76. Conclusions relating to the Project and climate change noted that design criteria may need to be adjusted. The report's recommended measures, developed before the final designs, include:

- Civil works
 - A. Increased height of access road above flood levels
 - B. Raise embankment on lagoons boundaries
 - C. Modification of side slope ratios to avoid soil loss in heavy rain
- Drainage design
 - D. Additional waterway opening at bridge sites
 - E. Additional cross-culvert capacity
 - F. Debris deflectors and energy dissipaters
 - G. Install Debris Deflectors
 - H. Sub-drainage systems
 - I. Turf surfaces on side slopes.
- Maintenance
 - J. Regular inspection and repair of drainage systems
 - K. Regular cleaning of culverts and side ditches
 - L. Regular cleaning of box and pipe culvert systems
 - M. Quick restoration of items following major flood events

77. Specific Recommendations from MPWT. The report also notes that MPWT have produced a series of Design Guide Recommendations that incorporate climate resilience. Relevant to the subproject the recommendations include:

- Road elevation: For access roads the crest level should be a minimum height of the water level of floods with a recurrence interval of 1 in 10 years plus 0.25 meters.

78. In terms of integration of these measures into the WWTP design, specifically the elevation of the access road and WWTP site itself are designed to account for flood levels. The drainage and WWTP design takes into account the potential implications of rainfall changes over the life of the facility, as for other subprojects in the Project. For maintenance, understanding the importance

of implementing a regular inspection programme for all infrastructure is incorporated into the training/capacity development elements of the project.

8. Hydrology

79. The hydrology of the Tonle Sap ecosystem is mostly determined by the over 4 000 km long Mekong river. The Tonle Sap lake is connected to the Mekong river through approximately 100 km long Tonle Sap river. The discharge of the Mekong reflects the pattern of the rainfall distribution throughout the year and follows the monsoon seasons. Consequently, the flow patterns display predictable cyclical changes. The maximum water level in the Mekong in Kratie (North Cambodia) is reached in September-October. The river flow decreases rapidly until December, and then slowly during the dry period, reaching minimum levels in late April.

80. From May as the rising water level in the Mekong reaches 7 metres above mean sea level, overland flow begins and the flow in many tributary rivers is reversed. The high velocity of the water at the beginning of the flood increases the carrying capacity and consequently reduces the clarity of the water by five to ten times compared with the dry season. The sediment load of the Mekong is low compared with other major rivers, and decreases downstream.¹⁵ however the sediment laden water does bring essential nutrients to the floodplain necessary for plant growth¹⁶.

81. Flow reversal also occurs in the Tonle Sap river. By the end of May, the water level of the Mekong in the confluence with the Tonle Sap river reaches sufficient height (9 m) to start pushing water from the Tonle Sap drainage area back in the channel. This results in an accumulation of water from the Mekong in the Tonle Sap lake and extensive flooding, increasing the surface area of the lake from about 2 500 km² to over 10 000 km². Maximum depth is reported to vary between less than 2 m in the dry season and up to 14 m at the peak. In October, the water level in the Mekong has sufficiently subsided for the flow in the Tonle Sap channel to reverse and the lake and the thousands of square kilometres of floodplain to be drained.

82. This flow reversal and natural 'flood pulse' of the Tonle Sap lake drainage area contributes to the natural flooding in Kampong Chhnang, including the floodplain on which the WWTP is constructed. The natural flood is largely found within the two National Roads which delineate the Tonle Sap Biosphere Reserve. Built over the last two decades, these elevated, all-year roads connect the provincial towns around the lake, while at the same time, inevitably, intercepting parts of the active flood plain.¹⁷ An example of a raised road is shown in Figure 8 (a and b) which is the WWTP access road will join, already elevated to allow access during the wet season. Although these roads are not high enough to completely prevent all-natural flood movement, they are examples of many raised roads around the Tonle Sap region which impact on the natural flood plain.

¹⁵ Mekong Committee, 1992 cited in UNFAO (2001) Tonle Sap Fisheries: A Case Study on Floodplain Gillnet Fisheries Tonle Sap Ecosystem, Part 1

¹⁶ UNDP/GEF (2006) An assessment of exotic species in the Tonle Sap Biosphere Reserve and associated threats to biodiversity

¹⁷ Mekong River Commission (August 2013) Learning from the lakes: IWRM implementation in Tonle Sap Lake of Cambodia and Songkhla Lake Basin of Thailand.

Figure 8 Raised road at site of WWTP access road



Source: PMIS Team

9. Surface Water

83. Tonle Sap is the river running between the Tonle Sap lake and the Mekong. The confluence with the Mekong is approximately 80km in Phnom Penh city. At Kampong Chhnang the Tonle Sap river has multiple channels with islands in between. At the Subproject location, the nearest channel is approximately 2.3 km and the main channel is approximately 4 km, to the east.

84. Boeung Tum occupies an area which is approximately 12 km long, depending on the season (Figure 9). It is a permanent water body, which is 1-1.5m deep in the dry season, 3-4 m deep in the wet season. A few fishers use the lake, but the primary use is for dry season rice, covering about 2000 ha. Also, some people use the area to grow lotus. Boeung Tum is entirely separate from the Tonle Sap River in dry season. Along the bank between the Boeung Tum wetland area and the nearest branch of the Tonle Sap river is a road, exposed in dry season, lined with stilted houses. In the wet season the two water bodies of Boeung Tum and Tonle Sap river will join as the river floods.

85. There are no water quality data available for the lake, however as shown in Figure 9, storm water, sewage and solid waste is seen flowing from the urban core through outfalls that lead to the lake. Therefore, it is anticipated that some level of contamination is present in the lake.

Figure 9 Towards Boeung Tum at WWTP proposed site



Source: PMIS Team

10. Air Quality and Noise

86. Field visits indicate that air quality and noise baseline levels in the Kampong Chhnang is

good, as the WWTP subproject is located in a relatively rural area and even within the town, there are no significant industrial/commercial zones to cause air quality degradation. Typically, in Cambodia, outside Phnom Penh or town centers there are few industrial pollution sources for noise or air and the volume of vehicular traffic is relatively low, however construction noise contributes to the noise baseline in many towns.

11. Natural Hazards

87. Storms and typhoons are not usually considered a major problem in Cambodia however storms do occasionally affect the country, with most storm-related damage being caused by localized floods associated with heavy rain. Tropical storms can also affect the level of Mekong River flooding experienced in a given year. Greatest damage occurs when these storms arrive during September and October when the seasonal discharge of the Mekong River is already high, and a second significant peak to the annual flood is generated. Also, wind damages property, agricultural produce and ecological systems.

Table 9: Natural Hazards in Kampong Chhnang Town (1996-2018)

Hazards	Deaths	Injured	Houses Destroyed	Houses Damaged	Victims	Evacuated
Flood	1	0	2	7	21739	1413
Fire	1	11	14	5	0	0
Storm	0	0	2	8	0	0
Lightening	1	0	0	0	0	0
Total	3	11	18	20	21739	1413

Source: National committee for disaster management, 2018

88. There are two major types of flood in Cambodia: (i) Mekong River flood and (ii) flash floods. Mekong River flood causes the Tonle Sap River to reverse its flow. This event is increased with heavy rains around the Tonle Sap Lake which affects Kampong Chhnang town and the wider province. This event is most severe when heavy rains coincide with a tropical depression and storm.

89. Flash flood results with repeated heavy rainfall in the mountainous areas. Flash flood lasts for only a few days but often cause severe damage to crops and infrastructure, particularly in tributaries around the Tonle Sap Lake.

D. Biological Environment

12. Flora and Fauna

90. The subproject sites and their main areas of influence are not habitats for rare species of flora and fauna.¹⁸ In particular for the Tonle Sap region, the project is not in areas of flooded forest or other notable habitat. In addition, biodiversity screening in both project cities using IBAT¹⁹ was carried out for the Second Urban Environmental Management in the Tonle Sap Basin Project. The IBAT tool indicated that the project area does not contain any protected areas or habitats of particular biodiversity value. This was confirmed with subsequent site visits to the Subproject area which shows it is in a highly disturbed environment dominated by agricultural and urban land use.

¹⁸ PPTA IEE. 2013.

¹⁹ IBAT is a central database for globally recognized biodiversity information including Key Biodiversity Areas and Legally Protected Areas <https://www.ibatforbusiness.org/>.

91. A specific biodiversity or ecological survey for flora and fauna has not been undertaken for this IEE, or the IEE for other Subprojects under the Project. A field assessment of ecological receptors has been made and supported by desk-based research.

92. The Subproject is located in a highly modified environment. Site visits and drone imagery for the Subproject (Figure 10) show the city's vegetation to be dominated by trees, which are primarily located within the middle of blocks, or within residential compounds, outside the right of way. The WWTP site and access road is in an area dominated by rice agriculture and Figure 10 (d) shows the scrub then cultivated lotus ponds leading to Boeung Tum.

Figure 10 Subproject area flora



Source: PMIS Team

93. **Aquatic flora.** UNFAO notes that cultured crops comprise a part of the macrophyte vegetation around the Tonle Sap lake ecosystem, such as maize, rice, lotus and beans, and the same is true of the seasonally inundated area around the Tonle Sap river. The natural flora of Boeung Tum has been modified extensively through dry season rice cultivation.

94. The Tonle Sap lake and river ecosystem includes a number of invasive alien species²⁰. A dominant species in the Tonle Sap river and lake ecosystem is water hyacinth (*Eichhornia crassipes*). An invasive weed it grows in large mats on the river surface, depleting oxygen levels and restricting navigation and fishing. Giant Mimosa (*Mimosa pigra*) is also an invasive alien species which is commonly found on drainage channels, canals and is rapidly spreading amongst the Tonle Sap river ecosystem where it will quickly invade open disturbed habitats.

²⁰ UNDP/GEF (2006) An assessment of exotic species in the Tonle Sap Biosphere Reserve and associated threats to biodiversity

95. **Fish Species.** Cambodia is rich in fish biodiversity with at least 500 fish species recorded in the Cambodia's Mekong River and nearly 300 fish species in Tonle Sap Lake. During the preparation of a pre-feasibility study IEE²¹ in the Project cities of Pursat and Kampong Chhnang, interviews were held in with local people regarding their understanding of fish species in the project area; the subproject urban areas correspond to those for this project. The results were similar for both towns. As an example, in Kampong Chhnang, 31 species were named, with the most common being (including Khmer name) Trey Riel, *Henicorhynchus* sp (carp); Trey Andaing Toun, *Clarias macrocephalus* (catfish); Trey Phtuok/Raws, *Channa striata* (snakehead); Trey Kranh, *Anabas testudineus* (climbing perch); and Trey Kamphlien *Trichogaster trichopterus* (Three spot gourami). It is noted that these species listed are not threatened, critical or endangered. Appendix 1 contains a detailed list of fish species observed by local people.

96. **Bird Species.** Cambodia has a number of protected bird habitats, including Prek Toal Core Zone of the Tonle Sap Biosphere Reserve on the Tonle Sap lake. This core zone will not be impacted upon by the project. As with fish species, the pre-feasibility study IEE²² in the subproject cities of Pursat and Kampong Chhnang undertook consultation with people resident in all the subproject areas in 2016 to identify bird species which are observed by local people. The people interviewed identified approximately 25 species in Kampong Chhnang observed in their local area. The pre-feasibility study team noted that *Heliopais Personata* (Masked Finfoot, an aquatic bird) is the only endangered species mentioned by the people resident in the subproject area. It is classified as endangered due to degradation of wetland and riverine lowland forest habitats in Asia. The favored habitat is well vegetated wetlands, including swamps and lake edges; these types of habitat are not within the area of influence for the project; the closest most recent sighting of the species around the Tonle Sap is at Boeung Chma (in 1998), a protected area which is 70 km from Kampong Chhnang town. The Kampong Chhnang WWTP is adjacent to a wetland area but the habitat is largely devoid of natural vegetation due to agricultural activities including lotus and rice farming. Appendix 1 contains a detailed list of bird species observed by local people.

E. Socio-Economic Environment

97. An important function of the town is as a port, for agricultural and fisheries products, as well as passenger ferries. Associated with this, an extensive fishing community lives on boats, floating houses and stilted houses in the channel adjacent to the town river frontage. The riverfront is also more and more developing as a tourist attraction. In 2015 the Provincial Government adopted a 5-year plan for the beautification of the riverfront area with the main objective to develop the tourism potential of this area. In general Kampong Chhnang province has been earmarked by Government as having significant tourism potential with the traditional crafts, natural environments and the fishing villages as potential attractions as well as the town's pottery craft, the river frontage, and eco-tourism to the west and across the Tonle Sap River.

13. Infrastructure and Development

98. There is a sewerage system in the town center that was built in the 1960s and extended in the 1980s. The system receives both rainwater and wastewater from houses and storm water from roadside inlets (manholes), although it is unclear whether the system was originally designed for the latter. The system has multiple outfall-points in the flood plain area of Tonle Sap River east of the town area where some of the wastewater is used in the dry season for irrigation. The system consists of about 9 km of pipelines with various diameters and 3 km of unlined surface drains. The central market has its own sewer and outfall. Many of the road-side inlets to the sewers seem to be blocked with waste and sediments. PDPWT has an operational sludge pump for cleaning manholes but no jetting equipment for cleaning pipes. It is estimated that only around 10 to 20 per cent of the town is connected to the sewerage system despite a free connection charge as the

²¹ TA-8556 REG: CDIA- Pre-feasibility studies for Second Tonle Sap Integrated Urban Management Project

²² TA-8556 REG: CDIA- Pre-feasibility studies for Second Tonle Sap Integrated Urban Management Project

system's coverage is limited.

99. A by-pass road is proposed to the southwest of the urban area linking the northern and southern sections of Road No.5. This will have the benefit of taking through-traffic out of the town center.

100. Approximately 11km west of the town center is an airport on which construction was started during the Khmer Rouge era but never finished. The Government has announced that this will be developed into an international airport by 2025.

101. Located within the Greater Mekong Subregion Southern Economic Corridor, the town can expect continued economic development and expansion. Several industries (such as garment drinks manufacturers) are located to the south of the municipality.

14. Physical Cultural Environment

102. The Subproject is located in an urban area with several pagodas which play a significant role in the town and culture of Cambodia. Other places of worship include a church which is within the Subproject construction area for the sewage network. No sites of archaeological heritage are known within the Subproject Aol.

15. Socio-Economic Survey Analysis

103. The Project Preparation Technical Assistance (PPTA) team undertook a detailed Socio-Economic Survey (SES) within 94 households in Kampong Chhnang town, in July 2013. No such detailed survey has been undertaken since then however the results are still anticipated to be valid. Table 10 summarizes the SES findings.

Table 10 Kampong Chhnang town SES urban infrastructure findings

Urban Infrastructure	Detail
Water Supply	38% sourced drinking water from boreholes; 19% from piped water supply connected to their houses; 14% from rivers/streams/springs; 10% from protected dug wells; 6.4% from piped water supply in their compounds. The rest reported as using rain water or purchasing water
Sanitation	66% had flush/pour flush toilets; 6.4% had pit latrines with septic tank; 7.4% had pit latrines without septic tank; 1% had dry pit latrines without slab; and 14% had no latrines, were using other's latrine. The remaining 5% had other form of sanitation facility or disposal method.
Drainage	77% did not have access to drains; 18% had access to earth drains; and the remaining 5% had access to closed and cement-lined open drains. 87% said their communes would flood during heavy rains and/or during river overflow. Of those served by drains, 12% reported drains to be too small; and about 10% reported their drains as clogged with sediment and/or solid waste
Solid Waste Collection	25% had access to solid waste collection services. The majority burn their garbage, the remainder bury or throw garbage anywhere.

Source: PPTA Team

104. Regarding employment in Kampong Chhnang town, the majority of the SES respondents were self-employed (77%). Employed respondents represented approximately 10%. About 3% of the respondents were unemployed; while 7% were retired. Of the households surveyed in the SES, 20% were female-headed; 11% were headed by disabled persons; and 11% were headed by an elderly person over 65 years old.

105. Housing quality in the town varies with a more basic construction seen associated with the edges of the town, particularly along the Tonle Sap river. These traditional stilted houses offer little protection from the impacts of construction such as noise, vibration and dust. Figure 11 shows typical housing located a few meters from the northern end of the road embankment and one typical of the town which is adjacent to the wetland area west of the WWTP site, in an area to be protected from flooding by the upgraded road embankment.

Figure 11 Example housing construction



Source: PMIS

V. ANTICIPATED IMPACTS AND MITIGATION MEASURES

A. Environmental Impact Screening and Assessment Methodology

106. The following discussion on environmental impacts screens the potential impacts according to the following factors and recommends mitigating activities on this basis:

- **“Receptor”**: the resource (human/natural environment/economic/social) which is potentially going to receive and have to cope with an impact.
- **“Sensitivity”**: ability to cope with an impact and/or its importance to the country of Cambodia. It is generally accepted that human health is always a high sensitivity receptor, however in terms of environmental/natural resources, the sensitivity varies according to the receptor e.g. scrubland with no significant biodiversity is considered less sensitive than a mature forest which supports ecosystems and livelihoods.
- **“Magnitude”**: the size of the potential impact. Impacts may be short term and considered low magnitude (e.g. noise or temporary reduction of income during a short construction project) or high magnitude (e.g. the poor disposal of large quantities of hazardous waste into a water course).

107. Where an impact may occur, if there is no receptor on which is potentially going to receive the impact, then mitigating actions will not be required. This follows the source-pathway-receptor model, whereby in order for there to be an impact, the pollutant or issue (source) needs to be present, the pathway to a receptor is needed (such as fissures in rocks, or water for human consumption) and a receptor must be present to receive the impact, such as humans, flora or fauna.

108. **Potential impact significance.** The following matrix was used during the screening process to anticipate the potential significance of impact, in order to identify the most significant likely impacts to be addressed in the Environmental Management Plan.

		MAGNITUDE OF IMPACT		
		LOW	MODERATE	HIGH
RECEPTOR SENSITIVITY & IMPORTANCE	LOW	Low	Low	Moderate
	MODERATE	Low	Moderate	High
	HIGH	Moderate	High	High

109. **Residual impact significance.** The residual significance of the impact is the potential impact that remains following mitigation. This more accurately describes the impacts of the project as it is anticipated that the requirements of the EMP will be followed and impacts satisfactorily mitigated.

110. The Impact Assessment is based on the impact of likely activities i.e. the source of impacts, required to construct and operate the Subproject. This approach is also designed to support the construction contractor who will plan construction works and therefore plan mitigation measures, in

terms of completion of specific construction activities or phases. For construction, the activities identified are as follows:

- Ground works.
- Production, transport and use of materials.
- Use of machinery & equipment.
- Trench excavations.
- Earthworks.
- Storage and use of chemicals and fuels.
- Spoil, solid waste and liquid waste management.
- Community health and safety (H&S) and urban access
- Occupational H&S and Emergency Response.
- Construction workers and camp management.
- Temporary land take.
- Restoration and rehabilitation.
- Utilities movement.

111. The activities above are assessed in terms of impacts on:

- Air quality
- Noise and vibration
- Soils
- Surface water and groundwater
- Materials (resource) use
- Flora and fauna
- Cultural heritage
- Socio-economics i.e. impacts on people and their business activities, including labor conditions.

B. Positive Impact and Environmental Benefits

112. The subproject will improve the urban environment and climate change-resilience, significantly contributing to a qualitative improvement in the lives of residents in Kampong Chhnang Town. The project includes household connections means the environmental benefit of the sewerage connections will be realized.

Table 11 Positives Impacts and Outcomes

Benefit	Positive Impact	Outcome
Improved storm water management	Relief from flooding in the urban core Reduced health and safety hazards Improved, safe mobility in the rainy season	Improved urban environment Improved health of residents Safe, climate-resilient communities and town Cleaner urban environment and rural surroundings
Improved wastewater collection and treatment	Improved sanitation Reduced environmental pollution from untreated sewage Reduced health and safety hazards	

Source: PMIS Team

C. Impacts and Mitigation Measures Relative to siting, design and planning

113. During the project planning, the project has taken into consideration the locations of the available sites and adapted the designs accordingly in order to reduce the environmental and

social impacts and particularly to promote the operational sustainability of the subprojects. The key major design to mitigate environmental risk is as follows:

- Flood protection of the WWTP site by land raising and embankment raising the level to 12 masl, which allows a freeboard of 0.2m based on a one in 50-year flood return period.

114. The final design and procurement documents will also incorporate measures to mitigate environmental impacts which are standard to this type of project. Examples include:

- Tree screens will be part of the basic WWTP design requirements, to screen the town from noise, odor and the visual impact of the WWTP site.
- Requirements and standards for the reinstatement of pavements and roads.
- Requirements for sound waste disposal practices.
- Requirements for use of approved borrow sites for land raising.
- Requirements for correcting damage to public or private property.

115. The WWTP is located in an active floodplain and is currently part of the Tonle Sap Great Lake natural flood plain. The Subproject will encroach on the floodplain which, as noted in the Baseline (hydrology) section, is being impacted by encroachment throughout the Tonle Sap area, in between the National Roads No. 5 and No. 6. The Subproject will provide a barrier to flood water for approximately 3km. In-fill behind the raised road is anticipated, and WWTP site will be raised and in-filled by the Subproject. Given the scale of the development around the Tonle Sap, particularly in secondary towns such as Kampong Chhnang which has significant areas of in-fill to the north of the town, the impact from the WWTP site on the flood plain is considered minor although contributing to a cumulative loss of natural flood plain around the Tonle Sap Great Lake.

116. Pre-Construction. During the planning and preparation for construction phase, relevant mitigation measures are also included in the EMP which relate to:

- Community consultation – this has already been started during this IEE phase and will continue during the DED phase and project implementation.
- GRM establishment and dissemination for this Subproject – this requires training for the PMU, GRM stakeholders to ensure they are able to establish and participate in an effective GRM.
- EMP and IEE updates – this IEE contributes to ensuring the safeguard documents accurately reflect the project design and the EMPs will be updated during project design if required. The IEE and EMP will also be updated with any required mitigation measures or design considerations as a result of the national EIA requirements.
- Review of contractor provided site specific construction EMPs.

117. These mitigation measures are specified in detail in the EMPs for the project.

D. Environmental Impact and Mitigation Measures during Construction

16. Ground works.

118. **Source of impacts:** Ground works are the preparatory activities needed to prepare a construction site, primarily clearing the sites of vegetation, grubbing stumps and roots and removing any waste materials. For the WWTP area there are accumulations of domestic waste which will need to be removed in order to prepare the land for construction. Materials resulting from clearing or grubbing maybe reused, but more likely will require disposal.

119. **Receptors impacted:** Soil (compaction and erosion), flora, fauna, surface water, waste.

120. **Potential impacts:** Erosion and deterioration of soils may occur where vegetation is

disturbed or removed; though for the most part the vegetation cover is scrub and the soil will be covered by the WWTP site, therefore, the likelihood of the impact to occur is relatively low and highly localized. The flora in the area is scrub and there is no evidence of significant fauna using the scrub as a habitat. The WWTP site is adjacent to a water body, on land which is currently subject to seasonal flooding. Therefore, there is potential for land clearance to add to existing sediment loading or other contaminants in the Boeung Tum drainage network. The land clearance will contribute to the waste disposal requirements for the Subproject but the waste from this activity should not be hazardous.

121. **Impact significance:** The impact significance is assessed as low on soil, flora and fauna receptors. The impacts are of relatively low magnitudes and the soil and flora receptors are highly modified and of low sensitivity. The water quality impact is assessed as moderate due to lateral linkage of the cleared area to Boeung Tum at the time of clearance; this will be dependent on the season and flood levels. The water in the lake is used by local residents, although not primarily for drinking²³ and high sediment loading over a short period of time could impact on use of the water.

122. **Mitigation measures and residual impact.** The mitigation measures are covered by those defined below for solid waste management, earthworks and use of machinery and equipment. Therefore, no further specific mitigation is needed for land clearance and grubbing. Following mitigation measures, the residual impact significance is assessed as low.

17. Production, storage, transport and use of construction materials

123. **Source of impacts:** Significant quantities of materials will be used for the construction of the WWTP and the installation of the drainage and sewage network. Asphalt and concrete batching plants will be required for WWTP construction and finishing road surfaces. The final Bill of Quantities is not available at this early phase for a detailed assessment but initial estimates for material requirements include WWTP in-fill and embankment of 970,000 m³ and sewer network back fill with sand of 104,000 m³.

124. At this early project preparation stage, the source of the material for in-fill is not known, however for other Subprojects within the Project for Kampong Chhnang, the borrow sites are newly established in agricultural type land south of the city i.e. the materials will not come from established currently licensed sites. It is anticipated that borrow sites or quarries will be required for this Subproject.

125. Transport of materials for the drainage and sewage network will take place in a dense urban area. For these volumes, broadly assuming a construction Heavy Goods Vehicle (HGV) carrying capacity of 8-10 m³, as larger capacity vehicles would not be practical in the urban area, the estimated HGV movements are in the order of 10-13,000 for the sewer network back fill and 97-121,000 for the WWTP in-fill. An example HGV used for construction and earth works in Kampong Chhnang is shown in Figure 12. Note HGV movements will be lowered for a larger capacity vehicle which would be more practical for the WWTP in-fill and embankment given their more rural locations.

²³ One resident during consultation said he used the lake for drinking.

Figure 12 Material/spoil transport in Kampong Chhnang



Source: PMIS

126. **Receptors impacted:** Air quality, water quality, noise and vibration, flora and fauna, socio-economics.

127. **Potential impacts:** The use of heavy construction vehicles to move construction materials including aggregates and any pre-fabricated structures, can impact on the local community by increasing the risk of traffic incidents, noise, vibration and air pollution (dust and fumes) associated with vehicle use and the movement of loose materials. Significant numbers of vehicle movements will be required, which will be a cumulative impact in the urban core which particularly around economic hubs such as the market, can already be crowded with motorbikes and cars. Tracking dust from HGVs onto the local road network also potentially spreads the impacts from the construction site to a wider area. Noise and dust will also arise during the loading and unloading of construction materials such as loose sand or in-fill materials.

128. The choice of borrow site location and stockpile / storage areas, could impact on flora and fauna or surface water, depending on where they are be located.

129. **Potential Impact Significance:** The impact significance is assessed as high given the increase in vehicle movements and the density of highly sensitive human receptors in the urban core.

130. **Mitigation Measures and Residual Impact.** The mitigation measures in the EMP include avoiding vehicle movements where possible by careful construction planning; sensitive location of any batching facilities; water sprays to dampen fugitive dust; covering loose materials during transport; locating stockpiles away from water sources; low speed limits on unmade roads and in the urban core; signage on national roads where heavy vehicles are turning; a separate Traffic Management Plan which manages construction traffic movements, scheduled to avoid congested and/or sensitive periods; widespread communication on traffic issues; criteria for borrow site selection. Following mitigation measures, the residual impact significance is assessed as medium; many of the impacts from vehicle movements can be lowered through good e.g. disturbance (dust, noise and traffic) can be controlled, but not avoided.

18. Use of Machinery & Equipment.

131. **Source of impacts:** The construction will require static and mobile machinery and equipment. This will include equipment used to break out and excavate trenches for the sewage network such as a roadsaw, handheld disc cutter, jackhammer or digger. Machinery for cleaning and improving the drainage network will also be required as well as standard heavy earth moving equipment used in the WWTP site preparation and construction such as excavators, bulldozers and backhoe loaders. The machinery will require regular maintenance and refueling which requires the use and disposal of hazardous fluids.

132. **Receptors impacted:** Air quality, noise and vibration, water quality, soil, socio-economics.

133. **Potential impacts:** The mobile machinery and equipment will cause noise and air quality impacts on local residents and business owners, particularly in densely populated urban areas. This will contribute to the cumulative impacts of existing traffic noise and local air pollution from vehicles particularly in the urban core. Also the type of informal housing around parts of the Subproject area means residents will be particularly affected by noise and dust, as their housing affords little protection.

134. The use of equipment may impact on water or soil quality if the machinery is not kept in good order, or is repaired without adequate preventative measures to protect against spillages and in the wrong location e.g. near a sensitive water receptor. Also, there are inherent occupational health and safety risks to when using construction equipment and risks to the community when large machinery is used in a confined urban context.

135. **Potential Impact Significance:** The impact significance is assessed as high for impacts on residents, as highly sensitive receptors and low for impact on water quality and soil. Also, the impacts will contribute to the cumulative noise and dust in the urban core from baseline traffic levels. Occupational H&S is considered separately.

136. **Mitigation Measures and Residual Impact:** The mitigation measures in the EMP will focus on good vehicle maintenance and spill prevention protocols; restriction of working hours from 8am-6pm; clear and advanced communication with the community including GRM information; use of mobile noise barriers around machinery; preventing vehicle maintenance/washing close to water courses. The residual impact is assessed as medium; noise and vibration impacts are short term and can be lowered through good practice but cannot be avoided; pollution and health and safety impacts can be avoided.

19. Trench excavations

137. **Source of impacts:** The Subproject requires approximately 38 km of pipes to be laid in excavated trenches. The exact methodology of trench excavation is not known at this stage of the project preparation; the excavation methods can have a significant influence on the impacts that such excavations may cause. The excavations are in a dense urban core, which in many places is crowded with traffic, market stalls, businesses and pedestrians. The streets are poorly lit, if at all and application of traffic regulations is not always effective. A recent ADB project in Battambang resulted in a tuk-tuk falling into an unguarded excavation²⁴. The impacts caused by the machinery to excavate the trenches are discussed above.

138. **Receptors impacted:** Air quality, noise and vibration, cultural heritage, socio-economics (Community and occupational health and safety).

139. **Potential impacts:** Impacts from trench excavation in urban areas and along public roads include increased noise and traffic generated by construction vehicles as well as road closures or restrictions. The excavation itself (dust) and traffic (emissions) will impact on localised air quality. The excavation will also generate spoil which will require disposal if it cannot be reused on site or elsewhere within the Subproject. The most significant impact will be on poorly managed open trenches in terms of community health and safety, for example if trenches are poorly lit, signed and guarded and also in terms of access to businesses, houses and places of worship.

140. **Potential Impact Significance:** The impact significance is assessed as high as community health and safety can directly be impacted on by poorly managed trenches with serious consequences.

²⁴ Discussion with ADB CARM, 2019

141. **Mitigation Measures and Residual Impact:** The measures required are covered by those specified for Earthworks, Use of Machinery and Equipment, Materials Production Transport and Use (Traffic Management Plan), and Occupational and Community Health and Safety. The residual impact is assessed as medium as health and safety impacts can be lowered through good practice, but traffic / road network disturbance and dust/noise cannot be fully avoided.

20. Earthworks.

142. **Source of impacts:** Earthworks comprise a major part of civil engineering projects and include excavation / cutting and placement and compaction of fill materials to create earth structures such as slopes and embankments²⁵. The Subproject will require significant earthworks. This includes cut and fill operations, formation of the raised roads with embankments and the large area of in-fill for the WWTP site. The majority of the major earthworks i.e. WWTP site and embankment are in a semi-rural area which is not heavily populated.

143. **Receptors impacted:** Air quality, noise and vibration, soil (compaction and loss), surface water (quality and flooding), socio-economics, cultural heritage.

144. **Potential impacts:** Earthworks activities can impact on air quality from fugitive dust generation, and emissions from vehicles, including noise and traffic disturbance from an increase in large vehicles on the roads. Earthworks can also affect water quality if drainage on not controlled sites is poorly managed. Poor site drainage during rainstorms can cause erosion of soil and subsequent increases in sediment loading in receiving waters and ponding or flooding, particularly if natural run off routes become blocked by construction activities. The construction sites in which these major earthworks take place also have inherent occupational and community health and safety risks from, for example, the use of large-scale machinery or the potential unauthorized access to the sites by community members.

145. Although no specific heritage sites are known in the area, given the cultural history of Cambodia, there is also a potential impact on cultural heritage through a chance find during earthworks.

146. **Potential Impact Significance:** The impact significance is assessed as high for H&S and moderate for dust and noise given the magnitude of impact is likely to be low although the receptors (residents and businesses) are highly sensitive; the majority of earthworks are in low density semi-rural areas. The impacts on water quality and flooding are assessed as moderate and low for cultural heritage.

147. **Mitigation Measures and Residual Impact:** The mitigation measures in the EMP include the provision of short term drainage on construction sites; work primarily during the dry season; the use of water sprays on earthworks to control dust; and the cessation of works if a chance find occurs until the find is investigated. Community and Occupation H&S measures are considered separately. The overall residual impact is assessed as moderate because environmental impacts can be lowered through good practice but traffic disturbance, noise and vibration from earthworks cannot be fully avoided and will impact on people.

21. Storage and Use of chemicals and fuels.

148. **Source of impacts:** Chemicals are required for the operation and maintenance of vehicles and equipment, e.g. degreasers, oils and fuels. Many of these substances can be harmful if allowed to enter the environment or come into contact with humans either through skin, ingestion or respiratory pathways. Volatile substances such as solvents emit Volatile Organic Compounds

²⁵ ICE (2015) Earthworks: A guide, Second Addition. Institute of Civil Engineers.

which contribute to low level ozone levels.

149. **Receptors impacted:** Air quality, water quality, soil (quality), socio-economics.

150. **Potential impacts:** Depending on the location of the chemical storage and use, there is potential for localized soil and water pollution to occur through contamination by poorly managed chemicals. Poor storage can also contribute to Volatile Organic Compound (VOC) emissions and its associated impacts on air quality, in the wider environment. Occupational H&S impacts may occur at any time particularly when using flammable chemicals and those which can impact on human health such as acids, cleaning chemicals and solvents.

151. **Potential Impact Significance:** The impact significance is assessed as moderate for impacts on air, water and soil as impacts will be in the main small scale unless a major rupture of a fuel tank occurs. The impact significance is assessed as high for H&S as significant harm could occur with long term consequences.

152. **Mitigation Measures and Residual Impact:** The mitigation measures in the EMP include a designated appropriate refueling area >200m from watercourses and water bodies; use of drip trays; storage in bunded areas with impermeable surfaces; clear labeling of containers; and spill control planning. Occupation H&S measures are considered separately.

22. Spoil, Solid Waste and Liquid Waste Management.

153. **Source of impacts:** Spoil will be generated during excavation for sewerage works and solid waste will be generated during all construction activities including the cleaning of the drainage network. Much of the spoil will be uncontaminated inert waste which can be reused where possible on the project. Non-inert wastes are those which undergo biological degradation such as organic wastes from septage, or food wastes. Some waste will be considered hazardous, as defined in national legislation (Sub decree No. 36) and international waste legislation (e.g. EU Directive 2008/98 on Waste and Decision on List of Wastes). This is waste which has significant potential to impact on the environment and human health.

154. **Receptors impacted:** Soil quality, water quality, materials/resource use, socio-economics.

155. **Potential impacts:** Inappropriate spoil and waste disposal can impact on receptors including soil quality and surface waters, as well as residents if biodegradable waste is indiscriminately dumped causing a nuisance. Receptors maybe sensitive, such as water bodies if spoil or waste is allowed to creep into water and the impacts can potentially be long term if wastes are hazardous such as used oils and chemical drums. Also inherent to the production of waste is the waste of resources.

156. **Potential Impact Significance:** The impact significance is assessed as high as sensitive water receptors could have long term impacts from hazardous waste disposal impacts.

157. **Mitigation Measures and Residual Impact:** The mitigation measures in the EMP include the application of the waste hierarchy with priority given to prevention of waste from being generated at source, then recycling and reuse of spoil and other recyclable materials. Waste collection will be included in the EMP to prevent escape of waste and littering. Contaminated and uncontaminated spoil will require disposal criteria and disposal locations approved if it is not reused. The overall residual impact is assessed as low as effective and safe waste management can be implemented.

23. Community Health and Safety (H&S) and Urban Access

158. **Source of impacts:** The Subproject will include extensive street works in an urban core, which can be crowded with people and traffic. A National Road also runs through the centre of the sewer service area, which is a trunk road connecting Phnom Penh to the Thai border. The construction work will generate many HGV movements, adding to the baseline traffic in the area.

159. **Receptors impacted:** Cultural heritage, Socio-economics

160. **Potential impacts:** Street works in an urban area needs specific attention paid to health and safety considerations. Construction machinery and excavations in an urban area will pose potential health and safety risks to the residents, visitors and business owners if management of the construction sites is not adequate. Impacts can include physical accidents involving machinery, trench excavations and the WWTP and embankment construction sites. Access to houses and businesses can be impaired which can pose risks when insecure access routes are used by pedestrians and motorbike riders to enter properties across excavations. The urban core also includes several places of worship which are central to specific festivals and celebrations.

161. **Potential Impact Significance:** The impact significance is assessed as moderate, due to a low magnitude of impact on highly sensitive human receptors.

162. **Mitigation Measures and Residual Impact:** The mitigation measures in the EMP include adequate signing, lighting and guarding of all street works; lighting and buffer zones around construction sites where needed on access roads and populated locations. For urban excavations, safe access will be maintained for pedestrians and vehicles to schools, markets, houses, pagodas and commercial establishments a Traffic Management Plan, as specified in Materials Production, Transport and Use' above. The work will be carried out in sections such that there is minimum disturbance to access for residents and businesses with backfilling completed at the end of each working day. Residual impact significance is assessed as low, impacts can be avoided through good practice.

24. Occupational H&S and Emergency Response.

163. **Source of impacts:** Typical of large construction projects, workers from overseas or from outside the locality are likely to be engaged, such workers are increasingly vulnerable to health care shocks, driven by lack of access to basic healthcare facilities and the absence of social support and financial protection.²⁶ The International Labor Organization (ILO) estimates that globally, there are 2.7 million occupational fatalities annually.²⁷ Of these deaths, the ILO notes that the construction sector 'has a disproportionately high rate of recorded accidents'²⁸. Accidents and incidents in the construction sector are not uncommon and can include small scale minor spillages to large scale releases to the environment, such a through a rupture to a fuel store, polluting soil and water, and accidents with machinery and vehicles leading to physical disability and death.

164. The 2020 COVID-19 virus has caused a global pandemic. It is a highly contagious virus which at the time of writing, has lead to 5.5 million confirmed cases and 350,000 deaths worldwide.²⁹ This virus is not anticipated to be eliminated within the short term, therefore is of relevance to the construction workers for this Subproject; everyone who is in close contact with colleagues, such as those who live in construction work camps, could be at risk of contracting and spreading the virus.

165. **Receptors impacted:** Socio-economics (Occupational Health and Safety), Water, Soil.

166. **Potential impacts:** The impacts from construction accidents on workers can be temporary or permanent or fatal. These impacts are of particular concern when in the context of poor public health services. Occupational H&S risks are particularly a concern in construction sites where excavations, heavy machinery and equipment is used. The depth of sewer excavations may

²⁶ ADB (2020) Outline Terms of Reference REG:TA Health Borders Special Economic Zones.

²⁷ <https://www.ilo.org/global/topics/safety-and-health-at-work/lang--en/index.htm>

²⁸ https://www.ilo.org/moscow/areas-of-work/occupational-safety-and-health/WCMS_249278/lang--en/index.htm

²⁹ World Health Organisation (WHO) COVID-19 Dashboard:

https://covid19.who.int/?gclid=EALalQobChMln_LCvufY6QIVeud3Ch2YCgYuEAAAYASAAEgJxIPD_BwE

require the need for additional trench supports to stop trench collapse, but this will be decided on by a case by case basis depending on the material being excavated.³⁰

167. Spillages can lead to release of chemicals or fuels harmful to the environment if an accident occurs. This can have localized impacts such as a small spillage on soil, or widespread environmental consequences for a major release which enters a water body. The impact will depend on the toxicity of the release.

168. **Potential Impact Significance:** The impact significance is assessed as high; the receptors (construction workers) are sensitive and the magnitude of an impact will be high, should life changing injury or a fatality occur.

169. **Mitigation Measures and Residual Impact:** The mitigation measures in the EMP include a combination of thorough training including induction and tool box talks by a trained H&S officer, and include training on COVID-19 related practices; warning signs for construction workers; clear Emergency Response Procedures for a minimum of injury, spillage and fire. Use of Personal Protection Equipment (PPE) is required but it considered a last resort as the first step is to remove the hazard. The residual impact significance is assessed as low; accident risks can be eliminated through good practice.

170. COVID-19 specific requirements include implementing ILO's Practical Guidance – Safe Return to Work where appropriate. ILO has developed 10 preventive measures for a safe return to work in the context of COVID-19 which are summarized below as related to construction work and in particular work camps. The table also incorporates additional COVID-19 management guidance specific to construction sites.

171. The contractor must implement the COVID-19 Mitigation Measures in the EMP and present a risk assessment relating to COVID-19 prior to any construction works or site preparation. PMU will review and approve the Risk Assessment, seeking advice and guidance from the Ministry of Health as required. This Risk Assessment is now a requirement of the Construction Environmental Management Plan (CEMP).

25. Construction Workers and Camp Management.

172. **Source of impacts:** Construction camps are often required to accommodate workers from outside the local area on large construction projects, and in line with similar projects in Cambodia, it is anticipated that a worker camp will be required for this Subproject. Camps can cause impacts both socially and environmentally. Socially an influx of workers from outside the area may cause social problems, particularly if the workers are from overseas and unfamiliar with local customs and laws. Environmentally a poorly sited and managed camp can pollute local soil and water courses, cause compaction of the soil and will generate biodegradable and plastic household-type wastes.

173. **Receptors impacted:** Socio-economics, water, soil.

174. **Potential impacts:** Social impacts include local social conflicts between workers and residents, over issues such as wildlife hunting, fishing and not conforming to local social norms and expectations in terms of behavior. Also, there can be local resentment if the workers are not nationals or from the local area. Environmentally, poorly managed sewage, chemicals and grey water can impact on local water courses and create long term contaminated land issues.

175. Impact associated with COVID-19 transmission in work camps are considered in

³⁰ International Finance Corporation /World Bank EHS Guidance for Occupational H&S does not give guidance on shoring excavations. Other jurisdictions such as UK Health and Safety Executive recommend shoring at 1.2m but it is dependent on the likelihood of material slippage.

Occupational H&S.

176. **Potential Impact Significance:** The impact significance is assessed as moderate.

177. **Mitigation Measures and Residual Impact:** The mitigation measures in the EMP include a preference for use of local workers, then workers renting houses within the area, instead of a camp. If this is not possible suitable accommodation will be provided in order to meet ILO Minimum Work Camp Standards, see supplementary table in EMP. In addition to ILO Requirements³¹, International Finance Corporation requirements are included in the EMP to the extent practicable. Good camp housekeeping will be maintained includes sounds waste management; relevant training on local laws and health protection measures provided including on COVID-19; first aid kits are required; communal areas will be provided; strict food hygiene standards will be maintained. The residual impact significance is assessed as low, with appropriate training, camp siting and management.

26. Temporary land take

178. **Source of impacts:** A staging area will be required for storing machinery, equipment, fuels, chemicals, stockpiles, and materials required for construction. Any pre-cast concrete will be made off site in a staging area. For the sewer network, land will be required that it outside the urban area therefore is likely to be in an agricultural or semi-rural area, given the surrounding land use. The construction camp, discussed above, is also considered to require temporary land take.

179. **Receptors impacted:** Soil, water, flora, fauna.

180. **Potential impacts:** There is potential for temporary land take to cause deterioration, specifically soil compaction which could impact on its use as agricultural land in the future. It may also cause localized soil pollution from any spillages. Water pollution may also occur from liquid storage should the site be poorly located. Both accidental releases and the physical presence of the construction activities may impact on flora and fauna in the immediate vicinity.

181. **Potential Impact Significance:** The impact significance is assessed as low as the impact should be a moderate magnitude, assessed as such due to the potential size of the land take given the construction camp and staging area and the sensitivity of the soil receptor is assessed as low, given the highly modified environment.

182. **Mitigation Measures and Residual Impact:** The mitigation measures in the EMP include the provision of a map to identify any areas of temporary land take, and a report on the condition of the land prior to its use by the construction company. The staging area will not be within 200m of a water course and the other mitigation measures in the EMP such as fuel storage and vehicle maintenance requirements will be followed. A plan for restoration following construction will be required in accordance with the Restoration and rehabilitation mitigation measures and any other contractual requirements related to normal construction practices. The residual impact is assessed as low following sound site selection, management and rehabilitation.

27. Restoration and rehabilitation.

183. **Source of impacts:** At the end of the construction phase, areas such as construction workers camps, staging areas, borrow sites and access roads may contain waste, spoil and other debris. The sites will not be in the condition they were before the construction started; damage may be accidental or predicted prior to construction. The sites will have been used for heavy vehicles and storage and use of potentially contaminating materials. Within the urban area, the excavation

³¹ ILO (2009) Workers' housing. ILO Helpdesk Factsheet No. 6

and reinstatement of trenches can cause vibration which is often a concern to property owners who. Although not identified in the consultation conducted to date, street works can cause anxiety amongst the local population if their structures (houses and businesses) are close to the right of way. Concerns about damage to buildings from vibration or accidental vehicle strikes are not uncommon.

184. **Receptors impacted:** Soil, socio-economics, flora and fauna.

185. **Potential impacts:** The use of construction sites outside the urban core, including unmade access roads e.g. from borrow sites, can result in loss of flora, fauna and soil degradation. Heavy construction traffic within a town, given the number of vehicle movements required, can impact on poor quality roads or minor roads which were not designed for HGVs. Accidental damage to property may also occur from vibration from construction equipment and HGVs as well as accidental building strikes during maneuvering. Typically, the project construction contract includes repairs caused by such damage and is also included in the EMP for consistency

186. **Potential Impact Significance:** The impact significance is assessed as moderate as the environmental receptors are of low value but the consequences for damage to buildings and public infrastructure is of more importance.

187. **Mitigation Measures and Residual Impact:** The mitigation measures in the EMP include a plan to be implemented on rehabilitation of borrow site such as contouring slopes; retention of topsoil on landfill construction areas to support vegetation screening; clear up of debris, waste, spoil and removal of any contaminated land e.g. oils spills; repair road damage and other accidental damage to the quality specified in the bill of quantities.

28. Utilities movement

188. **Source of impacts:** Any street works has potential impact on existing utilities infrastructure, including communications cables, water, and electricity. Also, overhead cables can also be damaged by tall vehicles or carrying large loads.

189. **Receptors impacted:** Socio-economics.

190. **Potential Impact.** The engineering team has established that the sewer along the road has no impact on the existing utilities of telephone and electricity supply but can have impact on the existing water supply connections. In case of the rider mains in the footpath, there might be many conflicts with underground fiber optic and telephone cables.

191. **Potential Impact Significance:** The impact significance is assessed as moderate; interruptions should be short term but will be very inconvenient to residents and businesses

192. **Mitigation Measures and Residual Impact:** The contractor will ensure planning and co-ordination with the utilities suppliers and provide early information for residents affected by any interruptions. Interruptions to significant receptors including healthcare facilities, should this be required, will require careful co-ordination actions and consultation. The Residual impact significance is assessed as low, after impacts are mitigated with good planning.

E. Impacts and Mitigation Measures during Operation

29. Operation and Maintenance.

193. **Source of impacts:** Operation of the WWTP and drainage and sewage network involves the cleaning and transport of potentially odorous materials and the operation involves open ponds or lagoons. A pumping station is required near a residential area which will require long term operation.

194. For all of the Subproject's components, inadequate maintenance and repair will lead to

ineffective operations and services. Without a budget for O&M being ring-fenced and clear procedures on how O&M will be performed, the WWTP may begin to operate ineffectively and effluent standards not maintained. If the drainage network is not cleared of silt it will render the network ineffective and will contribute to flooding within the town.

195. **Receptors impacted:** Air quality, water quality, noise, socio-economics

196. **Potential impacts:** The release of poorly treated wastewater will potentially be an environmental consequence because it is concentrated in one discharge point, rather than without a WWTP where there are many dilute discharge points. Poor WWTP maintenance can therefore impact on water quality, soil quality and local residents will be subject to odor issues. It is critical that the designed effluent standards are met and maintained. As a result of maintenance of the WWTP and the sewerage and drainage network, sludge require disposal. This can include sludge contaminated with pollutants from roads such as hydrocarbons and rubber particles, or sludge from WWTP maintenance which may contain pathogens if operation is not effective and sludge is not fully mineralised. Sludge disposal is largely unregulated in Cambodia, which increases the risk throughout operation. In addition, operation of WWTPs inevitably lead to odor nuisance if they are pond based, regardless of how well operated the site is. The pumping station may lead to noise impacts, but this is to be determined by the final design.

197. **Potential Impact Significance:** The impact significance is assessed as high, given the sensitivity of the operatives and community and the potential magnitude of environmental impact if the WWTP operates below the design standard, particularly in dry season where dilution will be limited.

198. **Mitigation Measures and Residual Impact:** The mitigation measures in the EMP include: The WWTP operator should be contactable and provide a signboard outside the site indicating key contacts; public complaints and their resolution will be recorded. Measures to support sound O&M are based on the development of an O&M manual by the Operator in collaboration with MPWT and MoE. It will provide clear methods and procedures for all aspects of the WWTP operation. A network maintenance schedule will be developed for sewerage and drainage. Ensure relevant staff attend available training during Subproject implementation and capacity development, and disseminate knowledge to colleagues. Ensure fully digested sludge is put to beneficial use without harm to human health or water courses where possible, and dispose e.g. landfill, sludge waste which would otherwise cause harm or contamination if applied to land. The operators will conduct a regular environmental analysis program. Develop and test procedures for emergency situations including COVID-19 outbreaks to ensure operational continuity. If well maintained, the residual impact of operation is moderate, but this will require budget and commitment.

30. Occupational Health and Safety.

199. **Source of impacts:** The maintenance of the drainage and sewerage network will include cleaning and entering manholes and the use of cleaning equipment such as high pressure water jets and working in and around ponds/lagoons. The current practice of hand desludging the sewer/drainage network should stop with the use of jet washing machines which is a positive health and safety impact. Particularly for the WWTP, there are risks around the use and handling of chemicals and the health risks associated with raw sewage and sewage sludge.

200. **Receptors impacted:** Socio-economics (health and safety)

201. **Potential impacts:** Impacts from operation and maintenance include the health risks associated with working in an environment with raw sewage and sewage sludge. Accidental contact can have serious health consequences, both short or long term. Also, occupation H&S

impacts may arise around the use of equipment, machinery, cleaning chemicals, if used and working around deep water. Another WWTP subproject under the Project³² will use dry calcium hypochlorite. This comes with additional specific health and environmental risks³³. Harm to health can be caused by inhalation, eye contact, skin contact and ingestion. Harm to the environment may be caused as the concentrated substance is highly toxic to aquatic life. It should be stored in a cool well-ventilated area in a closed and labeled container. Specific training should be provided on its handling. Note similar chemicals are used in wastewater treatment sites elsewhere in Cambodia.

202. **Potential Impact Significance:** The impact significance is assessed as high given the potential health risks to workers.

203. **Mitigation Measures and Residual Impact:** The mitigation measures in the EMP include the development of rigorous site specific health and safety procedures which sets out how the operators will complete a comprehensive H&S training programme; Undertake risk assessments; Use of appropriate PPE; Retain Material Safety Data Sheets on all chemicals used; Undertake health assessments; develop emergency procedures and provide access to first aid. The residual impact is low with adequate H&S mitigation measures.

31. Unanticipated Impacts during Construction and Operation

204. In the event, unanticipated impacts become apparent during project implementation, the borrower will: (i) inform and seek ADB's advice; (ii) assess the significance of such unanticipated impacts; (iii) evaluate the options available to address them; and (iv) update the IEE including EMP. ADB will help the borrower mobilize the resources required to mitigate any adverse unanticipated impacts or damage.

³² Pursat WWTP

³³ Material Safety Data Sheet, Calcium Hypochlorite, Breckland Scientific revision date 23/10/18

VI. INFORMATION DISCLOSURE AND PUBLIC CONSULTATIONS

A. Information Disclosure

205. This IEE will be disclosed by ADB as required including a copy on the Project section of ADB's website. Environmental information on the project, including the IEE and other safeguards information will be disclosed in accordance with ADB's Public Communications Policy (2011) and SPS (2009). This includes:

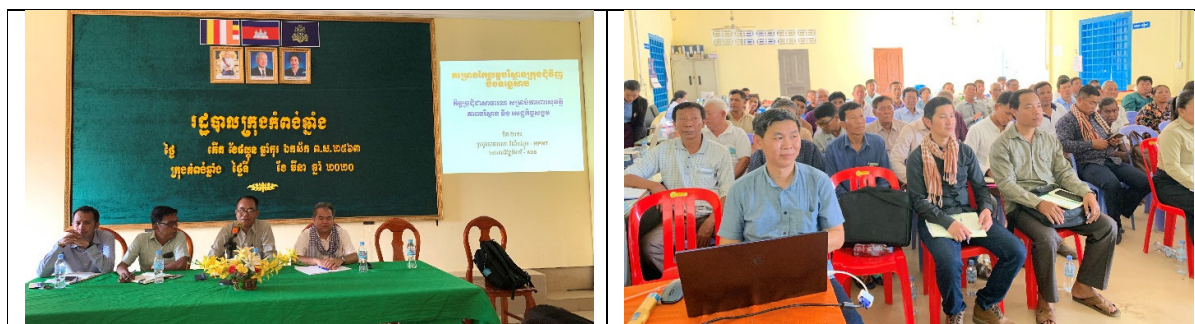
- (i) The EMP will be translated into Khmer and be available for review PDPWT offices;
- (ii) The IEE will be disclosed on ADB's project website (www.adb.org);
- (iii) Copies of the IEE are available upon request; and
- (iv) Semi-annual environmental reports on project's compliance with the Environmental Management Plan (EMP) and other necessary information will be available at www.adb.org.

B. Public Consultations during Project Preparation

206. ADB's Safeguard Policy Statement requires meaningful consultation with stakeholders early on in the project cycle. As a result, Subproject specific public consultation took place on 12th March 2020 in Kampong Chhnang, in the Municipality office. This is separate to the consultation that has taken place for the Project as a whole. Consultation took place prior to Ministry of Health restrictions on mass gatherings (issued 3rd April) and restrictions on internal movement (issued 9th April)³⁴.

207. The Subproject consultation included participants from all of the four Sangkats that comprise the project area; in Kampong Chhnang Municipality (district) there are four Sangkats (communes), B'er, Phsar Chhnang, Khsam and Kampong Chhnang. Participants included 19 village chiefs from all four Sangkats.

Figure 13 Subproject public consultation meeting



Source: PMIS

208. The public consultation meeting showed the participants in the consultation to actively support and agree with the project, understanding that it will serve to improve the local environment. A number of questions were raised by participants and answers given in response to the PMIS team asking questions, as shown in Table 12.

³⁴ http://www.cdcmoh.gov.kh/images/Document/Coronaviruses/COVID-19/WHO-MOH_SITREP/COVID_19_JointWHO-MOH_SITREP_6July2020_FINAL.pdf Wearing facemasks, hand hygiene and respiratory etiquette have not formally been required.

Table 12 Consultation response 12th March 2020

Participants	Comments / Requests / Questions / Issues	Project Response
Municipality Sangkat B'er Sangkat Phsar Chhnang Sangkat Khsam Sangkat Kampong Chhnang	1. All agree with, and support the sub-project (Sewerage collecting system and WWTP). 2. Does the project affect to small shops and houses along the road in Sangkat B'er? 3. Does the project affect to local resident's land in WWTP site? 4. Does the sewerage system collect from every Sangkat and treat at WWTP site? 5. Does the water from toilet can discharge to this system? 6. Does the discharge from WWTP affect to water quality? Due to water in the big lake (WWTP site) use bath, washing, cooking and drinking as well.	1. No response required 2. Social Specialist response 3. Social Specialist response 4. Yes, a map showing the collection area is part of the public information booklet 5. Yes water from toilets should discharge to this collection system. 6. The water discharged from the WWTP will meet national standards for effluent and therefore should not negatively impact on the lake or its uses [The team noted only one person who said water is used for consumption] 7. The Municipality requested: a) that Sangkats and villages representative extend the information to local people b) Local people to join future consultation on the project and prohibit on new construction on the right of way

Source: PMIS

C. Public Consultations during Project Implementation

209. The PIU ESC will undertake consultation following the finalization of the detailed design, and again will conduct consultation interviews within four to six weeks of construction starting and then again, every three months until the end of construction. This is set out in the Environmental Monitoring Plan.

210. It is suggested that the consultations take the form of meetings and site-based discussions and include the following:

- (i) Environmental impacts of civil works (e.g., solid & liquid waste, erosion, local flooding, pollution);
- (ii) Any unforeseen impacts caused accidentally e.g. through spillages;
- (iii) Civil nuisance (e.g., noise, dust, disrupted business & agricultural activity, social issues, community health and safety);
- (iv) Impaired use of access road to WWTP site and roads within urban core (e.g. traffic issues and access); and
- (v) GRM and its procedures including details of persons to contact and contact details

211. In summary, informal monitoring interviews with affected people will focus on complaints about community disturbance from construction activities, as well as public concerns about ecological protection, soil / land concerns and access issues. This will form part of the PIU's role in Environmental Monitoring and will contribute to overall Project monitoring.

D. Consultation during Operation

212. The mitigation measures for this IEE specify that the WWTP operator, in collaboration with PDPWT undertake consultations with local residents to discuss any operational impacts or concerns.

VII. Grievance Redress Mechanism

A. GRM Objective

213. The GRM for this Subproject will be consistent with the requirements of the ADB Safeguard Policy Statement (2009) and will be established to prevent and address community concerns, reduce risks, and assist the project to maximize environmental and social benefits. The GRM will be accessible to all members of the community and free of charge. In addition to serving as a platform to resolve grievances, the GRM will help achieve the following objectives:

- Open channels for effective communication, including the identification of new environmental issues of concern arising from the project;
- Demonstrate concerns about community members and their environmental well-being; and
- Prevent and mitigate any adverse environmental impacts on communities caused by project implementation and operations.

32. Grievance Redress System

214. The Subproject will be incorporated into the existing Grievance Redress Mechanism (GRM) for the Project. The Project GRM was established prior to construction works starting in Kampong Chhnang for the landfill subproject. The same GRM approach will be used, however the local GRM entry points will be geographically specific to this Subproject.

215. The following roles and responsibilities for the GRM are set out in Table 13.

Table 13: GRM Roles and Responsibilities

Role	Responsibilities in GRM
MPWT / Executing Agency	Establish the GRM Set up a Grievance Redress Committee (GRC)
Grievance Redress Committee	Members: Sangkat representative Village leaders or representative PIU-Environment Safeguard Counterpart (PIU-ESC) PMU-Environment Safeguard Officer (PMU-ESO) Municipality representatives Provincial representatives Function: GRM Access Point and Decision Making Monitor and record complaints
PMU-Environmental Safeguard Officer (ESO)	Oversight of GRM implementation and use Co-ordination with PIU-ESC GRM Record keeping and document storage of all GRM complaints (Formal or Informal) Contact with ADB if Affected People appeal the process GRM reporting
PIU- Environmental Safeguard Counterpart (ESC)	GRM implementation at the town level Responsible for keeping the PMU informed
Contractor	Entry point for affected people during construction
Local Government Institutions (Village representative, Sangkat representative, Municipal government representative)	Entry point for affected people during construction

33. Access to the mechanism.

216. The PMU-ESO and counterparts in the PIUs, will ensure that

- The public, especially the residents and business owners, in the main areas of influence of the subprojects, are aware of their rights to access, and will have access to, the GRM free of administrative and legal charges;
- The GRM is fully disclosed prior to construction: (a) in public consultations or social/community events, (b) through posters displayed in the offices of the PMU, PIU, Municipality and concerned Villages/Sangkats and at strategic places within the main areas of influence of subprojects (posters to include names and contact details of the PMU-ESO and PIU-ESC); and (c) sign boards at construction sites and camps.
- Access points will participate in the GRM and will include:
 - (i) Village representative, e.g. Village Chief
 - (ii) Sangkat representative e.g. from Sangkat Committee
 - (iii) Municipal government representative
 - (iv) PIU-ESC and PMU-ESO

34. Communication on the GRM: Project Hotline

217. The GRM will be communicated to the public and affected people as a Project Hotline; this is considered to be more resonant with people than a 'grievance redress mechanism'. This will include a project **hotline notice board** to be located in each active construction site which must include three locations around the town in for the drainage and sewage network construction and construction camps and staging areas.

218. The project hotline notice board will include the following information in Annex 2 and will require a designated telephone number which is for the project and not personal to individual members of staff.

35. Recording Project Hotline or GRM issues: Steps and Timeline

219. Complaints will be managed centrally by the PMU-ESO. Records will be kept of complaints made to the other access points, and the date they were passed to PMU for investigation but the main burden of recording detailed information should be on the PMU-ESO. All complaints will be compiled centrally by PMU-ESO to ensure none are missed and trends are identified. This will include all formal and informal complaints and their resolution.

220. For comments, suggestions or minor issues that can be managed within the construction area, the Hotline Access Point will record the following information (Table 14), and will inform the PMU:

Table 14: Project Hotline Informal Contact with Affected People

Timing	For Hotline Access Point Person	
Day 1	Date of Contact to Hotline [or verbal contact with GRM access point]	<i>Example: 25-08-19</i>
	Name of Person & Contact Details [If Given]	<i>K. Srey, 012 90129901</i>
	Construction Site / Project Activity [relevant to person]	<i>Wastewater treatment site</i>
	Suggestion / Comment / Complaint: [give detail]	<i>Suggestion: Contractor moves broken concrete pile away from path to improve access</i>
	Date PMU (Phnom Penh) Informed:	<i>26-08-19</i>

	Name of Person in PMU Informed:	<i>T. Pheap, PMU-ESO</i>
Day 2	Action Taken: [for suggestions / comments, for questions, for complaints]	<i>Site Supervisor informed. Concrete moved the next day.</i>
	For PMU: Follow Up	
Day 4	Follow Up with Affected Person (AP) [date of call, site visit, evidence e.g. photograph from AP or Hotline Access Point]	<i>Called K. Srey. Confirmed concrete moved and access is clear</i>
	Further action or resolved? [describe if the problem is solved or action needed]	<i>Resolved</i>

221. For issues that cannot be resolved on site, by discussion with the contractor, the PMU will use the following table (Table 15) to record and resolve the issue.

Table 15: Project Hotline Formal Contact with Affected People

Timing	For Hotline Access Point Person	
Day 1	Date of Contact to Hotline [or verbal contact with GRM access point]	<i>Example 22-02-19</i>
	Name of Person & Contact Details [If Given]	<i>D. Than, 092 90129901</i>
	Construction Site / Project Activity [relevant to person]	<i>Drain excavation</i>
	Suggestion / Comment / Complaint: [give detail]	<i>Complaint: Contractor has cut off water supply to house</i>
	Date PMU (Phnom Penh) Informed:	<i>22-02-19</i>
	Name of Person in PMU Informed:	<i>T. Pheap, PMU-ESO</i>
Day 2	Action Taken: [for suggestions / comments, for questions, for complaints]	<i>Site Supervisor informed. Contractor disagrees.</i>
	For PMU: Follow Up	
Day 4	Follow Up with Affected Person [date of call, site visit, evidence e.g. photograph from AP or Hotline Access Point]	<i>Called D. Than. Confirmed water supply not restored</i>
	Further action or resolved? [describe if the problem is solved or action needed]	<i>Not resolved Contractor disagrees. Water supply was never connected.</i>
	For PMU if Complaint Not Resolved:	
Day 5	Complaint Screening: [explain why it is valid/not valid]	<i>Valid complaint. All houses in the road have a water supply.</i>
	Date Person informed of Screening [tell affected person if PMU considers the complaint valid]	<i>26-02-19</i>
Day 6-7	Investigation & Agreement [discuss on site with PMU, PIU, Contractor and others as required. Identify a solution]	<i>Meeting on site. Contractor will replace the PVC water pipe. Agreed on 28-02-19</i>
	Date for implementing resolution [to be completed within 15 days of initial complaint]	<i>30-02-19</i>
Day 16	Implementation Follow Up [Contact PIU/Contractor/Site Supervisor and get evidence from site e.g. photographs of completed works]	<i>PIU photos via Telegram of completed pipe work. Discussed with contractor by phone</i>
Day 20	Solution Satisfaction Follow Up [Contact Affected Person, obtain signed letter of satisfaction that complaint resolved]	<i>Call to D. Than. Water supply restored. Letter is signed. PIU sent copy via Telegram</i>

222. **Informal Approach (minor issues).** Informally, an affected person (AP) can give a suggestion, comment, question or complaint through:

- Directly to the Contractor during construction;
- Directly to any other Access Point such as village chief; or
- Use the project hotline contact numbers.

223. The contractor will initially ensure its worker /staff member hands a GRM Contact Card (required by this EMP) to the complainant. The contractor will also immediately inform the PMU of the comment/question/complaint.

224. For minor issues, if possible, the contractor will rectify the problem within one day of any complaint or implementable suggestion. For more significant issues, that may require changes to construction practices, project design or additional budget, the PMU will use the formal approach to managing the affected persons comments/complaints.

225. During operation the affected people will be required to contact the operator as the project hotline approach and PMU, as an office, will no longer be operating.

226. **Formal Approach (significant issues).** If the issue cannot be resolved informally or the affected person is not satisfied with the resolution so far, the PMU will be required to screen the complaint and engage with other stakeholders as needed to find a solution. As set out in Table 15 the steps to be followed by the PMU are:

- **Complaint Screening.** Screening to check the complaint is valid i.e. is as a result of the project activities. Affected Person is immediately informed of the screening results. If the complaint/issue is screened as non-Project-related and/or invalid, the affected person will be advised that he/she can raise his/her complaint to the second stage of the complaint process; and the PMU-ESO will formally forward the complaint to the District Office
- **Investigation & Agreement.** PIU, Contractor and affected person will discuss the complaint at the site within 2 days of screening. Agreement on actions and measures and a date for implementation of resolution will be agreed. Agreement will be documented using Table 15 and filed by PMU-ESO; PIU, AP, Contractor/Operator will have copies.
- **Implementation Follow Up.** PMU-ESO will follow up to check the implementation of the resolution. The PMU-ESO will obtain evidence on implementation through, site visit and /or photographs and will contact the contractor, PIU and Site Supervisor.
- **Solution Satisfaction Follow Up.** Four days after implementation of the solution the PMU-ESO will contact the affected person to confirm that the solution is working. PIU will secure a written confirmation of satisfaction from the affected person and will forward this to the PMU-ESO.

36. Managing Unresolved Complaints

227. **District Level.** For actions not taken within the agreed timeframe and when an affected person is dissatisfied with the action taken at the First Stage, the person can raise a complaint to the District Office GRC Representative. The District Office has 15 days within which to resolve the complaint to the satisfaction of all concerned. If the complaint cannot be solved at this stage, the District Office will bring the case to the Provincial Grievance Redress Committee representative.

228. **Provincial Level Appeal.** If the affected person remains 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.

- Within 30 days of the submission of the grievance, the Provincial GRC representative must make a written decision and submit copies to the MPWT, GRC members and the affected person.
- If appeal is found not valid, the provincial authority shall write the affected person and declare the grievance closed. In the event of an appeal, the MPWT shall immediately report to the PMU. The PMU shall inform ADB immediately.

229. **ADB Intervention.** If a resolution is not found, affected people should be encouraged to contact the i) ADB Cambodia Resident Mission or ii) the Southeast Asia Department of ADB in Manila. Finally, the Accountability Mechanism of the ADB can be used. The Affected Person should contact the Complaints Receiving Officer of the ADB via the following addresses:

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

230. **ADB 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

231. The Project's GRM should not impede access to the country's jurisdiction or administrative remedies. Accessing the country's legal system and GRM can be done at the same time. If efforts to resolve disputes using the grievance procedures remain unresolved or unsatisfactory, the AP has the right to directly discuss his/her concern/complaint with ADB.

232. The PMU-ESO will record all complaints, suggestions, comments including those dealt with within the project site and those elevated to the GRC. This will include all resolutions and satisfaction of affected people.

233. The number of grievances recorded and resolved and the outcomes will be displayed at the offices of PIU, PMU and Municipality and reported in the monthly progress reports, semi-annual monitoring reports during construction and annual monitoring reports during operation, submitted to ADB.

234. All costs involved in resolving complaints (meetings, consultations, communication and reporting/information dissemination) will be borne by the PMU. In cases where affected people do not have the writing skills or are unable to express their grievances verbally, they may seek third-party assistance.

VIII. ENVIRONMENTAL MANAGEMENT PLAN

A. Objectives

235. This is the EMP for the Subproject. The EMP aims to avoid impacts where possible and mitigate those impacts which cannot be eliminated to an acceptable and minimum level. The EMP includes requirements for:

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

236. This EMP will be updated to reflect the detailed designs during the DED phase before procurement. The updated EMP will be included in the Bidding Documents and will be tailored to meet the needs of the contractor.

B. Institutional Arrangements and Their Responsibilities

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

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

239. A summary of the key functions for project implementation and environmental safeguards is presented in Table 16 and detail on the responsibilities of each function is in Table 17.

Table 16: Key Functions for Project Implementation

Role	Abbreviation	Location	Summary of Overall Function
Project Steering Committee	PSC	Phnom Penh	Policy and technical guidance for subproject implementation
Project Management Unit	PMU	Phnom Penh within MPWT	Responsible for general project implementation and reporting
PMU Environment Safeguards Officer	PMU-ESO	Phnom Penh within PMU	Existing MPWT staff seconded/assigned to the PMU for the environmental management of the Project EMP compliance across the subprojects for environmental safeguards – Full Time
Project Implementation Unit	PIU	Provinces within PDPWT	Responsible for subproject implementation
PIU Environmental Safeguard Counterpart	PIU-ESC	Provinces within PIU	Nominated person responsible for subproject environmental monitoring and support to PMU-ESO
Contractor Environmental, Health and Safety Officer	C-EHSO	Construction Site	Mitigation measure implementation and reporting

Project Management and Implementation Support Consultants	PMIS	Phnom Penh	Project final design and implementation, support and capacity development Engineering supervision for all construction and reporting including Construction Supervision Consultant (PMIS-CSC)
International and National Environment Specialists	PMIS -I/NES	Phnom Penh within PMIS team	Environmental safeguards and reporting support during design and implementation - Intermittent
Asian Development Bank	ADB	-	Review project progress, compliance with covenants and advise on corrective actions

Table 17: Responsibilities for Environmental Safeguards

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

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

37. Institutional Capacity Review and Needs

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

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

242. A training program is set out Table 18 which addresses the safeguard reporting and implementation requirements during construction. For Operation, the Project is under discussion with MPWT with regards to operational training requirements. The Project consultancy contract has a provisional sum³⁵ for targeted training allocated for O&M training for all infrastructure components under the Project. A Variation Order is planned to increase the budget to allow an additional sum for specific O&M training for this subproject.

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

Table 18: Capacity building and training requirement

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

³⁵ \$20,000

C. Mitigation Measures

244. Comprehensive mitigation measures are set out in Table 19 below which set the minimum standards required by the construction Contractor and indicates operational mitigation measures to be implemented by the Operator. In addition, the construction Contractor is required to develop specific Construction Environmental Management Plan (CEMP) which sets out the contractor's approach to implementing this EMP and any specific method statements or plans requested.

Table 19: Mitigation Measures

Subproject Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Estimated Cost ³⁶ (\$)	Responsibility	
				Implementation	Supervision
PRE-CONSTRUCTION					
Design	Noise and Water quality	1. Finalize design to ensure reduction of noise from pumping station and design for minimal maintenance requirement to support operation to the design standard.	Include in project cost	PMIS	EA
Confirmation of required resettlement, relocations, & compensation	No negative environmental impacts	2. No Affected households	See resettlement plans	Resettlement committees (IRC)	EA/IA
Disclosure, & engagement of community	No community impacts	3. Initiate Information Disclosure and Grievance process of IEE 4. Consultation of community based on final detailed designs	Include in project cost	PIU	PMU
GRM Dissemination	No community impacts	5. Establish GRM and clarify roles and responsibilities 6. Provide contractor with GRM contact details to be used for: a) GRM sign boards b) GRM Contact Cards for Affected People	Included in Project cost	PMU	PMU
		7. Erect sign boards at the construction site entrance with: 8. A. Project details 9. B. GRM procedures and contact details 10. Print 'GRM Contact Cards' for all workers to give to complainants and keep cards with all vehicles, machinery and site managers/foremen	Included in Bid Price	Contractor	PMU

³⁶ Costs will need to be updated during detailed design phase

Subproject Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Estimated Cost ³⁶ (\$)	Responsibility	
				Implementation	Supervision
National IEIA Approval	All	11. Affected People Training. Contractor to raise awareness of all workers on how to respond when an affected person or member of the public has a complaint i.e. direct the person to the most senior site manager present at the time and provide a 'GRM Contact Card' 12. Ensure IEIA approvals are in place and include baseline environmental surveys as required by MoE 13. Update IEE and EMP to include: a) A. final detailed design b) B. further necessary environmental protection measures c) C. approved national IEIA requirements & mitigation measures. d) D. environmental quality baseline monitoring (water, air, noise) e) IEIA approved by MoE prior to contract award 14. The contractor(s) will develop a Construction EMP (C-EMP) that includes the mitigation measures set out in this table as a minimum and will include detailed individual management sub-plans for: a) Solid and Liquid Waste Management; b) Community Health and Safety and Access c) Occupational Health and Safety and Emergency Response; d) Construction Workers and Camp Management (if required). 15. The CEMP will include a map of each construction site, with copies held by the Contractor and PIU, showing as a minimum: - a). Access routes, b). storage areas for waste, c). storage area for chemicals such as fuels, d) concrete mixing, e) stockpile storage areas (on & off site), f) first aid kit and equipment used in emergency response, g) location of worker camps (if required) and construction staging areas and h) borrow sites.	Included in Bid Price	PMU	MoE
IEE and EMP Updated	All		Included in Project cost	Local licensed Company and PMIS	ADB/ PMU
Construction EMP (C-EMP) Approvals	All		Included in Bid price	Contractor (C-EHSO)	PMU/ PMIS
Obtain & activate permits and licenses	Compliance obligations	16. Approval of C-EMP including site maps as required by CEMP before construction is allowed to start. 17. Contractors to comply with all statutory requirements set out by Government for use of construction equipment, and operation construction plants. 18. Contractor to ensure all required permits including materials	Include in Project cost	PMU/ PMIS	EA
			Include in bid price	Contractor	PMU

Subproject Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Estimated Cost ^{3c} (\$)	Responsibility	
				Implementation	Supervision
UXO survey, & removal		extraction permits are in place prior to construction. 19. Ensure national military is consulted to confirm all relevant areas are clear from UXO in accordance with national standards / guidance. 20. Ensure any areas used for resettlement (if required) are confirmed clear of UXO. 21. UXO Clearance specialists to clear areas where necessary and provide evidence of clearance to PMU in advance of construction 22. Incorporate EMP into the bid and contract requirements, including Particular Conditions for Bidding Documents.	To be confirmed if required No cost	UXO specialists / military PMU/ PMIS EA	PMU
CONSTRUCTION PHASE					
Production, Transport and Use of Construction Materials	Air quality Resource use Waste Water Quality	23. A Traffic Management Plan will be developed and submitted to PMU for approval. This will show how a) construction traffic movements scheduled to avoid congested and/or sensitive periods; b) how traffic flows will be maintained safely c) safety measures to reduce risk of accidents including signs and speed controls. d) use of flag men	Included in Bid Price	Contractor	PIU/ PMU
		24. Asphalt and concrete batching facilities will be located at least 500m downwind from the nearest dwellings in order to reduce the impact of fumes on humans and to be fitted with necessary equipment such as bag house filters to reduce fugitive dust emissions. 25. Water will be sprayed on material handling areas, and borrow pits where fugitive dust is generated if it will impact on workers or residents. 26. Trucks carrying dry construction materials such as earth will be covered with tarpaulins or other suitable cover. 27. Stockpiles and materials will be stored at least 50m from surface waters with drainage directed away from the irrigation canals or drainage channels 28. Driving on unmade roads, trucks will be limited to 15 km per hour. 29. Maintain all exhaust systems in good working order; undertake regular equipment maintenance;			
Use of Machinery & Equipment	Air quality Noise and vibration		Included in Bid Price	Contractor	PIU/ PMU

Subproject Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Estimated Cost ³⁶ (\$)	Responsibility	
				Implementation	Supervision
Earthworks	Water Quality Soil Socio-economics	30. Restrict construction activities using heavy machinery work between 8am-6pm;			
		31. 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			
		32. Public notification of construction operations will incorporate noise considerations; information procedure of handling complaints through the Grievance Redress Mechanism will be disseminated.			
		33. Ensure noise monitoring is undertaken near sensitive receptors, particularly dwellings when construction machinery is operational			
		34. All construction workers will use appropriate Personal Protective Equipment (PPE) including ear defenders when operating machinery;			
Earthworks	Water quality Air quality Cultural heritage/ Chance Finds	35. No washing or repair of machinery within 50m of surface waters including irrigation canals.	Included in Bid Price	Contractor	PIU/ PMU
		36. Use mobile Noise Barriers in populated the urban core			
		37. Provision of adequate short-term drainage away from construction sites and all excavations to prevent contaminated run off entering Boeung Tum, irrigation canals or other water bodies.			
		38. Installation of temporary storm drains or ditches for construction sites to manage and control the flow and direction of surface water run off			
		39. Spray water on areas being worked if fugitive dust is generated if it will impact on workers or residents.			
Storage and Use of chemicals and fuels	Air quality Water quality Soil quality	40. If earthworks reveal cultural chance finds, the contractor will stop work immediately, fence off the area, and notify the PMU. Work will not commence until MPWT approval is given.	Included in Bid Price	Contractor	PIU/ PMU
		41. Refueling only in designated areas which are to be 200m from a water course and drip trays to be used when refueling or topping up / changing machinery fluids			
		42. Construction fluids such as oils, and fuels should be stored and handled on a bunded impermeable surface; a bund will be provided around any above ground fuel storage tanks with a capacity of 110% of the largest single tank.			
		43. All chemicals and fuels will be labeled			
		44. Spill control measures will be included in emergency response measures			
Implementation of Spoil,	Soil quality	45. Sub-plan will include measures to explain how the contractor will:	Included in bid	Contractor	PIU/ PMU

Subproject Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Estimated Cost ³⁶ (\$)	Responsibility	
				Implementation	Supervision
Solid and Liquid Waste Management Sub-Plan A	Water quality, Resource use Socio-economics	Follow the waste hierarchy and demonstrate how waste will be prevented, reused and recycled Implement effective management of materials on site through good house-keeping and work planning to prevent spoilage (waste). Clear arrangements for storage and transportation of all hazardous and non-hazardous waste to an authorized and approved disposal point (approved by Provincial Department of Environment). Recyclables to be separated at source and given/sold to recycler (plastic, metal, card, paper as a minimum) All solid waste to be stored in containers with lids. Prohibit burning of waste at all times; Train all vehicles/drivers to prevent any unauthorized waste disposal from vehicles Immediately clear and waste which escapes including waste in water ways including drainage ditches Identify criteria for spoil disposal including levels of contamination and location for spoil disposal (to be approved by municipal authorities) No disposal of spoil on agriculturally productive land or within 50 m of a water course	price		
Implementation of Community Health and Safety and Access Sub-plan B	Socio-economics	46. Community H&S and Access - measures to be included in the management sub-plan will include: a) Signing, lighting, guarding. Details of signs, lighting, and fencing, and buffer zones which will be provided around all construction sites including access roads and populated (Kampong Chhnang urban centre). b) Use of Warning signs which will be set up if mud is likely on public roads. Mud will be removed at the end of each day. Other spillages on public roads will be removed immediately. c) Details of how safe access will be maintained for pedestrians and vehicles (motorbikes and cars) to schools, markets, houses, pagodas and commercial establishments during excavations for pipe network and WWTP construction.	Included in bid price	Contractor	PIU/ PMU
Implementation of Occupational Health and	Socio-economics (Occupational	47. Occupational H&S measures to be included in the management sub-plan will include:	Included in bid price	Contractor	PIU/ PMU

Subproject Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Estimated Cost ³⁶ (\$)	Responsibility	
				Implementation	Supervision
Safety and Emergency Response Sub-plan C	Health and Safety), Water, Soil.	d) Assurance that all workers are equipped with, and use Personal Protective Equipment (PPE). e) Specifications for the PPE to be used on site and the contractors' approach to enforcement of its use by workers f) Details of signage giving occupational health and safety warnings and information disclosure within all construction sites – sub-plan to include example warnings. g) Details of worker education and awareness seminars for construction hazards will be given. A construction site safety program will be developed and distributed to workers. h) Details of daily toolbox meetings (safety briefings) i) Details of the site accident record book which will be maintained where all major or minor accidents and incidents are recorded with actions taken. j) Details of safety precautions when using 220 to 240V Electric Power tools if the workers are likely to be working within wet or flooded environments. k) Details of safety precautions taken for working in trenches.			
		48. The Emergency Response Plan will set out detailed Preventative Measures for all types of incidents covered in the Emergency Plan. This will include: l) Prevention of Injury and Accidents – to include Personal Protective Equipment requirements for construction workers, training requirements m) Prevention of Spillage - All construction fluids such as oils, and fuels will be stored on hard standing with sealed drainage with a capacity of 110% of the largest fuel container, will include procedures on refueling and maintaining vehicles. n) Prevention of Fire – to include measures for Ignition Sources including prevention of smoking on construction site, management of flammable materials and liquid. o) Other Incidents – prevention measures relevant to other issues considered relevant by the contractor			

Subproject Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Estimated Cost ³⁶ (\$)	Responsibility	
				Implementation	Supervision
Implementation of Construction Workers Camp Management Sub-Plan D	Socio-economics Soil quality Water quality	p) The plan will outline: a. Organization of emergency areas b. Roles and responsibilities c. Training and updating plan 49. The Contractor will develop Emergency Response Procedures prior to construction. The procedures will cover actions to be taken in case of: a) Worker injury (e.g. construction or traffic accident) b) Spillage (e.g. fuel spillage) c) Fire (e.g. fuel or chemicals storage area); and d) Any other incidents anticipated by the contractor. 50. The Contractor will follow the COVID-19 Mitigation Measures in the EMP (see separate table) which include a risk assessment relating to COVID-19 prior to any construction works or site preparation to be approved by the Project.			
		51. [if required] If a camp for construction workers is required the contractor will set out a management plan which will include: a) A map showing camp lay out, welfare facilities, and first aid kit locations. b) details of security at night for camp workers and a no weapons policy c) A schedule of training for workers including: - HIV Aids education awareness. - Relevant laws for foreign labor (including hunting, fishing and traffic rules); d) An approach to give priority to local labor force and retain evidence of how local labor recruitment efforts were undertaken	Included in bid price	Contractor	PIU/ PMU
		52. The contractor will follow the Camp Siting and Management Mitigation Measures in the EMP (see separate table)			

Subproject Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Estimated Cost ^{3c} (\$)	Responsibility	
				Implementation	Supervision
		53. If a construction camp is not required, the contractor will not require a Management Plan but will: a) Provide adequate waste disposal facilities including garbage cans for workers. b) Provide welfare facilities including water for washing, drinking and include facilities for male and female workers c) Provide toilets for male and female construction workers with a cleaning schedule 54. The contractor will give priority to local labor force and retain evidence of how local labor recruitment efforts were undertaken 55. For all temporary land take, the contractor will: a) Provide a layout map of staging area or other land take and its location which will not be within 200m of any surface water body and not in an area liable to flood b) Report on the condition of the land prior to its use for the Subproject 56. The site will not be at least 50m from a residential property 57. Topsoil from construction areas (WWTP) will be retained and used for landfill landscaping and rehabilitation 58. The contractor will provide a clear plan of how the following sites will be restored to their original condition following the end of construction: a) Worker camp b) Temporary land take c) Borrow sites 59. Any damage shall be repaired as per the technical specification in the bidding documents 60. All waste will be removed, and compacted ground restored. 61. Ensure planning and co-ordination with the water supply service provider 62. Early information for residents affected by any interruptions. 63. Significant receptors including healthcare facilities will require specific detailed co-ordination actions and consultation. 64. Follow requirements in Technical Specification regarding tree size, planting and aftercare requirements 65. Native species only to be approved by PDoE			
Temporary land take	Soil, water, flora, fauna		Included in bid price	Contractor	PIU/ PMU
Restoration and Rehabilitation	Contamination of soil and waste disposal, community health and safety		Included in bid price	Contractor	PIU/ PMU
Utilities disruption	Socio-economics		Included in Bid Price	Contractor	PIU/PMU
WWTP Landscaping	Flora		Included in Bid Price	Contractor	PIU/ PMU/ PDOE

Subproject Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Estimated Cost ³⁶ (\$)	Responsibility	
				Implementation	Supervision
POST-CONSTRUCTION					
Operation & Maintenance	Water quality, soil quality, socio-economics	66. The operator will ensure adequate ring fenced budget for the operation and maintenance			
		67. The operator will develop operational plans to include: a) clear methods and procedures for all aspects of the WWTP operation; b) a network and WWTP maintenance schedule in accordance with the design and ensure all repairs are completed before the start of each rainy season c) Environmental analysis program for regularly testing effluent and surface water quality and identify beneficial uses for any sludge disposal, ensuring any hazardous or non-hazardous sludge disposal does not pollute the environment or cause harm to human health. d) Procedures for emergency situations including business continuity planning for COVID-19 or similar issues. e) Regular meetings with local representatives such as village chiefs to discuss any arising nuisance issues. 68. The operator will develop: a) Specific health and safety procedures b) A comprehensive H&S training program; c) Undertake risk assessments for the use of calcium hypochlorite and other chemicals used on site and retain the Material Safety Data Sheet for the chemicals on site; d) An approach to ensure the use of appropriate PPE; e) Develop emergency procedures and f) Provide access to first aid	O&M cost	DPWT	MPWT

38. COVID-19:

245. WHO³⁷ defines '*quarantine*' as the separation of a person who is not ill but who may have been exposed to an infectious person, with the objective of monitoring their symptoms and ensuring the early detection of cases. '*Isolation*' is the separation of a person who is showing symptoms or has confirmed COVID-19 to prevent the spread of infection or contamination.

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

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

³⁷ WHO (19 March 2020) Considerations for quarantine of individuals in the context of containment for coronavirus disease (COVID-19) https://apps.who.int/iris/bitstream/handle/10665/331497/WHO-2019-nCoV-IHR_Quarantine-2020.2-eng.pdf

personal hygiene	washing (soap, water or alcohol gel) with a posted hand washing protocol at site entries, exits, bathrooms, communal areas, offices, and any other areas with commonly touched surfaces. • Inform workers of the need to avoid physical contact when greeting, and avoid touching eyes, nose and mouth. • Inform workers of the need to cover the mouth and nose with a disposable handkerchief when coughing or sneezing or the crook of their arm. • Dispose of tissues in a lined and covered waste bin and wash hands afterwards.
6. Provide personal protective equipment (PPE) and inform workers of its correct use	• Identify appropriate PPE related to the tasks and health and safety risks faced by workers according to the results of risk assessment and the level of risk, and provide it to workers free of charge and in sufficient number, along with instructions, procedures, training and supervision. • Non-medical face-coverings (such as homemade cloth masks) should be worn as mitigation for catching and transmitting the virus, but are not to be treated as substitutes for proper handwashing.
7. Health surveillance and insurance	• Before entering the site, staff and visitors must confirm that they are not currently exhibiting flu-like symptoms. • Monitor the health status of workers, develop protocols for cases of suspected and confirmed COVID-19. The protocol will state that : ○ workers with symptoms or confirmed cases must be isolated within the construction camp or stay at home for 7 days after symptoms started. ○ If symptoms persist after 7 days the person must isolate until the symptoms stop. ○ People who have been in close contact with the person with confirmed COVID-19 be quarantined for 14 days. • All workers in quarantine or isolation must be provided with adequate food, water, medical assistance and sanitation. • Identify workers who have had close contact with people infected with COVID-19 and follow national medical guidance. • Communicate confirmed cases of COVID-19 infection to the appropriate authorities. • All workers should be provided with health insurance that includes COVID-19 treatment
8. Consider other hazards, including psychosocial	• Promote a safe and healthy working environment free from violence and harassment. • Encourage health promotion and wellbeing in the workplace through enough rest, balance of physical and mental activity and adequate work-life balance. • Implement prevention and control measures for the use and storage of chemicals, particularly those used for disinfection during COVID-19.
9. Review emergency preparedness plans	• Develop an emergency plan adapted to COVID-19 and regularly review it.
10. Review and update preventive and control measures as the	• Periodically monitor prevention and control measures to determine whether they have been adequate to avoid or minimize risk, and identify and implement corrective actions for continuous improvement. • Establish and maintain records related to work-related injuries, illnesses and

situation evolves	incidents, worker exposures, monitoring of the work environment and workers' health. • Construction Workers and Camp Management.
Source: Adapted from: ILO, ³⁸ WHO, ^{39 40, 41} Canada Construction Association, ⁴² and UK Government. ⁴³	

³⁸ ILO (May 2020) Practical Guidance: Safe Return to Work. Ten Action Points.

³⁹ WHO (19 March 2020) Getting your workplace ready for COVID-19

⁴⁰ WHO (17 March 2020) Home care for patients with COVID-19 presenting with mild symptoms and management of their contacts

⁴¹ WHO (16 April 2020) considerations in adjusting public health and social measures in the context of COVID-19

⁴² Canada Construction Association (April 2020, version 4) COVID-19 Standardised protocols for all Canadian construction sites.

⁴³ www.gov.uk (19 May 2020) Working safely during coronavirus COVID-19: Construction and other outdoor work

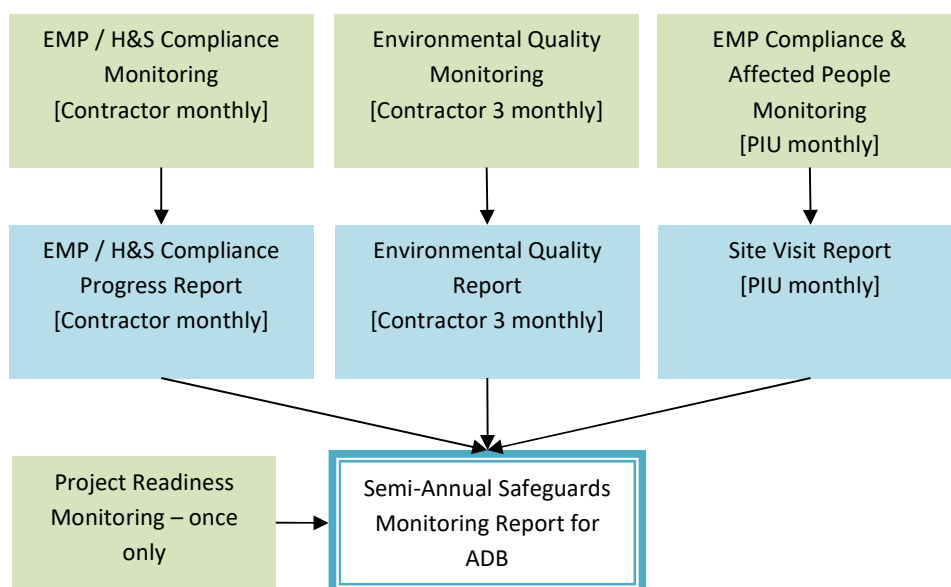
EMP SUPPLEMENTARY TABLE B Worker Camp Siting and Management Mitigation Measures for Health and Safety and COVID-19	
1. Siting	• Not in area liable to flooding, landslide or other natural disaster • Not in area affected by construction dust, noise, sewage or other pollution • Not in a residential area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

	Electrical cables to be in safe condition, elevated and not in areas liable to flood
6. Inspection	2 weekly inspection to inspect for cleanliness, state of repair of building, accommodation and fire equipment. - Record inspection results and retain for review
Source: Adapted from ILO Workers' Housing Factsheet No.6. ⁴⁴	

D. Monitoring and Reporting

247. Monitoring and reporting are linked. All monitoring is reported and supports the collation of the semi-annual monitoring report required by ADB, as shown in Figure 14.

Figure 14 Monitoring and reporting outline



248. The project monitoring required by the EMP and its costs is shown in Table 20.

Table 20: Monitoring requirement

Monitoring Type	Purpose	Estimated Cost or Source of Budget
1. Project readiness monitoring	Monitoring to check progress on project readiness and close gaps through corrective actions	No additional cost, part of project activities
2. Project phase environmental quality monitoring	To be conducted by a competent authority or person appointed by the Contractor, involving the collection and analyses of air quality, noise and water quality data at	\$15,800/year from project budget

⁴⁴ ILO (2009) Workers' housing. ILO Helpdesk Factsheet No. 6

	designated monitoring locations for assessing compliance with applicable environmental quality and emission standards during construction See	EIA and UXO requires separate budget
3. EMP compliance monitoring	To be conducted by the Contractor's-EHSO and verified by PIU/PMU with support from PMIS- I/NES during project implementation. See Table 23	No additional cost, part of project implementation activities
4. Affected People monitoring	A consultative approach. This is to be conducted by the PIU via consulting affected people on the impacts during construction. See Table 23	No additional cost, part of project implementation activities
5. Operational phase environmental quality monitoring	This is required as part of the operation of the WWTP will be undertaken by the relevant government department See Table 22.	Included in operator O&M costs

249. 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.

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

39. Project Readiness Monitoring

251. Before construction, the PMIS Consultant will monitor the project's readiness on environmental management based on a set of indicators and report it to ADB and PMU, see Table 21. 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 21: Project Readiness Assessment Indicators

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

	this EMP			
6. EMP financial support	The required funds have been set aside for EMP implementation including training and capacity building	Y/N		

40. Environmental Quality Monitoring

252. Prior to construction, baseline analysis will be conducted by a licensed EIA company. The Subproject IEE will be updated with baseline analysis from the approved IEIA report prior to construction.

253. During construction, the impact on the sensitive environmental receptors will be monitored and compared against the relevant national standard. During operation, the relevant operator will be expected to maintain an adequate budget to ensure environmental monitoring can be undertaken as specified in Table 22.

Table 22: Environmental quality monitoring requirements

Aspects/Parameters to be Monitored	Location	Means of Monitoring	Frequency	Estimated Cost (USD)*	Responsibility
A. Prior to Construction Phase (INCLUDED IN DOMESTIC IEIA COST)					
1 Ambient air quality CO, NO ₂ , SO ₂ , TSP, O ₃ , Pb, PM 10 &PM 2.5	Receptors near WWTP site and urban core network	Analytical methods outlined in the guideline of the MoE, or applied by MoE	Once	3,250	Implement: PMU via EIA company Verify: PMIS
			Once		
2 Ambient noise levels L _{max} , L _{min} , L _{eq}					
3 Surface water quality pH, DO, TSS, Fe, BOD5, COD, Oil and Grease, Detergent, SO ₄ , NH ₃ , TN, TP, Pb, AS, Cd, Hg and Total Coliform.	Boeung Tum	Analytical methods outlined in Cambodia's Drinking Water Quality Standards, 2004	Once	750	
4. Mine Clearance and Unexploded ordnance	To be included in Bill of Quantities				
Sub-Total (Prior to construction for baseline data)				4,000	
*Costs include laboratory analysis and associated costs of sampling such as transport and accommodation based on MoE quote					
B. Construction Phase					
5. Ambient air quality	Housing near WWTP	Analytical methods outlined	Every 3 month	8,000	Implement:

CO, NO ₂ , SO ₂ , TSP, O ₃ , Pb, PM 10 & PM 2.5 (Monitor only when construction activities occur within 250 m of nearest residential receptor)	site and Urban receptor in town (Market, Pagoda, Hospital)	in the guideline of the MoE or applied by. MoE.		Contractor Verify: PMU / PMIS
6. Ambient noise levels Lmax, Lmin, Leq (Monitor only when construction activities occur within 100 m of nearest residential receptor)				
7. Surface water quality pH, TSS, BOD5, COD, Oil and Grease, TN, TP	Boeung Tum, open water close to construction site	Analytical methods outlined in Cambodia's Drinking Water Quality Standards, 2004	3,000	
8. Field observation from related Ministry or department e.g. MoE, DoE	Project location	Using field observation	4,800 ⁴⁵	Implement: MoE/DoE
Sub-Total (Construction) PER YEAR				
C. Operation Phase				
9. Surface water quality pH, TSS, BOD5, COD, TN, TP and Total Coliform.	Boeung Tum, open water within 500m of outfall	Analytical methods outlined in Cambodia's Drinking Water Quality Standards, 2004	Every 3 month	Implement: Operator Verify: DPWT/MPWT
10. Effluent quality COD, BOD, TSS, TN, TP, NH3, pH, Oil /Grease as per Annex 2 of Sub-decree 27.	Final effluent from WWTP	Analytical methods outlined in the guideline of the MoE or applied by. MoE.	Every 3 month minimum	Implement: Operator Verify: DPWT/MPWT
			Included in O&M cost of Operator	
			Included in O&M cost of Operator	

41. EMP compliance monitoring

254. In order for the EMP to be effective, all its mitigation measures in the EMP must be monitored to ensure they are implemented. Table 23

⁴⁵ Budgets for MoE staff to monitor environmental problems during construction stage.

defines the responsibilities of the Contractor and PIU to support the PMU in monitoring the monthly progress against the EMP during construction. Note this applies to construction only; during operation, it is the responsibility of the appropriate ministry or its line department to ensure monitoring of operational facilities is incorporated in the operations and maintenance manual and carried out routinely. Table 23 also shows the PIU/PMU responsibility for monitoring through consultation with affected people.

Table 23: EMP compliance and affected people monitoring

Environmental Indicators /EMP activity	Location	Method & Frequency	Responsibility		Estimated Costs (USD)
			Implement	Verify	
Construction Phase – All Sub-Projects					
Air Quality & Noise	Civil works sites	Monthly checking against mitigation measures specified in this EMP	Contractor EHSO	PIU-ESC With support from PMIS-N/IES	Included in project budget / contract
Water Quality	Civil works sites	Monthly checking against mitigation measures specified in this EMP			
Traffic Management Plan	Civil works sites	Monthly checking against mitigation measures specified in this EMP			
Implementation of Solid and Liquid Waste Management Sub-Plan	Civil works sites	Monthly checking against mitigation measures specified in this EMP			
Implementation of Community Health and Safety and Access Subplan	Civil works sites	Monthly checking against mitigation measures specified in this EMP			
Implementation of Occupational Health and Safety and Emergency Response Sub-Plan	Civil works sites	Monthly checking against mitigation measures specified in this EMP			
Implementation of Construction Workers and Camp Management Sub-Plan	Civil works sites	Monthly checking against mitigation measures specified in this EMP			

Environmental Indicators /EMP activity	Location	Method & Frequency	Responsibility		Estimated Costs (USD)
			Implement	Verify	
Community Issues - At all construction locations Environmental impacts of civil works (e.g., solid & liquid waste, local flooding, pollution). Any unforeseen impacts caused by accidentally e.g. through spillages Civil nuisance (e.g., noise, disrupted business, social issues, community health and safety). Impaired use of access roads (e.g. traffic issues and access). GRM and its procedures & key contacts		Consultation interview with Affected People Using the form in Appendix 1 4-6 weeks after construction starts Every 2 months until end of construction	PMU-ESO	PIU-ESC	Included in PIU staff/travel budget

42. Reporting requirements

255. Environmental monitoring reports are designed to coincide with monitoring i.e. all monitoring will be reported. The monthly reports will be used to collate the semi-annual environmental monitoring report. This report will be prepared semi-annually for the EA by the Project Management and Implementation Support consultants in collaboration with PMU's Environmental Safeguard Officer and sent to MPWT's Environmental Safeguard Office, MoE and ADB. The reports will table all indicators measured with the monitoring plan of EMP and will include relevant national environmental quality standards. Table 24 gives reporting requirements.

Table 24. Reporting Requirements

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

4	Environmental Safeguards Monitoring Report	Semi-Annual	Full EMP Implementation and Adherence to Environmental Covenants/Conditions	PMU	ADB
---	--	-------------	---	-----	-----

43. Mechanisms for Feedback and Adjustment

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

IX. CONCLUSIONS

A. Conclusions

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

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

259. The most significant long-term impacts from the project will arise from WWTP operations. Short term impacts will arise from street works in a dense urban core. As a result, there is a comprehensive training and capacity building component to the project which is essential for ensuring the investment is financially and environmentally sustainable and beneficial.

260. A robust Grievance Redress Mechanism will be established. It will ensure that all unplanned impacts which cause grievances for affected people are managed swiftly and a satisfactory outcome brought about.

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

B. Recommendations

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

ANNEXES

Annex 1 Fauna species in Subproject area

Table 25: Fish species in Kampong Chhnang and Pursat town

Order	Family	Scientific name	Local name
Osteoglossiformes	Notopteridae	<i>Notopterus notopterus</i>	Trey Slat
		<i>Chitala blanci</i>	Trey Krai
Clupeiformes	Clupeidae	<i>Clupeichthys gonignathus</i>	Trey Bandol Ampov
Cypriniformes	Cyprinidae	<i>Rasbora spp.</i>	Trey Changwa
		<i>Cyclocheilichthys sp.</i>	Trey Chhkok
		<i>Hypsibarbus sp.</i>	Trey Chhpin
		<i>Puntiolites falcifer</i>	Trey Chrokaing
		<i>Morulus sp.</i>	Trey Kaek
		<i>Cirrhinus microlepis</i>	Trey Proul
		<i>Thynnichthys thynnoides</i>	Trey Linh
		<i>Henicorhynchus sp</i>	Trey Riel
Siluriformes	Clariidae	<i>Clarias macrocephalus</i>	Trey Andaing Toun
		<i>Clarius batrachus</i>	Trey Andaing Roueng
	Bagridae	<i>Pseudambassis notatus</i>	Trey Kanchan Chras
	Pangasiidae	<i>Pangasius lamaudiei</i>	Trey Po
		<i>Pangasius sp.</i>	Trey Pra
		<i>Pangasius sp.</i>	Trey Chhwiet
	Siluridae	<i>Micronema micronema</i>	Trey Kes
		<i>Belodonticthys dinema</i>	Trey Klang hay
		<i>Ompok bimaculatus</i>	Trey Kromorm
		<i>Wallago attu</i>	Trey Sanday
Perciformes	Channidae	<i>Channa macropeltes</i>	Trey Chhdaur
		<i>Channa striata</i>	Trey Phtuok/Raws
	Nandidae	<i>Pristolepis fasciata</i>	Trey Kantrawb
	Anabantidae	<i>Anabas testudineus</i>	Trey Kranh
	Belontiidae	<i>Trichogaster trichopterus</i>	Trey Kamphlien
	Cichlidae	<i>Oreochromis mossambicus</i>	Trey Tilapha
	Eleotridae	<i>Oxyeleotris marmorata</i>	Trey Damrey
Beloniformes	Belonidae	<i>Xenentodom cancila</i>	Trey Ptoung
Synbranchiformes	Mastacembelidae	<i>Macrognathus siamensis</i>	Trey Chhlonh
Pleuronectiformes	Soleidae	<i>Achiroides sp.</i>	Trey Andat chke

Source: PMIS Team, data from TA-8556 REG: CDIA- Pre-feasibility studies for Second Tonle Sap Integrated Urban Management Project

Table 26: Locally observed bird species, Kampong Chhnang and Pursat town Residents

Khmer Name	English Name	Scientific Name	IUCN Status
Antep Khmao	Black Drongo	<i>Dicrurus macroercus</i>	LC
Antep Tongkontrai	Great Racket-tailed Drongo	<i>Dicrurus paradiseus</i>	LC
Brocheav	Bat	<i>Chiroptera</i>	LC

Khmer Name	English Name	Scientific Name	IUCN Status
Chab krouch	Yellow-vented Bulbul	<i>Pycnonotus blanfordi</i>	LC
Chab Tet	Common Tailorbird	<i>Orthotomus sutorius</i>	LC
Chreng	Flying Fox	<i>Pteropus</i>	LC
Chungkong Kras Champus Khmao	Great Thick-knee	<i>Esacus recurvirostris</i>	NT
Chab Dounta Tnoat	Brown Shrike	<i>Lanius cristatus</i>	LC
Chab Pouk Troung Loeung	Asian Golden Weaver	<i>Ploceus hypoxanthus</i>	NT
Chor Lor Cheung Pou Hout	Nordmann's Greenshank	<i>Tringa guttifer</i>	EN
Dom Dou	Black-tailed crane	<i>Amauornis bicolor</i>	LC
Ka-ek	Large-billed Crow	<i>Corvus macrorhynchos</i>	LC
Khlom	Water cock	<i>Gallicrex cinerea</i>	LC
Khvek	Snipe	<i>Gallinago gallinago</i>	LC
Kleng Srak	Barn Owl	<i>Tyto alba</i>	LC
Kok	Great White Egret	<i>Egretta alba</i>	LC
Kok Sacmut	Pacific Reef Egret	<i>Egretta cinerea</i>	LC
Kok Kroung Thom	Great Egret	<i>Casmerodius albus</i>	LC
Kok Kroung Touch	Little Egret	<i>Egretta garzetta</i>	LC
Kor Dob Kbal Khmao	Black-capped Kingfisher	<i>Halcyon pileata</i>	LC
Kreal	Sarus Crane	<i>Grus antigone</i>	LC
Kro Sapropes	Grey Heron	<i>Ardea cinerea</i>	LC
Kro Sa Champosthom	Great-billed Heron	<i>Ardea sumatrana</i>	LC
Kroling Kroloung	Black-collared Starling	<i>Sturnus nigricollis</i>	LC
Kruoch Art	Barred Buttonquail	<i>Turnix suscitator</i>	LC
Lo Lok	Red Collared Dove	<i>Streptopelia chinensis</i>	LC
La-out Tom	Greater Coucal	<i>Centropus sinensis</i>	LC
Mann Teuk	White-breasted Water hen	<i>Amauormis phoenocures</i>	LC
Meam touchprey	Asian Barred Owlet	<i>Glaucidium cucloides</i>	LC
Popich Thmar	Blue Rock Thrush	<i>Monticola solitarius</i>	LC
Popich Khmao	Black Bulbul	<i>Hypsipetes leucocephalus</i>	LC
Popich Tracheak Krahorm Sor	Red-whiskered Bulbul	<i>Pycnonotus jocosus</i>	LC
Popoul Teuk	Masked Finfoot	<i>Heliopais Personata</i>	EN
Preap Sor kmao	Pied Imperial Pigeon	<i>Ducula bicolor</i>	LC
Preap Prey	Green Imperial Pigeon	<i>Ducula aenea</i>	LC
Pro Vek	Lesser Whisling Duck	<i>Dendrocygna Javanica</i>	LC
Roneal	Painted Stork	<i>Mycteria Leucocephala</i>	LC
Sa Rikakeo	Common Myna	<i>Acridotheres Tristis</i>	LC
Sa Rikakeo Krobey	White-vented Myna	<i>Acridotheres grandis</i>	LC
Sek Kheav	Grey-head Parakeet	<i>Psittacula finschii</i>	LC
Sambok Trapeang	yellow bittern	<i>Ixobrychus sinensis</i>	LC
Tea Prey	Garganey	<i>Anas querquedula</i>	LC
Tituy	Owl	<i>Strigiformes</i>	LC

Khmer Name	English Name	Scientific Name	IUCN Status
Tro Cheakkam	Barn Swallow	<i>Hirundo rustica</i>	LC
Tung Propes	Spot-billed Pelican	<i>Pelecanus philippensis</i>	NT
LC = Least Concern, NT = Near Threatened, En=Endangered			

Source: PMIS Team, data from TA-8556 REG: CDIA- Pre-feasibility studies for Second Tonle Sap Integrated Urban Management Project

Annex 2 GRM Project Hotline Notice

Project Hotline

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

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

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

You can also contact ADB directly:

ADB, Phnom Penh Office:

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