

Initial Environmental Examination

July 2020

CAM: Integrated Urban Environmental
Management in the Tonle Sap Basin Project -
Pursat and Kampong Chhnang Urban Area
Environmental Improvements

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 September 2014 available on
<https://www.adb.org/projects/42285-013/main#project-documents>.

CURRENCY EQUIVALENTS

(as of 4th April 2019)

Currency Unit	-	Riel (KHR)
USD 1.00	=	KHR 4,036
USD 0.000245	=	KHR 1.00

ABBREVIATIONS

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

WEIGHTS AND MEASURES

C	–	Celsius/centigrade
dBA	–	decibel audible
ha	–	hectare/s
km	–	kilometer/s
km ²	–	square kilometer/s
kph	–	kilometer/s per hour
m	–	meter/s
m ³	–	cubic meter/s
masl	–	meter/s above sea level
mg/l	–	milligram/s per liter
mm	–	millimetre/s
tpd	–	tonnes per day

NOTES

In the report, “\$” refers to US dollars, unless otherwise stated.

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Table of Contents

EXECUTIVE SUMMARY	1
1.1. <i>The Project</i>	1
1.2. <i>Key Findings and Mitigation Measures (Update after all designs finalised)</i>	1
1.3. <i>Conclusion</i>	4
1. INTRODUCTION.....	5
1.1. <i>Background and introduction</i>	5
2. POLICY, LEGAL & ADMINISTRATIVE FRAMEWORK	7
2.1. <i>Environmental Assessment Requirements</i>	7
2.2. <i>National Environmental Policy and Legislation</i>	9
2.3. <i>International Agreements</i>	15
3. DESCRIPTION OF THE SUBPROJECTS	16
3.1. <i>Rationale</i>	16
3.2. <i>Project Impact, Outcome and Benefits</i>	16
3.3. <i>Project Outputs</i>	17
3.4. <i>Detailed Description of Landfill Subprojects</i>	18
3.5. <i>Pursat Drainage and Wastewater Subproject</i>	25
3.6. <i>Borrow Sites</i>	1
4. ALTERNATIVES ANALYSIS.....	3
5. DESCRIPTION OF THE ENVIRONMENT	6
5.1. <i>Subprojects' areas of Influence</i>	6
5.2. <i>Physical/Chemical Environment</i>	9
5.3. <i>Biological Environment: Flora and Fauna</i>	21
5.4. <i>Socio-economic Environment</i>	24
5.5. <i>Affected Households</i>	26
5.6. <i>Physical Cultural Environment</i>	26
6. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES	27
6.1. <i>Positive Environmental Impacts and Benefits</i>	27
6.2. <i>Potential Impact Screening</i>	27
6.3. <i>Impacts and Mitigation Measures Relative to siting, design and planning</i>	28
6.4. <i>Impacts and Mitigation Measures during Construction</i>	29
6.5. <i>Impacts and Mitigation Measures during Operation</i>	34
7. INFORMATION DISCLOSURE, CONSULTATION AND PARTICIPATION	38
7.1. <i>Introduction</i>	38
7.2. <i>Consultation during project preparation</i>	38
7.3. <i>Consultation during detailed design</i>	39
7.4. <i>Consultation during project implementation</i>	42
8. GRIEVANCE REDRESS MECHANISM	44
8.1. <i>Objective</i>	44
8.2. <i>Proposed Approach</i>	44
8.3. <i>Access to the Mechanism</i>	44
8.4. <i>Communication on the GRM: Project Hotline</i>	45
8.5. <i>Recording Project Hotline or GRM issues: Steps and Timeline</i>	46
8.6. <i>Managing Unresolved Complaints</i>	49
9. ENVIRONMENTAL MANAGEMENT PLAN	51
10. CONCLUSION AND RECOMMENDATIONS	53
10.1. <i>Conclusions</i>	53
10.2. <i>Recommendations</i>	53

List of figures

Figure 1 Pursat Landfill Location	20
Figure 2 Pursat Landfill and access road	21
Figure 3 Kampong Chhnang Landfill Location	22
Figure 4: Pursat Landfill Layout.....	23
Figure 5: Kampong Chhnang Landfill Layout.....	23
Figure 6 Pursat Landfill Access Road	25
Figure 7 current flooding and drainage/sewage network in Pursat	26
Figure 8 WWTP Treatment Process	27
Figure 9 WWTP Layout.....	1
Figure 10 Drainage Layout.....	2
Figure 11 Borrow site location and detail for Pursat subprojects	1
Figure 13. Soil Map of Tonle Sap Basin.....	13
Figure 14: Geotechnical investigation boreholes in Kampong Chhnang landfill	14
Figure 16: Geotechnical investigation boreholes in Pursat Drainage.....	16
Figure 17: Pursat WWTP Effluent Receiving Canal.....	17
Figure 18: Pursat Landfill Site Land Use.....	22
Figure 19: Kampong Chhnang Landfill Site Land Use	22
Figure 20: Pursat WWTP Site Land Use.....	23

List of tables

Table 1: Relevant Laws, Regulations and Guidelines in Cambodia	10
Table 2: Comparison of Landfill Selection Criteria	13
Table 3: Key and International Standards	14
Table 4: Waste Arisings Model for Kampong Chhnang and Pursat	18
Table 5: Summary of Receptors for all subprojects.....	8
Table 6: Monthly and Annual Rainfall, Pursat, 2008-2016	9
Table 7: Monthly and Annual Rainfall, Kampong Chhnang, 2008-2012.....	10
Table 8: Impacts from Climate Change on Sanitation Infrastructure (wastewater collection and treatment).....	10
Table 9: Surface water quality in Kampong Chhnang and Pursat from IEIA report.....	18
Table 10: Air quality baseline and standards, Pursat and Kampong Chhnang	19
Table 11: Noise baseline and standards, Pursat and Kampong Chhnang	19
Table 12: Natural Hazards in Pursat Town (1996-2018)	20
Table 13: Natural Hazards in Kampong Chhnang Town (1996-2018)	20
Table 14: Urban Infrastructure, Kampong Chhnang and Pursat town.....	25
Table 15: List of disease in Pursat and Kampong Chhnang	25
Table 16: Environmental Benefits, Positive Impacts and Outcomes	27
Table 17: Potential Spoil Volumes	32
Table 18 : Environmental Safeguard Public Meeting	39
Table 19 : Local Government Consultation Meeting, 2019	39
Table 20 : Pursat Public Consultation Results 22-12-2018	40
Table 21: GRM Roles and Responsibilities	44
Table 22: Project Hotline Informal Contact with Affected People	47
Table 23: Project Hotline Formal Contact with Affected People.....	47
Table 24: Key Roles for Project Implementation	51

List of Annexes

Annex 1. Environmental Quality Standards Applied in the IEE	54
Annex 2: Photographs of subproject	59
Annex 3: Borehole Log Samples.....	61
Annex 4: Flora and Fauna Species in Subproject Areas.....	64
Annex 5: Supporting information from Socio-Economic Survey (2013).....	68
Annex 6: Notes of Consultations from Project Preparation and Design	72
Annex 7: Affected Person Monitoring consultation form.....	88
Annex 8: Affected Person Monitoring corrective action form.....	92

EXECUTIVE SUMMARY

1.1. The Project

1. This Initial Environmental Examination (IEE) is an update to the two original IEEs, disclosed in 2014, for the Integrated Urban Environmental Management in the Tonle Sap Basin Project (the project known as IUENTSP. As set out in the Project Administration Manual (PAM), the project will contribute to increased economic activities and environmental protection in towns in the Tonle Sap Basin. It responds to the need of municipal governments for integrated urban environmental management in urban areas around Tonle Sap Lake.

2. The project will improve urban services in Pursat town through the provision of:

- Wastewater treatment;
- Drainage and sewage network; and
- Improved solid waste management (SWM) collection and disposal by controlled landfill.

3. The project will improve urban services in Kampong Chhnang town through the provision of:

- improved SWM collection and disposal by controlled landfill.

4. In addition, the project will improve urban services and enhance climate change resilience in Kampong Chhnang and Pursat municipalities through urban area environmental improvements; community mobilization and environmental improvements; strengthened sector coordination and operations; and strengthened capacity for project implementation, and operation and maintenance (O&M).

5. The project is classified as category B for environment as confirmed during the project preparation and during the detailed engineering design (DED) phase. This is a consolidated IEE covering all subprojects undertaken in accordance with ADB Safeguards Policy Statement (SPS) 2009. Each subproject under this IEE has a separate Environmental Management Plan (EMP) and has been subject to an Initial Environmental Impact Assessment (IEIA) as required by Cambodian law.

1.2. Key Findings and Mitigation Measures (Update after all designs finalised)

6. The environmental baseline study confirms that the local communities are the most sensitive receptors in the project area. No protected areas or habitats and species of conservation value were identified in the project area of influence.

7. The project sites are located in varying environments, Kampong Chhnang landfill is located in a very disturbed site used for borrow material adjacent to a quarry and Pursat landfill is located in an agricultural area, used primarily for rice growing. The wastewater treatment plant (WWTP) in Kampong Chhnang is also on a site that has previously been used for development, containing abandoned concrete buildings. The urban drainage and sewage network is in the urban core, which is densely populated with houses and businesses.

8. For the landfill sites, the key environmental impacts will be during operation. Both have households within 500m, as such it is considered important to mitigate the impacts of

living long term near an operational landfill site through the provision of household improvements i.e. glass windows, fly screens and a tree screen for the gardens, in order to reduce the impacts of pests, dusts and odor. In addition, the landfill site designs include appropriate groundwater protection in order to mitigate the risk of contamination from leachate. A compacted clay layer and an asphalt concrete liner will be constructed. The IEE found that the Pursat landfill site is in an area that floods regularly during the wet season as the high groundwater combines with surface water. Therefore the design raises the base of the cell to above predicted groundwater height through additional fill. Both landfill sites will include groundwater monitoring wells which the operator should test regularly to identify if contamination is present and include leachate management.

9. In Kampong Chhnang the combined sewage and drainage system effluent will be discharged into a defunct canal that is currently visibly contaminated with sewage. However it is known through consultation that water in secondary and tertiary canal network is used for household purposes. Without the use of large pumping stations, which would be unsustainable to operate, the WWTP is unable to discharge effluent to any other location. The design uses gravity to drain the town and the flow through the WWTP is also gravity based in order to reduce the risk of failing pumps and maintenance costs. Therefore the focus of the EMP for this project is the effective operation and treatment of all influent before discharge. The baseline identifies that the Pursat river is at a higher level than the canal and therefore will not be impacted on by effluent from the WWTP.

10. The installation of the sewer and drainage network will impact most significantly on people living and working in the area during construction. The impacts will be localised and short term but will include increased levels of dust, noise and traffic in Pursat town centre. These impacts will add to the cumulative noise and traffic already in the town centre. The mitigation of these impacts in the EMP focuses on good construction practice to ensure the communities health and safety is not put at risk from trench excavations, and to control dust and noise through water spraying and use of mobile noise barriers to protect local residents and businesses. This subproject will also require good communication with the local community to inform them in advance of the construction works and associated traffic disruption.

11. In summary, the most significant environment risks associated with the subprojects are during the operation phase. The WWTP and solid waste sites can cause environmental pollution if they are not managed and maintained effectively. Such pollution can include long term risks to groundwater and soils from poor leachate management and medium term risks to water and land quality from WWTP effluent discharges. Also impacts from dust and odor will be associated with the landfills throughout their operational life which will impact on residents within the landfill area of influence.

12. Impacts during construction will be localized and short-term and limited to the common impacts associated with any construction project and its associated earth works. This includes the generation of noise, dust, pollutants, and traffic. These impacts will particularly be felt in the urban core where excavation for pipe networks will be required in higher density areas.

13. If effectively managed, the subprojects will bring about environmental improvements to the local project areas and urban cores of both towns. The current environment is being contaminated with uncollected waste and sewage and the growing pressures on the urban areas means that this is likely to continue. Also in Pursat town, wet season flooding regularly occurs as drainage is currently inadequate. The improvement of urban drainage and wastewater treatment facilities will mean that the pollution of the environment and localized flooding should be reduced and the risks to human health and water quality will be reduced.

14. The EMPs aim to avoid impacts where possible and mitigate those impacts which cannot be eliminated to an acceptable and minimum level. The EMPs include 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

15. The project includes a capacity building program to provide technical training and address institutional issues relating to operation and maintenance and to promote the sustainable provision of quality services. This is particularly relevant to maintaining operational standards for the landfills, urban drainage and WWTP. The Project Management and Implementation Support Consultant will be responsible for arranging relevant training. As set out in the EMPs, environmental training will include the following:

- EMP development and implementation
- Undertaking consultation with Affected People
- Implementing and using the Grievance Redress Mechanism
- Environmental protection for construction projects
- Environmental monitoring and reporting.

16. The key mitigation measures during construction will include:

- Contractors to prepare site specific Construction Environmental Management Plans (C-EMPs) based on subproject EMPs and maps to ensure all stakeholders are clear on where activities will take place.
- Good construction practices will be adopted to ensure minimal disturbance to affected persons from construction related nuisance, such as noise, dust and emissions.
- Access to properties and agricultural land to be maintained and any damage to be restored to pre-project condition.
- A community and occupational health and safety plan, emphasizing the need to address risks in particular to site operatives and people in the Pursat urban core.

17. Mitigation and monitoring measures are also required for the operation phase. The importance of training in landfill operations, urban drainage maintenance and WWTP management should be emphasized if the investments are to be sustainable, and operations are to be effectively maintained as per the subproject designs. Recognizing that operator performance is critical to environmental performance, a detailed long-term operator training plan and associated budget is provided in the capacity development component of this project.

18. 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). A programme of regular consultation with affected people and disclosure of key construction activities will be implemented during construction to ensure unanticipated impacts are identified and remedied.

19. A Grievance Redress Mechanism (GRM) will be established to receive comments and facilitate resolution of affected people's concerns and grievances about project social and

environmental safeguards performance. It should address affected people's concerns promptly, using a transparent process that is readily accessible to all affected people. It will contain multiple entry points to allow affected people to approach the person or institution most suitable for them.

1.3. Conclusion

20. The main project risks related to environment include: (i) low institutional capacity for environmental management and the possibility that the Project Management Unit (PMU) and Implementing Agency or operator will fail to monitor the environmental impact and implement the EMP during the construction and operation of the project; (ii) the PMU and Implementing Agency fail to implement corrective actions as issues arise during project implementation (iii) inadequate budget is allocated for maintenance of the drainage network, WWTP, and landfills and in particular the development of the next phase of cells in an appropriate manner.

21. This IEE was undertaken to determine the environmental issues and concerns associated with all subprojects. As a result of understanding the environmental baseline, receptors and project activities, EMPs for each subproject have been developed. The EMPs, if implemented effectively, will mitigate impacts on the natural environment and affected people to an acceptable level.

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

1. INTRODUCTION

1.1. Background and introduction

23. This consolidated Initial Environmental Examination (IEE) is an update to the two original IEEs, disclosed in 2014, for the Integrated Urban Environmental Management in the Tonle Sap Basin Project (the project known as IUEMTSP). The original IEEs are available at:

- Kampong Chhnang: <https://www.adb.org/projects/documents/integrated-urban-environmental-management-tonle-sap-basin-kampong-chhnang-iee>
- Pursat: <https://www.adb.org/projects/documents/integrated-urban-environmental-management-tonle-sap-basin-pursat-iee>

24. This update covers all reflects a number of significant changes from the 2014 IEEs including:

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

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

- Output 1: Kampong Chhnang Urban Area Environment Improvements
 - improved solid waste management (SWM) collection and disposal by controlled landfill
- Output 2: Pursat Urban Area Environment Improvements
 - wastewater treatment, drainage and sewage network and improved SWM collection and disposal by controlled landfill
- Output 3: Community Mobilization and Environment Improvements
- Output 4: Strengthened Sector Coordination and Operations
- Output 5: Strengthened Capacity for Project Implementation, Operation and Maintenance

1.1.1. ADB and Domestic Environmental Due Diligence

26. This IEE was updated during the Detailed Design phase. The project classification of environment category B has been confirmed during project preparation. This consolidated IEE covers all subprojects under Outputs 1 and 2 and has been prepared based on the final detailed designs. Each subproject under this IEE has a separate Environmental Management Plan (EMP). The IEE and EMPs have been undertaken in accordance with ADB Safeguards Policy Statement (SPS) 2009 and Royal Government of Cambodia (the Government) environmental requirements and guidelines.

27. **Scope of IEE.** This IEE covers Outputs 1 and 2 i.e. the major physical infrastructure interventions. Output 3 is covered by an Environmental Assessment and Review Framework which was developed during the project preparation and will be used to screen and assess Output 3 subprojects as more information on the scope of Output 3 is known. Outputs 4 and 5 contribute to effective implementation and operation of Outputs 1 and 2 therefore will

contribute to environmental performance.

28. An approved company, registered with the Ministry of Environment (MoE) has undertaken separate Initial Environmental Impact Assessment (IEIAs) for each subproject. The results of the IEIAs are incorporated into this IEE, including the baseline environmental monitoring and consultation.

1.1.2. Structure of This Report

29. This IEE report follows the format prescribed in ADB SPS 2009. For the purposes of this project, this is a consolidated IEE containing information for all Output 1 and 2 subprojects including:

- The policy legal and administrative framework;
- A description of the project and all subprojects;
- The environmental baseline for the project locations;
- Alternatives analysis for all subproject interventions; and
- Information on disclosure and consultation for this IEE.

30. Appendices to this report contain the Environmental Management Plans (EMPs) for each subproject. The EMPs are specifically designed to aid the construction contractors and operators in management of environmental impacts and therefore contain:

- 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.

31. In addition, the EMPs also include detailed receptor maps and site location maps to support contractors with preparation of site-specific Construction EMPs (CEMPs) that should include specific protection and monitoring measures in respect of sensitive receptors.

2. POLICY, LEGAL & ADMINISTRATIVE FRAMEWORK

2.1. Environmental Assessment Requirements

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

33. SPS 2009 environmental assessment requirements specify that:

- At an early stage of project preparation, the borrower/client will identify potential direct, indirect, cumulative, and induced environmental impacts on and risks to physical, biological, socioeconomic, and cultural resources and determine their significance and scope, in consultation with stakeholders, including affected people and concerned nongovernment organizations. If potentially adverse environmental impacts and risks are identified, the borrower/client will undertake an environmental assessment as early as possible in the project cycle.
- The assessment process will be based on current information, including an accurate project description, and appropriate environmental and social baseline data;
- Impacts and risks will be 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;

34. Other requirements of SPS 2009 include:

- Alternatives analysis. 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). In addition: (i) The EMP will be translated into Khmer language and be made available at each provincial department of public works and transport (PDPWT); (ii) The IEE will be disclosed on ADB's project website (www.adb.org);

- Grievance redress mechanism. The borrower/client will establish a mechanism to receive and facilitate resolution of affected people's concerns, complaints, and grievances about the project's environmental performance.
- Monitoring. The borrower/client will monitor and measure the progress of implementation of the EMP.

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

36. These climate change risks are assessed in the project Climate Resilience Vulnerability Assessment (April 2018) and are reflected where appropriate in the project designs.

37. **Domestic EIA Requirements.** Environmental assessment in Cambodia is governed by the following law and guideline document:

- Sub-decree on EIA Process No. 72 (1999). This law provides the detailed guidelines for implementation of the EIA Process. Its Annex requires the conduct of IEIA or EIA on the following activities under the Project: (i) waste processing, burning activities, all sizes; (ii) wastewater treatment plants, all sizes; (iii) drainage systems, >5,000 ha.
- Declaration on Guideline for Conducting IEIA and EIA Reports No. 376 (2009). This declaration specifies the basic contents of IEIA/EIA Reports, which should include: (i) introduction; (ii) legal framework; (iii) project description; (iv) description of the existing environment; (v) public participation; (vi) assessment of, and mitigation measures for, significant environmental impacts; (vii) environmental management plan; (viii) cost-benefit analysis; and (ix) conclusion and recommendations.

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

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

40. In line with other similar ADB projects in similar project areas with a similar selection of subprojects, IEIAs have been undertaken for this project by a registered company, authorized to complete IEIA reports. The IEIA reports are submitted to MoE on behalf of the project owner, MPWT.

41. From consultation with the MoE through the Deputy Director of the EIA Department,

on 26 June 2013, it was learned that: ¹

- For projects comprising of subprojects, such as the Project: (i) Subprojects that are mentioned in the Annex of Sub-Decree No. 72 ANRK.BK, will require individual IEIA Reports; and (ii) Subprojects that are not mentioned in the Annex of Sub-Decree No. 72 ANRK.BK can be covered in one IEIA Report.
- The IEEs prepared by the ADB PPTA Team, following ADB's SPS 2009, can be accepted as a basis for IEIA Reports

42. This means that for the Project, separate IEIA were required and approved by MoE as follows :

- Kampong Chhnang landfill site, approved DATE TBC
- Pursat wastewater treatment plant and drainage, approved DATE TBC
- Pursat landfill site, approved DATE TBC

2.2. National Environmental Policy and Legislation

2.2.1. Legal Framework for Environmental Management

43. 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.

44. 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.

2.2.2. Policies and legal instruments

45. 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.

46. 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

¹ Consultation of PPTA National Environmental Specialist with Mr. Danh Serei, Deputy Director, EIA-MoE, on 26 June 2013.

- Reduce activities which impact negatively on the environment.

47. Specific regulations and standards for environmental quality are contained in three sub-decrees:

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

48. A summary of legislative and policy instruments relevant to the project is presented in **Error! Unknown switch argument..** The key environmental quality standards applied to the EMP for this IEE are listed in **Error! Unknown switch argument.** and presented in detail in **Error! Unknown switch argument..** The most stringent limit (national or international) shall apply.

Table 1: Relevant Laws, Regulations and Guidelines in Cambodia

Law/Regulation/Guideline	Year	Brief Description
Royal Decree on the Protection of Natural Areas	1993	Has classified the 23 protected areas in Cambodia into four categories, namely: (i) natural parks; (ii) wildlife sanctuaries; (iii) protected landscapes; and (iv) multiple-use areas. Designated the Tonle Sap (316,250 ha) as a multiple-use area or area necessary for the stability of the water, forestry, wildlife and fishery resources, for entertainment/ tourism, and for conservation of long-term existing natural resources with a view to assure sustainable economic development.
Royal Decree on the Establishment and Management of Tonle Sap Biosphere Reserve (Royal Decree No. NS/RKT/0401/070)	2001	Establishes the Tonle Sap Biosphere Reserve (TSBR) in accordance with the statutory framework of the World Network of Biosphere Reserves. Divides the TSBR into 3 zones: (i) core areas; (ii) buffer zone and (iii) flexible transition zone.
Protected Areas Law (Royal Decree No. NS/RKM/0208/007)	2008	Defines the framework of management, conservation & development of protected areas to ensure the conservation of biodiversity, & sustainable use of natural resources in protected areas. It divides the protected area into 4 zones namely, core zone, conservation zone, sustainable use zone & community zone. Article 36 strictly prohibits all types of public infrastructure in the Core Zone & Conservation Zone; & allows development of public infrastructures in the Sustainable Use Zone & Community Zone with approval from the Royal Government at MoE's request. Article 41 provides for the protection of each protected area against destructive/harmful practices, e.g., destroying water quality in all forms, poisoning, using chemical substances, disposing of solid and liquid wastes into water or on land.
Law on the Protection of Cultural Heritage (NS/RKM/0196/26)	1996	Regulates the protection of national cultural heritage and cultural property in general against illegal destruction, modification, alteration, excavation, alienation, exportation or importation. Its Article 37 stipulates that in case of chance find of a cultural property during construction, work should be stopped and the person who found the property should immediately make a declaration to the local police, who shall, in turn, transmit the property to the Provincial Governor without delay.
Law on Land	2001	Provides that: (i) unless it is in the public interest, no

Law/Regulation/Guideline	Year	Brief Description
		person may be deprived of ownership of his immovable property; and (ii) ownership deprivation shall be carried out according to legal forms and procedures and after an advanced payment of fair and just compensation. (Article 5)
Law on Water Resources Management	2007	Requires license/permit/written authorization for the: (i) abstraction & use of water resources other than for domestic purposes, watering for animal husbandry, fishing & irrigation of domestic gardens and orchards; (ii) extraction of sand, soil & gravel from the beds & banks of water courses, lakes, canals & reservoirs; (iii) filling of river, tributary, stream, natural lakes, canal & reservoir; and (iv) discharge, disposal or deposit of polluting substances that are likely to deteriorate water quality and to endanger human, animal and plant health. (Articles 12 & 22) Its Article 24 stipulates that MOWRAM, in collaboration with other concerned agencies, may designate a floodplain area as flood retention area.
Labor law	1997	This law governs relations between employers and workers resulting from employment contracts to be performed within the territory of the Kingdom of Cambodia, regardless of where the contract was made and what the nationality and residences of the contracted parties are. This law applies to every enterprise or establishment of industry, mining, commerce, crafts, agriculture, services, land or water transportation, whether public, semi-public or private, non-religious or religious; whether they are of professional education or charitable characteristic as well as the liberal profession, associations or groups of any nature whatsoever. This law shall also apply to every personnel who is not governed by the Common Statutes for Civil Servants or by the Diplomatic Statutes as well as officials in the public service who are temporarily appointed.
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.
Cambodian land traffic law	2015	The land traffic law governs all road users in the Kingdom of Cambodia. The law is aimed at: 1. Maintaining order and safety in road trafficking, which allowed for public traffic throughout the Kingdom of Cambodia; 2. Protecting human and animal lives and environment ; 3. Curbing the effect on human health and the damage of the state and private properties; and 4. Curbing the offenses stemmed from the use of the roads.
Law on Road	2014	This law has objective to management, development of roads infrastructure sector and to ensure the road traffic safety in the Kingdom of Cambodia. This law has the following aims: 1.To protection of public property, protection and enhance of roads quality, maintaining orders, facilitate of the roads traffic and roads transportation; 2. To determine the policy, strategy, and developing plan for the construction, repair, and maintenance of roads infrastructure including to set up measures and technical regulations; 3. To promoted and

Law/Regulation/Guideline	Year	Brief Description
		encourage the private sector to participant in the construction, repair, maintenance, and developing of roads infrastructure; 4.To promoted cooperation and integrations of the nation, region, sub-region, and worlds on the roads infrastructure sector; 5. To encourage for conduct research program on roads technique and to transfer of new technique for the roads infrastructure development in the Kingdom of Cambodia; and 6.To development of human resources in roads infrastructure sector in the Kingdom of Cambodia.
Sub-Decree on Demarcation of 647,406 Hectare Flooded Forest Domain in Six Provinces adjacent to Tonle Sap Lake (Sub-decree No. 197 ANKr/BK)	2011	Stipulates a zoning system for the area between the national highways and the Tonle Sap Lake system and the nature of agriculture activities that are permitted and banned in each zone.
Sub-decree on Water Pollution Control (Sub-decree No. 27 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 Annexes 2, 4 and 5 provide the industrial effluent standards, including effluent from wastewater stabilization ponds, water quality standards for public waters for the purpose of biodiversity conservation, and water quality standards for public waters and health, respectively.
Sub-decree on solid waste Management (Sub-decree No. 36 ANK/BK),	1999	Regulates solid waste management to ensure the protection of human health and the conservation of biodiversity.
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).
Sub Decree on E-waste management on electrical and electronic equipment.	2015	This Sub Decree covers all the activities regarding disposal, storage, collection, transport, recycling, dumping of electrical and electronic equipment (EEE) waste. Ministry of Environment (MoE) will be in role of responsible the prevention, protection, as well as minimizing/reduction all activities that impact to human health and environment from all sources polluted by EEE waste. Dumping EEE waste in landfill, public space, water system is strictly restricted. Any person who wishes to conduct business activities in line with the e-waste management, (including storage, recycling, and collecting EEE waste) shall apply for licenses from the Ministry of Environment. In addition, importation of EEE second hand is now subjected to approval from the MoE. The Prakas of MoE that will specify the fee and procedure for obtaining relevant license and approval mentioned above is not yet approved.
Sub-decree No. 235 on the management of drainage system and wastewater treatment system	2017	This sub-decree aims to improve the management of drainage system and wastewater systems efficiently, transparently and accountably to ensure the safety of public health and biodiversity.
Environmental Guidelines on Solid Waste Management	2006	Contains a Landfill Ordinance that regulates landfill requirements to: (i) reduce as far as possible the adverse

Law/Regulation/Guideline	Year	Brief Description
		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.
Guidance on Selection of Landfill Sites	2016	The Guidance sets out the requirements for site selection in terms of: - Distance to receptor 1 km from any residential property 3 km from any school/health centre/natural resources/water source 5 km from any place of worship and resort 8 km from an airport 10 km from town center 15 km from any heritage site - Hydrology - Not in a flooded area - Depth to Groundwater – More than 3m - Cell Design - Gas collection (flaring) - Leachate collection system - Leachate treatment (lagoon) - Clay liner $\geq$ 1m (first liner) - HDPE liner (second liner) - Permeable liner (third liner) - Drainage system - Depth 1m, width 0,6 m

49. **Landfill Site Guidance.** During the update of this IEE, a meeting was held at MoE² Phnom Penh on 31 October 2017 in order to discuss the application of the guidance for ADB projects. MoE advised the project team to follow the guidance where possible, but recognized it was not always possible given the very stringent requirements. MoE emphasized that groundwater protection was the main concern however the requirements could be applied pragmatically with MoE review of the landfill design before it is finalised.

50. A comparison of national and international landfill siting guidance is in **Error! Unknown switch argument.** The table shows that the minimum distance to houses in any of the international guidance is 250 m (ADB and World Bank/IFC) however ADB guidance also refers to daily cover indicating that 250m is appropriate for a site which has daily cover. The highest depth to groundwater in any of the international guidance is 1.5 m (World Bank/IFC). The Cambodian guidance is most stringent for distance to housing (1km) and depth to groundwater (>3m).

² Participants: HE Heng Nareth, Director General, General Directorate of Environmental Protection, MOE; HE Vong Pisith, Deputy Director General, MPWT; Mr Dy Kiden, Director, Department of Solid Waste Management, MOE; Ms Genevieve O'Farrell, Environmental Specialist, ADB; Ms Rachel Wildblood, Environmental Specialist, TS-1; Mr Teemu Jantunen, Resettlement and Social Development Specialist, TS-1; Mr Chea Mong, National Environmental Specialist, TS-1; Mr Mongtoeun Yim, National Solid Waste Management Specialist, TS-1.

Table 2: Comparison of Landfill Selection Criteria

Source of Guidance	Residential Receptors	Water Receptors
International Solid Waste Association (ISWA) - Guidelines for Design and Operation of Municipal Solid Waste Landfills in Tropical Climates (2013).	Not located in the immediate proximity of occupied dwellings Minimum 500m	No distance given
ADB – Integrated SWM for Local Governments., A Practical Guide (2017)	No residential development within 250 m	The site must be located in an area where the landfill's operation will not detrimentally affect environmentally sensitive resources such as aquifer/groundwater
World Bank / IFC EHS Guidelines: Sanitary Landfill (2007)	Typically further than 250 meters (for gas only, no mention of dust/odor)	Perennial stream should not be located within 300 down gradient Groundwater's seasonally high table level (i.e., 10 year high) should be at least 1.5 meters below
Cambodian Landfill Site Selection Guidance	1km from residences	Out of flooded area Depth to ground water over 3m

Table 3: Key and International 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 (for drinking)	Drinking water Quality Standards, 2004	WHO Guidelines for Drinking-water Quality, Fourth Edition, 2011
Groundwater (ambient)	Ministry of Handicrafts and Industry Groundwater Quality Standards	Groundwater Directive (GWD, 2006/118/EC)
Surface water quality	Annex 4, Water Quality Standards for Public Waters for the Purpose of Biodiversity Conservation, and Annex 5, Water Quality Standards for Public Waters and Health, of Sub-decree on Water Pollution Control, 1999	United States Environmental Protection Agency National Recommended Water Quality Criteria Mekong River Commission (MRC)_ Technical Guidelines for the Protection of Aquatic Life MRC Technical Guidelines for the Protection of Human Health
Effluent quality (including leachate)	Annex 2, Effluent standard (Discharged wastewater to public water areas or sewers), of Sub-decree on Water Pollution Control, 1999	EHS General Guidelines and Guidelines for Water and Sanitation

51. 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 subprojects.

2.3. International Agreements

52. 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.

53. 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.

3. DESCRIPTION OF THE SUBPROJECTS

3.1. Rationale

54. As set out in the Project Administration Manual (PAM)³, the project will contribute to increased economic activities and environmental protection in towns in the Tonle Sap Basin. It responds to the need of municipal governments for integrated urban environmental management in urban areas around Tonle Sap Lake. The project will improve urban services and enhance climate change resilience in Kampong Chhnang and Pursat municipalities through urban area environmental improvements; community mobilization and environmental improvements; strengthened sector coordination and operations; and strengthened capacity for project implementation, and O&M. The project follows the Tonle Sap Urban Areas Development Framework and Kampong Chhnang and Pursat municipalities' urban development strategies to 2030.

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

56. Lack of climate resilient infrastructure, especially around the Tonle Sap, leaves residents vulnerable from flooding and climate-induced disasters. Both municipalities suffer from flooding for 6 to 8 months in a year. In Kampong Chhnang, residents are affected by flooding from the Tonle Sap river, which causes the most inundation damage, and the run-off from the hills around the town. The annual hydrological cycle of the Tonle Sap is the main cause of flooding. The existing embankment along the Tonle Sap was overtopped in 2011 and resulted in severe flooding. Climate resilient infrastructure investment is the government's first priority. In Pursat, residents are affected by flooding from both the Pursat River and lack of drainage, which causes the most inundation damage in the town center and affects 80% of the area. The town center lies in a depression and the natural slope of the town is away from the river towards old channels of the Pursat River.

57. Limited solid waste collection and poor management is a major environmental issue in flood-prone areas of the Tonle Sap and a major health concern for communities, especially women. The responsibility for solid waste management falls with municipality and aspects of solid waste management (SWM) are contracted out to the private sector without contract monitoring and supervision. The project will improve SWM through institutional strengthening of urban service units, private sector contract management, construction of new controlled landfills, and awareness on menstrual hygiene management⁴⁵.

3.2. Project Impact, Outcome and Benefits

58. As defined in the PAM, the impact and outcome are as follows:

³ Project Administration Manual: Project Number: 42285 Loan and/or Grant Number(s): L3311/L8295/G0454-CAM

⁴ Ibid.

⁵ Included within the Community Mobilization and Environmental Improvements (Output 3) subprojects, see Paragraph 64.

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

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

60. The sustainable long term environmental benefit of improved waste management will only be realised if effective waste collection is implemented and service coverage is increased, by the municipal authorities and the landfill sites are maintained and managed to the design standard by the operators. Unless the waste is effectively transported to the landfill site, it will not benefit the majority of the urban and peri-urban residents. For improved waste collection, this is anticipated to require as a minimum:

- procurement of private sector waste collection service providers;
- reliable contracts for service providers and regular payment of fees
- central budget support and improved waste service fee collection from users
- service coverage increase, to expand from the central urban core only which will necessitate collection route planning and staffing
- a public information campaign to encourage participation in the waste collection service;
- Operation of the landfill site will require considerable budget support, training and expertise in order to meet the basic design standards.

61. These waste collection improvements and long term support for landfill management are outside the scope of this project but will however pose the main environmental risks.

3.3. Project Outputs

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

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

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

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

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

67. **Error! Reference source not found.**Annex 2 presents photographs of the current subproject sites and conditions.

3.4. Detailed Description of Landfill Subprojects

68. A summary of the detailed engineering designs relevant to this IEE is provided here. The final designs for each project city are broadly the same therefore the technology is discussed here for both landfills.

69. This subproject will: (i) develop Stage 1 of the proposed controlled landfill; and (ii) procure waste collection and landfill equipment in Kampong Chhnang and Pursat municipalities.

3.4.1. Waste arisings

70. The assumptions made for modeling waste arisings are shown in **Error! Unknown switch argument.** using Kampong Chhnang as an example. A starting point of 0.53 kg/capita is used for 2019 waste arisings.

Table 4: Waste Arisings Model for Kampong Chhnang and Pursat

SOLID WASTE MANAGEMENT - KAMPONG CHHNANG													
PRELIMINARY STATISTICAL INFORMATION													
		2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Population													
Projected	No.	59 200	60 408	61 640	62 731	63 841	64 971	66 121	67 292	68 483	69 510	70 553	71 611
Urban Growth Rate	%	0,0%	2,0%	2,0%	1,8%	1,8%	1,8%	1,8%	1,8%	1,8%	1,5%	1,5%	1,5%
Households	No.	13 156	13 424	13 698	13 940	14 187	14 438	14 694	14 954	15 218	15 447	15 678	15 914
Waste Generation													
Waste Generation	kg/person/day	0,53	0,54	0,54	0,55	0,55	0,56	0,56	0,57	0,57	0,58	0,58	0,59
Daily Waste Generated	tonnes/day	31,4	32,6	33,3	34,5	35,1	36,4	37,0	38,4	39,0	40,3	40,9	42,3
Waste to be Collected	%	30 %	35 %	40 %	45 %	50 %	55 %	60 %	70 %	70 %	75 %	75 %	80 %
Waste to be Collected	tonnes/day	9,4	11,4	13,3	15,5	17,6	20,0	22,2	26,8	27,3	30,2	30,7	33,8
Waste to be Collected	tonnes/yr	2 937	3 562	4 154	4 844	5 478	6 243	6 932	8 377	8 525	9 434	9 575	10 546
Waste Collected - Cumulative	tonnes	2 937	6 499	10 653	15 497	20 975	27 218	34 150	42 527	51 052	60 486	70 061	80 607
Waste Collected - Cumulative	m3 (m3=600 kg)	4 895	10 832	17 755	25 828	34 958	45 364	56 916	70 878	85 087	100 810	116 769	134 345

Source: DED Design Report

3.4.2. Landfill technology outline

71. The DED report states that a controlled landfill will be built, which is considered to be the appropriate standard of intervention. It provides the best balance between capital cost and operating difficulty compared with environmental controls and sustainability. The landfill includes the following features:

- Full perimeter fence to be constructed in phases;
- Buildings for the gatehouse, generator where required and office buildings and ablution facilities;
- An artificially lined cell (asphalt) with sufficient life for five years operation (Phase 1);
- Cell base raised above groundwater and flood level;
- A leachate collection system;

- Internal access roads (asphalt)
- Appurtenant works such as solar power lighting, septic tanks, generators;
- Equipment for example, a multipurpose tractor, waste compactor collection trucks (5 and 10 ton) and hook lift collection trucks

3.4.3. Landfill Construction

72. The project will include the following investments

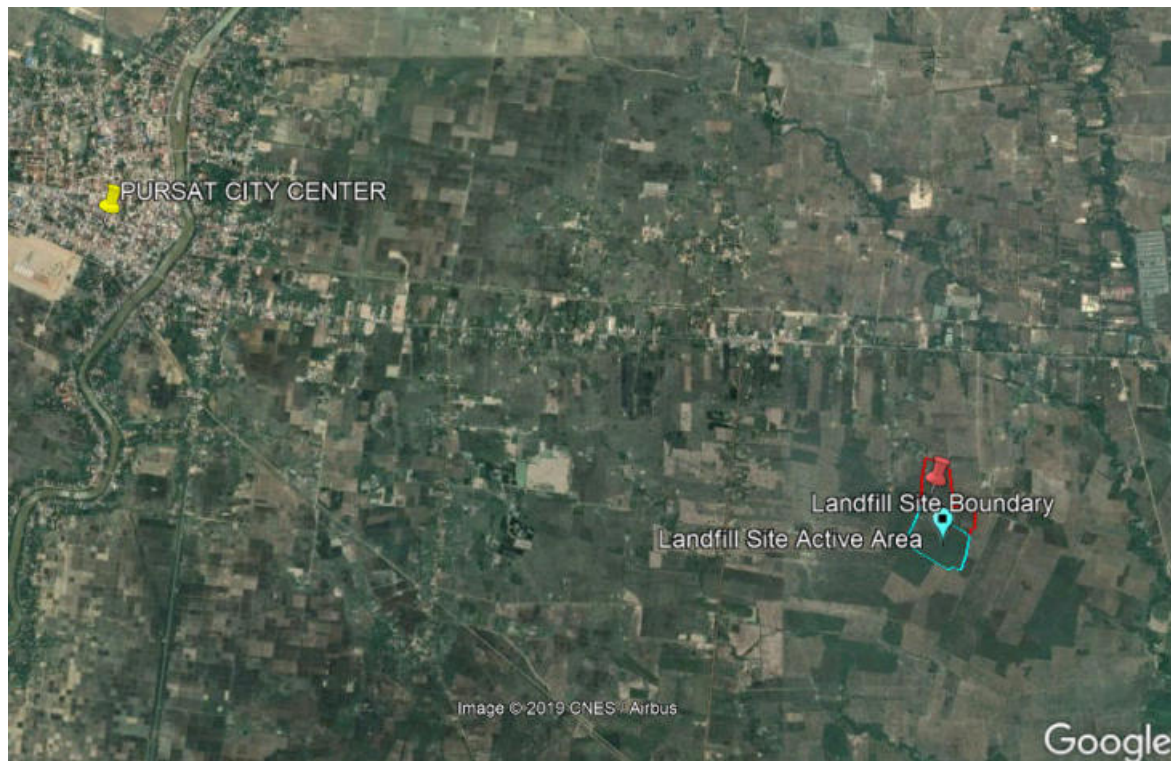
- | | |
|---|--|
| • Earthworks for the site construction; | • Buildings; |
| • Administration building | • Generator building |
| • Gatehouse | • Parking area |
| • Roads, dikes, hardstanding; | • Pursat Only: 1500m access road with 7 pipe culverts; |
| • Site infrastructure | • Lighting (solar) |
| • Water tank | • Septic tank |
| • Leachate pumping station | • Groundwater monitoring wells x 2 |
| • Water supply well x1 | • Leachate lagoons (aerated x 1, sedimentation x 1) to further promote evaporation and as additional storage |
| • Pursat Only: Sludge drying bed for sludge from WWTP | |

73. Waste pickers will not be allowed on site in accordance with a direction from the General Department of Resettlement (GDR). The waste pickers identified by the social and resettlement team will therefore be considered in the resettlement plan which includes income restoration and retraining. This is the preferable approach; the active promotion of hand sorting unsegregated waste should be discouraged as this does not represent modern good international best practice and yields limited recyclables compared to the health and safety risk. Therefore retraining for a long term sustainable alternative income is the preferred choice.

3.4.4. Pursat Selected Sites and Subproject Location

74. Pursat Site. The proposed controlled landfill will be developed at a site in Toul Makak Keut Village, Roleab Commune, Sampov Meas District, Pursat Municipality. The site is on government-owned land and was identified by the Municipal Government and considered appropriate in terms of its location, as it is 7 km east of the town center (**Error! Unknown switch argument.**) and about 1.5 km south of the NR5. Currently, access to the site from NR5 is through an existing earth road that will be upgraded to double bitumen surface treatment (DBST) under the subproject and extended to the site. It is a challenging site in terms of flood risk and protection of groundwater. The location of the landfill site is given in **Error! Unknown switch argument.** It shows the area of the site to be developed (active landfill site area) and the remainder of the site (landfill site boundary) which is also part of the land provided by the government.

Figure 1 Pursat Landfill Location



Source: PMIS Team

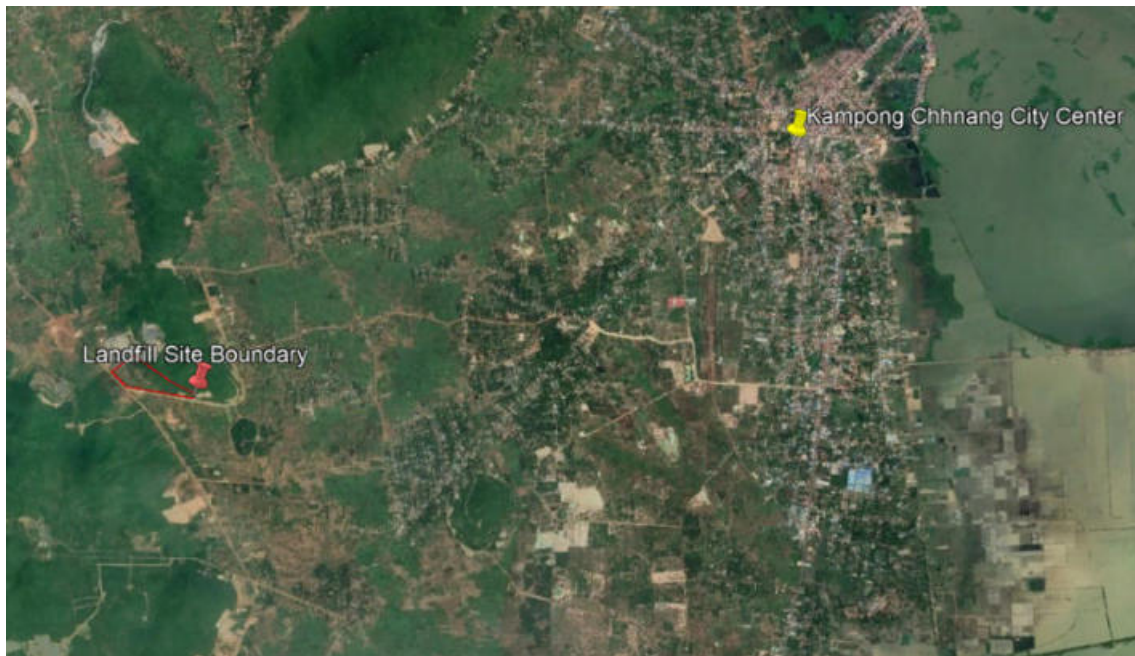
Figure 2 Pursat Landfill and access road



Source: PMIS Team

75. Kampong Chhnang Site. The proposed controlled landfill will be developed adjacent to an existing quarry, using the quarry access road, at Trapeang Sbov Village, Pongro Commune of Rolea B'ier District. The site, on public land controlled by the Province of Kampong Chhnang, is about 9 km from the town center and can be accessed from road # 53 through a 3.3 km long laterite public road. The location of the landfill is shown in Figure 3.

Figure 3 Kampong Chhnang Landfill Location

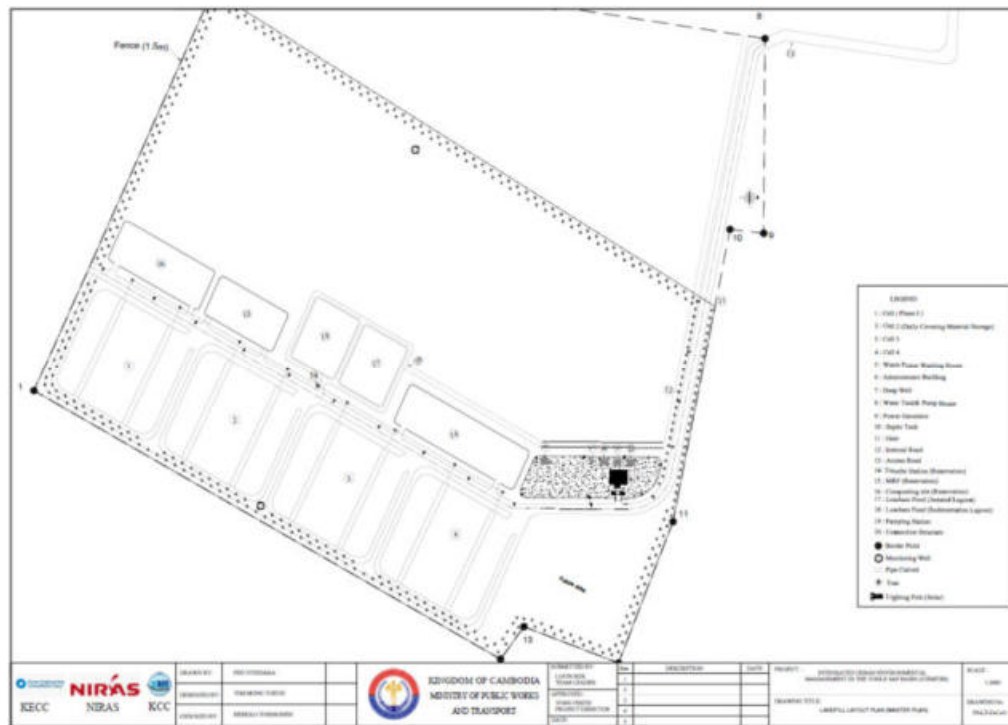


Source: PMIS Team

3.4.5. Landfill Layout and Approach

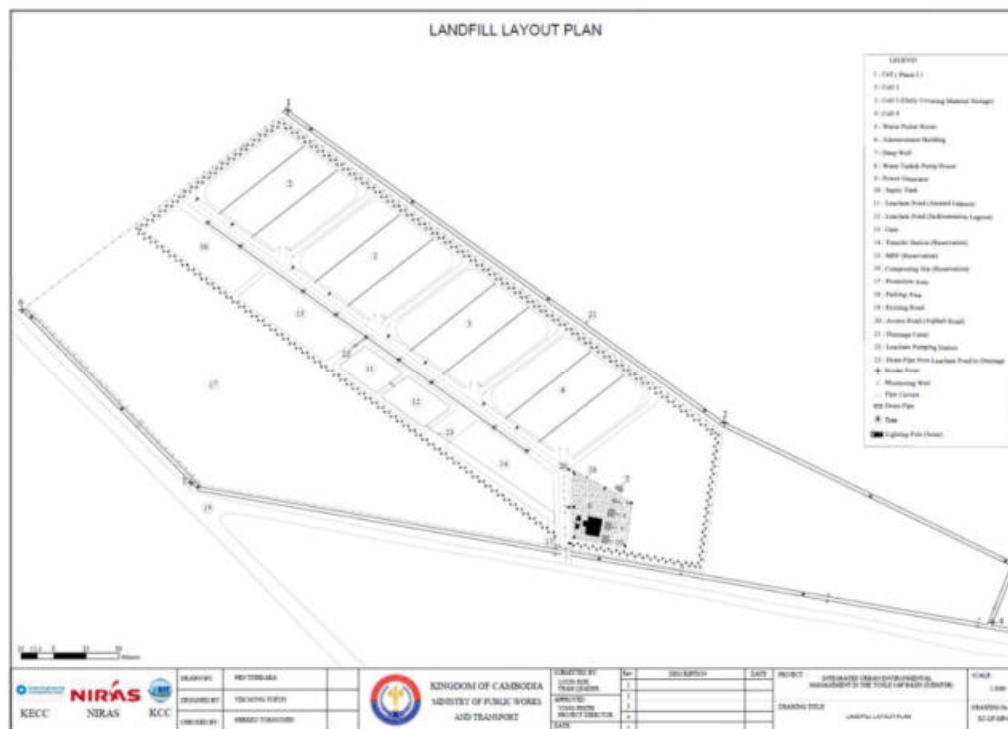
76. The controlled landfill will be developed in four main stages, adopting a cell staging approach and staged development strategy that will attain a capacity sufficient for the landfill to operate for about 30 years. Under the Project, only Stage 1 (of the four stages) will be developed. The first cell in Stage 1 is 0.72 ha with a volume of 52,000m³ for Pursat and 0.64 ha with a volume of 42,000 m³ for Kampong Chhnang. This gives an operational life of approximately 5 years for Stage 1. The layout of the landfill including cells and ancillary buildings is shown in **Error! Unknown switch argument.** for Pursat and **Error! Unknown switch argument.** for Kampong Chhnang.

Figure 4: Pursat Landfill Layout



Source: Detailed Engineering Design Report

Figure 5: Kampong Chhnang Landfill Layout



Source: Detailed Engineering Design Report

3.4.6. Leachate management

77. Leachate treatment options were reviewed during the detailed design stage and the chosen approach is based on:

- initial retention/evaporation,
- recirculation to the landfill area when applicable (dry season)
- pH-adjustment, when applicable
- aeration ponds/lagoons
- subsequent settling ponds/lagoons

78. **Leachate circulation.** Leachate is collected and re-injected into the waste mass. This process greatly accelerates decomposition and therefore gas production and has the impact of converting some leachate volume into landfill gas and reducing the overall volume of leachate for disposal. Calculations show that evaporation is comparable to rainfall in the project area. The waste mass represents as significant storage area for wet season leachate which will then be evaporated during dry season. There will be no discharge of effluent/leachate from the site. The predictions for increase in rainfall⁶ show a potential increase in rainfall and an increase in rainfall intensity. An increase of approximately 7% in precipitation is anticipated in 2050. Over the lifespan of Stage 1 of the site (5 years) the changes in precipitation and intensity are not anticipated to impact on the site's approach to leachate management.

79. The design of the landfill includes lagoons for both storage of leachate in wet season and to promote evaporation in dry season. Although for the design the lagoons are not strictly necessary they offer a further reduction in risk to the environment by additional storage capacity.

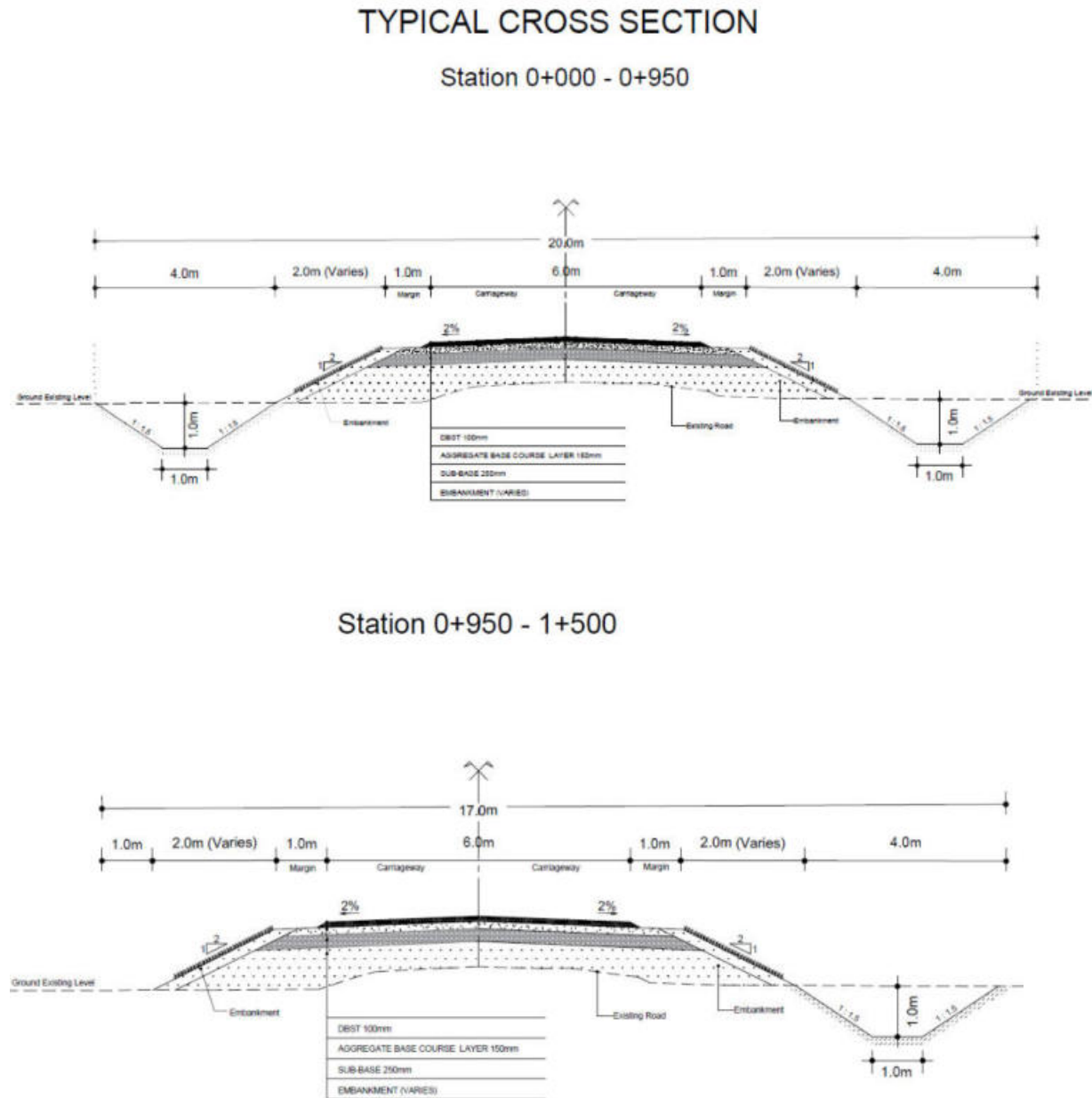
80. Landfill Gas. Management of landfill gas is not included in the project. Gas will be generated after approximately 5 years and therefore no further details are included in the project design.

3.4.7. Pursat Access Road

81. The access road to landfill is separated into 2 sections, first section is from 0 to 950 m and the second section is from 950 to 1500 m. The section 1 will provide drainage in both sides and the section 2 on one side. **Error! Unknown switch argument.** shows the road cross section. The road will require an embankment of approximately 1m and will be built along the alignment of the current earth road, within the right of way. The road design includes culverts (7 pipe culverts, 1 m diameter) to allow adequate cross flow of natural drainage.

⁶ Climate Resilience Vulnerability Assessment Report (April 2018) Climate Change Adaptation in Urban Development (Package 2). Integrated Urban Environmental Management in the Tonle Sap Basin Project (Tonle Sap 1). ADB Grant : 0454-CAM

Figure 6 Pursat Landfill Access Road



Source: DED Report: Cross section of access road (0-950m) and (950-1500m)

3.5. Pursat Drainage and Wastewater Subproject

82. The detailed engineering design for the Pursat drainage and wastewater sub-project identifies a number of issues with the existing network which are to be improved by the new design, including:

- Drains without planning and design, including incomplete drains not connected to any outlet
- Blocked drains and manholes caused by unmanaged solid waste and encroachment onto or over drains.

83. Drains are manually cleaned but the maintenance operations and network are not adequate, leading to regular flooding, shown in Figure 7.

Figure 7 current flooding and drainage/sewage network in Pursat



84. The design of the drainage and wastewater sub-project has included a review of data for rainfall intensity duration frequency (IDF) curves, required for computing the surface runoff. The design is based on a detailed rainfall analysis providing IDF data prepared for ADB in 2006⁷. In addition storm analysis was undertaken and the overall modelling for the drainage system is based on the US EPA's Storm Water Management Model (ver 5.1.006). This model enables a discharge computation to be made.

85. The drainage system subproject includes:

- Main drains: a total of 23.5 Km which includes
 - Reinforced Concrete Pipe, 600mm dia., Class B1 5.2 km
 - Reinforced Concrete Pipe, 800mm dia., Class B1 14.1 km
 - Reinforced Concrete Pipe, 1000mm dia., Class B1 2.2 km
 - Reinforced Concrete Pipe, 1200mm dia., Class B1 1.1 km
 - Reinforced Concrete Pipe, 1500mm dia., Class B1 0.9 km
- 1942 manholes of varying sizes. The spacing of the manholes are varied to suit the connection to the existing road side rain inlets cum manholes at right angles to minimize the excavation works.

86. **Error! Unknown switch argument.** shows the new and existing drainage network.

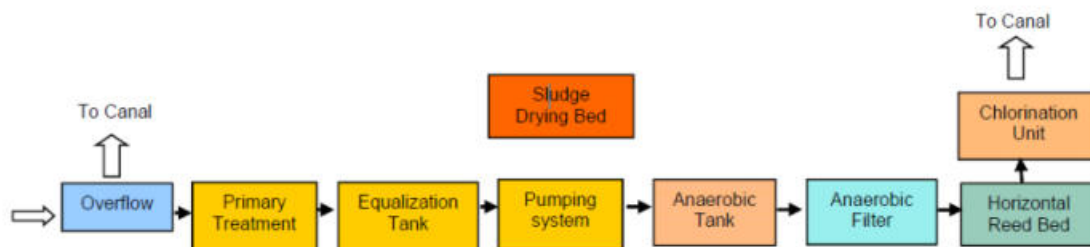
87. **Wastewater treatment plant design.** The treatment method for Pursat WWTP is Horizontal Reed Bed Treatment (HRBT) comprising:

⁷ A comparison was made between rainfall data in Cambodia: Preparing the Greater Mekong Subregion: Rehabilitation of the Railway in Cambodia (JICA Funded) (2006) and Provincial Climate Change Adaptation in Urban Development (Package 2) Integrated Urban Environmental Management in the Tonle Sap Basin Project (Tonle Sap 1) (2018). The design team note that there is little difference in the IDF data, with the 2006 report giving slightly higher figures. The team also looked at other data sources including MPWT guidelines which resulted in significantly lower rainfall predictions. As a result the 2006 data were used and the design follows EU guidelines for residential areas which recommends an IDF curve with a 2 year return period for residential areas and a duration of 15 minutes.

- an overflow unit
- equalization tank
- pumping unit
- anaerobic tank followed by an anaerobic Filter and a Horizontal Reed Bed and
- a chlorination unit.

88. This method of treatment is found to be successful in tropical climate and also found to be operationally easy. The main advantage of this method is less land requirement and the least maintenance. Figure 8 shows the main steps for the treatment of wastewater.

Figure 8 WWTP Treatment Process



Source: Engineering Design Report v0.1 (February 2019)

89. **The overflow unit** will divert the excess flow other than the peak flow of the dry weather flow (PDWF). Since the flow rates are very low for automated weir-based overflow structures, simple gated chamber is proposed with a calibrated opening set at the inlet to the grit chamber. A bar screen is also proposed to trap floating materials from entering into the canal.

90. **The primary treatment** will be a bar screen to trap the floating components, a grit chamber to trap heavy particles as sand and gravel and a grease trap to isolate the grease from entering the septic tank. The bar screens, the grit chamber and grease trap shall be manually operated. The sludge and solids shall be collected and transported to sludge drying bed manually.

91. **The equalization tank** is proposed before the pumping unit to normalize the peak sewage flows in the system so that a constant pump discharge can be generated.

92. **Anaerobic tank** has been designed to provide the volume for sedimentation, sludge storage and the scum space. The design is based 22 hours retention time. Four numbers tanks with volume of 490 m³ each is provided.

93. **The anaerobic filter** comprises a watertight tank containing a bed of submerged filter media which retains the biological solids within the reactor as a fixed film attached to the media, as solids trapped within the interstices of the media, or as solids suspended within or beneath the media in the form of a granulated or flocculated sludge mass. The wastewater flow through the media is continuous and it comes into contact with the biomass in the filter and is subject to anaerobic decomposition. A total of 10.8 hours retention time and a three-chambered anaerobic filter is proposed in series. This arrangement provides a multiple filtering system to ensure the highest efficiency.

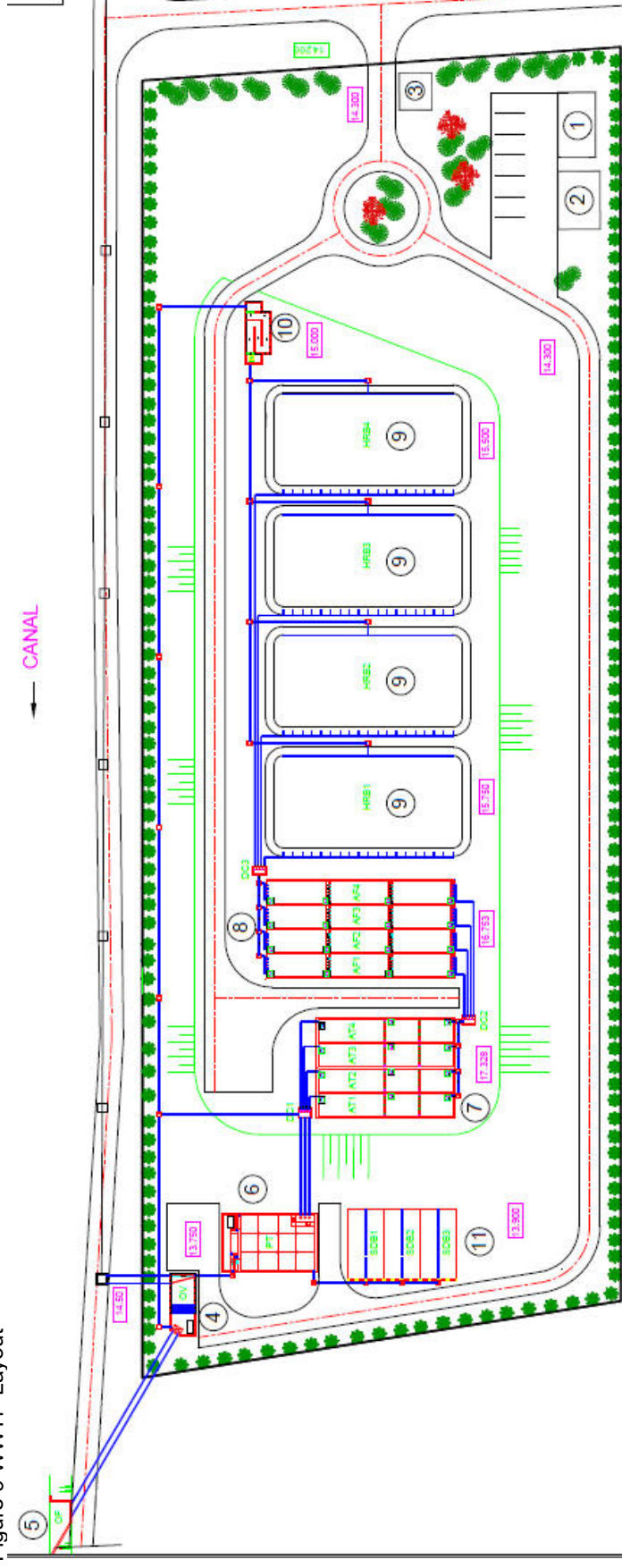
94. **The Horizontal Reed Bed Treatment** will treat wastewater BOD, COD, suspended solids (SS), nitrogen compounds, phosphorus compounds, heavy metals and pathogenic organisms. BOD₅ at inlet of 80 mg/l is designed to be reduced to 30 mg/l.

95. **The chlorination unit** will ensure effluent standards are met. A dry calcium hypochlorite feeding system is proposed which shall prepare and automatically deliver a consistently accurate dose of liquid available chlorine for disinfection applications

96. **The sludge drying beds** are proposed for processing the sludge. A 45 to 60 days interval is proposed for partial sludge extraction of the anaerobic tank. A smaller sludge drying bed (@50% capacity) is proposed at the treatment plant itself and a unit is provided at the solid waste compound.

97. **A layout plan** has been prepared to fit into the available area. The treatment plant also includes the administrative buildings, equipment and generator shed and guard house. A concrete pavement is proposed for the access inside the treatment plant. The layout is shown in **Error! Unknown switch argument.**

Figure 9 WWTP Layout



Key 1. Equipment store 2. Office Building 3. Guard House 4. Chlorination chamber 5. Overflow chamber 6. Primary Treatment Tank 7. Anaerobic Tank 8. Anaerobic Filter 9. Horizontal Reed Bed 10. Chlorination chamber 11. Chlorination chamber

Source: Engineering Design Report v0.1 (February 2019)

Figure 10 Drainage Layout





Source: Engineering Design Team

98. **Operation and maintenance.** The design report notes the types of maintenance required for the drainage and WWTP. Depending on the wastewater flow characteristics, surrounding soils condition, and quality of construction, the pipeline can suffer from clogging, scouring, corrosion, collapse, and, ultimately, the system's deterioration. The collection system is designed to serve for a specific useful life. Hence, it is incumbent for the Municipality to provide adequate operation and maintenance to maximize the benefit throughout its designed useful life.

- For the drainage network, preventive or routine maintenance must be carried out to prevent any breakdown of the system and to avoid emergency operations to deal with clogged sewer lines or over flowing manholes or backing up of sewage in to a house or structural failure of the system.
- For the WWTP the design report sets out the frequency of observation inspections for all parts of the system. Examples include daily pump checks, weekly grit/sand checks, monthly overflow inspections in dry season and cutting reeds every 3 months.

3.6. Borrow Sites

99. Borrow sites for suitable construction materials were identified during the DED phase and the materials tested. One site is identified for each town and formal permission for the sites will be requested by the contractor to MoE before construction starts, as reflected in the EMP. This IEE baseline includes the borrow site areas; the location of the borrow sites is shown in **Error! Unknown switch argument.** for Pursat, which is approximately 5km west of the town centre, and is within an existing area of borrow sites/excavations, **Error! Unknown switch argument.** for Kampong Chhnang which is an abandoned agricultural area approximately 5km west of road #53.

Figure 11 Borrow site location and detail for Pursat subprojects

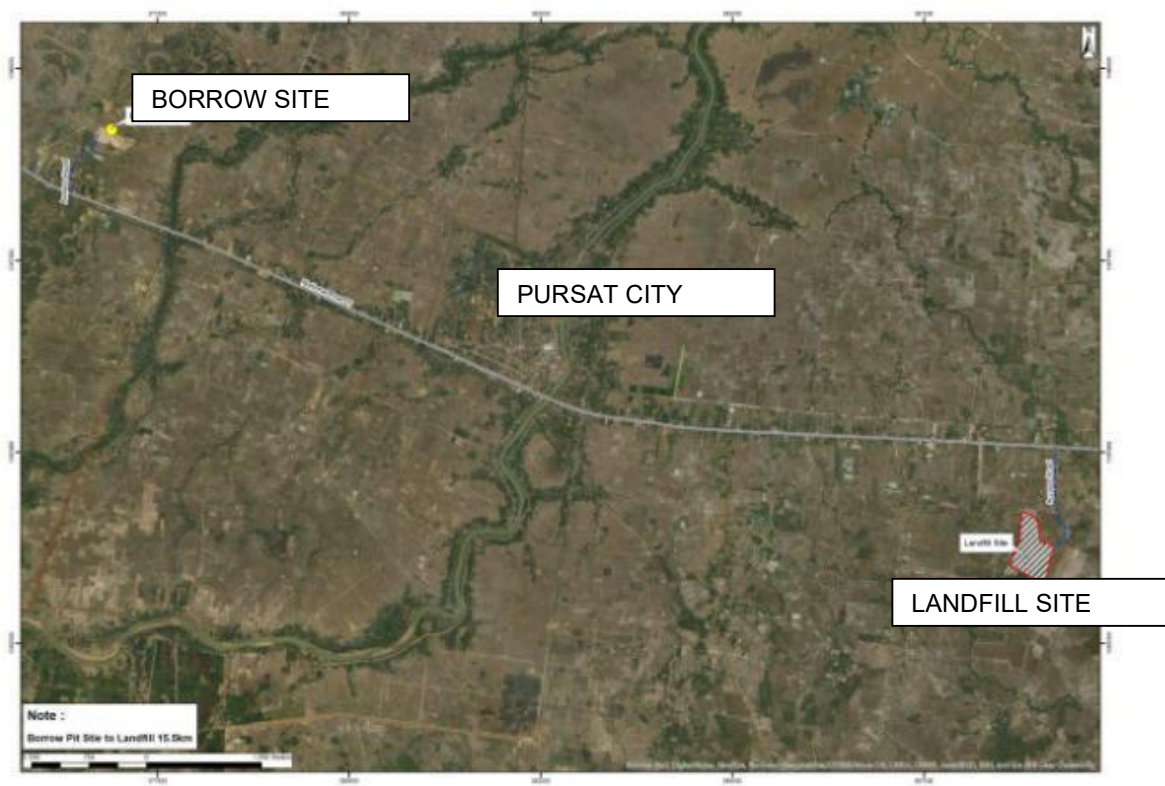
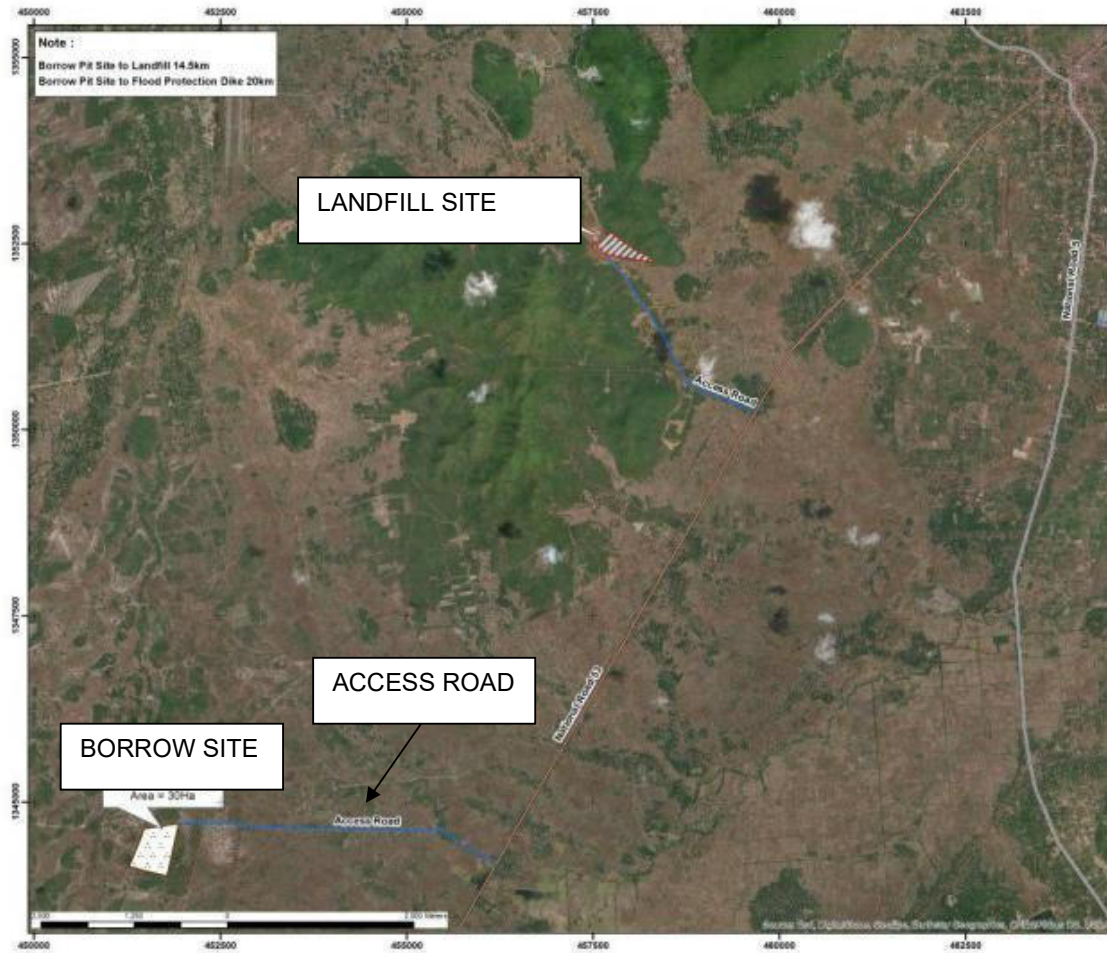


Figure 12 Borrow site location and detail for Kampong Chhnang subprojects





4. ALTERNATIVES ANALYSIS

100. The 'no project' alternative considered the likely consequences of not implementing the proposed subproject interventions. For this project, it would mean that the current pressures on the environment are maintained and the lack of waste and wastewater management would persist. This may be an impediment to development of the project towns and they would become increasingly 'unliveable' as population and commercial pressures impact on the urban environment. The new wastewater, drainage and SWM improvements will ensure that the towns are future proofed and that new developments are less likely to impact negatively on the environment. Therefore it can be determined that the 'No action alternative' is not a reasonable option if the future environmental quality in these provincial capitals is to be maintained and improved.

101. **Leachate management.** Selection of the approach for leachate management for the landfills considered a number of alternative approaches. Several treatment methods are available, from advanced and expensive membrane technologies to simple biological treatment.

102. From practical experience under similar conditions, low-tech, biological methods like aeration and subsequent sedimentation is suitable. Anaerobic treatment is also an option, but this may require substantial areas for implementation which is not available at the

proposed sites.

103. Based on review of many relevant studies and practical results in various leachate management approaches it is concluded that the most suitable, feasible and appropriate treatment will be a combination of various measures:

- initial retention/evaporation,
- recirculation to the landfill area when applicable (dry season)
- pH-adjustment, when applicable
- aeration ponds/lagoons
- subsequent settling ponds/lagoons
- final polishing in wetland pond (possible future solution outside the scope of this project).

104. The leachate management approach chosen (recirculation and evaporation) will ensure no leachate or effluent will be released to the natural environment.

105. **Landfill liner selection.** The waste engineer has provided a discussion on why asphalt lining is the preferred option to a plastic based HDPE liner. Bituminous materials are used in construction works all over the world for applications such as road surfaces and pavements and also as an impervious lining material. Asphalt lining's positive features compared other lining materials are presented below:

- More economical as the total price of landfill lining is normally lower than with any other liner material
- Faster to install, taking weeks/days instead of months/weeks to complete
- More contractors have skills and equipment to construct asphalt lining ensuring more completion at bidding
- No requirement for special works or equipment
- Not affected by inclement weather whilst being laid or afterwards, giving the landfill operator a quicker response time for starting his landfill operations.
- A much thinner lining system to construct, with the total thickness generally averaging approximately 300 mm. (including no need for drainage layer (only ditches are needed) and protection layer) a saving of a metre or more of void space against most other lining systems.
- Strong and constructed to provide hydraulic permeability results of $\leq 1 \times 10^{-13}$ m/s, tested up to 10 bar (100 m) head of water pressure meaning good environmental protection.
- Constructed using an extensive Construction Quality Assurance procedure and all results can be re-tested throughout the construction period and afterwards without destroying the integrity of the lining material.
- Nontoxic - It does not contain mobile toxic compounds that may pollute the ground or surface water.
- Completely stability when placed on slopes of up to 1:1:5 under all conditions of waste and leachate cover.
- Unaffected by vandalism and all natural weather conditions that may be experienced before covering with waste.
- Capable of having rubber tyred construction plant and vehicles run on the surface without fear of damaging the lining system.

- Strong enough to support landfill material, daily cover material and capping material without thinning or deforming.
- Unaffected by leachate and gases normally found in landfills.
- Chemical and Biological Resistant against fire and aging at temperatures over 50° C

106. For the Pursat drainage network, a number of alternatives are identified in the design report:

- a) Replace all the drainage network including the manholes/rain inlet and introduce a separate sewerage and storm water drainage system. This alternative would require more than 24 Km of new drainage system including separate sewer lines and house connections. In addition, it would require excavation and reinstatement of roads and sidewalks in the entire town. The cost of this alternative was estimated to amount to approximately USD 25M. This amount exceeded by far the available budget provision of USD 8.15M
- b) Retain the existing side drainage and manholes and lay new storm water drainage /combined system at the center of the road with proper design with outlets to the waste water treatment plant and overflow to an irrigation canal adjacent to the waste water treatment plant. Repair the rain inlet and manholes including replacement of broken slabs, cleaning of the manholes and pipes. This alternative will require excavation for the main lines and reinstatement of the roads along the main lines.

107. As discussed above and the construction difficulties and the budget limitations, the second alternative has been selected and further developed.

108. For the WWTP alternatives considered include conventional lagoon based systems which include large waste stabilization ponds. The rationale for the reed bed method and discounting of alternatives is primarily based on its low maintenance requirements, few electro-mechanical systems and most importantly to fit the plant in the available 2.8 ha of allocated land for the treatment. The available area is not adequate for conventional waste stabilization pond, which requires about 12 ha of land.

109. The treatment process is also referred to as constructed wetland or root zone treatment in various literatures. The rationale for this selection is that wetlands have been used for at least 90 years for the disposal of wastewater; most discharges were to natural wetlands (U.S. EPA, 1999). The 1990s saw a major increase in the number of these systems as the application expanded for use not only to treat municipal wastewater, but also storm water, industrial and mining wastes, and agricultural wastes. Normally the reed bed plant is constructed with a primary treatment (usually settling tank or anaerobic ponds), Horizontal Reed Bed and followed by Vertical Reed Bed. Where the re-use of the effluent is sought, the outflow from the Vertical Reed Bed is further treated in polishing ponds and often chlorinated. Putting two reed beds in series (Horizontal followed by Vertical Reed Bed) requires a large area. In Pursat, the land is not available to extent to include the two reed beds. As a result, the chosen design is selected which has a footprint which fits within the land available.

5. DESCRIPTION OF THE ENVIRONMENT

5.1. Subprojects' areas of Influence

110. All subproject site options were visited for the preparation of this IEE, with particular attention paid to identifying:

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

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

- (i) The primary project site(s) and related facilities that the borrower/client develops or controls. The primary project sites for this project include direct construction sites, pipelines, canals, access roads, borrow pits, disposal areas, and construction camps.
- (ii) Associated facilities that are not funded as part of the project whose viability and existence depends exclusively on the project. No associated facilities are anticipated for this project.
- (iii) Effects from cumulative impacts from further planned development of the project, other sources of similar impacts. 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 centres will continue, leading to further developments around the subproject areas.

112. 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 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. SPS 2009 requires the assessment to identify potential transboundary effects, such as air pollution, and global impacts, such as emission of greenhouse gases.

113. For the purposes of this IEE, the area of influence for amenity issues is taken to be 250 m, based on noise levels, as follows:

- WHO Community Noise Limits: One Hour LAeq 55 dBA (Outside; residential receptor, day time limit)
- Construction Noise: Backhoe excavator 80dBA at 15m and concrete mixer 79dBA at 15m. 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. However, this would not be the case where vegetation is removed.

- Calculation: At 250m the noise at a receptor is approximately 55 dBA (WHO limit).

114. A table with GPS locations of receptors for the project is shown in **Error! Unknown switch argument..**

Table 5: Summary of Receptors for all subprojects

City	Subproject	GPS (Site)	Surface Water Receptors & GPS	Socio-Economic & Cultural Receptors	Land Cover/ Ecological Receptors	Protected Status	Area
Kg Chhnang	Landfill	12°14'02.57"N, 104°36'39.68"E	Groundwater (perched) Pond (agriculture) 12°13'50.38"N, 104°37'9.85"E	Houses 0.35 km west site, Trapeang Sbov Village	Quarry (adjacent), mountain (behind) Farm land (west/southern border)	None	
	WWTP & Drainage	12°33'7.81"N 103°54'36.06"E	Canal (12°33'8.83"N, 103°54'37.52"E) (effluent discharge)	Densely populated residential & commercial areas Market area Peal Gnaek Pagoda Water and power supplies - cables and electricity poles in residential areas and commercial areas Low quality housing within 50m from WWTP site boundary and along track 2-4m wide adjacent to canal (1m sewer installation). Sampov Meas Hospital Pursat Secondary School Orphanage Support Centre	Farmland on the east and north site	None	
	Landfill	12°30'59.28"N, 103°58'37.21"E	Groundwater and flood water Surface water drainage 12°31'11.09"N, 103°58'34.43"E Pond (agriculture) 12°31'3.20"N, 103°58'50.39"E	Houses along access road (adjacent) and East and West of landfill site (within 300m)	Farm land	None	

5.2. Physical/Chemical Environment

115. **Geographic Location.** Pursat town is the provincial capital of Pursat province and lies midway between the Tonle Sap Lake in the east and Cardamom Mountains in the west, along the banks of the Pursat River. Kampong Chhnang town is the provincial capital of Kampong Chhnang province which occupies the south-eastern edge of the Tonle Sap Basin. Both cities are located on National Road No. 5.

116. **Climate.** Cambodia is situated in a tropical zone, between 10 and 14-degree latitude north of the equator. Its climate is influenced by the monsoon cycle and has two distinct seasons, the dry and rainy seasons. The northeast monsoon brings in the dry season from November to April. The dry season is cooler from November to January when cool air from Siberia flows in, and is dry and hot from February to April. The rainy season is experienced from May to October, as southwest monsoon brings in moisture and rains from the Indian Ocean. Average temperature has minimal variations regionally and seasonally. Weather is coolest in January and hottest in April. Relative humidity ranges between 65-70% in March and 85-90% in September. The rainy season accounts for about 80-90% of the annual rainfall, varying between 1,200 and 2,000 mm across the country. October is the wettest month; January/February, with the least rainfall or driest. Mean wind speed in Cambodia is low at about 2 m/s. December is known as the month of strong steady wind from the north. Typhoons, which often devastate coastal Vietnam, rarely cause damage in Cambodia. Annual evaporation is from 2,000 to 2,200 mm, i.e., highest in March and April at 200 mm to 240 mm and lowest in September-October at 120 mm to 150 mm⁸.

117. Throughout the Tonle Sap Basin: (i) temperatures are fairly uniform; and (ii) annual rainfall varies between 800 and 2,000 mm. Records in the Pursat town's Rainfall Station in the past nine years, 2008-2016, show an average annual rainfall of 1,500 mm (see **Error! Unknown switch argument.**) and records show an average of 1,600mm in Kampong Chhnang (**Error! Unknown switch argument.**).

Table 6: Monthly and Annual Rainfall, Pursat, 2008-2016

Year	Monthly Rainfall, mm												Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
2008	13.5	7.0	77.0	164.2	237.2	189.9	188.8	324.3	210.1	301.9	228.2	6.0	1,948.1
2009	1.6	28.4	56.2	117.9	108.0	126.0	146.1	185.6	175.2	162.7	34.9	0.0	1,142.6
2010	0.0	26.7	30.1	107.9	86.8	238.4	196.0	237.6	167.1	273.8	25.4	0.0	1,389.8
2011	0.0	0.7	62.7	51.3	114.3	106.1	201.0	214.9	206.1	418.1	69.2	44.0	1,488.4
2012	12.1	26.3	156.4	161.5	170.6	57.8	252.6	155.8	248.1	209.5	189.5	0.0	1,640.2
2013	0	0	80.3	93.3	79.4	282	225.6	239.8	172.3	249	132.9	41.7	1596.3
2014	0	0	9.3	75.3	71.8	123.6	218.1	125.1	236.3	268.1	88.8	70.4	1286.8
2015	1.9	0.4	54.1	18.3	177.3	84.8	122.1	219.1	130	275.3	172	4.8	1260.1
2016	46.4	0	0	43.7	54.1	131	194.4	185.1	492.5	400.1	128.8	55.3	1731.4
Average													1511.4

Source: Provincial Department of Water Resources and Meteorology of Pursat Province 2017

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

Year	Monthly Rainfall (mm)												Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
2008	0.0	11.0	2.6	25.0	259.3	97.1	170.6	92.0	326.0	169.2	267.0	0.0	1,419.8
2009	0.0	0.0	64.0	73.5	195.8	164.6	275.6	273.0	299.1	289.0	0.0	0.0	1,634.6
2010	26.2	22.1	148.6	40.5	191.6	80.8	126.5	147.4	147.4	236.8	51.7	0.0	1,219.6
2011	0.0	0.0	73.0	185.0	138.0	249.0	259.7	265.0	301.0	237.0	210.5	11.0	1,929.2
2012	94.0	17.0	24.0	96.0	135.4	187.5	318.1	293.5	180.5	269.5	212.3	3.3	1,831.1
Average													1,606.9

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

118. **Climate Change.** A Climate Risk and Vulnerability Assessment (CRVA) has been undertaken for this project (April 2018)⁹ based on site visits and climate change projections for the Year 2050 and Representative Concentration Pathway¹⁰ (RCP) 8.5. The CRVA noted that many sites are vulnerable to flooding and as such mitigation measures in the design are required; the most significant climate change risks associated with the subprojects are during operation. Both WWTPs and landfill sites can be impacted by heavy rain and flooding. Increased temperatures and droughts can reduce potable water supplies which may directly impact the flows into the WWTP. However, if effectively managed, the CRVA notes that new facilities will bring about improvements to the living conditions of the population of the project areas.

119. **Error! Reference source not found.** shows the impacts from climate change on the subprojects as identified by the CRVA. These issues are managed through design mitigation measures where appropriate.

120. .

Table 8: NEW**Table 9: Impacts from Climate Change on Sanitation Infrastructure (wastewater collection and treatment)**

Climate Change Factor	Impact
Warmer Temperatures	- Increased operating challenges to biological and chemical processes of treatment facilities. - Increased temperatures and increased evaporation in receiving water bodies, changing chemical balances and increased

⁹ Climate Change Adaptation in Urban Development (Package 2), Integrated Urban Environmental Management in the Tonle Sap Basin Project (Tonle Sap 1) ADB Grant : 0454-CAM. April 2018

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

	eutrophication. ▪ Reduced capacity to meet wastewater treatment requirements and standards
▪ More Frequent and/or Intense Extreme Weather Events	▪ Increased risk of direct flood damage to treatment plant, pumping and conveyance, and outfall. ▪ Increased risk of untreated sewage overflows contaminating water supply sources. ▪ Changes in quantity and quality of watershed runoff and in the resulting non-point source pollution loads to receiving waters.

Source: Project CRVA

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

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

122. A Provincial Climate Change Adaptation Strategy around Tonle Sap was issued in December 2019. Similar to the CRVA it examines climate related extremes using the RCP of 8.5. The overall conclusion of the Climate Change Adaptation Strategy is that annual precipitation around Tonle Sap will rise slowly, if at all. The main change in rainfall will occur in the three wettest months of the year, August, September and October. In low lying areas flooding is generally caused by the rainfall in the wettest months of the year and lasts for several weeks. In such a case, changes in monthly rainfall are of more importance than rain falling over a shorter time period. Projections suggest that there will be little, if any, increase by 2030 but could increase by over 20% by 2070.

123. Conclusions relating to the subprojects and climate change are as follows:

- For landfills, local conditions such as the conditions of drainage and other developments that may affect drainage are more important than an increase in rainfall.
- For Pursat drainage (and WWTP) the changes in rain fall and temperature might affect some design criteria.

124. The report’s recommended measures include:

- Civil works
 - Increased height of access road above flood levels
 - Raise embankment on Lagoons boundaries

- Modification of side slope ratios to avoid soil loss in heavy rain
- Drainage design
 - Additional waterway opening at bridge sites
 - Additional cross-culvert capacity
 - Debris deflectors and energy dissipaters
 - Install Debris Deflectors
 - Sub-drainage systems
 - Turf surfaces on side slopes.
- Maintenance
 - Regular inspection and repair of drainage systems
 - Regular cleaning of culverts and side ditches
 - Regular cleaning of box and pipe culvert systems
 - Quick restoration of items following major flood events

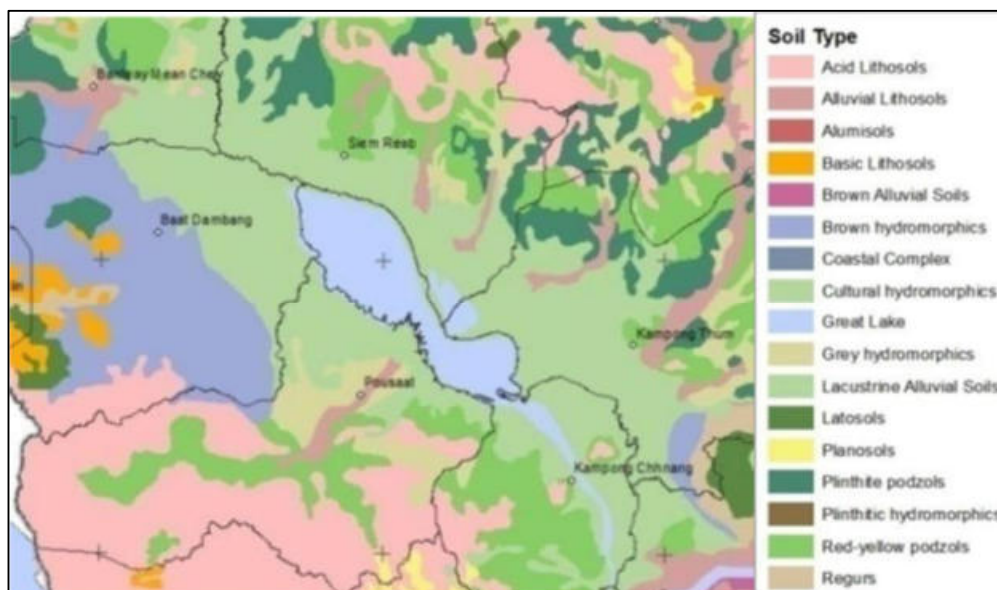
125. Specific Recommendations from MPWT. The report also notes that MPWT have produced a series of Design Guide Recommendations that incorporate climate resilience. Relevant to the subproject the recommendations include:

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

126. In terms of integration of these measures into the final design, specifically the access roads are designed to account for flood levels and the drainage and WWTP design takes into account the potential implications of rainfall changes over the life of the facility. For maintenance, understanding the importance of implementing a regular inspection programme for all infrastructure is incorporated into the training/capacity development elements of the project.

127. **Geography, Geology, Topography.** The project is located in two of the six provinces that surround the Tonle Sap lake basin. The area is dominated by the Tonle Sap lake and this has affected the soil characteristics. As shown in **Error! Unknown switch argument.** the subproject areas in Pursat are dominated by alluvial soils and lithosols and red-yellow podzols in Kampong Chhnang from which minerals such as iron have been leached.

Figure 13. Soil Map of Tonle Sap Basin



Source: Dr Seng Vang Deputy Director, MAFF, presentation 2015, with UN FAO¹¹

128. The topography of the area is generally flat, forming part of the Tonle Sap floodplain area. As a result, the majority of the subprojects are in flat low lying areas.

129. The borehole log for the landfill site in Kampong Chhnang shows that the soil is very dense yellow, gray clayey coarse sand with gravel from the upper layers 0 to 0.50 m and after is weathered rock and weak rock; in general the borehole tests stopped around 1.5-2.5m as the site is underlain by rock.

130. The borehole log for urban drainage in Pursat town shows that the soil is firm to stiff brown light-gray and sandy lean clay to 3.45m where the medium dense light gray occur to 4.95 m. Hard gray brown yellow and sandy lean clay is found from 6.45 m to 9.95m. The water level is range from 0.5 m to 3.5 m but some boreholes water level is not present

131. The borehole logs for the landfill site in Pursat town show that the soil is very stiff yellowish gray, sandy lean clay to 1.95m, medium dense light gray, silty fine sand occur at 3.45m and then very stiff light gray occur from 4.95 m to 6.45m. Medium dense light gray is found at 7.95 m and stiff yellow gray, sandy lean clay is found to the end of the borehole at 9.95m. Groundwater was not found during the sampling. An example borehole log for the landfill site is shown in Annex 3.

¹¹ Asian Soil Partnership Consultation Workshop on Sustainable Management and Protection of Soil Resources 13-15 May 2015, Bangkok, Thailand.

Figure 14: Geotechnical investigation boreholes in Kampong Chhnang landfill



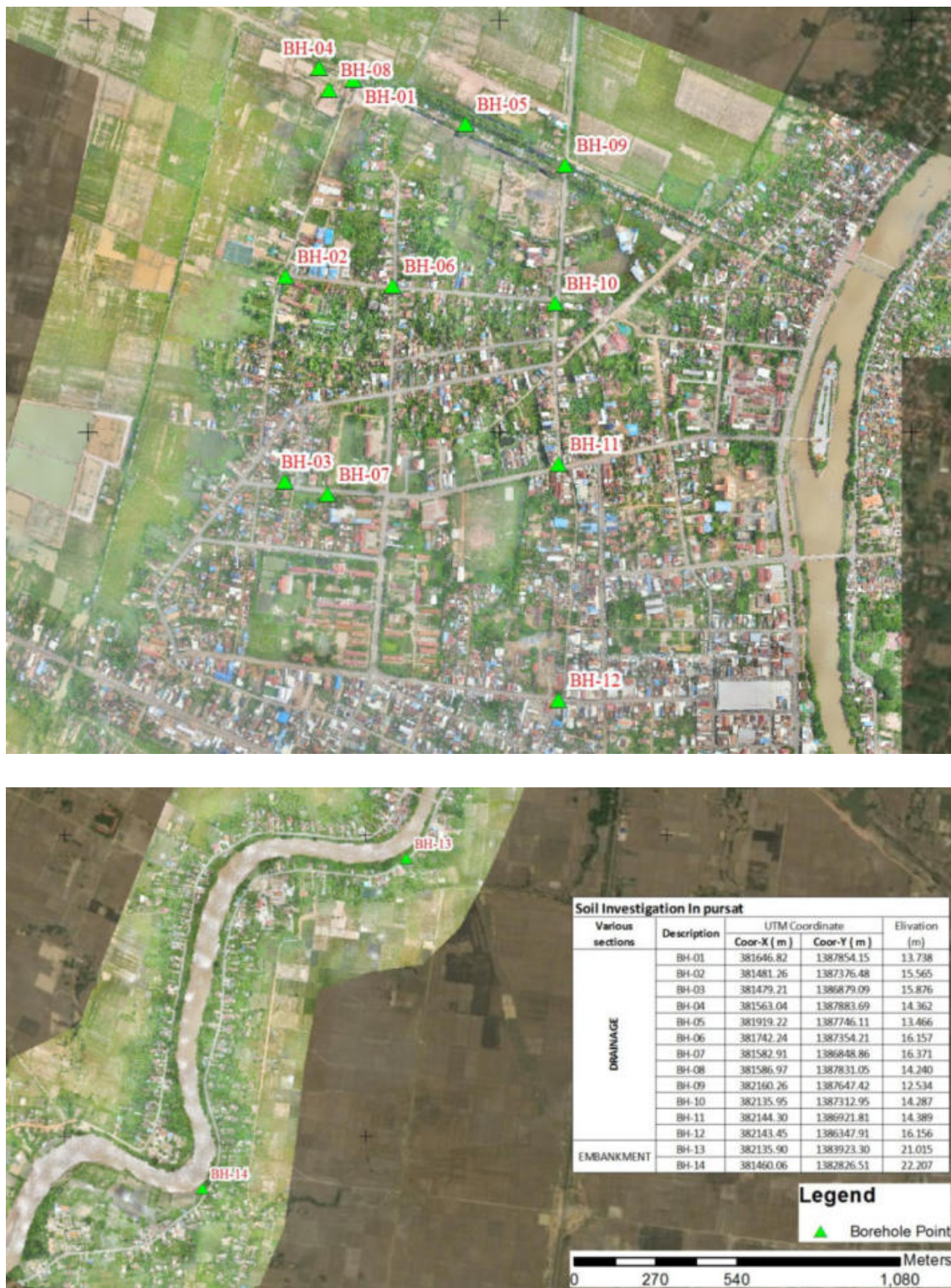
Source: DED report

Figure 15: Geotechnical investigation boreholes in Pursat landfill



Source: DED report

Figure 16: Geotechnical investigation boreholes in Pursat Drainage



Source: DED report (Not to scale)

132. **Surface Water.** In Pursat, the main surface water feature is Pursat River which has its catchment area in the upland and mountainous areas of the Cardamom Mountain in the

west and empties into the Tonle Sap Lake in the east. It is about 250 km long. Downstream at Veal Commune (boundary of Pursat Town with Kandieng District), flow is less than that upstream at Bac Trakuon due to water diversion at Damnak Ampil Weir for irrigation. Pursat River provides mainly amenity value for the Town, as well as the main source of drinking water and irrigation water for the surrounding agricultural areas.

133. **Drainage and WWTP subproject.** Pursat river, described above, is at a higher level than the canal. Therefore the main surface water feature for the drainage and WWTP is the canal into which effluent will drain. The canal no longer functions as an irrigation canal; it is not in use and given the levels of the canal and the surrounding area, will never have functioned effectively as an irrigation canal, however it is still classified an irrigation canal. Raw sewage accumulates in the first section before the treatment plant (to the east). When it rains, sewage is washed out to branch canals and eventually to rice fields when the storm flow overtops the canal. MOWRAM agreed at a meeting with the Governor during DED phase, that the treated effluent and storm water can be discharged to the canal.

134. The canal crosses a stream 3km west of the WWTP site. The stream appears to be very low flow in dry season and flows away from Pursat river. The canal also crosses a dry natural stream bed at around 1km west which is a series of ponds in the dry season.

135. Figure 17 shows the existing water quality in the canal adjacent to the WWTP which is heavily contaminated with solid waste and sewage.

Figure 17: Pursat WWTP Effluent Receiving Canal



Source: PMIS Team

136. **Kampong Chhnang and Pursat landfill sites.** There are no natural permanent water bodies and stream networks within a 2-km radius from the proposed landfill sites. For Kampong Chhnang landfill site, there are abandoned borrow pits and artificial drainage

along the quarry access road. Run-off from the foothills is collected through unevenly dug channels and ends at borrow pits. For Pursat landfill site there is a drainage ditch to the north west of the site.

137. Both landfill sites are close to surface water ponds used for agriculture and are identified in **Error! Unknown switch argument.** (environmental receptors).

Table 10: Surface water quality in Kampong Chhnang and Pursat from IEIA report

No	Parameters	Unit	Results / Sample Number			Natioal Standard
			Pond ⁽¹⁾	Irrigation canal ⁽²⁾	Pursat River	
1	pH	-	7.29	8.70	7.39	6.5 - 8.5
2	Temperature	°C	21.06	-	-	-
3	TDS	mg/L	710.00	257.00	34.00	< 1000
4	DO	mg/L	6.66	5.8	7.20	7.5-2.0
5	TSS	mg/L	35.00	59.00	29.00	1-15
6	(BOD)5	mg/L	1.63	24.35	1.40	< 30
7	(COD)Cr	mg/L	4.96	53.32	3.52	1.0-8.0
8	Oil and Grease	mg/L	3.46	8.49	6.39	< 5.0
9	Arsenic (As)	mg/L	0.23	0.003	0.001	< 0.01
10	Nitrate (NO3)	mg/L	0.0002	-	-	-
11	Cadmium (Cd)	mg/L	ND	ND	ND	< 0.001
12	Iron (Fe-total)	mg/L	0.27	0.03	0.07	< 1
13	Copper (Cu)	mg/L	ND	-	-	-
14	Lead (Pb)	mg/L	0.0001	ND	ND	< 0.01
15	Mercury (Total)	Mg/L	0.0002	ND	ND	< 0.0005
16	Total Nitrogen (TN)	mg/L	0.44	7.70	0.57	0.1-0.6
	Detergent	mg/L	-	0.11	ND	< 5.0
	Sulphate (SO ₄)	mg/L	-	8.64	2.75	< 300
17	Total Phosphorus (TP)	mg/L	0.02	0.96	0.02	0.005-0.05
18	Total Coli form	MPN/100	1500	2.4*10 ³	1.5*10 ³	< 1000

Source: IEIA Report [Location of the pond (Kampong Chhnang Landfill) X=458505 Y=1352111; Irrigation canal X=381990 Y=1387711]

138. **Groundwater.** The geotechnical survey (November 2017) undertaken during the project design phase for both landfill sites and Pursat wastewater/drainage, which gives baseline groundwater data for the project. It showed that:

- **Pursat landfill:** No groundwater was encountered; the boreholes were drilled to a depth of 10m during the time of the survey. However groundwater is known to be high at Pursat landfill at the peak of the wet season every year, and the area is known to flood. This is discussed in Section Paragraph 142 (Natural Hazards, Flooding).
- **Kampong Chhnang landfill.** All 10 boreholes encountered groundwater at a depth of 0.5 to 1.3m. Water bearing materials (clays and gravels) overlay bedrock which started at between 0.5 to 6m meaning the boreholes stopped at the bedrock. Therefore the groundwater encountered is anticipated to be a contained perched water lens recharged by runoff from the mountain not by groundwater flow.
- **Pursat WWTP and drainage.** Four of the 12 boreholes do not encounter water, some of which were drilled to a depth of 10m. The remaining boreholes encountered water between 0.5 to 3.5m depth.

139. **Air Quality.** Field visits indicate that air quality in the project sites is good, as the project areas are located in rural areas without significant industrial/commercial zones to cause air quality degradation. Typically, in Cambodia, outside Phnom Penh or town centres there are few industrial pollution sources and the volume of vehicular traffic is relatively low. However, Kampong Chhnang landfill is located adjacent to an active quarry which generates

dust.

140. According to the Table 11 below the results of air quality in the project site both Kampong Chhnang and Pursat meet the national standard. It appears that the WHO standard is not met for Ozone in Location 1 however the time for sampling is not comparable for both standards.

Table 11: Air quality baseline and standards, Pursat and Kampong Chhnang

No	Parameters	Unit	National Standard	WHO Ambient Air Quality Standard	Pursat drainage (1)	Pursat Landfill (2)	Kampong Chhnang Landfill (3)
1	CO	mg/m3	20 (8hr av)	-	0.54	0.12	0.28
2	NO2	mg/m3	0.1 (24hr av)	0.04 (24hr Av)	0.015	0.010	0.012
3	SO2	mg/m3	0.3 (24hr av)	0.02 (24hr av)	0.010	0.005	0.008
4	Ozone (O3)	mg/m3	0.2 (1hr av)	0.1 (8hr av)	0.10	0.06	0.23
5	TSP	mg/m3	0.33 (24hr av)	-	0.075	0.068	0.054
6	Pb	mg/m3	0.005 (24hr av)	-	ND	ND	ND
7	CH4	mg/m3	-	-	-	-	-
8	PM 10	mg/m3	-	0.05 (24hr av)	0.035	0.036	0.025
9	PM 2.5	mg/m3	-	0.025 (24hr av)	0.013	0.021	0.012

Source: IEIA report, 2018

141. The Cambodian standard is not adjusted to noise pressure levels for the human ear (LAeq), instead the standard is decibel Average (dB(A)). The IEIA baseline is based on Laeq, therefore it is not clear as to whether the national standards are met. The WHO standards for residential receptors are not met for location 1 (day and night) and location 2 does not meet WHO standards for night time. (see Table 12).

Table 12: Noise baseline and standards, Pursat and Kampong Chhnang

Time	National Standard dB(A)	Result, dB(A)		
		LAeq	Lmax	Lmin
Pursat drainage (1)				
Day (6:00 - 18:00)	60	46.4-65.5	62.0-85.9	36.5-44.3
Evening (18:00 - 22:00)	50	51.7-59.7	54.5-75.9	46.9-52.3
Night (22:00 - 6:00)	45	49.5-58.5	53.9-71.6	44.0-49.9
Pursat Landfill (2)				
Day (6:00 - 18:00)	60	32.2-45.6	42.1-65.9	21.9-38.6
Evening (18:00 - 22:00)	50	42.7-53.1	53.1-56.3	37.0-46.9
Night (22:00 - 6:00)	45	46.7-52.0	49.3-53.8	41.1-47.2
Kampong Chhnang Landfill (3)				
Day (6:00 - 18:00)	60	39.5-46.6	56.5-104.8	46.1-51.9
Evening (18:00 - 22:00)	50	37.3-47.2	55.0-74.1	44.8-52.5
Night (22:00 - 6:00)	45	37.5-39.2	55.8-103.6	44.1-52.8
WHO Community Noise Standards Laeq (dBA)	Daytime 07:00 – 22:00		Night Time 22:00 – 07:00	
Receptor: Residential, institutional or educational	55		45	
Receptor: Industrial, commercial	70		70	

Source: IEIA report, 2018

142. **Natural Hazards.** Storms and typhoons are not usually considered a major problem in Cambodia however storms do occasionally affect the country, with most storm-related damage being caused by localized floods associated with heavy rain. Tropical storms can also affect the level of Mekong River flooding experienced in a given year. Greatest damage occurs when these storms arrive during September and October when the seasonal

discharge of the Mekong River is already high, and a second significant peak to the annual flood is generated. Also, wind damages property, agricultural produce and ecological systems.

Table 13: Natural Hazards in Pursat Town (1996-2018)

Hazards	Deaths	Injured	Houses Destroyed	Houses Damaged	Victims	Affected	Evacuated
Flood	0	0	0	0	2669	0	2669
Fire	0	0	3	7	0	0	0
Storm	0	0	1	2	14	0	0
Drought	0	0	0	0	4113	0	0
lightening	7	3	0	0	0	16	0
Total	7	3	4	9	6796	16	2669

Source: National Committee for Disaster management, 2018

Table 14: Natural Hazards in Kampong Chhnang Town (1996-2018)

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

Source: National committee for disaster management, 2018

143. **Flooding.** There are two major types of flood in Cambodia: (i) Mekong River flood and (ii) flash floods. Mekong River flood occurs with cumulative rainfall in the upper catchments throughout the rainy season, causing a slow but steady rise in water levels lasting for several days. This causes the Tonle Sap River to reverse its flow, expanding the Tonle Sap Lake to six times its dry season size. This event is increased with heavy rains around the Tonle Sap Lake, affecting the provinces around the lake and the southern provinces. This event is most severe when heavy rains coincide with a tropical depression and storm.

144. Flash flood results with repeated heavy rainfall in the mountainous areas. Flash flood lasts for only a few days but often cause severe damages to crops and infrastructure, particularly in tributaries around the Tonle Sap Lake. Pursat is one of the Provinces that is prone to flash floods. According to the most recent Strategic National Action Plan for Disaster Risk Reduction (2008-2013)¹², the flood-prone Pursat communes along Tonle Sap Lake are among priority flood-prone communes.

145. Pursat landfill is in an area prone to flooding with a low gradient meaning during the wet season, rain water combined with rising groundwater levels gives rise to surface water flooding to a depth of at least 0.5m, noting that at the landfill site, this information is anecdotal but site visits confirm these depths are seen regularly during the wet season.

¹² Information obtained during original IEE preparation

5.3. Biological Environment: Flora and Fauna ¹³

146. Both Pursat and Kampong Chhnang towns lie partly within the Tonle Sap Biosphere Reserve. The projects are in Zone 1 which means permission is not required for development.

147. The population around the project cities is largely rural and most natural vegetation has been replaced by agricultural crops, particularly rice. The Tonle Sap Lake and its wetlands and seasonally inundated forests, are part of the country's water systems that provide habitats harbouring high levels of biodiversity.

148. The subproject sites and their main areas of influence are not habitats of rare species of flora and fauna¹⁴. This is supported by the project locations as the subproject locations are not in areas of flooded forest or other notable habitat. In addition biodiversity screening of comparable project sites in both project cities using IBAT¹⁵ was carried out for the Second Urban Environmental Management in the Tonle Sap Basin Project. The IBAT tool showed that the project area does not contain any protected areas or habitats of particular biodiversity value. Site visits showed landfill subprojects are located in highly disturbed environments dominated by agricultural land use with scattered trees. The Pursat drainage and WWTP project is located in an urban environment.

149. Pursat Landfill site is located in an area that was dominated by scrub but is now primarily agricultural land as shown in **Error! Unknown switch argument..** The southern part of the active landfill site is currently scrub with low level vegetation and the remainder is cultivated rice fields. Kampong Chhnang landfill (Figure 19) is located adjacent to a quarry in an area used for borrow sites and spoil disposal with scrub vegetation and also farmland to the south and east. Neither site offer notable habitats for flora and mammalian fauna.

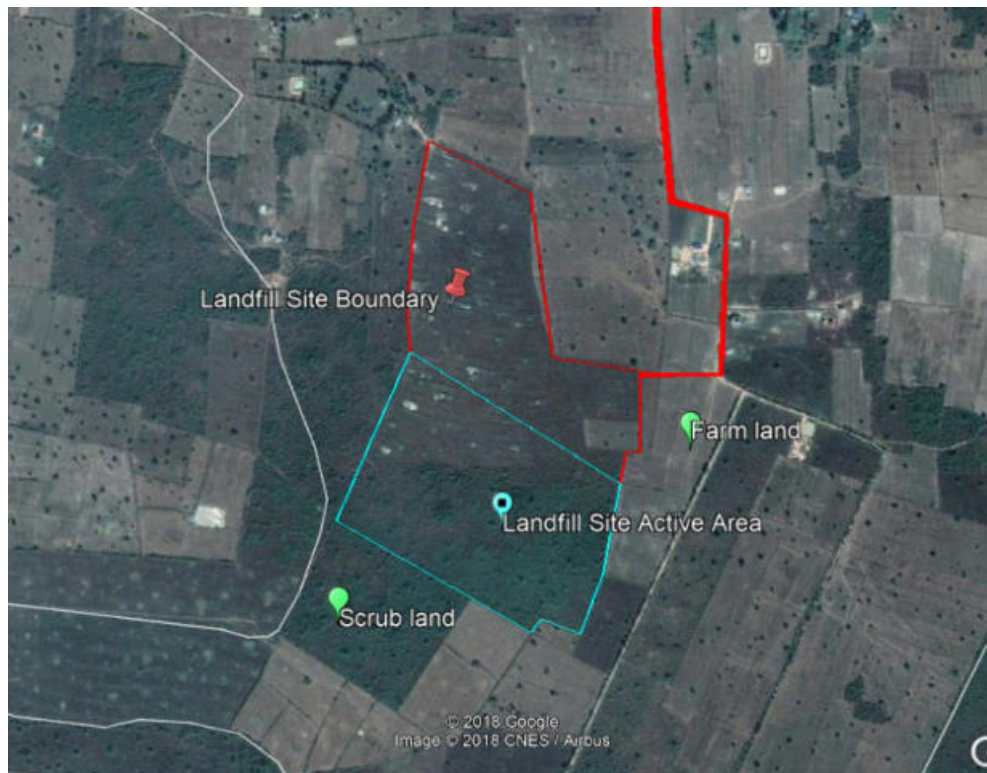
150. Pursat WWTP site (Figure 20) is located in an area previously use for water treatment and is now fenced off, contains low grass like vegetation and concrete structures containing rain water. As such it is not likely to be a notable habitat for flora and mammalian fauna.

¹³ This Section is lifted from the Cambodia Tropical Forestry and Biodiversity (118/119) Assessment. February 2011. USAID Cambodia.

¹⁴ PPTA IEE. 2013.

¹⁵ IBAT is a central database for globally recognized biodiversity information including Key Biodiversity Areas and Legally Protected Areas <https://www.ibatforbusiness.org/>.

Figure 18: Pursat Landfill Site Land Use



Source: PMIS Team

Figure 19: Kampong Chhnang Landfill Site Land Use



Source: PMIS Team

Figure 20: Pursat WWTP Site Land Use



Source: PMIS Team

151. **Fish Species.** Cambodia is rich in fish biodiversity with at least 500 fish species recorded in the Cambodia's Mekong River and nearly 300 fish species in Tonle Sap Lake. During the preparation of a pre-feasibility study IEE¹⁶ in the subproject cities of Pursat and Kampong Chhnang, interviews were held in with local people regarding their understanding of fish species in the project area; the subproject urban areas correspond to those for this project. The results were similar for both subproject towns and are given in Annex 4. As an example, in Kampong Chhnang, 31 species were named, with the most common being (including Khmer name) Trey Riel, *Henicorhynchus* sp (carp); Trey Andaing Toun, *Clarias macrocephalus* (catfish); Trey Phtuok/Raws, *Channa striata* (snakehead); Trey Kranh, *Anabas testudineus* (climbing perch); and Trey Kamphlien *Trichogaster trichopterus* (Three spot gourami). It is noted that these species listed are not threatened, critical or endangered.

152. **Bird Species.** Cambodia has a number of protected bird habitats, including Prek Toal Core Zone on the Tonle Sap lake. This core zone will not be impacted upon by the project. As with fish species, the pre-feasibility study IEE¹⁷ in the subproject cities of Pursat and Kampong Chhnang undertook consultation with people resident in all the subproject areas in 2016 to identify actual bird species which are observed by local people. The people interviewed identified approximately 25 species in Kampong Chhnang and 28 in Pursat observed in their locality; the results are given in Annex 4 which includes updated species identified by the IEIA team during site visits and consultation. The pre-feasibility study team noted that *Heliopais Personata* (Masked Finfoot, an aquatic bird) is the only endangered species mentioned by the people resident in the subproject area. It is classified as endangered due to degradation of wetland and riverine lowland forest habitats in Asia. The favoured habitat is well vegetated wetlands, including swamps and lake edges; these types of habitat are not within the area of influence for the project; the closest most recent sighting of the species around the Tonle Sap is at Boung Chma (in 1998) which is 50 and 70 km

¹⁶ TA-8556 REG: CDIA- Pre-feasibility studies for Second Tonle Sap Integrated Urban Management Project

¹⁷ TA-8556 REG: CDIA- Pre-feasibility studies for Second Tonle Sap Integrated Urban Management Project

respectively from Pursat and Kampong Chhnang towns. The Kampong Chhnang embankment is adjacent to a river edge but the habitat is devoid of natural vegetation. . The IEIA team also noted an endangered bird species (*Tringa guttifer*) however the exact location of sightings of this species, the basis of its inclusion in the list (i.e. secondary data source or recent local observation) are not known; it is primarily considered a coastal wader therefore wetlands around the Tonle Sap lake are not anticipated to be a primary habitat for this migratory species.

153. The IEIA team through consultation with local people and secondary data sources identified a number species of flora and fauna which are or were known in the subproject areas. These are given in Annex 4 and include reptiles, animals and trees, however as with the bird data, the basis for the additional flora and fauna species and exact sources of data are not known and therefore are treated with some caution.

5.4. Socio-economic Environment

154. **Population.** In 2017, Pursat Municipality had a total population of 63,773 people. The total population included many rural villages within the Municipality. The PPTA Team estimated the urban population within the Municipality to be only 42,085 and the total population of the urban agglomeration area, 49,044, in 2011. The embankment protection and drainage improvement works will take place in the town center where population density is highest.

155. In the 2008 census, Kampong Chhnang Municipality registered a total population of 38,121 persons (7,415 families). With a land area of nearly 47 km², the Municipality had a gross population density of 817 persons /km². By 2018, it was estimated that the Municipality had a population of 40,745 persons and a gross population density of 866 people/km². Ph'er Commune had the highest population density at 2,803 p persons /km², followed by Phsar Chhnang Commune at 1,667 persons /km². The existing embankment runs through communes with least population density (Kampong Chhnang and Khsam) and with the second highest population density (Phsar Chhnang) (source Kampong Chhnang Municipality, 2018).

156. **Employment, Poverty and Vulnerable Households Pursat:** The PPTA team undertook a socio-economic household survey (SES) in 2013. Of the 126 households surveyed in the SES, the majority, nearly 45% of male household heads were not employed, followed by 17% as engaged in agriculture. In contrast, most of the surveyed female household heads, nearly 63%, were primarily engaged in wholesale or retail trade (62.5%), followed by approximately 13% as engaged in agriculture. Overall, the proportion of those employed in the primary sectors, i.e., agriculture (16.7%), fishing (2.4%), forestry (1.6%), in Pursat Municipality appeared much lower than provincial figures.

157. Of the 126 households surveyed in the SES, 13.5% were female-headed; (11% were headed by disabled persons; and 10% were headed by an elderly (over 65 years old). The SES data revealed half of the surveyed female-headed households with incomes just at or below the poverty line, underscoring the vulnerability of a proportion of female-headed households in the Project area.

158. **Employment, Poverty and Vulnerable Households Kampong Chhnang:** Of the respondents in the PPTA's SES, 77%, were self-employed. Employed respondents represented approximately 10%. About 3% of the respondents were without occupation; while 7% were retired. Of the 94 households surveyed in the SES: (i) 20% were female-headed; (ii) 11% were headed by disabled persons; and (iii) 11% were headed by an elderly (over 65 years old).

159. **Error! Unknown switch argument.** shows information obtained from the PPTA SES with regards to the existing urban infrastructure, as related to the subprojects. Additional supporting information is provided in Annex 5.

Table 15: Urban Infrastructure, Kampong Chhnang and Pursat town

Urban Infrastructure	Pursat	Kampong Chhnang
Water Supply	64% sourced drinking water from piped water supply connected to their houses; 10% from rivers/streams/springs; 9% used rain water; 8% from piped water supply in their compounds; 3% from protected dug wells; and the rest used water from boreholes, unprotected dug wells, 5-gallon containers and others	38% sourced drinking water from boreholes; 19% from piped water supply connected to their houses; 14% from rivers/streams/springs; 10% from protected dug wells; 6.4% from piped water supply in their compounds. The rest reported as using rain water or purchasing water
Sanitation	80% had flush/pour flush toilets; 10% had pit latrines with septic tank; 3.2% had pit latrines without septic tank; and 6% had no latrines and used other's latrine. The remaining households had other forms of sanitation facility or disposal methods.	66% had flush/pour flush toilets; 6.4% had pit latrines with septic tank; 7.4% had pit latrines without septic tank; 1% had dry pit latrines without slab; and 14% had no latrines, were using other's latrine. The remaining 5% had other form of sanitation facility or disposal method.
Drainage	75% had no access to drains; 13% had access to earth drains; and the remaining 12% had access to closed and cement-lined open drains. 75% said their communes flood during heavy rains and/or during river overflow. Of those served by drains, 79% reported drains to be too small; and about 11% reported their drains as clogged with sediment and/or solid waste	77% did not have access to drains; 18% had access to earth drains; and the remaining 5% had access to closed and cement-lined open drains. 87% said their communes would flood during heavy rains and/or during river overflow. Of those served by drains, 12% reported drains to be too small; and about 10% reported their drains as clogged with sediment and/or solid waste
Solid Waste Collection	11% had access to solid waste collection services while 81% burned their garbage. The remainder bury or throw garbage anywhere.	25% had access to solid waste collection services. The majority burn their garbage, the remainder bury or throw garbage anywhere.

160. During informal consultation for Pursat WWTP, the PMIS team talked to a shop owner in Anglong Hat village approximately 2.5 km from the WWTP canal (12°34'16.92"N 103°54'36.86"E). The shop owner noted that some people use the water bodies in the area for household uses, such as washing, although it was not clear if this also included drinking. However given the water quality in the canal adjacent to the WWTP it is not anticipated that close to the urban area people use the canal for anything household uses.

161. [People health: According to the interview with local people found that catch cool has highest percentage \(18 to 21 %\) in Pursat and Kampong Chhnang sub-projects.](#)

Table 16: List of disease in Pursat and Kampong Chhnang

No	Type of disease	Location of Sub-projects
----	-----------------	--------------------------

		PS Landfill (%)	PS Drainage (%)	KCHH Landfill (%)
1	Catch cool	19.49	21	18
2	Fever	18.79	20	18
3	Headache	15.08	15	14
4	Cough	13.92	14	14
5	Dysentery	12.99	13	13
6	Gastritis	6.26	7	10
7	Typhoid	3.71	3	4
8	Arthritis	2.55	4	4
9	Respiratory	2.32	1	2
10	Hypertension	2.32	2	
11	Eye pain	0.93		2
12	Heart disease	0.93		
13	Diabetes	0.70		
Total		100%	100%	100%

Source: IEIA study, 2018

5.5. Affected Households

162. For both landfill sites, 8 houses in Kampong Chhnang and 4 in Pursat are within 500m of the sites and are provided with impact mitigating glass windows, fly screens and trees screens. Any further permanent or temporary impacts such as the relocation of businesses will be will be responsibility of GDR to address, with the support of the social and resettlement specialist.

5.6. Physical Cultural Environment

163. Within the project area of influence, the pagoda's around Pursat town are the only known cultural resources present. These are relevant to the drainage and wastewater project in Pursat only. There are no physical cultural resources that will be affected by the remaining proposed subprojects. According to the Municipalities¹⁸, no chance finds of archaeological/ historical relics have yet been experienced or reported.

¹⁸ During interviews held during PPTA.

6. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

6.1. Positive Environmental Impacts and Benefits

164. The subprojects will improve the urban environment and climate change-resilience, significantly contributing to a qualitative improvement in the lives of residents in Pursat and Kampong Chhnang Town. **Error! Unknown switch argument.** presents the environmental benefits, positive impacts and outcomes of the proposed subprojects.

Table 17: Environmental Benefits, Positive Impacts and Outcomes

Aspect				
Province/subproject		Benefits	Positive impact	Outcome
Pursat Province				
Drainage System Improvements		Improved storm- and wastewater management	Relief from flooding Improved sanitation Reduced health and safety hazards Improved, safe mobility in the rainy season	Improved urban environment Safe, climate-resilient communities and Town
Solid Waste Management		Improved solid waste collection and disposal	Reduced/eradicated open & indiscriminate dumping & burning of SWM & relief from its associated issues (fumes & uncontrolled gas emissions, odor, nuisance, contamination of water resources, clogging of drains, health & safety risks)	Improved urban environment Safe communities and Town
Kampong Chhnang Province				
Flood Protection		Improved protection from annual flooding from the Tonle Sap Safe perennial access	Relief from flooding Reduced health and safety risks Improved mobility/access	Improved urban environment, Safe, climate change resilient communities/ Town
Solid Waste Management		Improved SWM collection & disposal	Reduced/eliminated open & indiscriminate dumping & burning of solid wastes and relief from its associated issues, fumes and uncontrolled gas emissions, odor & nuisance, contamination of water resources, health and safety risks, clogging of drains	Improved urban environment, Safe communities and Town

6.2. Potential Impact Screening

165. Screening environmental impacts allows minor impacts to be screened out, allowing the EMP to focus on those impacts which are most in need of mitigation measures. The following section on environmental impacts screens the potential impacts according to the following factors and recommends mitigating activities on this basis:

- **“Receptor”**: the resource (human/natural environment/economic/social) which is potentially going to receive and have to cope with an impact.

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

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

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

		Magnitude of Impact		
		LOW	MEDIUM	HIGH
Receptor Sensitivity & Importance	LOW	Low	Low	Medium
	MEDIUM	Low	Medium	High
	HIGH	Medium	High	High

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

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

169. During the project planning, the project has taken into consideration the locations of the available sites and adapted the designs accordingly in order to reduce the environmental and social impacts and particularly to promote the operational sustainability of the subprojects. The key major design to mitigated environmental risk:

- **Pursat landfill.** The DED team raised the level of the landfill cell base to 0.5m above the anticipated flood levels for the site on top of which is a 0.6m geological barrier and then asphalt lining. This is required to ensure that the protection of the groundwater is maintained. The depth of fill is a maximum of 1m, depending on the natural ground level. This also means surface water will not be able to run over the waste mound as the raised area will be above surface water level.

- The landfill base and sides shall consist of both a geological barrier (600mm thick) which satisfies permeability and thickness requirements in terms of protection of soil, ground water and surface water, and an asphalt impermeable layer (50mm).
- **Pursat WWTP.** The site is small and close to housing therefore the WWTP design locates the majority of potentially odorous processes underground, contained by concrete covering. The main sludge drying bed is also to be located at the landfill site, as opposed to within the WWTP area, which is further from residential areas where odor and pests would be problematic. The technology chosen is designed to minimize the chance of breakdown and operating costs. Once wastewater is in the WWTP, no pumping is needed (gravity only) to pass the effluent through the system.

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

- Community consultation – this has already been started during the DED phase and will continue during the project implementation.
- GRM establishment and dissemination – this requires training for the PMU, GRM stakeholders to ensure they are able to establish and participate in an effective GRM.
- EMP and IEE updates – this updated IEE contributes to ensuring the safeguard documents accurately reflect the project design and the EMPs will be updated during project planning if required.
- Review of contractor provided site specific construction EMPs.

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

6.4. Impacts and Mitigation Measures during Construction

6.4.1. Land clearance and grubbing. Subprojects: WWTP site and landfills.

172. **Potential Impacts.** The clearing and grubbing shall consist of clearing the sites of vegetation, grubbing stumps and roots and removing any waste materials¹⁹. For the WWTP, the demolition and removal of an existing concrete structure on the site is included in site clearance. Materials resulting from clearing or grubbing maybe reused, but more likely will require disposal. Potential impacts will be associated with the noise from removal of the concrete structure and the use of machinery, and the disposal of waste arisings. The new borrow site in Kampong Chhnang may require some limited clearance.

- **Potential Impact Significance:** Low – the impacts are short term and are not in the immediate vicinity of significant numbers of housing.
- **Residual Impact Significance:** Low – mitigation measures will be applied to ensure the impacts are as low as possible.

173. **Mitigation Measures.** The mitigation measures are covered by those defined below for solid waste management and use of machinery and equipment. Therefore no further mitigation is needed for land clearance and grubbing.

6.4.2. Production, Transport and Use of materials. Subprojects: All.

174. **Potential Impacts.** The use of heavy construction vehicles to move construction materials including loose aggregates and any pre-fabricated structures, can impact on the

¹⁹ For Kampong Chhnang landfill this does not include removal of the current spoil heap which is encroaching on the site from the quarry; there is an agreement from the quarry operators that this will be removed by them

local community by increasing the risk of traffic incidents, noise and air pollution (dust and fumes) associated with vehicle use and the movement of loose materials. Asphalt and concrete batching plants will be required for WWTP construction and finishing road surfaces. A new borrow site in Kampong Chhnang is required to production of construction fill. The impact screening is:

- **Potential Impact Significance:** High - drainage will be implemented in dense urban area with many potential sensitive receptors (Pursat drainage area)
- **Residual Impact Significance:** Medium –impacts can be lowered through good practice. Disturbance (dust, noise and traffic) can be controlled but not avoided.

175. **Mitigation Measures.** The mitigation measures in the EMP include sensitive location of any batching facilities; water sprays to dampen fugitive dust; covering loose materials during transport; locating stockpiles away from water sources; speed limits on unmade roads e.g. from borrow site; signage on national roads where heavy vehicles are turning; Construction traffic movements can be scheduled to avoid congested and/or sensitive periods and the borrow site can be sign posted, fenced or contoured to ensure unauthorised/accidental access to any steep sided pits

6.4.3. Use of Machinery & Equipment. Subprojects: All.

176. **Potential Impacts.** Static or mobile machinery and equipment will cause noise and air quality impacts on local residents and business owners, particularly in densely populated urban areas. This will contribute to the cumulative impacts of existing traffic noise and local air pollution from vehicles particularly in Pursat centre. Also the low quality housing along the canal will be particularly affected by noise and dust as their housing afford little protection.

177. The use of equipment may impact on water or soil quality if the machinery is not kept in good order, or is repaired in the wrong location e.g. near a sensitive receptor. Also there are inherent occupational health and safety risks to when using construction equipment. The impact screening is:

- **Potential Impact Significance:** High – potential sensitive receptors, cumulative noise and air pollution impacts in Pursat urban core.
- **Residual Impact Significance:** Medium – noise impacts can be lowered through good practice but cannot be avoided but are short term; pollution and health and safety impacts can be avoided.

178. **Mitigation Measures.** The measures will focus on good vehicle maintenance; restriction of working hours from 8am-6pm; clear and advanced communication with the community including GRM information; use of mobile noise barriers around machinery; use of PPE for noise protection by construction staff; preventing vehicle maintenance/washing close to water course.

6.4.4. Trench excavations. Subproject: Pursat drainage and sewage network.

179. **Potential Impacts.** Impacts from trench excavation in urban areas and along public roads include increased noise and traffic generated by construction vehicles as well as road closures or restrictions. The excavation itself (dust) and traffic (emissions) will impact on localised air quality. The most significant impact will be on poorly managed trenches in terms of community health and safety, for example if trenches are not well signposted and lit. In particular the low quality housing adjacent to the canal are on a track in which a 1m diameter pipe will be installed. The impact screening is:

- **Potential Impact Significance:** High – drainage will be implemented in dense urban area with many potential sensitive receptors including market stall holders close to excavation sites.
- **Residual Impact Significance:** Medium – impacts can be lowered through good practice but traffic / road network disturbance and dust/noise cannot be fully avoided.

180. **Mitigation measures.** The measures required are covered by those specified for earthworks, traffic management, use of machinery and community health and safety.

6.4.5. Earthworks. Subproject: All

181. **Potential Impacts.** Earthworks includes excavations, the formation of the landfill sites including slopes and embankments, and cut and fill operations. These activities can impact on air quality from fugitive dust generation, water quality if drainage is not controlled either from water used on site or particularly from rain water and there is potential to discover chance finds and articles of cultural heritage importance.

- **Potential Impact Significance: High** – potential sensitive receptors, impacts from dust and noise may be intense in Pursat urban core and will contribute to cumulative impacts from general traffic. Impacts on water quality from construction drainage is low given the location of surface water and the receptor sensitivity, e.g. existing sewage/waste polluted canal adjacent to Pursat WWTP; no natural streams are within the area of influence for the landfill sites.
- **Residual Impact Significance: Medium** – impacts can be lowered through good practice but traffic / road network disturbance cannot be avoided and will impact on people. Drainage impacts can be controlled

182. **Mitigation measures.** The measures required relate to the provision of short term drainage on construction sites; the use of water sprays on earthworks to control dust; and the cessation of works if a chance find occurs until the find is investigated.

6.4.6. Storage and Use of chemicals and fuels. Subprojects: All

183. **Potential Impacts.** Chemicals are required for the operation and maintenance of vehicles and equipment, e.g. degreasers, oils and fuels. Land can be contaminated by poorly stored and used chemicals and fuels and water can be contaminated, depending on the location of activities involving the chemicals. Therefore standard good practice is required. The impact screening is:

- **Potential Impact Significance:** Medium – potential short term impacts on land spillages; sensitive water receptors are not present and the magnitude of any spillage is anticipated to be limited.
- **Residual Impact Significance:** Low – impacts can be avoided through good practice.

184. **Mitigation Measures.** The construction sites will require a designated appropriate refuelling area >200m from watercourses and waterbodies; use of drip trays; storage in bunded and impermeable surfaces; clear labelling of containers; and spill control planning.

6.4.7. Spoil, Solid Waste and Liquid Waste Management. Subprojects: All

185. **Potential Impacts.** Spoil will be generated during excavation for drainage works and solid waste will be generated during all subproject construction activities. Inappropriate spoil and waste disposal can impact on receptors including land quality, agricultural production

and surface waters. Receptors maybe highly sensitive, such as water bodies if spoil or waste is allowed to creep into water, and the impacts can be long term. Wastes may be hazardous including used oils and chemical drums. Also the production of waste means an inherent use of resources. **Error! Unknown switch argument.** gives potential volumes of soil for each subproject which will have significant spoil production.

Table 18: Potential Spoil Volumes

Subprojects	Excavated Soil
Kampong Chhnang	
1. Controlled landfill	
Cut/excavated	66,650.00 m ²
Used as cover material	
Used as compacted backfill	79,845.50 m ³
Pursat	
1. Control landfill	
Cut/excavated	3,394.00 m ³
Used as cover material	
Used as compacted backfill and Access road	79,845.50 m ³

Obtained from the DD Engineers.

- **Potential Impact Significance: High** – sensitive receptors and hazardous wastes.
- **Residual Impact Significance: Low** – simply mitigated but resource use cannot be avoided

186. **Mitigation Measures.** With adequate waste disposal approaches, including prevention of waste from being generated through recycling and reuse of spoil, waste generation should not have significant impacts on environmental receptors. Contaminated and uncontaminated spoil will require disposal criteria and disposal locations approved if it is not reused.

6.4.8. Community Health and Safety (H&S) and Urban Access. Subproject: Pursat Drainage and WWTP

187. **Potential Impact.** During excavations, movement of construction vehicles, and general construction, the local community can be affected by H&S risks and access to their businesses, particularly given the urban nature of the work. The community health and safety impacts for the landfills focus on vehicle movements which are covered elsewhere in the EMP (Vehicle and machinery use). The impact screening is:

- **Potential Impact Significance:** Medium – potential sensitive receptors, low likelihood of serious incident
- **Residual Impact Significance:** Low –impacts can be avoided through good practice

188. **Mitigation Measures.** Recommended mitigation measures include fencing or protective barriers, lighting and buffer zones around construction sites where needed on access roads and populated locations. Clear signage and speed controls are required for traffic. For urban excavations safe access will be maintained for pedestrians and vehicles to schools, markets, houses, pagodas and commercial establishments.

6.4.9. Occupational H&S and Emergency Response. Subproject: All

189. **Potential Impacts.** Occupational H&S risks are particularly a concern in construction sites where excavations, heavy machinery and equipment is used. The depth of sewer/drainage excavations may require the need for additional trench supports to stop

trench collapse but this will be decided on by a case by case basis, depending on the material²⁰.

- **Potential Impact Significance:** High - the receptors (construction workers) are considered sensitive and the magnitude of an impact will be high, should life changing injury or a fatality occur
- **Residual Impact Significance:** Low –accident risks can be reduced through good practice

190. **Mitigation Measures.** The measures will include a combination of good training including induction and tool box talks by a trained H&S officer; warning signs for construction workers; clear emergency procedures for a minimum of injury, spillage and fire. Use of Personal Protection Equipment (PPE) is required but it considered a last resort as the first step is to remove the hazard.

6.4.10. Construction Workers and Camp Management. Subproject: All

191. **Potential Impacts.** The influx of workers from outside the area may cause social problems, particularly if the workers are from overseas and unfamiliar with local customs and laws. Also the establishment of worker camps, if used in the construction phase, can cause water and soil contamination and will produce household type wastes

- **Potential Impact Significance:** Medium - risk of social impacts, and impacts on water quality if camp poorly sited.
- **Residual Impact Significance:** Low – with appropriate training and siting.

192. **Mitigation Measures.** Suitable accommodation will be provided including sanitation, first aid and drinking water; latrines not to be located near surface water or in high ground water areas; camp housekeeping includes good waste management; relevant training on local laws and health protection measures provided; and priority given to local labour force engagement.

6.4.11. Construction staging area. Subproject: All

193. **Potential Impacts.** A staging area will be required for storing machinery, stockpiles and equipment required for construction. Particularly for Pursat drainage and WWTP, this site will be located well outside the construction area; for the landfills, the contractor may set up a staging area within the landfill site areas if space allows. The main potential impact from a staging area is on soil quality from machinery and fuel storage, and the noise and traffic associated with vehicle movements. The site(s) will not be located close to surface water body.

- **Potential Impact Significance: Medium** – the staging areas will not be located close to residential receptors or water bodies, but impacts on land quality maybe medium term if management of the site is poor.
- **Residual Impact Significance: Low** –impacts can be lowered through good practice and appropriate siting of the staging area.

194. **Mitigation Measures.** The contractor will provide a map to identify the staging area and this will not be within 100m of a water course and the other mitigation measures in the

²⁰ IFC/World Bank EHS Guidance for Occupational H&S does not give guidance on shoring excavations. Other jurisdictions such as UK Health and Safety Executive recommend shoring at 1.2m but it is dependent on the likelihood of material slippage.

EMP such as fuel storage and vehicle maintenance requirements will be followed. A plan for restoration following construction will be required.

6.4.12. Restoration and rehabilitation. Subproject: All

195. **Potential Impact.** At the end of construction period, areas such as construction workers camp, staging areas, borrow sites and access roads will may contain waste, spoil and other debris. The borrow site (Kampong Chhnang) may cause a risk to livestock or human H&S if it is steep sided and will fill with rainwater. The use of public highways and proximity to private properties during excavation may cause unforeseen damage from heavy vehicles and equipment, e.g. damage to road surfaces. The project Bill of Quantities includes repairs caused by such damage and is also included in the EMP for consistency

- **Potential Impact Significance: Medium** – these sites will not be near sensitive receptors; limited vegetation clearance will be required and H&S risks may be presented by borrow site (Kampong Chhnang).
- **Residual Impact Significance: Low** – impacts can be lowered through site clear up and rehabilitation.

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

6.4.13. Utilities disruption. Subproject: Pursat drainage

197. **Potential Impact.** The drain alone has no impact on the existing utilities of telephone and electricity supply but can have impact on the existing water supply connections.

- **Potential Impact Significance: Medium** – interruptions should be short term.
- **Residual Impact Significance: Low** – impacts can be lowered through good planning.

198. **Mitigation Measures.** The contractor will ensure planning and co-ordination with the water supply service provider and early information for residents affected by any interruptions. Interruptions to significant receptors including healthcare facilities, should this be required, will require careful co-ordination actions and consultation.

6.5. Impacts and Mitigation Measures during Operation

199. During operation, direct impacts will mainly relate to landfill and WWTP site operation. Also for all subprojects, inadequate maintenance and repair will lead to ineffective operations and services.

6.5.1. Landfill nuisance within 500m. Subproject: Landfills

200. **Potential impacts.** Households close to the landfill sites will be affected by noise, dust and pests from the sites which will be significantly exacerbated if the sites are poorly managed. For example, the use of soil cover over layers of waste reduces flies associated with landfill sites.

- **Potential Impact Significance:** High – the receptors (residents) are sensitive to the impacts from the site and they will be long term throughout the operation of the landfill.
- **Residual Impact Significance:** Medium – mitigation measures will be applied to ensure the impacts are as low as possible but the proximity of a landfill site cannot be fully mitigated.

201. **Mitigation Measures.** Households within 500m of the landfill sites will be offered upgrades to their houses included glass windows, fly screens and trees screens for the garden. These will be installed during construction by the contractor. In addition, the landfills have landscaping including tree planting specified in the technical specification which will be planted by the construction contractor.

6.5.2. General Community Nuisance. Subprojects: Landfills and WWTP

202. **Potential impacts.** In addition to households within 500m, the remainder of the community will be impacted by odor and dust from the landfill. Also the WWTP may cause odor and pest nuisance if poorly managed.

- **Potential Impact Significance:** Medium – the community is sensitive to the impacts from the site but will not be living close to the site e.g. may pass by on a journey. However impacts will be long term throughout the operation of the landfill. The majority of WWTP operations are enclosed.
- **Residual Impact Significance:** Medium – mitigation measures will be applied to ensure the impacts are as low as possible but the landfill site cannot be fully mitigated.

203. **Mitigation Measures.** The landfill and WWTP operator should be contactable and provide a signboard outside the site indicating key contacts; public complaints and their resolution will be recorded. For landfill, there will be a requirement for waste loads to be covered; litter collections; tree screen; and wheel washing are included within the operations of the chosen operator.

6.5.3. Community H&S. Subprojects: Landfills

204. **Potential impacts.** Unauthorised access to the site can put people at risk of accident, particularly for landfill sites. Waste pickers are not allowed to access the sites unless they are paid staff²¹

- **Potential Impact Significance:** Medium – some likelihood of access given a culture of waste picking.
- **Residual Impact Significance:** Low – risk of access can be lowered.

205. **Mitigation Measures.** The operator should identify practical measures to prevent unauthorized access including training staff to identify and remove people if required and maintaining fences as far as they are installed during construction.

6.5.4. Controlled Landfill Operation. Subprojects: Landfills

206. **Potential impacts.** Impacts may result from: (i) air emissions / pollution from dust, odor and run-off; (ii) ground water contamination from leachate; (iii) soil contamination from

²¹ Decision by GDR. Appropriate income restoration is provided in the resettlement plans for the project, in collaboration with GDR.

leachate/litter; (iv) visual impact on the landscape; (v) pests/rodents/vermin, bird and stray animal attraction; (vi) wind-blown litter; (vii) fire; (viii) health and safety hazards and nuisance for, community along the access roads; and (ix) workers health and safety hazards.

- **Potential Impact Significance:** High –sensitive receptors and long term impacts associated with in-ground disposal of waste.
- **Residual Impact Significance:** Medium – mitigation measures will be applied to ensure the impacts are as low as possible but impacts from a landfill site cannot be fully mitigated e.g. odor and pests, and legacy impacts will remain when the site is closed.

207. **Mitigation Measures.** Measures focus on sound operation through the development of a working plan which covers the main aspects of landfill operation such as waste placement, soil cover, and compaction. Environmental protection and monitoring includes groundwater wells and testing surface water ponds and boundary odor monitoring. The project includes an extensive training investment under the Capacity Development Plan 2018-2022, which for solid waste will include training provided by PMIS experts, external experts and training outside Cambodia.

208. **Drainage and WWTP Operations and Maintenance.** Without a budget for O&M being ring-fenced and clear procedures on how O&M will be performed, the WWTP may begin to operate ineffectively and can impact on water quality, soil quality and local residents will be subject to odor issues if the drainage network is not clearly of silt with the provided equipment. The release of poorly treated wastewater will potentially be of environmental consequence because it is concentrated in one discharge point, than without a WWTP where there are many dilute discharge points. It is critical that the designed effluent standards are met and maintained. The impact screening is:

- **Potential Impact Significance:** High– highly sensitive human receptors and potentially large magnitude impacts from concentrated wastewater release
- **Residual Impact Significance:** Low –can be minimized through good practices including a budget

209. **Mitigation measures.** Measures to support sound O&M are based on the development of an O&M manual which is part of the Capacity Development Plan for the project. It will provide clear methods and procedures for all aspects of the WWTP operation; a network maintenance schedule; ring fencing appropriate budget; ensuring relevant staff attend training and disseminate knowledge to colleagues; environmental analysis program and procedures for emergency situations.

6.5.5. Occupational Health and Safety. Subproject: All

210. **Potential Impacts.** The operations of the subprojects will mean potential health and safety risks to staff, particularly for the WWTP around the use and handling of chemicals and the health risks associated with raw sewage and sewage sludge. Landfill risks include handling waste, bioaerosols, proximity to sewage sludge in the drying beds (Pursat only) and use of landfill machinery. The current practice of hand desludging the sewer/drainage network should stop with the use of jet washing machines.

211. For Pursat WWTP the facility will use dry calcium hypochlorite. This comes with additional specific health and environmental risks²². Harm to health can be caused by inhalation, eye contact, skin contact and ingestion. Harm to the environment may be caused as the concentrated substance is highly toxic to aquatic life. It should be stored in a cool well

²² Material Safety Data Sheet, Calcium Hypochlorite, Breckland Scientific revision date 23/10/18

ventilated area in a closed and labelled container. Specific training should be provided on its handling. Note similar chemicals are used in water treatment sites elsewhere in Cambodia.

- **Potential Impact Significance: High**– highly sensitive human receptors with long term occupational exposure to potential risks
- **Residual Impact Significance: Low** –can be minimized through good practices in the work place

212. **Mitigation measures.** Include the development of rigorous site specific health and safety procedures which sets out how the operators will complete a comprehensive H&S training programme; Undertake risk assessments; Use of appropriate PPE; Undertake health assessments; develop emergency procedures and provide access to first aid,

6.5.6. Unanticipated Impacts during Construction and Operation

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

7. INFORMATION DISCLOSURE, CONSULTATION AND PARTICIPATION

7.1. Introduction

214. Stakeholder consultation and participation was an essential process in project preparation. The process in engaging stakeholders and affected people involved workshops, socio-economic survey and specific safeguard consultations.

215. The consultation detailed in this IEE includes: i) engagement during project preparation; and ii) engagement during detailed design. Consultation during implementation is also specified.

7.2. Consultation during project preparation

216. Workshops, which had the active involvement of representatives from national ministries and agencies, the six provinces and six municipalities, were held to obtain stakeholders agreement/ confirmation on several aspects of project preparation, including the set of criteria for town prioritization and the selection of priority towns and subprojects. The Inception Workshop of 25 April 2013 resulted, among others, in: (i) a stakeholders' agreement to focus current investments on two towns; (ii) the incorporation of stakeholder's feedback on the set of criteria for town prioritization; and (iii) arriving at the selection of Kampong Chhnang and Pursat for the current project preparation, based on the town prioritization scoring exercise and recommendation of the executing agency. In the Interim Workshop of 24 June 2014, the stakeholders, among others: (i) confirmed the proposed subprojects for further design and feasibility; and (ii) provided their capacity development needs.

217. A Socio-Economic Survey (SES) was conducted on 19-22 July 2013 in Pursat province and 16-18 July 2013 in Kampong Chhnang province. It incorporated environmental queries recommended by the Environmental Specialists of the PPTA, such as those concerning access to and satisfaction/problems with the existing basic services, experiences with natural hazards, priority environmental issues, and perceived benefits from and adverse impacts of the Project. In Pursat, the survey covered 126 households, representing 5% of the total households in villages in which the proposed subprojects will be implemented. In Kampong Chhnang, the survey covered 94 households, representing 5% of the total households in villages in which the proposed subprojects will be implemented.

218. Environmental safeguard-specific consultations included: (i) formal discussions/ meetings with relevant government institutions; (ii) some brief informal interviews with randomly picked relevant persons during site visits; and (iii) an environmental safeguard public meeting, the details are presented in Annex 6.

219. In the environmental safeguard public meeting held on 24 October 2013 at the Peal Gnaek Pagoda, Pursat Municipality, attended by 49 persons representing the population in the subproject sites and other meeting held on 25 October 2013 at the Aranh Pagoda, Kampong Chhnang Municipality, attended by 24 persons representing the population in the subproject sites, the following were presented: (i) general overview of the subprojects; (ii) subproject benefits, positive impacts and outcomes; (iii) potential environmental impacts from the subprojects; (iv) proposed measures to mitigate them; (v) existence & implementation of environmental management plans (EMPs) that include environmental mitigation and monitoring; (vi) existence and observance of a grievance redress mechanism during project implementation; and (vii) compliance with Government and ADB environmental safeguard policies. No question, issue or concern was raised during the

public meeting.

Table 19 : Environmental Safeguard Public Meeting

Date	Consultation Venue	Consulted Group	No. of Participants			Issues raised / Discussions / Responses / Outcomes
			Total	M	F	
24 Oct 2013	Peal Gnaek Pagoda, Pursat Municipality	Representatives from Subprojects' villages	49	21	28	No question, issue, concern raised.
25 Oct 2013	Aranh Pagoda, Kampong Chhnang Municipality	Representatives from Subprojects' villages	24	17	7	No question, issue, concern raised.

220. To date, the following information have been disclosed during an environmental safeguard public meeting held on 24 October 2013 at the Peal Gnaek Pagoda, Pursat Municipality and other public meeting held on 25 October 2013 at Aranh Pagoda, Kampong Chhnang Municipality: (i) Subproject/sub-component descriptions, locations and activities; (ii) environmental benefits, positive impacts and outcomes of the subprojects; (iv) potential salient environmental impacts and mitigation measures, particularly during construction and operation; (v) environmental monitoring that is open to active community participation; (vi) general features of the proposed environmental grievance redress mechanism; and (vii) status of compliance with national and ADB safeguards requirements.

221. The IEE for the PPTA was disclosed as per ADB requirements. The updated IEE reflecting detailed engineering design will also be disclosed.

7.3. Consultation during detailed design

222. During the project design phase, consultation was undertaken by the PMIS team in collaboration with the IEIA team, in order to ensure effective use of resources and to limit the risk of 'consultation fatigue' amongst participants.

223. As required by the IEIA, public consultation with related departments during project design was conducted on 27th March, 2019 in the Pursat Provincial Department of Environment office. The participants are from six departments are as follows: municipality of Pursat, Department of Environment, Department of Women's Affairs, Department of Agriculture, Forestry and Fisheries, Water Supply Authority and PDPWT. The consultation was conducted for both Pursat sub-projects. The Results of public consultation is shown in table 21 below.

224. In Kampong Chhnang the public consultation held on 26th March, 2019 in the department of environment of Kampong Chhnang. The participants are from seven departments as follow: municipality of Kampong Chhnang, department of environment, department of women affair, department of agriculture, forestry and fisheries, department of land management, urban planning and construction, department of rural development and department of planning. The Results of public consultation is shown in **Error! Unknown switch argument..**

Table 20 : Local Government Consultation Meeting, 2019

Meeting at Kampong Chhnang Department of Environment office 26-03-2019	
	Comments / Requests / Questions / Issues

Municipality, DPWT, DOE, DAFF, DOWA, DOLMUP&C, Water supply authority	• All agree with, and support the sub-project (improve SWM collection and disposal by controlled landfill). • The landfill site should managed by department of public work and transportation • Request that the project should separate waste to make compose for profit. • Request to growth tree around the landfill site • Request to SBK [IEIA firm] to study on forest cover by using 2002 data as baseline data • Request to consider on women and children in landfill especially on hygiene and health • Request that the new landfill site should locate in these two villages (Phnom Touch village, Pongro commune; Trapeang Sbov village, Sre Thmey commune) due ot it's easy to separate the land title. • Request that the project owner should properly manage the landfill. • Project owner should consider on local infrastructure before construction. • Project owner should cooperate with licence on solid company. • Request that the project owner should consider on smell and leachate which impact to local health as well staffs and workers.
Meeting at Pursat province, Department of Public Work and Transportation office 27-03-2019	
	Comments / Requests / Questions / Issues
Municipality, DPWT, DOE, DAFF, DOWA, DOLMUP&C, Water supply authority	• All agree with, and support the two sub-projects (Drainage and swage network, Wastewater Treatment Plant (WWTP) and improved solid waste management (SWM) collection and disposal by controlled landfill. • Request that the project owner/contractor should conduct air quality sampling before construction • Request to conduct environmental impact assessment • Request that the project should separate waste to make compose due to it is a profit. • The landfill site should be managed by MPWT • Request to inform all related department to solve all issues • Request that the project owner should study land use around the landfill site to avoid future issues. • The water supply network should locate in the edge of road to avoid impact

225. **Pursat Public Consultation.** Consultation with local people for both Pursat subprojects was conducted on 22th December, 2018, by the IEIA team. Six villages participated (Peal Njek 1, Peal Njek 2, Ra, Kbal Hong, Chamkar Chek Cheung and Chamkar Chek Tboung) with 61 people attending (31 women). **Error! Unknown switch argument.** shows the consultation results. The response on behalf of the project to the consultation concerns is not specified in the IEIA report however the majority of the relevant concerns regarding construction will be adequately mitigated through implementation of a robust environmental management plan. However many of the concerns also relate to long term operational impacts such as landfill odour, leachate, vermin and soil contamination. These issues can only be mitigated through sound operations and management once the sites are operational.

Table 22 : Pursat Public Consultation Results 22-12-2018

Urban drainage and WWTP: Public consultation with local people in Sankat Prey Nji 22-12-2018	
Pursat Municipality	Comments / Requests / Questions / Issues

Peal Njek 1, Peal Njek 2, Ra, Kbal Hong, Chamkar Chek Cheung and Chamkar Chek Tboundg	• All agree with, and support the sub-project (drainage system and wwtp). • The sub-project should impact to people's house along the road • Impacted to clean water system during construction • The project could injure to workers and people around the road by heavy machine • The sub-project will reduce the flood during raining • Reduced on road destroy by flood • Help to waste water from people's house • Help to sub-protect on other diseases from water • Request to sub-project to build laterite road in ChamKhar Chek Chueng village • Request to sub-project to study and control on existing drainage before improvement and to avoid impact to people's land. • Request to sub-project to start construction in the dry season next year (2019) due to people could travel smoothly in rainy season.
Solid Waste Management: Public consultation with local people in Toul Mkak Village, Sangkat Rolea, Pursat Municipality (22nd, December 2018)	
	• People worried about leachate from waste collection truck during transport waste to landfill. • Loss of place for cow feeding ground and wood for household consumption. • Worry about flies and other insect if bad management. • Odor impact to local people around the landfill site. • Request to sub-project to follow technical standard of landfill management • Request to sub-project to select local people to work in landfill site as waste pickers or security • Request to build drainage system around the project site to avoid leachate from landfill cells. • Request to install electrical poll from Toul Mkak village to Trach village • Request to sub-project during operation to pack properly to avoid leachate and drop of waste from waste truck. • Local people will receive new access road • If the operation of landfill, follow the management tool the people will get good health. • Good environment if no waste and good management
Solid Waste Management: Public consultation with local people in Sres Strong Village, Sangkat Srey Thmey, Pursat Municipality (22nd, December 2018)	
	• Worry about the project implementation doesn't follow the standard • People worries about leachate from waste collection truck during transport waste to landfill. • Loss of place for cow feeding ground and wood for household consumption. • Worry about flies and other insect if bad management. • Odor impact to local people around the landfill site. • Worry about the itchy from leachate from landfill during rainy season

	• Request to sub-project to select local people especially waste pickers to work in landfill • Request to sub-project to construct 1800 of laterite road for this village • Request to improve canal along the waste pickers house • Request for depth well for local people • Request to manage landfill by follow the standard • Request to sub-project to select local people to work in landfill site as waste pickers or security • Request to build drainage system around the project site to avoid leachate from landfill cells. • Request to install electrical poll from Toul Mkak village to Trach village • Request to sub-project during operation to pack properly
Solid Waste Management: Public consultation with local people in Trapeang Sbov Village, Sre Thmey commune, Rolea Brea district (19 th , December 2018)	
	• Too many flies (disease contamination) • Odor affect to local people • Contamination to surface and ground water sources • Agriculture soil contamination for local people • Spread of waste if no standard collection waste trucks • Affected to people (itchy, Respiratory disease..) and animal • Request to operator to manage on waste collection • Request to operator to collect all the waste • Request to construct DBT road in village and commune • Request to select drivers who have driving licence and obey traffic law.
Solid Waste Management: Public consultation with local people in Phnom Touch Village, Pongro commune, Rolea Brea district (19 th , December 2018)	
	• Too many flies (disease contamination) • Odor affect to local people • Contaminated to surface and ground water sources • Agriculture soil contamination for local people • Spreading of waste if no standard collection waste trucks • Affected to people (itchy, Respiratory disease..) and animal • Request to operator to follow the plan • Request to project owner and local authority cooperate to manage the waste. • Request to manage waste in project area • Request to provide service to rural area

7.4. Consultation during project implementation

226. Stakeholder consultations will continue through subprojects implementation and operation. 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.

227. The EMPs set out the consultation requirements. The PIU and PMU will collaborate to undertake consultation after detailed designs are completed and will conduct consultation interviews within 4-6 weeks of construction starting and then again, every 3 months until the end of construction. This is set out in the Environmental Monitoring Plan provided in the EMP for each subproject. Consultation of affected people will be a key part of monitoring the impact of the project on people. A consultation monitoring form and corrective action form are shown in Annex 7 and 8 respectively.

8. GRIEVANCE REDRESS MECHANISM

8.1. Objective

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

229. The GRM is set out here in accordance with the approved approach established during Project Preparation, which remains valid. This is a separate grievance system to that managed by General Department of Resettlement which deals with resettlement issues only.

8.2. Proposed Approach

230. The following roles and responsibilities for the GRM is set out in **Error! Unknown switch argument..**

Table 23: GRM Roles and Responsibilities

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

8.3. Access to the Mechanism

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

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

8.4. Communication on the GRM: Project Hotline

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

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

Project Hotline

Project: Construction of [drainage and sewage network / Wastewater Treatment Plant / or landfill] in [town]

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

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

You can also contact ADB directly:

ADB, Phnom Penh Office:
[Name] and [Phone Number] and [email address]

ADB Southeast Asia Department of ADB, Manila, Philippines:
[Name] and [Phone Number] and [email address]

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

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

235. For comments, suggestions or minor issues that can be managed within the construction area, the Hotline Access Point will record the following information, and will

inform the PMU:

Table 24: Project Hotline Informal Contact with Affected People

TIMING	For Hotline Access Point Person	
Day 1	1. Date of Contact to Hotline [or verbal contact with GRM access point]	<i>Example: 25-08-19</i>
	2. Name of Person & Contact Details [If Given]	<i>K. Srey, 012 90129901</i>
	3. Construction Site / Project Activity [relevant to person]	<i>Wastewater treatment site</i>
	4. Suggestion / Comment / Complaint: [give detail]	<i>Suggestion: Contractor moves broken concrete pile away from path to improve access</i>
	5. Date PMU (Phnom Penh) Informed:	<i>26-08-19</i>
	6. Name of Person in PMU Informed:	<i>T. Pheap, PMU-ESO</i>
Day 2	7. Action Taken: [for suggestions / comments, for questions, for complaints]	<i>Site Supervisor informed. Concrete moved the next day.</i>
	For PMU: Follow Up	
Day 4	8. Follow Up with Affected Person [date of call, site visit, evidence e.g. photograph from AP or Hotline Access Point]	<i>Called K. Srey. Confirmed concrete moved and access is clear</i>
	9. Further action or resolved? [describe if the problem is solved or action needed]	<i>Resolved</i>

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

Table 25: Project Hotline Formal Contact with Affected People

TIMING	For Hotline Access Point Person	
Day 1	1. Date of Contact to Hotline [or verbal contact with GRM access point]	<i>Example 22-02-19</i>
	2. Name of Person & Contact Details [If Given]	<i>D. Than, 092 90129901</i>
	3. Construction Site / Project Activity [relevant to person]	<i>Drain excavation</i>
	4. Suggestion / Comment / Complaint: [give detail]	<i>Complaint: Contractor has cut off water supply to house</i>
	5. Date PMU (Phnom Penh) Informed:	<i>22-02-19</i>
	6. Name of Person in PMU Informed:	<i>T. Pheap, PMU-ESO</i>
Day 2	7. Action Taken: [for suggestions / comments, for questions, for complaints]	<i>Site Supervisor informed. Contractor disagrees.</i>
	For PMU: Follow Up	
Day 4	8. Follow Up with Affected Person [date of call, site visit, evidence e.g. photograph from AP or Hotline Access Point]	<i>Called D. Than. Confirmed water supply not restored</i>
	9. Further action or resolved? [describe if the problem is solved or action needed]	<i>Not resolved Contractor disagrees. Water supply was never connected.</i>
	For PMU if Complaint Not Resolved:	

Day 5	10. Complaint Screening: [explain why it is valid/not valid]	<i>Valid complaint. All houses in the road have a water supply.</i>
	11. Date Person informed of Screening [tell affected person if PMU considers the complaint valid]	<i>26-02-19</i>
Day 6-7	12. Investigation & Agreement [discuss on site with PMU, PIU, Contractor and others as required. Identify a solution]	<i>Meeting on site. Contractor will replace the PVC water pipe. Agreed on 28-02-19</i>
	13. Date for implementing resolution [to be completed within 15 days of initial complaint]	<i>30-02-19</i>
Day 16	14. Implementation Follow Up [Contact PIU/Contractor/Site Supervisor and get evidence from site e.g. photographs of completed works]	<i>PIU photos via Telegram of completed pipe work. Discussed with contractor by phone</i>
Day 20	15. Solution Satisfaction Follow Up [Contact Affected Person, obtain signed letter of satisfaction that complaint resolved]	<i>Call to D. Than. Water supply restored. Letter is signed. PIU sent copy via Telegram</i>

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

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

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

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

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

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

- **Complaint Screening.** Screening to check the complaint is valid i.e. is as a result of the project activities. Affected Person is immediately informed of the screening results. If the complaint/issue is screened as non-Project-related and/or invalid, the affected person will be advised that he/she can raise his/her complaint to the second stage of the complaint process; and the PMU-ESO will formally forward the complaint to the District Office
- **Investigation & Agreement.** PIU, Contractor and affected person will discuss the complaint at the site within 2 days of screening. Agreement on actions and measures and a date for implementation of resolution will be agreed. Agreement will be documented using **Error! Unknown switch argument.** and filed by PMU-ESO; PIU, AP, Contractor/Operator will have copies.

- **Implementation Follow Up.** PMU-ESO will follow up to check the implementation of the resolution. The PMU-ESO will obtain evidence on implementation through, site visit and /or photographs and will contact the contractor, PIU and Site Supervisor.
- **Solution Satisfaction Follow Up.** Four days after implementation of the solution the PMU-ESO will contact the affected person to confirm that the solution is working. PIU will secure a written confirmation of satisfaction from the affected person and will forward this to the PMU-ESO.

8.6. Managing Unresolved Complaints

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

243. **Provincial Level Appeal.** If the affected person remains dissatisfied (or, in the event the issue/impact persists despite actions undertaken), AP can appeal for assistance from the district in the elevation of his/her complaint to the provincial authority. The provincial authority shall call all parties concerned to review the history of the grievance and resolution process taken and assess the validity of the appeal.

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

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

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

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

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

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

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

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

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

9. ENVIRONMENTAL MANAGEMENT PLAN

250. A detailed EMP is provided for each subproject. The EMPs aim 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.

251. 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 EA will establish a Project Steering Committee (PSC) and Project Management Unit (PMU) based in Phnom Penh, responsible for general project implementation. The Implementing Agency is the Provincial Department of Public Works and Transport (PDPWT) in each sub-project city. The PDPWT will establish a Project Implementation Unit (PIU) in each province, comprising relevant provincial government representatives including the Provincial Department of the Environment.

252. A summary of the key functions for project implementation and therefore environmental safeguards is presented in **Error! Unknown switch argument..**

Table 26: Key Roles for Project Implementation

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

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

253. The EMP for each subproject is in a separate document.

10. CONCLUSION AND RECOMMENDATIONS

10.1. Conclusions

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

255. The most significant impacts from the project will arise from landfill operations and WWTP operations. As a result, there is a comprehensive training and capacity building component to the project which is essential for ensuring the investment is financially and environmentally sustainable and beneficial. However for the benefits of two new landfills to be fully realised, the waste collection service needs to be significantly improved and extended beyond its current limited scope.

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

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

10.2. Recommendations

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

Annex 1. Environmental Quality Standards Applied in the IEE

(1) Ambient Air Quality Standards

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

Parameter	Averaging Period	Standard	
		Unit	Value
Nitrogen Dioxide (NO ₂)	24 hours	mg /m ³	0.1
Sulfur Dioxide (SO ₂)	24 hours	mg /m ³	0.3
Carbon Monoxide (CO)	8 hours	mg /m ³	20
Ozone (O ₃)	1 hours	mg /m ³	0.2
Lead (Pb)	24 hours	mg /m ³	0.005
TSP	24 hours	mg /m ³	0.33
PM 2.5 (use WHO value in Cambodia)	24 hours	mg /m ³	0.025
PM 10 (use WHO value in Cambodia)	24 hours	mg /m ³	0.05

(2) Ambient Noise Standards

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

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

(3) Surface Water Quality Standard

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

Annex 2 of Sub-decree on Water Pollution Control

Effluent standard for pollution sources discharging 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	BOD ₅ (5 days at 200 C)	mg/l	< 30	< 80
4	COD	mg/l	< 50	< 100
5	Total Suspended Solids	mg/l	< 50	< 80
6	Total Dissolved Solids	mg/l	< 1000	< 2000
7	Grease and Oil	mg/l	< 5.0	< 15
8	Detergents	mg/l	< 5.0	< 15
9	Phenols	mg/l	< 0.1	< 1.2
10	Nitrate (NO ₃)	mg/l	< 10	< 20
11	Chlorine (free)	mg/l	< 1.0	< 2.0
12	Chloride (ion)	mg/l	< 500	< 700
13	Sulphate (as SO ₄)	mg/l	< 300	< 500

14	Sulphide (as Sulphur)	mg/l	< 0.2	< 1.0
15	Phosphate (PO ₄)	mg/l	< 3.0	< 6.0
16	Cyanide (CN)	mg/l	< 0.2	< 1.5
17	Barium (Ba)	mg/l	< 4.0	< 7.0
18	Arsenic (As)	mg/l	< 0.10	< 1.0
19	Tin (Sn)	mg/l	< 2.0	< 8.0
20	Iron (Fe)	mg/l	< 1.0	< 20
21	Boron (B)	mg/l	< 1.0	< 5.0
22	Manganese (Mn)	mg/l	< 1.0	< 5.0
23	Cadmium (Cd)	mg/l	< 0.1	< 0.5
24	Chromium (Cr)+3	mg/l	< 0.2	< 1.0
25	Chromium (Cr)+6	mg/l	< 0.05	< 0.5
26	Copper (Cu)	mg/l	< 0.2	< 1.0
27	Lead (Pb)	mg/l	< 0.1	< 1.0
28	Mercury (Hg)	mg/l	< 0.002	< 0.05
29	Nickel (Ni)	mg/l	< 0.2	< 1.0
30	Selenium (Se)	mg/l	< 0.05	< 0.5
31	Silver (Ag)	mg/l	< 0.1	< 0.5
32	Zinc (Zn)	mg/l	< 1.0	< 3.0
33	Molybdenum (Mo)	mg/l	< 0.1	< 1.0
34	Ammonia (NH ₃)	mg/l	< 5.0	< 7.0
35	DO	mg/l	>2.0	>1.0
36	Polychlorinated Byphehyl	mg/l	<0.003	<0.003
37	Calcium	mg/l	<150	<200
38	Magnesium	mg/l	<150	<200
39	Carbon tetrachloride	mg/l	<3	<3
40	Hexachloro benzene	mg/l	<2	<2
41	DTT	mg/l	<1.3	<1.3
42	Endrin	mg/l	<0.01	<0.01
43	Dieldrin	mg/l	<0.01	<0.01
44	Aldrin	mg/l	<0.01	<0.01
45	Isodrin	mg/l	<0.01	<0.01
46	Perchloro ethylene	mg/l	<2.5	<2.5
47	Hexachloro butadiene	mg/l	<3	<3
48	Chloroform	mg/l	<1	<1
49	1,2 Dichloro ethylene	mg/l	<2.5	<2.5
50	Trichloro ethylene	mg/l	<1	<1
51	Trichloro benzene	mg/l	<2	<2
52	Hexachloro cyclohexene	mg/l	<2	<2

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

Annex 4 of Sub-decree on Water Pollution Control

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

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

River:		
Parameter	Standard	
	Unit	Value
pH	mg/l	6.5 – 8.5
BOD ₅	mg/l	1 – 10
Suspended Solid	mg/l	25 – 100
Dissolved Oxygen	mg/l	2.0 - 7.5
Coliform	MPN/100ml	< 5000
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:

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

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

(6) Groundwater Quality Standard (for drinking) from Ministry of Handicrafts and Industry
Note National law based on WHO (2003) Standards

No 1	Parameter	Standard	
		Unit	Value
2	pH	-	6.5-8.5
3	Turbidity	NTU	5.0
4	Chloride (Cl-)	mg/l	250
5	Sulphate (SO ₄)	mg/l	250
6	Aluminum (Al)	mg/l	0.2
7	Copper (Cu)	mg/l	1.0
8	Iron (Fe)	mg/l	0.3
9	Manganese (Mn)	mg/l	0.1
10	Zinc (Zn)	mg/l	3.0
11	Total Coli form	MPN/100ml	0
12	Mercury (Hg)	mg/l	0.001
13	Lead (Pb)	mg/l	0.01
14	Arsenic (As)	mg/l	0.05
15	Nitrate (NO ₃)	mg/l	50
16	Nitrite (NO ₂)	mg/l	3

(7) Effluent Quality Standard

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

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

No	Parameter	Standard (Allowable limits for pollutant substance discharging) to		
		Unit	Value (Protected public water area)	Value (Public water area and sewer)
1	Temperature	0C	< 45	< 45
2	pH		6 – 9	5 - 9
3	BOD5 (5 days at 200 C)	mg/l	< 30	< 80
4	COD	mg/l	< 50	< 100
5	Total Suspended Solids	mg/l	< 50	< 80
6	Total Dissolved Solids	mg/l	< 1000	< 2000
7	Grease and Oil	mg/l	< 5.0	< 15
8	Detergents	mg/l	< 5.0	< 15
9	Phenols	mg/l	< 0.1	< 1.2
10	Nitrate (NO3)	mg/l	< 10	< 20
11	Chlorine (free)	mg/l	< 1.0	< 2.0
12	Chloride (ion)	mg/l	< 500	< 700
13	Sulphate (as SO4)	mg/l	< 300	< 500
14	Sulphide (as Sulphur)	mg/l	< 0.2	< 1.0
15	Phosphate (PO4)	mg/l	< 3.0	< 6.0
16	Cyanide (CN)	mg/l	< 0.2	< 1.5
17	Barium (Ba)	mg/l	< 4.0	< 7.0
18	Arsenic (As)	mg/l	< 0.10	< 1.0
19	Tin (Sn)	mg/l	< 2.0	< 8.0
20	Iron (Fe)	mg/l	< 1.0	< 20
21	Boron (B)	mg/l	< 1.0	< 5.0
22	Manganese (Mn)	mg/l	< 1.0	< 5.0
23	Cadmium (Cd)	mg/l	< 0.1	< 0.5
24	Chromium (Cr)+3	mg/l	< 0.2	< 1.0
25	Chromium (Cr)+6	mg/l	< 0.05	< 0.5
26	Copper (Cu)	mg/l	< 0.2	< 1.0
27	Lead (Pb)	mg/l	< 0.1	< 1.0
28	Mercury (Hg)	mg/l	< 0.002	< 0.05
29	Nickel (Ni)	mg/l	< 0.2	< 1.0
30	Selenium (Se)	mg/l	< 0.05	< 0.5
31	Silver (Ag)	mg/l	< 0.1	< 0.5
32	Zinc (Zn)	mg/l	< 1.0	< 3.0
33	Molybdenum (Mo)	mg/l	< 0.1	< 1.0
34	Ammonia (NH3)	mg/l	< 5.0	< 7.0
35	DO	mg/l	>2.0	>1.0
36	Polychlorinated Biphenyl	mg/l	<0.003	<0.003
37	Calcium	mg/l	<150	<200
38	Magnesium	mg/l	<150	<200
39	Carbon tetrachloride	mg/l	<3	<3
40	Hexachloro benzene	mg/l	<2	<2
41	DTT	mg/l	<1.3	<1.3
42	Endrin	mg/l	<0.01	<0.01
43	Dieldrin	mg/l	<0.01	<0.01
44	Aldrin	mg/l	<0.01	<0.01
45	Isodrin	mg/l	<0.01	<0.01
46	Perchloro ethylene	mg/l	<2.5	<2.5
47	Hexachloro butadiene	mg/l	<3	<3

48	Chloroform	mg/l	<1	<1
49	1,2 Dichloro ethylene	mg/l	<2.5	<2.5
50	Trichloro ethylene	mg/l	<1	<1
51	Trichloro benzene	mg/l	<2	<2
52	Hexaxhloro cyclohexene	mg/l	<2	<2

Annex 2: Photographs of subproject

1. Pursat Solid waste and service	
	
Pursat Existing dump site in Pursat town	
	
Waste collection truck in Pursat town	
	
Exiting road to new proposed landfill	

2. Pursat Drainage and WWTP	
	
Existing canal near WWTP (receiving water body for effluent)	Existing WWTP of Pursat
3. Kampong Chhnang Solid waste	
	
Kampong Chhnang Waste collection truck	
	
Existing dump site at Kampong Chhnang province	

Annex 3: Borehole Log Samples

Bore hole log BH-24 for Kampong Chhnang landfill

BORE HOLE LOG BH-24

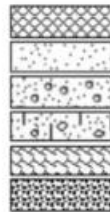
Contractor : Partner of Construction and Development Services Inc.		Method: Rotary Hollow Stem Auger		Project : Integrated Urban Environmental Management in the Tonle Sap basin	
Client : Korea Engineering Consultants Corp		Casing Size : 100 mm		Location : Kampong Chhnang Town (Landfill)	
		Northing : 1352486		Start Date : 08/08/2017	
		Easting : 457607		Finish Date : 08/08/2017	

Sampling Depth, m		Type of Sampling		Strata, (m)	Legend	Description of soil	SPT - N Value Blow/300mm				Depth of water inflow: m Depth of water Level: 0.8m	
From -	To	U	SPT				N0=150mm	N1=300mm	N2=450mm	N=N1-N2		
	0.00											
D1: 0.00 -	0.50		SPT	1.00		Very dense yellow, gray Clayey coarse Sand with gravel	>50	>50	>50	100		
D2: 0.50 -	1.50		SPT	1.00		Weathering Rock, Weak Rock	>50	>50	>50	100		
END OF SPT TEST 1.50m												

Consistency	Very soft	Soft	Firm	Stiff	Very Stiff	Hard
Clay, Blows/300mm	Less 2	2 - 4	4 - 8	8 - 15	15 - 30	> 30
Relative Density of Sand, Blows/300mm	Very Loose		Loose	Med. Dense	Dense	Very Dense
Fine	1 - 2		3 - 6	7 - 15	16 - 30	?
Medium	2 - 3		4 - 7	8 - 20	21 - 40	> 40
Coarse	4		4 - 10	10 - 30	30 - 50	50
Unit weight of granular soil base, γ_{sat} kN/m ³	11 - 16		14 - 18	17 - 20	17 - 22	20 - 23

LEGEND

Silty Sand, Sandy Silt
 Stiff to hard Sandy Clay, lean Clay
 Firm to stiff Silty Clay
 Stiff to hard Clay, fat Clay
 Clayey Sand
 V. Soft to soft Clay, organic Clay



Fill soil, Top soil
 Fine to medium sand
 Gravely Sand, Clean Sand
 Silty Sand with gravel
 Weather Rock
 Sand Stone

SPT: Standard
 Penetration Test
 U: Undisturbed
 Sample
 SPT
 SPT - N Value

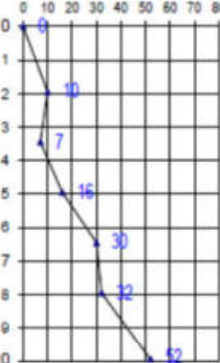
Bore hole log BH-01 for Pursat drainage

BORE HOLE LOG BH-1

Contractor : Partner of Construction and Development Services Inc.		Method: Rotary Hollow Stem Auger		Project : Integrated Urban Environmental Management in the Tonle Sap basin	
Client : Korea Engineering Consultants Corp		Casing Size : 180 mm		Location : Pursat Town (Drainage)	
		Northing : 1387854		Start Date : 19/08/2017	
		Easting : 381646 Elevation: 13.738m		Finish Date : 19/08/2017	

Sampling Depth, m		Type of Sampling		Strata, (m)	Legend	Description of soil	▲ SPT - N Value Blow/300mm				Depth of water inflow: m Depth of water Level: non		
From -	To	U	SPT				N0=150mm	N1=300mm	N2=450mm	N=N1+N2	▲ SPT , N (Blow/300mm)		
	0.00									0			
D1: 1.50 -	1.95		SPT	3.00		Firm to stiff brown light-gray, sandy lean CLAY (CL)	4	4	6	10			
D2: 3.00 -	3.45		SPT				2	2	5	7			
D3: 4.50 -	4.95		SPT	1.50		Medium dense light-gray, silty fine SAND (SM)	5	7	9	16			
D4: 6.00 -	6.45		SPT	5.00		Hard gray brown yellow, sandy lean CLAY (CL)	8	12	18	30			
D5: 7.50 -	7.95		SPT					8	14	18	32		
D6: 9.50 -	9.95		SPT					11	21	31	52		

END OF SPT TEST 10.00m



Summary of Laboratory Test BH-01																						
Sample	Depth(m)		SPT - N Value, Every 150cm Blows / 300mm				Soil description	Unified Classification	NMC W (%)	Bulk density γ_w (g/cm ³)	Dry density γ_d (g/cm ³)	Atterberg limit			Grain size			Consolidation			Shear Strength	
												LL (%)	PI (%)	PI (%)	Clay and silt %	Sand %	Gravel %	M _v (m ³ /t/kN)	C _v (m ³ /t/s)	K _u (M _v -C _v) ^{0.01} (m/s)		
	From	To	N1	N2	N3	N _{avg} (N2+N)															Unconfined Com. Strength q_u (kg/cm ²)	Cohesion Kpa
D1	1.50	1.95	4	4	6	10	Firm to stiff brown light-gray, sandy lean CLAY	CL	13.23	-	-	26.35	15.92	10.43	60.88	39.12	0.00	-	-	-	-	-
D2	3.00	3.45	2	2	5	7			26.65	-	-	48.25	20.70	27.55	77.07	22.93	0.00	-	-	-	-	-
D3	4.50	4.95	5	7	9	16	Medium dense light-gray, silty fine SAND	SM	10.61	-	-	-	-	NP	47.22	52.53	0.25	-	-	-	-	-
D4	6.00	6.45	8	12	18	30	Hard gray brown yellow, sandy lean CLAY	CL	14.84	-	-	32.65	17.19	15.46	71.63	28.22	0.15	-	-	-	-	-
D5	7.50	7.95	8	14	18	32			16.34	-	-	37.25	18.10	19.15	77.34	22.32	0.34	-	-	-	-	-
D6	9.50	9.95	11	21	31	52			13.90	-	-	31.60	16.65	14.95	72.50	27.50	0.00	-	-	-	-	-

Bore hole log BH-01 for Pursat landfill

BORE HOLE LOG BH-15

Contractor : Partner of Construction and Development Services Inc.		Method: Rotary Hollow Stem Auger		Project : Integrated Urban Environmental Management in the Tonle Sap basin	
Client : Korea Engineering Consultants Corp		Casing Size : 180 mm		Location : Pursat Town (Landfill)	
		Northing : 1383754		Start Date : 14/09/2017	
		Easting : 388777 Elevation: 18.42m		Finish Date : 14/09/2017	

Sampling Depth, m	From - To	Type of Sampling		Strata, (m)	Legend	Description of soil	SPT - N Value Blow/300mm				Depth of water inflow: non Depth of water Level: non
		U	SPT				N0=150mm	N1=300mm	N2=450mm	N=N1-42	
	0.00									0	
D1: 1.50 -	1.95		SPT	1.50		Very stiff yellowish gray, sandy lean CLAY (CL)	6	7	9	16	
D2: 3.00 -	3.45		SPT	1.50		Medium dense light gray, silty fine SAND (SM)	4	5	10	15	
D3: 4.50 -	4.95		SPT	1.50		Very stiff light gray, sandy lean CLAY (CL)	4	7	13	20	
D4: 6.00 -	6.45		SPT	1.50		Stiff light gray, sandy SILT (ML)	6	8	6	14	
D5: 7.50 -	7.95		SPT	1.50		Medium dense light gray, clayey SAND with gravel (SC-GW)	5	10	11	21	
D6: 9.50 -	9.95		SPT	2.00		Stiff yellow gray, sandy lean CLAY (CL)	4	5	7	12	
END OF SPT TEST 10.00m											

Summary of Laboratory Test BH-15																							
Sample	Depth(m)		SPT - N Value, Every 150Cm Blows / 300mm				Soil description	Unified Classification	NMC W (%)	Bulk density γ_s (g/cm ³)	Dry density γ_d (g/cm ³)	Atterberg limit			Grain size		Consolidation			Unconfined Com. Strength q_u (kg/cm ²)	Shear Strength		
	From	To	N1	N2	N3	N= N2+N3						LL (%)	PL (%)	PI (%)	Clay and Silt %	Sand %	Gravel %	M _v (m ³ /MN)	C _v (m ² /s)		K _h M _v *C _v *10.01 m/s	Cohesion c_u (kg/cm ²)	Friction Angle Degree (°)
D1	1.50	1.95	6	7	9	16	Very stiff yellowish gray, sandy lean CLAY	CL	9.54	-	-	20.05	11.95	8.10	69.03	30.97	0.00	-	-	-	-	-	-
D2	3.00	3.45	4	5	10	15	Medium dense light gray, silty fine SAND	SM	19.42	-	-	-	-	NP	24.37	75.54	0.09	-	-	-	-	-	-
D3	4.50	4.95	4	7	13	20	Very stiff light gray, sandy lean CLAY	CL	20.35	-	-	27.35	14.62	12.73	53.20	46.80	0.00	-	-	-	-	-	-
D4	6.00	6.45	6	8	6	14	Stiff light gray, sandy SILT	ML	11.72	-	-	-	-	NP	50.93	49.07	0.00	-	-	-	-	-	-
D5	7.50	7.95	5	10	11	21	Medium dense light gray, clayey SAND with gravel	SC-GW	14.29	-	-	41.00	18.73	22.27	36.41	62.49	1.10	-	-	-	-	-	-
D6	9.50	9.95	4	5	7	12	Stiff yellow gray, sandy lean CLAY	CL	15.87	-	-	25.15	13.94	11.21	59.81	40.19	0.00	-	-	-	-	-	-

Annex 4: Flora and Fauna Species in Subproject Areas

Fish species in Kampong Chhnang and Pursat town

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

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

Locally observed bird species, Kampong Chhnang and Pursat town Residents

No	Khmer Name	English Name	Scientific Name	IUCN Status
1	Antep Khmao*	Black Drongo	<i>Dicrurus macroercus</i>	LC
2	Antep Tongkonrai*	Great Racket-tailed Drongo	<i>Dicrurus paradiseus</i>	LC
3	Brocheav	Bat	<i>Chiroptera</i>	LC
4	Chab krouch	Yellow-vented Bulbul	<i>Pycnonotus blanfordi</i>	LC

No	Khmer Name	English Name	Scientific Name	IUCN Status
5	Chab Tet	Common Tailorbird	<i>Orthotomus sutorius</i>	LC
6	Chreng	Flying Fox	<i>Pteropus</i>	LC
7	Chungkong Kras Champus Khmao*	Great Thick-knee	<i>Esacus recurvirostris</i>	NT
8	Chab Dounta Tnoat*	Brown Shrike	<i>Lanius cristatus</i>	LC
9	Chab Pouk Troung Loeung*	Asian Golden Weaver	<i>Ploceus hypoxanthus</i>	NT
10	Chor Lor Cheung Pou Hout*	Nordmann's Greenshank	<i>Tringa guttifer</i>	EN
11	Dom Dou	Black-tailed crane	<i>Amaurornis bicolor</i>	LC
12	Ka-ek	Large-billed Crow	<i>Corvus macrorhynchos</i>	LC
13	Khloem	Water cock	<i>Gallicrex cinerea</i>	LC
14	Khvek	Snipe	<i>Gallinago gallinago</i>	LC
15	Kleng Srak	Barn Owl	<i>Tyto alba</i>	LC
16	Kok	Great White Egret	<i>Egretta alba</i>	LC
17	Kok Sacmut*	Pacific Reef Egret	<i>Egretta cinerea</i>	LC
18	Kok Kroung Thom*	Great Egret	<i>Casmerodius albus</i>	LC
19	Kok Kroung Touch*	Little Egret	<i>Egretta garzetta</i>	LC
20	Kor Dob Kbal Khmao*	Black-capped Kingfisher	<i>Halcyon pileata</i>	LC
21	Kreal	Sarus Crane	<i>Grus antigone</i>	LC
22	Kro Sapropes	Grey Heron	<i>Ardea cinerea</i>	LC
23	Kro Champosthom* Sa	Great-billed Heron	<i>Ardea sumatrana</i>	LC
24	Kroling Kroloung	Black-collared Starling	<i>Sturnus nigricollis</i>	LC
25	Kruoch Art	Barred Buttonquail	<i>Turnix suscitator</i>	LC
26	Lo Lok	Red Collared Dove	<i>Streptopelia chinensis</i>	LC
27	La-out Tom*	Greater Coucal	<i>Centropus sinensis</i>	LC
28	Mann Teuk	White-breasted Water hen	<i>Amaurornis phoenocures</i>	LC
29	Meam touchprey	Asian Barred Owlet	<i>Glaucidium cuculoides</i>	LC
30	Popich Thmar	Blue Rock Thrush	<i>Monticola solitarius</i>	LC
31	Popich Khmao	Black Bulbul	<i>Hypsipetes leucocephalus</i>	LC
32	Popich Tracheak Krahorm Sor	Red-whiskered Bulbul	<i>Pycnonotus jocosus</i>	LC
33	Popoul Teuk	Masked Finfoot	<i>Heliopais Personata</i>	EN
34	Preap Sor kmao	Pied Imperial Pigeon	<i>Ducula bicolor</i>	LC
35	Preap Prey*	Green Imperial Pigeon	<i>Ducula aenea</i>	LC
36	Pro Vek	Lesser Whistling Duck	<i>Dendrocygna Javanica</i>	LC
37	Roneal	Painted Stork	<i>Mycteria Leucocephala</i>	LC
38	Sa Rikakeo	Common Myna	<i>Acridotheres Tristis</i>	LC
39	Sa Rikakeo Krobey*	White-vented Myna	<i>Acridotheres grandis</i>	LC
40	Sek Kheav	Grey-head Parakeet	<i>Psittacula finschii</i>	LC
41	Sambok Trapeang	yellow bittorn	<i>Ixobrychus sinensis</i>	LC
42	Tea Prey	Garganey	<i>Anas querquedula</i>	LC
43	Tituy	Owl	<i>Strigiformes</i>	LC
44	Tro Cheakkam	Barn Swallow	<i>Hirundo rustica</i>	LC
45	Tung Propes	Spot-billed Pelican	<i>Pelecanus philippensis</i>	NT

Key: LC = Least Concern, NT = Near Threatened, En=Endangered, R=Rare, No Data = taxon has not yet been assessed for the IUCN Red List

Source: PMIS Team, data from TA-8556 REG: CDIA- Pre-feasibility studies for Second Tonle Sap Integrated Urban Management Project and *IEIA report 2018 (asterisked species)

List of reptile and wild animal species in Pursat and Kampong Chhnang

No.	Khmer Name	English Name	Scientific Name	IUCN Status	MAFF Staus
1	Puos Sanlab Kangkeb	Chequered Keelback	Xenochrophis piscator	-	C
2	Puos Khsekor Khnornng Veng	Common Bronzeback	Dendrelaphis pictus	-	C
3	Puos Vekdom Bouk	Indochinese Spitting Cobra	Naja siamensis	Vu	R
4	Thlen Sbek Ouch	Speckled Leaf-litter Skink	Scincella reevesii	-	C
5	Puos Vekroneam	King Cobra	Ophiophagus hannah	Vu	R
6	Puos Angkach Meas	Striped kukri Snake	Oligodon taeniatus	LC	C
7	Puos Porplek Prey	Inornate Kukri Snake	Oligodon inornatus	LC	C
8	Puos Prey	Common Ratsnake	Ptyas mucosus	-	-
9	Puos Khsekor	Striped Keelback	Amphiesma stolata	LC	C
10	Kandol Sre	Rat	Rat soo	-	-
11	Kambrok Thom	Black Giant Squirrel	Ratufa bicolor	NT	R
12	Skar Touch	Small Asium Mongoose	Herpestes javanicus	LC	C
13	Tonsay Kul	Lepus peguensis	Siamese Hare	LC	C
14	Kanghen	Menetes berdmorei	Berddmore's Squirrel	LC	C
15	Kang Hech	Tamiops maritimus	Eastern Striped Squirrel	LC	C

Key: LC = Least Concern, NT = Near Threatened, En=Endangered, R=Rare, Vu=Vulnerable MAFF status: C=

Source: IEIA team 2018

Tree species around Pursat and Kampong Chhnang landfill locations

No	Khmer name	Scientific Name	Family	IUCN Status
1	Trasek	<i>Peltophorum dasyrrhachis</i> Kurz, var	Caesalpinaceae	I
2	Chhleik	<i>Terminalia alata</i> , F. Heyne ex Roth	Combretaceae	I
3	Tbeng	<i>Dipterocarpus obtusifolius</i> , Teysm.	Dipterocarpaceae	II
4	Lngeang	<i>Cratogeomys prunifolium</i> , Dyer.	Hypericaceae	III
5	Jhin	<i>Melastoma sanguineum</i>	Melastomaceae	
6	Pdao Pres	<i>Korthalsia bejaudii</i>	Palmae	
7	Russey Prich	<i>Arundinaria pusilla</i>	Gramineae	
8	Thlong	<i>Ternstroemia penangiana</i>	Theaceae	
9	Damloung Chrouk	<i>Dioscorea oryzetorum</i>	Dioscoreaceae	
10	Vor Chuy	<i>Stephanocaulon juventas</i>	Asclepiadaceae	
11	Vor Saovmav	<i>Passiflora foetida</i>	Passifloraceae	
12	Bonlar Sa-et	<i>Acacia concinna</i>	Leguminosae	
13	Kra Sang	<i>Feroniella lucida</i>	Rutaceae	

14	Vor meas	<i>Cassytha filiformis</i>	Lauraceae	
15	Tontrean Khet	<i>Chromolaena odorata</i>	Compositae	
16	Anhchong	<i>Gmelina asiatica</i>	Verbenaceae	
17	Phlou	<i>Cyclea peltata</i>	Menispermaceae	
18	Tor Yeng	<i>Diospyros helferi</i> , C.B.Clarke	Ebenaceae	
19	Lang	<i>Dalbergia lanceolaria</i> var. <i>lakhonensis</i>	Leguminosae - Papilionoidae	
20	Pchek	<i>Shorea obtusa</i> , Woll.	Dipterocarpaceae	
21	Sukrom	<i>Xylia dolabriformis</i> , Benth.	Mimosaceae	
22	Kor Kos	<i>Sindora cochinchinensis</i> , Baill.	Caesalpiniaceae	
23	Rang Phnom	<i>Shorea siamensis</i> , Miq.	Dipterocarpaceae	
24	Smach	<i>Melaluca leucadendron</i> , L.	Mytaceae	
25	Ka Basprey	<i>Cochiospermum religiosum</i>	Cochlospermaceae	
26	Ta Lak	<i>Canarium album</i>	Burseraceae	
27	Derm Teukdos	<i>Euphorbia hirta</i>	Euphorbiaceae	
28	Thmenhtrey Tom	<i>Bridelia pedicellata</i>	Euphorbiaceae	
29	Kdang Gea	<i>Cananga odorata</i>	Annonaceae	
30	Sangkor	<i>Zizyphus oenoplia</i>	Rhamnaceae	
31	Tean Prey	<i>Vitex holpadenon</i>	Verbenaceae	
32	Preal Khsach	<i>Helicteres elliptica</i>	Sterculiaceae	
33	Derm Promatmonus	<i>Brucea javanica</i>	Simaroubaceae	
34	Vor Trey	<i>Ichnocapus frutescens</i>	Apocynaceae	
35	Bruch Svar	<i>Archidendron quocense</i>	Leguminosae - Mimosoideae	
36	Vor Thneng	<i>Aganonerion polymorphum</i>	Apocynaceae	
37	Thkov	<i>Anthocephalus chinensis</i>	Rubiaceae	
38	Tro Bekprey	<i>Dioscorea oryzetorum</i>	Dioscoreaceae	
39	Dam Ioungteuk	<i>Dioscorca pentaphylla</i>	Dioscoreaceae	
40	Krokhub Prey	<i>Scolopia spinosa</i>	Flacourtiaceae	
41	Chan Krong	<i>Lepisanthes tetraphylla</i>	Sapindaceae	
42	Lbork	<i>Dispyros ehretioides</i>	Ebenaceae	
43	Smao Kontuy Kombrok	<i>Uraria lagopodioides</i>	Leguminosae - Papilionoidae	
44	Plauv kangkeb	<i>Oldenlandia fraterna</i>	Rubiaceae	
45	Mrenh	<i>Milietia erythrocalyx</i>	Leguminosae - Papilionoidae	

Source: IEIA team, 2018

Annex 5: Supporting information from Socio-Economic Survey (2013)

Socio-Economic Survey

The PPTA's Socio-Economic Survey (SES), conducted on 19-22 July 2013, had environmental questions recommended by the Environmental Specialists incorporated into the survey questionnaire. The relevant survey inquiries are those about access to and satisfaction with the existing basic services, satisfaction level with current social and environmental conditions, and priority environmental and infrastructure issues. The SES involved 126 households, or 5% of total households in villages in which the proposed subprojects will be implemented. Of the 126 respondents, 59 (47%) were male; 67 (53%) were female.

Table 1 Surveyed Households in Pursat Town

Indicator		Number	Proportion (%)
HH size	1-3 Persons	22	17.5
	4-6 Persons	84	66.7
	7-9 Persons	16	12.7
	10 Persons & Above	4	3.2
	Total	126	100.0
Sex of HH head	Female	17	13.5
	Male	109	86.5
	Total	126	100.0
Age of HH head	>65 years old	13	10.3
	65 years old and below	113	89.7
	Total	126	100.0
Ethnicity of HH head	Khmer	126	100.0
	Vietnamese	0	0.0
	Chinese	0	0.0
	Cham	0	0.0
	Total	126	100.0
HH monthly income	Less than 65\$	6	4.8
	65\$-99\$	3	2.4
	100\$-299\$	62	49.2
	300\$-499\$	25	19.8
	500\$-699\$	16	12.7
	700\$-899\$	5	4.0
	900\$-1099\$	1	0.8
	1100\$ & More	8	6.3
	Total	126	100.0

Some relevant findings from the household survey are presented in the description of socio-economic environment. Featured in this Annex are the summary of some observed conditions of surroundings of houses of surveyed households, their top ten priority environmental issues, level of awareness among them about the proposed Project, their perceived Project benefits and adverse impacts, and their willingness to participate in public consultations.

Table 2 Observed Conditions of Surroundings of Houses of Surveyed Households

Observed Conditions	Number	Proportion (%)
Very narrow passages between houses	52	41.3
Too many power connections to neighborhood's main supply line	13	10.3
No access at all	2	1.6
Many astray animals roaming around	24	19.0
None of the above	43	34.1
Total	126	100.0

Table 3 Top Ten Priority Environmental Issues – Pursat Town

Environmental Issue	Number	Proportion (%)
Dust	82	65.1
Gas emission (burning, vehicle emission)	69	54.8
Noise	47	37.3
Polluted Rivers	41	32.5
Low level of water in rivers/drying out of rivers	7	5.6
Poor access to potable water	42	33.3
Deteriorating groundwater quality	11	8.7
Depleting groundwater level	8	6.3
Dry Spell/drought	18	14.3
Soil pollution	54	42.9
Environmental Issue	Number	Proportion (%)
Soil erosion/landslide	19	15.1
Flooding	88	69.8
Need to improve sanitation facilities	83	65.9
Inadequate solid waste management	69	54.8
Poor roads	72	57.1
Lack of roads	60	47.6
Inadequate public transportation	46	36.5
Unreliable power supply	54	42.9
Need to improve primary health care facilities	79	62.7
Secondary health care facilities too far	60	47.6
Inadequate primary education facilities	60	47.6
Need to improve educational facilities	53	42.1
Need access to adequate secondary educational facilities	37	29.4
Others	5	4.0
Total	1,164	100.0

Table 4 Awareness of, Perceived Benefits from, and Adverse Impacts of, the Project

Particulars	Number	Proportion (%)
Aware of the Project		
Aware	25	19.8
Not aware	101	80.2
Total	126	100.0
Perceived benefits from Project		
Preventing virus & diseases	38	32.5
Do not have bad smell/garbage	33	28.2
Landslide prevention	13	11.1
Flood prevention	27	23.1
Promoting the view	5	4.3
Make good social order	11	9.4
Have clean water	6	5.1
Have smooth roads	4	3.4
Good living standard	10	8.5
Helpful for the next generation	1	0.9
Preventing the bad water	2	1.7
Attract foreign visitors here	2	1.7
None	3	2.6
Don't know	0	0.0
Total	117	100.0

Perceived Project's adverse impacts	Will affect house and roads	24	19.0
	Will affect agricultural land	26	20.6
	Have floods during wet season	1	0.8
	Will pollute the environment	3	2.4
	Will affect fish habitat	6	4.8
	Will expend too much money	2	1.6
	Will make noise to people	1	0.8
	None	38	30.2
	Don't know	25	19.8
	Total	126	100.0

Table 5 Willingness to Participate in Project's Public Consultations

Willing to Participate			Not Willing to Participate		
No.	Proportion (%)	Reasons	No.	Proportion (%)	Reasons
117	92.9	Have knowledge about society To understand about the Project Have good environment Have good order to throw garbage Helpful for the next generation Share information to other people Village can be developed	9	7.1	Have health problem No one informed Busy at work/house work It far away from workshop place

Table 6 Income and expend for waste picker in Kg Chhnang landfill

No	Name of Waste Picker	Sex	Number	Type of employment /occupation	Income (\$)		Expend (\$)	
					Month	Annual	Month	Annual
1	Phun Sophath	M	1	waste Picker	200.00	2,400.00	115.00	1,380.00
2	Chea Sarin	M	1	waste Picker	150.00	1,800.00	140.50	1,686.00
3	Kem Saran	F	2	waste Picker	222.50	2,670.00	155.00	1,860.00
4	Meas Makara	M	1	waste Picker	250.00	3,000.00	210.00	2,518.50
5	Kem Sarin	M	2	waste Picker	150.00	1,800.00	133.50	1,602.00
6	Lim Thim	M	1	Gar/W. Picker	400.00	4,800.00	336.00	4,032.00
7	Heang Hoeun	M	3	Gar/W. Picker	325.00	3,900.00	186.00	2,232.00
8	Im Voeun	M	2	waste Picker	200.00	2,400.00	177.50	2,130.00
9	Dy Say	F	1	Farmer/W. Picker	120.00	1,440.00	73.50	882.00
Total			14		2,017.50	24,210.00	1,527.00	18,322.50

Source: Waste picker interview, 2018; Note: Gar=Garment worker

Table 7: Number of waste picker by age and gender

No	Name	Age Range							
		0 - 14		15 - 29		30 - 44		45 - 64	
		F	M	F	M	F	M	F	M
1	Phun Sophath				1	1			
2	Chea Sarin				1				

3	Kem Saran						2	2	
4	Meas Makara		1	1					
5	Kem Sarin		1	1					
6	Lim Thim		2		1	1			
7	Heang Hoeun		3						
8	Im Voeun	1		1			1		
9	Dy Say					1			
Total		1	7	3	3	3	3	2	0

Source: Waste picker interview

Annex 6: Notes of Consultations from Project Preparation and Design

Consultations held during project preparation:

Formal Discussions/Meetings with Relevant Government Institutions

Date	Institution	Person/s Met	Key Points
29 May 2013	Pursat PDPWT	Mr. Kang Penghak, Director Mr. King Kong, Deputy Director	The Director said that PDPWT is not involved with environmental issues. Generally, environmental issue such as SWM is under the Pursat Town & PDoE. The PDPWT deals with wastewater only. In his opinion, the main environmental concern is insufficient drainage system in the town. Willing to assist in project activities, if needed.
29 May 2013	Pursat PDoE	Mr. Thay Chantha, Director	The main environmental issues are SWM, wastewater management and lack of drainage system, and lack of proper landfill site. Proposed to have a good landfill site study..
29 May 2013	Pursat Town	Mr. Chnay Matinal, Governor Mr. Ngin Mien, Deputy Governor	Governor welcomes the Project. The environmental concerns at present are SWM & lack of proper landfill site. He expects town's environmental issues to be solved with the implementation of the Project.
23 June 2013	EIA Dept. of MoE	Mr. Danh Serei, Deputy Director	For projects comprising of subprojects, such as the IUEMTSB Project: (i) Subprojects that are mentioned in the Annex of Sub-decree No. 72 ANRK.BK, will require individual IEIA Reports; and (ii) Subprojects that are not mentioned in the Annex of Sub-decree No. 72 ANRK.BK can be covered in one IEIA Report. The IEEs prepared by the ADB PPTA Team, following ADB's SPS 2009, can be accepted as IEIA Reports.
15 Aug 2013	Pursat Town	Mr. Ngin Mien, Deputy Governor and Town staff	Closed dumpsite About 5.5 km from the town center. Commissioned in 2001, decommissioned in 2004. Disposed volume of 1 truck daily, 7 days a week. Serviced area was only the market, but HHs living near the market disposed of their SW in the market area. Site is public land, 2 ha. Now the site has decreased in size because informal settlers have come to settle on the land. Only 1 cell, about 30 m x 30 m, about 4-5 m deep. Site used to be forested but informal settlers cut down the trees in order to settle. In the vicinity, there are open dug wells for domestic uses No incidence of diseases, or fire/explosion incident. Existing dumpsite About 5 km from town center Commissioned in 2004 Disposed volume is 3 trucks daily, 7 days a week. Land is 3 ha, of which 1 ha is owned by the Municipality, & 2 ha is private land, owned by the SW collection service provider. 2 HHs working for the provider stay on site, source water from an open dug well. About 30 scavengers operating at the site. During the rainy season only few of them operate.
Date	Institution	Person/s Met	Key Points
15 Aug 2013	PDoE of Pursat	Director of PDoE	Subprojects' EA requirements: Embankment protection on Pursat River would require an EIA, since subproject will impact on the river and livelihood. Controlled landfill would require an EIA as it will be a long-term activity. Drainage would require an IEIA. People living along the Pursat River depend on the river water for food (fish) and livelihood.

			Old dumpsite was closed because people opposed to the operation and closed the road leading to the dumpsite. Not much waste dumped on the site. After meeting with the Governor of the Province, the existing site was evaluated and found to be better than the old/closed site.
17 Oct 2013	EIA Dept. of MoE	Mr. Danh Serei, Deputy Director	GoC report requirement: Proponent to undergo screening to determine the type of report to be prepared, an IEIA or EIA. On this, the agreement made in order to hasten the screening process was for a description (with sufficient details to allow proper screening) to be submitted to his office by Friday, 18 October 2013. GoC requires individual report for each subproject. On this, depending on the screening results, the EIA Dept. will recommend to the MoE, possibly: (i) for individual report for each subproject; (ii) for some subprojects may be covered together under one report; and/or (iii) determination of IEIA or EIA requirement. EIA Dept. to submit its recommendations by Wednesday, 23 Oct 2013. GoC's requirement for EIA Report: primary data for key receptors social impact assessment Pre-FS Report to be submitted in Khmer MPWT as the official project proponent Review process IEIA review, maximum 30 working days EIA review, maximum 30 working days He informed that the process would take almost a year for an EIA, including preparation, revision or additional requirements and review. On the length of the process, the EIA Dept. will cooperate to expedite the process. Mr. Serei said that he is normally consulted by donors on environmental safeguard requirement. However, seldom do these projects go through the process, as prescribed by Law. On this, he was assured that ADB requires compliance with national requirements. GoC's environmental clearance would be secured prior to loan finalization.
January 2014		ADB Mission / Loan Fact-finding Mission with MPWT and local authorities	Site inspection and visitation to all subproject sites, including dumpsites and due diligence
June 2014		ADB Mission / Loan Fact-finding Mission with MPWT and local authorities	Site inspection and visitation to all subproject sites, including dumpsites and due diligence

Some Brief Informal Random Interviews with Affected Persons/Beneficiaries

Date	Persons Interviewed		Relevant Notes
30 May 2013	Mrs. Hin Korn Spean Thmar Village , Prey Nhi Commune		- Has not heard about the Project, nor aware that some improvements will be made in the area. - Willing to participate in public consultations to get more information about the Project. 
30 May 2013	Mr. Chhneang Sitha Spean Thmar Village Prey Nhi Commune		- Has not heard about the Project, nor aware that some improvements will be made in the area. - Willing to participate in public consultations. (No photo taken.)
14 Aug 2013	Mr. Im Main (Scavenger) Srah Srang Village, Prey Nhi Commune		- Started waste picking at the existing dumpsite 5 years ago. - He and his family live in the same village as the dumpsite, but they live outside the dumpsite. - They earn \$50 per month with scavenging cardboards, cans and hard plastic. Operate from 9:00 AM till 6:00 PM with lunch break in between. - There are 30 scavengers operating at the site, including young and old. - Dump site is burning/smoking in the dry season.  

Date	Persons Interviewed	Relevant Notes
14 Aug 2013	HHs living at the existing dumpsite	▪ There are 4 families living within the existing dump site, working for the SW collection service provider. ▪ Have lived here for 7 years. ▪ Get water from an open dug well across the site (not within the site). ▪ In the dry season, they boil the water taken from this open dug well for drinking. In the rainy season they collect rain water. ▪ They suffer from skin diseases, frequently have diarrhea; when the dump is smoking, have coughs. ▪ The children go to school that is about 4-5 km from where they are living.
		▪ She belongs to the HH that is 2nd nearest to the closed dump site, specifically situated at the junction of the main road and dump site access road. Her HH has been living here for 10 years and was here when the dump site was still operating. ▪ During operation of the dump site, odor and flies were the complaints. Many people would get sick now and then. So people had demonstrations on the road demanding for the closure of the dump site. ▪ Now that the dump site is closed, no complaint has been heard from the villagers. The village environment is better. ▪ Her HH's sources of water are pond (in front of her house for washing & general cleaning) & rainwater. Rainwater or water from the dug well of nearby neighbor is for drinking (but boiled) and cooking.



Environmental Safeguard Public Meeting (2013, Project Preparation)

Public consultation Pursat
Date: September 19, 2013

Venue: Wat Peal Nhaek, Sangkat Phtah Prey, Pursat Town, Pursat Province
Community Participants: 26 Men, 61 Women
PPTA team members: Maria Lorena Cleto, Mel Sophanna, May Simorn, Sok Heng
MPWT representative: Mr. Bong Rada

Date	19 / 09 /2013
Consultation Location	Wat Pheal Nhak, Pheal Nhak Village, Sangkat Phah Prey, Pursat Town, Pursat Province.
Consulted Group	Villagers of proposed project
Consulting Group	PPTA Resettlement and Environmental Teams

No.	Name	Gender	Age	Occupation/ Institution	Address			Signature
					Village	Sangkat/ Commune	District	
1	Chhay Madinal	M		Municipal Governor				
2	Um Sovann	M	62	Village Chief	Spean Thmei	Roleap	sompovmeas	
3	Long Chantonn	F	54	Village Chief	Peal Nhack2	Phtah Prey	Sompovmeas	
4	Van Sokha	M	53	Village Chief			Sompovmeas	
5	Sun Sephal	F	56	Village Chief	Peal Nhack1	Phtah Prey	Sompovmeas	
6	Sean Sokheng	M	50	Deputy of Village Chief	Peal Nhack1	Phtah Prey	Sompovmeas	
7	Yong Saren	M	60	Deputy of Village Chief		Phtah Prey	Sompovmeas	
8	Yen Sena	F	56	Village Chief		Phtah Prey	Sompovmeas	
9	Chan Socheat	F	56	1 st Commune chief		Phtah Prey	Sompovmeas	
10	Nu Khanna	F	56	Deputy of Village Chief	Peal Nhack2	Phtah Prey	Sompovmeas	
11	Pharn Khun	M	70	People	Peal Nhack2	Phtah Prey	Sompovmeas	
12	Phrak Rai	M	54	Famer	Peal Nhack2	Phtah Prey	Sompovmeas	
13	Khav Heng	M	63	People	Peal Nhack2	Phtah Prey	Sompovmeas	
14	Kheom Sophana	M	59	Famer	SpeanTmor	Phtah Prey	Sompovmeas	

15	Phrak Sav	M	46	Police	Peal Nhack2	Phtah Prey	Sompovmeas	
16	Chhoun Seng	M	60	Seller	Peal Nhack2	Phtah Prey	Sompovmeas	
17	Khung Vy	M	50	People	Chamkar Chek Choung	Phtah Prey	Sompovmeas	
18	Tarm Somoun	M	61	People	Kbal Hong	Phtah Prey	Sompovmeas	
19	Thai Rethy	M	42	People	Peal Nhack2	Phtah Prey	Sompovmeas	
20	Seng Sarert	M	28	Guard	Phom Ra	Phtah Prey	Sompovmeas	
21	Keom Leav	M	49	People	Soreya Khrom	Phtah Prey	Sompovmeas	
22	Long choy	M	33	Famer	Thnori Japen	Phtah Prey	Sompovmeas	
23	Som Chhoung	M	48	Famer	Thnori Japen	Phtah Prey	Sompovmeas	
24	Kheom Thorn	M	33	Motor Taxi	Phom Ra	Phtah Prey	Sompovmeas	
25	Lun Dalis	M	38	Seller	Peal Nhack2	Phtah Prey	Sompovmeas	
26	En Vorn	F	70	People	Peal Nhack2	Phtah Prey	Sompovmeas	
27	Khat Chheang	F	63	Seller	Peal Nhack2	Phtah Prey	Sompovmeas	
28	Yong Toch	F	47	Seller	Peal Nhack2	Phtah Prey	Sompovmeas	
29	Bu Sokun	F	39	Seller	Peal Nhack2	Phtah Prey	Sompovmeas	
30	Derm Sein	F	74	People	Kbal Hong	Phtah Prey	Sompovmeas	
31	Rous Sreyden	F	24	People	Peal Nhack2	Phtah Prey	Sompovmeas	
32	Oung Tey	F	41	Seller	Peal Nhack2	Phtah Prey	Sompovmeas	
33	Lun Vannak	F	42	Seller	Peal Nhack2	Phtah Prey	Sompovmeas	
34	Soy Buntul	M	43	People	Chamkar Chek Choung	Phtah Prey	Sompovmeas	
35	Dy Phuy	M	80	Famer	Chamkar Chek Choung	Phtah Prey	Sompovmeas	
36	To Seong	F	66	Seller	Peal Nhack2	Phtah Prey	Sompovmeas	
37	Eng Chay	F	72	People	Chamkar Chek Choung	Phtah Prey	Sompovmeas	
38	Deom Tey	F	57	Seller	Peal Nhack2	Phtah Prey	Sompovmeas	
39	Ret Channa	F	19	Seller	Peal Nhack2	Phtah Prey	Sompovmeas	
40	Nop Pern	F	52	Seller	Chamkar Chek Thbong	Phtah Prey	Sompovmeas	
41	Ron Sreyoun	F	40	Seller	Peal Nhack2	Phtah Prey	Sompovmeas	
42	Nop Sreyon	F	34	People	Chamkar ChekThbong	Phtah Prey	Sompovmeas	
43	Kert Chot	F	50	People	Kbal Hong	Phtah Prey	Sompovmeas	
44	Eam En	F	46	People	Kbal Hong	Phtah Prey	Sompovmeas	
45	Yon Savy	F	44	People	Kbal Hong	Phtah Prey	Sompovmeas	
46	Noun Mom	F	30	People	Kbal Hong	Phtah Prey	Sompovmeas	
47	Sok Mart	F	42	People	Kbal Hong	Phtah Prey	Sompovmeas	
48	An Saret	F	55	People	Kbal Hong	Phtah Prey	Sompovmeas	
49	Ev Sokunthy	F	53	People	Peal Nhack1	Phtah Prey	Sompovmeas	
50	Khern Yon	F	57	People	Peal Nhack2	Phtah Prey	Sompovmeas	
51	Chum Na	F	53	People	Thnol ToTeong	Phtah Prey	Sompovmeas	
52	Rat Na	F	33	People	Thnol Japen	Phtah Prey	Sompovmeas	
53	Chom Breong	F	54	Seller	Peal Nhack2	Phtah Prey	Sompovmeas	
54	Put Som	F	64	Famer	Peal Nhack2	Phtah Prey	Sompovmeas	
55	Cheam Theon	M	58	Famer		Phtah Prey	Sompovmeas	
56	Phour Seno	M	47	Famer	Chamkar ChackChoung	Phtah Prey	Sompovmeas	
57	Tet Sophat	M	65	Famer	Spean Tmor	Phtah Prey	Sompovmeas	

58	Khoun Net	F	30	Famer	Peal Nhack2	Phtah Prey	Sompovmeas	
59	Yeay Pun	F	70	People	Peal Nhack2	Phtah Prey	Sompovmeas	
60	Thon Seanglim	F	40	People	Peal Nhack2	Phtah Prey	Sompovmeas	
61	Shoun Thy	F	96	People	Peal Nhack2	Phtah Prey	Sompovmeas	
62	Doung Sreymom	F	55	People	Peal Nhack2	Phtah Prey	Sompovmeas	
63	Yern Srey	F	47	People	Peal Nhack2	Phtah Prey	Sompovmeas	
64	Ket Dara	M	50	Fabrication	Peal Nhack2	Phtah Prey	Sompovmeas	
65	Orb Naiy	F	65	People	Peal Nhack2	Phtah Prey	Sompovmeas	
66	Samreot Yen	F	58	People	Peal Nhack2	Phtah Prey	Sompovmeas	
67	Nheok Mern	F	61	People	Peal Nhack2	Phtah Prey	Sompovmeas	
68	Touch Senat	F	57	Seller	Peal Nhack2	Phtah Prey	Sompovmeas	
69	Srey Mom	F	48	Seller	Peal Nhack2	Phtah Prey	Sompovmeas	
70	Cheay Mach	F	75	People	Peal Nhack2	Phtah Prey	Sompovmeas	
71	Eam Sreymom	F	27	Construction	Phom Ra	Phtah Prey	Sompovmeas	
72	Phech Han	F	76	People	Phom Ra	Phtah Prey	Sompovmeas	
73	Eam Van	F	61	People	Phom Ra	Phtah Prey	Sompovmeas	
74	Yeom Phorn	F	50	Seller	Peal Nhack2	Phtah Prey	Sompovmeas	
75	Mul Pov	F	55	Famer	Peal Nhack2	Phtah Prey	Sompovmeas	
76	Kheom Sokhunthy	F	53	People	Peal Nhack2	Phtah Prey	Sompovmeas	
77	Kheng Samnang	M	33	carpentry	Soreya Khrom	Phtah Prey	Sompovmeas	
78	Yong Sothy	F	24	People	Chamkar Chacktbong	Phtah Prey	Sompovmeas	
79	Pech Ny	F	34	People	Chamkar Chacktbong	Phtah Prey	Sompovmeas	
80	Munh Bunseng	F	18	People	Chamkar Chacktbong	Phtah Prey	Sompovmeas	
81	Huy Kley	F	32	Famer	Chamkar Chacktbong	Phtah Prey	Sompovmeas	
82	Ly Vin	F	64	People	Phom Ra	Phtah Prey	Sompovmeas	
83	Kheom Hat	F	48	Seler	Phom Ra	Phtah Prey	Sompovmeas	
84	Parn Chenda	F	53	People	Peal Nhack1	Phtah Prey	Sompovmeas	
85	Rous Rachna	F	33	People	Thnol Japen	Phtah Prey	Sompovmeas	
86	Kok Mouy	F	65	Sewing	Peal Nhack2	Phtah Prey	Sompovmeas	
87	Sok Chomren	F	61	People	Peal Nhack2	Phtah Prey	Sompovmeas	
TOTAL Participants: 87 [60 (68.97) Females and 27 (31.03%) Males]								

Participants

Ms. Maria Lorena Cleto, International Resettlement and Social Safeguards Specialist;
 Mr. Mel Sophanna, National Resettlement and Social Safeguards Specialist;
 Mr. Phai Sok Heng, Engineer and Deputy team leader;
 Mr. May Simon, National Environmental Specialist;
 Mr. Vong Rada, Officer, Ministry of Public Works and Transportation
 Ms. Tep Chinda, Minute Taker;
 Mr. Chhay Madinal, Municipal Governor of Pursat;
 Local Authorities and Villagers (see attached list of attendance)

Main Agenda:

Find out affected persons' suggestions and preferences regarding compensation, allowances and assistance, relocation of structures
 Activities that will be carried out during TA as part of project preparation;
 Inform the cut-off date
 Timeframe of project preparation and possible time of implementation

Project disclosure

Mr. Chhay Madinal, governor of Pursat municipality, welcomed his town dwellers to the meeting. He mentioned “today is a special day that ADB project is willing support our Pursat town. The town population are growing year by year which leads to town facing a lot of problems especially waste water, solid waste and flood management. For detailed information in relation to the project will be presented by national and international consultants who are with us in a few seconds later”.

Mr. Mel Sophanna, National resettlement and social safeguards specialist, introduced himself and team to participants. He gave warm welcome remarks to local authorities and villagers who spent their busiest time to participate in the valuable meeting. He also thanked municipal governor for precisely opening his remarks.

Mr. Sophanna presents a brief introduction about project to participants in the meeting. He informed that the project title called: Integrated Urban Environmental Management in the Tonle Sap Basin. In Pursat town the project will focus on: 1). River bank protection; 2). Roads and drainage improvement in Pursat town; 3). Wastewater treatment plant and solid waste management (Land field).

He emphasized that “the project will try to minimize any impact on people properties and as well as public properties. So the river bank protection in Pursat will build only two Groynes for minimization on affected properties of people as well as public. The drainage system will install on the existing ROW in order to avoid the impact on extended structures as well as the business on the sidewalk.

These few days our team will check the project site and conduct the IOL with households which will be potentially affected by the proposed project.

Ms. Maria Lorena Cleto, International Resettlement and Social Safeguards Specialist, expressed her sincere thanks to local authorities and participants for their cooperation and adds some important points regarding ADB safeguards policies on resettlement. She also mentioned the contents of the meeting today and what the team will do during two to three days in Pursat.

Team will conduct the IOL with those household's properties such as houses, store, fence and trees will be affected. For the affected properties will be compensated to the properties owners when the project is implemented.

After Ms. Maria and Mr. Sophanna finished the speech, the participants are given chance to raise questions.

Issues raised by the participants

Q1. Ms. Kinh Eng Lay, deputy director of Department of Women Affair, questioned: Is there compensation if small stores will be affected by the project?

Q2. Ms. Reth Ratana, live in Peal Nhaek 2 village, Sangkat Phtah Prey, asked: if the structures or properties will be affected by the project will these lost properties compensated?

Responses to the Questions

A1: Ms. Maria Lorena Cleto: Every affected properties from big to small structures will be compensated according to ADB policy and based on Replacement Cost Study.

A2. Ms. Maria Lorena Cleto: On the riverbank, the project will work on some part where there is small impact or no resettlement issue. In addition, Mr. Chhay Madinal, Pursat City Governor, responded to the same question that those have occupied on the river bank earlier, the government will provide compensation on their affected properties. On the other hand, recently built structures (after the cut-off date).

Closing discussion

Before ending the public consultation, Mr. Mel Sophanna asked the participants, is there anyone else have other questions or any suggestion? Then he continues to ask his final question, do everyone here wish to have this project come to Pursat city? Please raise your hand up if you all want this project. Then all participants raised their hand up to show their support for the Project.

He reminded to participants and local authorities that the IOL survey sets the Cut-off date for the project. The new land encroachers after this date will not be eligible to receive compensation from the project.

Lastly, Mr. Sophanna thanks local authorities and participants for their active participation in the meeting until the end, especially thank village headman, vice-village head for organizing this meeting.



Public consultation Pursat

Date: October 12, 2013

Main Agenda:

- Date: Monday 12 October 2013
- Venue: Wat Pealnhaek, Sangkat Phtah Prey, Pursat.
- Time: 2:30pm – 04:00p.m
- Participants: 7 Men, 10 Women

Participants

Mr. Mel Sophanna, National Resettlement and Social Safeguards Specialist;
 Ms. Tep Chinda, Minute Taker
 Local Authorities and Villagers (see below list of attendance)

Attendance List:

No.	Name	Gender	Occupation/ Institution	Address			Contact Number
				Village	Sangkat/ Commune	District	
1	Leng Khimleang	M	People	Pheal Nhak1	Phtah Prey	Sompovm eas	012980804
2	Soem Chanthy	F	Deputy of Village Chief	Toul Mkak	Phtah Prey	Sompovm eas	0976287646
3	Puo Sino	M	Village Chief	Chamkar Chakcherng	Phtah Prey	Sompovm eas	012785885
4	Soy Bunmom	F	People	Chamkar Chakcherng	Phtah Prey	Sompovm eas	012757056

5	Soy Buntol	M	People	Chamkar Chakcherng	Phtah Prey	Sompovm eas	012594382
6	Muong Sovun	F	People	Chamkar Chakcherng	Phtah Prey	Sompovm eas	012382736
7	Phann Vanno	F	People	Chamkar Chaktbong	Phtah Prey	Sompovm eas	0973919869
8	Meas Chanly	F	People	Chamkar Chakcherng	Phtah Prey	Sompovm eas	
9	Chhoem Hern	M	Village Chief	Chamkar Chaktbong	Phtah Prey	Sompovm eas	0121714590
10	Yong Sarin	M	Deputy of Village Chief	Chamkar Chakcherng	Phtah Prey	Sompovm eas	0979219686
11	Leng Heak	F	People	Toul Mkak	Phtah Prey	Sompovm eas	
12	Toem Saorn	F	People	Prey Nhey	Phtah Prey	Sompovm eas	017426795
13	Suos Kim	F	Saler	Toul Mkak	Phtah Prey	Sompovm eas	0977797115
14	Some Chamrern	M	Village Chief	Toul Mkak	Phtah Prey		012687583
15	Chhoem Oun	F	People	Chamkar Chakcherng	Phtah Prey	Sompovm eas	
16	Chhoem Sopheap	F	People	Chamkar Chakcherng	Phtah Prey	Sompovm eas	012394150
17	Sao Mong	M	Sangkat Chief		Phtah Prey	Sompovm eas	012230137
Total: 17, Male 7 = 42.2% , Female 10 = 58.8%							

Main Agenda:

Discuss the work done and result of IOL

Discuss Resettlement policy in general terms

Find out from the affected people their suggestions and preferences regarding compensation, allowances and assistance, relocation of structures

Re-inform the cutoff date

Minutes:

Mr. Sao Mong, Sangkat Chief of Phtah Prey, welcomed the national consultant team and participants for presentation and discussion of results of the IOL.

Mr. Mel Sophanna, National resettlement and social safeguards specialist, introduced himself and his assistant to participants. He thanked local authorities and participants for their participation.

He then presented the IOL findings: only three villages were found to be affected by the Project. Chamchar Chek Choeng (drainage), Chamchar Chek Tbong (drainage), Tuol Mkak

There was difficulty in finding people's names using land along the existing access road to the landfill. He mentioned findings of IOL—size of access road (COI of 13.3 m), and the team used the centerline of the existing road to measure the COI. On the left side, because of the open canal, the strip to be acquired (loss of land use) will only be 1.5 meters width, while on the right where there is no canal, the strip will be 4.5 meters wide.

There are owners we have not yet identified in the 300 m. long extension of the existing access road. But the other persons in the area also could not identify the AH because they said sometimes the owner may be in Phnom Penh and the planter may be renting but they cannot give the names either. They have never seen these AHs whenever they go to the fields to plant.

After Mr. Sophanna finished the discussion on the IOL findings, he opened the floor for participants to raise any issues or concerns regarding the finding and receive their suggestions.

Issues raised by the participants

Q1. Mr. Sim Chamroeun, Village head of Tuol Mkak, suggested that the team check with cadastral office for the unidentified land owners

Q2. Mr. Leng Kimleang, who owns long and wide strip of land on the left side of the access road to landfill asked why don't you ask designer/engineer team widen the road starting from the edge of the canal towards the right because he already donated the land that was used for the road. Before, this road was narrow. He already contributed to have the road widened.

Suggestion: Owners (11) on the other said, because Mr. Kimleang is rich, he can afford the loss more than them while they have only small land, if more gotten from them they will be more hard hit than Mr. Kimleang

Q3: They asked if access road is in private land in that extension section, what will happen?

Suggestion: Mr. Phur Sino, Village head of Chamkar Chek Choeng, mentioned that there will be no problem for those who extended into the ROW of the roads for the drainage (stores and secondary structure) because he already informed since there is provincial project for road expansion and they have been told already.

Responses to the Questions

A1: Mr. Sophanna: I have been checking with cadastral official but the cadastral official is still trying to locate because there are many documents that piled up from before the election. But he said he will cooperate and will give as soon as possible.

A2: Mr. Sophanna: I will bring your suggestion to engineer team whether they can reduce the base width; however, Mr. Sophanna said he cannot himself decided to reduce the access road or not, because the technical requirement at present is 13.3 for the road.

A3: Mr. Sophanna: If there is affect private land (land with title) the compensation will be made based on the replacement cost study. Then he confirm the land price with the participants that from the RCS found that the price of the land 7 km from town and attached to national road costs about 5-7 USD/m². From 1 km from the national road but same distance from town, around 1 USD/m². At 2 km from national road, around half of that. Is that correct? Most participants answered "YES".

Response to Suggestion: Mr. Sophanna said we only counted what will be affected for our project. So those affected will be compensated best on concept of replacement cost.

Closing discussion

Before ending the public consultation, Mr. Mel Sophanna asked the participants for any more questions or any suggestion?

Then he reminded to participants and local authorities that the IOL survey had established the Cut-off-date for the project. The new land encroachers after this date will not be eligible to receive compensation from the project.

Lastly, Mr. Sophanna thanks local authorities and participants for their active participation in the meeting until the end, especially thank village headman, vice-village head for organizing this meeting and providing the place for the meeting.

Integrated Urban Environmental Management in the Tonle Sap Basin Project ADB PPTA 7585-CAM Environmental Public Consultation — Pursat Town

Attendance Sheet

Date	24.10.2013					
Consultation Location	Boe Chhisek Village, Pursat Municipality,					
Consulted Group	representatives from involved village					
Consulting Group	PPTA Environmental Team					
No.	Name	Address	Gender	Age	Occupation	Representation
1	ឈ្មោះ ហង់	ភូមិបឹងក្រវាញ II	ប្រុស	54	រក្សា	អង្គភាព
2	អៀង គឹម ណា	ភូមិបឹងក្រវាញ II	ប្រុស	34	ស្មៅ	អង្គភាព
3	សៀម ភី ណា	ភូមិបឹងក្រវាញ II	ប្រុស	59	ស្មៅ	អង្គភាព
4	ឈ្មោះ ហង់	—	ប្រុស	—	—	—
5	ឈ្មោះ ហង់	—	ប្រុស	59	ស្មៅ	អង្គភាព
6	ឈ្មោះ ហង់	—	ប្រុស	40	—	អង្គភាព
7	ឈ្មោះ ហង់	—	ប្រុស	51	—	អង្គភាព
8	ឈ្មោះ ហង់	—	ប្រុស	65	ស្មៅ	អង្គភាព
9	ឈ្មោះ ហង់	—	ប្រុស	37	ស្មៅ	អង្គភាព
10	ឈ្មោះ ហង់	—	ប្រុស	61	ស្មៅ	អង្គភាព
11	ឈ្មោះ ហង់	—	ប្រុស	—	—	—
12	ឈ្មោះ ហង់	ភូមិបឹងក្រវាញ II	ប្រុស	42	ស្មៅ	អង្គភាព
13	ឈ្មោះ ហង់	ភូមិបឹងក្រវាញ II	ប្រុស	68	ស្មៅ	អង្គភាព
14	ឈ្មោះ ហង់	—	ប្រុស	43	ស្មៅ	អង្គភាព

Date	20.10.2015					
Consultation Location	Real Okhnaik, Nagala, Forest municipality					
Consulted Group	representatives from involved villages					
Consulting Group	PPTA Environmental Team					
No.	Name	Address	Gender	Age	Occupation	Representation
16	နီကီ လီမာရပ်	ဗဟာလကရိပ်	မ	49	စိုက်ပျိုး	စိုက်ပျိုး
17	ဒီပဲနီ	ဗဟာလကရိပ်	မ	53	စိုက်ပျိုး	
18	စိုက်ပျိုးစိုက်ပျိုး	—	မ			
19	မုဒါ နီမာရပ်	—	မ			
20	မာ မာ	—	မ			
21	နီ နီမာ	—	မ			
22	မုဒါ နီမာ	—	မ			
23	စိုက်ပျိုးစိုက်ပျိုး	—	မ			
24	မုဒါ နီမာ	—	မ			
25	မုဒါ နီမာ	—	မ			
26	မုဒါ နီမာ	—	မ			
27	မုဒါ နီမာ	—	မ			
28	မုဒါ နီမာ	—	မ			
29	မုဒါ နီမာ	—	မ			
30	မုဒါ နီမာ	—	မ			

Date	20.10.2015					
Consultation Location	Real Okhnaik, Nagala, Forest municipality					
Consulted Group	representatives from involved villages					
Consulting Group	PPTA Environmental Team					
No.	Name	Address	Gender	Age	Occupation	Representation
31	မုဒါ နီမာ	ဗဟာလကရိပ်	မ	58	စိုက်ပျိုး	စိုက်ပျိုး
32	မုဒါ နီမာ	ဗဟာလကရိပ်	မ	60	စိုက်ပျိုး	
33	မုဒါ နီမာ	ဗဟာလကရိပ်	မ	67	စိုက်ပျိုး	
34	မုဒါ နီမာ	ဗဟာလကရိပ်	မ	34	စိုက်ပျိုး	
35	မုဒါ နီမာ	ဗဟာလကရိပ်	မ	60	စိုက်ပျိုး	
36	မုဒါ နီမာ	ဗဟာလကရိပ်	မ	56	စိုက်ပျိုး	
37	မုဒါ နီမာ	ဗဟာလကရိပ်	မ	32	စိုက်ပျိုး	
38	မုဒါ နီမာ	ဗဟာလကရိပ်	မ	44	စိုက်ပျိုး	
39	မုဒါ နီမာ	ဗဟာလကရိပ်	မ	30	စိုက်ပျိုး	
40	မုဒါ နီမာ	ဗဟာလကရိပ်	မ	57	စိုက်ပျိုး	
41	မုဒါ နီမာ	ဗဟာလကရိပ်	မ	60	စိုက်ပျိုး	
42	မုဒါ နီမာ	ဗဟာလကရိပ်	မ	42	စိုက်ပျိုး	
43	မုဒါ နီမာ	ဗဟာလကရိပ်	မ	55	စိုက်ပျိုး	
44	မုဒါ နီမာ	ဗဟာလကရိပ်	မ	48	စိုက်ပျိုး	
45	မုဒါ နီမာ	ဗဟာလကရိပ်	မ	37	စိုက်ပျိုး	

Date	2014-10-20					
Consultation Location	Aral Gokhale, Gode, Arant municipal					
Consulted Group	representatives from Thuphal village					
Consulting Group	PPTA Environmental Team					
No.	Name	Address	Gender	Age	Occupation	Representation
46	မိုးစိုး-အောင်	ကျေးရွာ	M	67	လယ်သမား	✓
47	မိုးစိုး-အောင်	ကျေးရွာ	M	63	လယ်သမား	✓
48	မိုးစိုး-အောင်	ကျေးရွာ	M	50	လယ်သမား	✓
49	မိုးစိုး-အောင်	ကျေးရွာ	M	78	လယ်သမား	✓
50	မိုးစိုး-အောင်	ကျေးရွာ	M	46	လယ်သမား	✓
51	မိုးစိုး-အောင်	ကျေးရွာ	M	32	လယ်သမား	✓
52						
53						
54						
55						
56						
57						
58						
59						
60						



Notes and photographs from consultation meetings held during project design (2018/2019)

Photographs from public consultation in DOE office, Kampong Chhnang



Photographs from local government consultation in DPWT office, Pursat province



Source: IEIA Team (2019)

Photographs from public consultation (six villages), Pursat province for both subprojects in Pursat



Public consultation with local people in Sangkat Prey Nji, Pursat Municipality (drainage and WWTP)



Public consultation with local people in Sres Srang Village, Sangkat Roleap, Pursat Municipality (Solid waste management)



Public consultation with local people in Toul Mkak Village, Sangkat Roleap, Pursat Municipality (Solid waste management)



Public consultation with local people in Kandeng Tom Village, Sangkat Sre Thmey, Rolea Brea district
(Solid waste management)



Public consultation with local people in Phnom Touch Village, Sangkat Pongro, Rolea Brea district
(Solid waste management)

Source: IEIA report, 2018

Annex 7: Affected Person Monitoring consultation form

For Solid Waste Management Subprojects Pursat and Kampong Chhnang and Waste Picker Consultation this is an example for that can be used during construction.

When to use this form: DURING CONSTRUCTION

1. Key Informant Interviews - individual answers recorded when consulting individual Affected People.

2. Focus Group Discussion – groups of 8 to 12 people (maximum 12)

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

Interview Discussion Points:

1. Impacts from CURRENT DUMPSITE	Record of Discussion
1a Before the project started, was the person disturbed by the current dumpsite? If yes, explain how and when. <i>What disturbed them? E.g. noise, dust, odor, pests?</i> <i>When did it disturb the person? E.g. all day, at night, intermittently</i>	
1b During the site closure, is the person disturbed by the project? If yes, explain how and when. <i>What disturbed them? E.g. noise, dust, odor, pests?</i> <i>When did it disturb the person? E.g. all day, at night, intermittently</i>	
1c If the person is disturbed by site closure works, what changes does the person suggest are made?	

Impacts from NEW LANDFILL CONSTRUCTION	
1. NOISE	
1a. Before the project started, was the person disturbed by noise? If yes, explain how and when. <i>Where did the noise come from? E.g. traffic, machinery, people, music</i> <i>When did it disturb the person? E.g. all day, at night, intermittently</i>	
1b. During the construction, is the person disturbed by noise from the project? If yes, explain how and when. <i>What type of noise and where did the noise come from? All day, at night, intermittently?</i>	

1c. If noise from construction is a problem, what changes does the person suggest are made?	
2. AIR QUALITY	Record of Discussion
2a Before the project started, was the person affected by air pollution or dust? If yes, explain how and when. <i>Where did the pollution or dust come from? E.g. traffic, machinery, construction, burning garbage, cooking stoves</i> <i>When was the dust or pollution a problem? E.g. all day, at night, intermittently</i>	
2b During the project, is the person disturbed by dust or pollution? If yes, explain how and when. <i>What type of noise and where did the noise come from? E.g. increased traffic congestion, construction machinery, construction workers, burning construction garbage etc</i> <i>When did it disturb the person? E.g. all day, at night, intermittently</i>	
2c If dust or air pollution from the construction is a problem, what changes does the person suggest are made?	
3. VEGETATION AND LAND USE	Record of Discussion
3a Before the project started, what was the vegetation like in the project area? <i>E.g. pasture land, trees, shrubs, rice fields.</i>	
3b During the project, has the person found the vegetation situation has changed? If yes, explain how and when.	
3c If impact on vegetation is unacceptable, what changes does the person suggest are made?	
4 COMMUNITY SAFETY	Record of Discussion
4a Before the project started, can you describe the community safety situation in the project area? <i>E.g. no problems, some accidents, difficulty crossing the roads</i>	
4b During the project, has the person found the community safety situation has changed? If yes, explain how and when. <i>Slower traffic so easier to cross the roads, construction vehicles are making a crossing harder / easier, more accidents / less accidents, construction site dangers, river bank unstable</i>	
4c If change in road safety is unacceptable, what changes does the person suggest are made?	
5. WATER QUALITY	Record of Discussion
5a Before the project started, was the person affected by poor water quality? If yes, explain how and when. <i>Ground water? Surface Water? which Water source? How was it polluted?</i>	

5b During the project, is the person affected by water pollution? If yes, explain how and when. <i>Ground water? Surface Water? which Water source? How is quality being affected?</i>	
5c If water quality from the construction is a problem, what changes does the person suggest are made?	
6. ACCESS	Record of Discussion
6a. Before the project started, was the person affected by difficulties accessing their property or business?	
6b. During the project, is the person affected by reduced access to their business, home or land? <i>Access to what is limited, and how?</i>	
6c If access limitations are not acceptable, please suggest changes which can be made?	
7. WASTE COLLECTION	Record of Discussion
7a Before the project started, did the person have a waste collection service in their area? <i>If yes, explain how long this service has been available?</i> <i>IF they have a service in their area, but do not use it, can they explain why not? Egg. Cost, bad service etc?</i>	
8. OTHER ISSUES	Record of Discussion
Any other issues about the project that the person wants to discuss? <i>Examples:</i> <i>wastewater concerns</i> <i>waste disposal</i> <i>impact on livelihood/business</i> <i>labour force & social issues</i> <i>Flooding</i>	

Waste Picker ONLY Questions for DED Phase

Date of Interview		Interviewer Name	
Interview Site: Where is the interview held? In school, on the road, in shop, meeting place		Affected Person Name & Status: - Ensure list of names taken for groups – include role and gender	

USE OF CURRENT DUMPSITE	Record of Discussion
Describe how the person uses the current site? <i>Frequency – how often do they pick waste at the site?</i> <i>Time – how long do they spend on the site (hours)?</i> <i>How far do they travel to get to the site (where do they live?)</i> <i>Do waste pickers generally have other family members working on the site too? So do children or siblings also work on the site? If yes, how many</i>	

<i>family members are on the site from each family?</i> • <i>How many waste pickers regularly work at this site?</i>	
Recyclable Materials – • <i>What materials does the person collect? E.g. hard plastic? Plastic Film? Metal cans?</i> • <i>WHERE and HOW does the person sell the recycling? – do they take it by motorbike to the town? Is it collected by a middle man from the site?</i>	
Health and Sanitation • On the site, what water source do they use for drinking? • What water source do they use for washing? • How does working on the dumpsite affect their health/ health of their family? • What do they do to protect their health when working on the site at the moment?	
Income (resettlement /social will ask questions on this)	
Alternative Livelihoods • If the person could have a “formal” role (a job) in collection of waste from householders, what is their opinion of this alternative? • Has the person tried to leave waste picking and have an alternative income? • Do most people have other jobs (formal or informal) as well as waste picking? If yes, what are the other jobs? • If the person could have training to do something different, what type of skills are they interested in? Such as own business, working in a factory, working in tourism etc?	

Annex 8: Affected Person Monitoring corrective action form

When to use this form:

1. After Consultation with Affected People including Key Informant Interviews and Focus Group Discussions when consultation shows a problem or correction needs to be implemented.

PMU Staff Responsible: (name and role)	Name:	Role:
Date this form is completed		
Form Issued to and Agreed by: (person responsible for corrective action)	Signature:	Date:

Date Consultation Held		
Details of Consultation -Key informant Interview or Focus group Discussion or Other -Location		
Affected Person/Organisation Contact details (if available): -Name & Contact Details		
Details of Issue: -Issues as described during consultation -Actions taken so far		
Corrective Action Needed - Next steps for PMU to resolve the issue		
Who Needs To Take Action	What Actions are Needed	
Example: Contractor	Example: Reduce noise on site after 6pm	
Example: CSC/Contractor	Example: Reduce dust levels by moving aggregate storage	
Deadlines for Corrective Action		
Date Person/Organisation informed about the Corrective Action they need to Take	Date Corrective Action Must be Completed	
Example: Contractor – 1 st April 2018	Example: Immediately	
Example: CSC/Contractor – 1 st April 2018	Example: By 8th April	