Initial Environmental Examination

June 2021

Cambodia: Fourth Greater Mekong Subregion Corridor Towns Development Project

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

CURRENCY EQUIVALENTS

(as of June 2020)

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

WEIGHTS AND MEASURES

dBA	-	A-weighted Decibel
km	-	Kilometre
km2	-	Square kilometre
LAeq	-	Equivalent Continuous Level ‘A weighting’ - ‘A’-weighting = correction by factors that weight sound to correlate with the sensitivity of the human ear to sounds at different frequencies
m	-	Meter
oC	-	Degree Celsius
PM10	-	Particulate Matter 10 micrometres or less
PM2.5	-	Particulate Matter 2.5 micrometres or less
µg/m3	-	Microgram per cubic meter

NOTE

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

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1 EXECUTIVE SUMMARY

1.1 The 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 Kampong Cham, Kratie, and Stung Treng.

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**

Sub-Project City	Wastewater Treatment Plant	Sewer System	Drainage	Landfill
Kampong Cham	5,000 m^3/day	137 km	4,3 km	900,000 m^3
Kratie	4,900 m^3/day	143 km	12 km	433,500 m^3
Stueng Treng	3.650 m^3/day	147 km	12 km	291,000 m^3

3. There is no current reticulated wastewater collection and treatment in Kampong Cham 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. The majority of households use an unsealed soakaway pit formed with locally available concrete ring sections. These do not allow for any significant treatment; liquid waste soaks into the ground if the water table is low enough (which varies with season and proximity to the river), and solids remain in the pit.

4. This IEE for the Kampong Cham 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 Kampong Cham City.

5. The environmental classification of the Subproject is confirmed as Category B. The IEE has been 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 June 2021). 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 IEE and EMP also incorporate the findings of the Initial Environmental and Social Impact Assessment (IESIA) approved by the Ministry of Environment (MoE) on 02 March 2021 (Annex 5). The IEE and EMP will be further updated if necessary.

6. The wastewater and drainage subproject comprises the following works:

- Construction of 33.8 km primary and secondary wastewater collection networks;
- Construction of 51.9 km tertiary wastewater network, including service connections for households, and commercial and institutional buildings;
- Construction of three (3) wastewater pump stations and 1.4 km associated pumping mains;
- Construction of 4.2 km storm drainage lines consisting of primary reinforced concrete U drains, box drains, trapezoidal drains, pipes, manholes and outlet structure;
- Construction of one (1) drainage pump station and demolition of the existing drainage pump station;
- Soil Improvement work including Prefabricated Vertical Drains (PVD) installation at WWTP filling area;
- Construction of a 5,000 m^3/day Wastewater Treatment Plant (WWTP) covering a total area of 11.26 ha consisting of
    a. A filled area for the primary treatment, sludge pond and other facilities of 2.15 ha
    b. Two wetland zones and the drainage corridor around the wetland zones of 3.75 ha
    c. A natural wetland zone of 4.5 ha.
- Construction of administration, workshop, electrical and security buildings at WWTP;
- Provision of operations and maintenance equipment.

7. The selected WWTP site is located in Beong Snay wetland, Sambour Meas commune, Kampong Cham City. Wastewater from the city area will be transported through wastewater pipelines to the WWTP. The WWTP site covers a total area of 11.26 ha. The surrounding land use includes housing, university, pagoda, agricultural land and undeveloped land

8. The proposed separate sewer system and drainage system in Kampong Cham town will be built in the main urban area to serve four communes (sangkats), namely:

a) Kampong Cham town (100%),
b) Veal Vong (100%),
c) Sambor Meas (50%), and
d) Boeng Kok (10%).

1.2 Key Findings

9. The site for the wastewater treatment plant is located in a wetland area known as Boeng Snay in Sambor Meas commune, Kampong Cham City. The area is bordered by residential areas and the Boeng Snay Pagoda to the north and northwest, rice fields and some residences to the west, and to the east reclaimed land for future urban expansion where currently the new Kampong Cham University has been established.

10. Boeng Snay and Boeng Bassac (west of Boeng Snay) are existing wetlands that receive and store wastewater and stormwater from large parts of Kampong Cham City. Most of Boeng Snay was reclaimed between 2010 and 2013 and reduced from about 107 ha to approximately 19 ha today.

11. An assessment of proximity to Key Biodiversity Areas and Protected Areas using the Integrated Biodiversity Assessment Tool (IBAT) shows that there are no such areas within a radius of 10 km from the site (Annex 4).

12. Impacts during construction will be localized and short-term and limited to common impacts associated with piling, earth works and construction of buildings in an urban setting. Particular attention will be taken to reduce noise, vibration and dust emissions and to ensure that proper safety precautions are in place for workers, pedestrians and road users in connection with roadside excavations. The construction of the WWTP itself will involve work

above or near water and on soft ground requiring special attention to work safety and minimising the risks of water pollution.

The most significant environment risks and impacts associated with the subproject are expected during the operation phase. The proximity to the Boeng Snay Pagoda, the University of Kampong Cham and 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 is drained into Boeng Snay causing poor water quality, the wastewater collection and treatment will have long-term positive effects on water quality in and around Boeng Snay. Furthermore, the expansion of the sewage collection networks, and the separation of wastewater from the drainage 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.

13. In Kampong Cham City, the new wastewater 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.

14. 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.

1.3 Environmental Management Plan

15. 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

16. 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

17. 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, vibrations, 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 Contractor's 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.

18. Mitigation and monitoring measures are also required for the construction and operation phase. 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.

19. A Grievance Redress Mechanism (GRM) will be established 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.

1.4 Conclusion

20. This IEE was undertaken to determine the environmental issues and concerns associated with the WWTP and drainage subproject. The assessment confirms that the project is classified as Category B for environment. There are no significant adverse impacts that cannot be readily mitigated if implemented effectively, the EMP aims at mitigating impacts on the natural environment and affected people to an acceptable level. The key parties for mitigation measure implementation are the construction Contractor(s) and the Operator(s). They will be supported by qualified national and international environmental consultants within the Project Management Consultant teams. The implementation of this EMP will be closely monitored and reported on by the relevant stakeholders in the project.

21. The impacts during construction will mainly be short-term and localized, and the most significant impacts will be linked to sheet piling and reclamation of an area in the Boeng Snay wetland for the primary wastewater treatment facilities and to installation of wastewater and drainage pipes 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.

22. The most significant environmental risks will arise from poor facility operation and maintenance and future uncontrolled urban development. The project will collect and treat wastewater from the urban centre of Kampong Cham and thereby reduce impacts on waterbodies and significantly improving the current situation.

23. Overall, the expected project outcome is improved urban environmental services in Kampong Cham 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.

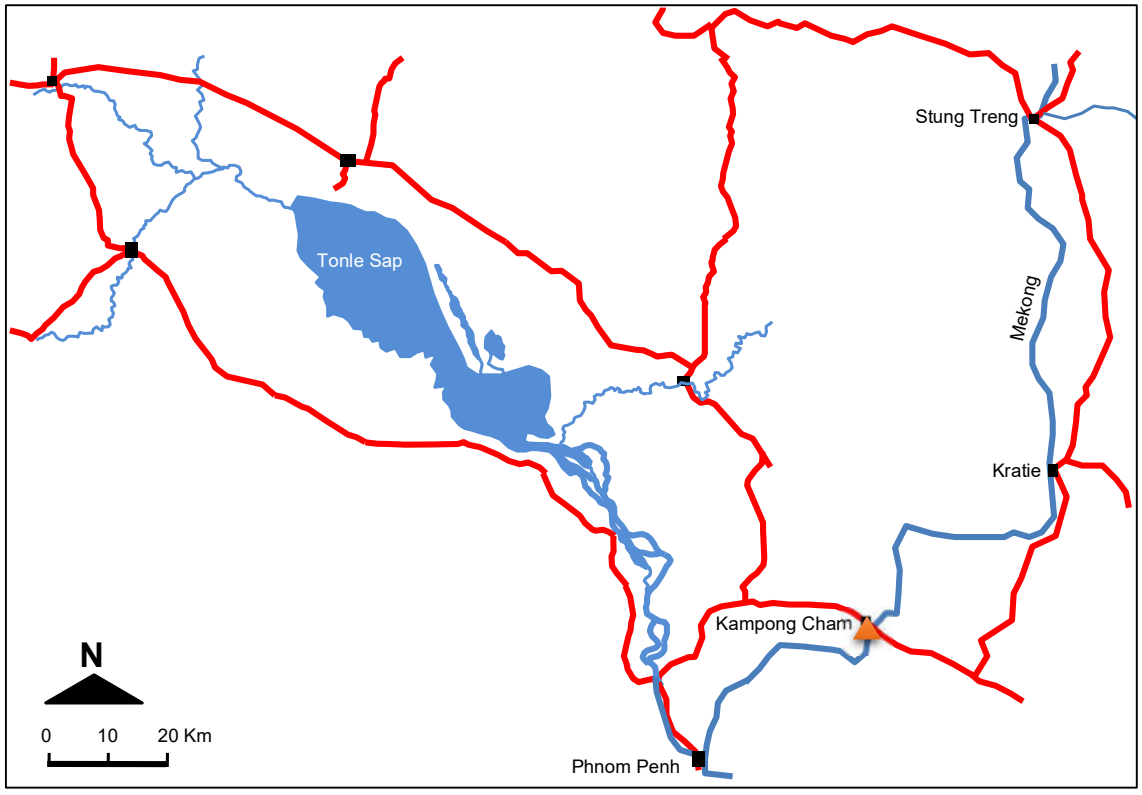
2 INTRODUCTION

2.1 Background and Location

24. 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).

25. 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

26. This IEE covers the construction and operation of Kampong Cham Wastewater Treatment Plant and Drainage System Subproject. The subproject is located in Kampong Cham City, Kampong Cham 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

27. 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.

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

29. 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.

30. 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 02 March 2021 (Annex 5).

2.3.2 Structure of the IEE

31. 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.

32. 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 Contractor's 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

33. 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.

34. 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;

35. 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.

36. 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.

37. 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

38. 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.

39. 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).

40. 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.

41. 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.

3.2 National Environmental Policy and Legislation

3.2.1 Legal Framework for Environmental Management

42. 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.

43. 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

44. 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.

45. 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.

46. 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).

47. 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 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

Law/Regulation/Guideline	Year	Summary
		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.
Sub-decree on Water Pollution Control (Sub-decree No. 27 ANRK/BK)	1999	Regulates activities that cause pollution in public water areas in order to sustain good water quality so that the protection of human health and the conservation of 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. As per agreement with MoE, the effluent standards applicable to the subproject are those in Annex 2 of this Sub-decree for *public water area and sewer*
Sub-decree on Solid Waste Management (Sub-decree No. 36 ANK/BK),	1999	Article 1: Regulates solid waste management to ensure the protection of human health and the conservation of biodiversity through using appropriate technical approaches. Article 2: This sub-decree applies to all activities related to disposal, storage, collection, transport, recycling, dumping of garbage and hazardous waste. 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. The authorities of the provinces and cities shall establish the waste management plan in their province and city for short, medium and long-term.
Sub-decree on Control of Air Pollution and Noise Disturbance (Sub-decree No. 42 ANK/BK	2000	Regulates air and noise pollution from mobile and fixed sources through monitoring, curb and mitigation activities to protect the environmental quality and public health. It contains the following relevant standards: (i)) ambient air quality standard (Annex 1); and (ii) maximum allowable noise level in public and residential areas (Annex 6). Article 3 A. “Source of pollution” is defined and separates mobile sources (including transport) and fixed sources such as factories and construction sites. Article 3 B. “Pollutant” is defined as smoke, dust, ash particle substance, gas, vapour, fog, odour, radio-active substance
Law on Land (NS/RKM/0801/14)	2001	Provides that: (i) unless it is in the public interest, no person may be deprived of ownership of his immovable property; and (ii) ownership deprivation shall be carried out according to legal forms and procedures and after an advanced payment of fair and just compensation. (Article 5)
Royal Decree on the Establishment and Management of Tonle Sap Biosphere Reserve (Royal Decree No. NS/RKT/0401/070)	2001	Establishes the Tonle Sap Biosphere Reserve (TSBR) in accordance with the statutory framework of the World Network of Biosphere Reserves. Divides the TSBR into 3 zones: (i) core areas; (ii) buffer zone and (iii) flexible transition zone. Core area: set aside for long term protection, human activity is limited to monitoring and research. Buffer zone: is area surrounding the core areas helping to protect the environment. It may accommodate education and training activities. Transition area: may contain a variety of agricultural activities and human settlements. Here all stakeholders have to cooperate to achieve sustainable development

Law/Regulation/Guideline	Year	Summary
Environmental Guidelines on Solid Waste Management[1]	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.
Labour Law (1997) Decree No. CS/RKM/0397/01	1997	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. 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. 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.
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	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. 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. 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. The law defines Protected Area as "*An area of the State's public properties in land or water territories, including coasts and sea, located in the area established by a Royal Decree or a new area*

Law/Regulation/Guideline	Year	Summary
		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". Each protected area shall be divided into four (4) management zoning systems: **1. Core zone:** management area(s) of high conservation values containing threatened and critically endangered species, and fragile ecosystems. Access to the zone is prohibited except the Nature Conservation and Protection Administration's officials and researchers who, with prior permission from the 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. **2. Conservation zone:** management area(s) of high conservation values containing natural resources, ecosystems, watershed areas, and Natural landscape located adjacent to the core zone. Access to the zone is allowed only with prior consent of the Nature Conservation and Protection Administration at the area with the exception of national security and defense sectors. Small-scale community uses of Non-Timber Forest Products to support local ethnic minorities' livelihood may be allowed under strict control, provided that they do not present serious adverse impacts on biodiversity within the zone. **3. Sustainable use zone:** management area(s) of high economic values for national economic development and management, and conservation of the protected area(s) itself thus contributing to the local community, and indigenous ethnic minorities' livelihood improvement. After consulting with relevant ministries and institutions, local authorities, and local communities in accordance with relevant laws and procedures, the Royal Government of Cambodia may permit development and investment activities in this zone in accordance with the request from the Ministry of Environment. **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).
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	**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. **Chapter 2:** This Charter presents the role and responsibilities of relevant agencies/institution: national level (MPWT, MoE and MoI), Provincial level (municipality, province, relevant provincial departments, city, district), and involved investment project owners. **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.

Law/Regulation/Guideline	Year	Summary
Prakas on Environmental Impact Assessment Classification for Development Projects No. 21 PRK.BST	2020	The Prakas determines the types and sizes of projects that are 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 travelers entry to Cambodia. MoH, June 2020	Guidance on Management Mitigation Measures for Health and Safety and COVID-19 ADB: Adapted from: ILO and WHO 2020

48. 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.

49. 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

50. 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.

51. 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.

52. 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

53. 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.

54. Located along the GMS Central Corridor, Kampong Cham is connected to Sihanoukville and Phnom Penh to the south and along National Highway No 7 to Kratie and Stung Treng and from there on to Pakse and Savannakhet in the Lao PDR meeting the East–West Economic Corridor. Thus, Kampong Cham has geographical advantages and potential to become an engine of growth in the region and reduce regional development disparities.

55. Drainage and flood protection is particularly important in cities such as Kampong Cham which is highly vulnerable to flooding. There is no reticulated wastewater collection and treatment system in Kampong Cham. 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.

56. 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.

57. 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.

4.1. Project Impact, Outcome, and Output

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

59. Output 1: Improved public environmental infrastructure including a sewage collection network, household and building service connections, a WWTP of capacity 5,000 m^3/d, pump stations and associated pumping mains, and a separate stormwater drainage system including drainage pumping station to mitigate flooding and resolve major urban drainage issues.

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

61. 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

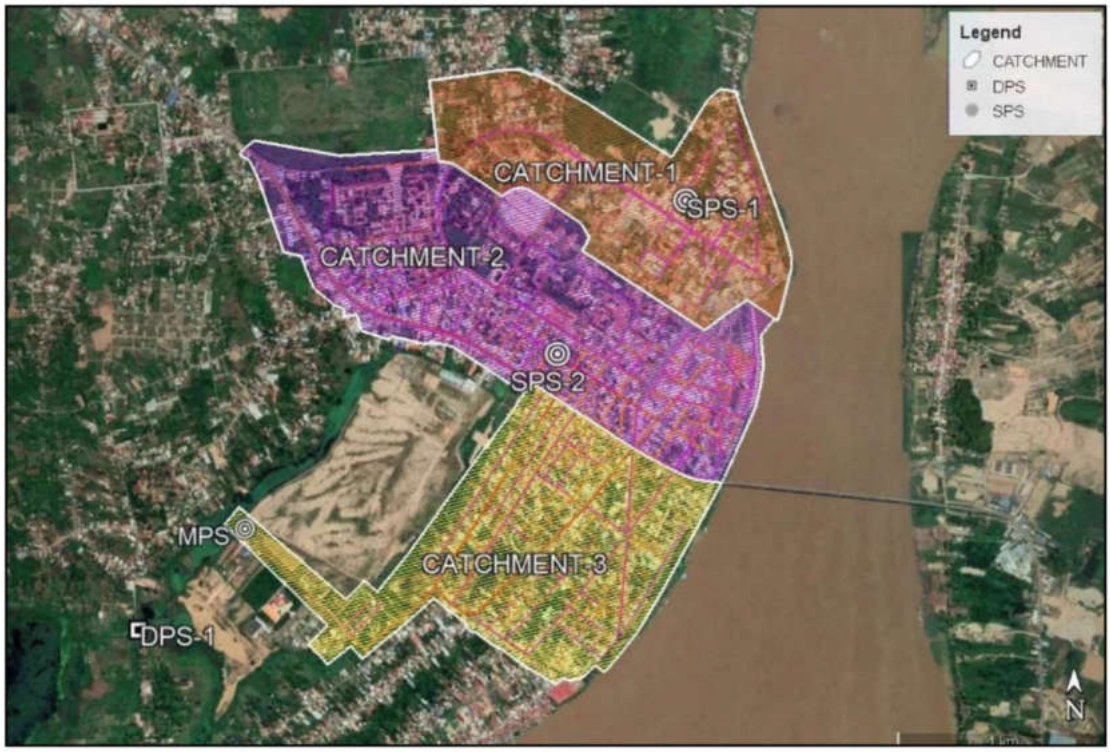
awareness on the benefits of proper sanitation and separate sewerage systems and safe disposal of solid waste.

4.2 Project Location and service coverage

62. Kampong Cham City in Kampong Cham Province lies on the banks of the Mekong River. With a distance to Phnom Penh of 80 km, about 360 km by Highway No. 7 to the border with Lao PDR and about 400 km by highway No 5 to the border with Thailand at Poipet, Kampong Cham City has a central location and good access to the national transport infrastructure network.

63. The service area for the sewerage and drainage collection networks covers the most densely populated central part of Kampong Cham City and includes the sangkats of Kampong Cham Town and Veal Vong and some parts of Sambuor Meas and Boeng Kok sankats. The service area is approximately 450 ha and has a population of about 22,000 (2018) – see Figure 2.

Figure 2: Wastewater and Drainage Service Area



64. The proposed site for the WWTP is located in Sambuor Meas sangkat and it covers an area of 11.26 ha within a 19 ha large wetland that formed part of an approximately 107 ha large wetland area known as Boeng Snay of which about 88 ha was reclaimed between 2010 and 2013. The location is indicated in Figure 9.

Figure 3: Overview Map with the location of the Wastewater Treatment Plant

65. The new stormwater drainage network will overlap with the sewage service area (see Figure 2). The primary objective of the drainage system is to mitigate flooding and resolve other drainage problems in the urban centre.

4.3 Subproject Salient Data

66. The main subproject components are listed below:

- Sewage Collection Network: 85.7 km gravity sewer network consisting of primary, secondary and tertiary (house service connections) sewer pipes.
- Three (3) Wastewater Pump Stations designed to collect wastewater flows from the sewer network and pump it to the WWTP.
- Rising Mains: 1.4 km of rising mains from the wastewater pump stations to the WWTP.
- Wastewater Treatment Plant with a 5,000 m^3/d capacity designed to comply with the applicable effluent standards:
    - Total area: 11.26 ha
    - Filled area for the primary treatment (anaerobic treatment ponds), sludge pond and other facilities: 2.15 ha
    - Wetland zone 1 and 2 and the drainage corridor around the wetland zones: 3.75 ha
    - The natural wetland zone 3 (retention reservoir): 4.5 ha.
    - Geotechnical soil improvement works for the filled area.
- Storm Drainage: 4.2 km drainage lines consisting of primary reinforced concrete U drains, box drains, trapezoidal drains, pipes, manholes and outlet structure.
- One (1) Drainage Pump Station.

4.3 Climate Change Adaptation

67. 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.

68. The design of the subproject incorporates several climate change resilient measures determined based on considerations of cost-effectiveness, and the likelihood and consequences of climate change predictions. The separation of wastewater from stormwater

and the design of the stormwater network to cope to cope with a climate change adjusted 1:50-year flood event will reduce adverse impacts of perennial flooding and reduce local soil and water contamination. 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.

4.4 Wastewater Treatment Plant Design

69. **Wastewater Projections**. 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 baseline of 21,000 to 22,865 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. In addition, a non-domestic (institutions, commercial enterprises) water consumption equivalent to 13,855 persons have been included in the calculations. 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 5,000 m^3/day by 2040.

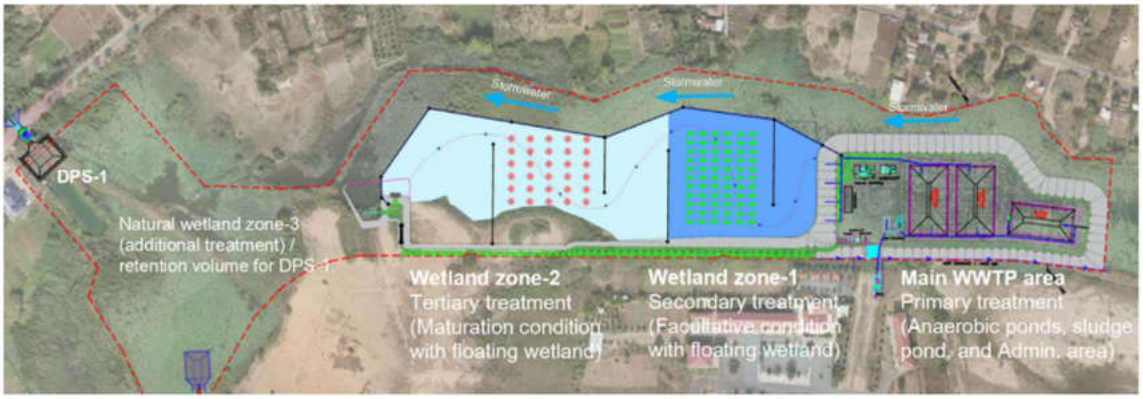
70. **Wastewater Treatment Technology**. Waste Stabilization Ponds has been chosen as the most appropriate technology. Due to unavailability of public land, the Ministry of Public Works and Transport made a hard decision to place the treatment plant within the remaining part of the Boeng Snay. The subsoil at the site consists of very soft clay and to ensure proper foundation conditions, geotechnical soil improvement work including installation of Prefabricated Vertical Drains (PVD) has to be undertaken. To reduce the costs and risks involved, it was decided to limit the area that would need to be filled above the maximum flood level and thus would need soil improvement to the area for primary treatment including the anaerobic ponds, sludge drying beds and other fixed structures and installations. The facultative and maturation treatment is designed to take place in floating wetland ponds utilizing the existing wetland.

71. The general layout of the wastewater treatment plant is displayed in Figure 4.

72. The wastewater treatment process consists of a series of different types of waste stabilization ponds/wetlands (anaerobic, facultative, maturation) that rely entirely on natural processes by algae, water plants 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. 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.

73. The slightly modified treatment technology and layout with two trains of anaerobic ponds followed by simulated facultative and maturation ponds with floating aquatic plants to provide additional treatment, directly in the existing lake using a simple impermeable curtain/boom to separate the wetland from the parallel drainage corridor is considered to be the optimal sewage treatment solution for this very complex WWTP site, providing simple but very good levels of treatment with the lowest possible construction and operating costs.

Figure 4: Overview of the Wastewater Treatment Plant Layout



4.4.1 Wastewater Treatment Plant Design Details and Parameters

74. Overview. The main WWTP process components and units include:

a) Inlet Screening Structure with channels for an automatic screen and a manually cleaned screen bypass;

b) Septage Receiving Structure with manually cleaned screen;

c) Two (2) Anaerobic Ponds in parallel with dimensions of 30.35 m (width) and 55 m (length), each pond;

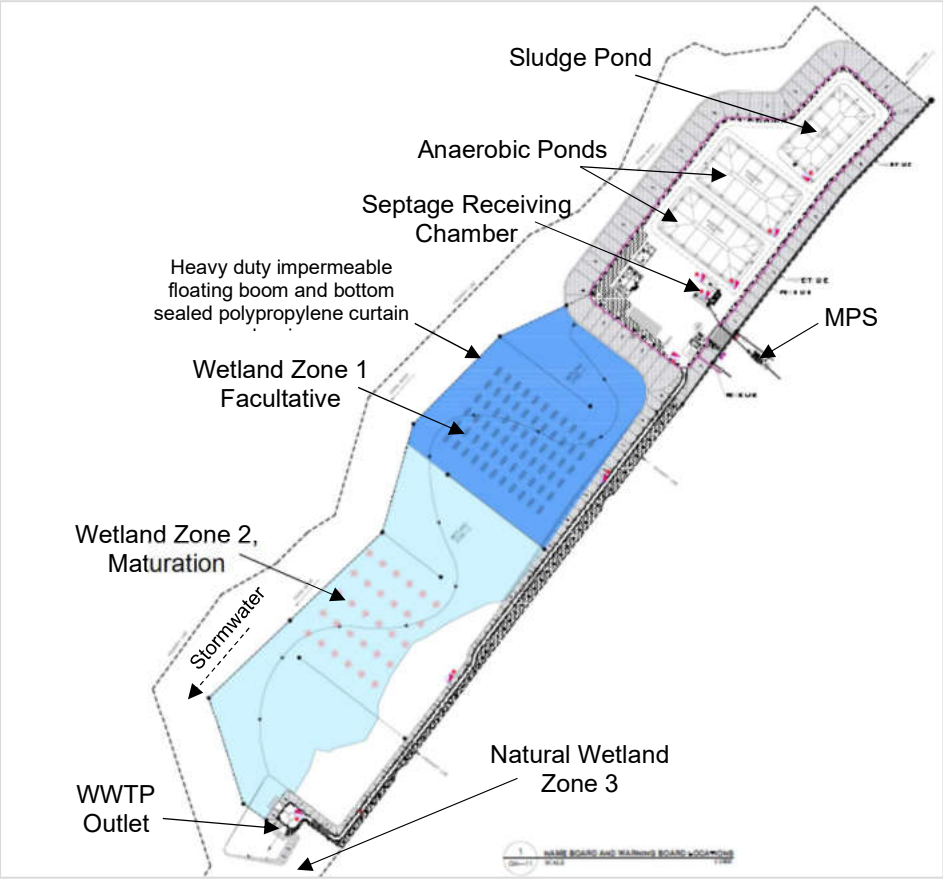
d) One (1) Wetland Zone-1 under facultative conditions with bamboo rafts with vetiver plants for further treatment, capacity volume 26,300 m^3 and surface area 12,300 m^2;

e) One (1) Wetland Zone-2 under maturation conditions with existing white lotus plant for additional treatment, capacity volume 20,800 m^3 and surface area 16,200 m^2;

f) One natural Wetland Zone-3/retention to DPS-1 (no construction), about 4.5 ha. Will function as a wetland to further reduce coliform bacteria and for polishing.

g) One (1) Sludge Treatment/ Drying Pond - dimensions of 24.75 m (width) and 50 m (length)

Figure 5: Wastewater Treatment Plant Components



75. **WWTP design details and parameters** (see Figure 5):

a) 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.

b) Septage Receiving Facility. The septage receiving chamber will be receiving septage wastewater coming from the mobile vacuum trucks. 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, an on to the WWTP ponds for further treatment in the anaerobic ponds. A water supply standpipe will be provided to facilitate cleaning of the screen. A concrete washdown pad for the trucks is included.

c) General design parameters

- WWTP design flow = 5,000 m^3/d
- Influent BOD concentration = 300 mg/L
- Temperature = 24 ºC

d) Anaerobic Ponds

- Design loading = 300 g BOD/m3 d
- Sides and bottom: HDPE liner on protective layer and compacted fill

- Retention time = 1 day
- Volume of anaerobic ponds = 2 x 2,500 = 5,000 m^3
- Percent Removal AP at 24 ºC = 68%
- BOD effluent concentration = 96 mg/L
- Liquid depth = 5 m

e) Wetland Zone-1, floating plants under facultative conditions

- Design surface loading = 280 kg BOD/ha day
- Permanent heavy duty long durability impermeable floating boom and bottom sealed flexible reinforced 1.5 mm polypropylene geomembrane barrier installed between lake water surface and lake bottom separating the wetland from the stormwater corridor
- Depth of wetland zone-1 under facultative conditions = 2.1 m (varies 1.9 to 2.6 m)
- Number of floating baffle walls = 2
- Number of treatment sub-zones = 2
- Area of floating wetland zone-1 under facultative conditions at 2.1 m depth = 12,300 m^2
- Retention time = 5 days
- Percent removal for anaerobic ponds + wetland zone -1 at 24 ºC = 80%

f) Wetland Zone-2, floating plants under maturation conditions

- Influent fecal coliform concentration = 5 x107 MPN/100 mL ºC
- Effluent fecal coliform concentration at 24 ºC = ≤ 1,000 MPN/100 mL (Range 500-2500 MPN/100ml)
- Permanent heavy duty long durability impermeable floating boom and bottom sealed flexible reinforced 1.5 mm polypropylene geomembrane barrier installed between lake water surface and lake bottom separating the wetland from the stormwater corridor
- Depth of wetland zone 2 = 1.3 m (varies 1.2 to 1.6m
- Number of floating baffle walls = 2
- Number of treatment sub-zones = 2
- Retention Time > 4 days
- Percent Removal for anaerobic ponds, wetland zone-1 and wetland zone-2 at 24 ºC = ≥ 90%
- Surface Area provided at Water Level +10.75 m for = 16,200 m^2
- Effluent from Effluent from Wetland – Zone 2 = 5000 m^3/d

g) Sludge drying pond

- Sludge ponds liquid level depth: 3.5 m
- Sludge generation rate: 0.04 m^3/person/year
- Sludge application thickness: 3 to 4 m
- Sludge drying time: 4 to 5 weeks, during the dry season
- Sludge pond walls: HDPE liner on protective layer and compacted fill
- Filter media: 20 mm crushed stone

- Under drainage pipes: perforated pipes
- Drainage pipes: solid wall pipes

h) The sludge treatment and drying system is provided to stabilize and dewater the sludge primarily from the anaerobic ponds but also from wetland zone-1. Desludging of the anaerobic ponds will be performed regularly when the accumulated sludge reaches about a third of the pond depth (likely every 3-5 years). Desludging of wetland zone-1 will likely not be necessary until after 10 years of operation. Excess rainwater is decanted to the anaerobic ponds by an adjustable floating pump decanter. The pond underdrains are dewatered to the WWTP inlet structure. The sludge drying ponds shall provide rapid dewatering and drying of the sludge in 4-5 weeks during the dry season. The sludge drying lagoon is designed to allow dried sludge to be removed manually or by excavator after sludge drying, with sludge dewatered to a dry solids content of 40% during the dry season. The stabilized and dried sludge will be disposed of at a landfill where it may be used as waste cover material.

i) WWTP Outlet Structure. The treated wastewater from Wetland zone-2 will flow through an overflow structure to the Natural wetland zone 3 where it will be mixed with the stormwater from the drainage corridor parallel to the wetlands. At the drainage pump station at the western border of the Natural wetland zone 3 the mixed stormwater and effluents from the WWTP will be pumped or moved by gravity across the road embankment to a natural channel that will conduct the water to Boeng Bassac (see Figure 6).

4.4.2 Treated Effluent Quality

76. 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 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 and Effluent Recipients

Table 4: Wastewater treatment design standards

Parameter	Unit	Design Standards

pH	-	6 – 8
BOD_5 (5 days at 20 ºC)	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	BOD5 Removal Rate (%)			Coliform Removal Rate (%)		
	12 ºC	20 ºC	25 ºC	12 ºC	20 ºC	25 ºC
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

4.4.3 Administration and Other Buildings and Utilities.

77. 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

78. 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.

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

80. Access and Internal Roads and Parking. There is no need to construct a new WWTP access road as a bitumen road has already been constructed to the university area. However, repairs of the access road may be necessary due to damages during construction. Internal roads will be constructed that will allow truck access to facilities. The roads will be surfaced with a concrete and laterite macadam. A 2-meter-wide pathway will provide pedestrian/motorbike access to the wetlands and the outlet structure for operation and maintenance.

81. On-site drainage. Perimeter diversion drainage channels to divert drainage around the WWTP site (incl. the wetlands) will be provided.

82. Access Gate and Perimeter Fencing and Lighting. Two gates will be provided, one at entry of the WWTP and the second to access the pathway to the outlet structure.

83. Water Supply. Water supply will come from the Water Supply Company or a deep-well onsite. An overhead HDPE tank will be installed for water storage. Water will be supplied by

gravity to administration and workshop buildings, and the inlet screening and septage receiving facility.

84. Sanitation Facility. Wastewater from the toilets and showers will be collected by PVC sewer pipes and will be conveyed to the MPS and from there to the WWTP for treatment.

4.4.4 Routine maintenance.

85. 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.

4.5 Wastewater Collection Network

86. 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, and one Main Pump Station, MPS), that will then pump the wastewater directly to the WWTP. The locating of the sewers has avoided private property.

87. 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

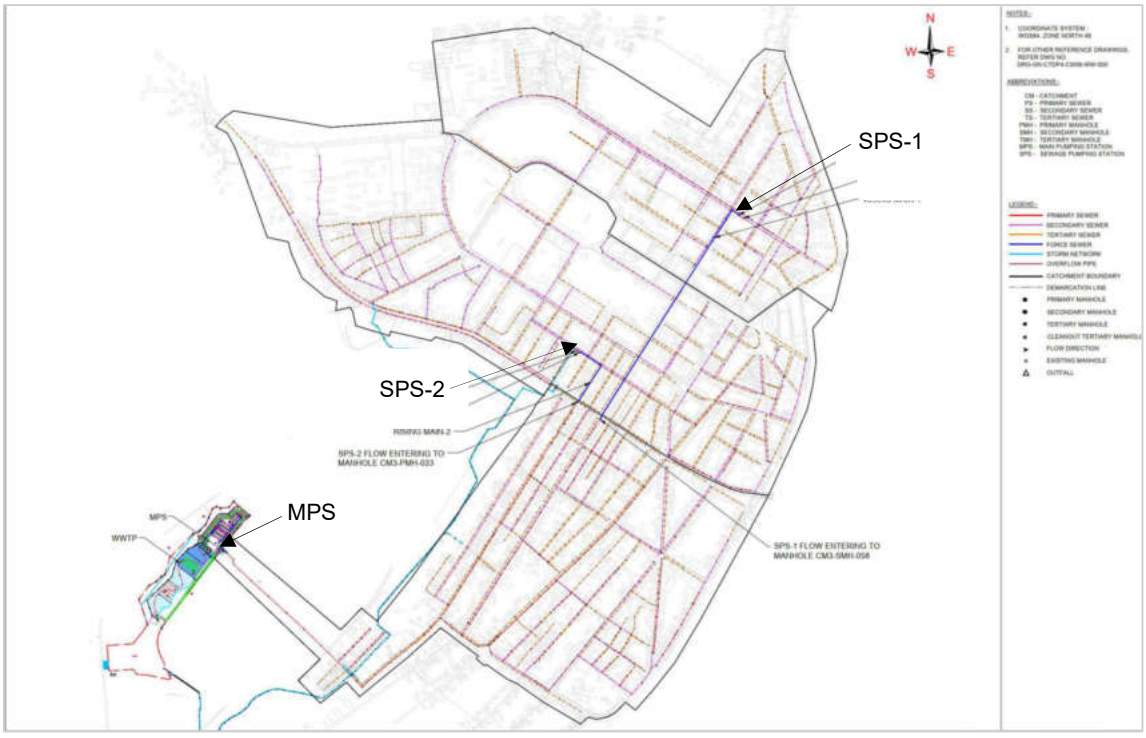


Table 6: Summary of the lengths and depths of the wastewater sewers

Depth (m)	Tertiary Sewers (km)	Secondary and Primary Gravity Sewers (km)	Rising Mains (km)	Total Length (km)
≤ 1.50	44.1	5.5	-	49.6
1.5 < Depth ≤ 3.0	7.5	18.7	1.4	27.5
3.0 < Depth ≤ 5.0	0.4	8.4	-	8.7
5.0 < Depth ≤ 7.0	-	1.2	-	1.2
Total Length	**51.9**	**33.8**	**1.4**	**87.1**

88. Based on soil investigations, pile foundation is required for the pump stations' wet wells, all non-process buildings and outlet structures.

89. Since excavations may require shoring[2]/sheet piling, the contractor will be required to conduct structural investigations of any building structures along the alignment that could be affected.

90. 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 loading[3].

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-550590.027 Y-1326174.000	X-549920.036 Y-1325608.091	X-548451.0173 Y-1324773.6484
Land Area	23 m^2	28 m^2	65 m^2
Existing Land Use	Residential Road/footpath Allowance	Residential Road Allowance	Residential Road Allowance
Existing Elevation	14.02 m	13.2 m	12.50 m
Pump Configuration	1 duty + 1 standby Submersible	1 duty + 1 standby Submersible	1 duty + 1 standby Submersible

91. 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 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.

92. An emergency trailer mounted mobile diesel generator including fuel tank will be provided. The trailer, generator and fuel tank will serve both wastewater pump stations (SPS-

[2] 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

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

1 and SPS-2) and will be stored at the WWTP site. The diesel generator at the WWTP will service the main pump station (MPS) in case of an emergency.

93. 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.

4.6 Stormwater Drainage System

94. The storm drainage system will cover the densely populated inner-city area. The service area is divided into four sub-catchments and one major existing riverside sub-catchment in consideration of the topography and flows from the existing drainage network (see Figure 8).

Figure 8: Stormwater Drainage System

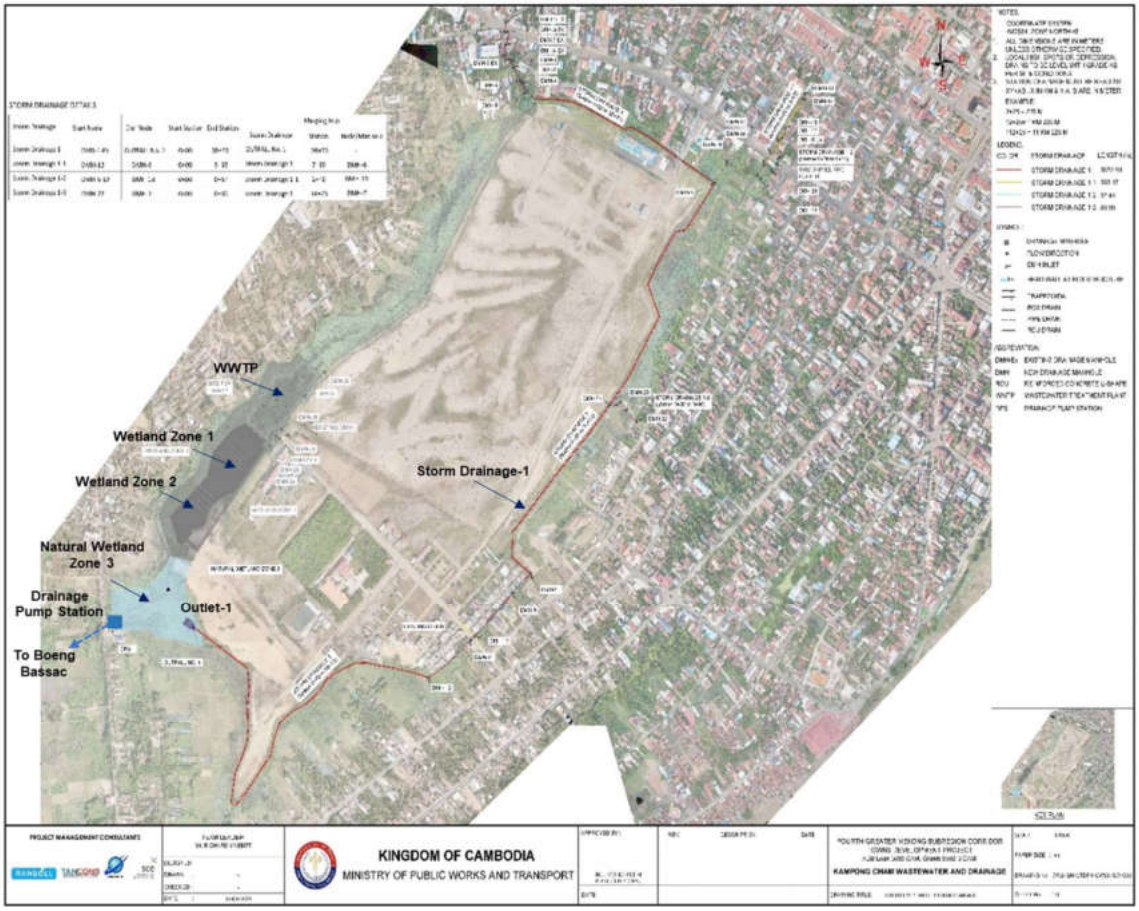
95. The storm drainage system includes primary RCU drains, box drains, trapezoidal drain, pipes, manholes and outlet structure and a Drainage Pump Station (DPS). The lengths and depths of the drains are summarised in Table 8. Some sections of the existing piped drainage system are in poor condition and will be either replaced or rehabilitated where sections of the existing drainage network will connect to the new drainage system.

96. Stormwater from the four sub-catchments is collected in the primary storm drainage-1 and discharged to the natural wetland zone 3 through Outlet-1 (see Figure 9).

Table 8: Stormwater drains

Dain Type	Length of Drain at 1.5 m to 3.0 m depth (km)	Length of Drain at >3.0 m depth (km)	Total (km)
RCU Drain	0.1	-	0.1
Box Drain	0.9	-	0.9
Pipe Drain	0.1	0.1	0.2
Trapezoidal Drain	1.7	1.3	3.0
Total	2.9	1.4	4.2

Figure 9: Outline of the drainage network



97. 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 9.

Table 9: Drainage Pump Station Key Data

Item	Drainage Pump Station
Location Coordinates	X-547947, Y-1324309
Land Area	1515 m^2

Item	Drainage Pump Station
Existing Land Use	Residential Road Allowance
Existing Elevation	+15.0 m
Pump Configuration	2 duty + 1 standby VT

98. The Drainage Pump Station is designed for dual operations for dry seasons and wet seasons. During the dry season, there is no need to operate the pumps, instead the water will be conducted by a gravity pipe. During the wet season, both pumping and gravity flow is required, and this operation will depend on the water elevation from the spillway (outlet structure) of the WWTP and the flood elevation of the downstream side of the pump discharge.

99. The stormwater and the treated wastewater from the wastewater treatment plant will mix in the natural wetland zone 3 and from there the Drainage Pump Station will conduct the water to the other side of the road embankment into a natural channel transferring the water to Boeng Bassac.

4.6. Associated & Existing Facilities

100. 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".

101. 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. Note that the existing drainage network in the service area is part of the future network and will be upgraded and repaired as necessary.

5 DESCRIPTION OF THE ENVIRONMENT

5.1 Project Area of Influence

102. 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.

103. 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.

104. 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).

105. 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.

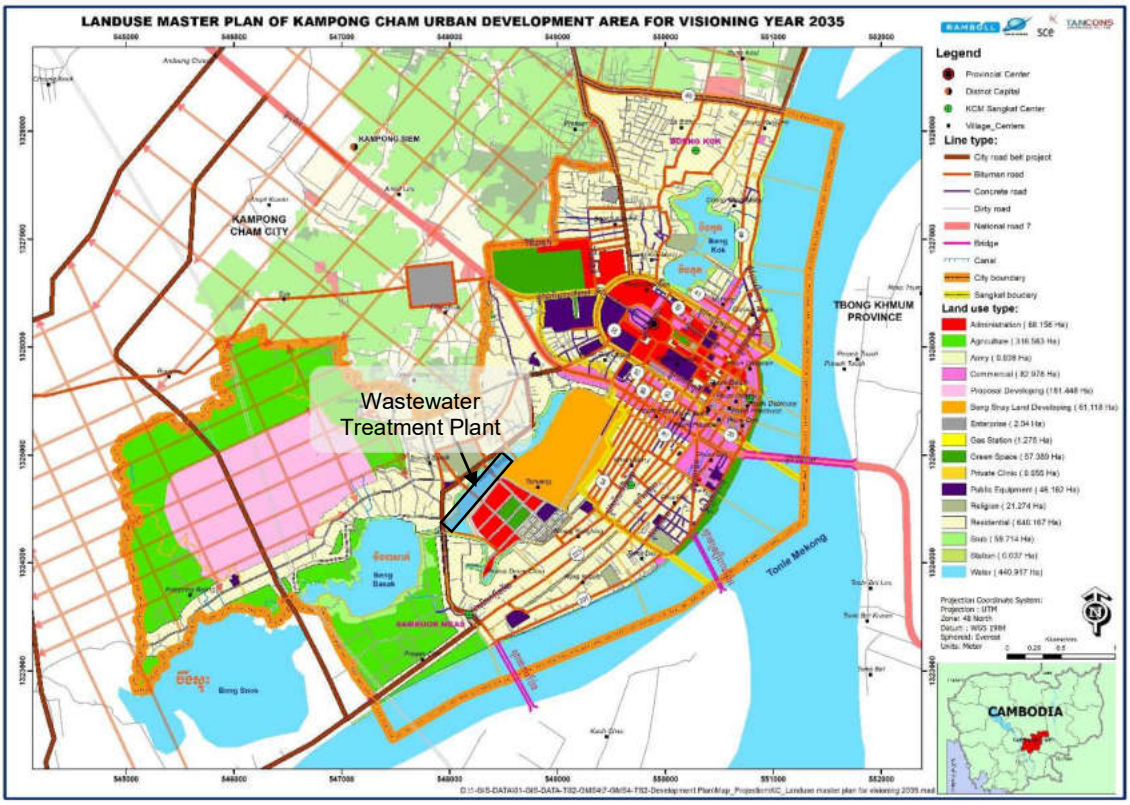
5.2 Baseline Receptors

5.2.1 General Description of WWTP site location

106. The WWTP site is located in a wetland area, Boeng Snay, Sambuor Meas sangkat, Kampong Cham City. The proposed site covers 11.26 ha of the 19 ha large Boeng Snay, which historically has received wastewater mixed with stormwater from Kampong Cham City. The original Boeng Snay covered an area of about 107 ha. Between 2010 and 2013, approximately 88 ha of the wetland was reclaimed.

107. The Land Use Masterplan for 2035 is displayed in Figure 10 (prepared before this Subproject was initiated) with the approximate location of the wastewater treatment plant added. The immediate current surroundings are indicated on the Google Earth image of August 2020 shown in Figure 11. As indicated on the land use plan and the Google Earth image, to the north and northwest of the WWTP, there is a residential area and within in that area lies the Boeng Snay Pagoda with its border approximately 100 m from the WWTP. The nearest houses are located 50-70 m from the WWTP, and the newly established Kampong Cham University compound borders the WWTP property line to the south-east. North-east of the WWTP lies the currently undeveloped area reclaimed from Boeng Snay where the soil is likely still undergoing settlement.

Figure 10: Kampong Cham Land Use Plan 2035



108. As noted in Section 4.2, the service area covers Kampong Cham Town sangkat, Veal Vong sangkat and some parts of Sambuor Meas and Boeng Kok sangkats. Kampong Cham Town is a mixed commercial and residential area and is also the seat of the provincial administration. Veal Vong is predominantly a residential area with important cultural sites including the Dei Doh pagoda, several churches and schools. Boeng Kok sangkat is mostly a residential area. The Chroy Thma Pagoda is located in Boeng Kok sangkat (see also Section 5.11).

Figure 11: Surroundings of the Wastewater Treatment Plant

109. **Surface Water Receptors**. The south-north running embankment road (elevation at about +15 m) immediately west of Boeng Snay functions as a barrier preventing flooding of

the area to the east of the road as long as water can be pumped from Boeng Snay to the natural channel on the other side of the road. Currently, the existing Drainage Pump Station conveys water from Boeng Snay across the embankment road to the natural channel and then to Boeng Bassac.

110. Boeng Bassac is located approximately 390 m west of Boeng Snay and covers an area of approximately 25 ha - 30 ha depending on season. The wetland is connected (seasonally) with the Mekong River by a small stream from the south-eastern corner.

111. Approximately 1 km west of Boeng Bassac, there is a 90 ha large wetland, Boeng Snous. Google Earth images indicate that the two wetlands are connected by a small stream although the stream is not clearly visible on the most recent image from August 2020 (see Figure 12).

Figure 12: Wetlands connected to the WWTP

112. A summary for key receptors is provided in Table 10. 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 10: 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	- Stream to Boeng Bassac and from there to the Mekong River (seasonally) via a 1.5 km long stream; and/or to Boeng Snous via 1 km long stream	- 50-70 m to the nearest houses - 100 m to the border of Boeng Snay Pagoda - Bordering the compound of Kampong Cham University - 200 m from Boeng Bassac Primary School - About 1 km from National Road No. 7 - About 1 km from densely populated areas	- In Boeng Snay wetland area	- No protected areas or Key Biodiversity areas within a 10 km radius of site - Nearest KBI is 50 km from the WWTP
Wastewater and Drainage network	- The drainage network has the same recipient as the WWTP	- Network in dense urban area, where there are houses, 2 pagodas, market, business shop, schools, and university. - Presence of local utilities services: electric line/pole, water supply, cable line, and other social service structures	- Paved and unpaved urban roads - Some street trees and limited urban vegetation	- As above

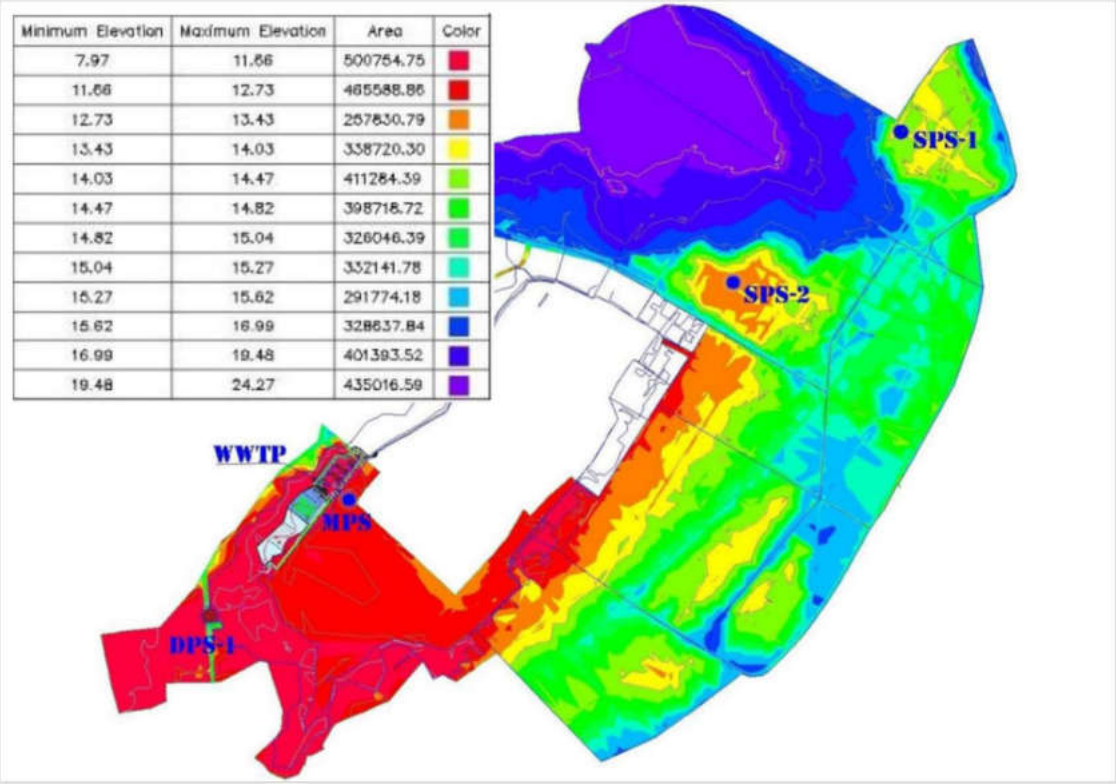
Project Component	Surface Water Receptors	Socio-Economic & Cultural Receptors	Land Cover/ Ecological Receptors	Protected Area Status
Wastewater pump stations (SPS-1 and SPS-2	- None	- Housing within a 20 m radius	- None	- None

5.3 Geography, Topography and Geology

5.3.1 Topography and Geography

113. The topography of the subproject area is illustrated in Figure 1Figure 13 (see also the drainage plan in Figure 8). The topography is generally flat gently sloping from elevations of about +25 m in the northern part of the area to the south where the WWTP is located in a low-lying area with elevations of +8 m to +12 m. A 200 m to 300 m wide strip along the Mekong River drains to the river.

Figure 13: Topography of the Subproject Area



5.3.2 Geology

114. The area of the site is situated within a belt of recent lacustrine (lake) sediments and alluvial deposits from the Holocene period. Geotechnical surveys carried out in the service area and at the WWTP site show near-surface rock to the north (down to 2 m depth, not penetrated), 7-10 m of generally soft clay in the area along the Mekong River, and 10 m of stiff clay further inland. Groundwater was detected at depths of 0.8 m to 1.6 m.

115. At the WWTP site itself, the surveys generally found 10-18 m of soft to very soft clay underlain by stiff clay down to drilling depths of 25 m.

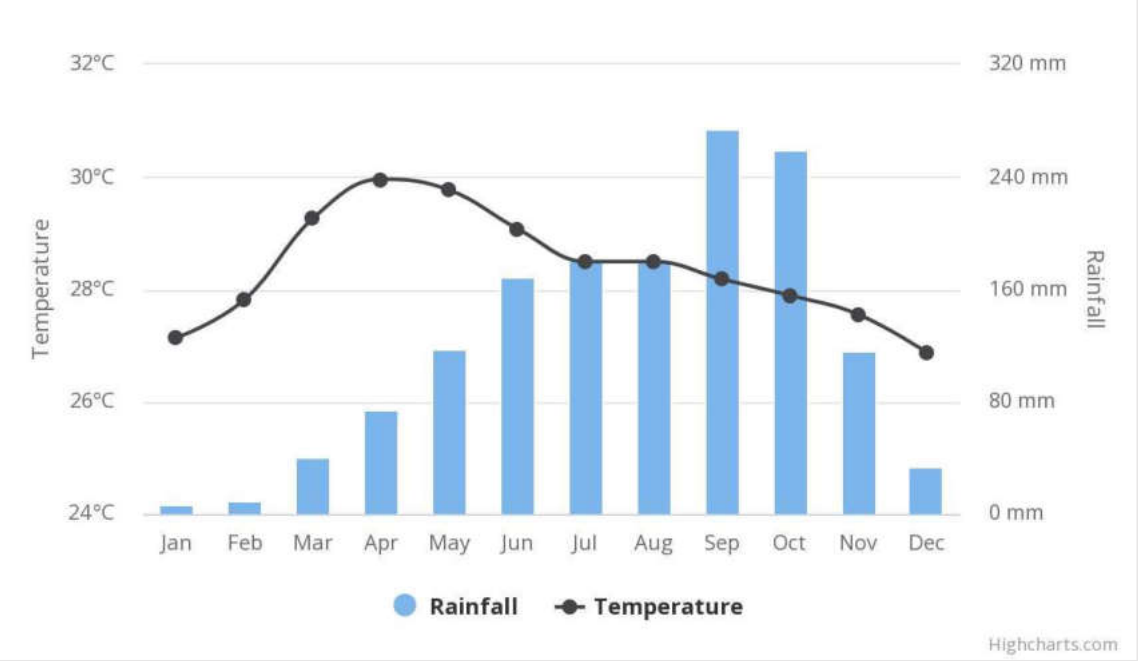
5.4 Meteorology and Climate

116. Kampong Cham is at an elevation of about 20 m above sea level and the climate for the area is classified as tropical wet and dry climate with dry winter (*Aw*) in the Köppen and Geiger

Climate Classification System[4]. The climate is dominated by the monsoon where the northeast monsoon brings drier and cooler air from early November to March, hotter air prevails in April and early May, and the southwest monsoon brings the rainy season from May to October.

117. The average rainfall and temperature for Kampong Cham from 1991 to 2016 are displayed in Figure 14. The average annual temperature in Kampong Cham is 27.7 °C and the annual rainfall is about 1519 mm. The temperatures are highest on average in April, at around 29.8 °C and lowest on average in December at 26.5 °C. The variation in the precipitation between the driest and wettest months is 265 mm and the variation in annual temperature is around 3.3 °C.[5]

Figure 14: Average Monthly Temperature and Rainfall for Kampong Cham 1991-2016



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

118. **Wind**. The average hourly wind speed in Kampong Cham is displayed in year lasts for 9.6 months, from the end of November to early September, with average wind speeds of more than 2.6 metre per second. The calmer time of year lasts for 2.4 months, from early September to end of November with average hourly wind speeds from 2.1 metre per second to 2.5 metre per second.

[6]. The chart indicates that there are minor seasonal variations.

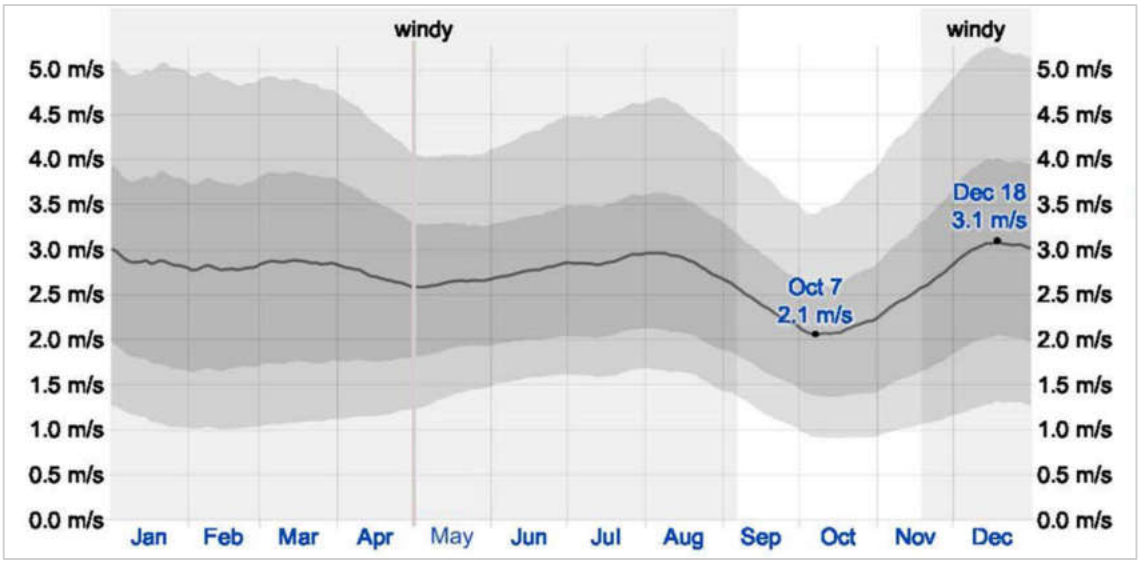
119. The windier part of the year lasts for 9.6 months, from the end of November to early September, with average wind speeds of more than 2.6 metre per second. The calmer time of year lasts for 2.4 months, from early September to end of November with average hourly wind speeds from 2.1 metre per second to 2.5 metre per second.

[4] The Köppen-and Geiger climate classification is one of the most widely used climate classification systems. The classification system divides climates into five main climate groups, with each group being divided based on seasonal precipitation and temperature patterns. https://en.wikipedia.org

[5] https://en.climate-data.org/asia/cambodia/kampong-cham/kampong-cham-26384/#climate-graph. Accessed on 01-May-2021

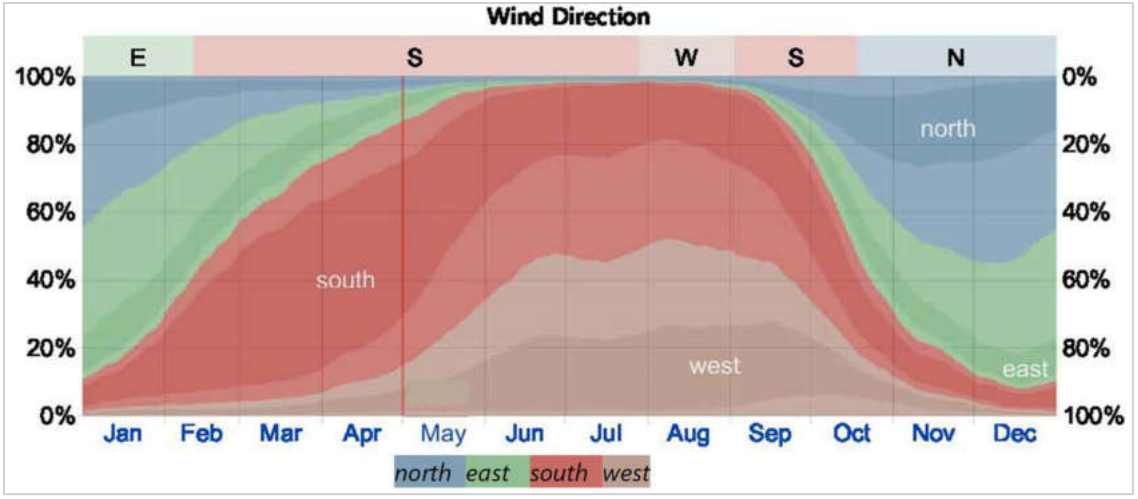
[6] https://weatherspark.com/y/115879/Average-Weather-in-Kampong-Cham-Cambodia-Year-Round. Accessed on 01-May-2021

Figure 15: Kampong Cham Average Hourly Wind Speeds[7]



120. The hourly average wind direction at 10 metre above the ground is displayed in Figure 16[8]. The predominant average hourly wind direction in Kampong Cham varies throughout the year. The most frequent wind direction from the south for 5.5 months, from the middle of February to the end of July and for 1.5 months, from the beginning of September to the end of October. The wind is most often from the north for 2.4 months, from the end of October to the end of December. The wind is most often from the east for 1.4 months, from the end of December to the middle of February.

Figure 16: Kampong Cham Average Wind Directions



The percentage of hours in which the mean wind direction is from each of the four cardinal wind directions, excluding hours in which the mean wind speed is less than 0.4 m/s. The lightly tinted areas at the boundaries are the percentage of hours spent in the implied intermediate directions (northeast, southeast, southwest, and northwest)

5.5 Climate Change Projections

121. According to the World Bank's Climate Change Knowledge Portal (https://climateknowledgeportal.worldbank.org/), for Cambodia, the mean annual

[7] The dark gray line indicates the average of mean hourly wind speeds with 25th to 75th and 10th to 90th percentile bands

[8] https://weatherspark.com/y/115879/Average-Weather-in-Kampong-Cham-Cambodia-Year-Round. Accessed on 01-May-2021

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 over Cambodia are unclear, with some areas experiencing increases and others decreases, but these changes are not statistically significant[9].

122. The key climate change predictions for Cambodia available in the World Bank's Climate Change Portal include that[10]:

a) mean annual temperature will rise by 1.54 °C (1.06 °C to 2.50 °C) in 2040-2059 (RCP[11] 8.5, Ensemble[12])
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)

123. The projected change in monthly temperature for Cambodia is shown in Figure 17 and the projected change in monthly precipitation is presented in

124. 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.

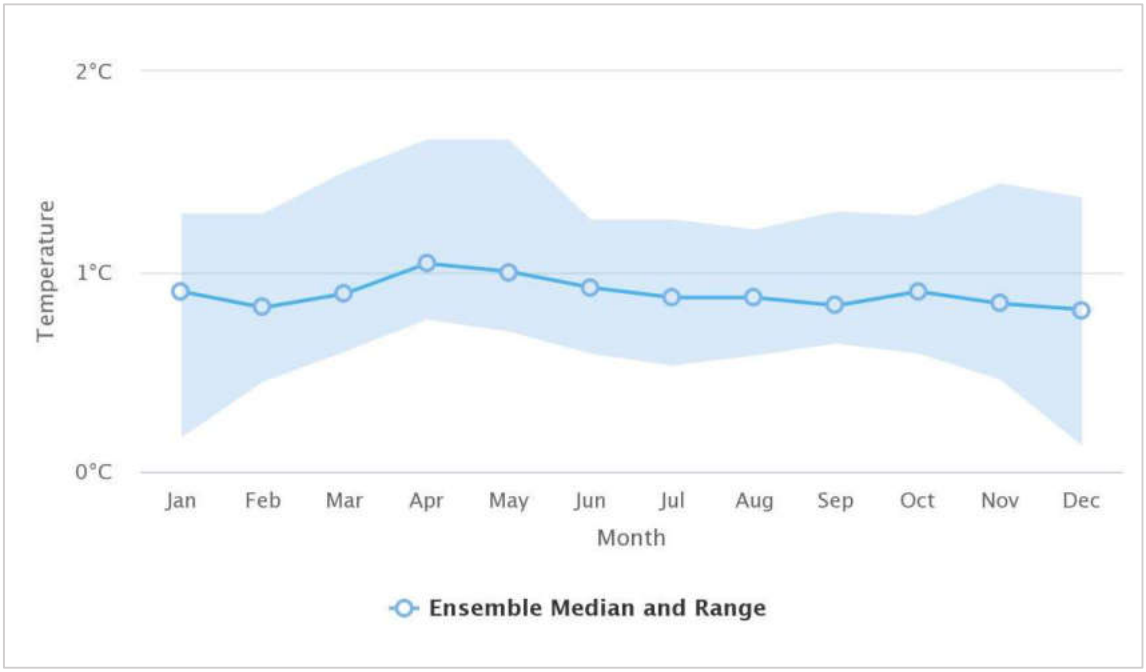
[9] https://climateknowledgeportal.worldbank.org/country/cambodia/climate-data-historical. Accessed on 01-May-2021

[10] https://climateknowledgeportal.worldbank.org/country/cambodia/climate-data-projections. Accessed on 01-May-2021

[11] RCP means Representative Concentration Pathways for different emission level scenarios

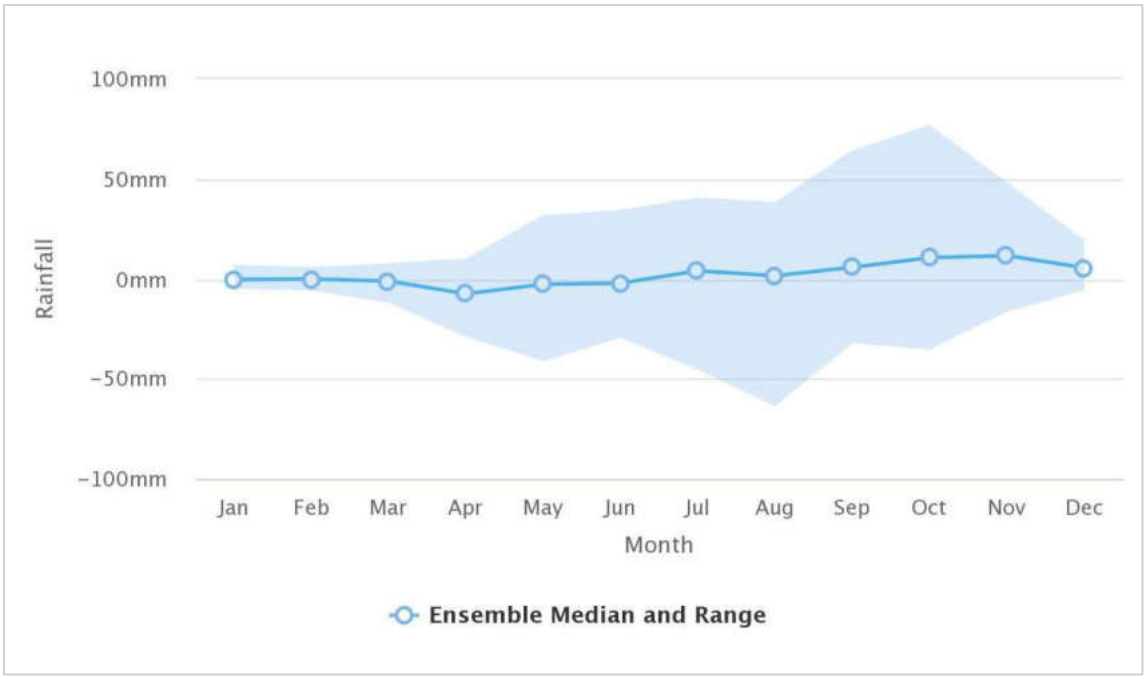
[12] A collection of model simulations characterizing a climate prediction or projection

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



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

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



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

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

5.6 Hydrology, Flooding and Other Natural Disasters

5.6.1 Hydrology

126. Kampong Cham is located on the right bank of the Mekong River and within the City boundary and its surroundings there are four large wetlands (see Figure 10 and Figure 19):

- Boeng Kok just north of the service area;
- Boeng Snay (and the WWTP site) in the middle, 19 ha. Note that most of Boeng Snay was reclaimed between 2010 and 2013;
- Boeng Bassac to the west, 25-30 ha; and
- Boeng Snous immediately west of the City boundary, 90 ha.

Figure 19: Surface Water Bodies

127. The wetlands have undergone significant changes over the past decade. These changes are visible on historic Google Earth images as presented in Figure 20, Figure 21 and Figure 22. Most notable is the reclamation of the main part of Boeng Snay which took place between 2010 and 2013. Both Boeng Bassac and Boeng Snous have also been reduced in size (the red line on Figure 20 indicates the 2020 lake shorelines).

Figure 20: Kampong Cham January 2003

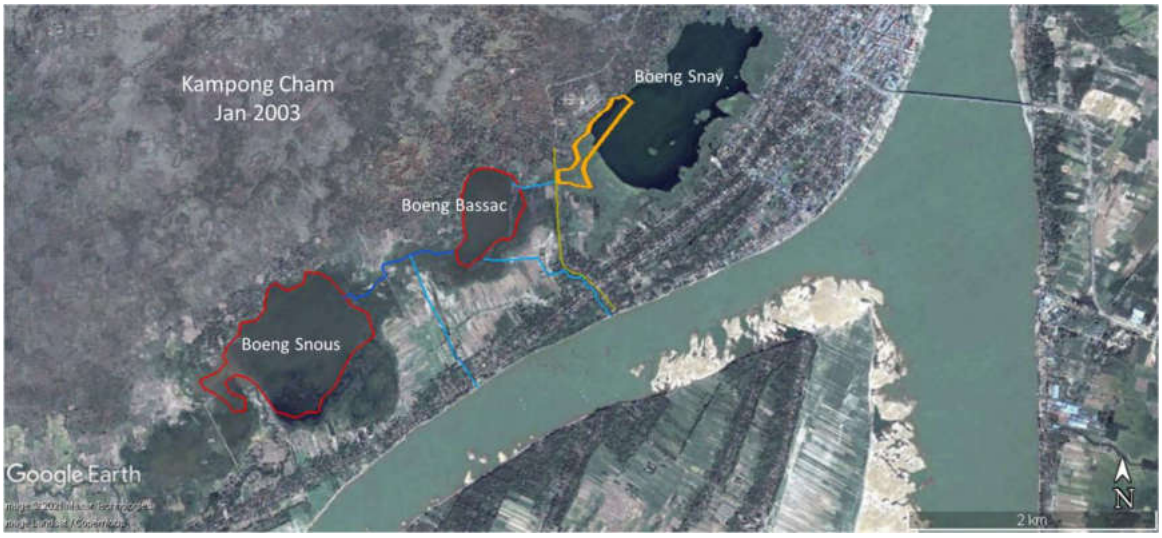


Figure 21: Kampong Cham September 2015

Figure 22: Kampong Cham August 2020

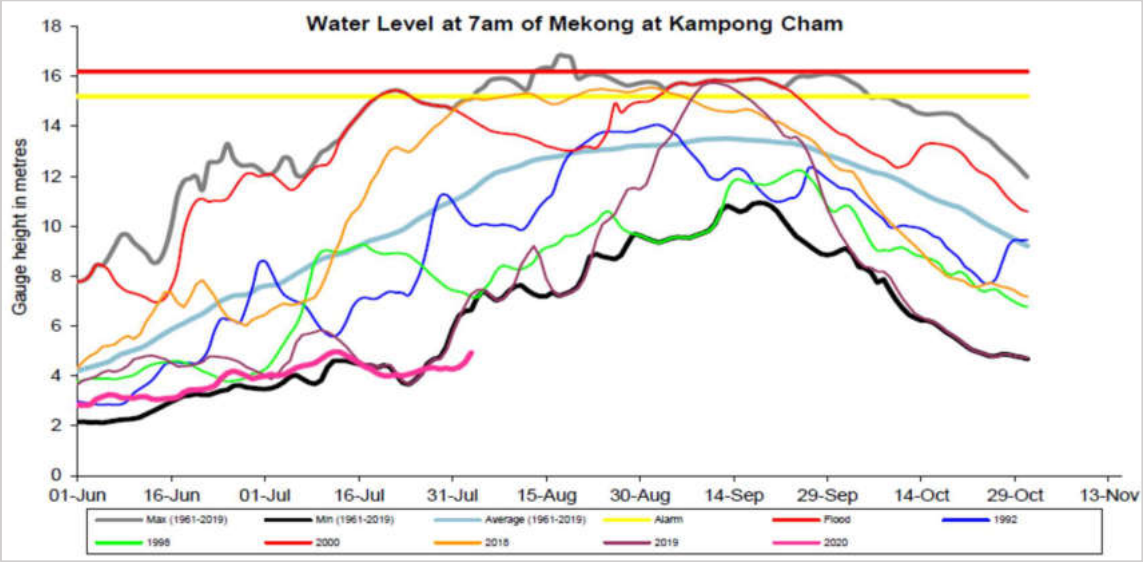
128. Boeng Kok to the north is not connected with the three other wetlands. Boeng Snay, Boeng Bassac and Boeng Snous are interconnected wetlands, although the channels that connects them have changed over time with some parts barely visible on the most recent Google Earth images. Boeng Bassac is connected to the Mekong River through a small stream and the images also show a stream to the Mekong River branching off from the channel between Boeng Bassac and Boeng Snous. However, it is not clear if these streams maintain flow throughout the year. Boeng Snay is not directly connected to the Mekong River. There is anecdotal information that the flow between the wetland streams and the Mekong River is reversed at times.

129. The natural flow from Boeng Snay to Boeng Bassac has been blocked by the north-south running road build on an embankment with elevation at about +15 m. The existing drainage pump station pumps water from Boeng Snay to the channel on the other side of the road which then conducts the water to Boeng Bassac.

5.6.2 Flooding

130. The central part of the city experiences localized flooding during rainfall events typically in the rainy season from July to September, in part due to discontinuity of flow between existing upstream and downstream drains. According to the Commune Database 2009-2014, for every 1,000 families in 2014, there were 28 that were seriously affected by floods. None were seriously affected by drought. From the socio-economic survey results, 32.5% of respondents had experienced flooding in various years (2004 to 2017). 74% indicated that flooding was caused by normal rains or monsoon; while 26% indicated that flooding was caused by extended monsoons, leading to the most serious flooding in terms of losses and damages. About 54% experienced flooding in 2017.

Figure 23: Mekong River Levels in the Rainy Season at Kampong Cham



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

131. The rainy season water levels in the Mekong River at Kampong Cham are presented in Figure 23. The station alarm level is 15.20 m while the flood level is 16.20 m. The Figure shows that during the period from 1961 to 2019, the maximum water level exceeded the flood level. However, apart from such extreme events, the City is protected from flooding by the dike along the Mekong River, and the primary concern is to ensure that the existing DPS / new DPS-1 Drainage Pump Station has sufficient capacity to pump away the rainfall from the upper side of the local embankment road. From local enquiry, the average elevation of the dyke/road is +15 m and the maximum flood level reported over the past 20-25 years in the lake is approximately 1.5-2 m below the road elevation. The ground elevation for the WWTP buildings and the primary treatment pond embankments has been set at +13.6 m. This allows for a freeboard of 0.5 m and includes an additional 0.10 m for climate change adaptation.

5.6.3 Other Natural Disasters

132. 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.

133. 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

134. The IESIA studies on the Subproject included water quality testing at two stations. One station in Boeng Bassac at the outlet of the channel between Boeng Snay and Boeng Bassac (SWQ-1), and the other in the Mekong River immediately downstream of the outlet from the stream that connects to the channel between Boeng Bassac and Boeng Snous (SWQ-2). The location of the stations is indicated in Figure 24 and the results are listed in Table 12.

Figure 24: Water Quality Monitoring Stations

Table 12: Water Quality Results

Parameters	Unit	Boeng Bassac		Mekong River	
		Lake Standards	Result	River Standards	Result
pH	-	6.5-8.5	**11.7**	6.5-8.5	**8.2**
Dissolved Oxygen	mg/L	2.0-7.5	**6.2**	2.0-7.5	**6.9**
TDS	mg/L	< 1000	**290**	< 1000	**76.0**
TSS	mg/L	1-1.5	**36**	25-100	**59.0**
BOD_5	mg/L	< 30	**2.8**	1-10	**1.2**
COD	mg/L	1-8	**12.74**	< 50	**2.94**
Oil and Grease	mg/L	< 5	**10.67**	< 5	**6.07**
Soap	mg/L	< 5	**0.08**	< 5	**N/A**
SO_4	mg/L	< 300	**2.0**	< 300	**22.0**
Total Nitrogen	mg/L	0.1-0.6	**1.31**	0.1-0.6	**0.58**
Total Phosphorous	mg/L	0.005-0.05	**0.47**	0.005-0.05	**0.03**
Arsenic (As)	mg/L	<0.01	**0.02**	< 0.01	**0.001**
Cadmium (Cd)	mg/L	< 0.001	**N/A**	< 0.001	**N/A**
Iron (Fe)	mg/L	< 1	**0.32**	< 1	**2**
Lead (Pb)	mg/L	< 0,01	**N/A**	< 0.01	**N/A**
Mercury (Hg)	mg/L	< 0.0005	**0.0003**	< 0.0005	**0.0001**
Total Coliform	MPN/100 ml	<1000	**$2.8x10^3$**	< 5000	**$1.5x10^3$**

Source: MoE Laboratory, IESIA report, PPIC July 2020

135. A visual analysis of Google Earth images indicates that substantial parts of the wetlands including Boeng Bassac are covered with macrophytes (water plants) and/or algae and the water quality results show non-compliance with the water quality standards applicable to lakes for pH, TSS, COD, Oil and Grease, Arsenic, Total Nitrogen, Total Phosphorous and Total Coliform – all of which indicate that the water quality in the wetland is significantly affected by urban wastewater. The high pH level may be an indication of carbon dioxide uptake by algal photosynthesis, although such a high pH may not be possible through removal of carbon dioxide alone.

5.7.2 Groundwater Quality

136. The Subproject IESIA studies included analyses of one groundwater sample obtained from a 22 m deep well inside Boeng Basac Primary School in Bassac Village about 200 m west of the WWTP. The results are presented in Table 13 and the location of the groundwater well is indicated in Figure 25. The results are within the drinking water quality standards except for iron – however this is not a health issue.

Table 13: Results of Groundwater Quality Analyses

Parameters	Unit	Drinking Water Quality Standards	Results
pH		6.5-8.5	6.8
Electric Conductivity	µS/cm	500-1500	451
TDS	mg/l	< 800	198
Turbidity	NTU	< 5	0.00
Calcium carbonate, CaCO3	mg/l	< 300	90
Chloride	mg/l	< 250	7.9
Fluoride	mg/l	< 1.5	0.29
Nitrate, NO3	mg/l	< 50	4.8
Sulphate, SO4	mg/l	< 250	9.0
Aluminium, Al	mg/l	< 0.2	0.14
Arsenic, As	mg/l	< 0.05	N/A
Cadmium, Cd	mg/l	< 0.003	N/A
Chromium, Cr	mg/l	< 0.05	0.003
Iron, Fe	mg/l	< 0.3	8.39
Manganese, Mn	mg/l	< 0.1	0.05
Mercury, Hg	mg/l	< 0.001	N/A
Total Coliform	MPN/100ml	0	< 30
E-coli	Count/ml	< 100	0

Source: MoE Laboratory, IESIA report, PPIC July 2020

Figure 25: Groundwater Sampling Station

5.8 Air Quality and Noise

137. The IESIA for the Subproject included measurements of ambient air quality and noise. The ambient air quality measurements are listed in Table 14 and the results of the noise measurements are presented in Table 15. The ambient air quality and noise measurements were performed at the same location as indicated in Figure 26 next to Kampong Cham University about 60 m east of the WWTP.

138. 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 PM2.5[13]

Table 14: Ambient Air Quality Measurements

Parameters	Duration	Unit	Standards	Result
Carbon monoxide, CO	8 hours	mg/m^3	< 20	3.5
NO_2	24 hours	mg/m^3	< 0.1	0.025
SO_2	24 hours	mg/m^3	< 0.30	0.022
Ozone, O_3	1 hour	mg/m^3	< 0.2	0.018
Total Suspended Particles, TSP	24 hours	mg/m^3	< 0.33	0.069
PM10	24 hours	mg/m^3	< 0.05	0.035
PM2.5	24 hours	mg/m^3	< 0.025	0.019

Source: MoE Laboratory, IESIA report PPIC July 2020

139. The noise measurements are within the Cambodian noise standards and are in the low end of typical city noise levels corresponding to the location of the station in the university compound away from significant city traffic noise.

Table 15: Noise Measurements

Time	Survey Period	Standard	Nosie Level dB(A)		
			Max	Min	Average
Day	6:00 - 7:00	60	63.8	37.7	48.3
	7:00 - 8:00		61.1	39.4	47.8
	8:00 - 9:00		61.2	36.8	48.6
	9:00 - 10:00		62.2	38.2	49.8
	10:00 - 11:00		62.6	39.1	50.4
	11:00 - 12:00		66.6	34.0	47.4
	12:00 - 13:00		65.5	38.4	44.0
	13:00 - 14:00		64.0	27.4	41.8
	14:00 - 15:00		65.2	36.8	49.1
	15:00 - 16:00		66.8	36.9	47.9
	16:00 - 17:00		66.4	36.9	48.2
	17:00 - 18:00		64,2	37.6	52.0
Evening	18:00 - 19:00	50	58.0	34.7	47.4
	19:00 - 20:00		56.3	33.3	42.4
	20:00 - 21:00		56.5	34.3	42.0
	21:00 - 22:00		55.4	32.7	40.1
Night	22:00 - 23:00	45	43.7	32.4	40.6
	23:00 - 00:00		44.8	30.9	39.4
	00:00 - 1:00		45.3	33.3	39.9
	1:00 - 2:00		45.4	33.3	44.4
	2:00 - 3:00		45.5	35.0	40.8
	3:00 - 4:00		51.4	34.2	43.4
	4:00 - 5:00		48.5	33.5	41.6
	5:00 - 6:00		47.7	34.6	41.7

Source: MoE Laboratory, IESIA report, PPIC July 2020

Figure 26: Ambient Air Quality and Noise Measurement Station

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

5.9 Protected Area

140. The proximity of the WWTP to Key Biodiversity Areas (KBI) 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 that there are no KBI or Protected Areas within a radius of 10 km from the site. The nearest of such areas is Prek Chhlong KBI 50 km northeast of the WWTP.

5.10 Ecological Resources

5.10.1 Flora

141. The vegetation within and around the subproject footprints generally include common trees, shrubs and grasses. The wetlands have been found to have areas along the shoreline covered with macrophytes which is also visible on Google Earth images. The area of Boeng Snay is waterlogged for almost the entire rainy season. The trunk sewers will be laid alongside Boeng Snay, a lagoon which has been partly filled for new urban development. Remaining vegetation are mainly shrubs and grasses. According to the DOE and the City Authorities no special flora species have been reported in or close to the town.

142. Pictures of Boeng Bassac and Boeng Snay are displayed in Figure 27 and Figure 28 respectively.

Figure 27: Pictures of Boeng Bassac

Vegetation at Boeng Bassac

Boeng Bassac	The existing pump station that pumps water from Boeng Snay to Boeng Bassac

Figure 28: Pictures of Boeng Snay

Vegetation at Boeng Snay

Vegetation at Boeng Snay

143. 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

144. 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.

145. The species of birds, reptiles and mammals listed by local residents are presented in Table 16.

Table 16: Species of Birds, Reptiles and Mammals Listed by Local Residents

N.	Local/Khmer Name	English Name	Scientific Name	IUCN Red List Category[14]
Birds				
1	Rolok Treng	Red Collared Dove	*Streptopelia tranquebarica*	LC
2	Kroch Oeunt	Barred Buttonquail	*Turnix suscitator*	LC
3	Rolok Bay	Spotted Dove	*Streptopelia chinensis*	LC
4	Preap Srok	Rock Pigeon	*Columba livia*	LC
5	Staing Slap Chhek	Shikra	*Accipiter badius*	LC
6	Staing Rolok	Black-shouldered Kite	*Elanus caeruleus*	LC
7	Khlek Srak	Barn Owl	*Tyto alba*	LC
8	Anteap Khmao	Black Drongo	*Dicrurus macrocercus*	LC
9	Trocheakam Khnong Sar	House Swift	*Apus affinis*	LC
10	Chap Kroch	Yellow-vented Bul bul	*Pycnonotus goiavier*	LC
11	Popich	Streak-eared Bulbul	*Pycnonotus blanfordi*	LC
12	Sarikakeo Kor	Common Myna	*Acridotheres tristis*	LC
13	Sarikakeo Vang	Hill Myna	*Gracula religiosa*	LC
14	Laot Thom	Greater Coucal	*Centropus sinensis*	LC
15	Tavaov	Asian Koel	*Eudynamys scolopacea*	LC
16	Chap Kanlang	Oliver-backed Sunbird	*Nectarinia jugularis*	LC
17	Chap Tet	Common Trailorbird	*Orthotomus sutorius*	LC
18	Chap Ankrung	Scaly-breasted Munia	*Lonchura punctulata*	LC
19	Chap Srok	Plain-backed Sparrow	*Passer flaveolus*	LC
20	Chap Phtas	Eurasian Tree Sparrow	*Passer montanus*	LC
21	Chap Dounta	Brown Shrike	*Lanius cristatus*	LC
22	Chap Kanlong	Brown-throated Sunbird	*Anthreptes malacensis*	LC
23	Tradeav Toch	Green Bee-eater	*Merops orientalis*	LC
24	Teav Khiev	Indian Roller	*Coracias benghalensis*	LC
25	Tracheakam	Barn Swallow	*Hirundo rustica*	LC
26	Lvea Chek	Oriental Magpie Robin	*Copsychus saularis*	LC
27	Popich Thmar	Blue Rock Thrush	*Monticola solitarius*	LC
28	Kroch Ean	Indochinese Bushlark	*Mirafra marionae*	LC
29	Pophleak Chhouvit	Savanna Nightjar	*Caprimulgus affinis*	LC
30	Popich Trachek Krahorm	Red-whiskered Bulbul	*Pycnonotus jocosus*	LC
31	Kroling Krolang	Black-collared Starling	*Sturnus nigricollis*	LC
32	Praveuk	Lesser Whistling-duck	*Dendrocygna javanica*	LC
33	Te Cabprey	Spot-billed Duck	*Anas poecilorhyncha*	LC
34	Provek	Cotton Pygmy-goose	*Nettapus coromandelianus*	LC
35	Khlek Khmao	Black Kite	*Milvus migrans*	LC

[14] The IUCN Red List Categories divides species into nine categories: Not Evaluated (NE), Data Deficient (DD), Least Concern (LC), Near Threatened (NT), Vulnerable (VU), Endangered (EN), Critically Endangered (CR), Extinct in the Wild (EW) and Extinct EX).

N.	Local/Khmer Name	English Name	Scientific Name	IUCN Red List Category[14]
36	Chap Srok	Striated Grassbird	*Megalurus palustris*	LC
37	Totear	Chinese Francolin	*Francolinus pintadeanus*	LC
38	Monn Prey	Red Junglefowl	*Gallus gallus*	LC
39	Meam Toch Prey	Asian Barred Owlet	*Glaucidium cuculoides*	LC
40	Titoy Thom Prey	Spot-bellied Eagle Owl	*Bubo nipalensis*	LC
41	Sek Sark	Red-breasted Parakeet	*Psittacula alexandri*	LC
42	Troses Thom	Greater Yellownape	*Picus flavinucha*	LC
43	Popul Khbal Teitung	Orange-breasted Green Pigeon	*Treron bicincta*	LC
44	Chek Tum Brak	Silver Oriole	*Oriolus mellianus*	LC
45	Lvea Chek Prey	White-rumped Shama	*Copsychus malabaricus*	LC
46	Kok Krort	Javan pond heron	*Ardeola speciosa*	LC
47	Monn Teuk Khmao	Common Moorhen	*Gallinula chloropus*	LC
48	Kok Krong	Intermediate Egret	*Egretta Intermedia*	LC
49	Kaeth Teuk Toch	Little Cormorant	*Microcarbo niger*	LC
Reptiles				
1	Chhing Chork	Four-clawed Gecko	*Gehyra mutilata*	NE
2	Tok Ke	Tockay Gecko	*Gekko Gecko*	LC
3	Thlen	Indian Forest Skink	*Sphenomorphus indicus*	NE
4	Bangkouy	Garden fence lizard	*Calotes versicolor*	NE
5	Pous Pralet	Plumbeous water snake	*Enhydris plumbea*	LC
8	Skar	Small Asian Mongoose	*Herpestes javanicus*	LC
9	Pous Sna Ansorg	Radiated ratsnake	*Coelognathus radiata*	NE
10	Pous Saing Seu	Keeled Rat Snake	*Ptyas carinata (Günther,1858)*	LC
11	Pous Khsekok	Buff Striped Keelback	*Amphiesma stolatum*	NE
12	Pous Thlang	Burmese Python	*Pyfthonmolurus bivittaftus*	NE
13	Pous Vek Dambok	Indochinese Spitting Cobra	*Naja siamensis*	VU
14	Kanchek Srok	Common tree frog	*Polypedates leucomystax*	LC
15	Kankep Ouk	Rugulose frog	*Hoplobatrachus rugulossus*	LC
16	King Kouk	Common Asian toad	*Bufo melanostictus*	LC
17	Hing Krabei	Common Asian Bull frog	*Kaloula pulchra*	LC
18	Kankep Sre	Paddy frog	*Fejervarya limnocharis*	LC
Mammals				
1	Tonsay Koul	Siamese Hare	*Lepus peguensis*	LC
2	Kandol Sre	Rat	*Rat spp.*	NE
3	PraCheav	Tomb Bat	*Taphozous theobaldi*	LC
6	Sampoch	Small Indian Civet	*Viverricula indica*	LC
7	Khlar Trei	Fishing Cat	*Prionailurus viverrinus*	VU

146. The interviews with local residents listed a large number of different bird species but none of these are on the IUCN Red List of Threatened[15] species.

147. The interviews listed two species (one reptile and one mammalian) that are classified as Vulnerable on the IUCN Red List:

[15] 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

- Indochinese Spitting Cobra (*Naja siamensis)* is found in Southeast Asia, including Thailand, Cambodia, Vietnam, and Laos.
- The Fishing Cat (*Prionailurus viverrinus*) is a medium-sized cat whose disjunct global range extends from eastern Pakistan through portions of India, Nepal and Sri Lanka, throughout Bangladesh and Mainland Southeast Asia to Sumatra and Java.[16] However, in 2015, the species was discovered at two sites in southwest Cambodia: Peam Krosaop Wildlife Sanctuary (Koh Kong Province) and Ream National Park (Sihanoukville Province)[17]. It would be quite remarkable if it is present in the wetlands of Kampong Cham and the listing of the species should be taken with caution.

148. **Fish Species.** The fish species listed by local residents are presented in Table 17.

Table 17: Fish Species Listed by Local Residents

N.	English Name	Scientific Name	IUCN Red List Category
1	Walking catfish	*Clarias batrachus*	LC
2	North African catfish	*Clarias gariepinus*	LC
3	Stinging catfish	*Heteropneustes*	LC
4	White-line catfish	*Mystus albolineatus*	LC
5		*Mystus bocourti*	VU
6	-	*Mystus multiradiatus*	LC
7	-	*Mystus wolffi*	LC
8	-	*Micronema cheveyi*	DD
9	Beardless barb	*Cyclocheilichthys apogon*	LC
10	Highfin barb	*Cyclocheilichthys armatus*	LC
11	Finged barb	*Cyclocheilichthys heteronema*	LC
12	-	*Cyclocheilichthys lagleri*	LC
13	Reticulate flying fox	*Crossocheilus reticulatus*	LC
14	Long-fin flying minnow	*Esomus longimanus*	DD
15	Flying minnow	*Esomus metallicus*	LC
16	Pavie's rasbora	*Rasbora paviei*	LC
17	-	*Scaphognathops stejnegeri*	NA
18	Catopra	*Pristolepis fasciata*	LC
19	Iridescent glassy perchlet	*Parambassis apogonoides*	LC
20	Snakehead Murrel	*Channa Striat*	LC
21	-	Luciosoma bleekeri	LC
22	Blackspotted catfish	Hemibagrus spilopterus	NA
23	-	Poropuntius normani	NA
24	Dusky face carb	Osteochilus lini	NA
25	Climbing perch	Anabas testudineus	DD
26	Freshwater garfish	Xenentodon cancila	NA
27	Talking gourami	Trichopsis pumila	NA
28	Marble goby	*Oxyeleotris marmorata*	LC
29	-	*Luciosoma bleekeri*	LC
30	-	*Ophichthus rutidoderma*	NA
31	Bleeker's sheatfish	*Micronema bleekeri*	NA
32	Grey bony-lip carp	*Osteochilus schlegeli*	DD
33	Swamp barb	*Puntius brevis*	LC

[16] https://wildcatsmagazine.nl/wild-cats/fishing-cat-prionailurus-viverrinus/

[17] https://wildcatconservation.org/tag/prionailurus-viverrinus/

N.	English Name	Scientific Name	IUCN Red List Category
34	Spotted barb	*Puntius rhombeus*	LC
35	Tiger barb	*Puntius partipentazona*	LC
36	Sumatran river sprat	*Clupeoides borneensis*	LC
37	Sleepy goby	*Clupeoides biocellatus*	LC
38	-	*Botia nigrolineata, Ambastaia nigrolineata*	VU
39	Sun loach	*Yasuhikotakia eas*	LC
40	Yellow loach	*Yasuhikotakia lecontei*	LC
41	Orangefin loach	*Yasuhikotakia modesta*	LC
42	Catopra	*Pritolepis fasciata*	LC
43	-	*Parambassis siamensis*	LC
44	Iredescent glassy perchlet	*Parambassis apogonoides*	LC
45	Croaking gourami	*Trichopsis vittata*	LC
46	-	*Betta prima*	LC
47	-	*Prionobutis koilomatodon*	NA
48	Kabili bublebee goby	*Brachhygobius kabiliensis*	NA
49	Gangetic leaffish	*Nandus nandus*	LC
50	Swamp eel	*Monupterus albus*	LC
51	Beneal eel	*Ophistermon bengalense*	NA
52	-	*Pteropangasius micronemus*	NA
53	-	*Clupisoma sinensis*	LC
54	-	*Hemisilurus mekongensis*	LC
55	Ompok eugeneiatus	*Makay glass catfish*	LC
56	Wallago	*Wallago attu*	VU
57	Crocodile catfish	*Bagarius suchus*	NT

149. The interviews with local residents listed the following Threatened fish species[18]:

a) *Mystus bocourti* (VU). The species occurs in medium to large-sized rivers, lakes and small ponds. Reported present in Cambodia, Thailand, Laos and Vietnam.

b) *Ambastaia nigrolineata* (VU) synonym *Botia nigrolineata*. The species occurs in clear, fast-flowing waters of the Mekong basin. Reported present in China, Laos, and Thailand.

c) Wallago, *Wallago attu* (VU). The species is found in large rivers, lakes and tanks. When the water level in the Mekong drops and the flood recedes, it moves to the Mekong or larger tributaries, where it stays in deep pools until the next inundation period. Reported present in 14 countries of South Asia and Southeast Asia.

d) Crocodile catfish, *Bagarius suchus* (NT). The species inhabit large rivers usually associated with rapids. Reported present in Laos and Thailand.

5.11 Physical and Cultural Resources

150. In addition to Boeng Snay Pagoda and Kampong Cham University located close to the WWTP (see Section 5.2), there are two other pagodas, churches, several schools and other education institutions, and government buildings including the Kampong Cham Provincial Hall in the service area (see Figure 29 and Figure 30).

Figure 29: Pagodas in the Subproject Area

[18] Information about the species based on https://www.fishbase.org

Figure 30: Pagodas in the Subproject Area

5.12 Basic Demographic and Social Data

151. The population in the four sangkats of Kampong Cham City and the estimated population within the service area are summarized in Table 18. The City had a total population of 40,788 and a total of 9197 families in 2019 corresponding to an average family size of 4.4 persons. 24 percent of the families had a female head.

Table 18: Kampong Cham Population 2019

Sangkat	% Within The Service Area	2019 Population	Estimated Population in the Service Area
Boeng Kok	20	9,667	1,933
Kampong Cham	100	5,550	5,550
Sambuor Meas	20	13,972	2,794
Veal Vong	100	11,599	11,599
Total		**40,788**	**21,877**
Percent of the City Population			**54%**

Source: PMC Population Analysis, Service Area Population for Kampong Cham Wastewater

152. The main occupation of the workforce in Kampong Cham town is summarised in Table 19.

Table 19: Occupation in Kampong Cham City

Occupation	Percent	People
Public and private services	83.6%	12,604
Businesses and trading	27.7%	4,176
Repair services	2.7%	407
Transportation services	7.8%	1,176
Workers or labour services	9.5%	1,432
Private employment	17.3%	2,608
Public/government employment	18.6%	2,804
Agricultural sectoral jobs/ services	13.4%	2,019
Handicraft sector jobs/ services	3.0%	456

Source: Provincial Department of Planning, 2020

153. The poverty rates for the sangkats of Kampong Cham City compared with Kampong Cham Province are summarised in Table 20.

Table 20: Poverty Rates in Kampong Cham

Administrative Unit	2017	2018	2019
Boeng Kok	8.29%	8.03%	9.66%
Kampong Cham Town	8.38%	9.62%	8.96%
Veal Vong	8.33%	8.44%	9.57%
Sambour Meas	5.53%	3.46%	3.60%
Kampong Cham City			7.95%
Kampong Cham Province			14.3%

Source: Provincial Department of Planning, 2020

154. **Water and Sanitation**. Most of the households in Kampong Cham City are connected to the public water supply network and only about 400 households in Sambour Meas, which has a somewhat more rural setting use groundwater or collect rainwater for gardening, watering animals or washing.

155. The access to basic sanitation in Kampong Cham City is summarised in Table 21.

Table 21: Kampong Cham Access to Basic Sanitation in 2019

Description	Boeng Kok	Kampong Cham	Sambour Meas	Veal Vong
Total No. of families	2,335	1,135	2,988	2,739
Families with access to basic sanitation	2,323	1,135	2,938	2,596
Percent of families with access to basic sanitation	99%	100%	98%	95%

6 ANTICIPATED IMPACTS AND MITIGATION MEASURES

6.1 Project Environmental Benefits

156. The Subproject is anticipated to have significant localized environmental benefits as practically all wastewater from the inner city of Kampong Cham City will be collected in a separate system and treated in a wastewater treatment plant thereby reducing water pollution and improving the water quality of the receiving wetlands in Kampong Cham City (and also in the Mekong River although to a much lesser extent).

157. The Subproject will improve drainage in Kampong Cham 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 Kampong Cham City.

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

6.2 Environmental Impact Screening

159. 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).

160. 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.

161. Table 22 summarizes the potential impacts associate with the proposed WWTP and drainage project during construction and operation.

Table 22: Screening of Impacts

Impact	Source	Receptors
Construction		
Degradation of Air Quality	- Exhaust fumes from construction machinery and equipment, movement of haulage trucks - Fugitive dust from earth works, loading, unloading and haulage of construction materials	- Nearby residents - Workers
Noise and vibration nuisance	- Noise from construction equipment - Pile driving - Earthworks and breaking of rock	- Nearby residents - Boeng Snay Pagoda - Boeng Bassac Primary School - Kampong Cham University - Workers
Impacts on water quality	- Construction work in or near Boeng Snay wetland - Discharge of contaminated runoff (suspended material, oil spills) - Accidental spills - Waste littering	- Fauna and flora in Boeng Snay wetland - Groundwater
Erosion or degradation of soil and land	- Earthworks near the wetland - Accidental spills/ poor management of waste	- Boeng Snay wetland
Disturbance of fauna or flora	- Reduced size of the Boeng Snay wetland - Cutting or removal of street trees	- Boeng Snay wetland flora and fauna - Communities
Risk of infections	- Influx of labour force for the construction work	- Communities - Workers
Reduced / degraded accessibility	- Excavation works / trenches in public areas - Presence of equipment in public areas	- Communities
Operation	-	-
Impacts on water quality	- Non-compliant effluents	- Fauna and flora in wetlands in Kampong Cham -
Odours	- WWTP operations - Treatment of sludge	- WWTP operators - Nearby residents - Boeng Snay Pagoda - Boeng Bassac Primary School - Kampong Cham University - Workers
Health and safety risks	- Use of equipment/maintenance of WWTP and networks - Presence of litter and pests in networks - Non-compliant effluents	- Workers - Communities

6.3 Design and Pre-Construction Phase

162. 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)[19]; 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 04 February 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, HHs, and PIU. The temporary impact agreement shall include provisions for restoring/rebuilding impacted assets or moving shops and stalls between contractor, HHs, and PIU.

f) **Unexploded ordinance**. The EA/IU/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.

[19] 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.

6.4 Environmental Impact and Mitigation Measures during Construction

6.4.1 Air Quality Impacts

163. 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.

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

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.

165. **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

166. Operation of construction equipment and vehicles at the different construction sites will generate noise emissions. Stationary equipment such as pile drivers, 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 vibrations[20]. Mobile equipment such as dozers, excavators, rollers and trucks do not generate impulsive noise.

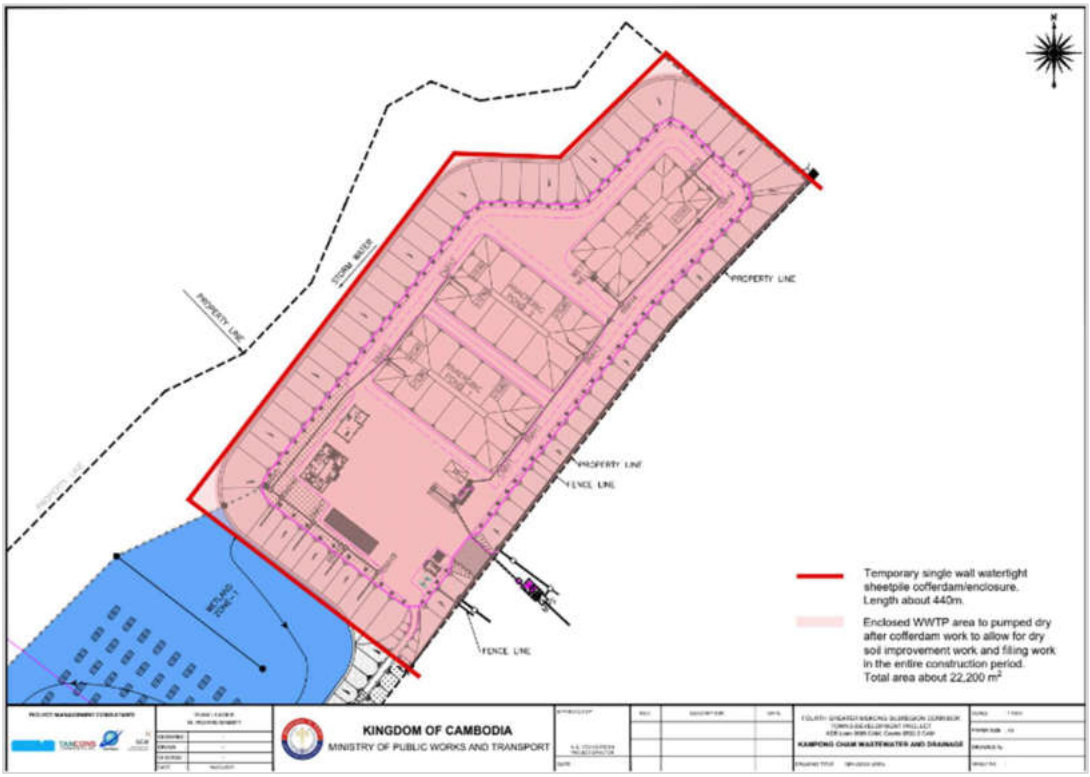
167. The reclamation of the area for the WWTP primary treatment facilities will require installation of a sheet pile cofferdam as indicated in Figure 31. The sheet pile driver will work 50-100 m from residents and 100-200 m from Boeng Snay Pagoda. A conservative noise calculation[21] assuming 1 pile driver (80 dB[22]), 1 excavator (82 dB) and 1 truck (70 dB) working at the same time would result in a noise level of 72 dB(A) at a distance of 50 m and 67 dB(A) at a distance of 100 m – not considering barriers, soft ground or any other noise attenuation factors. The sheet piles will likely be left in place. The subsequent construction work will continue to involve noisy equipment (although not generating vibrations or impulsive noise) and the noise levels will be similar.

[20] 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

[21] Using New Zealand Government Transport Agency's construction noise calculator, https://www.nzta.govt.nz/

[22] 10 m from the source

Figure 31: Sheet Pile Cofferdam Enclosure



168. The calculated noise levels at the nearby residential area exceed the Cambodian daytime (06:00-18:00) noise standard of 60 dB(A). In addition, the main construction activities will take place some 400 m from Boeng Bassac Primary School and about 150 m from Kampong Cham University for which the noise standard is 45 dB(A)[23]. 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)$L_{Aeq(15min)}$ for work lasting less than 20 weeks and 70 dB(A)$L_{Aeq(15min)}$ for work lasting more than 20 weeks[24]. However, 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 Contractor's Environmental Management Plan as the specific measures will depend on the construction equipment and methods.

169. In terms of vibrations, installation of a sheet pile cofferdam using impact or percussion piling may impact nearby structures including possibly fragile historical artifacts at Boeng Snay Pagoda. As with noise, the specific mitigation measures will be determined under the Contractor's Environmental Management Plan. To determine the method with the least impacts and the measures to be applied, the predictive plot developed by Whyley and Sarsby[25] can be applied (see Figure 32).

170. Impact piling causes ground vibrations of a short duration that dies out between each blow (unless a high frequency hammer is used). Vibratory piling, on the other hand, causes

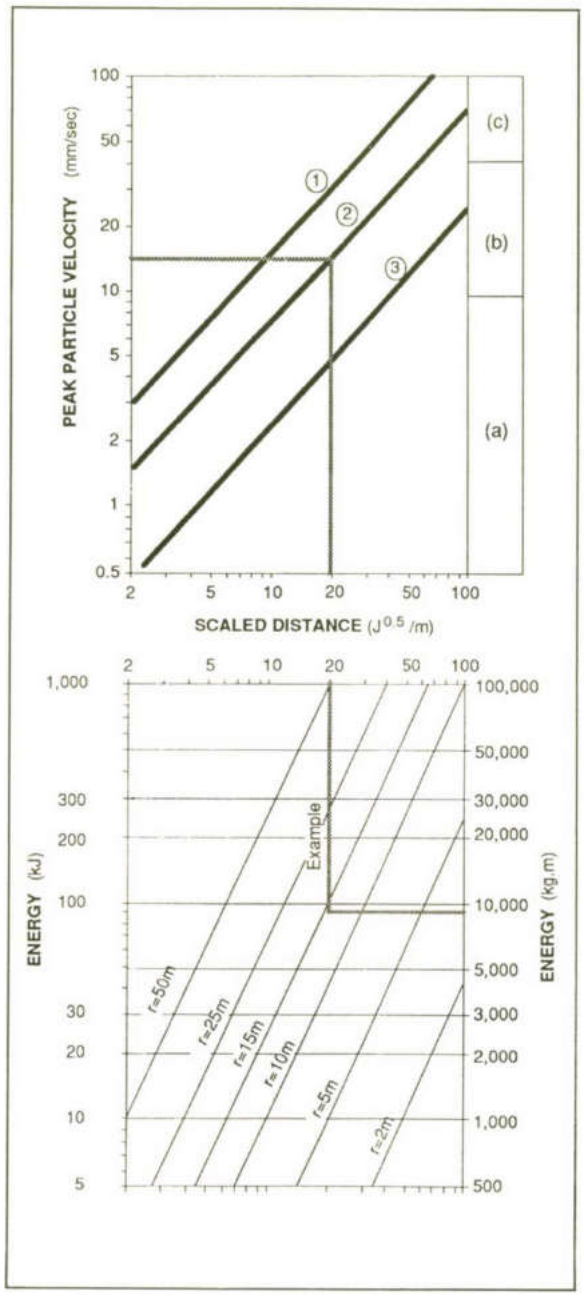
[23] Sub-decree No. 42 ANK/BK on Control of Air Pollution and Noise Disturbance, 10 July 2000

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

[25] Whyley, P.J. & Sarsby, R.W. (1992). Ground borne vibration from piling. Ground Engineering, Vol. May 1992, pp. 32-37. https://cdn.ca.emap.com/wp-content/uploads/sites/13/1992/05/GE-May-1992-Ground-borne-vibration-from-piling.pdf

comparatively less ground vibration, but the piling is uninterrupted, and this can generate resonance in nearby structures which may increase the risk of damages or discomfort.

Figure 32: Vibration Predictive Plot



Line 1: Upper bound for stiff or dense soil

Line 2: Upper bound for firm to stiff or medium dense soils

Line 3: Upper bound for soft or loose soils

Damage criteria

The column to the rigth of the plot are suggested damage criteria for relatively new, fairly sound, residential structures:

(a) No problem, proceed with the work;

(b) Further investigations are required. Obtain specific vibration data in order to calibrate the site, e.g. conduct a trial drive or drop a large weight into the ground and measure the resulting vibrations, and thereafter derive site specific relationships;

(c) Traditional impulse driving not recommended. redesign the works.

These damage criteria shall be adjusted based on surveys of the nearby structures.

Example shown on the plot:
For a site using a BSP- B35 hammer (energy per blow 8850 kg.m) find potential vibration level at new residential structures 15 m distant, when driving through firm to stiff and medium dense soil. Follow 8850 kg.m energy line to distance of 15 m. Draw line vertically upwards through 'Scaled Distance'axis to meet line for firm to stiff and medium dense soils (line 2). Draw horizontal line to PPV axis giving upper bound of 15 mm/s. Further investigation and/or site calibration is required. Alternatively use a lighter hammer or alternative construction method.

Source: Whyley, P.J. & Sarsby, R.W. (1992). Ground borne vibration from piling. Ground Engineering, Vol. May 1992, pp. 32-37. https://cdn.ca.emap.com/wp-content/uploads/sites/13/1992/05/GE-May-1992-Ground-borne-vibration-from-piling.pdf

171. With respect to noise nuisances from construction of the wastewater and drainage network, the geotechnical survey encountered near-surface rock in the northern part of the service area, and trench excavations for wastewater pipes may therefore require the use of rock breaking equipment generating localized and temporary loud noise emissions including impulsive noise.

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

a) Use recent equipment and Maintain all exhaust systems in good working order; undertake regular equipment maintenance.
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; information procedure of handling complaints through the Grievance Redress Mechanism will be disseminated.
e) Ensure noise monitoring is undertaken near sensitive receptors (hospitals, schools, places of worship) when construction machinery is in operation.
f) Ensure that noise control options such as silencers and mufflers are fitted to exhausts, compressors and fans for construction equipment (such as hydraulic excavator, bulldozer, front loader, backhoe and trucks);
g) Implementation of operating and maintenance practices of equipment and machinery to ensure that they are well-maintained;
h) 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.
i) Use of mobile noise barriers where noisy activities are taking place.
j) As part of a traffic management plan, speed limits should be set for trucks and other work machinery when passing through residential areas where vehicle speed will be reduced to max 30 km/hour. Engines should be turned off when not in use.

173. The following specific noise and vibration mitigation measures will be applied for sheet piling:

a) Prior to start of sheet piling, the contractor shall carry out baseline noise measurements to establish the background noise levels (at least for a period of 72 consecutive hours) in accordance with internationally recognized standards.
b) As part of the CEMP, the contractor shall prepare and submit a sheet piling noise and vibration subplan describing the construction methods, construction equipment and the proposed noise and vibration abatement methods. The subplan shall: (1) Include a reasoning for the proposed construction method based on indicative assessments of the noise and vibration impacts of various alternatives also taking background noise levels into account, (2) include description of sheet pile driving tests with monitoring of noise and vibrations to calibrate the initial assessment and determine site specific methods and practices that generate less intrusive noise and vibrations, (3) consider using temporary moveable noise barriers or other forms of noise attenuation measures (4) include a detailed noise and vibration monitoring programme, and (5) include a community information and consultation programme.
c) The contractor shall conduct property condition surveys and assessments of nearby structures prior to start of sheet piling, during sheet piling and after completion of the piling to identify potential vibration impacts from pile driving and differentiate that from existing damages. The contractor shall obtain permission from property owners and administrators prior to undertaking inspections.

d) The contractor shall carry out noise and vibration monitoring at sensitive receptors during sheet piling.

6.4.3 Water Quality Impacts

174. The construction activities may cause impacts on water quality by: (1) direct disturbance of the banks and bed of Boeng Snay wetland, (2) reclamation and dewatering of the area for the primary treatment facilities, (3) dewatering of excavations for wastewater and drainage pipes, (4) runoff from exposed ground and material stockpiles, (5) concrete placement and washing areas, and (6) polluted runoff/spills from fuel storage/refuelling sites.

175. The construction of the WWTP will take place in and near Boeng Snay. These activities and in particular sheet piling and reclamation and dewatering of the area for the primary treatment facilities are likely to disturb the lakebed, generate turbulence thereby resuspending particles in the water, and the activities may cause discharge of sediment-laden runoff into the wetland. However, it is assessed that the likely increase in the concentration of suspended solids during periods with construction activities will be transient and localized. The large surface area, low flow velocities and rectangular shape of the wetland with the long side in the flow direction is likely to promote settlement of the particles within short distances from the construction activities. In addition, the contractor will be required to implement good management practises and undertake regular environmental quality monitoring to identify and address emerging water quality problems.

176. 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.

177. Runoff from construction sites with exposed ground or workshop areas may be polluted with sediments, cementious wash off or oil and grease. Good construction practises and regular control and monitoring are considered sufficient to effectively mitigate these potential impacts.

178. **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) If found necessary, install silt fences or other forms of filters to contain the sediment load in Boeng Snay wetland;
h) Install adequate short-term drainage to collect potentially contaminated runoff or process water and provide settlement ponds or tanks with the appropriate design to ensure sufficient time for the particles to settle.

i) 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.

j) All maintenance and refuelling of vehicles and machinery must take place in designated areas, within retention bunds (mobile retention bunds if necessary).

k) 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.

l) 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.

m) No washing or repair of machinery within 50 m from surface waters.

n) There shall be no disposal of spoil on agriculturally productive land or within 50 m of a water course.

o) 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.

p) 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.

q) Construction working areas will be clearly demarcated and encroachment onto adjacent areas avoided.

r) 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.

s) Pit latrines and septic tanks should be placed at least 2 m above the groundwater table must be located at least 50 m from surface water bodies and water wells and in areas of suitable soil profiles.

t) Monitoring shall be conducted on effluents and on receiving water bodies.

179. **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

180. 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.

181. 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.

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

6.4.5 Flora and Fauna Impacts

183. The WWTP will be constructed in Boeng Snay wetland and the reclaimed part of the treatment plant will take-up about 2.5 ha of the 19 ha large wetland. The wetland used to cover 107 ha until about 88 ha was reclaimed in 2010-2013. The wetland has over the recent history of Kampong Cham received the wastewater and most of the stormwater generated in Kampong Cham, and the wetland together with the adjoining Boeng Bassac wetland have functioned as a sort of natural “wastewater treatment system” and are therefore (as the water

quality presented in Table 12 indicates) clearly affected by urban wastewater and not compliant with the national water quality standards for lakes.

184. There are no Key Biodiversity Areas (KBIs) or Protected Areas within a radius of 10 km from the WWTP and the nearest KBI/Protected Area is 50 km northeast of the site. On the other hand, the interviews with local residents during the IESIA studies provided a long list of wildlife species (see Section 5.10.2) and even though the species and their habitats have not been scientifically confirmed, the information does suggest that the wetlands have important roles to play for the local wildlife.

185. The selection of the site for the WWTP was made based on an evaluation of alternative sites and was favoured due to unavailability of other more suitable public land within a reasonable distance from the City and also considering topography. To reduce the permanent loss of wetland as well as to minimise the very costly reclamation, the original design of the WWTP was revised to only include reclamation of wetland area for the primary treatment thus reducing the permanent loss of wetland by about half.

186. On balance, the conversion of 2.5 ha polluted wetland to a controlled engineered primary treatment facility does bring significant positive effects in terms of improved water quality for the wetlands as a whole and their increased capacity to support typical wetland lifeforms in the long-term.

187. 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.

188. **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.

189. 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.

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

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

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

6.4.6 Borrow Pits and Spoil Disposal

193. 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.

194. Table 23 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 23: 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)	

195. **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.

196. The contractor shall:

a) obtain and document agreement with the landowner;
b) ensure minimisation of vegetation and habitat loss and limit land clearance to only the land required for the borrow pit / spoil disposal;
c) Set out the site boundaries and ensure that the surrounding land is not disturbed;
d) prohibit the use of burning to clear and control vegetation;
e) 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

197. 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.

198. 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

199. 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.

200. **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.

201. **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.

202. 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

203. The main occupational health and safety risks include:

a) 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.
b) Working above or near the wetland.
c) Operating a sheet pile driving rig mounted on a barge.
d) Working with heavy construction equipment.

204. **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 guidelines[26]
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.

205. General occupational health and safety measures include:

a) A supervised danger zone will be established around the pile driving rig.
b) At least one lifesaving skiff will be immediately available at locations where employees are working over or adjacent to water.
c) Provide fall protection when workers are exposed to unguarded platforms or walkways higher than 2 m.
d) Guard against danger to persons at work from falling objects (earth, rock or other material) by suitable sloping[27], shielding[28] or shoring[29];
e) Ensure there are safe ways to enter and exit the excavation.
f) Trenches will have cave-in protection such as sloping, shielding or shoring.
g) Materials will be kept at least 0.6 m away from the edge of a trench.
h) Adequate ventilation will be secured at all workplaces so as to maintain an atmosphere fit for respiration.
i) Excavations will be kept dry.
j) Provision will be made for safety precautions when using high voltage electric power tools.

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[26] 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

[27] 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/

[28] 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/

[29] 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

k) 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.
l) Daily toolbox meetings (safety briefings) will be carried out.
m) An accident record book will be maintained where all major or minor accidents and incidents are recorded with actions taken.
n) Worker education and awareness events for construction hazards will be given. A construction site safety program will be developed and distributed to workers.
o) The contractor shall appoint an Environment, Health and Safety Officer who is qualified engineer.
p) Adequate first aid equipment will be made available on site.
q) Training and awareness will be provided to the workers on safety management and HIV-AIDs.
r) The contractor will set out an Emergency Response Plan in accordance with the requirements outlined in the EMP.

206. 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 shoos 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 guidelines[30]
c) Safety glasses (rock/surface breaking, piling, crushing/grinding, cutting)
d) Welding hoods with clear safety glasses under (welding)
e) Workers working over or near water, where the danger of drowning exists, will be provided with life jacket or buoyant work vests.

6.4.10 Labour Camp Impacts

207. 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.

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

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.

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

209. 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

210. 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.

211. 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.

212. 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.

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

6.5.1 Impacts on Surface Water

214. 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 the natural wetland zone 3 where it will mix with the stormwater from the drainage corridor parallel to the wetlands. At the drainage pump station at the western border of the Natural wetland zone 3, the mixed stormwater and effluents from the WWTP will be pumped or moved by gravity across the road embankment to a natural channel that will

conduct the water to Boeng Bassac – a large wetland connected to the Mekong River (seasonally) through a small stream (see also Section 4.4.1 and Figure 6).

215. The wastewater from the service area that currently is discharged untreated into Boeng Snay and from there to Boeng Bassac, will be treated down to compliance with the applicable effluent standards thereby significantly reducing the load on the wetlands. However, it should be noted that the stormwater from the northern part of the City outside the service area may still be mixed with wastewater, and although the water quality will be improved, it is uncertain if the quality of the water that flows into Boeng Bassac (the treated water mixed with the untreated stormwater) will meet the ambient water quality standards.

216. As discussed in Section 5.7.1, the wetlands including Boeng Bassac are clearly affected by urban wastewater and they have for a long time functioned as a sort of "natural treatment system", but they are not in a natural condition, and it is outside the scope of this Subproject to bring these wetlands into natural conditions.

217. Overflow at the pump stations. The risk of overflow with raw wastewater at the pump stations will be minimized by installation of alarm systems. 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 connected to the emergency generator at the WWTP and a mobile emergency generator with fuel tank stationed at the WWTP will 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.

218. 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 issues[31] (see also Section 4.4.4):
    i. Sludge management including treatment, disposal and emergency situations.
    ii. Operational water testing and control procedures to timely identify and troubleshoot operational problems.
    iii. Maintenance of wetland plants.
    iv. Emergency procedures including schedule for testing and upgrading procedures.
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.

[31] 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

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

219. 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 6 m below ground surface. The emergency generator at the WWTP which will serve both the WWTP itself and the main pump station will be equipped with adequate noise attenuating provisions to meet all exterior noise level requirements.

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

6.5.3 Groundwater Impacts

221. 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 joints[32], and the pump stations will be constructed with water-tight concrete. At the WWTP, the anaerobic pond sides and bottoms will be equipped with a HDPE liner over well-compacted clay. In addition, the more than 10 m thick clay layer underneath the WWTP will function as an effective barrier against infiltration to any deeper groundwater aquifer.

6.5.4 Odour Impacts

222. 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/L[33], and considering that typical sulphate concentrations in domestic wastewater is less than 100 mg/L, nuisance odours from the anaerobic ponds are not likely.

223. 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.

224. Due to the proximity to housing, the Kampong Cham University and the Boeng Snay Pagoda, occasional odour nuisances cannot be ruled out, and implementation of additional mitigation measures may be necessary.

225. Odour at the pump stations. The pump stations will be located in the urban area and at pump station SPS-1 and SPS-2, there are houses within a 20 m radius. However, 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

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

[33] 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

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.

226. 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) 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.
h) Use quick-disconnect fittings between pumper truck and receiving station to minimize exposure of septage to the atmosphere.
i) Wash-down facilities to clean up any spills, with drainage into the holding tank
j) Avoid free fall of septage by extending receiving pipes below the water surface
k) Introduce septage at slow controlled rates to avoid turbulence or agitation.
l) Ventilate the air from the tank to an odour biofilter.
m) Clean tanks, trucks and equipment daily.

6.5.5 Disposal of sludge from the WWTP

227. 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 be removed annually or every two years. Sludge from anaerobic treatment is largely inert, can be dried and landfilled or spread on agricultural land. During the first two years of operation of the wastewater treatment plants, sludge will be collected and 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 only be dried and landfilled.

6.5.6 Occupational Health and Safety

228. The main occupational health and safety issues during operations include[34]:

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 sewage 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;

[34] CUPE BC, Wastewater Treatment Plant Occupational Health and Safety Bulletin. https://www.cupe.bc.ca/

e) Risk of falls into treatment ponds or wetlands.

229. 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) Provide a lifesaving skiff at the wetland ponds.
c) Conduct regular education of workers/staff on the health and safety plan.
d) Conduct safety training sessions at the beginning of each shift.
e) Avoid direct contact with sewage.
f) Avoid aerosolizing wastewater or minimizing exposure time in areas where aerosolizing is occurring.
g) Provide first aid services, supplies and equipment.
h) Undertake regular health checks of workers/staff.
i) 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.

230. 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):

e) 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.
f) 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.
g) Conduct training and education of workers in infection prevention and control practices.
h) Provide clear and visible guidelines on how to prevent infection at the construction site.

6.5.7 Community Health and Safety Risks

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

232. As mentioned in para 217, the risk to public health from exposure to overflowing raw wastewater is negligible.

233. To prevent unauthorized access to the WWTP, an access gate and a perimeter fence will be erected around the primary treatment facilities.

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

7 ANALYSIS OF ALTERNATIVES

7.1 No Project Alternative

235. 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.

236. Boeng Snay which receives wastewater and stormwater from the City was almost entirely reclaimed in 2010-2013, and this has caused wastewater mixed with stormwater to flow and accumulate around the edges of the old lake. From Boeng Snay, the water flows to Boeng Bassac which is also clearly affected by urban wastewater. The existing drainage system is also unable to cope with flooding and the flood risks are likely to increase in the future due to climate change.

237. 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 Kampong Cham.

7.2 Wastewater Treatment Design and Technology Alternatives

238. 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.

239. 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.

240. 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.
- The slightly modified treatment technology and layout involve two trains of anaerobic ponds followed by simulated facultative and maturation ponds with floating aquatic plants to provide additional treatment, directly in the existing lake conditions using a simple impermeable curtain/boom to separate the wetland from the parallel drainage corridor. This is considered to be the optimal sewage treatment solution for this very complex WWTP site, providing simple but very good levels of treatment with the lowest possible construction and operating costs, which will allow for timely construction of the WWTP within 36 months.

241. 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.

242. 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.

243. **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.

244. 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.

245. 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

246. During Project Preparation, meetings were held with stakeholders to obtain views and opinions on the subproject and this also assisted the project team with development of the sub-project outline designs.

247. CDIA Preparation Phase. During the preparation of the first IEE and EMP for the sub-project, consultations took place within the subproject area. An outline of the consultation meetings held in Kampong Cham is provided in Table 24. The details of these consultations are not repeated here but are available in the disclosed IEE documents 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 24: CDIA Phase Consultations Held

Location	Dates	Stakeholders or Groups Met*	
Kampong Cham	From : 30/07/2017 To 08/09/2017	MoE MOWRAM PDPWT PDoE PDWRAM PDLMUPC Local Authority Group Women Group Vulnerable Group	Kampong Cham Commune Boeng Kok Commune
MoE	Ministry of Environment		
MOWRAM	Ministry of Water Resources and Meteorology		
PDoE	Provincial Department of Environment		
PDPWT	Provincial Department of Public work and Transportation		
PDWRAM	Provincial Department of Water Resources and Meteorology		
PDLMUP	Provincial Department of Land Management and Urban Planning		
PDoP	Provincial Department of Planning.		

248. Preparation of the DED IEE. Further consultations were undertaken in two formats during this IEE preparation: (i) a household socio-economic survey which was undertaken by a trained team of researchers, and which included a number of questions to inform this IEE; and (ii) consultation focus groups, undertaken in collaboration between the environmental and social team members and aimed to inform the project team on concerns people may have and how they may wish to see their concerns mitigated.

249. Household socio-economic surveys were undertaken for this project in January 2018 and included a number of questions relevant to environmental and social safeguards. The questionnaire was designed with inputs from the environmental, financial, and engineering specialists on the team. A sample of 271 households in each town was determined. The respondent views are summarized below. Where appropriate, corresponding mitigation measures are included in the EMP.

250. The household survey confirms that drainage and wastewater collection service coverage is low in all three towns: 27% of households in Kampong Cham. Service with solid waste collection among the sampled household was then 67% in Kampong Cham. Almost no households in the sample have access to open canal drains.

251. The survey identified the following main problems in the subproject towns:

- Inadequate disposal of residential wastewater
- Inadequate disposal of human excreta
- Flooding and inadequate storm water management
- Poor quality of drinking water
- Difficult access to drinking water.

252. Consultations with provincial and city authorities. The IESIA consultants facilitated consultations with relevant provincial and city authorities. The consultations were held on 20 July 2020 at the Kampong Cham Provincial Hall. The results of the consultations are summarized below.

253. Summary of consultations with provincial and city authorities:

Provincial Governor

- We support this important project.
- The project should cover all areas of the city, because all most every year there is flooding in the city due to lack of proper drainage.
- The construction should be implemented as soon as possible and according to schedule.

Kampong Cham City

- We strongly support this project, because the project is good for our city as it will control and manage wastewater and stormwater.
- The project should cover all residential areas of Kampong Cham City, because other areas also have problems with wastewater and stormwater.
- There may be some impacts during construction in urban area, which should be properly addressed.
- We will help to ensure that project related impacts on social or economic activities are avoided or resolved before the construction starts.

Provincial Department of Public Works and Transport

- We are the Implementation Agency, and we will support and coordinate the project implementation.
- We will help to ensure that all comments are considered.

Provncial Department of Environment

- The potential impacts on the environment during construction are temporary, but during operation the impacts may be long-term.
- The wastewater discharge from WWTP should be monitored regularly to ensure compliance with the effluent standards.
- Odour may affect residents nearly the WWTP. Mitigation measures should be implemented, and odour should be monitored.

Provincial Department of Water Resources and Meteorology

- The wastewater discharge from WWTP must be monitored
- The project should implement a Mitigation Plan with measures to mitigate the potential impacts on local people living near the WWTP.
- The project should collaborate with the provincial authorities and CMAC for mince clearing to ensure, there not UXOs are located in the project areas.
- Before and during excavation, the contractor should conduct detailed site survey of nearby structures and utilities.

Provincial Department of Culture, Fine, and Art

- We support this proposed project for wastewater treatment and drainage in the city.
- During construction, the project should collaborate with our department to prevent impacts on any archaeological or historical artifacts that may be found during excavation work.
- The project should inform and collaborate with local authorities and people to prevent or minimize effects on cultural assets (pagodas).

Provincial Department of Rural Development

- We support this project for management of wastewater and drainage in Kampong Cham City. We agree with the comments made by the other participants.
- The project should discuss the use of sludge as fertilizer with the Department of Agriculture, Forest, and Fishery.

Provincial Department of Land Management, Urban Planning and Construction

- The project should study and consider the right-of-way and private land and try to avoid impacting on private land.
- Please note that all land in Kampong Cham cite has land titles.
- The project should cover all residential areas in the city. Some areas next to the project area are also often flooded.

Provincial Department of Planning

- UXOs and mines should be surveyed and cleared before the construction starts.
- The construction company and their workers should be informed to the local authorities and our department.
- Occupational health and safety measures should be prepared in compliance with national regulations.
- The project should provide safety signs and safety equipment for the construction work.
- The project should implement proper mitigation of impacts on social resources and business activities during construction in the city areas,

Provincial Department of Agriculture, Forest, and Fishery

- We support this project to improve wastewater treatment and drainage in the city.
- The project should provide traffic signs, safety signs at the construction sites
- The project should negotiate and resolve any impacts on social resources during construction.
- The project should monitor wastewater discharge from the WWTP and reduce the impacts from the WWTP on the environment and local people.
- The project should test sludge for content of pollutants and pathogens before using it as fertilizer in agriculture.

Provincial Waterworks Authority

- This is an important project for Kampong Cham City, and we will cooperate with the project.
- The water pipes are located underground in the subproject area. Before and during construction (excavation), we will collaborate with project to ensure that water pipes are not affected.
- Please inform our department about the project construction schedule and construction locations.

Provincial Hall

- We support this project and agree with comments made by the other authorities.
- The population growth should be considered for the design capacity of the project components.
- If possible, the project should cover all residential areas in the Kampong Cham City.
- The project should plan the alignment for sewage and drainage lines within the right-of-way of the roads. Detailed surveys on the impacts on properties, structures, and local utilities should be carried out.
- The project should monitor the wastewater discharge from the WWTP and ensure that it complies with the effluent standards. The wastewater should be analysed by the laboratory of the Ministry of Environment.
- Odour is a concern and tree planting should be provided around the WWTP site to reduce odour. Air quality monitoring should be carried out 2 times/year.

Participants

No	Name	Institution/Agency	Position
1	Mr. Han Kosal	Kampong Cham Provincial Hall	Deputy Governor

No	Name	Institution/Agency	Position
2	Mr. Hean Lina	Kampong Cham Town	Deputy Governor
3	Mr. Nil Bunly	Provincial Department of Public Works and Transport	Chief office
4	Mr. Va Sroen	Provncial Department of Environment	Chief office
5	Mr. Chhun Bunarith	Provincial Department of Water Resources and Meteorology	Deputy Department
6	Mr. Rath Pisak	Provincial Department of Culture, Fine, and Art	Deputy Department
7	Mr. Ke Buntheoun	Provincial Department of Rural Development	Deputy Department
8	Mr. Thoun Vicheanay	Provincial Department of Land Management, Urban Planning and Construction	Chief office
9	Mr. Chheng Heang	PDoLVT	Director Department
10	Mr. Noun Noy	Mine Action Plan Unit	Director of MAPU
11	Mr. Som Ros	Provincial Police Quarter	Deputy Leader
12	Mr. Hing Nareth	Provincial Department of Planning	Deputy Department
13	Mr. Katek Sovannak	Provincial Department of Agriculture, Forest, and Fishery	Deputy Department
14	Mr. Var Samreth	Provincial Waterworks Authority	Official
15	Mr. Sam Piseth	Provincial Hall	Deputy Chief of Administration

254. Stakeholder consultations will continue through project implementation and operation, following the Project Stakeholder Participation Plan. All stakeholders must be invited and encouraged to participate in community consultations. To facilitate the engagement of stakeholders, the PMU and PIU will maintain good communication and collaboration with Commune Councils and Village Leaders. The PMU, PIU Contractors and/or Operators will be open to contact by the public on matters concerning the progress of the subprojects, adverse impacts, mitigation measures and environmental monitoring and grievances.

255. **Focus Group Discussions (FGD)**. FGDs were conducted by the PPTA social and environmental team in 7th-8th December 2017 at the project sites of Kampong Cham town. The objectives of the FGDs were to:

a) Present to the stakeholders and affected people the sites for subprojects in the provincial towns and inform them of the project activities.
b) Understand the main issues that may occur in the proposed sub-project areas, as raised by local people.
c) Understand the potential social and environmental resources located/used in the subproject sites.
d) Receive issues, feedback, and comments from stakeholders or affected people regarding social, gender and environmental issues/resources in the proposed sites.
e) Receive comments and suggestions for mitigation measures to improve adverse impacts from project design, construction, and operation stages.

256. The FGDs consultation meetings elicited the following comments from the stakeholders:

- Almost every year during the rainy season, village areas in Kampong Cham and Boeng Kok communes are flooded.
- Women worry mostly about decrease in local business or income during flooding (flooded roadway and lack of clients)
- Women also consider the negative impacts on community sanitation and public health, especially for their children.

- Women are mostly responsible for household work during floods.
- Flooding is caused by the lack of culverts and drainage system in the town.
- Some parts of drainage are destroyed, and some areas are not connected to public drainage system or with no drainage.
- Some households have installed and use own drainage (but have low capacity and standards).
- Flooding impacts the quality of life of the community through poor sanitation, increase in waterborne diseases, bad smell, polluted water, and bringing solid wastes from upstream area through runoff.
- Some schools are flooded during heavy rain affecting travel time to school (delayed and reduced learning time).
- Environmental problems that were associated with drainage and the WWTP construction such as dust, noise, air, etc. are considered small and temporary during construction stage.
- The local people are not much concerned about the environmental issues during construction.
- The people said, need the culvert/drainage system and WWTP in their town.

257. **Inclusion of Affected People's Views**. The mitigation measures in the EMP reflects the results of the consultations during IEE preparation. The results of the consultations with communities are summarized in Table 25. Where appropriate, a response to the comment or concern is signposted in the EMP.

Table 25: Consultation FGD in Boeng Kok and Kampong Cham Commune

Issues/problems, feedbacks, comments and questions in Kampong ChamTown	Response
- All most every year during raining season in the village areas of Kampong Cham and Boeng Kok commune is flooded. - The most women worried during flood occurs the local business or income is decreased (flood roadway and lack client). They also consider of negative impacts on community sanitation, and public health, especially their children. - The women more responsible for household jobs during flood. - The flood cause from lack of culverts and drainage system in the Town. Some parts of drainage are destroyed (can't use) and some areas are not connected to public drainage system or not drainage. - Some households installed and used own drainage (not capacity and standards). - The flood is impacted to quality of life of the community (poor sanitation, increasing waterborne diseases, bad smell, polluted water, and bringing solid wastes from upstream area through runoff. - Some schools were flooded during heavy rain, can be affected to school time (delayed learning time). - The solid waste is a problem in this area cause from: o waste collector is not enough capacity (equipment and staffs), the waste truck can't come on the time (should be 2 days/time). o some households are not waste collection service, o some households don't want to cooperate/use waste collecting subcontractor, and don't satisfy with waste collection fee (the normal household: 2$/month). - Environmental problems associated with drainage construction and WWTP activities (i.e., dust, noise, air, etc.). The impacts are small and temporary only during construction stage, these impacts	- The engineers will study hydrology and install the culvert. - Now is study time, we don't know which subprojects will be selected yet. - We will report your ideas to MPWT, ADB, DPWT, and provincial Authority for decide.

the local people are not concerning too much. They need culvert/drainage system and WWTP in their town.	

8.2 Public Consultations during Project Implementation

258. 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.

259. 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.

260. 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

261. The WWTP operator, in collaboration with MPWT/PDPWT, MoE/PDoE, MOWRAM/PDOWRAM, MAFF/PDAFF, Provincial-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

262. 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

263. 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.

264. 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.

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

10 Environmental Management Plan

266. The EMP has been prepared as a standalone document (latest updated version of June 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.

267. 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 Kampong Cham City. The PDPWT has established a Project Implementation Unit comprising relevant provincial government representatives including the Provincial Department of Environment.

268. A summary of the key functions for project implementation and therefore environmental safeguards is presented in Table 26.

Table 26: 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
Project Implementation Unit	PIU	Provinces within PDPWT	Responsible for sub-project implementation

Role	Abbreviation	Location	Summary of overall function
PIU Safeguards Focal Point	PIU-SFP	Provinces within PIU	Responsible for sub-project environmental and social safeguard monitoring
Contractor Environmental Health & Safety Officer	C-EHS	Construction Site	Mitigation measure implementation and reporting
Contractor Environmental Compliance Officer	C-EC	Construction Site	Mitigation measure implementation temporary impacts agreements and restoring/rehabilitation, and reporting.
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 actions.

11 Conclusions and Recommendations

11.1 Conclusions

269. This IEE was prepared to identify the environmental issues and risks associated with the proposed wastewater treatment and drainage project in Kampong Cham 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.

270. 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.

271. 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.

272. During operations the most significant environmental risks can potentially arise from poor facility operation and maintenance and future uncontrolled urban development which may cause release of non-complying effluents, and nuisances due to exposure to odours. The wetland habitats within the project area of influence have been altered through years of uncontrolled development and discharge of untreated wastewater. The subproject will significantly reduce the pollution load on the wetlands; however, as the service area for the WWTP does not cover the entire catchment to the wetlands, it may not be sufficient to bring the wetlands into natural conditions. In addition to a strict control on quality of effluents and receiving water bodies, flood mitigation and emergency response measures will be developed to be incorporated into the plant operations and maintenance manual.

273. 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.

274. A robust Grievance Redress Mechanism will be established as outlined in the IEE and the EMP. The mechanism will ensure that all unplanned impacts which cause grievances for affected people are managed and a satisfactory outcome brought about swiftly.

275. Overall, the project is anticipated to bring environmental benefits to Kampong Cham 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

276. 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.

277. The next step in implementation of the Environmental Safeguards is the preparation of the 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 will form the basis of the Environmental Management System of the Contractor during the construction phase. The CEMP shall contain a number of subplans dealing with specific topics, such as noise and vibration 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.

278. 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 (NO2)	24 hours	mg /m3	0.1
Sulfur Dioxide (SO2)	24 hours	mg /m3	0.3
Carbon Monoxide (CO)	24 hours	mg /m3	20
PM 2.5	24 hours		-
PM 10	24 hours		-

(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	5
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	0C	< 45	< 45
2	pH		6 – 9	5 - 9
3	BOD5 (5 days at 200 C)	mg/l	< 30	< 80
4	COD	mg/l	< 50	< 100
5	Total Suspended Solids	mg/l	< 60	< 120
6	Total Dissolved Solids	mg/l	< 1000	< 2000
7	Grease and Oil	mg/l	< 5.0	< 15
8	Detergents	mg/l	< 5.0	< 15
9	Phenols	mg/l	< 0.1	< 1.2
10	Nitrate (NO3)	mg/l	< 10	< 20
11	Chlorine (free)	mg/l	< 1.0	< 2.0

No	Parameters	Unit	Allowable limits for pollutant substance discharging to	
			Protected public water area	Public water area and sewer
12	Chloride (ion)	mg/l	< 500	< 700
13	Sulphate (as SO4)	mg/l	< 300	< 500
14	Sulphide (as Sulphur)	mg/l	< 0.2	< 1.0
15	Phosphate (PO4)	mg/l	< 3.0	< 6.0
16	Cyanide (CN)	mg/l	< 0.2	< 1.5
17	Barium (Ba)	mg/l	< 4.0	< 7.0
18	Arsenic (As)	mg/l	< 0.10	< 1.0
19	Tin (Sn)	mg/l	< 2.0	< 8.0
20	Iron (Fe)	mg/l	< 1.0	< 20
21	Boron (B)	mg/l	< 1.0	< 5.0
22	Manganese (Mn)	mg/l	< 1.0	< 5.0
23	Cadmium (Cd)	mg/l	< 0.1	< 0.5
24	Chromium (Cr+3)	mg/l	< 0.2	< 1.0
25	Chromium (Cr+6)	mg/l	< 0.05	< 0.5
26	Copper (Cu)	mg/l	< 0.2	< 1.0
27	Lead (Pb)	mg/l	< 0.1	< 1.0
28	Mercury (Hg)	mg/l	< 0.002	< 0.05
29	Nickel (Ni)	mg/l	< 0.2	< 1.0
30	Selenium (Se)	mg/l	< 0.05	< 0.5
31	Silver (Ag)	mg/l	< 0.1	< 0.5
32	Zinc (Zn)	mg/l	< 1.0	< 3.0
33	Molybdenum (Mo)	mg/l	< 0.1	< 1.0
34	Ammonia (NH3)	mg/l	< 5.0	< 7.0
35	DO	mg/l	>2.0	>1.0
36	Polychlorinated Byphemyl	mg/l	<0.003	<0.003
37	Calcium	mg/l	<150	<200
38	Magnesium	mg/l	<150	<200
39	Carbon tetrachloride	mg/l	<3	<3
40	Hexachloro benzene	mg/l	<2	<2
41	DTT	mg/l	<1.3	<1.3
42	Endrin	mg/l	<0.01	<0.01
43	Dieldrin	mg/l	<0.01	<0.01

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

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

Annex 4 of Sub-decree on Water Pollution Control

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

Source: Sub-decree No. 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	Diedrin	µg/l	< 0.01
6	Aldrin	µg/l	< 0.005
7	Isodrin	µg/l	< 0.005
8	Perchloroethylene	µg/l	< 10
9	Hexachlorobutadiene	µg/l	< 0.1
10	Chloroform	µg/l	< 12
11	1,2 Trichloroethylene	µg/l	< 10
12	Trichloroethylene	µg/l	< 10
13	Trichlorobenzene	µg/l	< 0.4
14	Hexachloroethylene	µg/l	< 0.05
15	Benzene	µg/l	< 10
16	Tetrachloroethylene	µg/l	< 10
17	Cadmium	µg/l	< 1
18	Total mercury	µg/l	< 0.5
19	Organic mercury	µg/l	0
20	Lead	µg/l	< 10
21	Chromium, valent 6	µg/l	< 50
22	Arsenic	µg/l	< 10
23	Selenium	µg/l	< 10
24	Polychlorobiohenyl	µg/l	0
25	Cyanide	µg/l	< 0.005

(4) 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 (SO4)	mg/l	250
9	(BOD)5	mg/l	NV
10	(COD) Mn	mg/l	NV
11	Aluminum (Al)	mg/l	0.2
12	Arsenic (As)	mg/l	0.05
13	Copper (Cu)	mg/l	1.0
14	Iron (Fe)	mg/l	0.3
15	Lead (Pb)	mg/l	0.01
16	Manganese (Mn)	mg/l	0.1
17	Mercury (Hg)	mg/l	0.001
18	Zinc (Zn)	mg/l	3.0
19	Total Coliform	MPN/100mlml	0

Annex 2: Field Meeting Notes in Kampong Cham

A. Coordination and Consultation Meeting with the Department of Public Works and Transport, Kampong Cham Province

Date:	02 Aug, 2017		
Time:	8:30 am		
Venue:	Meeting room of the Department of Public Works and Transport, Kampong Cham Province		
Present:	Mr. Nil Bunly	Chief of drainage office	DPWT, Kampong Cham
	Mr. Van Chan Ou	Chief of administration office	DPWT, Kampong Cham
	Mr. Khan RA	DTL	MPWT-ADB, PPTA
	Ms. Delfa Uy	Environmental specialist	MPWT-ADB, PPTA
	Mr. Yim Chamnan	Environmental specialist	MPWT-ADB, PPTA
	Mr. Michael Alcazaren	Social safeguards specialist	MPWT-ADB, PPTA
	Mr. Mel Sophanna	Social safeguards specialist	MPWT-ADB, PPTA

Highlights:

River Bank protection

- We think, is good project for Kampong Cham, because the river bank erode or destroy every year, make to impact on road, houses and any communities structures.
- There some small houses and cottages on the river bank of RoW and a few floating houses are located on the River Bank protection sub-project.
- For floating houses is not problem, when we construction they will move out and when finish they can move back to same place.
- Some houses or cottages they are knew of the land use in the RoW. The DPWT and local authorities informed to them of land in the RoW and River Bank is belonged to state.
- A few trees and fruit trees are located on the river bank, before construction, the DPWT will collaborate with local authorities to negotiate with affected people cut or move out (these fruit trees is belonged to local people).

Drainage and WWTP

- The population in Kampong Cham Town is increasing time to time, so improvement of drainage system and construction the WWTP is very important for town for (i) recusing the flood in town during raining season, (ii) Mitigating the pollution to Mekong water quality, because all the waste water from town is directly discharge in to Mekong River without treating.
- All most every year, in Kampong Cham Town is flooded by runoff when heavy rain and when Mekong River Flood is big, the water level rises up to 15 m deep.
- There are a few families are cultivating of lotuses and fish pond in this area, but they knew is the public land, and they promise to move out then provincial government needs for development project.

B. Coordination and Consultation Meeting with the Department of Environment (DoE), Kampong Cham Province

Date:	02 Aug, 2017		
Time:	10:00 am		
Venue:	Meeting room of the Department of Public Works and Transport, Kampong Cham Province		
Present:	Mr. Khi Tang Lay	Director Department	DoE, Kampong Cham
	Mr. Lay Chhay	Deputy Director	DoE, Kampong Cham
	Mr. Kem Borey	Branch Manager of CINTRI	CINTRI (solid waste)
	Mr. Khan RA	DTL	MPWT-ADB, PPTA
	Ms. Delfa Uy	Environmental specialist	MPWT-ADB, PPTA
	Mr. Yim Chamnan	Environmental specialist	MPWT-ADB, PPTA

Highlights:

- These proposed sub-projects are very important for Kampong Cham Town as River Bank protection and WWTP.
- River Bank Protection sub-project is for reducing bank damage in the Kampong Cham Town, providing good environmental condition on the river bank for local recreation place. WWTP sub-project will mitigate the pollution in the Mekong River. The provincial governor proposed this WWTP, but we don't have enough budget.
- Will be impacted of project on the environment and social, but I think there are a few. Small, and temporary impacts, mostly during construction such as: noise, dust, traffic issues, there are not significant.
- A few fruit trees are located in project site, are not main issues, the DPWT will collaborate with local authorities, and affected people to cut and move out, these trees are private properties belong to local communities.
- The MoE some time collects Mekong water to analysis in Phnom Penh, the sampling location is near the Mekong Bridge. From MoE, we have the existing data of Mekong water quality in 2017

- Solid Waste is collect and transport by subcontractor (CINTRI) for this town. The CINTRI has owner private open dumping sites for disposal solid wastes is located in Chamkar Leu District is about 30 km from Kampong Cham Town.
- In waste disposed site, there are 5-6 people collect any wastes for selling to recycling places, they are pore families are living near the disposed sites.
- All the families in Kampong Cham Town have water supply from town's water supply authority access to their households. So climate change (drought) is not big impact concerning to water supply in Kampong Cham town.

C. Coordination and Consultation Meeting with Kampong Cham Town, Kampong Cham

Date:	02 Aug, 2017		
Time:	2:30 pm		
Venue:	Meeting room of the Department of Public Works and Transport, Kampong Cham Province		
Present:	Mr. Kim Tay	Chief District Council	Kampong Cham Town
	Mr. Phork Samin	District council member	Kampong Cham Town
	Mr. Seng Rotha	Chief of administration office	Kampong Cham Town
	Mr. Paong Saveth	Deputy chief of administration	Kampong Cham Town
	Ms. Chhean Sophy	Deputy chief of administration	Kampong Cham Town
	Mr. Mon Heng	Commune council	Veal Vong Commune
	Ms. Delfa Uy	Environmental specialist	MPWT-ADB, PPTA
	Mr. Yim Chamnan	Environmental specialist	MPWT-ADB, PPTA
	Mr. Khan RA	DTL	MPWT-ADB, PPTA

Highlights:

- Kampong Cham Town some time is flooded when heavy rain in August and September. And also wen big Mekong Flood during wet season.
- We have problem of drainage (too old, damage, and some place not drainage system). This town don't have WWTP. The waste water discharge into Mekong River without treatment.
- There a few impacts of this project such as:
  - The houses are located in river bank, but not problem the local people ready knew this land is belong to public (they will move out), the compensation is small issues.
  - There are not any sensitive areas or dangerous species located near the project sites.
  - The a few families are cultivate lotus and aquacultures on the WWTP proposed site, but we will inform them to move out when the project need, is public land.
- The solid waste is collecting and transporting by private company (CINTRI) all the town, but the are a few families are located far from center don't want to pay for waste collection fee and they manage for themselves (burning or out underground).

D. Coordination and Consultation Meeting PDWRAM, Kampong Cham Province

Date:	02 Aug, 2017		
Time:	4:30 pm		
Venue:	Meeting room of the Department of WRAM, Kampong Cham Province		
Present:	Mr. Hun Sary	Deputy Department of WRAM	PDWRAM, Kampong Cham
	Ms. Delfa Uy	Environmental specialist	MPWT-ADB, PPTA
	Mr. Yim Chamnan	Environmental specialist	MPWT-ADB, PPTA
	Mr. Khan RA	DTL	MPWT-ADB, PPTA

Highlights:

- We are support this project, for improving the water and river bank management with environmental considering.
- We put water level point in the MWRAM point and in Mekong Bridge on the river. The water level rise to 15 is emergency point. We will inform to local authorities and communities by TV, Radio, and committee emergency group (Commune, District, and Provincial level).
- PDRWAM don't have water quality laboratory. The water quality is available in MOWRAM, Phnom Penh.
- PDWRAM has only water level, temperature, rainfall data.

<table>
<tr><td>  </td><td>  </td></tr>
<tr><td colspan="2">Consultation with PDPWT, Kampong Cham</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>Consultation with DoE, Kampong Cham</td><td>Consultation with Kampong Cham Town</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>Condition Mekong River Kampong Cham Town on 3 August, 2017</td><td>Water level of Mekong River on 03 August, 2017</td></tr>
</table>

E. Random Interviews at the Site of the Proposed Drainage Component

Date:	02 August 2017	
Time:	1:40 pm	
Venue:	Village 1, Veal Vong Commune, Kampong Cham Town	
Name: Age: Gender: Address:	Mr. Ngy Tang Heng 73 year olds Male Village 1, Veal Vong Commune, Kampong Cham	Highlights: ○ All most very year this village is flooded caused by runoff from heavy rain and Mekong River Water. In year 1996-97 is big flood from Mekong River. The flood is about 1-2 m deep, the people use boats from travelling.

		○ This are is lowland or deep than town so improve or building culvert for runoff and waste water is very important for our village to reduce food and provide drainage for waste water. We are happy. ○ In this village some areas have drainage system and some are not. ○ Some land in this project area is belonged to private families, the project may be impact to land use in this village. The resettlement plan should be prepared. ○ We are welcome to project, so the some impacts from project during construction are not main issues (small and short time)

Table: The Participants list of the Proposed Drainage Component

No	Name	Sex	Village/Commune	Function	Phone
1	Mr. Ngy Tang Heng	M	Village 1, Veal Vong Commune	Villager	
2	Mr. Chheag Sokunthea		-	-	
3	Ms. Sao Houn	F	-	-	
4	Ms. Sim Ny	F	-	-	

F. Random Interviews at the Pumping Station Site for the Proposed WWTP Component

Date:	02 August 2017	
Time:	1:00 pm	
Venue:	Beung Bassac Village, Sambour Meas Commune, Kampong Cham Town	
Name: Age: Gender: Address:	**- Mr. Ban Lorn** 76 year olds Male Beung Bassac Village, Sambour Meas Commune. **- Mr. In Thy** 61 year olds Male Beung Bassac Village, Sambour Meas Commune.	Highlights: ○ Happy and support to this project for reduce waste water pollution in Mekong River. ○ In Kampong Cham Town the waste water is directly discharging into the Mekong River no treatment. ○ This proposed site is lowland area, flooded area in wet season. In the dry season remaining small water in middle of site. The local name is Bassac like. Is public land, but they still use some parts of this land. ○ A few families are cultivating in this area lotus farm, fish ponds and family fishing. ○ We think is very minor impact from the project during construction and operation (noise, smell, and dust), because the village is located far from project site. ○ The local communities use the existing road for connection from village to village, go to school, to markets.

Annex 3: Consultation During IEE Preparation

Consultation Meetings: Focus Group Discussion (FGD). The main objectives of FGDs are to:

1. Present to the stakeholders and affected people the sites for subprojects in the provincial towns and inform them of the project activities.
2. Understand the main issues that may occur in the proposed sub-project areas, as raised by local people.
3. Understand the potential social and environmental resources located/used in the subproject sites.
4. Receiving issues, feedback, and comments from stakeholders or affected people regarding social, gender and environmental issues/resources in the proposed sites.
5. Receiving comments and suggestions for mitigation measures to improve any adverse environmental and social impacts from project design, construction, and operation stages.

Identification of Participants to Consultation Meeting Stakeholders invited to attend FGDs were identified by National Social Specialist and National Environmental Specialist with assistance from commune chiefs of subproject areas. These focus group members come from:

- Representative of communities or affected communities (men and women)
- Chiefs/ deputy village chiefs, the villages are located in and close to the subproject sites.
- Commune chiefs/deputy commune chiefs and commune council members. These communes are located in and around the proposed subprojects sites.

The discussion questions concerned:

- Physical Resources: Water resources and water quality, soil quality, and air quality (noise and odor).
- Ecological Resources: forest/vegetation, wildlife and fish.
- Social Issues/Resources: Land use, water use, agricultural activities, cultural resources, infrastructure, utility services, education, and cultural-touristic resources.

The format of the FGD is summarized as follows:

1. Introduction to the project - describe the project and potential construction activities.
2. Mitigation Measures. Describe potential mitigation measures (EMP) and monitoring
3. Consultation Discussion. Discussion on topics and questions:

   A. How does the community use the environment & natural resources? Example: what are water sources (drinking, washing etc). Vegetation/Fish/Forest, land use etc
   B. What are the community's concerns regarding Construction Impacts?
   C. What are the community's concerns regarding Operation Impacts?
   D. What are the Mitigation Measures the community would like during Construction?
   E. What are the Mitigation Measures the community would like during Operation?

There is only 02 FGD meetings conducted in the Kampong Town for FGD meeting in Beong Kok commune and Kampong Cham commune. The meeting is conducted in Beong Kok Commune Office on 08 September, 2017. The summary of key comments and feedbacks are shown in IEE report.

FGD's Pictures in Kampong Cham Town


The FGD meeting activities in Beong Kok and Kampong Cham Commune, Kampong Cham Town

FGD Meeting in Beong Kok and Kampong Cham Commune, Kampong Cham Town					
1	Mr. Peang Sarun	M	Beong Kok Commune	Commune chief	
2	Ms. Lay Mom	F	--	Villager	
3	Ms. Te Srey	F	--	--	
4	Ms. Lay Mei	F	--	--	
5	Mr. Khot Onn	M	--	--	
6	Ms. On Heng	F	--	--	
7	Ms. Mom Hun	F	--	--	
8	Ms. Kim Inn	F	--	--	
9	Ms. Khen Tankheng	F	--	--	
10	Ms. Van Thon	F	--	--	
11	Mr. Srun Vunchan	M	--	--	
12	Mr. Sok Sameth	M	Kampong Cham Commune	Deputy commune chief	011 707 054
13	Mr. Koy Kun	M	--	Village chief	092 934 801
14	Ms. Hem Leap	F	--	Villager	

Annex 4: IBAT Proximity Analysis

Integrated Biodiversity Assessment Tool

PROXIMITY REPORT
KAMPONG CHAM WASTEWATER

Country: Cambodia

Location: [12, 105.4]

Date of analysis: 22 April 2021 (GMT)

Size of site: 0 km^2

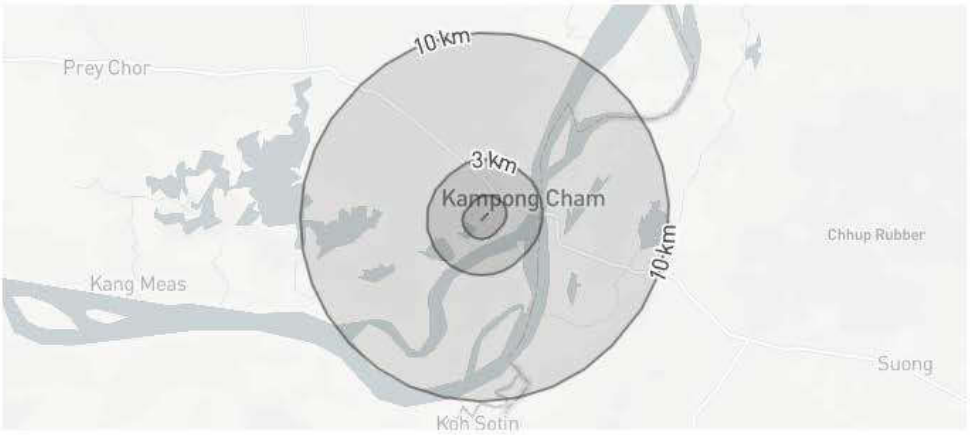
Buffers applied: 1 km | 3 km | 10 km

Generated by: Peter Gammelgaard Jensen

Organisation: ADB

Overlaps with:

Protected Areas	0
Key Biodiversity Areas	0
IUCN Red List	72



Displaying project location and buffers: 1 km, 3 km, 10 km

About this report

This report presents the results of [6690-15845] proximity analysis to identify the biodiversity features and species which are located within the following buffers: 1 km, 3 km, 10 km.

This report is one part of a package generated by IBAT on 22 April 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.

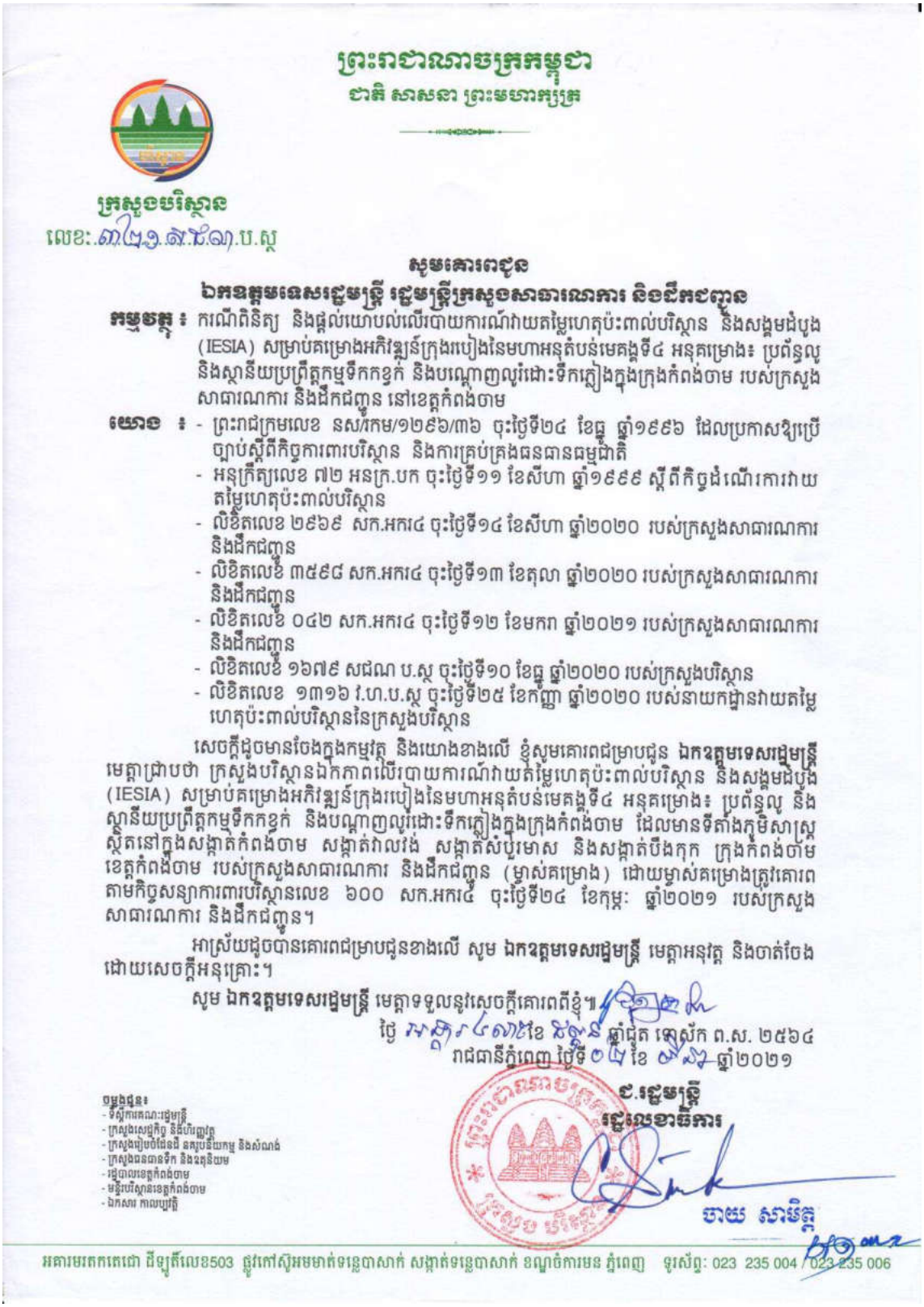
WARNING: IBAT aims to provide the most up-to-date and accurate information available at the time of analysis. There is however a possibility of incomplete, incorrect or out-of-date information. All findings in this report must be supported by further desktop review, consultation with experts and/or on-the-ground 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 - April 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.

Annex 5: Ministry of Environment Approval of the IESIA



ព្រះរាជាណាចក្រកម្ពុជា
ជាតិ សាសនា ព្រះមហាក្សត្រ

ក្រសួងបរិស្ថាន
លេខ:.៣២១.ស.ជ.ប.ស

សូមគោរពជូន

ឯកឧត្តមទេសរដ្ឋមន្ត្រី រដ្ឋមន្ត្រីក្រសួងសាធារណការ និងដឹកជញ្ជូន

កម្មវត្ថុ ៖ ការពិនិត្យ និងផ្តល់យោបល់លើរបាយការណ៍វាយតម្លៃហេតុប៉ះពាល់បរិស្ថាន និងសង្គមដំបូង (IESIA) សម្រាប់គម្រោងអភិវឌ្ឍន៍ក្រុងរបៀងនៃមហាអនុតំបន់មេគង្គទី៤ អនុគម្រោង៖ ប្រព័ន្ធលូ និងស្ថានីយប្រព្រឹត្តកម្មទឹកកខ្វក់ និងបណ្តាញលូរំដោះទឹកភ្លៀងក្នុងក្រុងកំពង់ចាម របស់ក្រសួងសាធារណការ និងដឹកជញ្ជូន នៅខេត្តកំពង់ចាម

យោង ៖
- ព្រះរាជក្រមលេខ នស/រកម/១២៩៦/៣៦ ចុះថ្ងៃទី២៤ ខែធ្នូ ឆ្នាំ១៩៩៦ ដែលប្រកាសឱ្យប្រើច្បាប់ស្តីពីកិច្ចការពារបរិស្ថាន និងការគ្រប់គ្រងធនធានធម្មជាតិ
- អនុក្រឹត្យលេខ ៧២ អនក្រ.បក ចុះថ្ងៃទី១១ ខែសីហា ឆ្នាំ១៩៩៩ ស្តីពីកិច្ចដំណើរការវាយតម្លៃហេតុប៉ះពាល់បរិស្ថាន
- លិខិតលេខ ២៩៦៩ សក.អករ៤ ចុះថ្ងៃទី១៤ ខែសីហា ឆ្នាំ២០២០ របស់ក្រសួងសាធារណការ និងដឹកជញ្ជូន
- លិខិតលេខ ៣៥៩៨ សក.អករ៤ ចុះថ្ងៃទី១៣ ខែតុលា ឆ្នាំ២០២០ របស់ក្រសួងសាធារណការ និងដឹកជញ្ជូន
- លិខិតលេខ ០៤២ សក.អករ៤ ចុះថ្ងៃទី១២ ខែមករា ឆ្នាំ២០២១ របស់ក្រសួងសាធារណការ និងដឹកជញ្ជូន
- លិខិតលេខ ១៦៧៩ សជណ ប.ស ចុះថ្ងៃទី១០ ខែធ្នូ ឆ្នាំ២០២០ របស់ក្រសួងបរិស្ថាន
- លិខិតលេខ ១៣១៦ រ.ហ.ប.ស ចុះថ្ងៃទី២៥ ខែកញ្ញា ឆ្នាំ២០២០ របស់នាយកដ្ឋានវាយតម្លៃហេតុប៉ះពាល់បរិស្ថាននៃក្រសួងបរិស្ថាន

សេចក្តីដូចមានចែងក្នុងកម្មវត្ថុ និងយោងខាងលើ ខ្ញុំសូមគោរពជម្រាបជូន **ឯកឧត្តមទេសរដ្ឋមន្ត្រី** មេត្តាជ្រាបថា ក្រសួងបរិស្ថានឯកភាពលើរបាយការណ៍វាយតម្លៃហេតុប៉ះពាល់បរិស្ថាន និងសង្គមដំបូង (IESIA) សម្រាប់គម្រោងអភិវឌ្ឍន៍ក្រុងរបៀងនៃមហាអនុតំបន់មេគង្គទី៤ អនុគម្រោង៖ ប្រព័ន្ធលូ និងស្ថានីយប្រព្រឹត្តកម្មទឹកកខ្វក់ និងបណ្តាញលូរំដោះទឹកភ្លៀងក្នុងក្រុងកំពង់ចាម ដែលមានទីតាំងភូមិសាស្ត្រស្ថិតនៅក្នុងសង្កាត់កំពង់ចាម សង្កាត់វាលវែង សង្កាត់សំបួរមាស និងសង្កាត់បឹងកុក ក្រុងកំពង់ចាម ខេត្តកំពង់ចាម របស់ក្រសួងសាធារណការ និងដឹកជញ្ជូន (ម្ចាស់គម្រោង) ដោយម្ចាស់គម្រោងត្រូវគោរពតាមកិច្ចសន្យាការពារបរិស្ថានលេខ ៦០០ សក.អករ៤ ចុះថ្ងៃទី២៤ ខែកុម្ភៈ ឆ្នាំ២០២១ របស់ក្រសួងសាធារណការ និងដឹកជញ្ជូន។

អាស្រ័យដូចបានគោរពជម្រាបជូនខាងលើ សូម **ឯកឧត្តមទេសរដ្ឋមន្ត្រី** មេត្តាអនុវត្ត និងចាត់ចែងដោយសេចក្តីអនុគ្រោះ។

សូម **ឯកឧត្តមទេសរដ្ឋមន្ត្រី** មេត្តាទទួលនូវសេចក្តីគោរពពីខ្ញុំ។

ថ្ងៃ អង្គារ ៤ ខែ មិថុនា ឆ្នាំជូត ឆស័ក ព.ស. ២៥៦៤
រាជធានីភ្នំពេញ ថ្ងៃទី ០៤ ខែ មិថុនា ឆ្នាំ២០២១

ជ.រដ្ឋមន្ត្រី
រដ្ឋលេខាធិការ

ចាយ សាមិត្ត

ចម្លងជូន៖
- ទីស្តីការគណៈរដ្ឋមន្ត្រី
- ក្រសួងសេដ្ឋកិច្ច និងហិរញ្ញវត្ថុ
- ក្រសួងរៀបចំដែនដី នគរូបនីយកម្ម និងសំណង់
- ក្រសួងធនធានទឹក និងឧតុនិយម
- រដ្ឋបាលខេត្តកំពង់ចាម
- មន្ទីរបរិស្ថានខេត្តកំពង់ចាម
- ឯកសារ កាលប្បវត្តិ

អគារមរតកតេជោ ជីឡូតិ៍លេខ503 ផ្លូវកៅស៊ូអមមាត់ទន្លេបាសាក់ សង្កាត់ទន្លេបាសាក់ ខណ្ឌចំការមន ភ្នំពេញ ទូរស័ព្ទ: 023 235 004 / 023 235 006

Kingdom of Cambodia
National Religion Kng

Ministry of Environment
N. 321 SCN MoE

TO
Senior Minister of the Ministry of Public Works and Transport

Object:

- Reviewing and comment on IESIA report of CTDP-4 project for Waste Water Treatment Plant and Drainage System in Kampong Chan Town, Kampong Cham Province of the MPWT.

Refer to:

- Royal Decree 1296/36 on 24 August 1996, on the declaration for using the law on Environmental Protection and Natural Resources Management.
- Sub-decree No 72 on 11 August 1999, on Environmental Impact Assessment Process.
- Letter No 2969, on 14 August 2020 from MPWT.
- Letter No 3598, on 13 October 2020 from MPWT.
- Letter No 042, on 12 January 2021 from MPWT,
- Letter No 1679, on 10 December 2020 from MoE,
- Letter No 1316, on 25 September 2020 from EIA Department, MoE.

Base on object and referring above, I would like to inform HE Senior Minister that, Ministry of Environment (MoE) accepted on Initial Environmental and Social Impact Assessment (IESIA) report of CTDP-4 for Waste Water Treatment Plan and Drainage System in Kampong Cham Town with in Kampong Cham, Veal Vong, Sambour Meas, and Beung Kok Commune/Sankat, Kampong Cham Town, Kampong Cham Province. The MPWT is project owner.

The project owner should comply with contract on environmental management No 600, on 24 February 2021 from MPWT.

Phnom Penh 02 March 2021
Representative of Ministry
Secretary of State

HE. Chay Samith