

Initial Environmental Examination

October 2021

Cambodia: Fourth Greater Mekong Subregion Corridor Towns Development Project

Wastewater Treatment Plant and Drainage System Subproject,
Stung Treng City, Stung Treng Province

Prepared by the Ministry of Public Works and Transport for the Asian Development Bank.
This is an updated version of the draft originally posted in May 2018 available on
<https://www.adb.org/projects/documents/cam-50099-002-iee>.

ABBREVIATIONS

ADB	-	Asian Development Bank
AASHTO	-	American Association of State Highway and Transportation Officials
BOD	-	Biochemical Oxygen Demand
CDIA	-	Cities Development Initiative for Asia
CEMP	-	Construction Environmental Management Plan
C-EHS	-	Contractor's Environment, Health and Safety Officer
CMAC	-	Cambodia Maine Action Centre
COD	-	Chemical Oxygen Demand
CRVA	-	Climate Risk Vulnerability Assessment
DDPP	-	Detailed Design and Project Preparation
EA	-	Executing Agency
EIA	-	Environmental Impact Assessment
EMP	-	Environmental Management Plan
FGD	-	Focus Group Discussion
GDR	-	General Department of Resettlement
GHG	-	Greenhouse Gas
GMS/CTDP-4	-	Fourth Greater Mekong Subregion Corridor Towns Development Project
GRM	-	Grievance Redress Mechanism
HIV	-	Human Immunodeficiency Virus
IA	-	Implementing Agency
IBA	-	Important Bird Area
IEE	-	Initial Environmental Examination
IESIA	-	Initial Environmental and Social Impact Assessment
KBA	-	Key Biodiversity Area
MAFF	-	Ministry of Agriculture, Forest, and Fishery
MoE	-	Ministry of Environment
MOWRAM	-	Ministry of Water Resources and Meteorology
MPS	-	Main Pumping Station
MPWT	-	Ministry of Public Works and Transport
PDoe	-	Provincial Department of Environment
PDPWT	-	Provincial Department of Public Works and Transport
PMC-I/NES	-	PMC-International and National Environmental Specialists
PIU	-	Project Implementation Unit
PIU-SFP	-	PIU Safeguards Focal Point
PMC	-	Project Management Consultant
PMU	-	Project Management Unit
PMU-ESO	-	PMU Environmental Safeguards Officer
PSC	-	Project Steering Committee
RCP	-	Representative Concentration Pathway
SHC	-	Sewer Household Connection
SPS	-	Safeguards Policy Statement
SPS-1	-	Sewage Pumping Station 1
SPS-2	-	Sewage Pumping Station 2
TS-2 Project	-	Second Urban Environmental Management in the Tonle Sap Basin Project
TSS	-	Total Suspended Solid
UXO	-	Unexploded Ordnance
WHO	-	World Health Organization
WWTP	-	Wastewater Treatment Plant

CURRENCY EQUIVALENTS

(as of June 2020)

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

WEIGHTS AND MEASURES

dB(A)	-	A-weighted Decibel
ha	-	Hectare
km	-	Kilometre
km ²	-	Square kilometre
LAeq	-	Equivalent Continuous Level 'A weighting' - 'A'-weighting = correction by factors that weight sound to correlate with the sensitivity of the human ear to sounds at different frequencies
m	-	Meter
°C	-	Degree Celsius
PM10	-	Particulate Matter 10 micrometres or less
PM2.5	-	Particulate Matter 2.5 micrometres or less
µg/m ³	-	Microgram per cubic meter

NOTE

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

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1 EXECUTIVE SUMMARY

1.1 Project Background

1. The Fourth Greater Mekong Subregion Corridor Towns Development Project (GMS/CTDP-4 or the Project) will support the Governments of Cambodia and the Lao People's Democratic Republic (PDR) in enhancing the competitiveness of selected towns located along the Central Mekong Economic Corridor in the Greater Mekong Subregion (GMS). It is aligned with the Government of Cambodia's Rectangular Strategy for national development. The third phase (RS- III 2013–2018) identifies integrated urban development as a priority and recognizes the need to manage environment and climate change to ensure the sustainability of Cambodia's economic growth and social development. The Project is also underpinned by Cambodia's National Green Growth Road Map (2010) which promotes access to clean water and sanitation. In Cambodia, the Project will improve urban services and enhance regional economic connectivity in the participating cities of Stung Treng, Kampong Cham and Kratie.

2. The GMS/CTDP-4 Project includes: (i) improving sanitation and flood control by establishing separate wastewater/sewage and stormwater drainage network facilities, and construction of Wastewater Treatment Plants (WWTP), (ii) improving solid waste management by establishing controlled landfills and providing solid waste collection vehicles. The existing dumpsites in Stung Treng and Kratie will be closed, (iii) town centre landscaping and rehabilitation to create liveable public spaces that foster tourism benefits, (iv) information and communications technology (ICT) based government systems to optimize operational transparency and resource efficiency in managing the new infrastructures, and (v) provincial five-year socioeconomic development plans to promote regional economic connectivity and coordinate their strategies (**Table 1**).

Table 1: Summary of CTDP-4 Subprojects

Subproject City	Lagoon based WWTP	Wastewater System	Drainage	Landfill
Kampong Cham	5,000 m ³ /day	137 km	4,3 km	436,208 m ³
Kratie	4,900 m ³ /day	143 km	12 km	203,119 m ³
Stueng Treng	3.650 m ³ /day	147 km	12 km	181,230 m ³

3. As with the other two cities of the Project, there is no reticulated wastewater collection and treatment system in Stung Treng. There are no records kept of numbers, volumes or condition of septic tanks in the town, and private septage collection and disposal operations are unregulated. There is no building code, stipulating requirements for urban on-site sanitation. Wastewater treatment is limited to septic tanks in the more modern houses, hotels and restaurants. The majority of households use an unsealed soak way pit, which do not provide any significant treatment. Liquid waste soaks into the ground if the water table is low enough and solids remain in the pit.

4. This IEE for the Stung Treng Wastewater Treatment and Drainage Subproject covers the construction and operation of a Wastewater Treatment Plant, and construction and operation of separate wastewater and stormwater networks in Stung Treng City.

5. The environmental classification of the Subproject is confirmed as Category B. The IEE was carried out in accordance with the Safeguard Policy Statement (2009) of the Asian Development Bank (ADB), and Cambodia's Law on Environmental Protection and Natural Resource Management (Preah Reach Kram/NS-PKM-1296/36) 1996, and its sub-decrees and implementing guidelines. A separate Environmental Management Plan (EMP) has been prepared (latest version dated October 2021), which will be part of the bidding documents. The IEE and EMP have been updated in conjunction with the finalization of the Detailed Engineering Design (DED) ensuring consistency between engineering designs and environmental mitigation measures. The previous IEE/EMP of May 2018 prepared and

disclosed during the preparation of the CTD-4 Project covering all the CTD-4 subprojects is available on ADB's website¹. The IEE and EMP also incorporate the findings of the Initial Environmental and Social Impact Assessment (IESIA) approved by the Ministry of Environment (MoE) on 20 May 2021 (**Annex 5**). The IEE and EMP will be further updated if necessary.

6. The subproject has a design period of 20 years to Year 2040. The main subproject components are listed below:

- Construction of 47.841 km primary and secondary sewers and 5.528 km tertiary sewers;
- Construction of service connections for 2,373 households, commercial and institutional buildings including onsite plumbing;
- Construction of three (3) wastewater pumping stations and 3.077 km of associated pumping mains;
- Upgradation of one (1) existing storm drainage pumping station with additional one pump in existing pump station building, associated pumping main, and other additional allied units and structures;
- Construction of a 2,900 m³/day Wastewater Treatment Plant (WWTP) above flood levels:
 - Total area 9.75 ha
 - Treatment ponds 4.31 ha
 - Operations area 0.161 ha
 - Internal access road 0.21 ha
 - Laterite wearing course on the 4.5 m wide access road the first 85 meter from the WWTP to the east
- Construction of administration, workshop, electrical and guard buildings at the WWTP site;
- Construction of 1.800 km storm drainage diversion (φ800–φ1000) for storm water management including outlet structure;
- Provision of operations & maintenance equipment.

7. The selected WWTP site is located in Krang Memay Village, Preah Bat Commune, Stueng Treng District on an open area at an aerial distance of approximately 4 km southwest of the city centre. Wastewater from the city area will be transported through wastewater pipelines to the WWTP. The WWTP site covers a total area of 9.75 ha of which about 4.31 ha will be used for the WWTP ponds, about 0.161 ha for the operation area and 0.21 ha land for access road between operation area and WWTP ponds.

8. The proposed separate sewer system and drainage system in Stung Treng District will be built in the main urban area to serve three communes (sangkats), namely Preah Bat, Srah Ruessei and Stung Treng.

1.2 Key Findings

9. The site for the wastewater treatment plant is located in Krang Memay Village, Preah Bat Commune, Stueng Treng District about 300 m east of the left bank of the Mekong River and about 4 km from the city centre. The site is surrounded by open land with shrub and patches of agricultural land.

¹ <https://www.adb.org/projects/documents/cam-50099-002-iee>

10. The subproject includes a separate sewage collection network with household and building service connections, pumping stations and associated pumping mains. In addition, the subproject includes a separate storm drainage diversion system with upgrading of existing drainage pumping station to mitigate flooding and resolve major drainage issues.

11. An assessment of proximity to Key Biodiversity Areas and Protected Areas using the Integrated Biodiversity Assessment Tool (IBAT) shows that the WWTP site is inside the Mekong River from Kratie to the Lao PDR, Key Biodiversity Area, 0.3 km east of the Northeast Corridor of Protected Area (overlaps with the Mekong River from Kratie to the Lao PDR Key Biodiversity Area, and 7.5 km south-southwest of the Stung Treng Ramsar Site which is a National Protected Area of Cambodia (**Annex 4**).

12. The location of the wastewater treatment plant site and its surroundings are summarized below:

- about 4 km for Stung Treng City centre.
- About 4 km by road from National Road No. 9
- about 300 m east of the Mekong River.
- The nearest single houses are 100 m – 150 m from the site boundary, and housing along the road on the left bank of the Mekong River approximately 250 m from the site boundary.
- The site is covered with grassland, shrub and cashew trees.
- The surrounding area in a 500 m radius is dominated by shrubland with patches of agricultural land
- The site is located inside the Mekong River from Kratie to the Lao PDR, Key Biodiversity Area.

13. The WWTP site of 9.75 ha is partly private land with 5 different landowners. The pump stations will be built on public land and the wastewater and drainage lines will be constructed within the road right-of-way.

14. For Stung Treng City, the new wastewater and drainage infrastructure will form the foundation for developing city wide wastewater systems in the years ahead. The intervention will be a catalyst to expansion of the city, which is currently hampered by inadequate municipal infrastructure including drainage and wastewater management services.

15. The community consultations show widespread support for the sub-project as the residents recognize the need for improved wastewater treatment. The communities are also subject to impacts from flooding and therefore are keen to see climate change proof drainage improvements in their city.

16. A Grievance Redress Mechanism (GRM) was established on 18 January 2019 to receive and facilitate resolution of affected peoples' concerns and grievances about social or environmental impacts associated with the subproject. The GRM will address such concerns and complaints promptly, using a transparent process that is readily accessible to all affected persons. The GRM will contain multiple entry points to allow affected people to approach the Contractor, PIU, their local leaders, the Ministry of Public Works and Transport or ADB.

1.3 Environmental Management Plan

17. The separate EMP aims to avoid impacts where possible and mitigate those impacts which cannot be eliminated to an acceptable and minimum level. The EMP includes:

- Summary of potential impacts
- Mitigation and monitoring measures
- Institutional arrangements and project responsibilities
- EMP budget for implementation
- Capacity building and training requirements
- Public consultation and information disclosure
- Grievance Redress Mechanism

18. The project includes a Capacity Building Program to address technical and institutional issues and ensure continued provision of quality services. The Project Management Consultant (PMC) will be responsible for ensuring adequate training during project implementation. The training will focus on:

- roles and responsibilities for implementation of the EMP (oversight, monitoring, supervision, reporting and actual on-the-ground implementation)
- updating of the EMP
- Grievance Redress Mechanism – roles and responsibilities
- Environmental protection and pollution control on construction sites (air, noise, wastewater, solid waste)
- Environmental monitoring methods, data collection, interpretation and reporting.
- Emergency preparation and response and other important site-specific environmental measures.

1.3.1 Pre-construction Phase

19. The pre-construction phase will involve development of the Construction Environmental Management Plan (CEMP) incorporating and detailing the environmental protection measures described in the EMP. The Contractor shall submit the CEMP to the Project Management Unit (PMU) for review and the Contractor is not allowed to start construction work until the CEMP has been approved. Preparation and training for the implementation of the CEMP will be undertaken. The construction site(s) must be surveyed and cleared for UXOs before construction is allowed to start.

1.3.2 Construction Phase

20. Impacts during construction will be localized and short-term and limited to common impacts associated with earth works, construction of buildings and trench excavations in an urban setting. Particular attention will be taken to reduce noise and dust emissions and to ensure that proper safety precautions are in place for workers, pedestrians and road users in connection with roadside excavations for pipes and pumping stations.

21. The key mitigation measures during construction will include to:

- Collaborate, inform, and coordinate with local agencies and affected people of project planning and activities
- Provide training and awareness on equipment use and environmental-social protection measures
- Implement good construction practices to ensure minimal risks and impacts to people, local communities and the surrounding environment from potential disturbances or emissions associated with construction activities, such as noise, dust and discharge of wastewater.
- Conduct regular monitoring of environmental, water, noise, and air quality, to verify compliance with national standards.
- Provide safety signs and other safety facilitations in project sites and workers/staffs. Ensure that people will continue to have unimpeded access to their properties and workplaces.
- The contractor shall prepare and implement the Construction Environmental Management Plan (CEMP) laying out the specific measures to mitigate impacts associated with the construction works. The CEMP shall include a community and occupational health and safety measures and other site-specific measures. The contractor shall obtain approval of the CEMP from the PMU before starting construction works.
- The Contractor shall assign a full-time environment, health and safety officer for the entire 3-year construction period, who will be responsible for CEMP implementation and supervision and for ensuring compliance with applicable

Cambodian environmental, health and safety legislation and with relevant IFC Environmental, Health and Safety guidelines.

22. Appropriate occupational health and safety measures for the construction workers will be implemented. Typical health and safety procedures include effective measure to prevent collapse or cave-in of deep excavations, safe driving and operation of heavy construction equipment, and correct use of PPEs to minimize the risk of injury and exposure to loud noise, dust. Proper hygiene and safety procedures will be implemented to prevent transmission of the SARS-CoV-2 virus², HIV and other pathogens. The contractor's environment, health and safety officer (see **Para 21**) will be responsible for ensuring that occupational and community health and safety standards including GRM are maintained in compliance with applicable Cambodian legislation and with relevant IFC Environmental, Health and Safety guidelines, and for ensuring that repeated training of the construction workers in occupational health and safety is undertaken.

1.3.3 Operational Phase

23. The most significant environment risks and impacts associated with the subproject are expected during the operation phase. The proximity to residences will require strict implementation of measures to prevent or minimise odour nuisances. Proper operation and maintenance of the WWTP will be implemented to ensure compliance with effluent standards thereby sufficiently minimising the risks to aquatic flora and fauna. It should also be taken into consideration that compared with the current situation where untreated wastewater seeps into the groundwater or is drained into the Mekong River or the Sekong River, the wastewater collection and treatment will have long-term positive effects. Furthermore, the separation of wastewater from the stormwater network will reduce odour nuisances and public health risks in the urban areas. In addition, people, businesses and institutions will benefit from improved disaster and climate change resilient infrastructure.

24. The importance of training in operation and maintenance of the wastewater treatment plant and the sewage and drainage network will be emphasized as this is crucial for ensuring optimal environmental performance. A detailed long-term operator training plan and associated budget is provided in the capacity development component of the project.

25. Appropriate occupational health and safety measures for the operators of the wastewater treatment plant and associated network will be implemented. Typical health and safety procedures include proper hygiene and safety procedures to prevent exposure to infectious materials or agents, correct use of PPEs to protect against dust and noise. Safety measures when cleaning or maintaining underground installations. Repeated training of operator staff will be planned and implemented.

1.4 Conclusion

26. This IEE was undertaken to determine the environmental issues and concerns associated with the Stung Treng Wastewater Treatment Plant and Drainage System Subproject. The assessment confirms that the project is classified as Category B for environment. All significant adverse impacts are well-known from experience with similar types of projects and will be effectively mitigated by conventional proven pollution control technologies and practices. The direct responsibilities for implementing the mitigation measures lies with the construction contractor during the construction phase and with the operator to the wastewater treatment plant and associated network system during the operational phase. They will be supported by qualified national and international environmental consultants of the Project Management Consultant. The implementation of the

² SARS-CoV-2 (severe acute respiratory syndrome coronavirus 2) is the causal agent of COVID-19 (Coronavirus Disease 2019)

mitigation measures will be closely monitored and reported on by the relevant stakeholders in the project.

27. The impacts during construction will mainly be short-term and localized, and the most significant potential impacts will be associated with earthworks at the WWTP site and trench excavations for the pipelines in the urban areas. A comprehensive training and capacity building component is therefore included in the subproject as this is essential for ensuring that the investment is both financially and environmentally sustainable and achieves anticipated outcomes.

28. For the operational phase of the project, the most significant environmental risks will arise from poor facility operation and maintenance, which may cause emission of nuisance odours or discharge of polluted poorly treated wastewater. However, when operated properly, the project will reduce impacts on waterbodies and the improve the urban environmental quality of Stung Treng City.

29. Overall, the expected project outcome is improved urban environmental services in Stung Treng City. It will improve wastewater and drainage management, reduce pollution impacts and provide long term urban environmental improvements which will also lead to community health benefits and promote sustainable city development.

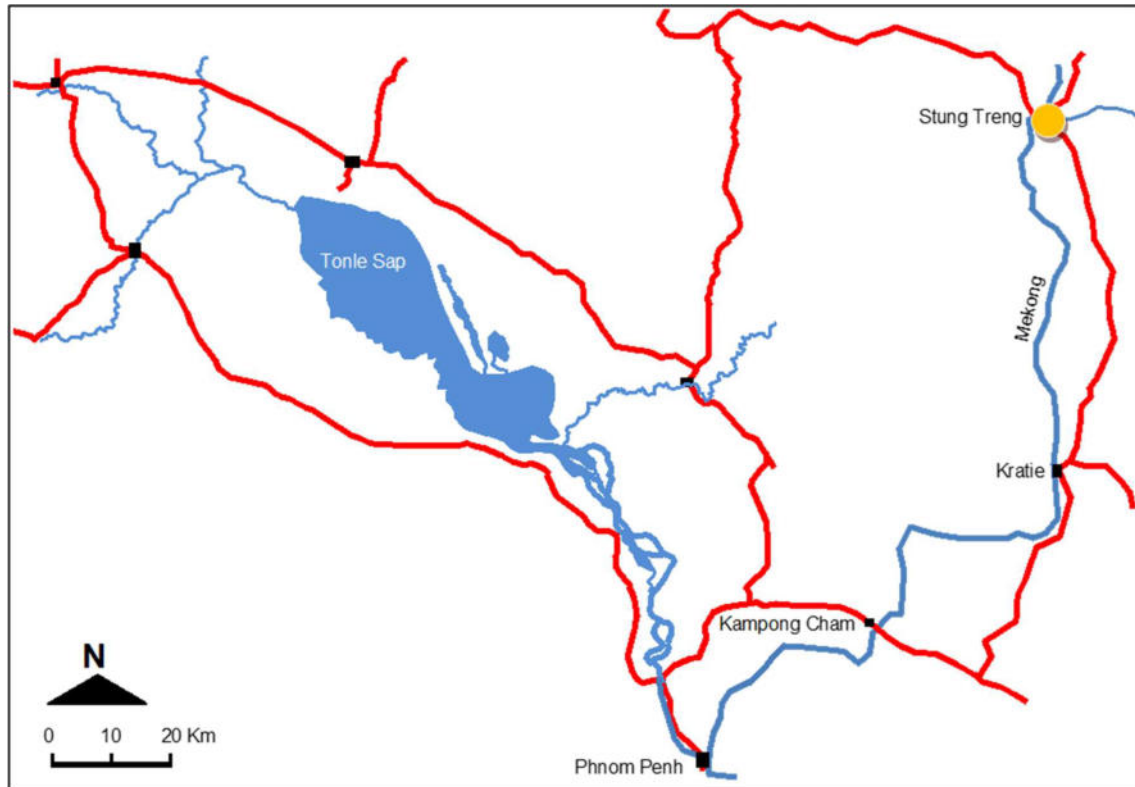
2 INTRODUCTION

2.1 Background and Location

30. The Fourth Greater Mekong Subregion Corridor Towns Development Project (GMS4 or CTDP-4 Project) will support the Governments of Cambodia and the Lao People's Democratic Republic (PDR) in enhancing the competitiveness of selected towns located along the Central Mekong Economic Corridor in the Greater Mekong Subregion (GMS). It is aligned with the Government of Cambodia's Rectangular Strategy for national development. The third phase (RS- III 2013–2018) identifies integrated urban development as a priority and recognizes the need to manage environment and climate change to ensure the sustainability of Cambodia's economic growth and social development. The Project is also underpinned by Cambodia's National Green Growth Road Map (2010) which promotes access to clean water and sanitation (PPTA 2018).

31. In Cambodia, the Project will improve urban services and enhance regional economic connectivity in the participating towns of Kampong Cham, Kratie, and Stung Treng province – see **Figure 1**.

Figure 1: Locations of Project Towns



2.2 Objective of IEE

32. This IEE covers the construction and operation of Stung Treng Wastewater Treatment Plant and Drainage System Subproject. The subproject is located in Stung Treng City, Stung Treng Province. The purposes of the IEE study are as follows:

- To understand the existing of natural and social environments in the project area, through studying the physical environment, biological environment, and social environment.
- To inform the project development activities to local agencies, affected people, and concerning parties to receive relevant information, key feedbacks, issues, and comments concerning environmental and social safeguards or impacts and proposed solutions or responses.
- To assess the impacts on the environmental-social resources in and around project site by the proposed project activities in order to provide the mitigation measures or correcting actions.
- To assess and predict the impact on environmental and social resources during construction, operation, and closure of the project.
- To extract valuable comments and experiences from ministries, related institutions, local authority, community, and stakeholders to improve the project activities with environmental sound technologies.
- To form the basis for development of an Environmental Management Plan for the construction and operational phases of the subproject.
- To ensure the project will contribute to sustainable economic development of Cambodia.

2.3 ADB and Domestic Environmental Due Diligence

2.3.1 IEE Requirements

33. The project classification of environment category B has been confirmed during project preparation. This IEE has been prepared in conjunction with the preparation of the detailed engineering design thereby ensuring that engineering designs, construction methods and operations are environmentally sound and in compliance the laws, regulations and guidelines of the Royal Government of Cambodia (RGC) and with ADB Safeguard Policies.

34. Based on the IEE, a standalone Environmental Management Plan (latest version of September 2021) has been prepared.

35. The IEE and/or EMP will be updated if found necessary to address any significant future changes to the Subproject and/or the context of the subproject.

36. The requirements for Ministry of Environment (MoE) approvals under Cambodian law are set out in detail in Section 3.1.2. An approved company, registered with the Ministry of Environment (MoE) has prepared a separate Initial Environmental and Social Impact Assessment (IESIA) report, which was approved by MoE on 20 May 2021 (**Annex 5**).

2.3.2 Structure of the IEE

37. This IEE report follows the format prescribed in ADB SPS 2009 and contains:

- The legal and administrative framework;
- A description of the project;
- The environmental baseline in the subproject locations;
- Analysis of relevant alternatives; and
- Information disclosure and consultations.

38. The Environmental Management Plan (EMP) for the Subproject is a standalone document that determines the environmental mitigation measures and sets out the environmental monitoring programmes for all phases of project implementation. The EMP is structured in the following main sections:

- Brief subproject descriptions
- Institutional arrangements and responsibilities for EMP implementation;
- Summary of environmental impacts on key receptors;
- Mitigation measures for implementation at all phases of construction and operation;
- Monitoring requirements;
- Consultation requirements during construction;
- Grievance Redress Mechanism; and
- Estimated costs of environmental safeguard measures.

Based on the EMP, the Contractor is required to develop the Construction Environmental Management Plan (CEMP), which shall include specific protection and monitoring measures taking sensitive receptors into account. The contractor shall obtain approval of the CEMP from the PMU before starting construction works.

3 POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

3.1 Environmental Assessment Requirements

3.1.1 Environmental Assessment Requirements of ADB

39. Safeguard requirements for all projects funded by ADB are defined in SPS 2009 which establishes an environmental review process to ensure that projects undertaken as part of programs funded through ADB loans are environmentally sound; are designed to operate in

compliance with applicable regulatory requirements; and are not likely to cause significant environmental, health, or safety hazards. 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.

40. SPS 2009 environmental assessment requirements specify that:

- At an early stage of project preparation, the borrower/client will identify potential direct, indirect, and cumulative environmental impacts 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 analysed in the context of the project's area of influence;
- Environmental impacts and risks will be analysed 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.

41. Other requirements of SPS 2009 include:

- Analysis of alternatives. There is a requirement to examine alternatives to the project's location, design, technology, and components and their potential environmental and social impacts and consider the no project alternative. SPS 2009 states that this is only for projects which have "significant adverse environmental impacts that are irreversible, diverse, or unprecedented" i.e., category A projects. This does not apply to this category B IEE but is included for completion.
- 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). This includes: (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.

42. 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, and (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.

43. These climate change risks are assessed in the project Climate Change Assessment and are reflected where appropriate in the project designs.

3.1.2 Environmental Assessments Requirements of Cambodia

44. Environmental assessment in Cambodia is governed by the following laws and guideline documents:

- Sub-decree on EIA Process No. 72 (1999). This law provides the detailed requirements for implementation of the EIA Process and designates roles and responsibilities for preparation, review and approval of EIA and IESIA reports
- Sub-decree on EIA Classification for Development Projects No. 21 (2020) determines the types and sizes of project that have to undertake a full EIA or an IESIA.
- Declaration on Guideline for Conducting IESIA and EIA Reports No. 376 (2009). This guideline specifies the basic contents of IESIA/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.

45. 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 IESIA/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).

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

47. A meeting held between the MoE, Ministry of Public Works and Transport (MPWT) and the consultants for the Project on 06 December 2017 confirmed that for the subprojects discussed, the following is required:

- The EIA department agrees that this project needs to prepare an IESIA report which can be informed by the IEE report and incorporate the additional baseline environmental survey (air and water quality) results.
- The EIA department agrees with and supports the project and will facilitate MoE to issue a letter of approval to MPWT after reviewing the IESIA report.
- A registered company, authorized to complete IESIA reports in Cambodia, is required to prepare the IESIA report on behalf of the project owner, MPWT.

48. The preparation of the IESIA for the Stung Treng Wastewater and Drainage System started in July 2020 following approval by MOE of the terms of reference for the study. After submission of the first draft IESIA, MOE conducted a site visit and based on comments from the ministry, the second draft IESIA was submitted for consideration at an inter-ministerial meeting in January 2021. The final IESIA incorporating comments from the inter-ministerial meeting was approved by MOE on 20 May 2021.

3.2 National Environmental Policy and Legislation

3.2.1 Legal Framework for Environmental Management

49. In 1993 the new Constitution of Cambodia included environmental considerations for the first time. Specifically, Article 59 states: “The State shall protect the environment and balance of abundant natural resources and establish a precise plan of management of land, water, air, wind, geology, ecological system, mines, energy, petrol and gas, rock and sand, gems, forests and forestry products, wildlife, fish and aquatic resources”. This led to the establishment of the Ministry of Environment. 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.

50. 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 of these sub-decrees and standards have been drafted but have not yet been ratified by parliament.

3.2.2 Policies and legal instruments

51. 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.

52. 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.

53. Specific regulations and standards for environmental quality relevant for the Subproject are contained in the following three sub-decrees:

- Sub-decree on Water Pollution Control (1999);
- Sub-decree on Air Pollution Control and Noise Disturbance (2000), and
- Sub-decree on Management on Sewage System and Wastewater Treatment Plant (2017).

54. A summary of legislative and policy instruments relevant to the subproject is presented in **Table 2**. A summary of national and international guidelines is presented in **Table 3**. The key environmental quality standards applicable to the Subproject are listed in **Annex 1**. **Error! Reference source not found.**

Table 2: Relevant Laws, Regulations and Guidelines

Law/Regulation/Guideline	Year	Summary
Royal Decree on the Protection of Natural Areas	1993	Classified 23 protected areas in Cambodia into four categories: (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 tourism, and for conservation of long-term existing natural resources with a view to assure sustainable

Law/Regulation/Guideline	Year	Summary
		economic development.
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.
Labour Law (1997) Decree No. CS/RKM/0397/01	1997	<p>This law governs relations between employers and workers resulting from employment contracts to be performed within Cambodia. The key sections relevant to this project include: Chapter VIII Health and Safety of Worker. The key provisions relate to the quality of the premises; cleaning and hygiene; lodging of personnel, if applicable (such as workers camp); ventilation and sanitation; individual protective instruments and work clothes; lighting and noise levels in the workplace.</p> <p>Article 230: Workplaces must guarantee the safety of workers. However, the only specific occupational health and safety Prakas relates to the garment industry and brick manufacture.</p> <p>Chapter IX: Work-Related Accidents Article 248: All occupational illness, as defined by law, shall be considered a work-related accident. The law sets out how accidents should be managed in terms of compensation.</p>
Sub-decree on Water Pollution Control (Sub-decree No. 27 ANRK/BK)	1999	<p>Regulates activities that cause pollution in public water areas in order to sustain good water quality so that the protection of human health and the conservation of biodiversity are ensured. Its Annex 2 provides the effluent standards, including effluents from wastewater stabilization ponds, and annex 4 and 5 contain water quality standards for public waters for the purpose of biodiversity conservation, and water quality standards for public waters and health, respectively.</p> <p>As per agreement with MoE, the effluent standards applicable to the subproject are those in Annex 2 of this Sub-decree for <i>public water area and sewer</i></p>
Sub-decree on Solid Waste Management (Sub-decree No. 36 ANK/BK),	1999	<p>Article 1: Regulates solid waste management to ensure the protection of human health and the conservation of biodiversity through using appropriate technical approaches.</p> <p>Article 2: This sub-decree applies to all activities related to disposal, storage, collection, transport, recycling, dumping of garbage and hazardous waste.</p> <p>Article 4: The Ministry of Environment shall establish guidelines on disposal, collection, transport, storage, recycling, minimizing, and dumping of household waste in provinces and cities in order to ensure the safe management of household waste.</p> <p>The authorities of the provinces and cities shall establish the waste management plan in their province and city for short, medium and long-term.</p>
Sub-decree on Control of Air Pollution and Noise Disturbance (Sub-decree No. 42 ANK/BK)	2000	<p>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); and (ii) maximum allowable noise level in public and residential areas (Annex 6).</p> <p>Article 3 A. "Source of pollution" is defined and separates mobile sources (including transport) and fixed sources such as factories and construction sites.</p> <p>Article 3 B. "Pollutant" is defined as smoke, dust, ash particle substance, gas, vapour, fog, odour, radio-active substance</p>
Law on Land (NS/RKM/0801/14)	2001	Provides that: (i) unless it is in the public interest, no person may be deprived of ownership of his immovable property; and (ii)

Law/Regulation/Guideline	Year	Summary
		ownership deprivation shall be carried out according to legal forms and procedures and after an advanced payment of fair and just compensation. (Article 5)
Royal Decree on the Establishment and Management of Tonle Sap Biosphere Reserve (Royal Decree No. NS/RKT/0401/070)	2001	<p>Establishes the Tonle Sap Biosphere Reserve in accordance with the statutory framework of the World Network of Biosphere Reserves. Divides the Tonle Sap Biosphere Reserve into 3 zones: (i) core areas; (ii) buffer zone and (iii) flexible transition zone.</p> <p>Core area: set aside for long term protection, human activity is limited to monitoring and research.</p> <p>Buffer zone: is area surrounding the core areas helping to protect the environment. It may accommodate education and training activities.</p> <p>Transition area: may contain a variety of agricultural activities and human settlements. Here all stakeholders have to cooperate to achieve sustainable development</p>
Environmental Guidelines on Solid Waste Management ³	2006	Contains a Landfill Ordinance that regulates landfill requirements to: (i) reduce as far as possible the adverse effects of waste disposal on the environment; (ii) preserve groundwater, surface water & air quality & to reduce emissions of greenhouse gases (iii) ensure waste is not harmful to human, natural & animal health during operation & decommissioning; and (iv) provide information and technical recommendation on the construction, operation and closing/follow-up management of landfills to ensure public health and safety and environmental protection.
Law on Water Resources Management (NS/RKM/0607/016)	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 Ministry of Water Resources and Meteorology (MOWRAM), in collaboration with other concerned agencies, may designate a floodplain area as flood retention area.
Royal Decree on Protected Areas (Royal Decree No. NS/RKM/0208/007)	2008	<p>Defines the framework of management, conservation and development of protected areas to ensure the conservation of biodiversity, & sustainable use of natural resources in protected areas.</p> <p>The Law gives the Royal Government of Cambodia the authority to establish or modify Protected Areas (Article 9 and 10). A Protected Area shall be established by sub-decree.</p> <p>Article 11 divides the protected area into 4 zones namely, core zone, conservation zone, sustainable use zone & community zone. 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, such as destroying water quality in all forms, poisoning, using of chemical substances, disposing of solid and liquid wastes into water or on land. Article 44 requires all proposals & investments within or adjacent to protected area boundary an Environmental and Social Impact Assessment.</p> <p>The law defines Protected Area as <i>"An area of the State's public properties in land or water territories, including coasts and sea,</i></p>

Law/Regulation/Guideline	Year	Summary
		<p><i>located in the area established by a Royal Decree or a new area established in the jurisdiction of the Ministry of Environment. These areas are of physical and biological importance which requires management by law with the purpose of protecting and maintaining biological, natural and cultural resources, and shall be sustainably managed in every generation for environmental, social and economic benefits".</i></p> <p>Each protected area shall be divided into four (4) management zoning systems:</p> <p>1. Core zone: management area(s) of high conservation values containing threatened and critically endangered species, and fragile ecosystems.</p> <p>Access to the zone is prohibited except the Nature Conservation and Protection Administration's officials and researchers who, with prior permission from the Ministry of Environment, conduct nature and scientific studies for the purpose of preservation and protection of biological resources and natural environment with the exception of national security and defence sectors.</p> <p>2. Conservation zone: management area(s) of high conservation values containing natural resources, ecosystems, watershed areas, and Natural landscape located adjacent to the core zone.</p> <p>Access to the zone is allowed only with prior consent of the Nature Conservation and Protection Administration at the area with the exception of national security and defense sectors.</p> <p>Small-scale community uses of Non-Timber Forest Products to support local ethnic minorities' livelihood may be allowed under strict control, provided that they do not present serious adverse impacts on biodiversity within the zone.</p> <p>3. Sustainable use zone: management area(s) of high economic values for national economic development and management, and conservation of the protected area(s) itself thus contributing to the local community, and indigenous ethnic minorities' livelihood improvement.</p> <p>After consulting with relevant ministries and institutions, local authorities, and local communities in accordance with relevant laws and procedures, the Royal Government of Cambodia may permit development and investment activities in this zone in accordance with the request from the Ministry of Environment.</p> <p>4. Community zone: management area(s) for socio-economic development of the local communities and indigenous ethnic minorities and may contain existing residential lands, paddy field and field garden or swidden (Chamkar).</p>
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 N.235 on Management of Sewage/Culvert System and Wastewater Treatment Plant	2017	<p>Article 3: This sub-decree is implemented to the management on Sewage System and Wastewater Treatment Plant in urban municipality, province, city, district and resort/recreational area of Royal Government of Cambodia. This sub-decree is not implemented on Industrial Wastewater Management.</p> <p>Chapter 2: This Charter presents the role and responsibilities of relevant agencies/institution: national level (MPWT, MoE and Mol), Provincial level (municipality, province, relevant provincial departments, city, district), and involved investment project owners.</p> <p>Article 25: The disposal of garbage, solid waste, oil waste, chemical waste, sludge waste from septic tank of WWTP factory into the pipe system, natural reservoir or into public water sources are prohibited.</p>
Prakas on Environmental	2020	The Prakas determines the types and sizes of projects that are

Law/Regulation/Guideline	Year	Summary
Impact Assessment Classification for Development Projects No. 21 PRK.BST		required to prepare environmental impact assessments. Projects having minor environmental impacts are required to prepare an Environmental Protection Agreement together with an Environmental Management Plan. Projects having medium impacts shall prepare an Initial Environmental Impact Assessment report, and projects with significant impacts are required to prepare a full EIA. All sizes of Natural Sewage Treatment and Drainage Projects are required to undertake an IESIA

Table 3: Key National Environmental Standards

Environmental Issue	National Standard	International Standard
Ambient air quality	Annex 1, 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, 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	Drinking water Quality Standards, 2004	WHO Guidelines for Drinking-water Quality, Fourth Edition, 2011
Surface water quality	Sub-decree No. 27 ANRK/BK 1999 on Water Pollution Control: Annex 4, Water Quality Standards for Public Waters for the Purpose of Biodiversity Conservation, and Annex 5, Water Quality Standards for Public Waters and Health	US EPA National Recommended Water Quality Criteria Mekong River Commission (MRC)_ Technical Guidelines for the Protection of Aquatic Life MRC Technical Guidelines for the Protection of Human Health
Effluent quality	Sub-decree No. 27 ANRK/BK 1999 on Water Pollution Control: Annex 2, Effluent standards for discharge of wastewater to public water area and sewer	IFC EHS General Guidelines, April 2007 IFC EHS Guidelines for Water and Sanitation, December 2007 IFC EHS Guidelines for Waste Management Facilities, December 2007 USEPA Effluent Limitations
Managing risk from COVID-19	Pricing policy for COVID-19 test, quarantine and treatment services to foreign travellers entry to Cambodia. MoH, June 2020	Guidance on Management Mitigation Measures for Health and Safety and COVID-19

55. The siting of project components (in this case the wastewater treatment plant in particular) is considered and approved through the IESIA review and approval process led by the Ministry of Environment where all concerned national and provincial authorities through inter-ministerial procedures can also raise objections or propose requirements.

56. 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 Plans for the sub-projects.

3.2. International Agreements

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

58. Cambodia joined the UNESCO Network of Biosphere Reserves in 1997. It is committed to the Millennium Development Goals, the seventh goal of which is to “ensure environmental sustainability”. It is among the 168 Governments that adopted the Hyogo Framework for Action 2005-2015, a 10-year global footprint for disaster risk reduction efforts, in January 2005. 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.

59. Cambodia also supports the global efforts against climate change by being a Party to the United Nations Framework Convention on Climate Change (UNFCCC) since 1996. Cambodia has adopted and ratified the Paris Agreement, and in 2020 the Government submitted an updated Intended Nationally Determined Contribution, which puts forward mitigation targets and adaptation actions towards a cleaner and greener economy to improve the lives of the citizens, in particular the vulnerable. The 2030 mitigation targets include reduction of methane emissions by better management of industrial wastewater in the food and beverage sector aiming at a reduction of 5-10% of total methane emissions in the wastewater sector.

4 DESCRIPTION OF THE PROJECT

4.1 Rationale

60. While Cambodia remains almost 80% rural, urbanization is accelerating with urban population expected to reach 30% by 2030. Economic development has been mostly concentrated in the north-western, western, and south-eastern regions where the large secondary cities, economic infrastructures (e.g. international seaports and airports), and tourism attractions are located; while the north-eastern provinces remain underdeveloped. The five provinces in the north-east contributed less than 8% of the national economy in 2016, suffering from low income per capita and high poverty incidence.

61. Stung Treng city is the capital of the Stung Treng Province in north-eastern Cambodia. It borders the provinces of Ratanakiri to the east, Mondulakiri and Kratie to the south and Kampong Thom and Preah Vihear to the west. The Province's northern boundary is Cambodia's international border with Laos. Stung Treng is located on the Sekong River, close to its confluence with the Mekong River. The city is served by National Highways No. 7 and National Road No. 64. Located along the GMS Inter-corridor Link, Stung Treng City is connected to Sihanoukville and Phnom Penh to the south, and to the north along National Highway No. 7 to the border with the Lao PDR and from there on to Pakse and Savannakhet in the Lao PDR meeting the East–West Economic Corridor. Thus, Stung Treng City has geographical advantages and potential to benefit from and contribute to economic growth in the region and reduce regional development disparities.

62. Stung Treng District consists of four sangkats with a total population of just over 37,000 (2019). Compared with other districts in Cambodia, Stung Treng District has a high economic potential⁴. The most significant economic sector in the city economy is tourism, trade, transport, and government.

63. As part of the Fourth Greater Mekong Subregion Corridor Towns Development Project (CTDP-4 Project), the Stung Treng Solid Waste Management Subproject will improve urban waste management services and thereby attract economic growth and promote Stung Treng City as a node in the regional economic corridors.

64. Drainage and flood protection is particularly important in cities such as Stung treng which is highly vulnerable to flooding. There is no reticulated wastewater collection and treatment system in Stung Treng City. There are no records kept of numbers, volumes or condition of septic tanks in the city, private septage trucks and septage disposal are unregulated, and there is no building code stipulating requirements for urban on-site sanitation. Wastewater treatment is limited to septic tanks in the more modern houses, hotels and restaurants. Untreated wastewater is discharged into canals that are connected to large wetland ponds and pose a threat to the urban environment, as well as the health of the population.

65. The objectives of the subproject are to (i) accelerate the development of Cambodia's second socioeconomic growth centre; and (ii) promote regional socioeconomic integration of provinces and towns along the GMS corridors (iii) support the scaling up for climate adaptation, public management reforms including use of ICT, expand regional connectivity and extend value-chains, and competitive, inclusive, and environmentally sustainable urban development.

66. The Ministry of Public Works and Transport (MPWT) is responsible for asset creation for urban sanitation, with the PDPWT responsible for operations and maintenance. Due to limited technical capacities at the provincial and municipal level, MPWT continues to be involved with the construction of large-scale infrastructure including wastewater treatment plants, and sewerage and drainage networks.

⁴ Cambodia, Achieving the Potential of Urbanization, World Bank, August 2018

4.2 Project Impact, Outcome, and Output

67. The expected project outcome will be improvement of urban environmental services in Stung Treng City and overall increased economic activity. The technical outputs of the Subproject are quantified below.

68. Output 1: Improved public environmental infrastructure including a sewage collection network, household and building service connections, a WWTP of capacity 2,900 m³/d, pumping stations and associated pumping mains and a separate wastewater collection network. The existing storm drainage pumping station will be upgraded together with associated pumping main.

69. Output 2: Improved institutional effectiveness. The project will strengthen institutional effectiveness through improving staff capacity in critical areas (including improved urban service delivery, operation and maintenance of urban facilities, public private partnerships and other institutional arrangements), supporting the establishment of urban service units, and dedicated consultant support for project management.

70. Output 3: Improved policy and planning environment. The project will enable to develop urban development strategies and master plans. It will develop a road map for financial sustainability for wastewater and solid waste (including a proposed road map and arrangement for tariffs, and mechanism for ensuring household connections). It will build community awareness on the benefits of proper sanitation and separate sewerage systems and safe disposal of solid waste.

4.3 Existing Wastewater Treatment and Drainage

71. The existing topography of Stung Treng urban area is flat in the parts adjacent to the Sekong and Mekong Rivers, with hilly terrain towards the south of the City centre. The City experiences flooding every rainy season, usually after a heavy rainfall where flood water gets trapped in the inner city resulting in flooding of residential and business in the lower-lying areas.

72. There is no reticulated wastewater collection and treatment in Stung Treng. There are no records kept of numbers, volumes or condition of septic tanks in the City, private septage trucks and septage disposal are unregulated, and there is no building code stipulating requirements for urban on-site sanitation. Wastewater treatment is limited to septic tanks/soke pits in the more modern houses, hotels and restaurants. Most of the households use an unsealed soakaway pit formed with locally available concrete ring sections. There are currently two private and no government septage trucks operating in Stung Treng, with septage typically being sold as fertilizer and discharged directly to agricultural land without treatment. There is presently no septage treatment facility for Stung Treng.

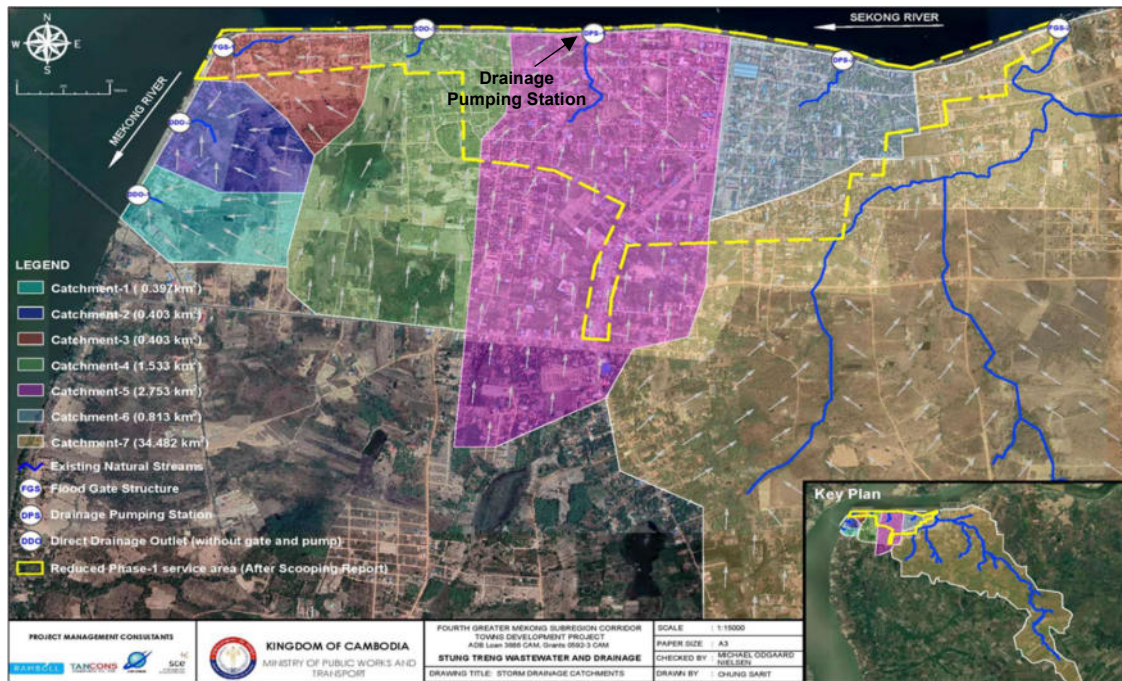
73. Based on the PPTA 2018 study and the socio-economic survey (SES) results, around 91% of households have toilet facilities of which 82.5% have flush toilets and 17.5% have latrines. 57.6% dispose of their own septic tank; 7.0% dispose of their wastewater near or behind their houses; 7.6% have soakaway pits 17.8% to public sewer pipe and 0.4% into farm near house. Only 9% have their septic tanks emptied. At present, there is no wastewater system within the city. About 91% of the surveyed people considered wastewater disposal a very serious problem. Most of the household wastewater is discharged into existing drainage pipes/culverts along the roads passing into earthen open drains, open low-lying areas and into rivers without any treatment.

74. As shown in **Figure 2**, the storm drainage of Stung Treng City is divided into seven sub-catchments associated with seven creeks and streams discharging into the Sekong and Mekong Rivers. The largest two of these creeks have flood control gates installed which are closed in the wet season to prevent river water flowing up the creeks into the town.

75. There is one drainage pumping station with flood gate located on a stream that discharges into Sekong River (see **Figure 2**). The local authorities can manually close the

flood gates and thereby avoid backflow flooding from the river. When the gates are closed, the pumps are operated to take rainwater from the urban area into the river.

Figure 2 Existing Drainage Pattern in Stung Treng City



4.4 Project Location and service coverage

76. The proposed WWTP site is located in Krang Memay Village, Preah Bat Commune, Stung Treng District. The site covers an area of 9.75 ha.

77. The location of the wastewater treatment plant and its service area are indicated on the map in **Figure 3**. The project is designed to cover three communes (sangkats) constituting the main urban area of Stung Treng namely Preah Bat, Srah Ruessei and Stung Treng. The service area is approximately 450 ha and has a population of about 19,700 (2020).

Figure 3: Wastewater and Drainage Service Area



78. The new stormwater drainage network will provide immediate improvements on the current flooding problem in the city centre area (see **Figure 3**). The proposed system covers an area of 7.58 ha and will significantly reduce the flow of storm water drainage in the city centre area and around the market and the consequent flooding in the city centre area. The storm drainage pipe has been designed based on an estimated 5-year frequency wet weather flow in the catchment.

4.5 Subproject Salient Data

79. The subproject has a design period of 20 years to Year 2040. The main subproject components are listed below:

- Construction of 47.841 km primary and secondary sewers and 5.528 km tertiary sewers;
- Construction of service connections for 2,373 households, commercial and institutional buildings including onsite plumbing;
- Construction of three (3) wastewater pumping stations and 3.077 km of associated pumping mains;
- Upgradation of one (1) existing storm drainage pumping station with additional one pump in existing pump station building, associated pumping main, and other additional allied units and structures;
- Construction of a 2,900 m³/day Wastewater Treatment Plant (WWTP) above flood levels:
 - Total area 9.75 ha
 - Treatment ponds 4.31 ha
 - Operations area 0.161 ha
 - Internal access road 0.21 ha
 - Laterite wearing course on the 4.5 m wide access road the first 85 meter from the WWTP to the east
- Construction of administration, workshop, electrical and guard buildings at the WWTP site;
- Construction of 1.800 km storm drainage diversion (ø800–ø1000) for storm water management including outlet structure;
- Provision of operations & maintenance equipment.

80. The investments cover the main areas of the city centre referred to as the phase 1 service area; however, the detailed design has incorporated planning aspects for future extensions to the wastewater system and the WWTP taken into consideration the proposed spatial development planning for Stung Treng.

4.3 Climate Change Adaptation

81. The project is classified as being at medium risk from future climate change impacts. The main climate change risks are due to the low capacity of the present stormwater drainage system coupled with predicted climate change comprising increased precipitation during the rainy season and occurrence of sudden heavy rainfall events which if not foreseen in the design of the subproject would lead to severe flooding in just a short time causing physical and economic losses.

82. This Subproject supports climate resilience in Stung Treng City through the improvement of storm drains and the installation of wastewater pipes that will reduce adverse

impacts caused by perennial flooding and contamination of the local environment. The design of subproject infrastructure likely to be affected by climate change incorporates safety margins to accommodate a 50-year return period adjusted for Climate Change with an expected increase in annual precipitation of 5%. As an extra precaution, an additional 0.6 m height above the projected design flood levels has been applied in the design of the structures.

4.6 Wastewater Treatment Plant Design

4.6.1 Wastewater Projections.

83. The design period for the subproject components is 20 years up to Year 2040 and the design is based on population growth forecasts in the service area from a design baseline of 20,700 to 22,500 in 2040. The capacity of the wastewater network and treatment plant is based on a gradual increase in water use from currently 120 litre per capita per day to 150 litre per capita per day in 2040. A non-domestic (institutions, commercial enterprises, army camp) water consumption equivalent to 5,700 persons have been included in the calculations (included in the population baseline of 20,700 people). When considering the proportion of water that is discharged to the wastewater system and also considering groundwater inflow and infiltration into groundwater, the total amount of wastewater from the service area is estimated at 2,900 m³/day by 2040.

4.6.2 Wastewater Treatment Technology.

84. Waste Stabilization Ponds has been chosen as the most appropriate technology. This technology consists of a series of different types of waste stabilization ponds (anaerobic, facultative, maturation) that rely entirely on natural processes by algae and bacteria with sunlight as the only energy source. This is a well-established, low-cost, low-maintenance, highly efficient, entirely natural and sustainable technology for domestic wastewater treatment in tropical climates.

85. The Wastewater Treatment Plant for Stung Treng City comprises a dual series of 2 x anaerobic, 2 x facultative and 2 x maturation ponds. The WWTP is designed to produce a high-quality effluent that will consistently remove BOD, COD, TSS and Total Coliform. Although the design (as is common practice) is based on BOD and faecal coliform removal – for which waste stabilization ponds are very effective - and not on removal of nutrients from the wastewater, the processes do also contribute to nutrient removal.

86. The treatment plant further includes a screening and septage receiving facility, a sludge drying pond, administration / operations building, workshop, electrical building and a diesel generator.

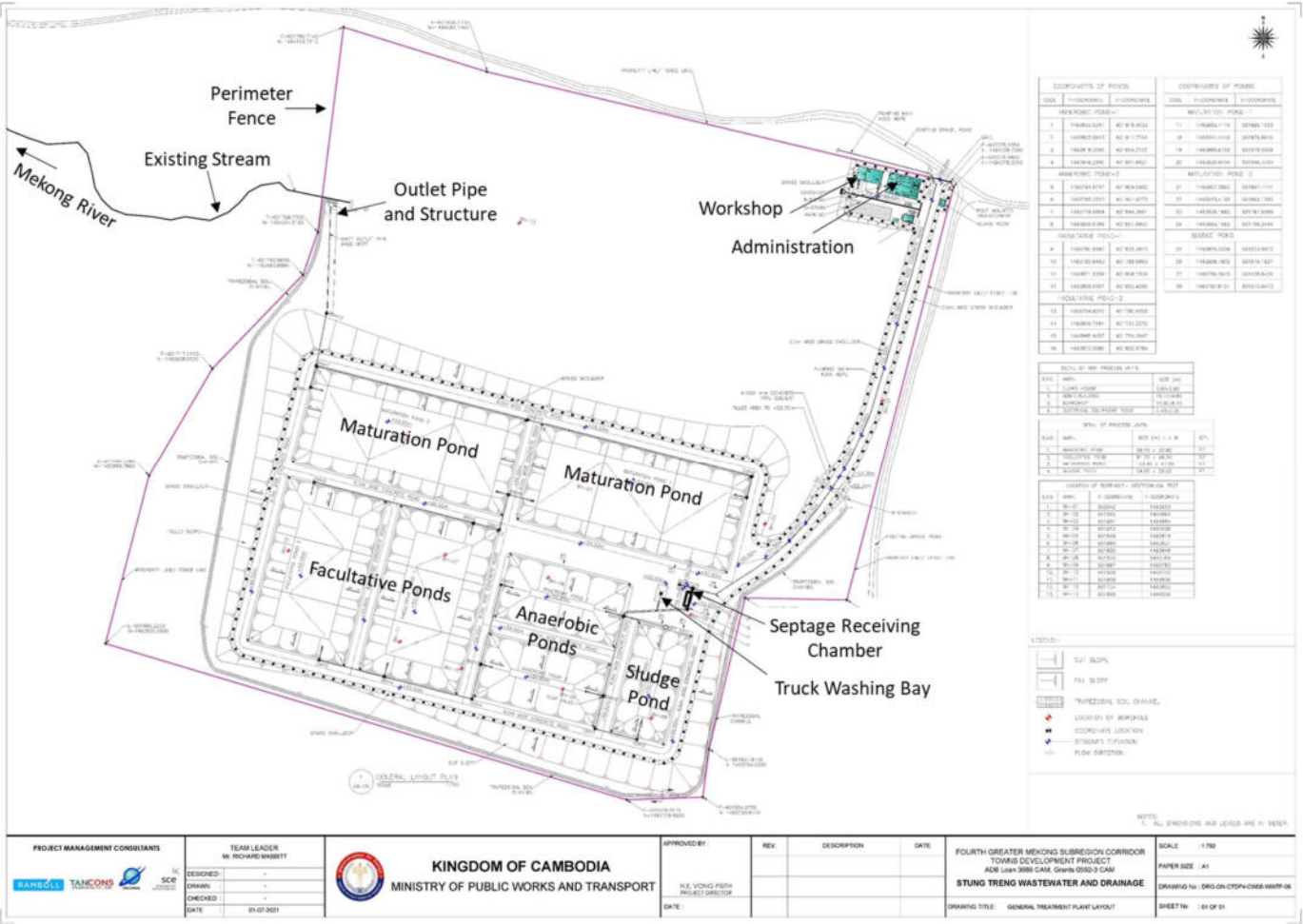
87. The layout of the wastewater treatment plant is displayed in **Figure 4**.

88. The main WWTP process components and units include:

- a) Inlet Screening Structure with channels for manually cleaned main screen and bypass screen;
- b) Septage Receiving Structure with manually cleaned screen;
- c) Two (2) Anaerobic Ponds in parallel with actual pond ground level dimensions including freeboard of 30.90 m (width) and 59.40 m (length), each pond. Total effective process volume 1450 m³/pond;
- d) Two (2) Facultative Ponds in parallel with actual dimensions including freeboard of 48.20 m (width) and 81.20 m (length), each pond. Total effective process volume 6317 m³/pond;
- e) Two (2) Maturation Ponds in parallel with actual dimensions including freeboard of 47.50 m (width) and 104.40 m (length), each pond. Total effective process volume 5339 m³/pond;

- f) One (1) Sludge Pond - actual dimensions including freeboard of 26.0 m (width) and 54.06 m (length). Total effective process volume 1939 m³.

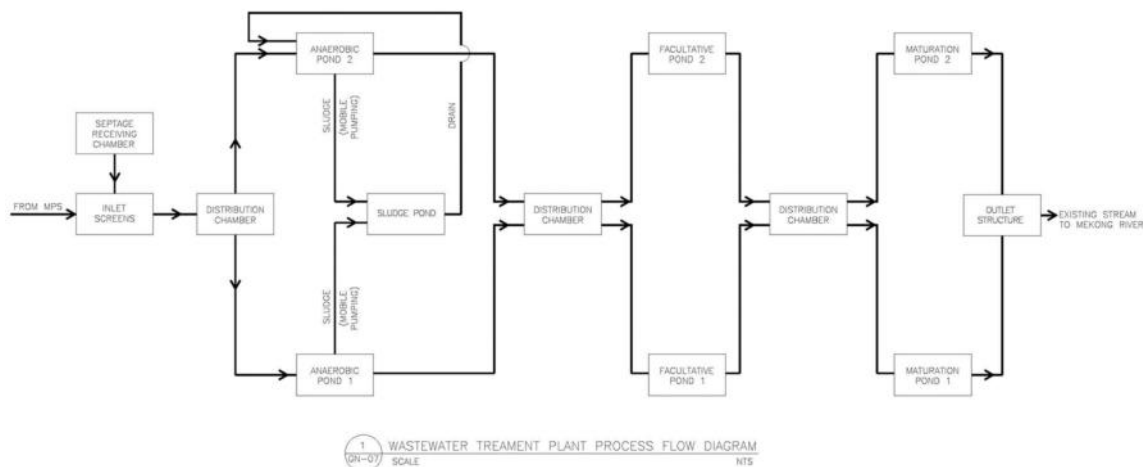
Figure 4: Wastewater Treatment Plant Layout



4.6.3 WWTP Design Details and Parameters

89. The wastewater treatment process is illustrated in the diagram in **Figure 5**.

Figure 5: Wastewater Treatment Process



4.6.4 WWTP design details and parameters

90. **Inlet and Sewage Screening Facility.** The WWTP inlet works receives sewage pumped from the main pumping station. The WWTP inlet works will consist of an influent channel with automatic screen, screenings compaction and dewatering screw press, a bypass channel with a manually cleaned screen, outlet manhole and distribution piping to the two anaerobic ponds. The screenings from the pre-treatment processes will be disposed of to the new engineered landfill.

91. **Septage Receiving Facility.** All houses that will be connected to the new wastewater system will have their septic tanks disconnected and taken out of use. Septage collected by vacuum trucks from private septic tanks outside the service area will be cotreated at the WWTP. The WWTP operational manual will include guidelines on scheduling receipt of septage to ensure that the amounts of septage received are within the capacity of the treatment plant. The vacuum trucks will bring the septage to the WWTP and empty the septage into the septage receiving chamber. A coarse screen is provided in the chamber to remove large solids from the wastewater. The septage collection trucks will discharge the septage to the chamber and from the chamber, the septage flows to the inlet channel with the fine screening facility, on to the anaerobic ponds for further treatment. A water supply standpipe will be provided to facilitate cleaning of the screen. A concrete washdown pad for the trucks is included.

92. **Anaerobic Ponds.** Anaerobic ponds normally receive raw wastewater with high organic loading that contain no dissolved oxygen and no algae. The proposed depth for anaerobic pond is 4.0 m with 0.6 m freeboard. The anaerobic ponds work extremely well in warm climates and achieve around 60% BOD removal at 20 °C and over 70% at 25 °C. Anaerobic ponds have the disadvantage of potentially releasing malodorous gases, if the system has operational problems. Hydrogen sulphide is the principal potential source of odour. If this should occur in Stung Treng WWTP, then it is possible to install a simple diffuser to spray a more pleasant smell and eliminate the bad odour. Also, earlier experience indicates that installation of additional floating rafts with floatation long rooted plants in the anaerobic pond would reduce odour.

Anaerobic ponds design specifications:

- Design loading = 300 g BOD/m³/day
- Retention time = 1 day
- Volume of anaerobic ponds = 2 x 1,450 = 2,900 m³
- Percent removal by anaerobic ponds at 24 °C = 68%
- BOD effluent concentration = 96 mg/L
- Liquid depth = 4 m
- High Density Poly-Ethylene (HDPE) liner on pond walls and bottom

93. **Facultative ponds.** Compared with anaerobic ponds, facultative ponds are shallower (2.55 m deep) and have much larger surface areas. The surface area is important because it allows atmospheric oxygen to dissolve and sunlight radiation to penetrate the water. The ponds will be equipped with 2 baffle walls in each pond to create longer distance and thus retention time for the wastewater flow through the ponds. Facultative ponds are designed for BOD removal based on a relatively low surface loading to permit the development of a healthy algal population, as the oxygen for BOD removal by the pond bacteria is mostly generated by algal photosynthesis. In most ponds both bacteria and algae are needed to maximize the decomposition of organic matter and the removal of other pollutants. Algae produce oxygen (photosynthesis) and also consume oxygen (respiration), but they leave an excess of oxygen that can then be used by aerobic bacteria for respiration and for the processes of oxidation (or stabilization) of the organic matter in the wastewater. Several types of invertebrates are present in the ponds where they control the population of algae, which then settles to the bottom. Heavy algal growth may block sunlight from penetrating into the pond. This decreases the potential for photosynthesis to contribute oxygen to the pond. The sludge comprising the sediment layer in the pond undergoes anaerobic digestion and may accumulate for many years without needing removal.

Facultative ponds design specifications:

- Design surface loading = 280 kg BOD/ha/day
- Depth of facultative ponds = 2.55 m
- Number of floating baffle walls = 4 (2 in each pond) provides 3 chambers in each pond
- Area of 2 facultative ponds = 7,825 m²
- Retention time = 5 days
- Percent removal, anaerobic + facultative ponds at 24 °C = 80%
- High Density Poly-Ethylene (HDPE) liner on pond walls and bottom.

94. **Maturation Ponds.** Some additional removal of organic matter and other pollutants will be achieved in maturation ponds. These ponds are included in the treatment line when high efficiencies of pathogen removal are required, either for discharge of the treated effluent in surface water bodies, or for use for irrigation or aquaculture.

95. The maturation ponds are shallow (1.5 m depth) with a large surface area to increase dissolution of oxygen in the water and give the bacteria enough oxygen to function properly. Shallow ponds benefit from high photosynthetic activity arising from the penetration of solar radiation. The photosynthetic activity of the algae results in a diurnal variation of dissolved oxygen concentration and pH. Supersaturation of dissolved oxygen may occur over the course of the day and the pH may rise to more than 9. High pH combined with ultraviolet radiation from sunlight contribute to the removal of pathogens, which given the large surface area of the maturation ponds, may include protozoan cysts and helminth eggs with sedimentation as the main mechanism. Sludge accumulation is very low in maturation ponds.

96. Each of the ponds will be equipped with 2 baffle walls which will increase the retention time and thereby the treatment efficacy.

Maturation ponds design specifications:

- Influent fecal coliform concentration = 5 x 10⁷ MPN/100 mL

- Effluent fecal coliform concentration at 24 °C \leq 1,000 MPN/100 mL (range 500-2500 MPN/100ml)
- Depth of maturation ponds = 1.5 m
- Number of floating baffle walls = 4 (2 in each maturation pond) providing 3 chambers in each pond
- Retention time > 4 days
- Percent removal (anaerobic, facultative, maturation) at 24 °C \geq 90%
- Surface area of 2 maturation ponds = 9,920 m²
- Effluent design flow from maturation ponds = 2,900 m³/d
- High Density Poly-Ethylene (HDPE) liner on pond walls and bottom

97. **Sludge Drying Pond.** Sludge extracted primarily from the anaerobic ponds will be dewatered, dried and stabilized in a sludge drying pond. Desludging of the anaerobic ponds will be performed regularly when the accumulated sludge reaches about a third of the pond volume corresponding to roughly 485 m³ liquid sludge per pond⁵. This has been calculated to occur after minimum 3 years of design flow; however actual operating conditions may allow up to 5 years (normally even longer based on experience) for sludge removal during the first 10-15 years of treatment plant operation depending on actual wastewater flow and amount of septage from septic tanks received at the septage receiving station.

98. The excess supernatant wastewater in the sludge drying pond will be pumped back to the anaerobic ponds. During the sludge stabilization phase - except from the drying phase - a supernatant layer will be maintained to prevent odours from escaping. Due to lack of information about the typical chemical and pathogenic characteristics of dried sludge from wastewater treatment in Cambodia and in particular the possibility of viable helminth ova remaining in the dried sludge⁶, the dewatered and dried sludge will be tested to ensure that it is within applicable national standards before it will be allowed to be used as soil conditioner or fertilizer in agriculture. If the sludge does not comply with the relevant standards for use in agriculture, it will be disposed of at the new controlled landfill in Stung Treng. .

Sludge drying pond design specifications:

- Sludge ponds liquid level depth 2.80 m and freeboard 0.6 m
- Sludge generation rate: 0.04 m³/person/year
- Sludge application thickness: 3 to 4 m
- Sludge drying time: 6 to 8 weeks, during the dry season
- Sludge pond walls and bottom: HDPE liner
- Filter media: 200 mm thick 20x20 mm crushed stone
- Underdrain pipes: 200 mm perforated pipes in rock drain
- Drainage pipes: 200 mm non-perforated solid wall pipes outside rock drain to sludge pond pumping station.

99. **WWTP Outlet Structure.** The treated effluent from the WWTP maturation ponds will be discharged into an existing natural stream. The stream is an ephemeral stream that only flows in the rainy season with a length of about 430 m. The stream discharges into the Mekong River (see **Figure 6**). The stream is not used for any domestic purposes.

4.6.5 Treated Effluent Quality

100. The WWTP is designed to deliver water in a quality within the applicable effluent standards (Sub-decree, No. 27 ANRK.BK on Water Pollution Control, MoE, 1999 for public water area and sewer). The design parameters are indicated in **Table 4** and the BOD5 and coliform bacterial removal rates are listed in **Table 5**. Note that although the design (as is

⁵ Liquid sludge has a high content of water, probably about 95%. When dried the content of solids in the sludge is about 40%

⁶ Arthur, J.P., Notes on the Design and Operation of Waste Stabilization Ponds in Warm Climates of Developing Countries, World Bank Technical Paper No. 7, 1983

common practice) is based on BOD and faecal coliform removal – for which waste stabilization ponds are very effective - and not on removal of nutrients from the wastewater, the processes do also contribute to nutrient removal. Note also that the Cambodian effluent standards do not include thresholds for bacteria, however the treated water will have a concentration of total coliform bacteria of well below the Cambodian National Ambient Water Quality Standard of 5,000 MPN/100 ml

Figure 6: WWTP Discharge Recipient



Table 4: Wastewater treatment design standards

Parameter	Unit	Design Standards
pH	-	6 – 8
BOD ₅ (5 days at 20 °C)	mg/L	< 80
COD	mg/L	< 100
Total Suspended Solids (TSS)	mg/L	< 120
Oil and Grease	mg/L	< 5
Coliform	MPN/100 ml	500-2500

Table 5: Anticipated BOD₅ and Coliform Removal Rates

Type of Pond System	BOD ₅ Removal Rate (%)			Coliform Removal Rate (%)		
	12 °C	20 °C	25 °C	12 °C	20 °C	25 °C
Anaerobic, facultative conditions wetland zone 1 (with 2 baffles), maturation conditions wetland zone 2 (with 2 baffles) (Equivalent to ponds baffled into each two zones)	94	95	95+	99.95	99.9996	99.99999

Source: Arthur, J. P. (1983), Design and Operation of Waste Stabilization Ponds in Warm Climates of Developing Countries, World Bank 1983

4.6.6 Administration and Other Buildings and Utilities.

101. Administration Building. A single-story building will be constructed to commercial standard, with an architectural style suitable for the Cambodian government. The surrounding area will be landscaped, and the building will include the following:

- a. Reception and waiting area
- b. Plant manager's office

- c. General offices
- d. Meeting room
- e. Male and female toilets
- f. Laboratory
- g. Kitchen
- h. Storage area

102. Workshop Building. A single-story building provided for performing maintenance and repairs of vehicles, pumps and equipment including a store for equipment and materials and an office.

103. Generator Building. An enclosed fully ventilated building will be provided to house the back-up power generator and its fuel tank.

104. Access and Internal Roads and Parking. A new WWTP access road has been proposed from entrance WWTP to proposed Admin area and WWTP pond process area. The internal roads network will be provided and constructed within treatment premises. These roads will allow truck access to facilities requiring regular attendance for maintenance and for suction truck etc. to deliver septage sludge at the WWTP. Both access and internal roads and operational areas will be surfaced with a concrete surface. There is also a provision of parking facilities for WWTP officials and other external staffs.

105. Sanitation Facility. Wastewater from the toilets and showers at the WWTP operation area (admin and workshop building) will be conveyed to septic tanks (not possible to connect to inlet chamber by gravity). The septic tanks will periodically be emptied, and the sludge will be transferred to the septage receiving station by vacuum truck.

106. Drainage. New RCU drains will be constructed for the WWTP operation area. Runoff from the admin building, workshop, electrical building, parking roof and guard room will be collected in RCU drains and finally discharged to open area. An open channel will catch the storm water from the cut slope area.

107. Access Gate and Perimeter Fencing and Lighting. One access gate will be installed at the entry of the WWTP. The perimeter fencing will be comprised of cyclone wire encased in GI pipe frame, topped with 3 rows of barbed wire. Site solar powered lighting will be provided for the treatment facility without any backup connection to the power supply network.

108. Water Supply. Water supply will come from the city water supply company from the existing water network located to the west of the WWTP close to the new future bridge. An overhead HDPE tank will be installed for water storage.

4.6.7 Routine maintenance.

109. The routine maintenance of the WWTP will include:

- a) Removing screenings and grit from the inlet and outlet works;
- b) Cutting grasses on the embankment, and removing it so that it does not fall in the ponds;
- c) Removing floating scum and floating macrophytes from the surface of the maturation and facultative ponds. This will be done to maximise the light energy reaching the pond algae, increase surface re-aeration, and prevent fly and mosquito breeding;
- d) Spraying scum on the surface of the anaerobic ponds and not removing it, since this will help the treatment processes;
- e) Removing any accumulated solids in the inlet and outlet works;
- f) Repairing any damaged embankment as soon as possible; and repairing any damage of the fences or gates.

4.7 Wastewater Collection Network

110. The wastewater collection network consists of gravity-based tertiary, secondary and primary sewers. The tertiary sewers connect the households with the secondary network, which conveys the wastewater to the primary sewers and on to three (3) pump stations (2 network Sewage Pump Stations, SPS-1 and SPS-2, and one Main Pump Station, MPS), that will then pump the wastewater directly to the WWTP. The sewers will be installed within the road right-of-way to avoid disturbing private properties.

111. The wastewater collection network is indicated in **Figure 7** and the lengths and depths of the sewers are summarized in **Table 6**.

Figure 7: Outline of the Wastewater Network

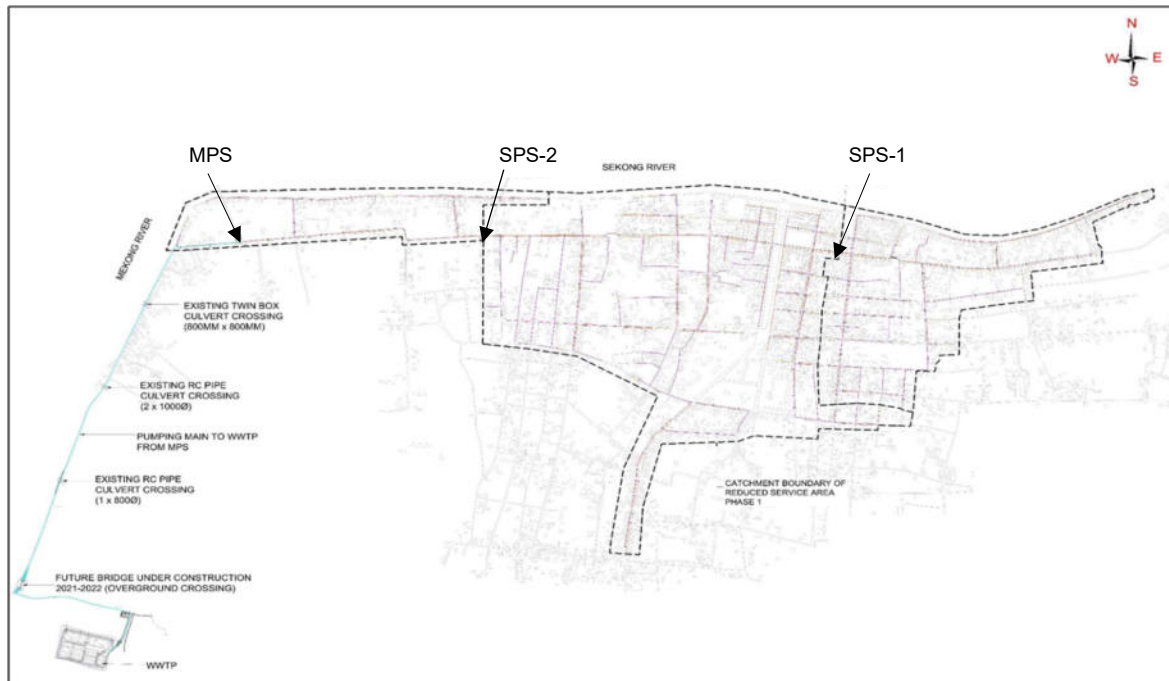


Table 6: Summary of the lengths and depths of the wastewater sewers

Depth (m)	Tertiary Sewers (km)	Secondary and Primary Gravity Sewers (km)	Rising Mains (km)	Total Length (km)
≤ 1.50	5.53	19.74	2.58	27.84
1.5 < Depth ≤ 3.0	-	23.96	0.50	24.46
3.0 < Depth ≤ 5.0	-	4.04	-	4.04
5.0 < Depth ≤ 7.0	-	0.11	-	0.11
Total Length	5.53	47.84	3.08	56.45

112. Since excavations may require shoring⁷/sheet piling, the contractor will be required to conduct structural investigations of any building structures along the alignment that could be affected.

⁷ Shoring is the provision of a support system for trench faces used to prevent movement of soil. Shoring or shielding is used when the location or depth of the cut makes sloping back to the maximum allowable slope impractical

113. The key data for the pump stations are presented in **Table 7** and their location is indicated in **Figure 7**. All pump station wet wells will be reinforced concrete structures designed for the containment of wastewater. The structures will be watertight, lined/coated for corrosion prevention, and designed for H-20 loading⁸ (H-30 in traffic area). Wet well depth shall not exceed 8 m.

Table 7: Pump Station Key Data

Item	Pump Station No.1 (SPS-1)	Pump Station No.2 (SPS-2)	Main Pump Station (MPS)
Location Coordinates	X: 605371.0843 Y: 1495910.3874 13°31'46.5"N 105°58'25.5"E	X: 603697.1189 Y: 1495967.8619 13°31'48.6"N 105°57'29.8"E	X: 602562.2012 Y: 1495963.0556 13°31'48.6"N 105°56'52.1"E
Land Area	83 m ²	186 m ²	895 m ²
Existing Land Use	Residential Road/footpath Allowance	Residential Road/Footpath Allowance	Residential Road Allowance
Existing Elevation	49.30 m	49.21 m	47.90 m
Pump Configuration	1 duty + 1 standby Submersible	1 duty + 1 standby Submersible	2 duty + 1 standby Submersible

114. As indicated in **Table 7**, the pump station wet wells will be equipped with a standby pump in case of malfunction of the duty pump. In addition, the pump stations will be equipped with remote alarm and monitoring systems with control unit at the WWTP administration building. The wet wells will have two alarms, the first alarm will signal if the pump is not activated at the designed water level, and the second alarm will send a warning of imminent overflow from the wet well. The pump stations will be equipped with remote alarm and monitoring systems.

115. An emergency generator with automatic transfer switch shall be installed at the drainage Pump Station (DPS), WWTP and MPS. SPS-1 and SPS-2 will be sharing a trailer mounted mobile generator including fuel tank.

116. The emergency generators will have a remote or skid mounted fuel tank with secondary containment adequate for 24-hour continuous operation.

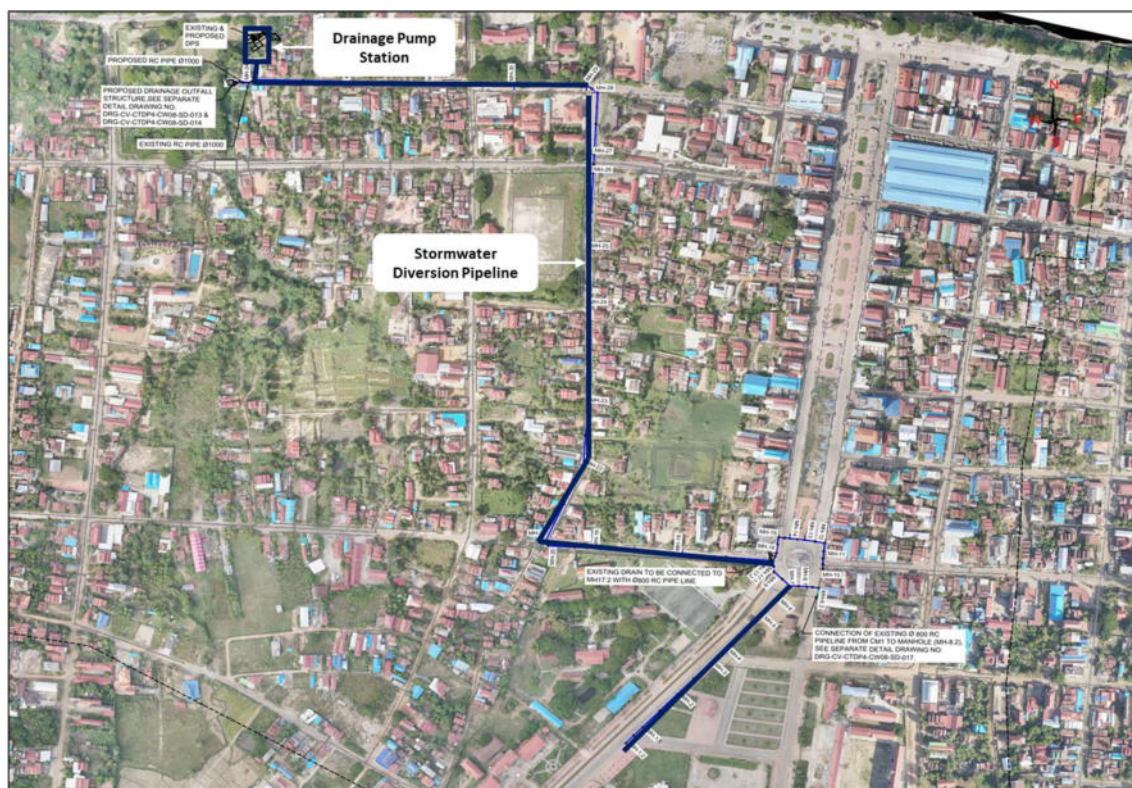
117. Odour control equipment is not included considering the cycle time of the pumps is less than 15 minutes. However, the stations will be equipped with a vent line terminating at ground level and ready for installation of odour control devices (carbon filter or biofilters) in the future if warranted.

4.8 Stormwater Drainage System

118. The storm drainage system will include a new 1800 m diversion storm drainage pipeline (sizes vary Ø800-Ø1000), connections to the existing drainage networks and to the existing drainage pump station (DPS-1) with discharge through a new outlet structure (see **Figure 8**).

⁸ This is the term used by AASHTO to describe normal moving traffic loading conditions up to 18-wheeler loading

Figure 8: Stormwater Drainage System



119. The existing drainage pump station has insufficient pumping capacity which at times results in localized flooding. The pump station will be replaced by a new pump station with sufficient pumping capacity to pump out both the water discharged from the wastewater treatment plant and the stormwater collected by the drainage network. Basic data on the drainage pump station is presented in **Table 8**.

Table 8: Drainage Pump Station Key Data

Item	Drainage Pump Station
Location Coordinates	X-604337.869, Y-1496150.508
Land Area	At Existing DPS-1, additional fill for Diesel Generator
Existing Land Use	Residential Road Allowance
Existing Elevation	+49.49 m
Pump Configuration	2 duty + 1 standby VT

120. The existing Drainage Pump Station will be upgraded with an additional drainage pump and pressure line. New reinforced concrete walls will be installed to strengthen the existing wet well walls.

121. An emergency generator with automatic transfer switch shall be installed at the Drainage Pump Station including a fuel tank with secondary containment adequate for 24-hour continuous operation.

4.6. Associated & Existing Facilities

122. Associated Facilities. SPS 2009 defines associated facilities as “facilities that are not funded as part of a project but whose viability and existence depend exclusively on the project, or whose goods or services are essential for successful operation of the project. The Subproject does not involve any “Associated Facilities”.

123. Existing Facilities. SPS 2009 states that for projects involving facilities and/or business activities that already exist, the borrower/client will undertake an environment and/or social compliance audit, including on-site assessment, to identify past or present concerns related to impacts on the environment (natural and social resources), involuntary resettlement, and Indigenous Peoples and Indigenous Peoples. The Subproject does not involve any "Existing Facilities.

5 DESCRIPTION OF THE ENVIRONMENT

5.1 Project Area of Influence

124. According to ADB's 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 project include direct construction sites, pipelines, canals, access roads, borrow pits, disposal areas, temporary impacts 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. No cumulative impacts in this regard are anticipated as a result of this or similar projects.
- (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 project, it is anticipated that the development of the urban centers will continue, leading to further developments around the sub-project areas.

125. The area of influence i.e. the area which is affected by the project, also depends on the environmental impact being considered. Local impacts with a narrow area of influence are those impacts arising from noise, dust and other amenity issues. A larger area of influence 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. ADB's SPS 2009 requires the assessment to identify potential transboundary effects, such as air pollution, and global impacts, such as emission of greenhouse gases.

126. For the purposes of this IEE, the area of influence is taken to be the service area for sewers and drainage, but shall also include a wider area estimated at 250 m around the construction sites boundaries, as this is considered the distance to reach acceptable sound levels from construction equipment noise:

- WHO Community Noise Limits: One Hour LAeq 55 dBA (Outside; residential receptor, daytime limit)
- Construction Noise: Backhoe excavator 80 dBA at 15 m and concrete mixer 79 dBA at 15 m. Source: Construction Noise Handbook (www.fhwa.dot.gov), US Department of Transport.
- Noise attenuation factor: a conservative 6 dBA each time the distance from the point source is doubled. Source: US Occupational Safety and Health Administration (www.osha.gov/dts/osta/otm/new_noise/). Note that in soft vegetated environments such as in agricultural fields, the noise attenuation will be significantly increased meaning the area of influence could be narrowed.
- Calculation: At 250 m the noise at a receptor is approximately 55 dBA (WHO limit).

127. During operations, the area of influence will also be linked to the discharge of effluents, and therefore encompasses the water body into which the treated effluent will be discharged.

5.2 Baseline Receptors

5.2.1 General Description of WWTP site location

128. The WWTP site is located in an open area in Krang Memay Village, Preah Bat Commune, Stung Treng District

129. A summary for key receptors is provided in **Table 9**. The distances given are approximate for each proposed site. These receptors are explored in more detail in the following sections describing the environmental baseline conditions.

Table 9: Summary of Environmental Sensitive Receptors for WWTP Subproject

Project Component	Surface Water Receptors	Socio-Economic & Cultural Receptors	Land Cover/ Ecological Receptors	Protected Area Status
Wastewater Treatment Plant	<ul style="list-style-type: none"> - the Mekong River via a 430 m long stream 	<ul style="list-style-type: none"> - 100 m – 150 m to the nearest single houses - 250 m to housing along the road on the left bank of the Mekong River - About 4 km from National Road No. 9 - About 2 km from densely populated areas - Five private landowners. Land acquisition by willing seller - willing buyer arrangement 	<ul style="list-style-type: none"> - The site is covered with grassland, shrub and cashew trees. - The surrounding area in a 500 m radius is dominated by shrubland with patches of agricultural land 	<ul style="list-style-type: none"> - The site is located inside the Mekong River from Kratie to the Lao PDR, Key Biodiversity Area. - 300 m east of the Northeast Biodiversity Corridor of Protected Area - 7.6 km south-southwest of the Stung Treng Protected Area (Ramsar Site)
Wastewater and Drainage network	<ul style="list-style-type: none"> - The stormwater drainage network discharges to the Mekong River and the Sekong River 	<ul style="list-style-type: none"> - Network in dense urban area, where there are houses, pagoda, market, business shop, schools. - Presence of local utilities services: electric line/pole, water supply, cable line, and other social service structures 	<ul style="list-style-type: none"> - Paved and unpaved urban roads - Some street trees and limited urban vegetation 	<ul style="list-style-type: none"> - Stung Treng District is partly inside Sekong River KBA and Mekong River from Kratie to the Lao PDR, KBA.
Wastewater and drainage pump stations (MPS, SPS-1 and SPS-2, DPS-1)	<ul style="list-style-type: none"> - The drainage pump station discharges to the Sekong River 	<ul style="list-style-type: none"> - MPS: 60 m to school, 60 m to pagoda and 25 m to nearest houses - SPS-1: next to kindergarten - SPS-2: 45 m to houses 	<ul style="list-style-type: none"> - As above 	<ul style="list-style-type: none"> - As above

130. As noted in **Section 4.4**, the project is designed to cover three communes (sangkats) constituting the main urban area of Stung Treng namely Preah Bat, Srah Ruessei and Stung Treng. These sangkats are partly inside Sekong River KBA and Mekong River from Kratie to the Lao PDR, KBA. The WWTP site itself is inside the Mekong River from Kratie to the Lao PDR, KBA. These two KBAs are not recognized as Protected Areas under Cambodian legislation and the subproject is not located inside any Protected Area as defined and designated under Cambodian legislation. However, the location inside the KBAs does indicate that the subproject is located in an area with important biodiversity which on the one hand underscores the importance and benefits of the improved environmental quality that the subproject is designed to deliver, and on the other hand highlights the need for proper pollution prevention and mitigation measures during construction and operation of the wastewater treatment and collection system.

131. The key receptors in the immediate surroundings of the WWTP are identified in **Figure 9** and **Figure 10**, and pictures of the sites are included in **Table 10**.

Figure 9 Key Receptors in the Immediate Vicinity of the Wastewater Treatment Plant

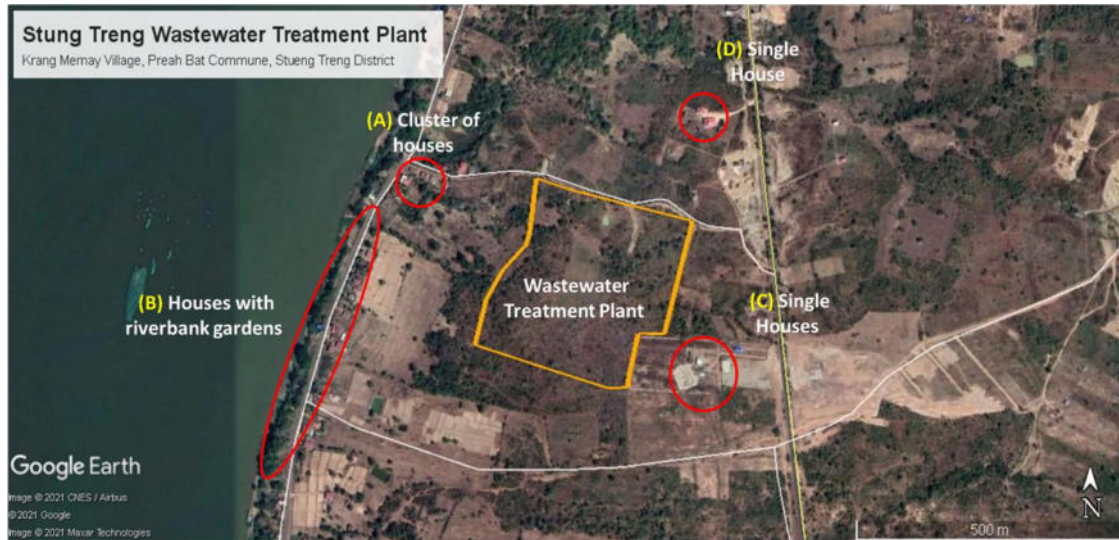


Figure 10 Key Receptors in the Immediate Vicinity of the Wastewater Treatment Plant

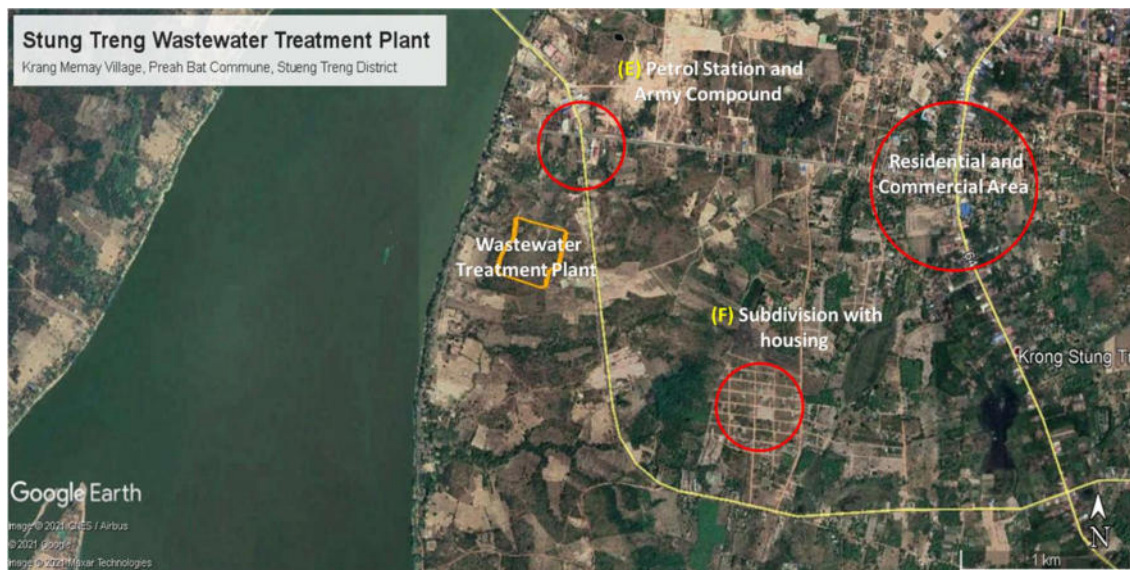


Table 10 Pictures of Key Receptors Surrounding the Wastewater Treatment Plant



B



C Single houses and fences



D



E Petrol station and guest house



F Subdivision, part of Krang Memay Village



132. The location and sensitive receptors near the wastewater pump stations are indicated on **Figure 11** (MPS), **Figure 12** (SPS-1) and on **Figure 13** (SPS-2).

Figure 11 Location of the MPS

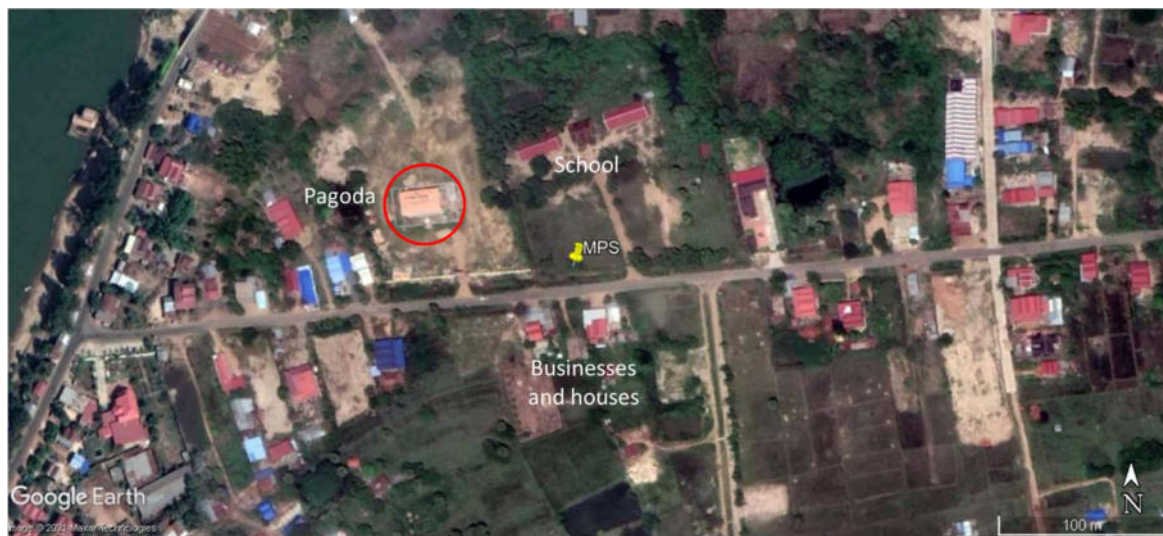
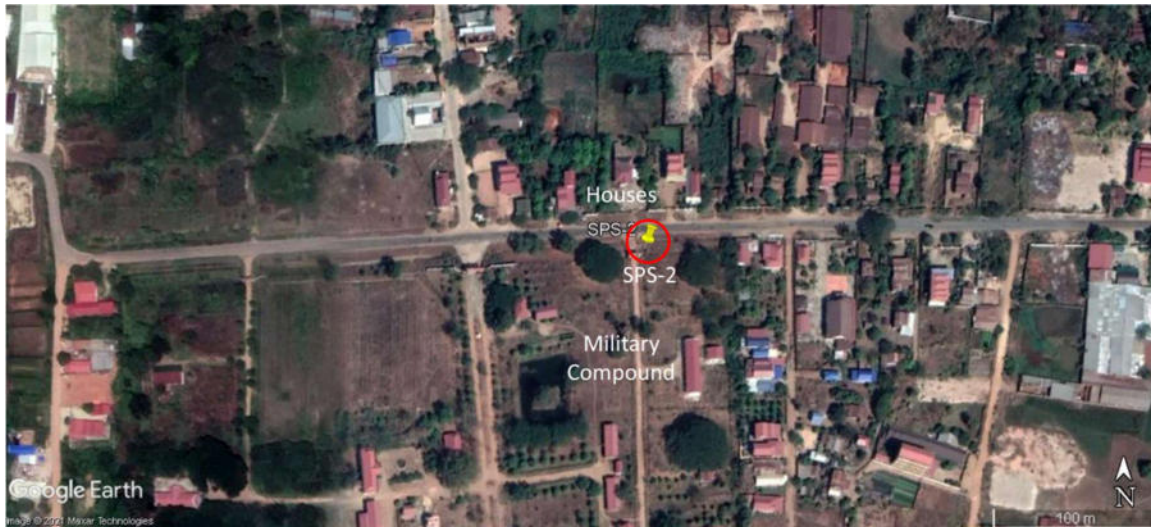


Figure 12 Location of SPS-1



Figure 13 Location of SPS-2



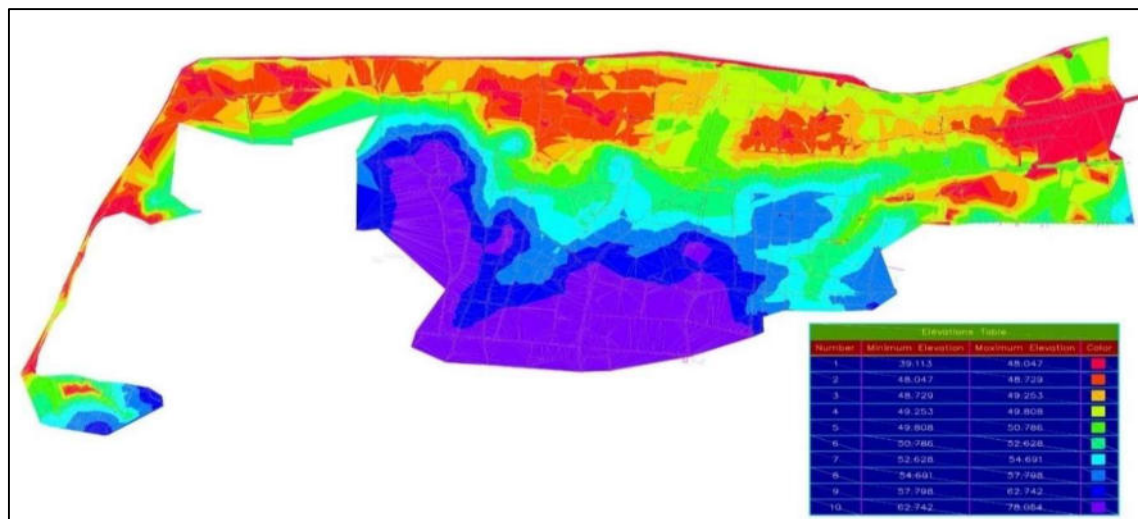
5.3 Geography, Topography and Geology

5.3.1 Topography and Geography

133. Stung Treng is situated on along the Sekong River and Mekong River, at the right bank. The topography of the city is characterized by a combination of low-lying flat land adjacent to the Mekong River and the Sekong River with elevations about 40 m asl. to 50 m asl. and increasingly hilly terrain towards the south of the City with elevations around 60 m als. to 70 m asl. The topography of the subproject area is illustrated in **Figure 14** (see also the drainage plan in **Figure 8**).

134. At the WWTP site the terrain gently slopes from the southeast with elevations of about 57 m asl. to 59 m asl. towards northwest with elevations of about 51 m asl.

Figure 14: Topography of the Subproject Area



5.3.2 Geology

135. Geotechnical investigations⁹ in Stung Treng City show that close to the Sekong River the geology is comprised of 5 m to 10 m of sandy clay layers followed by sandstone, and further inland the sandstone layer is typically found at 4 m to 8 m depth. The groundwater was found at 3 m – 4 m below the existing ground surface.

136. At the wastewater treatment plant site, the geotechnical investigations¹⁰ found 5 m of completely weathered rock. Groundwater was detected at depths between 2.5 m and 4 m below ground.

5.4 Meteorology and Climate

137. The climate for Strung Treng Province is classified as tropical wet and dry climate (Aw) according to the Köppen-Geiger climate classification.

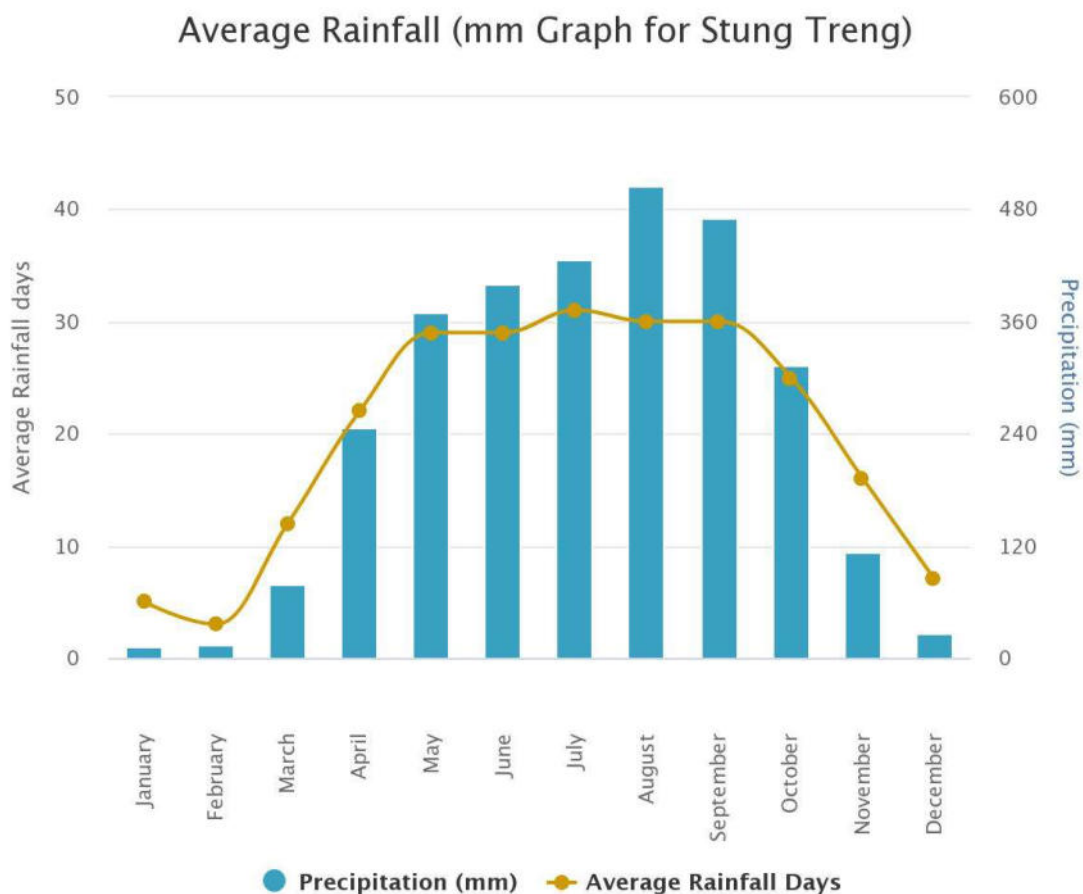
138. The average monthly rainfall (mm) and average rainfall days 1909-2021 is presented in **Figure 15**. The rainy season lasts 5.5 months, from May 1 to October 19, with a greater than 31% chance of a given day being a wet day. The chance of a wet day peaks at 60% on August 29. The dry season lasts 6.5 months, from October 19 to May 1. The smallest chance of a wet day is 1% on January 11.

⁹ Geotechnical Investigations for Stung Treng City Area, TS-2 and CTD-4 Projects, Ramboll, SCE, and Tancon, June 2021

¹⁰ Geotechnical Investigations for Stung Treng Wastewater Treatment Plant, TS-2 and CTD-4 Projects, Ramboll, SCE, and Tancon, January 2021

¹¹ <https://weatherspark.com/> accessed on 21 July 2021

Figure 15: Monthly Average Rainfall and Rainfall Days, Strung Treng (1991-2020)



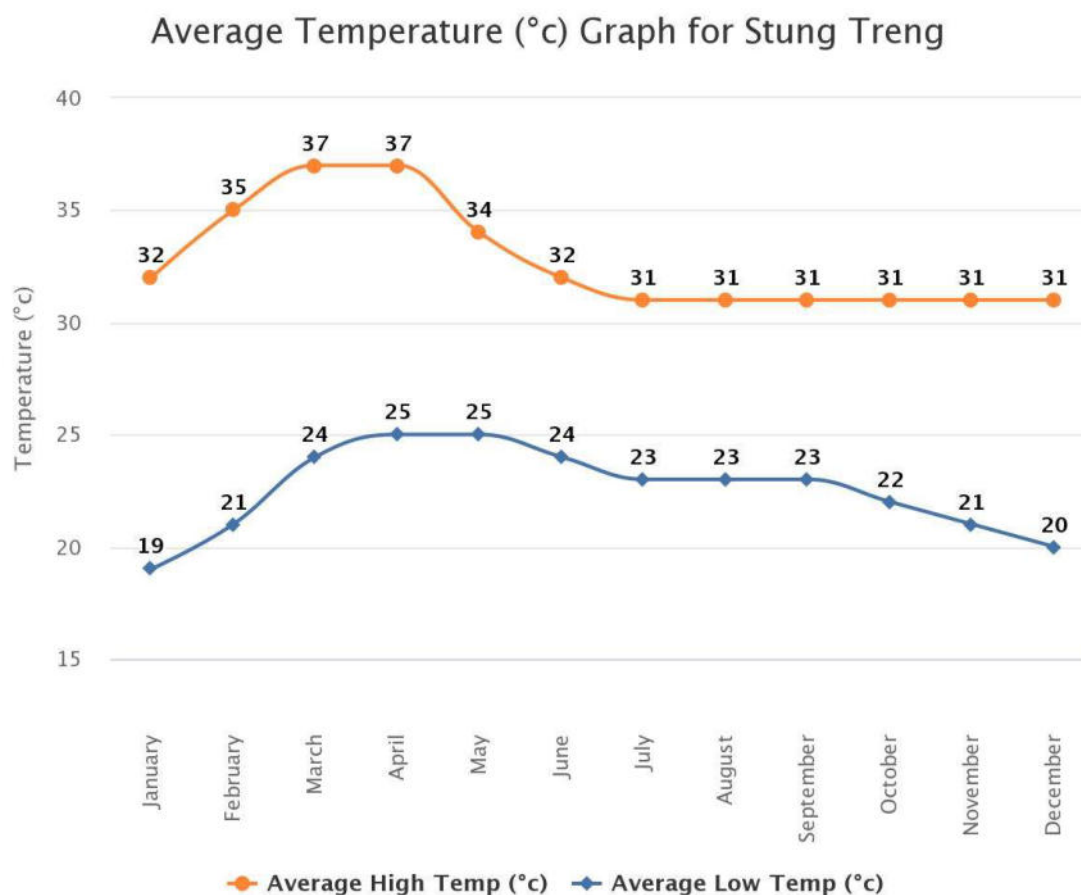
Source: <https://www.worldweatheronline.com/stung-treng-weather-averages/stung-treng/kh.aspx> accessed on 21-July-2021

139. The average monthly maximum and minimum temperatures (1909-2021) are displayed on the chart in **Figure 16**.

140. Over the course of the year, the temperature typically varies from 19°C to 38°C and is rarely below 16°C or above 41°C. The hot season lasts for 2.2 months, from February 27 to May 2, with an average daily high temperature above 37°C. The hottest day of the year is March 28, with an average high of 38°C and low of 25°C.

141. The cool season lasts for 6.5 months, from June 20 to January 6, with an average daily high temperature below 32°C.

Figure 16: Average Maximum and Minimum Monthly Temperatures 1909-2021, Stung Treng



Source: <https://www.worldweatheronline.com/stung-treng-weather-averages/stung-treng/kh.aspx> accessed on 21-July-2021

142. The average hourly wind speed in Stung Treng is 1.2 m/s and only varies with +/- 0.2 m/s over the course of the year¹²,

5.5 Climate Change Projections

143. According to the World Bank's Climate Change Knowledge Portal (<https://climateknowledgeportal.worldbank.org/>), for Cambodia, the mean annual temperatures have increased by 0.8°C since 1960, at a rate of about 0.18°C per decade. The rate of increase is most rapid in the drier seasons (December-February and March-May), increasing 0.20-0.23°C per decade, and is slower in the wet seasons (June-August and September-November), increasing 0.13-0.16°C per decade. Since 1960, the frequency of 'hot' days has increased significantly (+46, with strongest increases noted in September-November), as has the frequency of 'hot' nights (+63, with strongest increases noted in December-February). The frequency of 'cold' days has decreased significantly in the September-February period. The average number of cold days per year has decreased by 19 (5.2%). This rate of decrease is most rapid in December-February. Mean rainfall trends

¹² <https://weatherspark.com/> accessed on 21 July 2021

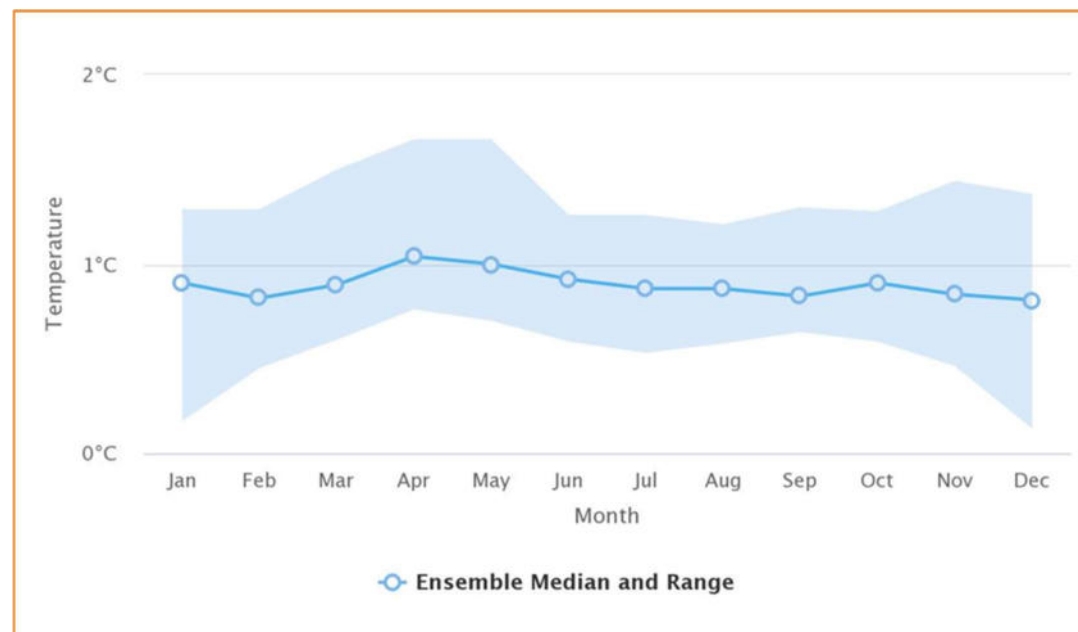
over Cambodia are unclear, with some areas experiencing increases and others decreases, but these changes are not statistically significant¹³.

144. The key climate change predictions for Cambodia available in the World Bank's Climate Change Portal include that¹⁴:

- a) mean annual temperature will rise by 1.54 °C (1.06 °C to 2.50 °C) in 2040-2059 (RCP¹⁵ 8.5, Ensemble¹⁶)
- b) annual precipitation will rise by 82.77 mm (-268.57 mm to 557.23 mm) in 2040-2059 (RCP 8.5, Ensemble)
- c) annual Maximum 5-day Rainfall (25-year Return Level) will rise by 34.42 mm (-91.71 mm to 455.53 mm) in 2040-2059 (RCP 8.5, Ensemble)

145. The projected change in monthly temperature for Cambodia is shown in **Figure 17** and the projected change in monthly precipitation is presented in **Figure 18**. As indicated in the large spread of precipitation projections there is not yet a clear picture for precipitation change, due to large model uncertainties. However, increases in rainfall appear to be likely during the monsoon season.

Figure 17: Projected Change in Monthly Temperature for Cambodia for 2020-2039



Source: <https://climateknowledgeportal.worldbank.org/country/cambodia/climate-data-projections>

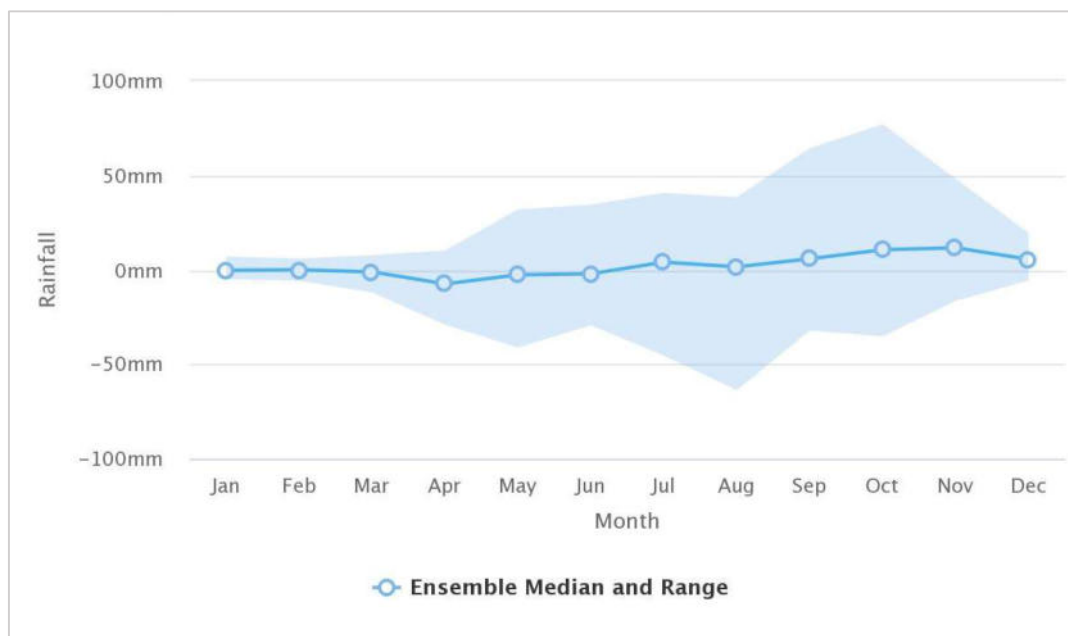
¹³ <https://climateknowledgeportal.worldbank.org/country/cambodia/climate-data-historical>. Accessed on 01-May-2021

¹⁴ <https://climateknowledgeportal.worldbank.org/country/cambodia/climate-data-projections>. Accessed on 01-May-2021

¹⁵ RCP means Representative Concentration Pathways for different emission level scenarios

¹⁶ A collection of model simulations characterizing a climate prediction or projection

Figure 18: Projected Change in Monthly Precipitation for Cambodia for 2020-2039



146. **Table 11** shows the impacts from climate change on the sub-projects as identified by the Climate Risk and Vulnerability Assessment (CRVA) undertaken for this project based on site visits and climate change projections for the Year 2050 and RCP 8.5. These issues are managed through design mitigation measures where appropriate.

Table 11: Impacts from Climate Change on the Subproject Infrastructure

Climate Change Factor	Impact
Warmer Temperatures	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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.

5.6 Hydrology, Flooding and Other Natural Disasters

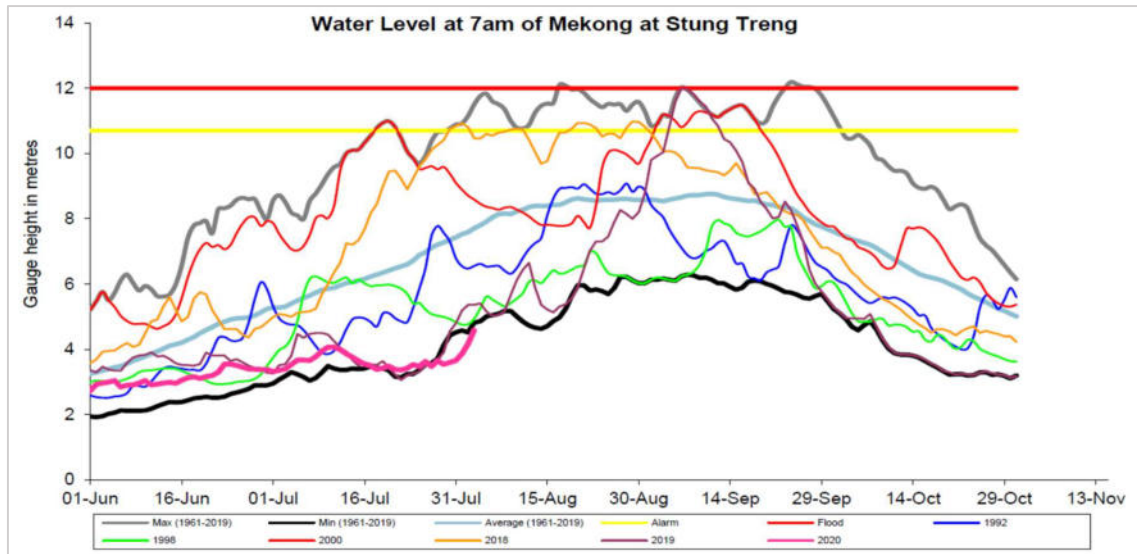
5.6.1 Hydrology and Flooding

147. Considering that the highest earlier recorded flood level in the Mekong in Stung Treng was at +48.79 m asl., the ground level at the proposed WWTP facility (process area + admin area) should be no less than +49.3 m asl. to avoid flooding of the WWTP area. Considering the topography for WWTP area, the proposed final design level of WWTP process area and admin area is set at +55.50 m asl.

148. Stung Treng City is not completely served with drainage and the City experiences flooding every rainy season, usually after a heavy rainfall. The rainy season water levels in the Mekong River at Stung Treng are presented in **Figure 19**. The station alarm level is 10.70 m corresponding to elevation 47.49 m asl. while the flood level is 12.0 m corresponding to elevation 48.79 m asl. The Figure shows that during the period from 1961 to 2019, the maximum water level exceeded the flood level.

149. The wastewater pump stations in the City will require minor filling to bring the concrete platforms above the flood risk level.

Figure 19: Mekong River Levels in the Rainy Season at Stung Treng



Source: Mekong River Commission, Regional Flood and Drought Management Centre Weekly Situation Report for the Wet Season in the Mekong River Basin Prepared on: 04/08/2020

5.6.2 Other Natural Disasters

150. Storms and typhoons are not usually considered a major problem in Cambodia as the country is protected by surrounding mountain ranges. 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, agriculture and ecological systems.

151. Seismic activity. According to JICA study on Natural Disaster Risk Assessment and Area Business Continuity Plan Formulation for Industrial Agglomerated Areas in the ASEAN Region, March 2015 all Cambodia is categorized as V and below on the Modified Mercalli Scale with no significant earthquake ever recorded.

5.7 Water Quality

5.7.1 Surface Water Quality

152. The IESIA studies on the Subproject included water quality testing at two stations in the Mekong River. Point one is upstream the stream that will discharge treated wastewater from the plant and Point 2 is downstream. The location of the stations is indicated in **Figure 20** and the results are listed in **Table 12**. The coordinates for the sampling stations are:

- Point 1: Mekong River Water is about 100m on the upstream of WWTP site (X: 601341 and Y: 1494200).
- Point 2: Mekong River Water is about 100m on the downstream of WWTP site (X: 601030 and Y: 1493296)

Figure 20: Water Quality Monitoring Stations



Table 12: Water Quality Results

No	Parameters	Unit	Standards	Results Point 1	Results Point 2
1	pH	-	6.5-8.5	7.80	7.80
2	TDS	mg/l	< 1.000	59.0	74.0
3	TSS	mg/l	25-100	35.0	49.0
4	DO	mg/l	7.5-2.0	7.40	7.0
5	BOD ₅	mg/l	1-10	1.0	1.60
6	COD	mg/l	<50	2.99	3.65
7	Oil and Grease	mg/l	<5	0.87	1.33
8	Detergent	mg/l	<5	0.0	0.0
9	Nitrate (NO ₂)	mg/l	50	1.0	1.50
10	Sulphate (SO ₂)	mg/l	<300	4.0	6.0
11	Total Nitrogen	mg/l	-	0.47	0.54
12	Total Phosphorous	mg/l	-	0.02	0.03
13	Lead (Pb)	mg/l	<0.01	0.002	0.0007
14	Arsenic (As)	mg/l	<0.01	0.0008	0.0008
15	Cadmium (Cd)	mg/l	<0.001	0.0005	0.01
16	Iron (Fe)	mg/l	-	2.38	3.18
17	Mercury (Hg)	mg/l	<0.0005	0.0	0.0
18	Cu	mg/l	-	0.01	0.06
19	Ni	mg/l	-	0.04	0.05
20	Zn	mg/l	-	0.0	0.0
21	Phenol	mg/l	-	0.0	0.0
22	NH ₃	mg/l	-	0.13	0.19
23	Total Coliform	MPN/100ml	<5000	2.3 x 10 ³	3.8 x 10 ³

Source: MoE Laboratory, IESIA, wastewater and drainage subproject in Stung Treng Town, July 2020

153. The results of the water quality analyses indicate compliance with the Cambodian surface water quality standards for rivers and for protection of public health. According to the water quality monitoring carried out under the Mekong River Commission, the water quality index for human health at Stung Treng (2010 - 2017) is category A meaning that the measurements are within the objectives virtually all of the time, and for aquatic life the index is category B, meaning that the water quality rarely depart from desirable levels¹⁷.

¹⁷ <https://portal.mrcmekong.org/monitoring/water-quality> accessed on 29-Sep-2021

5.8 Air Quality and Noise

154. The IESIA for the Subproject included measurements of ambient air quality and noise. The ambient air quality measurements are listed in **Table 13** and the results of the noise measurements are presented in **Table 14**. The ambient air quality and noise measurements were performed at the same location as indicated in **Figure 21** at the centre of the WWTP site.

155. The ambient air quality measurements are within the Cambodian ambient air quality standards and the air quality can be characterized as “moderate” based on USEPA Air Quality Index for PM_{2.5}¹⁸

Table 13: Ambient Air Quality Measurements

Parameters	Averaging Period	Unit	Standards	Result
Carbon monoxide, CO	8-hour	mg/m ³	< 20	06
NO ₂	24-hour	mg/m ³	< 0.1	0.029
SO ₂	24-hour	mg/m ³	< 0.3	0.037
Ozone, O ₃	1-hour	mg/m ³	< 0.2	0.011
Lead, Pb	24-hour	mg/m ³	< 0.005	0
Total Suspended Particles, TSP	24-hour	mg/m ³	< 0.33	0.075
PM ₁₀ ¹⁹	24-hour	mg/m ³	< 0.05	0.044
PM _{2.5} ²⁰	24-hour	mg/m ³	< 0.025	0.020

Source: MoE Laboratory, IESIA report PPIC July 2020

156. The noise measurements are within the Cambodian noise standards for both residential and commercial areas, except with respect to the night-time measurements that are slightly above the night-time standard for residential areas (somewhat unexpected given the location away from any known noise sources including traffic noise).

Table 14: Noise Measurements

Time	Survey Period	Standards dB(A)	Noise Level dB(A)		
			Max	Min	Average
Day	6:00 - 7:00	Commercial 70 Residential 60	51.3	35.0	43.0
	7:00 - 8:00		63.3	35.1	50.0
	8:00 - 9:00		52.3	36.3	44.0
	9:00 - 10:00		52.8	34.9	43.8
	10:00 - 11:00		62.6	34.8	47.7
	11:00 - 12:00		63.7	40.3	51.0
	12:00 - 13:00		61.3	34.4	47.7
	13:00 - 14:00		63.8	40.9	52.3
	14:00 - 15:00		60.8	34.0	47.4
	15:00 - 16:00		65.2	42.9	54.5
	16:00 - 17:00		64.3	42.6	54.4
Evening	17:00 - 18:00		63.8	40.0	53.4
	18:00 - 19:00	Commercial 65 Residential 50	56.9	34.9	45.5
	19:00 - 20:00		54.2	35.7	45.0
	20:00 - 21:00		48.3	38.4	43.0
	21:00 - 22:00		53.6	43.4	45.5

¹⁸ https://www.epa.gov/sites/production/files/2016-04/documents/2012_aqi_factsheet.pdf

¹⁹ WHO ambient air quality guideline value

²⁰ WHO ambient air quality guideline value

Time	Survey Period	Standards dB(A)	Noise Level dB(A)		
			Max	Min	Average
Night	22:00 - 23:00	Commercial 50 Residential 45	49.8	44.9	47.4
	23:00 - 00:00		52.7	42.6	47.6
	00:00 - 1:00		53.7	46.0	49.8
	1:00 - 2:00		48.0	43.6	45.8
	2:00 - 3:00		49.7	43.0	45.8
	3:00 - 4:00		45.3	42.6	44.0
	4:00 - 5:00		54.7	43.5	49.1
	5:00 - 6:00		51.0	39.8	45.4
	24-hour average	Commercial 70 ²¹	56.0	41.4	47.8

Source: MoE Laboratory, IESIA report, PPIC July 2020

Figure 21: Ambient Air Quality and Noise Measurement Station



5.9 Protected Areas and Key Biodiversity Areas

157. The proximity of the WWTP to Key Biodiversity Areas (KBA) and National Protected Areas, Ramsar Sites etc. has been analysed using the Integrated Biodiversity Assessment Tool (IBAT). The IBAT Proximity Report (attached in **Annex 4**) shows the site is located inside the Mekong River from Kratie to the Lao PDR, Key Biodiversity Area, it is 300 m east of the Northeast Biodiversity Corridor of Protected Area and 7.6 km south-southwest of the Stung Treng Protected Area (Ramsar Site). The wastewater and drainage service area lies partly inside the Sekong River KBA and the Mekong River from Kratie to the Lao PDR, KBA.

158. The Mekong River from Kratie to the Lao PDR, Key Biodiversity Area, which from 7.6 km north-northeast of the WWTP site overlaps with the Stung Treng Protected Area (Ramsar Site), is an Important Bird Area (IBA). The KBA comprises the Mekong River and associated riverine vegetation. The Mekong River is very varied along the KBA reach with wide single channel stretches and other sections that are braided into a number of channels and islands which give rise to a diversity of habitats and fish and bird species. The stretch along the Mekong River where the WWTP site is located includes single houses along the riverbank road with riverbank gardens and agricultural activities further inland.

²¹ IFC Environmental, Health and Safety Industrial Guideline: Noise Management, 30 April 2007

5.10 Ecological Resources

5.10.1 Flora

159. The vegetation within and around the WWTP site generally include common trees, shrubs and grasses (see **Figure 22**).

Figure 22: Pictures of the WWTP Site (September 2021)



160. Street trees are present in the corridor of impact for the construction of the wastewater and drainage network. Street trees are important for the city environment not only as a landscaping and beautification element but very importantly also for reducing runoff, promoting infiltration and improving urban micro-climate creating a pleasant and uplifting ambience.

5.10.2 Fauna

161. The IESIA studies included interviews with local residents to identify wildlife species observed in the areas around the WWTP site. During the interviews, a photo catalogue of likely species was used to help identify the species. It should be noted that the identification of species through this process is subject to considerable uncertainties and should not be understood as a scientific identification.

162. The species of birds listed by local residents are presented in **Table 15**.

Table 15: Bird Species of Birds Listed by Local Residents

No	Khmer Name	English Name	Scientific Name	IUCN
1	Kroch Eunt	Barred Buttonquail	<i>Turnix suscitator</i>	LC
2	Kroch Touch	Small Buttonquail	<i>Turin sylvatica</i>	LC
3	Lolok Traing	Red Collared Dove	<i>Streptopelia</i>	LC
4	Lolok Bay	Eastern Spotted Dove	<i>Spilopelia chinensis</i>	LC
5	Preab Srok	Rock Pigeon	<i>Columba livia</i>	LC
6	Staing Lolok	Black-shouldered Kite	<i>Elanus caeruleus</i>	LC
7	Khleung Slak	Barn Owl	<i>Tyto alba</i>	LC
8	Kaek	Large-billed Crow	<i>Corvus macrorhynchos</i>	LC
9	Anleap Khmao	Black Drongo	<i>Dicrurus macrocercus</i>	LC
10	Tro Math Khla	Racket-tailed Treepie	<i>Crypsirina temia</i>	LC
11	Ta Vao	Plaintive Cuckoo	<i>Cacomantis merulinus</i>	LC
12	Auth Thom	Greater Coucal	<i>Centropus sinensis</i>	LC
13	Ta Vao	Asian Koel	<i>Eudynamys scolopacea</i>	LC
14	Tradeav Beytoun	Blue-tailed Bee-eater	<i>Merops philippinus</i>	LC
15	Tradeav Touch	Green Bee-eater	<i>Merops orientalis</i>	LC
16	Tear Kheiv	Indian Roller	<i>Coracias benghalensis</i>	LC
17	PalKor Ambok	Coppersmith Barbet	<i>Megalaima haemacephala</i>	LC
18	Tracheak Kam	Barn Swallow	<i>Hirundo rustica</i>	LC
19	Tracheak Kam Thnot	Asian Palm Swift	<i>Cypsiurus balasiensis</i>	LC

No	Khmer Name	English Name	Scientific Name	IUCN
20	Tracheak Kam Chhek	Fork-tailed Swift	<i>Apus pacificus</i>	LC
21	Lvea Chek	Oriental Magpie Robin	<i>Copsychus saularis</i>	LC
22	Kachok Steav Khmao	Pied Fantail	<i>Rhipidura javanica</i>	LC
23	Popich Thnot	Common Stonechat	<i>Saxicola torquata</i>	LC
24	Popich Thar	Blue Rock Thrush	<i>Monticola solitarius</i>	LC
25	Khtop Dei Leuk	Mongolian Yellow Wagtail	<i>Motacilla (tschutschensis) macronyx</i>	LC
26	Popich Krahon Sar	Red-whiskered Bulbul	<i>Pycnonotus jocosus</i>	LC
27	Chap Kroch	Yellow-vented Bul bul	<i>Pycnonotus goiavier</i>	LC
28	SarikaKeo Kor	Common Myna	<i>Acridotheres tristis</i>	LC
29	Sarika keo Krabei	White-vented Myna	<i>Acridotheres grandis</i>	LC
30	Kroling Kralog	Black-collared Starling	<i>Sturnus nigricollis</i>	LC
31	Kroling Kralog Sar	Asian Pied Starling	<i>Sturnus contra</i>	LC
32	Kanchreav	Vinous-breasted Starling	<i>Sturnus burmannicus</i>	LC
33	Chap Kralang	Oliver-backed Sunbird	<i>Nectarinia jugularis</i>	LC
34	Chap Kraharm	Red-throated Flycatcher	<i>Ficedula parva</i>	LC
35	Chap Kbal Khmao	Chestnut Munia	<i>Lonchura atricapilla</i>	LC
36	Chap Phtas Thoch	Indian Sparrow	<i>Passer (domesticus) indicus</i>	LC
37	Kaek Toek Toch	Little Cormorant	<i>Microcarbo niger</i>	LC
38	Smorch	Oriental Darter	<i>Anhinga melanogaster</i>	NT
39	Krasar Prapheas	Grey Heron	<i>Ardea cinerea</i>	-
40	Kok Krong Thom	Great White Egret	<i>Ardea alba</i>	-
41	Khvek	Jack Snipe	<i>Lymnocyrtus minimus</i>	LC
42	Proveuk	Lesser Whistling-duck	<i>Dendrocygna javanica</i>	LC
43	Teakap Prey	Indian Spot-billed Duck	<i>Anas poecilorhyncha</i>	LC
44	Popous Teuk	Little Grebe	<i>Tachybaptus ruficollis</i>	-
45	Mean Teuk	White-breasted Waterhen	<i>Amaurornis phoenicurus</i>	LC
46	Khlek Khmao	Black Kite	<i>Milvus migrans</i>	-
47	Roath Tonsay	Hen Harrier	<i>Circus cyaneus</i>	LC
48	Chheung Tean	Black-winged Stilt	<i>Himantopus himantopus</i>	-
49	Tradeavich Tonle	River Lapwing	<i>Vanellus duvaucelii</i>	NT
50	Titteat Toch	Red Knot	<i>Calidris canutus</i>	NT
51	Rumpe Toch	Little Tern	<i>Sternula albifrons</i>	LC
52	Rumpe Tonle	River Tern	<i>Sterna aurantia</i>	NT
53	Kadorb Khbal Khmao	Black-capped Kingfisher	<i>Halcyon pileata</i>	LC
54	Totea	Chinese Francolin	<i>Francolinus pintadeanus</i>	LC
55	Mean Prey	Red Junglefowl	<i>Gallus gallus</i>	LC
56	Kangork	Green Peafowl	<i>Pavo muticus</i>	VU
57	Stang Slabsroch Sar	White-rumped Pygmy-falcon	<i>Polihierax insignis</i>	NT
58	Trachekam Prey	Crested Treeswift	<i>Hemiprocne coronata</i>	LC
59	Meam Toch Prey	Asian Barred Owlet	<i>Glaucidium cuculoides</i>	LC
60	Tittuy Thom	Spot-bellied Eagle Owl	<i>Bubo nipalensis</i>	LC
61	Sek Sark	Red-breasted Parakeet	<i>Psittacula alexandri</i>	NT
62	Sek Som	Alexandrine Parakeet	<i>Psittacula eupatria</i>	NT
63	Sek Ath	Blossom-headed Parakeet	<i>Psittacula roseata</i>	NT
64	Sek Krech	Vernal Hanging-parrot	<i>Loriculus vernalis</i>	LC
65	Keng Kan Thom	Great Hornbill	<i>Buceros bicornis</i>	VU
66	Troses Toch Kmaosar	Grey-capped Woodpecker	<i>Picoides canicapillus</i>	LC
67	Troses Pous Thnot	Rufous-bellied Woodpecker	<i>Dendrocopos hyperythrus</i>	LC
68	Troses Khnang Pleung	Common Flameback	<i>Dinopium javanense</i>	LC
69	Trases Thom	Greater Yellowthroat	<i>Chrysophlegma flavinucha</i>	LC
70	Trases Damrei	Great Slaty Woodpecker	<i>Mulleripicus pulverulentus</i>	VU
71	Popou Champosleung	Thick-billed Green Pigeon	<i>Treron curvirostra</i>	LC
72	Chektom Khbal Khmao	Black-hooded Oriole	<i>Oriolus xanthomus</i>	LC
73	Chektom Kar Khmao	Black-naped Oriole	<i>Oriolus chinensis</i>	-
74	Bakou	Common Hoopoe	<i>Upupa epops</i>	-
75	Lveachek Prey	White-rumped Shama	<i>Kittacincla malabarica</i>	-
76	Chekteas Thom	Grey-chinned Minivet	<i>Pericrocotus solaris</i>	LC
77	Chekkchei Phleung	Golden-fronted Leafbird	<i>Chloropsis aurifrons</i>	-
78	Popich Khmao	Black Bulbul	<i>Hypsipetes leucocephalus</i>	LC
79	Sarikakeo Vorg	Common Hill Myna	<i>Gracula religiosa</i>	LC
80	Sarikakeo Leung	Golden-crested Myna	<i>Ampeliceps coronatus</i>	LC
81	Chaptet Prey	Dark-necked Tailorbird	<i>Orthotomus atrogularis</i>	-
82	Chap Daunta Khmao	White-browed Shrike-babbler	<i>Pteruthius aeralatus</i>	LC

No	Khmer Name	English Name	Scientific Name	IUCN
83	Chap Kanlang Kraharm	Crimson Sunbird	<i>Aethopyga siparaja</i>	LC

163. The Mekong River from Kratie to the Lao PDR KBA (and IBA) supports a large proportion of the global population of Mekong Wagtail *Motacilla samveasnae* (NT), a recently described species, which is thought to be endemic to the Mekong River and its major tributaries. In addition, the KBA/IBA supports significant populations of a suite of riverine avian species that have declined severely throughout mainland South-east Asia, including River Lapwing *Vanellus duvaucelii* (NT), Great Thick Knee *Esacus recurvirostris* (NT) and River Tern *Sterna aurantia* (VU). Furthermore, a number of globally threatened and near-threatened species have been recorded at the IBA in small numbers, including White-rumped Vulture *Gyps bengalensis* (CR), Red-headed Vulture *Sarcogyps calvus* (CR) and Oriental Darter *Anhinga melanogaster* (NT)²².

164. The KBA hosts a range of Threatened²³ fish species such as the Irrawaddy Dolphin *Orcaella brevirostris* (CR), Jullien's Golden Carp *Probarbus jullieni* (CR), Mekong Giant Catfish *Pangasianodon gigas* (CR), Giant Pangasius *Pangasius saritwongsei* (CR), Mekong Giant Salmon Carp *Aptosyax grypus* (CR), and more than 20 Endangered or Vulnerable species.

5.11 Physical and Cultural Resources

165. There are no cultural resources near the WWTP site, but there are pagodas along roads in the City where wastewater pipes will be installed.

5.12 Basic Demographic and Social Data

166. The population in Stung Treng City is summarized in **Table 16**. The City had a total population of 31,011 and a total of 7,058 families in 2019 corresponding to an average family size of 4.4 persons. 9.8 percent of the families had a female head.

Table 16: Stung Treng City Population 2019

	Description	2017	2018	2019
1	Number of Families	6,962	7,242	7,058
2	Population	32,754	33,063	31,011
3	Female	16,360	16,367	15,388
4	Growth Rate (%)	0.1 %	0.9 %	- 6.2 %
5	Female Head of Family (%)	9.8	9.9	9.8
6	Family Size (members/family)	4.7	4.6	4.4
7	Population from 18-60 year-old	17,472	16,957	16,247
8	Population over 61-year-old	2,577	3,246	3,357

Source: Provincial Department of Planning, 2020

167. **Table 17** indicates employment in Stung Treng City by the main economic sectors. The highest employment is in business and trading followed by agriculture and government services.

²² BirdLife International (2021) Important Bird Areas factsheet: Mekong River from Kratie to Lao PDR. Downloaded from <http://www.birdlife.org> on 29/09/2021

²³ The term Threatened is generally used to refer to the three IUCN Red List Categories critically endangered (CR), endangered (EN) and vulnerable (VU), where vulnerable refers to the least at risk of those three categories

Table 17 Employment Data for Stung Treng City

Description	Percentage (%)
Public and Private Employment	
• Government employee	19.2 %
• Private and NGO employee	4.3 %
• Workers	6.2 %
Local Services	
• Business and trading	35.3 %
• Vehicle and machine repair and maintenance	4.7 %
• Transportation services	3.4 %
Agriculture	24.9 %
Handicraft	2.0 %

Source: Provincial Department of Planning, 2020

168. Access to different sources of water for domestic use is summarized in **Table 18**.

Table 18 Access to Water for Domestic Use in Stung Treng City, 2019

Description	Stung Treng	Sras Russey	Preah Bath
Total Number of Families	3,476	1,103	933
Families with connected to public water supply	3,314	1,074	434
Families using groundwater, wells with pump	356	94	40
Families using groundwater, wells with hand pump	343	104	91
Families using pond water	No	05	50
Families using water from river or stream	162	24	399

Source: Provincial Department of Planning, 2020

169. The poverty rates in Stung Treng City divided by commune are presented in **Table 19**.

Table 19 The poverty Rate by Commune in Stung Treng City, 2019

Commune Name	Poverty Rate 2019
Stung Treng	3.2 %
Sras Russey	11.2 %
Preah Bath	11.6 %

6 ANTICIPATED IMPACTS AND MITIGATION MEASURES

6.1 Project Environmental Benefits

170. The Subproject is anticipated to have significant localized environmental benefits as practically all wastewater from the inner city of Stung Treng City will be collected in a separate system and treated in a wastewater treatment plant thereby improving the urban sanitation and reducing water pollution in the Mekong River and the Sekong River.

171. The Subproject will improve drainage in Stung Treng City thereby reducing the risk of flooding and thus the risk of harm and damages, loss of assets and income. Overall, the combined effect to flood mitigation and separation of wastewater from stormwater will increase the health and safety of the residents in Stung Treng City.

172. Naturally, to sustain these benefits, proper operation and maintenance of the services and facilities are required.

6.2 Environmental Impact Screening

173. This chapter screens the potential impacts linked to project activities according to the following factors and recommends mitigating activities on this basis:

- a) “Receptor”: the resource (human/natural environment/economic/social) which is potentially going to receive and have to cope with an impact.
- b) “Sensitivity”: ability to cope with an impact and/or its importance to Cambodia. It is generally accepted that human health is always a high sensitivity receptor, however in terms of environmental/natural resources, the sensitivity varies according to the receptor e.g. scrubland with no significant biodiversity is considered less sensitive than a water body which supports ecosystems and livelihoods through fishing.
- c) “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 and long term (e.g. the pollution of surface and ground water quality).

174. Where an impact may occur, if there is no receptor to potentially 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, physical and ecological resources /flora or fauna.

175. **Table 20** summarizes the potential impacts associate with the proposed WWTP and drainage project during construction and operation.

Table 20: Screening of Impacts

Impact	Source	Receptors
Construction		
Degradation of Air Quality	<ul style="list-style-type: none"> - Exhaust fumes from construction machinery and equipment, movement of haulage trucks - Fugitive dust from earth works, loading, unloading and haulage of construction materials 	<ul style="list-style-type: none"> - Nearby residents - Workers
Noise and vibration nuisance	<ul style="list-style-type: none"> - Noise from construction equipment - Earthworks 	<ul style="list-style-type: none"> - Nearby residents - Workers
Impacts on water quality	<ul style="list-style-type: none"> - Discharge of contaminated runoff (suspended material, oil spills) - Accidental spills - Waste littering 	<ul style="list-style-type: none"> - Local streams - Groundwater
Erosion or degradation of soil and land	<ul style="list-style-type: none"> - Earthworks - Accidental spills/ poor management of waste 	<ul style="list-style-type: none"> - WWTP site and its immediate surroundings
Flora and fauna	<ul style="list-style-type: none"> - Removal of street trees for construction of pipelines 	<ul style="list-style-type: none"> - Local communities
Risk of infections	<ul style="list-style-type: none"> - Influx of labour force for the construction work 	<ul style="list-style-type: none"> - Communities - Workers
Reduced accessibility	<ul style="list-style-type: none"> - Excavation works / trenches in public areas - Presence of equipment in public areas 	<ul style="list-style-type: none"> - Communities
Operation		
Impacts on water quality	<ul style="list-style-type: none"> - Non-compliant effluents 	<ul style="list-style-type: none"> - Fauna and flora in recipient stream
Odours	<ul style="list-style-type: none"> - WWTP operations - Treatment of sludge 	<ul style="list-style-type: none"> - WWTP operators - Nearby residents
Health and safety risks	<ul style="list-style-type: none"> - Use of equipment/maintenance of WWTP and networks - Presence of litter and pests in networks - Non-compliant effluents 	<ul style="list-style-type: none"> - Workers - Nearby residents - Communities

6.3 Design and Pre-Construction Phase

176. The purpose of carrying out environmental and social impact assessment is to predict likely significant environmental or social risks and impacts and to ensure that appropriate mitigation measures are planned and designed as part of the project development and ultimately implemented as integral parts of project construction and operation. Ideally, this will prevent harm to people and the environment, reduce the risk of delays and cost overruns and, in addition, for environmental infrastructure projects such as this Subproject, improve the local environment and facilitate socioeconomic progress for the involved communities. To ensure that the impact assessment is constructive and effective and that it will lead to the desired outcomes, the following measures have been developed and will be initiated prior to start of construction:

- a) **Institutional set up and strengthening.** (a) appointment of a Safeguards Focal Point within each PIU (PIU-SFP) (b) appointment of Environmental Safeguards

- Officer in the PMU (PMU-ESO)²⁴; and (c) contracting of international and national Project Management Consultant for Environmental Safeguards (PMC- I/NES). Prior to the start of construction, an environmental capacity building and training program will be delivered by the PIC. The training will focus on ADB's and Cambodia's relevant environmental, health and safety laws, regulations and policies; implementation of the EMP, environmental monitoring, requirements for information disclosure, public consultation and the project GRM. Training will be provided to the PIUs, and contractors.
- b) **Grievance Redress Mechanism.** The GRM is designed to receive, evaluate and facilitate the resolution of residents' concerns, complaints and grievances during the subproject implementation. The Grievance Redress Committee (GRC) covering the Subproject was established on 18 January 2019 and is fully operational. In accordance with the GRM (see Environmental Management Plan), the PIU-SFPs will be responsible for day-to-day monitoring of the GRM and the PMU-ESO will assume overall responsibility for coordinating and reporting on GRM. The PIUs/PMU will issue public notices to inform the public within the project area of influence of the GRM contact information (GRM website address, PIU/PMU address and telephone number, PIU/PMU contact point email address) and local entry points (e.g. contractors and country-system via Grievance Redress Committee).
 - c) **EMP in bidding document.** The EMP related to this IEE will be incorporated in the bid documents and construction contracts to provide basis for Contractors to develop the CEMP.
 - d) **Disclosure and Consultation:** Information disclosure and consultation activities will be continued with affected people and other interested stakeholders, including but not limited to the project implementation schedule, key construction activities (in particular those that result in disturbance or nuisance) GRM and status of compensation (if relevant).
 - e) **Temporary impact agreement.** Temporary Impact Agreements signed for restoring/rebuilding impacted assets or moving shops and stalls shall be signed prior to any works between contractor, households and PIU. The temporary impact agreement shall include provisions for restoring/rebuilding impacted assets or moving shops and stalls between contractor, households, and PIU.
 - f) **Unexploded ordinance.** The EA/PU/PIU will coordinate with the Cambodia Mine Action Centre to undertake UXO clearance in the project area of influence prior to civil works, as deemed necessary. UXO clearance will include surveys and explosive detection, removal, transport and destruction in accordance with the national regulations. During this process warning signs will be erected to warn households and communities. The UXO clearance certificate will be provided to ADB prior to construction.

6.4 Environmental Impact and Mitigation Measures during Construction

6.4.1 Air Quality Impacts

177. Temporary air quality impacts are anticipated during the construction phase of the subproject. The receptors sensitive to air quality are residents, schools, places of worship/historical sites and institutions within the service area and around the proposed WWTP site, particularly downwind of the construction activities.

178. The following sources are likely to contribute to air quality impacts during construction:

²⁴ CAM: Fourth Greater Mekong Subregion Corridor Towns Development Project will fund a full-time ESO position within PMU that can also support this project and TS1 during implementation.

- a) Exhaust fumes from construction equipment and vehicle movement which will lead to minor temporary and localized increases in ambient air concentrations of nitrogen oxides (NOx) and sulphur oxides (SOx);
- b) Fugitive dust from earthworks and breaking of concrete surfaces or rock in trench excavations, stockpiling and loading and unloading of construction materials.

179. Air Quality Mitigation. Mitigation measures to protect sensitive receptors from air quality issues include:

- a) Water will be sprayed frequently at construction sites, material handling areas, unpaved transport routes, borrow pits, excavation areas, where and when fugitive dust is generated.
- b) Trucks carrying dry and loose construction materials such as earth will be covered with tarpaulins or other suitable cover.
- c) Construction equipment will be operated and maintained in accordance with the manufacturer's instructions to reduce engine exhaust emissions.
- d) Residents along roads where excavations are required for wastewater and drainage pipes will be notified well in advance of works starting.
- e) Vehicle speed will be reduced to max 30 km/hour in each inhabited area.
- f) All open burning of construction and demolition waste material and refuse will be prohibited.

6.4.2 Noise Impacts

180. Operation of construction equipment and vehicles at the different construction sites will generate noise emissions. Stationary equipment such as jackhammers, and pavement breakers produce impact-type noises generating impulsive noise (noise of short duration and high intensity) typically repeated over time. Such equipment also generates ground vibrations²⁵. Mobile equipment such as dozers, excavators, rollers and trucks do not generate impulsive noise.

181. A conservative noise calculation²⁶ with one backhoe (80 dB²⁷), one excavator (82 dB), one truck (70 dB) and one bulldozer (90 dB) working at the same time would result in a noise level of 70 dB(A) at a distance of 150 m and 67 dB(A) at a distance of 200 m – not considering barriers, soft ground or any other noise attenuation factors. These noise levels are within the daytime standard for commercial areas (70 dB(A) see also **Annex 1**) but exceed the Cambodian daytime (06:00-18:00) noise standard for residential areas of 60 dB(A).

182. Jurisdictions with a long history of pollution control regulations often have developed noise standards specifically for construction activities. For example, the New Zealand daytime (07:30-18:00) construction noise standard for residential areas is 75 dB(A) LAeq(15min) for work lasting less than 20 weeks and 70 dB(A) LAeq(15min) for work lasting more than 20 weeks²⁸. All things considered including that actual noise levels are often lower than theoretic calculations, the assessment calls for implementation of specific noise mitigation measures. These measures are best developed under the Construction Environmental Management Plan as the specific measures will depend on the construction equipment and methods.

²⁵ Vibrations are usually measured in peak particle velocity (ppv) in units of millimetres per second (mm/s) - the instantaneous maximum velocity reached by the vibrating surface as it oscillates about its normal position

²⁶ Using New Zealand Government Transport Agency's construction noise calculator, <https://www.nzta.govt.nz/>

²⁷ 10 m from the source

²⁸ New Zealand Government Transport Agency, State highway construction and maintenance noise and vibration guide, August 2019

183. With respect to noise nuisances from construction of the wastewater and drainage network, trench excavations for wastewater pipes may at some places require the use of rock breaking equipment generating localized and temporary loud noise emissions including impulsive noise.

184. Noise Mitigation. Potential impacts from noise will be mitigated through the following general measures:

- a) Equipment, machinery and exhaust systems will be regularly serviced and maintained in good working order in accordance with the manufacturer's instructions.
- b) Restrict construction working hours using heavy machinery to daytime between 07:30-18:00 on weekdays.
- c) The contractor shall collaborate with local authorities, school administrations, pagoda managers and affected people to define proper working hours to mitigate the impact of noise (including in streets or near sensitive receptors like hospitals, schools, places of worship).
- d) The contractor shall provide advance warning to the nearby communities on timing of noisy activities and seek suggestions from community members to reduce noise annoyance particularly related to noise sensitive activities at receptors such as periods of worship at pagodas. Public notification of construction operations will incorporate noise considerations and information procedures for handling complaints through the Grievance Redress Mechanism will be disseminated.
- e) Noise monitoring will be undertaken near sensitive receptors (residential areas, hospitals, schools, places of worship) during periods with construction activities.
- f) Noise control options such as silencers and mufflers will be fitted to exhausts, compressors and fans (such as hydraulic excavator, bulldozer, front loader, backhoe and trucks);
- g) The contractor shall provide all construction personnel working in the vicinity of noisy construction activities (defined as those activities generating noise levels greater than 80 dB(A)), or any construction personnel who requests hearing protection, with hearing protection equipment.
- h) Use of mobile noise barriers where noisy activities are taking place.
- i) As part of a traffic management plan, a speed limit of 30 km/hour (or any lower limit determined by local traffic regulations) will be set for trucks and other work machinery when passing through residential areas. Engines will be turned off when not in use.

6.4.3 Water Quality Impacts

185. The construction activities may cause impacts on water quality by runoff from exposed ground and material stockpiles, concrete placement and washing areas, or polluted runoff/spills from fuel storage/refuelling sites.

186. At the WWTP, sediment-laden or otherwise polluted runoff may enter a small stream that connects to the Mekong River; however, standard conventional good practices for runoff management and pollution control can effectively eliminate such risks.

187. Trench excavations for wastewater and drainage pipes will have to be kept dry and will in some sections have to be dewatered due to groundwater infiltration (geotechnical investigations detected groundwater table at shallow depths – see **Section 5.3.2**) and/or inflow of surface runoff. Water in excavations may be polluted with sediments and occasionally small amounts of hydrocarbons from construction equipment. Good construction practises and regular control and monitoring are considered sufficient to effectively mitigate these potential impacts.

188. Water Quality Mitigation. Potential impacts on water quality will be mitigated through the following measures:

- a) Minimize the area of disturbed surfaces and sequence and schedule work to minimize the duration of time that large erodible surfaces are exposed;
- b) Where practicable reuse stormwater for various purposes to reduce the amount of water that would otherwise have to be treated and discharged, and to reduce consumption of water from other sources;
- c) Design and construct non-erodible channels or bunds to prevent runoff from eroding batter faces or entering excavations;
- d) Ensure that runoff is channelled safely over batter slopes and onto stable areas;
- e) Ensure that pump outfalls and outfalls from any temporary treatment do not cause or generate erosion of land, banks or beds;
- f) Pumps for dewatering of trenches or pits should be placed on a gravel base in a sump or inside a large diameter perforated pipe or manhole ring;
- g) Install adequate short-term drainage to collect potentially contaminated runoff or process water and provide settlement ponds with the appropriate design to ensure sufficient time for the particles to settle.
- h) All chemicals and hydrocarbon products used on construction sites will be stored on an impervious surface, under cover, in adequate tanks or containers and within secondary containment. A bund will be provided around any above ground fuel storage tanks with capacity of 110% of the largest single tank. Storage of chemicals or hydrocarbon products shall be at least 50 m from surface water bodies with no direct drainage to surface water.
- i) All maintenance and refuelling of vehicles and machinery must take place in designated areas, within retention bunds (mobile retention bunds if necessary).
- j) Similarly, all wastes, especially hazardous waste shall be collected and stored on an impervious surface, under cover and in adequate tanks or containers and within secondary containment for liquid hazardous waste.
- k) Stockpiles and materials will be stored at least 50 m from surface waters with drainage directed away from the canals or drainage channels and streams or water sources.
- l) No washing or repair of machinery within 50 m from surface waters.
- m) There shall be no disposal of spoil on agriculturally productive land or within 50 m of a water course.
- n) Measures to rehabilitate borrow sites shall be included in the CEMP and will involve contouring of the slopes within each site and replanting sites with native species.
- o) Topsoil present on construction sites will be removed and stockpiled in labelled areas for later use in rehabilitation of the construction sites including borrow sites.
- p) Construction working areas will be clearly demarcated and encroachment onto adjacent areas avoided.
- q) Portable toilets and small wastewater treatment units will be provided on construction sites and construction camps for the workers and canteens. All sanitary facilities should be located at least 50 m from surface water bodies. All workers must be instructed to use these facilities, which shall be kept clean at all times.
- r) Pit latrines and septic tanks should be placed at least 2 m above the groundwater table and must be located at least 50 m from surface water bodies and water wells and in areas of suitable soil profiles.
- s) Monitoring shall be conducted on effluents and on receiving water bodies.

189. Groundwater. Groundwater is not anticipated to be affected by the construction activities. In any case, the surface water protection measures listed above will also protect against groundwater contamination.

6.4.4 Erosion

190. Soil erosion is not anticipated to be a significant problem during the construction phase. The most likely risk of erosion is due to runoff on exposed and unfinished embankment batter surfaces for the primary treatment ponds.

191. There may be a risk of erosion at borrow sites. However, as these sites will be identified and proposed by the contractor the relevant risks and mitigation measures shall be described in the CEMP.

192. **Erosion Mitigation.** Mitigation of potential erosion impacts are included under **Section 6.4.3.**

6.4.5 Flora and Fauna Impacts

193. As noted in **Section 4.4**, the project is designed to cover three communes (sangcats) constituting the main urban area of Stung Treng namely Preah Bat, Srah Ruessei and Stung Treng. These sangcats are partly inside the Sekong River Key Biodiversity Area and the Mekong River from Kratie to the Lao PDR, Key Biodiversity Area (see **Section 5.2.1** and **Section 5.10**). The WWTP site itself is inside the Mekong River from Kratie to the Lao PDR, Key Biodiversity Area. These Key Biodiversity Areas are large areas covering urban, rural and natural environments. In terms of this subproject, the parts of the service area and the WWTP site that are inside the Key Biodiversity Areas, are urban or semi-urban areas. This, on the one hand underscores the importance and benefits of the improved environmental quality that the subproject is designed to deliver, and on the other hand highlights the need for proper pollution prevention and mitigation measures during construction (and operation) of the wastewater treatment and collection system.

194. The WWTP site is covered with secondary shrub and grasses, and with some parts used for cashew farming. The surveys have not identified any fauna or flora biodiversity of conservation value. The conversion of 4.7 ha (out of the 9.75 ha large site) from secondary shrub, grasses and cashew plantation into a lagoon-based wastewater treatment plant, will not have any significant effects on biodiversity.

195. The excavation for wastewater and drainage pipes along city streets may require removal of street trees. As noted in **Section 5.10.1**, street trees are important for the city environment not only as a landscaping and beautification element but very importantly also for reducing runoff, promoting infiltration and improving urban micro-climate creating a pleasant and uplifting ambience. It is therefore important to preserve street trees to the extent practicable.

196. **Flora and Fauna Impact Mitigation.** To minimise the removal of street trees, the contractor shall, before start of construction work, conduct a survey and map out every single tree that the contractor believes must be removed. The PIU and PMC will review the survey results and determine if the removal is unavoidable with the aim of preserving all trees 3 m high or higher to the extent practicable. The contractor shall then prepare a plan for replanting or planting of new trees – preferably within the street right-of-way environment – for approval by the PIU/PMC. Tree planting shall be of native species that will fit into the street environment.

197. The contractor shall obtain permission from the relevant local authorities to remove the trees that cannot be avoided, and the contractor shall record and report on removal of trees 3 m high or higher.

198. Vegetation and habitat losses will be limited to only the land required for the Subproject components.

199. Burning to clear and control vegetation will be prohibited.

200. The use of herbicides to control vegetation will be prohibited.

6.4.6 Borrow Pits and Spoil Disposal

201. The necessary cut and fill for the construction of the Wastewater Treatment Plant may be balanced within the site itself, which means that import/export of large amounts of materials may not be required.

202. The measures identified in this **Section 6.4.6** are applicable in case import or external disposal of materials are necessary.

203. The contractor shall propose borrow pits and spoil disposal sites in the CEMP. Where possible existing borrow pits or spoil disposal sites shall be used. If new sites are needed, the contractor shall obtain approval from the relevant authorities and from PMU/PMC to ensure that sensitive habitats are avoided, and that appropriate mitigation and rehabilitation measures will be implemented.

204. **Table 21** contains key selection criteria which the contractor shall apply for the proposed sites and present the results in the CEMP. The proposed sites shall be clearly marked on topographic maps and site layout drawings in the CEMP and provided with information about the amounts and types of materials to be excavated or disposed.

Table 21: Borrow Pit and Spoil Disposal Site Selection Criteria

Site Selection Criteria	Proposed Site Conditions
Preferably on degraded or lower value land such as grasslands, land devoid of forest or with highly degraded forest cover, or land with poor soil quality	
Not in ecological sensitive area (e.g. Protected Area or Key Biodiversity Area or on land that hosts Threatened (IUCN Red List) plant or animal species	
Not in wetlands, waterways or in riparian zones	
Not in agricultural productive land	
Not in land with spiritual, cultural, historical or archaeological value	
On lower slope land, so that stable landforms can be created. If possible, land with a slope more than 10% shall generally not be used for spoil disposal, where possible	
Not on unstable slopes, where the added weight could trigger mass movement	
Not where groundwater emerges, or a thick organic layer is present	
Above the 0.05 (5%) Annual Exceedance Probability flood line	
Backfilling of excavation voids (for spoil disposal)	

205. **Borrow Pit and Spoil Disposal Site Mitigation Measures.** The contractor is required to implement the following mitigation measures with respect to handling/excavation of borrow materials and disposal of spoils.

206. The contractor shall:

- obtain and document agreement with the landowner;
- ensure minimisation of vegetation and habitat loss and limit land clearance to only the land required for the borrow pit / spoil disposal;
- Set out the site boundaries and ensure that the surrounding land is not disturbed;
- prohibit the use of burning to clear and control vegetation;
- ensure that spoil is disposed of only at the designated disposal sites and that no material is side tipped along roads or down slopes, dumped on private or public land, or dumped in water bodies;

- f) ensure that all necessary disposal site preparation activities are completed prior to the start of the related spoil generation, handling and disposal;
- g) The contractor shall install erosion and sediment controls such as sedimentation ponds, non-erodible channels or bunds at each site and progressively adjust the measures as the landform changes, to minimise on-site erosion and prevent off-site sedimentation;
- h) ensure that only inert waste is disposed of at spoil disposal sites;
- i) ensure that roots and stumps and other vegetation debris are separated from the spoil materials prior to disposal and either mulched on-site for reuse in landscaping or ground stabilization works, left to decompose naturally, or otherwise safely disposed;
- j) conduct routine inspections, not less frequently than once a week, of water pollution, erosion and sediment control measures, and promptly undertake necessary maintenance, repair and upgrading works to ensure that the design capacity is maintained;
- k) undertake inspections within 24 hours of a heavy rainfall event;
- l) undertake progressive rehabilitation of disturbed areas taking into consideration what the final land use will be;
- m) conserve topsoil for later site rehabilitation;
- n) recontour the sites, fill depressions and revegetate the sites to create a final surface that is consistent with the original topography of the area;
- o) design the final landforms and slopes to protect groundwater quality, to prevent surface water ponding, to facilitate revegetation, to convey runoff in a non-erosive manner, and to account for long term settlement;
- p) revegetate the sites in such a way as to establish a diverse, effective, and long-lasting vegetative cover that is capable of self-regeneration without continued dependence on irrigation, soil amendments or fertilizer, and is at least equal in extent of cover to the natural vegetation of the surrounding area;
- q) use appropriate native and non-invasive plant species for re-vegetation and rehabilitation work.

6.4.7 Solid waste management

207. Impacts may arise from waste generated during construction such as inert wastes e.g. spoil, biodegradable wastes e.g. cleared vegetation, and hazardous wastes e.g. oily wastes. Poor waste management can lead to impacts such as wind-blown litter, contamination of water bodies, impacts on health of populations.

208. Potential impacts linked to waste will be mitigated through the following measures:

- a) The contractor shall develop and implement a solid and liquid waste management plan under the CEMP.
- b) The contractor shall aim at reducing waste generation through careful planning of material and equipment use, good maintenance of equipment, and repair.
- c) The contractor shall ensure effective management of materials on site through good housekeeping and work planning;
- d) The contractor shall make clear arrangements for storage and transportation of all hazardous and non-hazardous waste to a duly authorised waste management enterprise (public or private).
- e) The contractor shall segregate recyclables (as a minimum: plastic containers, scrap metal and metal cans, glass containers, cardboard and paper) for collection or purchase by duly authorised recyclers.
- f) No waste will be stored within 20 m of a water body
- g) All solid waste will be stored in containers with lids.
- h) All worksites will be equipped with containers for waste collection

- i) Littering and indiscriminate disposal of waste will be prohibited and strictly controlled.
- j) All open burning of waste will be prohibited.

6.4.8 Community Impacts including Health and Safety

209. Health and safety risks for the communities associated with air, water, noise and vibration emissions from the construction work are addressed under the relevant headings in this chapter. The other main community health and safety risks include:

- k) Risk of traffic accidents due to increased heavy traffic in populated areas;
- l) Risk of accidents including falls into excavations or being struck by moving construction equipment;
- m) Risk of structural damages to buildings/structures near excavations due to undermining;
- n) Risk of transmission of the SARS-CoV-2 virus due to influx of workers and work being performed in populated city areas;
- o) Transmission of sexually transmitted infectious diseases due to influx of workers and location of labour camps close to communities.

210. **Mitigation of Community Health and Safety Risks.** The key community health and safety measures include:

- a) Prior to start of construction work at a particular area, the contractor in cooperation with the PIU will consult with the local authorities and affected residents. Inform them about the upcoming construction work, safety precautions and how to raise concerns or file complaints (GRM);
- b) Prior to excavation work, the contractor shall survey the site and the nearby buildings/structures and assess the risk of damages and the need for precautionary measures;
- c) The contractor shall fence off excavations with secure barriers and guard rails to prevent pedestrians and vehicles falling into them. Barriers and guard rails should be clearly visible and not causing any unnecessary obstruction.
- d) Where children might get onto a site out of hours, the contractor shall take precautions such as backfilling or securely covering excavations.
- e) The contractor shall install traffic signage and fluorescent bollards and warning lights to direct traffic and prevent vehicles driving into the lanes with construction activities.
- f) The contractor in cooperation with the local authorities shall implement traffic management to ensure a smooth traffic and prevent congestion.
- g) The contractor in cooperation with the PIU and the local authorities shall enforce speed limits for construction related traffic to max 30 km/hour within the City;
- h) Mitigation measures towards the risk of SARS-CoV-2 transmission and transmission of sexually transmitted diseases are included under **Section 6.4.10**.

211. **Socio-Economic Impacts (accessibility).** The installation of wastewater and drainage systems will require excavation on parts of the town's road network where businesses and other activities take place. The community in and around these areas will be disrupted by the noise and dust, as described above, and by temporary impaired access (for themselves and their customers) to their properties and business premises. The works will also have temporary impact on pavements/walkways, kerbs, minor secondary structures (signposts, eaves) and may require relocating small businesses for an interim period during construction.

212. Potential socio-economic impacts from road excavations will be mitigated through the following measures:

- a) Implementation of measures identified in Resettlement Action Plan and Social Impact Assessment.
- b) Warning given to residents 4 weeks in advance of any excavations.

- c) Implement traffic management procedures to ensure smooth traffic. Provide traffic signs, control vehicle speeds and be able to warn drivers in advance for any changes to road surface or traffic direction.
- d) Provide adequate and safe pedestrian and vehicular (motorbike) access to enter and exit buildings across any open trenches.
- e) Temporary restoring/rebuilding the impacted assets or relocation of shops and stalls through cooperation, between construction contractor, residents, business owners and the PIU.
- f) Define and adjust suitable working hours in urban areas or at sensitive sites. Open access road for entry and exit for business sites. Remove the unsuitable soil and materials (spoils) from construction sites which are in front of houses and shops.
- g) Restoration or compensation of any damage to properties.
- h) Consideration and management of potential localized flood impacts.

6.4.9 Occupational Health and Safety

213. The main occupational health and safety risks include:

- g) Working in excavations (trenches 1.5 m – 5 m deep, and excavation pits for wet-wells at pump stations). Work in excavations is well-known to be one of the most hazardous construction works with a history of serious injuries and fatalities. Specific hazards include: Cave-in of the trench/excavation pit, falling objects, slips or falls into the trench/pit, water in the excavation, asphyxiation due to lack of oxygen, exposed utility lines (underground and overhead), moving machinery near the edge of the excavation that could cause a collapse.
- h) Working with heavy construction equipment.

214. Mitigation of Occupational Health and Safety Risks. As a general rule, prior to start of any new work, the contractor shall:

- a) prepare a health and safety plan containing site-specific precautions in accordance with relevant occupational health and safety guidelines²⁹
- b) inspect and check the relevant construction equipment to ensure that it meets the applicable mechanical and safety requirements.
- c) Inspect the worksite to ensure that the equipment can be safely mobilized and operated, and that there are no unmitigated risks (typical factors to consider include: proximity and physical condition of nearby structures, soil classification, soft ground, surface and ground water).
- d) Conduct training of workers on work practices, health and safety measures, use of personal protective equipment and emergency response.

215. General occupational health and safety measures include:

- a) Provide fall protection when workers are exposed to unguarded platforms or walkways higher than 2 m.
- b) Guard against danger to persons at work from falling objects (earth, rock or other material) by suitable sloping³⁰, shielding³¹ or shoring³²;

²⁹ For example, guidelines issued by the US Department of Labour, Occupational Safety and Health Administration, <https://www.osha.gov/> or the US National Institute for Occupational Safety and Health, <https://www.cdc.gov/niosh/index.htm>

³⁰ Sloping means a method of protecting employees from cave-ins by excavating to form sides of an excavation that are inclined away from the excavation so as to prevent cave-ins, <https://www.osha.gov/>

³¹ Shield (Shield system) is a structure that is able to withstand the forces imposed on it by a cave-in and thereby protect employees within the structure. Shields can be permanent structures or can be designed to be portable and moved along as work progresses, <https://www.osha.gov/>

- c) Ensure there are safe ways to enter and exit the excavation.
- d) Trenches will have cave-in protection such as sloping, shielding or shoring.
- e) Materials will be kept at least 0.6 m away from the edge of a trench.
- f) Adequate ventilation will be secured at all workplaces so as to maintain an atmosphere fit for respiration.
- g) Excavations will be kept dry.
- h) Provision will be made for safety precautions when using high voltage electric power tools.
- i) The health and safety measures at the worksite will be inspected at least once in every day during which persons are at work there, and after any event likely to have affected the strength or stability of the excavation or the shoring.
- j) Daily toolbox meetings (safety briefings) will be carried out.
- k) An accident record book will be maintained where all major or minor accidents and incidents are recorded with actions taken.
- l) Worker education and awareness events for construction hazards will be given. A construction site safety program will be developed and distributed to workers.
- m) The contractor shall appoint an Environment, Health and Safety Officer who is a qualified engineer. The officer will be responsible for ensuring compliance with applicable Cambodian environmental, health and safety legislation and with relevant IFC Environmental, Health and Safety guidelines.
- n) Adequate first aid equipment will be made available on site.
- o) Training and awareness will be provided to the workers on safety management and HIV-AIDS.
- p) The contractor will set out an Emergency Response Plan in accordance with the requirements outlined in the EMP.

216. All workers and visitors to the worksites will be provided with and shall wear the relevant Personal Protective Equipment. Standard mandatory PPE include:

- a) hard hat
- b) high visibility clothing in yellow or orange material with reflective panels
- c) safety shoes with metal toe cap

Work specific PPE include:

- a) Cut-resistant work gloves
- b) Ear protection (earplugs or muffs) wherever it is not feasible to reduce the noise levels or duration of exposures to those specified in internationally recognized guidelines³³
- c) Safety glasses (rock/surface breaking, piling, crushing/grinding, cutting)
- d) Welding hoods with clear safety glasses under (welding)

6.4.10 Labour Camp Impacts

217. Labour camps can impact on the environment and the local communities if not adequately managed and located. This will include impacts from latrines, waste and health and safety risks for the local communities.

218. The contractor will prepare and implement a Camp management plan (the plan shall be included in the CEMP) which shall include at least:

³² Shoring means a structure such as a metal hydraulic, mechanical or timber shoring system that supports the sides of an excavation and which is designed to prevent cave-ins, <https://www.osha.gov>

³³ Occupational Noise Exposure Revised Criteria 1998, Centers for Disease Control and Prevention, <https://www.cdc.gov/niosh/topics/noise/reducenoiseexposure/regsguidance.html>

- a) Map showing camp lay out, adequate accommodation and sanitation for male and female workers.
- b) Sanitation commodities: toilets, showers (1 per 15 pax min), waste storage areas and adequate containers.
- c) Health and safety equipment, including firefighting equipment.
- d) Labour recruitment procedures with priority to local labour.
- e) Rehabilitation plan for how the camp site will be restored to its original condition after the construction work has been completed.
- f) that causes the COVID-19 disease will be prevented or
- g) Contractor camps will be located away from residential areas, schools and other populated areas. The camps will be fenced, and access will be controlled.

219. The risk of transmission of the SARS-CoV-2 virus will be prevented or minimised by implementation of the relevant measures instructed by the Royal Government of Cambodia, General Department of Labour as well as any updated guidelines of the WHO or ADB. The key measures include:

- a) Conduct risk communication, training, and education for the contractor and the workers on the relevant infection prevention and control practices.
- b) Adopt engineering, organizational and administrative measures, plan work so employees can keep distance from each other and minimise contact.
- c) Provide clear and visible guidelines on how to prevent infection at the construction site and initiatives taken.
- d) Regularly clean and disinfect toilet and bathrooms.
- e) Promote personal hygiene (including hand and respiratory hygiene), make wash basins and sanitizers available.
- f) Screen on entry the temperature of each person entering the work site and record their contact details to facilitate tracking of infected persons should there be a need.
- g) Health surveillance and insurance.
- h) Review and update preventive and control measures as the situation evolves.
- i) Individuals who have been potentially exposed to the virus, or who are exhibiting flu-like symptoms shall immediately to inform their supervisor, stay at home and self-isolate; and contact local health authorities for further direction. Such individuals may not return to work until the proper health authorities have lifted the self-isolation;
- j) All areas on site potentially infected by a confirmed or probable case will be barricaded to keep individuals two meters away until the area has been properly disinfected.

6.5 Environmental Impact and Mitigation Measures during Operation

220. The most important risks to the environment and communities associated with the operation of the WWTP and the wastewater and drainage systems include the risk of non-compliance with applicable effluent standards, and the risk of odour emissions from the WWTP that may affect nearby communities.

221. Overall, these risks are mitigated through application of appropriate and internationally acceptable engineering standards, control and supervision with construction works and use of construction materials, and by ensuring that the plant and the networks will be duly and properly operated and maintained throughout the design life of the subproject.

222. To ensure that the subproject will be duly and properly operated and maintained, operation and maintenance equipment is included in the construction contract and the contractor is required to prepare an operation and maintenance manual and conduct training of the operator. In addition, at the end of the commissioning period, there shall be a six (6)

months operations and maintenance period where the contractor shall provide an operations and maintenance manager and relevant operations and maintenance staff to operate the WWTP and the wastewater and drainage networks. During this period, the contractor shall provide on-the-job training for operator's employees.

223. Capacity building on operational phase environmental management is outlined in the EMP.

6.5.1 Impacts on Surface Water

224. No significant impacts on surface water are expected during the operation of the WWTP and the wastewater network (including pump stations). The WWTP is designed to deliver water in a quality within the applicable effluent standards (Sub-decree, No. 27 ANRK.BK on Water Pollution Control, MoE, 1999 for public water area and sewer). The treated wastewater will be discharged to a 430 m long small ephemeral stream that without the project would only flow in the rainy season and from there into the Mekong River (see **Figure 6**) which given the huge dilution effect (WWTP discharge < 0.05 m³/s, Mekong River Discharge > 1000 m³/s) will not have any measurable impact on the water quality in the river. The stream itself is not used for any domestic purposes.

225. **Overflow at the pump stations.** The risk of overflow with raw wastewater at the pump stations will be minimized by installation of online alarm systems connected to the operations office at the WWTP. Each pump station will also be equipped with a standby pump in case of malfunction of the duty pump. In case of power outage, the emergency holding capacity in the wet well itself and in the upstream section of the wastewater pipe will provide sufficient time for mobilizing emergency power supply. The main pump station will be equipped with an emergency generator and fuel tank with sufficient fuel for 24-hour operation. The two network pump stations (SPS-1 and SPS-2) will be serviced by an emergency mobile generator with fuel tank stationed at the WWTP to be deployed to the network pump stations in case of power outage. In the unlikely event that these precautions are insufficient to prevent overflow, the raw wastewater will automatically be directed to the stormwater system thus preventing it from flowing onto streets or properties and causing public health risks. In addition, the stormwater pipelines will be constructed with reinforced concrete cover thus further preventing direct exposure to raw wastewater.

226. In summary, the operational phase surface water impact mitigation measures include:

- a) Final design ensures that the applicable effluent standards in Sub-decree, No. 27 ANRK.BK on Water Pollution Control, MoE, 1999 (public water area and sewer) are met.
- b) The design includes appropriately sized sludge drying facilities. Reuse/disposal of dried biosolids will be determined before plant commissioning.
- c) Implementation of an operation and maintenance manual to be developed prior to commissioning which will provide clear methods and procedures for all aspects of the WWTP, sewer and drainage operation, including the following key issues³⁴ (see also **Section 4.6.7**):
 - i. Sludge management including treatment, disposal and emergency situations.
 - ii. Operational water testing and control procedures to timely identify and troubleshoot operational problems.
 - iii. Emergency procedures including schedule for testing and upgrading procedures.

³⁴ The Contractor may refer the applicable WB Group EHS Guidelines for WWTP operation, which are available at: www.ifc.org/ehsguidelines - The <https://www.ifc.org/wps/wcm/connect/0d8cb86a-9120-4e37-98f7-cfb1a941f235/Final%2B-%2BWater%2BAnd%2BSanitation.pdf?MOD=AJPERES&CVID=jkD216C>

- d) A six (6) months operations and maintenance period where the contractor shall provide an operations and maintenance manager and relevant operations and maintenance staff to operate the WWTP and the wastewater and drainage networks.
- e) Effluent water quality monitoring.
- f) Ambient water quality monitoring.
- g) Regularly monitor the wastewater system structures and provide maintenance or corrective actions.
- h) Pump station overflow alarm, standby pumps, and emergency generators.

6.5.2 Noise Impacts

227. No noise impacts are expected during normal operation of the pumping stations, since the stations will be equipped with submersible pumps installed in wet wells approximately 5 m below ground surface. The emergency generator at the main pump station will be equipped with adequate noise attenuating provisions to meet all exterior noise level requirements.

228. The operation of the WWTP does not involve any activities that would generate significant noise emissions.

6.5.3 Groundwater Impacts

229. Groundwater infiltration into the sewers or seepage from the sewers into groundwater will be mitigated to the extent possible by using High Density Poly-Ethylene (HDPE) pipes tightly jointed by fusion welded joints³⁵, and the pump stations will be constructed with water-tight concrete. At the WWTP, all pond sides and bottoms will be equipped with a HDPE liner over well-compacted clay.

6.5.4 Odour Impacts

230. **Odour at the WWTP.** During the operation of the WWTP generation of nuisance odour may occur. The most likely sources of odour are the inlet chamber, the anaerobic ponds, the septage receiving facility and the sludge drying beds. For the wastewater, the travel time in the sewers is relatively short and septic conditions which would generate foul odour are therefore not likely to be present in the inlet chamber. Odour nuisance from anaerobic ponds is typically due to hydrogen sulphide, however, anaerobic ponds usually have a floating cover of scum that reduces emission of odours. In addition, odour problems (hydrogen sulphide) are not likely to occur with sulphate concentrations in the raw wastewater less than 500 mg/L³⁶, and considering that typical sulphate concentrations in domestic wastewater is less than 100 mg/L, nuisance odours from the anaerobic ponds are not likely.

231. The septage receiving facility is the most likely source of odour problems at the WWTP. Septage has an offensive odour, and the discharge of septage from the vacuum trucks into the septage chamber can release odours. To minimise odour problems, the septage will be discharged directly into a fully covered chamber thus reducing the exposure of the septage to the atmosphere. Proper operation and maintenance of the facility will further reduce generation of odours from handling of septage.

232. Due to the proximity to housing, occasional odour nuisances cannot be ruled out, and implementation of additional mitigation measures may be necessary.

233. **Odour at the pump stations.** The pump stations will be located in the urban area. SPS-1 will be next to a kindergarten, and at the MPS housing/businesses are located 25 m

³⁵ Fusion welding is a process that uses heat to join or fuse two or more materials by heating them to melting point.

³⁶ IRC International Water and Sanitation Centre, 2004, Waste Stabilisation Ponds
https://www.pseau.org/outils/ouvrages/irc_university_of_leeds_waste_stabilization_ponds_2004.pdf

from the station. At SPS-2, the nearest housing is 45 m from station. With proper operation and maintenance including hosing the wet wells to remove settled solids and considering that the cycle time of the pumps is less than 15 minutes, septic conditions are not likely to develop at the pumping stations. Nevertheless, the frequency and duration of odorous events will be closely monitored, and the stations will be made ready for installation of odour control measures in the future should this be warranted.

234. Mitigation measures to minimise nuisance odour will include:

- a) Regular monitoring and maintenance of the WWTP, pipelines, and pump stations.
- b) Quarterly meetings between operator and DPWT with residents and / or their representatives to identify odour or nuisance issues;
- c) Movement of any sludge materials off site on days of low wind speed;
- d) Provide tree plantings (tree screen) around the WWTP site to reduce propagation of odours;
- e) The sludge loading trucks shall be covered;
- f) Conduct air quality monitoring inside and near the WWTP. The air quality shall comply with national standards of Sub-decree on Air Pollution and Noise Disturbance 2000;
- g) If odour monitoring indicates nuisance odour from the anaerobic ponds, then it will be considered to install a simple diffuser at the anaerobic pond area to spray a nicer smell that will eliminate the bad odour. Also, to reduce odour, it will be considered to install additional floating rafts with floating long rooted plants in the anaerobic pond.
- h) Ventilation - to avoid septic conditions and generation of toxic gases in the pump stations' wet wells, a venting system will be installed to provide air circulation. If necessary, ventilation stacks with odour filter treatment (carbon filters, biofilter) will be added.
- i) Use quick-disconnect fittings between pumper truck and receiving station to minimize exposure of septage to the atmosphere.
- j) Wash-down facilities to clean up any spills, with drainage into the holding tank.
- k) Avoid free fall of septage by extending receiving pipes below the water surface.
- l) Introduce septage at slow controlled rates to avoid turbulence or agitation.
- m) Ventilate the air from the tank to an odour biofilter.
- n) Clean tanks, trucks and equipment daily.

6.5.5 Disposal of sludge from the WWTP

235. The wastewater treatment plant is designed with anaerobic lagoons to treat wastewater delivered from the sewer lines. Based on the conceptual plan of the wastewater treatment plant, sludge will have to be removed roughly every three years. Stabilized sludge from anaerobic treatment is largely inert, can be dried and landfilled or spread on agricultural land. The first batch of removed sludge (after the first three years of operation) will be analysed to check quality/pollution content (this include bacterial load, but also metals and other chemical compounds) before these are applied to agricultural land. If the results show consistent absence of contamination and comply with applicable standards (Cambodian or FAO) for agricultural use, only then can this be applied to agricultural land, otherwise, sludge will be dried and landfilled.

6.5.6 Occupational Health and Safety

236. The main occupational health and safety issues during operations include³⁷:

³⁷ CUPE BC, Wastewater Treatment Plant Occupational Health and Safety Bulletin. <https://www.cupe.bc.ca/>

- a) Exposure to biological agents such as bacteria, protozoa, viruses, helminths and fungi. The main routes of exposure are hand-to-mouth contact. Inhalation of a suspension of particles (aerosols) is a less common means of exposure but may occur whenever wastewater is agitated or aerosolized. This may occur near wastewater inlets, septage receiving chamber, at the sludge pond and when hosing down wet wells, pipes and tanks.
- b) Asphyxiation due to lack of oxygen when working in confined spaces.
- c) Explosion risks (methane, hydrogen sulphide) or risk of exposure to toxic gases such as carbon monoxide and hydrogen sulphide when working in confined spaces.
- d) Risk of slips, trips and falls on wet floors;
- e) Risk of falls into treatment ponds or wetlands.

237. The basic occupational health and safety measures include:

- a) Preparation and implementation of a health and safety plan containing: (1) procedures to eliminate or minimize the risk of exposure to biological agents, (2) personal hygiene practices, (3) instructions in proper use of personal protective equipment, (4) emergency procedures.
- b) Conduct regular education of workers/staff on the health and safety plan.
- c) Conduct safety training sessions at the beginning of each shift.
- d) Avoid direct contact with sewage.
- e) Avoid aerosolizing wastewater or minimizing exposure time in areas where aerosolizing is occurring.
- f) Provide first aid services, supplies and equipment.
- g) Undertake regular health checks of workers/staff.
- h) Use appropriate protective clothing at work (coveralls) and personal protective equipment (safety boots, gloves, plastic face shields, lifejacket) and, where required wearing respiratory protective equipment.

238. Risk of transmission of SARS-CoV-2 virus to workers and in the community will be mitigated through the following measures (note that as of writing this report, the risk of SARS-CoV-2 transmission 2-3 years from now is unpredictable):

- a) Plan and execute work in compliance with the most recent country-specific COVID-19 risk management regulations and directives including directions of the General Department of Labour.
- b) Conduct workplace risk assessment to identify low, medium or high exposure risk to the virus. Prepare an action plan for prevention and mitigation of SARS-CoV-2 transmission.
- c) Conduct training and education of workers in infection prevention and control practices.
- d) Provide clear and visible guidelines on how to prevent infection at the construction site.

6.5.7 Community Health and Safety Risks

239. Community health and safety risks associated with odour nuisances and impacts on surface water are addressed above under the respective sections.

240. As mentioned in **para 225**, the risk to public health from exposure to overflowing raw wastewater is negligible.

241. To prevent unauthorized access to the WWTP, an access gate and a perimeter fence will be erected around the WWTP site.

242. The risk of SARS-CoV-2 transmission is addressed above under **Section 6.5.6**.

7 ANALYSIS OF ALTERNATIVES

7.1 No Project Alternative

243. The rationale for the subproject is presented in **Section 4.1**. The reason for assessing project alternatives is to ensure that the chosen project is the project that fulfils the project objectives and needs with the least environmental and social impacts.

244. There is no reticulated wastewater collection and treatment system in Stung Treng and private septage collection and disposal operations are unregulated. Wastewater treatment is limited to septic tanks in the more modern houses, hotels and restaurants. Most of the households use an unsealed soakaway pit which do not allow for any significant treatment. Septage is typically being sold as fertilizer and discharged directly to agricultural land without treatment. Inadequate management of sewage/wastewater discharge can cause surface water and groundwater pollution, resulting in the spread of disease and destruction of aquatic life. During flooding, there is a risk of human contact with raw sewage.

245. The 'do nothing' alternative, combined with an increasing urban growth and urban pressure, would lead to an increasingly lower urban environmental quality for the residents of Stung Treng City.

7.2 Wastewater Treatment Design and Technology Alternatives

246. Alternative technological options were considered for wastewater treatment and are described in detail in the Feasibility Study Report - Engineering Designs; a summary is provided here.

247. The assessment of the most appropriate technology was conducted based on the following factors:

- Physical location, such as land availability and topography;
- Cost, including cost of construction and operation;
- Environmental performance, including impact on receiving water of effluent and obtainable effluent standards; and
- Technical capacity, operator experience within Cambodia.

248. Alternative options considered for the WWTP technology and sludge management included:

- **Waste Stabilization Ponds** treatment technology was selected for the WWTP. There is good practical experience with this technology in Cambodia. The Waste Stabilization Pond technique was chosen because compared with other technologies, it provides a high level of treatment, has lower construction costs, and has the lowest operating costs. Looking at site and soil condition and to fit the ADB allocated budget and shorten the construction period and accelerate the work, the treatment method was modified as summarised here below, however, the overall treatment principles remain the same as a conventional Waste Stabilization Pond system.

249. Options for sludge management included:

- A sludge stabilization and drying pond for stabilization, treatment and drying of sludge taken from the anaerobic lagoon.
- A sludge drying reed bed with an autochthonous macrophytes planted bed used for drying sludge taken from the anaerobic lagoon.
- A Small Anaerobic Lagoon used for septage primary treatment similar to Option 1 for sludge stabilization, without the under-drains component of Option 1 Pond.

250. The sludge stabilization and drying pond was selected because it provides effective, low-cost treatment and dewatering of sludge. It is similar to option 3, small anaerobic lagoon, but also provides dewatering. The septage receiving station will be installed with chamber and coarse screening, ahead of the automatic fine screen, with screened sewage flow then transferred to the anaerobic ponds for further treatment as part of the WWTP waste stream.

251. Combined versus separate sewer system. Separate systems offer greater pollution control than combined systems. Separate systems convey all the wastewater to the treatment plant, while in combined systems, during high rainfall periods, overflows allow all pollutants to be discharged to the water bodies.

252. Under the urban sanitation policy of the Cambodia National Guidelines on Water Supply and Sanitation (2003) Item 4 states “The use of separate sewerage and drainage systems should be promoted and encouraged particularly in new installation areas”. Consistent with the national policy, the design of a separate sewage system will be developed in the central key areas of the sub-project cities.

253. A separate system was selected as it environmentally more appropriate: it negates the need for treatment of storm water flow and therefore lowers the associated energy and carbon costs. In addition, the enhanced level of control over sewage contaminated wastewater offered by a separate system is preferred.

8 INFORMATION DISCLOSURE AND PUBLIC CONSULTATIONS

8.1 Public Consultations during Project Preparation

254. During Project Preparation, meetings were held with stakeholders to obtain views and opinions on the subproject, which were then taken into consideration in the design of the subproject.

255. During the preparation of the common IEE and EMP for the CT-4 subprojects in 2017/2018, consultations for the Stung Treng Wastewater and Drainage Subproject were carried out on 04, 07 and 08 August 2017, involving focus group discussions with representatives of communities, village chiefs/deputy village chiefs, commune chiefs/deputy commune chiefs and commune council members of Stung Treng, Preah Bat, Srach Russei sangkats. An outline of the focus group consultations held in Stung Treng is provided in **Table 22**. The details of these consultations are not repeated here but are available in the disclosed IEE for the CDIA phase. In general, the consultations found that the subproject is welcomed due to its positive benefits, however concerns were raised regarding the environmental and social impacts arising primarily from construction.

Table 22: Focus Group Consultations in 2017

Commune	Design Response
<ul style="list-style-type: none"> Flood from runoff is a problem in Stung Treng commune during the rainy season because of lack of drainage. Some culverts/drainage are too old and are damaged. Mothers worry about sending children to school, diseases, and sometimes babies drown in flood waters. Agricultural products, poultry and livestock are also negatively affected. Men worry about their daily livelihood because flooding destroys infrastructure. All the wastewater is discharged to Mekong River without treatment. Flood affects road structures, fruit trees/vegetables, and education (school time is delayed) and local business activities. 	<ul style="list-style-type: none"> The subproject design includes improvements to the drainage system that will reduce flood problems in the inner city. Wastewater from the city will be collected and treated thereby reducing the impacts on surface water quality and the risks to public health.

Commune	Design Response
<ul style="list-style-type: none"> The participants said that the improvement of the drainage system including the WWTP are important for the environment, Mekong River and for community health. The participants are not concerned too much about the impacts from project construction activities on natural and social environment The participants added that noise and air pollution during construction are temporary and are no big issues. 	

256. As part of the preparation of the IESIA and in conjunction with the preparation of this IEE and the Detailed Engineering Design, further consultations and site visits were undertaken. On 27 July 2020, a consultation meeting was held at Stung Treng Provincial Hall. The key comments from the meeting are summarised in **Table 23**, and the minutes of meeting is attached in **Annex 3**. The meeting was chaired by the Provincial Governor and included representatives from the following organisations:

- Provincial Department of Public Works and Transport
- Provincial Department of Environment
- Provincial Department of Water Resources and Meteorology
- Provincial Department of Culture and Fine Art
- Provincial Department of Rural Development
- Provincial Department of Land Management, Urban Planning and Construction
- Provincial Department of Planning
- Provincial Department of Agriculture, Forest, and Fishery
- Provincial Department of Health
- Provincial Department of Tourist

Table 23 Summary of IEE and Detailed Engineering Design Stage Consultations

Stakeholder	Key Comments	Design Response
Provincial Governor	<ul style="list-style-type: none"> The Provincial Hall supports this subproject. Stung Treng town floods all most every year and some town areas have no drainage and sewage system. This project will control and mitigate the flood in Stung Treng town and the wastewater from the town (houses and business areas) will be treated before being discharged to the river, so the water pollution will be managed or mitigated. The project should extend or cover all areas of the town (whole town), because almost every year the drainage-sewage system is damaged. 	<ul style="list-style-type: none"> The project is designed to cover the main urban areas of the City and will address the main flood problems in the inner city. The design life is 20 years until 2040, however, the detailed design has incorporated planning aspects for future extensions to the sewerage system and the wastewater treatment plant
Stung Treng City Authority	<ul style="list-style-type: none"> we strongly support this project, and we will collaborate and coordinate with the project If possible, the project should be extended to all village areas in Stung Treng town. The impacts of the project on properties/structures and utilities are in the RoW and minor, because most subproject areas are located on the public land. If there are some impact to structures the IRC/GDR will provide the compensation. There are no sensitive issues during construction of the WWTP, because the site is outside village area. But after construction, the project should provide tree planting around the WWTP site to reduce odour from the WWTP. Provide technical measures to mitigate the odour and to ensure proper wastewater treatment during operation of WWTP. 	<ul style="list-style-type: none"> The design life is 20 years until 2040, however, the detailed design has incorporated planning aspects for future extensions to the sewerage system and the wastewater treatment plant. Impacts on structures and properties will be carefully studied and registered as part of the social safeguards. The design and the treatment technology include measures to minimize odour problems. Odour will be monitored during operations
Provincial Department of	<ul style="list-style-type: none"> We support this project at all stages, because PDPWT is the project owner and the 	<ul style="list-style-type: none"> The number of pump stations has been determined based on

Stakeholder	Key Comments	Design Response
Public Works and Transport	Implementation Agency (PIU), - The project should study if it can reduce the number of pump stations.	engineering calculations and topographic surveys
Provincial Department of Environment	- We support this subproject 100% - During project construction there are no major issues. But during project operation, the environmental impacts from discharge of wastewater from the WWTP, odour (air quality) should be considered including monitoring schedule. - The project owner should conduct regular environmental quality monitoring: water quality monitoring, effluent monitoring, and air quality.	- Regular environmental quality monitoring has been incorporated in the environmental management plan
Provincial Department of Water Resources and Meteorology	- The project area of drainage and sewage system should be extended to all commune areas in Stung Treng town. - Will the business owners and houses be connected to the sewage pipes? is it free?	- Businesses and households will be connected to the wastewater collection system
Provincial Department of Culture and Fine Art	- We are happy and support this project because we have problems with flooding and wastewater in our town. - There are no cultural resources in the subproject areas.	- Chance find procedures are included in the EMP
Provincial Department of Rural Development	- We support this project - At the WWTP site, some land is private land and have land titles. The project owner and GDR please negotiate with landowners to buy this land as soon as possible, because the land price is increasing day by day. - The project management and project owner should provide information about the project and collaborate with local authorities and relevant institutions to resolve or avoid affecting any structures and properties located in the ROW.	- Impacts on structures and properties will be carefully studied and registered as part of the social safeguards. -
Provincial Department of Planning	- Provide traffic signs, safety signs on the construction sites - Negotiate and resolve the any impacts on social resources during construction.	- Traffic safety and management is required under the EMP and will also be included in the CEMP
Provincial Department of Agriculture, Forest, and Fishery	- More impacts will occur during project operation and maintenance stage. - Can we use sludge from WWTP for agricultural crops (fertilizer)?	- The use of sludge will be checked during the operation. It may be possible.
Provincial Waterworks Authority	- We support this project. It is an important project for Stung Treng town. - No major issues during the construction stage. - During operations, environmental and social receptors around WWTP site may be affected. - The sludge for WWTP, where will it be stored and managed? - If the sludge is toxic, how will it be managed?	- The project is designed with a sludge stabilization and dewatering pond. Dewatering will take place every three years. - The use of sludge will be checked during the operation. It may be possible.
Provincial Hall, Mine Action Unite	- The project should collaborate with the Provincial Mine Action Unit for mine clearing of the subproject areas	- Collaboration with the Mine Action Unit is required under the EMP
Provincial Department of Police	- The contractors' and staff must be aware of the road traffic regulations and other social laws. - All transportation vehicles or trucks should have the relevant permits. - The truck transport of materials shall be done safely, especially when the trucks pass urban areas and sensitive areas.	- Training and awareness of the contractor's staff are required under the EMP
Provincial Department of	- Some tourist sites are located along the Mekong River and good water quality is important for	- The design and the treatment technology include measures to

Stakeholder	Key Comments	Design Response
Tourism	tourism. - We agree with some comments made by other participants concerning protection or mitigation of odour from the WWTP and on the quality of wastewater discharged from the WWTP into the river.	minimize odour problems. - Odour will be monitored during operations - The project is designed to comply with the relevant effluent standards
Provincial Department of Health	- This subproject is good for environmental quality and public health. - The impacts from project construction are not a big issue, but the construction should be finished on time. - The impacts from project operations may occur. So the ADB and the project owner should prepare a plan and budget to manage and mitigate these impacts	-

257. A combined site visit and consultation meeting was carried out on 08 and 09 October 2020 with participants from MoE Review Team, the Provincial Department of Public Works and Transport, Provincial Department of Environment, Stung Treng City and commune authorities, PMC, and PPIC Team. Meeting notes are attached in **Annex 2**.

258. The participants at the meeting expressed their support to the project and their readiness to collaborate with the planned improvements to the wastewater and drainage systems. The meeting concluded that the project owner and the contractor should provide best methods for mitigation the negative impacts on social receptors, and the operation of the project shall comply with design standards and provide mitigation measures for impacts on environmental quality and social receptors.

8.2 Public Consultations during Project Implementation

259. In addition to consultations undertaken during preparation of the subproject, consultations will take place during implementation. The PIU Safeguard Focal Point (PIU-SFP) will undertake consultations following the finalization of the detailed design, and will conduct consultations within 4-6 weeks of construction starting and then again every 3 months until the end of construction. This is set out in the Environmental Monitoring Plan.

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

- Environmental impacts of civil works (e.g., solid & liquid waste, erosion, local flooding, pollution);
- Any unforeseen impacts caused accidentally e.g. through spillages;
- Civil nuisance (e.g., noise, dust, disrupted business activities & farming activity, social issues, community health and safety);
- Impaired use of access roads to disposal sites for sludge and wastes from STP (e.g. traffic issues, odour, dust and access); and
- GRM and its procedures including details of persons to contact and contact details.

261. In summary, informal 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. A sample Environmental Monitoring Interview Form is provided in the EMP.

8.3 Consultation during Operation

262. The WWTP operator, in collaboration with MPWT/PDPWT, MoE/PDoE, MOWRAM/PDOWRAM, MAFF/PDAFF, Provincial and Town Authorities, and other concerned agencies will undertake quarterly consultations with local residents to discuss any

operational impacts or concerns of operation and implement corrective actions as may be necessary.

8.4 Information Disclosure

263. Environmental information on the project, including the IEE and other safeguard information will be disclosed in accordance with ADB's Public Communications Policy (2011) and ADB's SPS (2009). This includes:

- a) The EMP will be translated into Khmer and be available for review at PDPWT offices;
- b) The IEE will be disclosed on ADB's project website (www.adb.org);
- c) Copies of the IEE should be available upon request; and
- d) Semi-annual or quarterly environmental reports on project's compliance with the Environmental Management Plan (EMP) and other necessary information will be available at www.adb.org.

9 GRIEVANCE REDRESS MECHANISM

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

265. The Access Points to the GRM are critical for ensuring it is useable for affected people (APs). The GRM Access points for this project, as set out in this GRM Mechanism will be:

- The Contractors
- District and Commune Councils
- The PIU office
- The Provincial Department of Public Works and Transport (PDWT)
- MPWT/PMU, and project consultant.

266. Full details of the GRM, its access points, and responsible parties are found in the EMP.

10 ENVIRONMENTAL MANAGEMENT PLAN

267. The EMP has been prepared as a standalone document (latest updated version of October 2021). 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 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.

268. The overall responsibility for EMP implementation and compliance with loan assurances lies with the Executing Agency, the Ministry of Public Works and Transport (MPWT). The Executing Agency has established a Project Steering Committee (PSC) and a Project Management Unit (PMU) based in Phnom Penh, responsible for general project implementation. The Implementing Agency is the Provincial Department of Public Works and Transport (PDPWT) of Stung Treng Province. The PDPWT has established a Project Implementation Unit comprising relevant provincial government representatives including the Provincial Department of Environment.

269. A summary of the key functions for project implementation and therefore environmental safeguards is presented in **Table 24**.³⁸

Table 24: Key Roles for Project Implementation

Role	Abbreviation	Location	Summary of overall function
Ministry of Public Works and Transport	MPWT	Phnom Penh	Accountable towards the Royal Government of Cambodia and ADB for the implementation of the Subproject and for ensuring compliance with loan covenants
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	EMP compliance across the sub-projects for environmental and social safeguards
Provincial Department of Public Works and Transport	PDPWT	Stung Treng Province	Subproject implementing agency. Approve budgets for the PIU and ensure coordination with provincial departments
Project Implementation Unit	PIU	Within Stung Treng PDPWT	Responsible for sub-project implementation
PIU Safeguards Focal Point	PIU-SFP	Provinces within PIU	Responsible for sub-project environmental and social safeguard monitoring
Contractor's Environment, Health & Safety Officer	C-EHS	Construction Site	Ensuring compliance with applicable Cambodian environmental, health and safety legislation and with relevant IFC Environmental, Health and Safety guidelines
Project Management Consultant	PMC	Phnom Penh	Project final design and implementation, support and capacity development
International and National Environment Specialists	PMC-I/NES	Phnom Penh within PMC team	Environmental safeguards and reporting support during design and implementation
Asian Development Bank	ADB	-	Review project progress, compliance with covenants and advise on corrective

³⁸ For further information see the Project Administration Manual, Kingdom of Cambodia: Fourth Greater Mekong Subregion Corridor Towns Development Project, Project Number: 50099-003, July 2018

Role	Abbreviation	Location	Summary of overall function
			actions.
Ministry of Environment (MOE)/ Provincial Department of Environment (PDoE)	MoE/PDoE	Phnom Penh	Responsible for environmental protection and natural resources conservation. Collaborate with the project to provide policies, environmental standards and advise. Review and approve EIA/IESIA reports. Conduct environmental compliance monitoring of the project

11 CONCLUSIONS AND RECOMMENDATIONS

11.1 Conclusions

270. This IEE was prepared to identify the environmental issues and risks associated with the proposed wastewater treatment and drainage project in Stung Treng City. The assessment confirms that the project is classified as Category B for environment and the anticipated effective implementation of the EMP combined with application of good construction practices and proper operation and maintenance of the facilities will prevent or minimise all the identified significant environmental impacts of the project to an acceptable level.

271. The key parties for mitigation and monitoring measure implementation are the construction contractors and the operators. The implementation of the EMP will be closely monitored and reported on by the units established under the Ministry of Public Works and Transport.

272. During construction, the most significant impacts will be linked to disturbance of communities when excavating and laying pipes in urban areas and in connection with the construction of the primary treatment facilities for the WWTP. Important disturbances include noise, access to homes and businesses and traffic congestion.

273. During operations the most significant environmental risks are associated with poor facility operation and maintenance, which may cause release of non-complying effluents, and nuisances due to exposure to odours. The subproject will significantly reduce the pollution load on receiving water bodies and improve the urban environmental quality by separate collection of wastewater and mitigation of flood risks in the inner city.

274. The subproject includes a comprehensive training and capacity building component which is essential for ensuring that the investment is both financially and environmentally sustainable and beneficial.

275. A robust Grievance Redress Mechanism has been established on 18 January 2019 as outlined in the IEE and the EMP to receive and facilitate resolution of affected peoples' concerns and grievances about social or environmental impacts associated with the subproject. The GRM will address such concerns and complaints promptly, using a transparent process that is readily accessible to all affected persons. The GRM contains multiple entry points to allow affected people to approach the Contractor, PIU, their local leaders, the Ministry of Public Works and Transport or ADB. The mechanism will ensure that all unplanned impacts which cause grievances for affected people are managed and a satisfactory outcome brought about swiftly.

276. Overall, the project is anticipated to bring environmental benefits to Stung Treng City and its inhabitants and visitors. It will serve to improve wastewater management, reduce

pollution impacts and will provide long term environmental improvements and public health benefits.

11.2 Recommendations

277. During both construction and operation, it is important to continue informing and consulting with the local communities and affected people about the progress of work and any changes or unusual situations; and to receive feedback and recommendations that may help to alleviate nuisances and improve the performance of the systems.

278. The selected construction contractor shall prepare an environmental management plan (the Construction Environmental Management Plan, CEMP). The CEMP shall be based on the EMP, but with more detailed descriptions of the measures to be implemented by the Contractor. The CEMP shall contain a number of subplans dealing with specific topics, such as noise management plan, spoil and borrow site management, solid and liquid waste management, community and occupational health and safety, emergency response, COVID-19 prevention and response plan, and Construction workers camp management (if required). The Contractor is required to obtain approval of the CEMP from the PMU before starting any construction works.

279. For the operational phase of the subproject, it is crucial that the Operation and Maintenance Manual provides clear methods and procedures for all aspects of the WWTP and pump station operation including management and monitoring of treated effluents and sludge, occupational health and safety, and performance monitoring and control.

Annex 1: Environmental Quality Standards

(1) Ambient Air Quality Standards

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

Parameter	Averaging Period	Standard	
		Unit	Value
Nitrogen Dioxide (NO ₂)	24 hours	mg/m ³	0.1
Sulfur Dioxide (SO ₂)	24 hours	mg/m ³	0.3
Carbon Monoxide (CO)	24 hours	mg/m ³	20
PM 2.5 WHO Ambient Air Quality Guidelines (2005)	24 hours	µg/m ³	25
PM 10 WHO Ambient Air Quality Guidelines (2005)	24 hours	µg/m ³	50

(2) Ambient Noise Standards

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

Area	06:00-18:00 dB(A)	18:00-22:00 dB(A)	22:00-06:00 dB(A)
Quiet area (hospital, school)	45	40	35
Residential area	60	50	45
Commercial area	70	65	50
Area with factories mixed with housing	75	70	50

(3) Surface Water Quality Standard

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

Annex 2 of Sub-decree on Water Pollution Control

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

No	Parameters	Unit	Allowable limits for pollutant substance discharging to	
			Protected public water area	Public water area and sewer
1	Temperature	°C	< 45	< 45
2	pH		6 – 9	5 - 9
3	BOD ₅ (5 days at 20 °C)	mg/l	< 30	< 80
4	COD	mg/l	< 50	< 100
5	Total Suspended Solids	mg/l	< 60	< 120
6	Total Dissolved Solids	mg/l	< 1000	< 2000
7	Grease and Oil	mg/l	< 5.0	< 15
8	Detergents	mg/l	< 5.0	< 15
9	Phenols	mg/l	< 0.1	< 1.2

No	Parameters	Unit	Allowable limits for pollutant substance discharging to	
			Protected public water area	Public water area and sewer
10	Nitrate (NO ₃)	mg/l	< 10	< 20
11	Chlorine (free)	mg/l	< 1.0	< 2.0
12	Chloride (ion)	mg/l	< 500	< 700
13	Sulphate (as SO ₄)	mg/l	< 300	< 500
14	Sulphide (as Sulphur)	mg/l	< 0.2	< 1.0
15	Phosphate (PO ₄)	mg/l	< 3.0	< 6.0
16	Cyanide (CN)	mg/l	< 0.2	< 1.5
17	Barium (Ba)	mg/l	< 4.0	< 7.0
18	Arsenic (As)	mg/l	< 0.10	< 1.0
19	Tin (Sn)	mg/l	< 2.0	< 8.0
20	Iron (Fe)	mg/l	< 1.0	< 20
21	Boron (B)	mg/l	< 1.0	< 5.0
22	Manganese (Mn)	mg/l	< 1.0	< 5.0
23	Cadmium (Cd)	mg/l	< 0.1	< 0.5
24	Chromium (Cr+3)	mg/l	< 0.2	< 1.0
25	Chromium (Cr+6)	mg/l	< 0.05	< 0.5
26	Copper (Cu)	mg/l	< 0.2	< 1.0
27	Lead (Pb)	mg/l	< 0.1	< 1.0
28	Mercury (Hg)	mg/l	< 0.002	< 0.05
29	Nickel (Ni)	mg/l	< 0.2	< 1.0
30	Selenium (Se)	mg/l	< 0.05	< 0.5
31	Silver (Ag)	mg/l	< 0.1	< 0.5
32	Zinc (Zn)	mg/l	< 1.0	< 3.0
33	Molybdenum (Mo)	mg/l	< 0.1	< 1.0
34	Ammonia (NH ₃)	mg/l	< 5.0	< 7.0
35	Dissolved Oxygen	mg/l	>2.0	>1.0
36	Polychlorinated Byphenyl	mg/l	<0.003	<0.003
37	Calcium	mg/l	<150	<200
38	Magnesium	mg/l	<150	<200
39	Carbon tetrachloride	mg/l	<3	<3
40	Hexachloro benzene	mg/l	<2	<2
41	DDT	mg/l	<1.3	<1.3

No	Parameters	Unit	Allowable limits for pollutant substance discharging to	
			Protected public water area	Public water area and sewer
42	Endrin	mg/l	<0.01	<0.01
43	Dieldrin	mg/l	<0.01	<0.01
44	Aldrin	mg/l	<0.01	<0.01
45	Isodrin	mg/l	<0.01	<0.01
46	Perchloro ethylene	mg/l	<2.5	<2.5
47	Hexachloro butadiene	mg/l	<3	<3
48	Chloroform	mg/l	<1	<1
49	1,2 Dichloro ethylene	mg/l	<2.5	<2.5
50	Trichloro ethylene	mg/l	<1	<1
51	Trichloro benzene	mg/l	<2	<2
52	Hexachloro cyclohexene	mg/l	<2	<2

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

Annex 4 of Sub-decree on Water Pollution Control

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

Source: Sub-decree No. 27 ANRK.BK on Water Pollution Control, MOE, 1999.

a) River

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

b) Lakes and Reservoirs

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

Annex 5 of Sub-decree on Water Pollution Control:

Water Quality Standard in public water areas for public health protection. Source: Sub-decree No. 27 ANRK.BK on Water Pollution Control, MOE, 1999

No	Parameter	Unit	Standard Value
1	Carbon tetrachloride	µg/l	< 12
2	Hexachloro-benzene	µg/l	< 0.03
3	DDT	µg/l	< 10
4	Endrin	µg/l	< 0.01
5	Dieldrin	µg/l	< 0.01
6	Aldrin	µg/l	< 0.005
7	Isodrin	µg/l	< 0.005
8	Perchloroethylene	µg/l	< 10
9	Hexachlorobutadiene	µg/l	< 0.1
10	Chloroform	µg/l	< 12
11	1,2 Trichloroethylene	µg/l	< 10
12	Trichloroethylene	µg/l	< 10
13	Trichlorobenzene	µg/l	< 0.4
14	Hexachloroethylene	µg/l	< 0.05
15	Benzene	µg/l	< 10
16	Tetrachloroethylene	µg/l	< 10
17	Cadmium	µg/l	< 1
18	Total mercury	µg/l	< 0.5
19	Organic mercury	µg/l	0
20	Lead	µg/l	< 10
21	Chromium, valent 6	µg/l	< 50
22	Arsenic	µg/l	< 10
23	Selenium	µg/l	< 10
24	Polychlorobiohenyl	µg/l	0
25	Cyanide	µg/l	< 0.005

(4) Drinking Water Quality Standard

No	Parameter	Drinking Water Quality Standard	
		Unit	Value
1	pH	-	6.5-8.5
2	Turbidity	NTU	5.0
3	Dissolved Oxygen (DO)	mg/l	NV
4	Total Suspended Solid (TSS)	mg/l	NV
5	Chloride (Cl-)	mg/l	250
6	Nitrate (NO3)	mg/l	50
7	Phosphate (PO4)	mg/l	NV

No	Parameter	Drinking Water Quality Standard	
		Unit	Value
8	Sulphate (SO ₄)	mg/l	250
9	(BOD) ₅	mg/l	NV
10	(COD) Mn	mg/l	NV
11	Aluminum (Al)	mg/l	0.2
12	Arsenic (As)	mg/l	0.05
13	Copper (Cu)	mg/l	1.0
14	Iron (Fe)	mg/l	0.3
15	Lead (Pb)	mg/l	0.01
16	Manganese (Mn)	mg/l	0.1
17	Mercury (Hg)	mg/l	0.001
18	Zinc (Zn)	mg/l	3.0
19	Total Coliform	MPN/100mlml	0

Annex 2: Field Meeting Notes

Stung Treng Wastewater and Drainage Subproject Site Visit

Component	Site visit for WWTP and Drainage system CTD4
Type of Activity	Site visit at Stung Treng City
Subproject	WWTP in Preah Bath commune, Stung Treng District and drainage system in commune areas of Stung Treng City
Start date	08-10-2020
End date	09-10-2020
Planned Activities	MoE team reviewed IESIA report, conducted site visits, and consulted with PIU, provincial and city authorities, and commune and village authorities.
Activities Carried Out	Summary of wastewater and drainage subproject, discussion and received feedbacks, and comments from local authorities
Appendix 1: Participants	
Appendix 2: Pictures	
Noted by	Yim Chamnan, National Environmental Specialist

Consultation Meeting in Stung Treng commune office, Stung Treng Town

On 08 October 2020 at 3:30 pm, in Stung Treng commune office, Stung Treng town, Stung Treng province.

The Participants represent MoE Review Team, PDPWT/PIU, PDoE, provincial, town, commune authorities, PMC, and PPIC Team. The list of attendees is in Appendix 1.

Objectives:

- Brief about the project location, work plan and activities
- Discuss the key environment and social impacts identified in the draft IESIA report
- Receive additional information from local communities or affected people
- Receive feedback (concerned issues, comments, and questions) from the participants
- Analyze the comments and concerns to update the IESIA report.

Discussions:

The proposed consultation: Present the work plan and activities of proposed building the WWTP and drainage system subproject in Stung Treng town to relevant local authorities. Receive concerns or issues from field visits are concerning to sensitive environmental and social receptor are in and near the project area.

On 09 October 2020, the MoE Review Team collaborated with PPIC Team, PIU, town and commune authorities and conducted site visits to the proposed WWTP and drainage sites in Stung Treng City. The key feedback, issues, and comments from consultation meeting are summarized below:

The key concerns, comments, and questions from the participants

- The issues and impacts on existing structures, properties, and others social resources are on the project sites for culverts pipe networks installation
- The Stung Treng provincial, town, and commune authorities support the WWTP and drainage subproject.

- The project area or corridor of impacts or alignment for installation the sewage and drainage culverts in the town.
- The resettlement and compensation process for WWTP site
- The WWTP site is located in Krang Memay village, Preah Bath commune, Stueng Treng town. The proposed site is about 9.75 ha. Some part of the site are private land and some are public land.
- The sewage and drainage system is located in the Stueng Treng town area and project plan to install culverts on the road alignment within the ROW.
- There are a few structures and trees within the ROW. How project plan to do?
- The impacts of project construction are concerned in the town area for installation culverts such as: traffic, business activities, and social safety.
- How to connect the wastewater from households to project sewage system? How will the project support?
- The WWTP site in Stung Treng has been difficult to find. But now the provincial authorities and concerned departments are agreed to select this for WWTP in Krang Memay village, Preah Bath commune.
- The local authorities are working with PMC and PIU to conduct site visits and surveys and we informed to our people of WWTP site in their area.
- Some land sites of WWTP are private land, but the owners agreed to sell for project, now is not yet negotiate with landowners.
- When will the resettlement team conduct survey and compensation? Should be done now?
- Our people are waiting for the negotiation form project resettlement team.
- A few people want to sell their land to other persons, but commune authority does not accept, due project needs this land for WWTP.
- Please inform to local authorities of project areas and schedule for negotiations with local people.
- The impacts of project construction activities are temporary and will affect local structures, utilities services, business, traffic, and public safety.
- The impacts during operation of the WWTP concern wastewater quality after treatment, and odour from WWTP, because a few houses are near the site.

Conclusion

Generally, all the participants for provincial, town and commune authorities support the project and will collaborate with the planned improvement of wastewater and drainage system. During construction of wastewater and drainage systems, the project owner and contractor should provide best methods for mitigation the negative impacts on social receptors. The operation of the project should comply with design standards and provide mitigation measures for impacts on environmental quality and social receptors. Some concerns and comments from this meeting PPIC team will update/revise in IESIA report.

Appendix 1: List of Participants

No	Name	Sex	Institution	Position	Phone
1	Chea Leng	M	IEA Department, MoE	Deputy director	012 249 798
2	Chhrin Narun	M	--	Chief office	086 266 629
3	Yim Sothan	M	--	Chief office	012 494 900
4	Saren Sokhom S.Somaly	F	--	Officer	085 309 222
5	Yim Chamnan	M	PMC (MPWT-ADB)	National Environment	
6	Pich Ramy	M	Stueng Treng Town	Deputy Governor	097 996 0244
7	Seth Kimteng	M	Preah Bath Commune	Commune chief	097 895 163
8	Rey Pheng	M	Sras Russey Commune	Commune chief	031 663 3746
9	Nou Vanna	M	PDPWT/PIU	Chief office	097 899 0204
10	Duong Sam Ol	M	Stueng Treng province	Chief office	097 380 2111
11	Yeth Run	M	PDoe	Deputy director	097 761 8165
12	Chea Vanna	M	Stueng Treng Commune	Commune chief	012 321 108
13	Noy Rach Viseth	M	PDoe	Chief office	089 808 245

No	Name	Sex	Institution	Position	Phone
14	Chhim Seyha	M	PPIC consultant	Group leader	012 312 202

Appendix 2: Pictures



The existing condition of vegetation are on the WWTP site



A few houses are located near (about 0.5 km) the WWTP site



The existing outlet with water-gate for manage the stormwater of town

Annex 3: Consultations During IEE Preparation

WWTP and Drainage System Subproject in Stung Treng Town

Summary of the Consultation Meeting on 27 July 2020

During preparation of the IESIA report for the wastewater and drainage system subproject in Stung Treng City, the Stung Treng PPIC Study Team conducted consultations with provincial authorities, relevant departments, and local authorities. The results of the consultations are summarized below.

Consulted with provincial-town governor, and relevant provincial departments on 27 July 2020 at meeting room of the provincial hall.

This consultation meeting organized by PPIC local consultant team and lead by Mr. Duong Poa Vice Governor of Stung Treng Province.

Provincial Governor

MPWT and MoE approved to PPIC local consultant to conduct the IESIA studies for the WWTP and Drainage System Subproject in Stung Treng City under the Fourth Greater Mekong Subregion Corridor Towns Development Project ADB L3686/G0592/G0593 CAM. Today we have consultation meeting with the city authorities and relevant provincial departments. All participants are encouraged to provide their feedback, comments or questions.

- The Provincial Hall supports this subproject. Stung Treng town floods almost every year and some town areas have no drainage and sewage system.
- This project will control and mitigate the flood in Stung Treng town and the wastewater from the town (houses and business areas) will be treated before being discharged to the river, so the water pollution will be managed or mitigated.
- The project should extend or cover all areas of the town (whole town), because almost every year the drainage-sewage system is damaged.

Stung Treng City Authority

- On behalf of the City Authority and our people, we strongly support this project, because the project is good for our town to manage and control wastewater and stormwater.
- We will collaborate and coordinate with the project team as needed by the project.
- If possible, the project should be extended to all village areas in Stung Treng town, because other villages also have problems with wastewater and stormwater.
- The impacts of the project on properties/structures and utilities are in the RoW and minor, because most subproject areas are located on the public land. If there are some impacts to structures the IRC/GDR will provide the compensation.
- There are some utilities that will be impacted during construction of the drainage and sewage system, so the project owner or contractor should inform us and concerned agencies.
- The impact during construction is temporary. But the contractor should implement or speed up the construction schedule.
- There are no sensitive issues during construction of the WWTP, because the site is outside village areas. But after construction, the project should provide tree planting around the WWTP site to reduce odour from the WWTP.
- Provide technical measures to mitigate the odour and to ensure proper wastewater treatment during operation of WWTP.

Provincial Department of Public Works and Transport

- PDWT supports, and coordinates for this project at all stages, because PDPWT is the project owner and the Implementation Agency (PIU),
- The project should study if we can reduce the number of pump stations. If we can reduce the number of pump stations, the operation cost will also be reduced.
- When will the construction of this subproject start?

Provincial Department of Environment

- We support this subproject 100%, for controlling and managing the storm water and wastewater in the Stung Treng Town, as well as for improving environmental conditions including water quality and public health.
- During project construction there are no major issues. But during project operation, the environmental impacts from discharge of wastewater from the WWTP, odour (air quality) should be considered including monitoring schedule.
- The WWT Ponds are open or closed? Can we use closed ponds to reduce odour.
- The project owner should conduct regular environmental quality monitoring: water quality monitoring, effluent monitoring, and air quality.

Provincial Department of Water Resources and Meteorology

- It is a good project for Stung Treng town for controlling stormwater and wastewater.
- The project area of drainage and sewage system should be extended to all commune areas in Stung Treng town.
- The flood in Stung Treng town is an issue, so the project should extend the drainage to the whole town for flood control.
- Will the business owners and houses be connected to the sewage pipes? is it free?

Provincial Department of Culture and Fine Art

- We are happy and support this project because we have problems with flooding and wastewater in our town.
- Department of Culture, and Fine Art agrees with the comments made by other departments with respect to project operations.
- There are no cultural resources in the subproject areas.

Provincial Department of Rural Development

- We support this project for managing the wastewater and drainage in Stung Treng town.
- We agree with some comments and questions made by other participants for sustainable development.
- At the WWTP site, some land is private land and have land titles. So, the project owner and GDR please try to negotiate with landowners to buy this land as soon as possible, because the land price is increasing day by day.
- The project management and project owner should provide information about the project, location and schedule and collaborate with local authorities and relevant institutions to resolve or avoid the affecting structures and properties located in the ROW.

PDOLMUPC

- The PDOLMUPC supports this project for managing the wastewater and drainage in Stung Treng town and supports some comments and issues raised by other departments.
- The PDOLMUPC is going to collaborate with the project concerning land titles and land types in the Stung Treng town.
- The project should provide detailed maps, we will identify the landowners.
- The project management should establish the provincial resettlement committee in accordance with the government policy.

PDOLVT

- We support this project for improving the environmental conditions in our town.
- We support earlier comments and feedback made by other departments.
- The construction staff, working activities should follow the PDOLVT regulation and policies.
- The work safety and safety policy should comply with the national regulations.

Provincial Department of Planning

- We support this good project in Stung Treng town.
- Agreed with some comments and feedbacks from other participants
- Provide traffic signs, safety signs on the construction sites
- Negotiate and resolve the any impacts on social resources during construction.

Provincial Department of Agriculture, Forest, and Fishery

- We agree with some comments, feedback, and issues raised by the participants.
- The drainage and sewage system is a problem in Stung Treng town, so the project is important for controlling and managing the stormwater and wastewater in the town area.
- Some houses, hotels, business buildings in Stung Treng town discharge wastewater directly in the river without treatment. So, the project construction should be started soon.

- We support and welcome this project. But the project owner and contractor should follow the construction schedule (short term construction is short term impacts).
- More impacts will occur during project operation and maintenance stage.
- Can we use sludge from WWTP for agricultural crops (fertilizer)?

Provincial Waterworks Authority

- We support this project. It is an important project for Stung Treng town.
- The project construction stage does not have any major issues. But during project operation, environmental and social receptors around the WWTP site may be affected.
- The sludge for WWTP, where will it be stored and managed?
- If sludge is toxic, how will it be managed?

Provincial Hall (Mine Action Unite)

- We support this project and agree with some comments raised by other participants and PPIC study team.
- The project should collaborate with the Provincial Mine Action Unit for mine clearing of the subprojects areas to ensure there are no UXO or mines located in the project sites before starting construction works.

Provincial Department of Police

- We agree with some comments raised by other participants, and we support this project for improving the environmental quality (wastewater and stormwater) in Stung Treng town.
- The contractors' and staff must be aware of the road traffic laws and other social laws.
- All transportation vehicles or trucks should have the relevant permits.
- The truck transport of materials shall be done safely, especially when the trucks pass urban areas and sensitive areas.

Provincial Department of Tourism

- We are very happy and support this project to improve the environmental conditions in Stung Treng town as well as the water quality in the Mekong River.
- Some houses and business buildings in the town discharge wastewater directly to the Mekong River
- Some tourist sites are located on the Mekong River Basin and the Mekong water quality is a one source the tourist want to see and to swim.
- We agree with some comments made by other participants concerning protection or mitigation of odour from the WWTP and on the quality of wastewater discharged from the WWTP into the river.

Provincial Department of Health

- We welcome and support this development project in Stung Treng town for sanitation and good environment.
- Almost every year the town is flooded by storm water mixed with wastewater.
- The wastewater from the town is discharged into the lake and river without treatment.
- This subproject is good for environmental quality and public health.
- The impacts from project construction is not a big issue (short term only during construction), but the construction should be finished on time.
- The impacts from project operations may will occur. So the ADB and the project owner (operator agencies) should be prepare a plan and budget to manage and mitigate these impacts
- The key impacts: odour, air quality from the WWTP and the quality of waste water discharged from the WWTP to public water.

Participants

No	Name	Institution/Agency	Position	Phone
1	Mr. Duong Poa	Stung Treng Provincial Hall	Deputy Governor	
2	Mr. Pich Ramy	Stung Treng Town	Deputy Governor	097 996 0244
3	Mr. Nou Vanna	PDPWT	Chief office of sewage	097 899 0204
4	Mr. Noy Paha Piseth	PDoE	Chief office	089 808 243
5	Mr. Pang Pang	PDoWRAM	Director Department	012 747 506
6	Mrs. Ngoch Saveun	PDoCFA	Deputy Director	088 910 7135

No	Name	Institution/Agency	Position	Phone
			Department	
7	Mr. Say Kea	PDRD	Deputy Director Department	077 776 477
8	Mr. Tep Dyny	PDLMUPC	Deputy Director Department	012 454 072
9	Mr. Bou Virun	PDOLVT	Director Department	012 443 666
10	Mr. Chav Monirath	Mine Action Plan Unit	Director of MAPU	011 910 326
11	Mr. Kong Rotana	Provincial Police Quarter	Chief of Traffic Office	097 960 9976
12	Mr. Lu Bunlaom	PDOP	Director Department	097 794 1106
13	Mr. Leang Seng	PDAFF	Director Department	012 922 918
14	Ms. Chong Chansavon	Provincial Waterworks Authority	Director	011 766 764
15	Mr. Say Proleung	PDH	Deputy Director Department	012 961 703
16	Oun Poa Seun	PDOT	Director Department	012 334 717

Note:

PDPWT	Provincial Department of Public Works and Transport
PDoe	Provincial Department of Environment
PDOWRAM	Provincial Department of Water Resources and Meteorology
PDofCA	Provincial Department of Culture, Fine, and Art
PDRD	Provincial Department of Rural Development
PDLMUPC	Provincial Department of Land Management, Urban Planning and Construction
PDOP	Provincial Department of Planning
PDAFF	Provincial Department of Agriculture, Forest, and Fishery
PDH	Provincial Department of Health
PDOT	Provincial Department of Tourism

Pictures





Annex 4: IBAT Proximity Analysis



Integrated Biodiversity Assessment Tool

PROXIMITY REPORT

STUNG TRENG WASTEWATER

Country: Cambodia

Location: [13.5, 105.9]

Date of analysis: 16 September 2021 (GMT)

Buffers applied: 1 km | 5 km | 15 km

IUCN Red List Biomes: Freshwater, Terrestrial

Generated by: Peter Gammelgaard Jensen

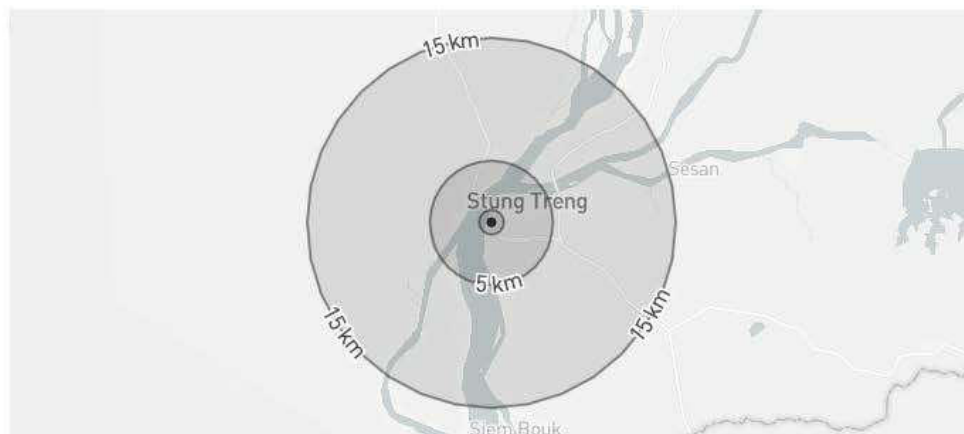
Organisation: ADB

Overlaps with:

Protected Areas	3
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Key Biodiversity Areas	4
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IUCN Red List	109
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Displaying project location and buffers: 1 km, 5 km, 15 km



About this report

This report presents the results of [6690-22015] proximity analysis to identify the biodiversity features and species which are located within the following buffers: 1 km, 5 km, 15 km.

This report is one part of a package generated by IBAT on 16 September 2021 (GMT) that includes full list of all species, protected areas, Key Biodiversity Areas in CSV format, maps showing the area of interest in relation to these features, and a 'How to read IBAT reports' document.

WARNING: IBAT aims to provide the most up-to-date and accurate information available at the time of analysis. There is however a possibility of incomplete, incorrect or out-of-date information. All findings in this report must be supported by further desktop review, consultation with experts and/or on-the-ground field assessment. Please consult IBAT for any additional disclaimers or recommendations applicable to the information used to generate this report.

Please note, sensitive species data are currently not included in IBAT reports in line with the [Sensitive Data Access Restrictions Policy for the IUCN Red List](#). This relates to sensitive Threatened species and KBAs triggered by sensitive species.

Data used to generate this report

- UNEP-WCMC and IUCN, 2021. Protected Planet: The World Database on Protected Areas (WDPA)[On-line], Cambridge, UK: UNEP-WCMC and IUCN. Available at: www.protectedplanet.net - September 2021.
- BirdLife International (on behalf of the KBA Partnership), 2021. Key Biodiversity Areas - April 2021.
- IUCN, 2021. IUCN Red List of Threatened Species - April 2021.
- IUCN. The IUCN Red List of Threatened Species. Version 2019-3. (2019). <https://www.iucnredlist.org>
- IUCN. Threats Classification Scheme (Version 3.2). (2019)
- Strassburg, B.B.N., Iribarrem, A., Beyer, H.L. et al. Global priority areas for ecosystem restoration. Nature 586, 724–729 (2020). <https://doi.org/10.1038/s41586-020-2784-9>

Protected Areas

The following protected areas are found within 1 km, 5 km, 15 km of the area of interest.
For further details please refer to the associated csv file in the report folder.

Area name	Within buffer of
NorthEast Corridor	1 km
NorthWest Corridor	15 km
Stung Treng	15 km

Key Biodiversity Areas

The following key biodiversity areas are found within 1 km, 5 km, 15 km of the area of interest.
For further details please refer to the associated csv file in the report folder.

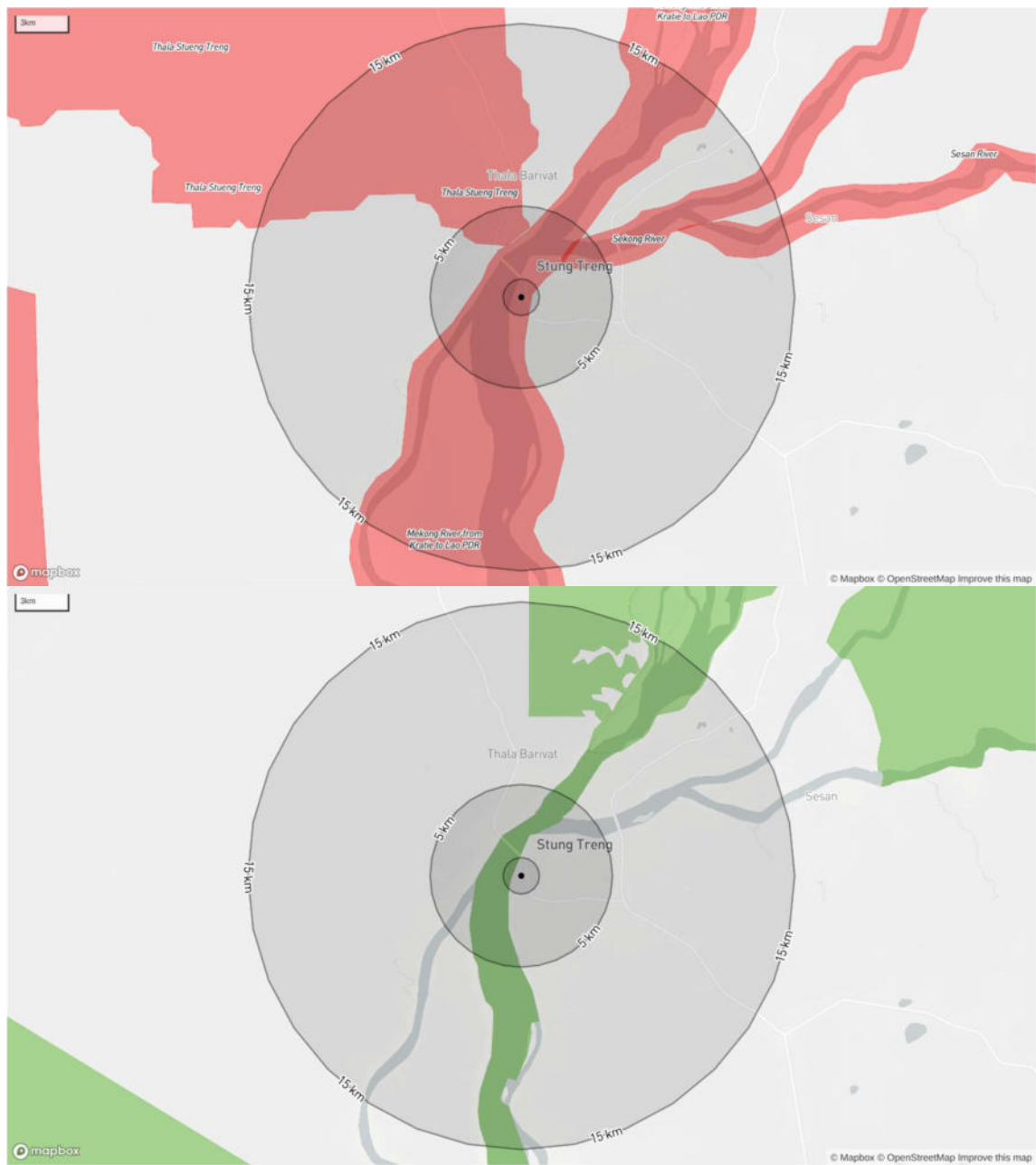
Area name	Distance
Mekong River from Kratie to Lao PDR	1 km
Sekong River	5 km
Thala Stung Treng	5 km
Sesan River	15 km

IUCN Red List of Threatened Species


The following threatened species are potentially found within 50km of the area of interest.

For the full IUCN Red List please refer to the associated csv in the report folder.


Species Name	Common Name	Taxonomic Group	IUCN Category	Population Trend	Biome



Annex 5: Ministry of Environment Approval of the IESIA



ព្រះរាជាណាចក្រកម្ពុជា
ជាតិ សាសនា ព្រះមហាក្សត្រ



ក្រសួងបរិស្ថាន
លេខ: ១៧៣៣.៣៧៧.ប.ស្ត

សូមគោរពជូន

ឯកឧត្តមទេសរដ្ឋមន្ត្រី រដ្ឋមន្ត្រីក្រសួងសាធារណការ និងដឹកជញ្ជូន

កម្មវត្ថុ : ករណីពិនិត្យ និងផ្តល់យោបល់លើរបាយការណ៍វាយតម្លៃហេតុប៉ះពាល់បរិស្ថាន និងសង្គមដំបូង (IESIA) សម្រាប់គម្រោងអភិវឌ្ឍន៍ក្រុងរបៀងនៃមហាអនុតំបន់មេគង្គទី៤ អនុគម្រោង៖ ប្រព័ន្ធលូ និងស្ថានីយប្រព្រឹត្តិកម្មទឹកកខ្វក់ និងបណ្តាញលូដោះទឹកភ្លៀងក្នុងក្រុងស្ទឹងត្រែង របស់ក្រសួងសាធារណការ និងដឹកជញ្ជូន នៅខេត្តស្ទឹងត្រែង

យោង :

- ព្រះរាជក្រមលេខ នស/រកម/១២៩៦/៣៦ ចុះថ្ងៃទី២៤ ខែធ្នូ ឆ្នាំ១៩៩៦ ដែលប្រកាសឱ្យប្រើច្បាប់ស្តីពីកិច្ចការពារបរិស្ថាន និងការគ្រប់គ្រងធនធានធម្មជាតិ
- អនុក្រឹត្យលេខ៧២ អនក្រ.បក ចុះថ្ងៃទី១១ ខែសីហា ឆ្នាំ១៩៩៩ ស្តីពីកិច្ចដំណើរការវាយតម្លៃហេតុប៉ះពាល់បរិស្ថាន
- លិខិតលេខ៣៣៩៤ សក.អករ៤ ចុះថ្ងៃទី២៩ ខែកញ្ញា ឆ្នាំ២០២០ របស់ក្រសួងសាធារណការ និងដឹកជញ្ជូន
- លិខិតលេខ៤០៤៥ សក.អករ៤ ចុះថ្ងៃទី១៩ ខែវិច្ឆិកា ឆ្នាំ២០២០ របស់ក្រសួងសាធារណការ និងដឹកជញ្ជូន
- លិខិតលេខ២៤៧ សក.អករ៤ ចុះថ្ងៃទី២៥ ខែកុម្ភៈ ឆ្នាំ២០២១ របស់ក្រសួងសាធារណការ និងដឹកជញ្ជូន
- លិខិតលេខ១១៣ សជណ ប.ស្ត ចុះថ្ងៃទី២៥ ខែមករា ឆ្នាំ២០២១ របស់ក្រសួងបរិស្ថាន
- លិខិតលេខ១៤៨៧ វ.ហ.ប.ស្ត ចុះថ្ងៃទី២៧ ខែតុលា ឆ្នាំ២០២០ របស់នាយកដ្ឋានវាយតម្លៃហេតុប៉ះពាល់បរិស្ថាននៃក្រសួងបរិស្ថាន


សេចក្តីដូចមានចែងក្នុងកម្មវត្ថុ និងយោងខាងលើ ខ្ញុំសូមគោរពជម្រាបជូន ឯកឧត្តមទេសរដ្ឋមន្ត្រី មេត្តាជ្រាបថា ក្រសួងបរិស្ថានឯកភាពលើរបាយការណ៍វាយតម្លៃហេតុប៉ះពាល់បរិស្ថាន និងសង្គមដំបូង (IESIA) សម្រាប់គម្រោងអភិវឌ្ឍន៍ក្រុងរបៀងនៃមហាអនុតំបន់មេគង្គទី៤ អនុគម្រោង៖ ប្រព័ន្ធលូ និងស្ថានីយប្រព្រឹត្តិកម្មទឹកកខ្វក់ និងបណ្តាញលូដោះទឹកភ្លៀងក្នុងក្រុងស្ទឹងត្រែង ដែលមានទីតាំងភូមិសាស្ត្រស្ថិតនៅក្នុងក្រុងស្ទឹងត្រែង ខេត្តស្ទឹងត្រែង របស់ក្រសួងសាធារណការ និងដឹកជញ្ជូន (ម្ចាស់គម្រោង) ដោយម្ចាស់គម្រោងត្រូវគោរពតាមកិច្ចសន្យាការពារបរិស្ថានលេខ១៤៦០ សក.អករ៤ ចុះថ្ងៃទី១១ ខែឧសភា ឆ្នាំ២០២១ របស់ក្រសួងសាធារណការ និងដឹកជញ្ជូន។

អាស្រ័យដូចបានគោរពជម្រាបជូនខាងលើ សូម ឯកឧត្តមទេសរដ្ឋមន្ត្រី មេត្តាអនុវត្ត និងចាត់ចែងដោយសេចក្តីអនុគ្រោះ។

សូម ឯកឧត្តមទេសរដ្ឋមន្ត្រី មេត្តាទទួលនូវសេចក្តីគោរពពីខ្ញុំ។


ថ្ងៃទី ២៧ ខែ តុលា ឆ្នាំ ២០២១ ឆ្នាំ ត្រីស័ក ព.ស. ២៥៦៥
រាជធានីភ្នំពេញ ថ្ងៃទី ២០ ខែ ឧសភា ឆ្នាំ ២០២១

ជ.រដ្ឋមន្ត្រី
រដ្ឋមន្ត្រីក្រសួងសាធារណការ


ស្រីសុខ ជាតិ

ចម្លងជូន៖

- ទីស្តីការគណៈរដ្ឋមន្ត្រី
- ក្រសួងសេដ្ឋកិច្ច និងហិរញ្ញវត្ថុ
- ក្រសួងរៀបចំដែនដី នគរូបនីយកម្ម និងសំណង់
- ក្រសួងទទួលបានទឹក និងឧតុនិយម
- រដ្ឋបាលខេត្តស្ទឹងត្រែង
- មន្ទីរបរិស្ថានខេត្តស្ទឹងត្រែង
- ឯកសារ កាលប្បវត្តិ



អគារមរតកគោរោ ជីឡូត៍លេខ៥០៣ ផ្លូវកៅស៊ូអមមាត់ទន្លេបាសាក់ សង្កាត់ទន្លេបាសាក់ ខណ្ឌចំការមន ភ្នំពេញ ទូរស័ព្ទ: ០២៣ ២៣៥ ០០៤ / ០២៣ ២៣៥ ០០៦

KINGDOM OF CAMBODIA

Nation Religion King

(Logo)

MINISTRY OF ENVIRONMENT

No. 673 S.Chh.N.MoE

Respectfully to

His Excellency Senior Minister and Minister of Public Works and Transport

Subject: Regarding the review and comment on the Initial Environmental and Social Impact Assessment - IESIA Report for the wastewater treatment plant and drainage system sub-project in Stueng Treng Town, Stueng Treng Province of the Fourth Great Mekong Sub-Region Corridor Towns Development project.

Ref.: - Royal Code No. NS/KRM/1296/36, dated December 24, 1996, promulgating the Law on Environmental Protection and Management of Natural Resources,
- Sub-Decree No. 72 Ankr.Bk, dated August 11, 1999, concerning the Environmental Impact Assessment Process,
- Letter No 3394 SK/OKR4, dated September 29, 2020, of the Ministry of Public Works and Transport,
- Letter No. 4045 SK/OKR4, dated November 19, 2020, of the Ministry of Public Works and Transport,
- Letter No. 647 SK/OKR4, dated February 25, 2021, of the Ministry of Public Works and Transport,
- Letter No. 113 S.C.N.MoE, dated January 25, 2021, of the Ministry of Environment,
- Letter No. 1487 V.H.MoE, dated October 27, 2020, of the Environmental Impact Assessment Department of Ministry of Environment,

With regard to the above mentioned subject and references, I would respectfully like to inform **Your Excellency Senior Minister** that the Ministry of Environment has approved the Initial Environmental and Social Impact Assessment Report for the wastewater treatment plant and drainage system sub-project in Stueng Treng Town of the Fourth Great Mekong Sub-Region Corridor Towns Development project located at Stueng Treng Town, Stueng Treng Province, the project of the Ministry of Public Works and Transport (Principal) subject to the Principal's compliance with the Environmental Protection Commitment No. 1460 SK/OKR4, dated May 11, 2021 of the Ministry of Public Works and Transport.

In view of the foregoing, may **Your Excellency Senior Minister** follow the above instruction and take appropriate action accordingly.

Please accept **Your Excellency Senior Minister**, the assurances of my highest regards.

Phnom Penh, May 20, 2021

For Minister

Secretary of State

(Signature and stamp)

CC:

- Office of the Council of Ministers
- Ministry of Economy and Finance
- Ministry of Land Management, Urban Planning and

SRUN DARITH

Construction

- Stueng Treng Provincial Administration
- Stueng Treng Provincial Department of Environment
- File – Archive