

# Environmental Management Plan

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July 2021

Cambodia: Fourth Greater Mekong Subregion  
Corridor Towns Development Project

Solid Waste Management Subproject, Kratie City,  
Kratie Province

Prepared by the Ministry of Public Works and Transport for the Asian Development Bank.

## CURRENCY EQUIVALENTS

(as of 2020)

Currency unit	–	riel (KR)
KR 1.00	=	\$ 0.000250
\$1.00	=	KR 4,000

## ABBREVIATIONS

ADB	–	Asian Development Bank
BOD	–	Biochemical Oxygen Demand
CDIA	–	Cities Development Initiative for Asia
CEMP	–	Construction Environmental Management Plan
C-EHS	–	Contractor Environmental Health and Safety Officer
CMAC	–	Cambodia Mine Action Center
COD	–	Chemical Oxygen Demand
CRVA	–	Climate Risk Vulnerability Assessment
DDPP	–	Detailed Design and Project Preparation
EA	–	Executing Agency
EIA	–	Environmental Impact Assessment
EMP	–	Environmental Management Plan
FGD	–	Focus Group Discussion
GHG	–	Greenhouse Gas
GMS4	-	Fourth Greater Mekong Sub-Region Corridor Towns Development Project
GRM	–	Grievance Redress Mechanism
IA	–	Implementing Agency
IEE	–	Initial Environmental Examination
IESIA	–	Initial Environmental and Social Impact Assessment
MoE	–	Ministry of Environment
MoH	–	Ministry of Health
MoLVT	-	Ministry of Labour and Vocational Training
MOWRAM	–	Ministry of Water Resources and Meteorology
MPWT	–	Ministry of Public Works and Transport
PDoE	–	Provincial Department of Environment
PMC-I/NES	–	PMC-International and National Environment Specialists
PIU	–	Project Implementation Unit
PIU-SFP	–	PIU Safeguards Focal Point
PMC	–	Project Management Consultant
PMU	–	Project Management Unit
PMU-ESO	–	PMU Environmental Safeguards Officer
PSC	–	Project Steering Committee
SHC	–	Sewer Household Connection
STP	–	Sewage Treatment Plant
SPS	–	Safeguards Policy Statement
TS-1	–	Tonle Sap Urban Environmental Improvement Project
TSBR	–	Tonle Sap Biosphere Reserve
TSS	–	Total Suspended Solid
UXO	–	Unexploded Ordnance
WHO	–	World Health Organisation
WW	–	Wastewater
WWTP	–	Wastewater Treatment Plant

## WEIGHTS AND MEASURES

dBA	–	A-weighted Decibel
km	–	Kilometer
km <sup>2</sup>	–	Square kilometer
L <sub>Aeq</sub>	–	Equivalent Continuous Level 'A weighting' - 'A'-weighting = correction by factors that weight sound to correlate with the sensitivity of the human ear to sounds at different frequencies
m	–	Meter
°C	–	Degree Celsius
PM <sub>10</sub>	–	Particulate Matter 10 micrometers or less
PM <sub>2.5</sub>	–	Particulate Matter 2.5 micrometers or less
µg/m <sup>3</sup>	–	Microgram per cubic meter

## NOTE

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

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# 1. INTRODUCTION

## 1.1. Purpose

1. This document is the environmental management plan (EMP) for the Solid Waste Management Subproject in Kratie City, Kratie Province under the Fourth Greater Mekong Sub-Region Corridor Towns Development Project (GMS/CTDP-4 or the Project), which supports the Governments of Cambodia and the Lao People's Democratic Republic (PDR) in enhancing the competitiveness of selected towns located along the Central Mekong Economic Corridor in the Greater Mekong Subregion (GMS).
2. The EMP defines mitigation and monitoring measures for all project phases and describes the institutional arrangements and division of responsibilities in terms of environmental management and monitoring. The EMP is designed to ensure that the Subproject complies with applicable environmental requirements under the laws and regulations of Cambodia as well as with the ADB Safeguard Policies. The EMP further aims at ensuring continual improvements in environmental performance over the course of the pre-construction, construction, and operation of the subproject in order to prevent, or otherwise minimise adverse environmental impacts.
3. The environmental classification of the Subproject is confirmed as Category B. The EMP has been carried out in accordance with the Safeguard Policy Statement (2009) of the Asian Development Bank (ADB), and Cambodia's Law on Environmental Protection and Natural Resource Management (Preah Reach Kram/NS-PKM-1296/36) 1996, and its sub-decrees and implementing guidelines. The EMP is based on the separate Initial Environmental Examination (IEE) of July 2021 and both the IEE and EMP have been updated in conjunction with the finalization of the Detailed Engineering Design (DED) ensuring consistency between engineering designs and environmental mitigation measures. The EMP also incorporates the findings of the Initial Environmental and Social Impact Assessment (IESIA) approved by the Ministry of Environment (MoE) on 20 May 2021. The EMP will be further updated if necessary. The previous EMP which was part of an IEE/EMP (May 2018) covering all subprojects under the CTDP-4 Project is available on ADB's website<sup>1</sup>.

## 1.2. Objectives of the EMP

4. The objective of the EMP is to determine and ensure implementation of the appropriate and necessary environmental and social mitigation and monitoring measures that are required to protect the environment and human health from impacts associated with the Subproject; and to fully comply with all environmental and social obligations including those required by the Laws of Cambodia and those required by ADB.
5. The EMP describes how the mitigation of adverse environmental and social impacts and measures to enhance the benefits of environmental protection will be implemented. It explains how the measures will be managed, who will implement them, and when and where they will be implemented.

## 1.3. Outline of Sub-Project Technical Approach

### 1.3.1. Landfill technology outline

6. The Kratie City Solid Waste Management Subproject consists of the following works and components:

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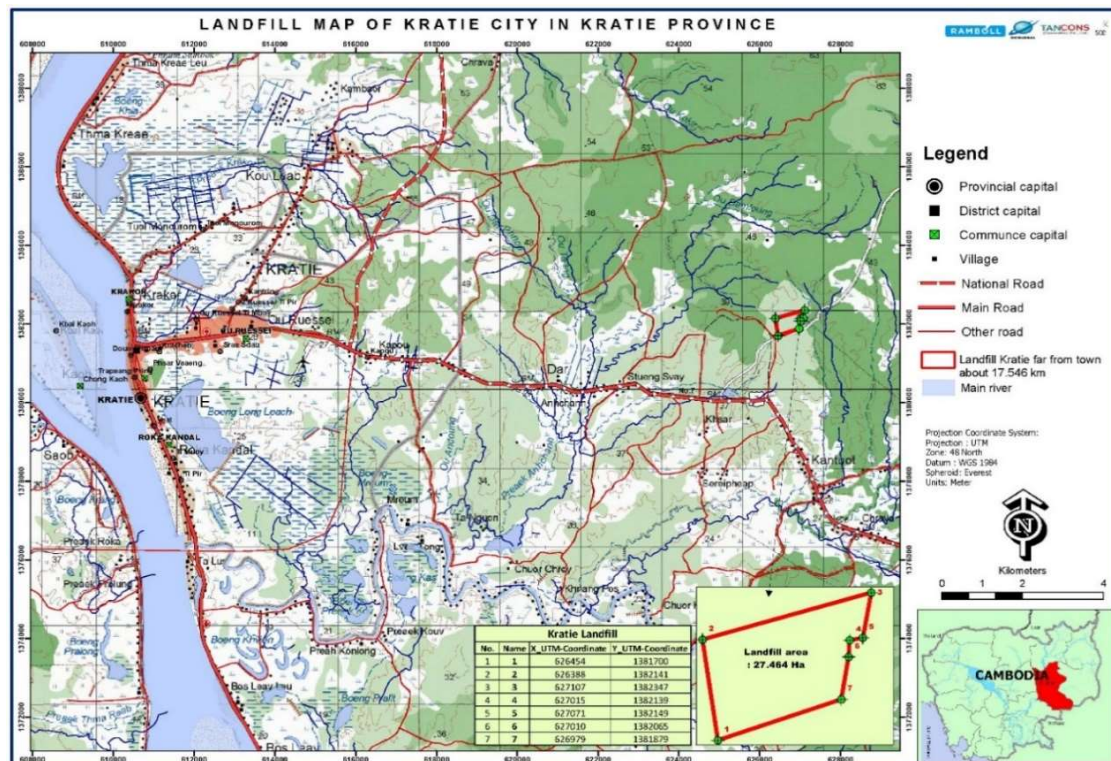
<sup>1</sup> <https://www.adb.org/projects/documents/cam-50099-002-iee>

- Upgrading of 2,020 metres of external access road to the landfill site to be above flood levels.
  - Construction of one controlled landfill cells out of a total of four cells.
  - Construction of one hazardous waste landfill cell.
  - Construction of a non-mechanical material recovery facility (MRF).
  - Construction of drainage, leachate collection, treatment, and recirculation system.
  - Construction of weighbridge, office, staff dining and rest room (combined building); workshop, electrical and mechanical room; and supply building.
  - Construction of 1,721 metres of concrete internal roads, with associated bunds and drainage.
  - Construction of wire mesh fencing, brick entrance wall, gate and security guardhouse.
  - Construction of car/vehicle washing facility.
  - Construction of hazardous waste storage building.
  - Provision of utilities, including construction of grid-tied solar system.
  - Provision of operations & maintenance (O&M) equipment.
  - Closure of the existing waste dumpsite at the landfill site and relocation of up to 7,344 tonnes of waste to the new landfill cell.
  - Closure of the old waste dumpsite.
  - The remediation and closure of the two waste dumpsites are based on a standalone Environmental Compliance Audit annexed to the IEE (July 2021).
7. The subproject components and facilities have a design life of 20 years up to 2040. Operations are expected to start in 2023.

#### 1.4. Project Location and Landfill Service Area

8. The controlled landfill site is located on state land in Khsar Village, Dar commune, Cheatr Borei District, Kratie Province (see **Figure 1**). The site covers an area of 27.85 ha.

**Figure 1: Kratie City Solid Waste Management Subproject**





### 1.4.1. Service Area and Population

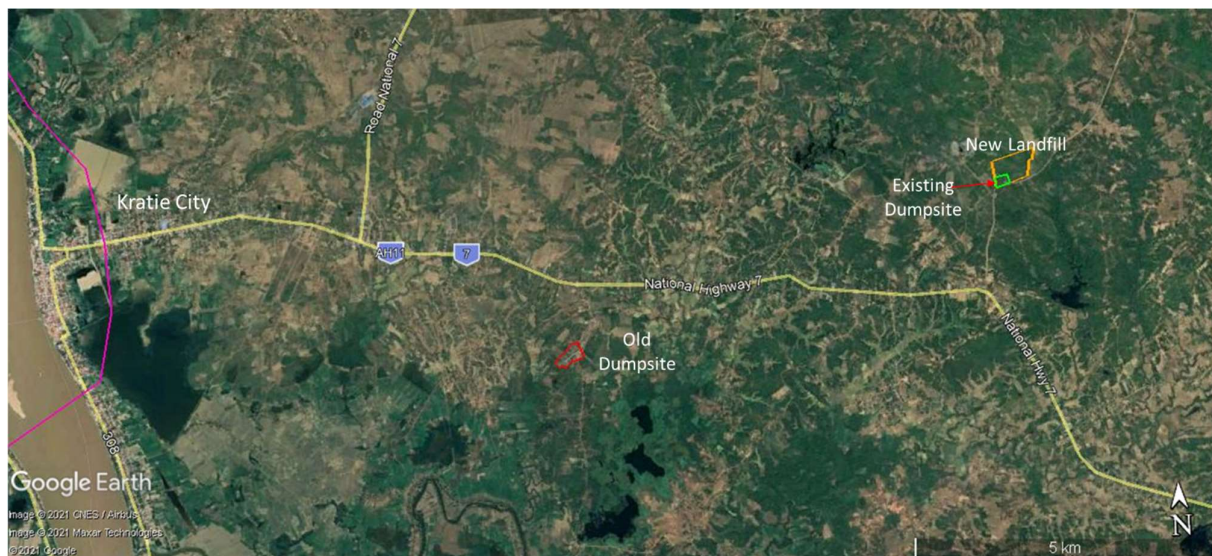
9. The intended service area for the new landfill covers the four sangkats of Kracheh, Krakor, Ou Ruessei, and Roka Kandal and possibly also villages close to the City along National Road No. 7 (Samret, Kou Loab, and Banteay, Dar, Anh Chanh, Stueng Svay and Khsar villages). The waste collection service area is displayed in **Figure 2**.

**Figure 2: Waste Collection Service Area**



10. The two waste dumpsites that will be closed under the Subproject are known as “the old dumpsite” located about 8 km east of the city and “the existing dumpsite” located within the proposed new landfill site about 15 km from Kratie City centre (see **Figure 3**).

**Figure 3: Overview Map of the Dumpsites and the New Landfill Site**



11. The existing dumpsite will be closed by relocating the existing waste in the new landfill cell as soon as the cell is ready to receive waste. The dumpsite area will then be backfilled and rehabilitated and become part of the landfill operation area.
12. The method of closure and remediation of the old dumpsite will be finally determined based on the assessments and recommendations in this IEE and the results of additional physical investigations of the site. The conceptual methods for closure and remediation<sup>2</sup> under consideration include:
  - a) Closure by removing the waste from the dump and disposing it at the new landfill.
  - b) In-place closure by capping the waste,
  - c) Closure by upgrading into a controlled engineered landfill, or
  - d) Isolation of waste from groundwater, using drainage/ engineered containment.

## 2. SUMMARY OF POTENTIAL RECEPTORS AND IMPACTS

13. The identification and proximity of sensitive receptors is summarised in **Table 1** and the receptors in the immediate surroundings are displayed in **Figure 4**.

**Table 1: Summary of Receptors in Sub-Project Area**

Project Component	Surface Water Receptors	Socio-Economic & Cultural Receptors	Land Cover/ Ecological Receptors	Protected Area Status
Landfill site including the existing dumpsite	<ul style="list-style-type: none"> <li>- Small stream that connects to Or Kantuot Stream crosses over the buffer zone in the north-eastern corner of the site</li> <li>- Or Kantuot Stream flows 2 km to a 16 ha irrigation reservoir</li> </ul>	<ul style="list-style-type: none"> <li>- State Land</li> <li>- about 15 km for Kratie City and 17 km from Mekong River</li> <li>- 2 km from national road No. 7</li> <li>- 2 km from Khsar village, Dar commune, with houses, schools, pagoda and other rural local utilities.</li> <li>- Primary school 1.7 km southwest of the site.</li> </ul>	<ul style="list-style-type: none"> <li>- The site is covered with degraded forest and secondary shrub</li> <li>- Surrounding area is upland area with secondary forest/shrub and patches of agricultural land</li> </ul>	<ul style="list-style-type: none"> <li>- Mondulkiri - Kratie Lowlands Key Biodiversity Area located about 11 km to the east</li> <li>- the Mekong River Kratie to Lao Border Key Biodiversity</li> </ul>

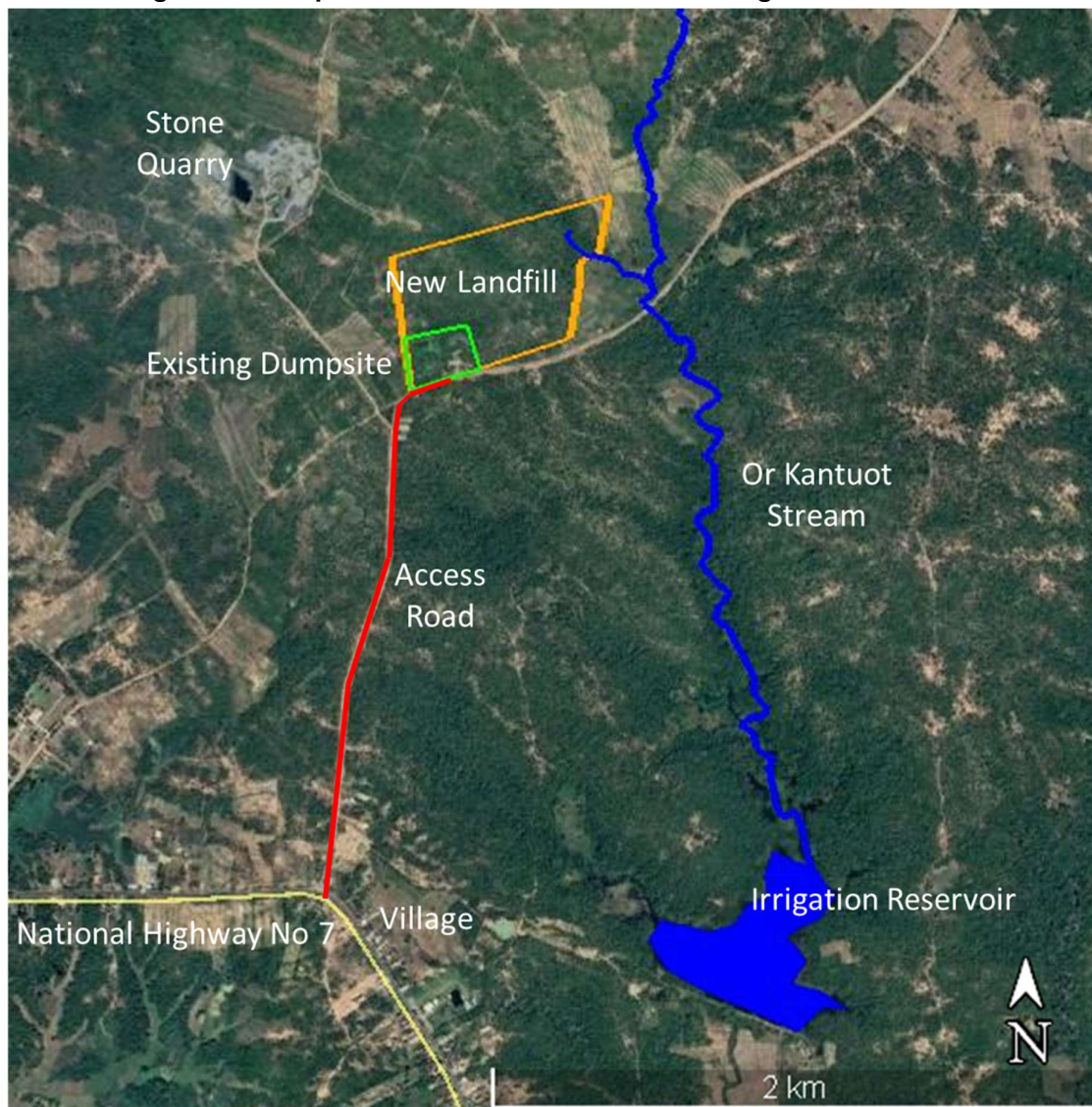
<sup>2</sup> A Roadmap for closing Waste Dumpsites, The World's most Polluted Places, ISWA, 2016, [https://www.iswa.org/fileadmin/galleries/About%20ISWA/ISWA\\_Roadmap\\_Report.pdf](https://www.iswa.org/fileadmin/galleries/About%20ISWA/ISWA_Roadmap_Report.pdf)



		- A stone quarry 350 m northwest of the site		Area about 15 km to the west
Old Dumpsite	<ul style="list-style-type: none"> <li>- Wetlands 1.3 km to the southeast and a small pond 0.3 km south of the site</li> <li>- 3 km from Prek Te River and within its catchment</li> </ul>	<ul style="list-style-type: none"> <li>- single houses/buildings next to the dumpsite and along the access road</li> <li>- 1.3 km to the nearest village along National Highway No. 7</li> <li>- big buddha statue along the dumpsite access road</li> </ul>	<ul style="list-style-type: none"> <li>- The site is covered with degraded forest and secondary shrub</li> <li>- Surrounding area is secondary forest/shrub in-between areas of agricultural land</li> </ul>	<ul style="list-style-type: none"> <li>- the Mekong River Kratie to Lao Border Key Biodiversity Area about 7.5 km to the west</li> <li>- Prek Prasab Protected Area 17 km to the northwest</li> </ul>

Source: Google Earth, IBAT proximity assessment, PMC site visits

**Figure 4: Receptors in the Immediate Surroundings of the Landfill**



14. The EMP sets forth the measures necessary to adequately mitigate the impacts on the receptors and the project site itself in accordance with the assessments in the IEE. A summary of potential adverse impacts on the receptors is presented in **Table 2**.

**Table 2: Screening of Impacts for Kratie Landfill**

Impact	Source	Receptors
<b>Construction</b>		
Degradation of Air Quality	<ul style="list-style-type: none"> <li>■ Exhaust fumes from construction machinery and equipment, movement of haulage trucks</li> <li>■ Asphalt pouring</li> <li>■ Fugitive dust from borrow pits and all excavation works</li> <li>■ Fugitive dust from loading, unloading and haulage of construction materials</li> <li>■ Fugitive dust from concrete batching plants.</li> </ul>	<ul style="list-style-type: none"> <li>■ Ambient Air</li> <li>■ Populations near project sites</li> <li>■ Workers</li> </ul>
Noise nuisance	<ul style="list-style-type: none"> <li>■ Noise from construction machinery and haulage trucks</li> <li>■ Noise from Generators</li> <li>■ Movement of material / dumping of material (including waste from dumpsite)</li> </ul>	<ul style="list-style-type: none"> <li>■ Populations near project sites</li> <li>■ Workers</li> <li>■ Waste pickers at the dumpsite</li> </ul>
Impacts on water quality	<ul style="list-style-type: none"> <li>■ Discharge of contaminated stormwater (suspended material, spills)</li> <li>■ Accidental Spills</li> <li>■ Waste / litter</li> </ul>	<ul style="list-style-type: none"> <li>■ No surface water body identified nearby</li> <li>■ Ground water</li> <li>■ Nearby agricultural fields</li> </ul>
Erosion or degradation of soil and land / Flooding	<ul style="list-style-type: none"> <li>■ Earthworks</li> <li>■ Accidental spills/ poor management of waste</li> </ul>	<ul style="list-style-type: none"> <li>■ Surface water bodies</li> <li>■ Communities</li> </ul>
Destruction of fauna and flora	<ul style="list-style-type: none"> <li>■ Clearing of construction sites (landfill, borrow pit)</li> </ul>	<ul style="list-style-type: none"> <li>■ Trees, bushes and shrubs</li> </ul>
Impacts on health and safety	<ul style="list-style-type: none"> <li>■ Traffic increase in residential areas from trucks movement</li> <li>■ Air emissions and effluents</li> <li>■ Use of construction equipment/tools</li> <li>■ COVID-19</li> </ul>	<ul style="list-style-type: none"> <li>■ Communities</li> <li>■ Workers</li> </ul>
<b>Operation</b>		
Degradation of Air quality	<ul style="list-style-type: none"> <li>■ Biogas Generation</li> <li>■ Smoke from waste fires</li> <li>■ Emissions from waste trucks and cover material trucks</li> </ul>	<ul style="list-style-type: none"> <li>■ Ambient air</li> <li>■ Nearby communities</li> </ul>
Impacts on water quality	<ul style="list-style-type: none"> <li>■ Non-compliant discharged leachates</li> <li>■ Contaminated stormwater</li> <li>■ Spills and windblown litter</li> </ul>	<ul style="list-style-type: none"> <li>■ Or Kantuot Stream</li> <li>■ Groundwater</li> <li>■ Nearby agricultural fields</li> <li>■ Fauna and Flora</li> </ul>
Odours and Dust	<ul style="list-style-type: none"> <li>■ Landfill operations / open cells</li> <li>■ Dust from movement of vehicles</li> </ul>	<ul style="list-style-type: none"> <li>■ Workers</li> <li>■ Informal recyclers</li> <li>■ Communities</li> </ul>
Impacts on Health and Safety	<ul style="list-style-type: none"> <li>■ Vectors and pests scavenging at the landfill</li> <li>■ Movement of waste trucks and trucks for cover material</li> <li>■ Accidental events such as fires and explosions</li> <li>■ Use of equipment/maintenance of landfill</li> <li>■ Presence of litter and pests around landfill</li> <li>■ Non-compliant effluents</li> <li>■ COVID 19</li> </ul>	<ul style="list-style-type: none"> <li>■ Workers</li> <li>■ Informal recyclers</li> <li>■ Communities</li> </ul>

### 3. INSTITUTIONAL ARRANGEMENTS AND RESPONSIBILITIES

15. The framework for implementation of the environmental management plan (EMP) for the project is described in this section. The key institutions, organizations and stakeholders relevant to environmental safeguards are set out below.
16. The overall responsibility for EMP implementation and compliance with loan assurances lies with the Executing Agency (EA), the Ministry of Public Works and Transport. The EA will establish a Project Management Unit (PMU) based in Phnom Penh, responsible for general project implementation. The Implementing Agency is the Provincial Department of Public Works and Transport (PDPWT) in 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.
17. A summary of the key functions for project implementation and environmental safeguards is presented in **Table 3**.

**Table 3: Key Roles for Project Implementation**

Role	Abbreviation	Location	Summary of Overall Function
Ministry of Public Works and Transport	MPWT	Phnom Penh	Accountable towards the Royal Government of Cambodia and ADB for the implementation of the Subproject and for ensuring compliance with loan covenants
Project Steering Committee	PSC	Phnom Penh	Policy and technical guidance for subproject implementation
Project Management Unit	PMU	Phnom Penh within MPWT	Responsible for general project implementation and reporting
PMU Environment Safeguards Officer (funded through CTDP4 Loan)	PMU-ESO	Phnom Penh within PMU	EMP compliance across the sub-projects for environmental safeguards - Full Time
Project Implementation Unit	PIU	Provinces within PDPWT	Responsible for sub-project implementation
PIU Safeguards Focal Point	PIU-SFP	Provinces within PIU	Responsible for sub-project environmental and social safeguard monitoring - Full Time
Contractor	-	Construction Site	Timely implementation of the construction work according to contract Preparation and implementation of the CEMP as approved by the PMU
Contractor Environmental Compliance Officer	C-EHS	Construction Site	Mitigation measure implementation and reporting
Project Management Consultants	PMC	Phnom Penh	Project final design and implementation, support and capacity development. Engineering supervision for all construction and reporting
International and National Environment Specialists	PMC-I/NES	Phnom Penh within PMC team	Environmental safeguards and reporting support during design and implementation - Intermittent
Asian Development Bank	ADB	-	Review project progress, compliance with covenants and advise on corrective actions
Ministry of Environment (MOE)/ Provincial Department of Environment (PDoE)	MoE/PDoE	Phnom Penh	Responsible for environmental protection and natural resources conservation. Collaborate with the project to provide policies, environmental standards and advise. Review and approve EIA/IESIA reports. Conduct environmental compliance monitoring of the project

18. A Project Steering Committee (PSC) has been established to provide policy and technical guidance for subproject implementation. The PSC is chaired by the EA and comprises relevant ministry of provincial departments representatives including the Ministry of Environment, General Department of Resettlement (GDR) and Ministry of Labour as a minimum.
19. External support to the Implementing Agency/PIU for EMP implementation during the project detailed design and implementation phase will be provided by the International and National Environment Specialists (I/NES) of the Project Management Consultants (PMC). An external Environmental Monitoring Institute (EMI) will be engaged to conduct the field sampling and laboratory analyses of environmental quality (e.g., water quality, air quality,

- noise) that cannot be performed by other functions within the project. In Cambodia, this can be performed by qualified staffs from the Ministry of Environment (MoE).
20. ADB is responsible for reviewing project progress reports and semi-annual environmental safeguards monitoring reports and undertaking review missions to ensure the project is implemented in line with the relevant environmental safeguard requirements, SPS (2009) and Royal Government of Cambodia regulations and guidelines.
  21. The Executing Agency is accountable for project implementation and operation on behalf of the Royal Government of Cambodia. The responsibilities of the Executing Agency in relation to environmental safeguards requirements are summarized below:
    - a) Overall responsibility for subproject implementation and management of the Project Management Unit (PMU);
    - b) Recruit and manage qualified ESO for PMU;
    - c) Recruit and manage Project Management Consultants
    - d) Ensure compliance with Loan Covenants;
    - e) Approve procurement plans, bidding documents, bid evaluation and contract awards including EMP;
    - f) Submit regular quarterly and annual subproject reports to ADB including summary on EMP and GRM implementation;
    - g) Ensure compliance of subproject/component implementation with ADB and Government social and environmental policies, guidelines and plans;
    - h) Approve proposed corrective actions in the event of identified impacts or non-compliance issues identified in monitoring and evaluation reports.
  22. The responsibilities of the Implementing Agency in relation to environmental safeguards requirements are summarized below:
    - a) Coordinate and monitor subproject implementation activities including all environmental safeguards activities;
    - b) Coordinate capacity development program for PIU;
    - c) Obtain necessary approvals from respective departments and other institutions prior to awarding of civil works contracts;
    - d) Support PMU-ESO in the implementation of EMP;
    - e) Coordinate regular reporting of PMU to EA on EMP implementation;
    - f) Undertake regular quality control inspection of subproject facilities;
    - g) Manage the handover of subproject facilities to agencies responsible for operation and maintenance; and
    - h) Ensure PIU engage with and follow the Grievance Redress Mechanism GRM.
  23. Specific environmental safeguard responsibilities are set out for each project phase as shown in **Table 4**.

**Table 4: EMP Responsibilities**

Responsible Entity	Engineering Detailed Design	Tendering & Pre-construction	Construction	Operation
Ministry of Public Works and Transport, Executing Agency	Accountable towards the Royal Government of Cambodia and ADB for the implementation of the Subproject and for ensuring compliance with loan covenants			
PMU / PMU-ESO	Update IEE/EMP	Engage PMC & PMU-ESO	Ensure EMP is implemented, and that the contractor(s) abide by the EMP	
	Review updated EMP	Coordinating the tendering process including overseeing incorporation of EMP clauses into the bidding documents	Supervising project construction (with support of PMC engineers)	
	Confirm that mitigation measures have been included in engineering detail design	Ensuring the procurement of environmentally responsible contractors and approve CEMP	Prepare and submit quarterly and annual reports including environmental safeguard reporting to ADB	
		Ensuring that domestic EIA approvals by MoE have been secured prior to the awarding of civil works contracts		
		Dissemination and coordination of Grievance Redress Mechanism	Ensure EMP implementation and submit regular monitoring reports to Implementing Agency and EA	
			ensure PIU-SFPs undertake regular site inspections as part of progress reporting	
PIU-SFP		Attend all pre-construction training courses regarding EMP implementation Establish GRM	Working closely with the contractors to ensure EMP implementation	
			Support GRM	
			Support Progress Monitoring and Reporting requirements working with PMU-ESO	



Responsible Entity	Engineering Detailed Design	Tendering & Pre-construction	Construction	Operation
			Conduct consultation interviews with affected people	
Project Management Consultants PMC	Engage appropriate engineer and safeguards staff Finalise Detailed Engineering Design in accordance with Environmental Safeguard principles	See PMC-I/NES	See PMC-I/NES	Operator training and support as per ToR in PAM
Project Management Consultants PMC (PMC-I/NES)]	Update IEE/EMP if needed	Provide training on EMP supervision and GRM to PMU, PIU and contractors setting up environmental management and internal monitoring systems at PUSO and civil works contracts level review tender and contractor documents review the Contractor's Environmental Management Plan Ensure grievance redress mechanism established Regular EMP and implementation monitoring Assess the subproject's readiness in terms of environmental management (see <b>Table 10</b> ) Coordinate public consultations	coordinate public consultation with PMU/ ESO/ PIU-SFP preparing annual EMP progress reports identifying environment-related implementation issues and necessary corrective actions Training of PMU, PIU and other stakeholders GRM and EMP implementation	Organize, prior to project completion report (PCR) mission, a survey to assess community satisfaction with project implementation and EMP implementation performance. Draft environment sections of the PCR.

Responsible Entity	Engineering Detailed Design	Tendering & Pre-construction	Construction	Operation
		Undertake Environmental Compliance Audits of the waste dumpsites and incorporate findings in the IEE	Organize, prior to project completion report (PCR) mission, a survey to assess community satisfaction with project implementation and EMP implementation performance. Draft environment sections of the PCR.	
Contractor		<p>Prepare Contractor's Environmental Management Plan and provide environmental track record in bid response</p> <p>Obtain approval of the CEMP from PMU before starting any works at site</p>	Ensure sufficient funding and human resources for proper and timely implementation of required mitigation and monitoring measures in the EMP throughout the construction phase	Ensure handover of sites is in accordance with EMP and any corrective actions identified in Project Completion Report are completed.
			Appoint an Environment, Health and Safety (EHS) officer to oversee EMP implementation related to environment, occupational health and safety on construction site	Develop an Operation and Maintenance Manual.
			Ensure health and safety	Conduct testing prior to commissioning.
			Implement mitigation measures	
			Act as a local entry point for the project GRM and collaborate with PMU on all GRM issues	
External Monitoring Institute		Undertake specialised environmental monitoring as contracted by PMU	Undertake specialised environmental monitoring as contracted by PMU	Undertake specialised environmental monitoring as contracted by Operator
Operator			Testing prior to commissioning to ensure discharge standards can be met	Ensure proper operation of project facilities according to design standards & monitoring
				Allocation of budget for O&M

### 3.1. Capacity Building

24. Currently there is little experience of monitoring and implementing environmental mitigation measures particularly at a provincial level. There is little enforcement of environmental or health and safety legislation and routine environmental monitoring is not undertaken apart from in major urban centres (air quality) or major rivers (water quality).
25. During the preparation of the IEE the team checked the capacity and experience at MPWT and found that there are a number of people who have fulfilled the role of 'focal point' for safeguards on a project-by-project basis, and there is an established Safeguards Team within the ministry of six people. This team have experience of working on highways projects but have not to date been involved with urban development projects and are willing to be involved in any training and site visits required during project implementation and will be issued copies of relevant monitoring reports, EMPs and other relevant safeguards documents.
26. In addition, through understanding existing operations for the landfill in Phnom Penh, and provincial disposal sites, it is clear that there is limited ability for operation and maintenance. The limiting factors affecting the operators' ability to maintain adequate standards are likely to be a function of (i) a lack of technical capacity and experience; and (ii) insufficient budget. A training program is set out in Table 5 which addresses the safeguard reporting and implementation requirements during construction, and the environmental and social risks from operations.
27. The engagement of a National Environmental Specialist for a duration of about 10 months spread throughout implementation will be critical to ensure the capacity of the PIU staff and to ensure monitoring and reporting are managed effectively during implementation. This person will also work closely with the PMU Environment Safeguards Officer (PMU-ESO) in order to ensure safeguards are implemented and monitored training for EMP implementation. The proposed training required for project implementation is set out in Table 53. Specifically, the training requirements for the project include to train the PIU, the contractor, municipal officers, and other relevant stakeholders on the implementation of the EMP.
28. As further specified in the Detailed Engineering Design, the Contractor is required to develop an Operation and Maintenance Manual for approval by the PMU. At the end of the construction and commissioning phase, the Contractor shall provide an Operation and Maintenance Manager and relevant staff to operate the landfill facility for a three-months period during which the Contractor shall carry out on-the-job training of the employer's operators in operation and maintenance of the facility. The training shall include implementation of measures and performance monitoring to ensure and document compliance with regulatory requirements and standards.

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<sup>3</sup> For budgeting purposes, refer to the Feasibility Report Volume 5, Institutional Strengthening and Capacity Building

**Table 5: Capacity Building and Training Requirements**

Subject / Content	Participants	Trainer/ Organisation	When/ Frequency	Duration (days / event)	Number of participants
EMP adjustment and implementation - Development and adjustment of the EMP, roles and responsibilities, monitoring, supervision and reporting	PMU, PIU, contractors	I/NES of Project Management Consultants	Twice - Once prior to, and once after 6 months of construction	2	10
Grievance Redress Mechanism (GRM) and roles and responsibilities	PMU, PIU, contractors, Commune Councils	I/NES of Project Management Consultants	Twice - Once prior to, and once after 6 months of construction	1	10
Development of the CEMP (content, function, roles and responsibilities, safeguard standards)	PMU, PIU, contractors	I/NES of PMC	Twice: Upon contract award and after submission of the first draft	1	5
On-the-job training on the implementation of the CEMP including monitoring and reporting requirements	PMU, PIU, contractors	I/NES of PMC	Twice: at the start of construction and 6 months into construction	2	5-10
Environmental protection Pollution control on construction sites (air, noise, effluents, solid waste)	PMU, PIU, contractors	I/NES of Project Management Consultants	Once (during project implementation)	2	10
Environmental monitoring - Monitoring methods, data collection and processing, reporting systems	PMU, PIU, contractors, Operators of Landfill	I/NES of Project Management Consultants & MoE (environmental analyst)	Once (at beginning of project construction)	2	10
CEMP implementation: Health and safety Pollution control and minimisation of disturbances Monitoring and reporting	Contractor's staff	Contractor's Environment, and Health and Safety Officers	To be specified in the CEMP	To be specified in the CEMP	To be specified in the CEMP
Operation and Maintenance	Operator staff	Contractor	On-the-job training over a three-months period	Daily	To be determined

## 4. MITIGATION MEASURES PLAN

### 4.1. Overview of Mitigation Measures

29. The Impact Mitigation Plans for the Subproject are presented in **Table 7: Pre-Construction Phase Mitigation Measures**, **Table 8: Construction Phase Mitigation Measures**, and **Table 9: Operational Phase Mitigation Measures**.

### 4.2. Contractor's Environmental Management Plan

30. The contractor is required to prepare the Contractor's Environmental Management Plan (CEMP) for review and approval by the PMU and PMC. The CEMP shall be prepared in accordance with the IEE and EMP for the Subproject approved by ADB and any other requirements stipulated in the bidding documents.
31. PMC has developed a CEMP template to guide the preparation of the CEMP.

#### 4.2.1. CEMP Subplans

32. The CEMP for this Subproject shall include the following subplans:
- Materials, Spoil and Borrow Site Management
  - Solid and liquid waste management
  - Air emissions management and monitoring
  - Noise and vibrations management and monitoring
  - Hazardous materials management
  - Management of incoming solid waste
  - Relocation of existing waste and clean-up of the existing waste dump
  - Erosion and sediment control
  - Surface water and groundwater monitoring
  - Community and Occupational Health and Safety
  - Emergency Preparedness and Response
  - Traffic Management
  - Labour Camp Management
  - COVID-19 health and safety subplan in accordance with national COVID-19 instructions and regulations.

#### 4.2.2. Borrow Pit and Spoil Disposal Site Selection

33. The contractor shall include the site selection criteria stipulated in **Table 6** when proposing sites for borrow pits and spoil disposal.

**Table 6: Site Selection Criteria for Borrow Pits and Spoil Disposal Sites**

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

Site Selection Criteria	Proposed Site Conditions
Not where groundwater emerges or a thick organic layer is present	
Above the 0.05 (5%) Annual Exceedance Probability flood line	
Backfilling of excavation voids (for spoil disposal)	

**Table 7: Pre-Construction Phase Mitigation Measures**

Sub-Project Activity	Environmental Risk or Impact	Pre-Construction Phase Mitigation Measures	Implemented by	Supervised by	Cost (\$)
National IESIA Approval	All	1. The IESIA has been prepared and it was approved by the MoE on 20 May 2021	PMU-PMC Local Firm	MoE	Included in project cost
Design	Surface water and groundwater pollution	2. The final detailed engineering design of the landfill ensures proper leachate containment, collection, treatment and recirculation preventing risks to surface water and groundwater	PMC-NIES	PMU	Part of Contract Cost
Disclosure and engagement of community through consultation	Any community related risks or impacts	3. Inform and consult with local communities about the final design, mitigation measures and the Grievance Redress Mechanism	PMU-ESO/ PIU-SFP	EA	Included in PMC cost package
Unexploded Ordnance (UXO) survey, & removal	Risk of injuries or fatalities among workers or members of the public	4. Ensure national military is consulted to confirm that all relevant areas are clear from UXO. This includes: a) All land designated for resettlement purposes (residential/businesses/farmland) b) All construction sites including 50 m either side of any access roads c) All associated areas including borrow sites. 5. Cambodian Mine Action Centre to clear areas where necessary and provide evidence of clearance to PMU in advance of construction. 6. As evidence, submit a certificate of UXO clearance and attach it as an annex to the subsequent monitoring report to ADB once the certificate of clearance has been awarded.	Cambodian Mine Action Centre PIU	PMU/PMC	To be confirmed as required
Tree survey for protection or cutting	Loss of trees	7. Survey for trees higher than 3 m within the construction area for protection or removal. Ensure DWPT and the local authorities have been informed and obtain a permit for tree removal. Addition replantation shall be sought upon completion of the work	Contractor	PMU/PMC	included in the bid price
Final Design	Flooding/ Climate Change	8. The final design incorporates adequate flood protection measures also considering climate change risks	PMC	EA	Included in consultancy contract price
Final Design	Emergency	9. The CEMP shall include an Emergency Response Plan 10. The operation and maintenance plan to be prepared prior to start operations shall include an emergency response plan	PMC	EA	Included in consultancy contract price

Sub-Project Activity	Environmental Risk or Impact	Pre-Construction Phase Mitigation Measures	Implemented by	Supervised by	Cost (\$)
Closure of waste dumpsites	Groundwater, surface water, public health	11. Undertake Environmental Compliance Audit of the dumpsites and incorporate the findings in the IEE and EMP	I/NES	PMU	Included in project cost
IEE and EMP Updated	All	12. The IEE and EMP have been updated reflecting the final detailed engineering design and incorporate appropriate mitigation measures.	I/NES	PMU	Included in project cost
Contractor's Environmental Management Plan (CEMP)	All construction related risks and impacts	13. The contractor shall prepare the CEMP for review and approval by PMC and PMU prior to starting any work on site	Contractor	PMC, PMU / EA	Included in project cost
GRM	Any risk or impact perceived as affected persons	14. Erect sign boards with project details and GRM procedures/contact details at the entrance to each construction site/camp or at strategic locations. 15. PMU to provide contractor with GRM contact details which the contractor will use to print 'GRM Contact Cards' for its staff to hand to complainants and will keep cards with all vehicles, machinery and site managers/foremen. 16. Contractor to raise awareness of all workers on how to respond when an affected person or member of the public has a complaint i.e. direct the person to the most senior site manager present at the time and provide a 'GRM Contact Card'.	Contractor	PMU/ PIU/ PMC	Included in bid price

**Table 8: Construction Phase Mitigation Measures**

Sub-Project Activity	Environmental Risk or Impact	Construction Phase Mitigation Measures	Implemented by	Supervised by	Cost (\$)
Civil works	Air quality	1. Select Borrow sites located as close as possible to the proposed landfill site to reduce distances. 2. Concrete batching facilities will be located at least 500 m (0.5 km) downwind from the nearest dwellings in order to reduce the impact of dust and fumes on humans and to be fitted with necessary equipment such as bag house filters to reduce fugitive dust emissions. 3. Water will be regularly sprayed to suppress fugitive dust at construction sites, material handling areas, access road and borrow pits. 4. Trucks carrying dry construction materials such as earth or waste will be covered with tarpaulins or other suitable cover. 5. Construction vehicles and machinery will be maintained to a high standard to minimize emissions and ensure compliance with the National exhaust emission standards. All mobile equipment should be fitted with catalytic converters. 6. A speed limit of 30 km/h for construction related traffic through inhabited areas and on the access road will be enforced.	Contractor	PMU/PMC	Included in bid price



Sub-Project Activity	Environmental Risk or Impact	Construction Phase Mitigation Measures	Implemented by	Supervised by	Cost (\$)
		<p>7. All open burning of construction and demolition waste material and refuse will be prohibited.</p> <p>8. Air quality monitoring will be carried out as prescribed in <b>Table 11</b></p>			
Civil Works	Noise	<p>9. Maintain all exhaust systems in good working order and undertake regular equipment maintenance to ensure compliance with applicable regulations and manufacturers' instructions.</p> <p>10. Implementation of operating and maintenance practices of equipment and machinery to ensure that they are well-maintained.</p> <p>11. Ensure that noise control options such as silencers and mufflers are fitted to exhausts, compressors and fans for construction equipment (such as hydraulic excavator, bulldozer, front loader, backhoe and trucks).</p> <p>12. Restrict construction activities using heavy machinery work between 8 am and 6 pm.</p> <p>13. Provide advance warning to the community on timing of noisy activities. Seek suggestions from community members to reduce noise annoyance and notify the communities about how to raise their concerns (if any) through the Grievance Redress Mechanism.</p> <p>14. Undertake noise monitoring at the closest residential area and other noise sensitive receptor during times with ongoing construction work to ensure compliance with the relevant noise standards.</p> <p>15. The contractor shall provide all construction personnel working in the vicinity of noisy construction activities (defined as those activities generating noise levels greater than 80 dB(A)), or any construction personnel who requests hearing protection, with hearing protection equipment.</p> <p>16. A speed limit of 30 km/h for construction related traffic through inhabited areas and on the access road will be enforced.</p> <p>17. Noise monitoring will be carried out as prescribed in <b>Table 11</b></p>	Contractor	PMU/PMC	Included in bid price
Civil Works	Flora or vegetation	<p>18. In accordance with the permit to cut or remove trees (to be obtained prior to start construction), all trees over 3 m in construction sites (landfill site and access road) shall be preserved, if they are not required and permitted to be removed. The cutting and removal of trees shall be informed to DPWT and the local authorities.</p> <p>19. An inventory shall be held of trees to be cut and addition replantation shall be sought upon completion of the work.</p> <p>20. Where possible, material from existing licensed borrow and quarry sites will be used. If new sites are needed, they will be subject to due diligence and approval by ADB, the PMU and Kratie PDoE to ensure that sensitive habitats are avoided and that an appropriate restoration plan (recontouring and replanting with native species).</p> <p>21. Set out the area to be cleared for vegetation and restrict land clearance to only the land required for the landfill components.</p>	Contractor	PMU/PMC	Included in bid price

Sub-Project Activity	Environmental Risk or Impact	Construction Phase Mitigation Measures	Implemented by	Supervised by	Cost (\$)
		<p>22. Provide awareness to construction staffs and follow up strictly monitoring on forest and wildlife resources management. The cutting of timber, and hunting or fishing and trading in wildlife will be prohibited.</p> <p>23. Burning to clear and control vegetation will be prohibited.</p> <p>24. The use of herbicides to control vegetation will be prohibited.</p>			
Civil Works	Surface Water and Groundwater	<p>25. Installation of temporary non-erodible ditches or bunds at the construction site to divert clean runoff away from exposed areas, and convey potentially dirty runoff to sediment control devices.</p> <p>26. Stockpiles and materials will be stored at least 50 m from surface waters with drainage directed away from the canals or drainage channels and streams or water sources.</p> <p>27. No washing or repair of machinery within 50 m of surface waters.</p> <p>28. Topsoil present on the construction site will be removed and stockpiled in labelled areas for later use in rehabilitation of the construction site.</p> <p>29. Construction working areas will be clearly demarcated and encroachment onto adjacent areas avoided.</p> <p>30. A vegetation buffer shall be maintained between the construction site and the nearest water body (small stream on the north-eastern part of the site).</p> <p>31. Portable toilets and small wastewater treatment units will be provided at the construction site and labour camps. All sanitary facilities will be located at least 50 m from surface water bodies. All workers must be instructed to use these facilities, which shall be kept clean at all times.</p> <p>32. Pit latrines and septic tanks should be placed at least 2 m above the groundwater table must be located at least 50 m from surface water bodies and water wells and in areas of suitable soil profiles.</p> <p>33. All hazardous materials including hazardous waste will be stored on an impervious surface, under cover, in adequate tanks or containers and within secondary containment. A bund will be provided around any above ground fuel storage tank with capacity of 110% of the largest single tank. Storage of hazardous materials shall be at least 50 m from surface water bodies with no direct drainage to surface water.</p> <p>34. Areas where spills of fuel or oil may occur will be equipped with easily accessible spill control kits to assist in prompt and effective spill control.</p> <p>35. Refuelling of machineries by service vehicles will be conducted with measures preventing oil spillage during refuelling including placement of buckets under refuelling nozzles.</p> <p>36. Stationary equipment such as motors, pumps, generators will be positioned over drip pans.</p> <p>37. Runoff accumulating at the bottom of excavation pits during construction will be pumped out, reused where practicable or otherwise conveyed to appropriate sediment retention devices before being discharged to the environment.</p>	Contractor	PMU/PMC	Included in bid price

Sub-Project Activity	Environmental Risk or Impact	Construction Phase Mitigation Measures	Implemented by	Supervised by	Cost (\$)
		<p>38. Hazardous waste (oil waste) shall be properly collected and stored in closed containers under shelter for recycling or disposal by a duly authorized enterprise.</p> <p>39. Water monitoring will be carried out as prescribed in <b>Table 11</b></p>			
Excavation	Unanticipated finding of artifacts	40. Upon a chance find of an artifact, all work will be stopped immediately, find left untouched, and the PIU will be notified to determine the next step and contact the responsible authority, if necessary.	Contractor	PMU/PMC	
Spoil and Borrow Site Management	Flora and Fauna Soil and land resources	<p>41. Where possible existing borrow pits or spoil disposal sites shall be used. If new sites are needed, the contractor shall obtain approval from the relevant authorities and from PMU/PMC to ensure that sensitive habitats are avoided and that appropriate mitigation and rehabilitation measures will be implemented.</p> <p>42. obtain and document agreement with the landowner;</p> <p>43. ensure minimisation of vegetation and habitat loss and limit land clearance to only the land required for the borrow pit / spoil disposal;</p> <p>44. Set out the site boundaries and ensure that the surrounding land is not disturbed;</p> <p>45. prohibit the use of burning to clear and control vegetation;</p> <p>46. ensure that spoil is disposed of only at the designated disposal sites and that no material is side tipped along roads or down slopes, dumped on private or public land, or dumped in water bodies;</p> <p>47. ensure that all necessary disposal site preparation activities are completed prior to the start of the related spoil generation, handling and disposal;</p> <p>48. The contractor shall install erosion and sediment controls such as sedimentation ponds, non-erodible channels or bunds at each site and progressively adjust the measures as the landform changes, to minimise on-site erosion and prevent off-site sedimentation;</p> <p>49. ensure that only inert waste is disposed of at spoil disposal sites;</p> <p>50. ensure that roots and stumps and other vegetation debris are separated from the spoil materials prior to disposal and either mulched on-site for reuse in landscaping or ground stabilization works, left to decompose naturally, or otherwise safely disposed;</p> <p>51. conduct routine inspections, not less frequently than once a week, of water pollution, erosion and sediment control measures, and promptly undertake necessary maintenance, repair and upgrading works to ensure that the design capacity is maintained;</p> <p>52. undertake inspections within 24 hours of a heavy rainfall event;</p> <p>53. undertake progressive rehabilitation of disturbed areas taking into consideration what the final land use will be;</p> <p>54. conserve topsoil for later site rehabilitation;</p> <p>55. recontour the sites, fill depressions and revegetate the sites to create a final surface that is consistent with the original topography of the area;</p>	Contractor	PMU/PMC	Included in bid price

Sub-Project Activity	Environmental Risk or Impact	Construction Phase Mitigation Measures	Implemented by	Supervised by	Cost (\$)
		<p>56. design the final landforms and slopes to protect groundwater quality, to prevent surface water ponding, to facilitate revegetation, to convey runoff in a non-erosive manner, and to account for long term settlement;</p> <p>57. revegetate the sites in such a way as to establish a diverse, effective, and long-lasting vegetative cover that is capable of self-regeneration without continued dependence on irrigation, soil amendments or fertilizer, and is at least equal in extent of cover to the natural vegetation of the surrounding area;</p> <p>58. use appropriate native and non-invasive plant species for re-vegetation and rehabilitation work.</p>			
Solid and Liquid Waste Management	Resource use and natural resource contamination	<p>59. Preparation of a Waste Management Plan as part of the CEMP before construction which applies the waste hierarchy to ensure efficient use and management of resources with a priority to prevent waste at source followed by recycling, and with disposal as the last resort.</p> <p>60. Recyclables will be separated at source and given/sold to recycler (plastic, metal, card, paper as a minimum).</p> <p>61. Safe temporary storage of hazardous waste as required under <b>Bullet 33</b>.</p> <p>62. To the extent possible, a duly authorized waste company will be contracted to recycle hazardous waste. Any remaining hazardous waste will be disposed in the Hazardous Waste Cell once completed.</p> <p>63. Non-hazardous, non-recyclable solid waste will be temporarily deposited and managed together with the incoming domestic waste and relocated to Cell 1 once the cell is ready to receive waste.</p> <p>64. There will be no burning of waste at the site.</p> <p>65. All vehicles/drivers will be provided with plastic bags for waste collection and prevent any unauthorized waste disposal with particular attention paid to prevention of littering.</p> <p>66. The Contractor will be required to train the workers in proper waste management.</p>	Contractor	PMU/PMC	Included in bid price
Closure of the existing dumpsite at the landfill site and management of incoming waste	Surface water, groundwater, occupational health and safety, public health	<p>67. Fence off the dumpsite area.</p> <p>68. Extinguished fires and prevent new fires.</p> <p>69. Clear the and remove vegetation without mixing it with waste.</p> <p>70. Test the water in the small pond and then reused it for dust suppression or treat it as necessary, before discharging it to the environment.</p> <p>71. Bulldoze the existing waste into low waste cells and cover with soil.</p> <p>72. Excavated narrow trenches to determine the depth of the waste deposits.</p> <p>73. Inspect and record incoming waste prior to disposal.</p> <p>74. Incoming waste will be built into waste cells and covered with soil;</p> <p>75. Construct temporary ditches and bunds to control leachate and manage surface runoff.</p> <p>76. Convey leachate to a small pond/tank for temporary storage until the leachate treatment system is ready to receive leachate.</p>	Contractor	PMU/PMC	Included in bid price

Sub-Project Activity	Environmental Risk or Impact	Construction Phase Mitigation Measures	Implemented by	Supervised by	Cost (\$)
		77. Train the informal recyclers in health and safety precautions and provide them with appropriate PPE; 78. Register the informal recyclers and ensure that only licensed adult recyclers work on the site. 79. When Cell 1 is ready to receive waste then excavate and deposit the waste under constant supervision by a trained supervisor (this includes the waste from the existing dumpsite and the domestic waste that has been temporarily deposited during the construction phase) in Cell 1 in accordance with the relevant waste management procedures.			
Community Health and Safety	Human health and safety	80. Prior to start of construction work, the contractor in cooperation with the PIU will consult with the local authorities and potentially affected residents. Inform them about the upcoming construction work, safety precautions and how to raise concerns or file complaints (GRM); 81. The contractor shall fence off the landfill construction area and control access to the site. 82. A speed limit of 30 km/h for construction related traffic through inhabited areas and on the access road will be enforced. 83. The contractor shall install traffic signage and fluorescent bollards and warning lights to direct traffic and prevent vehicles driving into the lanes with construction activities. 84. The contractor in cooperation with the local authorities shall implement traffic management to ensure a smooth traffic and prevent congestion. 85. Mitigation measures towards the risk of SARS-CoV-2 transmission and transmission of sexually transmitted diseases are included under item 101 and items 105-123	Contractor	PMU/PMC	Included in bid price
Occupational Health and Safety and Emergency Response	Human health and safety	86. Prepare a health and safety plan containing site-specific precautions in accordance with relevant occupational health and safety guidelines; 87. Inspect and check the relevant construction equipment to ensure that it meets the applicable mechanical and safety requirements; 88. Inspect the worksite to ensure that the equipment can be safely mobilized and operated, and that there are no unmitigated risks; 89. Install appropriate fencing and control access to the site; 90. Install appropriate safety signage and markings; 91. Provide fall protection when workers are exposed to unguarded platforms or walkways higher than 2 m; 92. Ensure there are safe ways to enter and exit the excavation; 93. Keep excavations dry; 94. provide safety precautions when using high voltage electric power tools; 95. carry out daily toolbox meetings (safety briefings); 96. Maintain an accident record book where all major or minor accidents and incidents are recorded with actions taken; 97. Educate the workers on construction hazards;	Contractor	PIU/PMU/PMC	Included in bid price

Sub-Project Activity	Environmental Risk or Impact	Construction Phase Mitigation Measures	Implemented by	Supervised by	Cost (\$)
		98. Train drivers on safe driving skills and traffic regulations; 99. Appoint an Environment, Health and Safety Officer who is a qualified engineer; 100. Make adequate first aid equipment available on site; 101. carry out training and awareness of the workers on HIV-AIDS prevention; 102. implement emergency preparedness and response procedures Response Plan as planned in the CEMP. 103. Ensure that all workers are equipped with and use Personal Protective Equipment (PEE). 104. The Contractor will set out an Emergency Response Plan			
Protection against the COVID-19 disease	Transmission of SARS-CoV-2 virus	105. Plan and execute work in compliance with country-specific COVID-19 risk management regulations and directives including directions of the General Department of Labour, MoLVT. 106. Conduct workplace risk assessment to identify low, medium or high exposure risk to COVID-19. Prepare an action plan for prevention and mitigation of the spreading of COVID-19. 107. Monitor the implementation of COVID-19 measures and apply the checklists in <b>Annex 7</b> . 108. Conduct Risk communication, training, and education. Training of workers in infection prevention and control practices. 109. Dissemination about COVID-19 prevention and mitigation measures to staff and workers through orientation or distributing leaflet/poster at information/safety board at each construction and camp site. 110. Daily checking temperature of staff and workers prior starting the works. 111. Staff and workers have to wear masks all the time and properly. 112. Do not share personal items or supplies such as phones, pens, notebooks, tools, etc. 113. Avoid common physical greetings, such as handshakes. 114. Maintain a minimum physical distance of one metre from others if possible. 115. Wash hands often with soap and water for at least 20 seconds after using the washroom, before handling food, after blowing nose, coughing, or sneezing, and before smoking. If hands are not visibly soiled, and soap and water are unavailable, alcohol-based hand sanitizer can be used. 116. All offices and jobsites implement additional cleaning measures of common areas. All door handles, railings, ladders, switches, controls, eating surfaces, shared tools and equipment, taps, toilets, and personal workstation areas are wiped down at least twice a day with a disinfectant, such as disinfectant wipes. Individuals are responsible for cleaning and disinfecting their workstations. 117. Commonly touched surfaces on vehicles and equipment are thoroughly cleaned and disinfected at the end of shifts and between users.	Contractor	PMU/PMC	Included in bid price

Sub-Project Activity	Environmental Risk or Impact	Construction Phase Mitigation Measures	Implemented by	Supervised by	Cost (\$)
		<p>118. Coughing or sneezing into a tissue or the bend of your arm, not your hand; And dispose of any tissues you have used as soon as possible in a lined waste basket and wash your hands afterwards.</p> <p>119. Responding measures if there is a COVID-19 case:</p> <p>120. Individuals who have been potentially exposed to the virus, or who are exhibiting flu-like symptoms such as fever, tiredness, coughing, or congestion are instructed to: Not come to work; Contact their supervisor and/or human resources department; Stay at home and self-isolate; and contact local health authorities for further direction.</p> <p>121. Such individuals are required to follow the directions of the local health authority and may not return to work until given approval by the proper health authorities.</p> <p>122. Individual who begin to display flu-like symptoms on site are instructed to avoid touching anything, take extra care to contain coughs and sneezes, and return home immediately to undergo self-isolation as directed by the local health authority.</p> <p>123. All areas on site potentially infected by a confirmed or probable case are barricaded to keep individuals two meters away until the area is properly cleaned and disinfected.</p>			
Labour Camp Management	Contamination of water, soil, waste production and social issues	<p>124. If a camp for construction workers is required, the contractor will set out a camp management plan in the CEMP together with a location map and a site layout map indicating the site facilities and infrastructure.</p> <p>125. The camp will have adequate and separate accommodation and sanitation facilities for male and female workers, and the facilities will meet good standards of health, hygiene and comfort.</p> <p>126. There will be adequate supply of clean and safe water, adequate waste and wastewater disposal systems, appropriate protection against heat, cold, noise, damp, fire and disease-carrying or poisonous animals (e.g. insects)</p> <p>127. Relevant training on camp management will be provided to all staff.</p> <p>128. Priority will be given to employ local labour and retain evidence of how local labour recruitment efforts were undertaken.</p> <p>129. At the end of the construction phase, all camp facilities, structures, installations and pavements (above ground and below ground, fixed and moveable) will be dismantled or demolished and removed (reused, sold/recycled, disposed of as waste) from the site.</p> <p>130. All chemicals, waste and pollution will be removed and safely disposed of.</p> <p>131. Septic tanks and other sanitary/waste disposal systems will be emptied, and the content disposed of in accordance with local regulations. The installations will be excavated and removed.</p> <p>132. The site will be recontoured, depressions backfilled. Topsoil will be applied, and the site will be revegetated</p>	Contractor	PMU/PMC	Included in bid price

Sub-Project Activity	Environmental Risk or Impact	Construction Phase Mitigation Measures	Implemented by	Supervised by	Cost (\$)
Emergency Preparedness and Response	Emergencies	<p>133.Preparation of an Emergency Preparedness and Response Plan.</p> <p>134.The Emergency Preparedness and Response Plan will contain:</p> <ol style="list-style-type: none"> <li>Emergency preparedness and response responsibilities</li> <li>Identification of hazards that may lead to an emergency situation</li> <li>Identification of people at risk</li> <li>Emergency response procedures</li> <li>Detection, evaluation and emergency level determination</li> <li>Notification and communication</li> <li>Emergency action</li> <li>Termination and follow-up</li> <li>Prevention and preparedness</li> <li>Training and exercises</li> <li>Emergency contacts</li> </ol> <p>135.The Emergency Preparedness and Response Plan will address the following emergencies:</p> <ol style="list-style-type: none"> <li>Traffic accident</li> <li>Serious injuries</li> <li>Fire</li> <li>Explosion</li> <li>Flooding</li> <li>Electrocution</li> <li>Chemical spill</li> <li>Structural collapse</li> <li>Poisoning</li> </ol>	Contractor	PMU/PMC	Included in bid price

**Table 9: Operational Phase Mitigation Measures**

Sub-Project Activity	Environmental Risk or Impact	Operational Phase Mitigation Measures	Implemented by	Supervised by	Cost (\$)
Start-up Phase Operation of the WWTP and networks	All	<ol style="list-style-type: none"> <li>The contractor shall develop an operation and maintenance manual for approval by the PMU and PMC.</li> <li>The contractor shall operate the landfill over a three-month period. The contractor shall provide an operations and maintenance manager and relevant operations and maintenance staff to operate the landfill. During the three-month period, the contractor shall and conduct on-the-job training of the operator's staff.</li> <li>The operation and maintenance plan shall include an environmental management plan (based on this EMP) for the operational phase. Minimum measures include: <ul style="list-style-type: none"> <li>Procedures for compacting and covering waste</li> </ul> </li> </ol>	Contractor	MPWT MoE	Included in bid price



Sub-Project Activity	Environmental Risk or Impact	Operational Phase Mitigation Measures	Implemented by	Supervised by	Cost (\$)
		<ul style="list-style-type: none"> <li>Controlling and minimising windblown waste</li> <li>Procedures for handling of non-hazardous waste</li> <li>Procedures for controlling and recording waste disposed of at the landfill, including origin, quantity, type of waste, collector.</li> <li>Operational procedures for leachate management</li> <li>Procedures for handling of hazardous waste including, transportation, labelling, temporary storage, separation according to their type and risks, and permanent disposal - in line with local and international regulations.</li> <li>Pests management procedures.</li> <li>Health and safety hazards and use of PPEs</li> </ul>			
Waste Handling and Disposal	Odour, dust, and fires	<ol style="list-style-type: none"> <li>All fuels or flammable solvents for operational use will be stored on an impervious surface, under cover, in adequate tanks or containers and within secondary containment. A bund will be provided around any above ground fuel storage tank with capacity of 110% of the largest single tank. Storage of such materials will be at least 50 m from surface water bodies with no direct drainage to surface water.</li> <li>Ensure that the waste is compacted and regularly covered with soil.</li> <li>Highly biodegradable and odorous wastes will be buried immediately with appropriate cover material.</li> <li>Spray water for dust suppression, particularly over exposed waste surfaces.</li> <li>Reduce drop heights where practicable.</li> <li>Set-up nets downwind of operated cell to capture potential windblown litter.</li> <li>Carry out weekly litter collection and removal of any wastes which are not deposited in cells, including waste at the boundary and access roads to the site.</li> <li>All transport of waste will be done with covered trucks.</li> <li>The access road and the internal roads will have concrete pavement thereby reducing dust generation.</li> <li>Washing wheels of vehicles before they leave site if they are muddy from accessing the landfill cells.</li> <li>Quarterly meetings with residents and / or their representatives to identify odour or nuisance issues.</li> <li>Provide and maintain a vegetation buffer with tree plantings around and in the landfill site to reduce noise, dust and odours.</li> <li>Gas generated at landfill will be ventilated to atmosphere. There is no plan to flare recovered landfill gas, but the design allows for retrofitting for flaring should that be necessary in the future.</li> <li>Implement strict control with fire risks at the landfill site including prevention of burning and smoking.</li> <li>A fire response team will be designated and trained to intervene in case of fire at the landfill.</li> </ol>	Operator	MPWT MoE	Included in operational costs

Sub-Project Activity	Environmental Risk or Impact	Operational Phase Mitigation Measures	Implemented by	Supervised by	Cost (\$)
		19. A fire water tank will be available at the landfill. 20. Odour monitoring will be carried out as prescribed in <b>Table 12</b> .			
Hazardous Waste Handling and Disposal	Health and safety, air quality, fire and explosion risk	21. Incoming hazardous waste will be inspected prior to acceptance. 22. The waste acceptance policy for hazardous wastes will be detailed in the Operation and Maintenance manual. It is envisaged that the majority of this waste will be securely stored in either HDPE plastic or steel drums, with exact requirements specified in the Operation and Maintenance manual. 23. Inspection and sorting of hazardous waste, temporary storage of recyclable hazardous waste and packaging of hazardous waste for disposal will take place in the Hazardous Waste Storage Facility. 24. The Hazardous Waste Storage Facility will be well ventilated and will have a sealed floor to control any spills.			
Stormwater drainage	Surface water, erosion, structural integrity	25. Drains will be constructed throughout the site in the form of reinforced concrete-lined open ditches and reinforced-concrete covered drains. These drains will divert storm water away from roads, landfill cells, buildings and facilities. The storm water will be discharged into the buffer zone. 26. Clean-up and remove litter and debris from drainage systems.			
Leachate Management	Surface water and Groundwater	27. The landfill cell design includes a single composite liner, which will block infiltration of leachate. The liner will consist of a 1 m thick low permeable compacted clay layer, a HDPE geomembrane and a protective geotextile. 28. Specific leachate management procedures to be included in the Operation and Maintenance Manual will strictly implemented. 29. Ensure proper containment of hazardous waste in designated drums before disposal in the hazardous waste cell. 30. Drains will be constructed throughout the site in the form of reinforced concrete-lined open ditches and reinforced-concrete covered drains. These drains will divert storm water away from roads, landfill cells, buildings and facilities. The storm water will be discharged into a ditch, which will be constructed as a simple natural channel, which will transport water to the existing pond that is on the site, which will act as a stormwater storage facility. 31. Potentially contaminated water, including leachates, will be treated prior to discharge to the environment. A series of leachate treatment ponds will ensure that in case of a rare release of leachate to the environment, effluent standards are likely to be met and that the absorptive capacity of the receiving waterways is not exceeded and not causing health risks to users of the water. 32. Leachate production will be minimised by (i) intercepting surface water run-on to the site and internal runoff, (ii) intermediate cover and waste compaction to reduce infiltration into the waste, (iii) building waste in pyramidal phases as opposed to being spread across the whole cell; and (iv) completing the main phases prior to the onset of the wet season.	Operator	MPWT MoE	Included in operational costs

Sub-Project Activity	Environmental Risk or Impact	Operational Phase Mitigation Measures	Implemented by	Supervised by	Cost (\$)
		<p>33. Ensure that only waste leachate is sent to the leachate treatment facility by separating rainwater from the inactive parts of a cell and discharging it as clean stormwater. Each section of a cell will be equipped with an interchangeable pipe system, initially set to stormwater, and subsequently turned via a valve to the leachate transport system when waste is deposited in that particular area.</p> <p>34. Operation of a low tech, easy to maintain, biological leachate treatment facility. Leachate is moved via gravity through a series of ponds: an anaerobic lagoon, aerobic lagoon, and a maturation lagoon in the form of a constructed wetland. There will also be a final treated water lagoon, which will provide a storage for the water and connected to a leachate recirculation system returning the liquid to the waste to manage flow rates and accelerate uniform settlement of the waste.</p> <p>35. Always comply with required operating standards to ensure effective treatment of leachates.</p> <p>36. Allocate adequate budget for O&amp;M of the landfill and surface water management.</p> <p>37. Recirculation of leachate to the landfill as necessary and practicable.</p> <p>38. In case of discharged effluents, monitor and report the quality of receiving water bodies around the landfill site.</p> <p>39. Protect the liner throughout lifespan of the landfill and ensure that it is not damaged by the daily waste handling operations.</p> <p>40. Groundwater and surface water quality monitoring will be carried out as prescribed in <b>Table 12</b></p>			
Landfill Operation	Pests, and spread of infectious diseases	<p>41. Conduct regular monitoring and recording of key vectors as part of landfill operations and management</p> <p>42. Provide worker immunization and health monitoring (e.g. for Hepatitis B and tetanus);</p> <p>43. Maintain good housekeeping in waste processing and storage areas</p> <p>44. Promptly compact and cover wastes in operated cells, especially for waste with the potential to attract vermin and flies, such as food wastes</p> <p>45. Grade the area properly to prevent ponding (to minimize insect breeding areas);</p> <p>46. Use integrated pest-control approaches to control vermin levels, treating infested areas</p> <p>47. Fully enclose the waste management site with fencing so that no livestock or wildlife is able to come in contact with the waste and thus prevent spread of livestock and zoonotic disease.</p>	Operator	MPWT MoE	Included in operational costs
Landfill Closure	Landscape Alteration and erosion	<p>48. Preventing infiltration by adding a cover at the top of the cell, consisting of topsoil (150 mm), Intermediate layer (150-300 mm), barrier layer (600 mm) and a gas collection layer (150 – 300 mm).</p>	Operator	MPWT MoE	Included in operational costs

Sub-Project Activity	Environmental Risk or Impact	Operational Phase Mitigation Measures	Implemented by	Supervised by	Cost (\$)
		<p>49. Re-vegetation of the cover shall be facilitated by a cover of topsoil and seeding with local appropriate species.</p> <p>50. Monitoring should be conducted even after closure of the cells. The monitoring should include structural movements and settlement, groundwater, landfill gas, leachate, and revegetation and erosion</p>			
Landfill Operation	Occupational Health and Safety	<p>51. Preparation and implementation of a health and safety plan containing: (1) procedures to eliminate or minimize the risk of exposure to biological agents and pests, (2) personal hygiene practices, (3) instructions in proper use of personal protective equipment, (4) emergency procedures.</p> <p>52. The Operator will appoint an Environment, Health and Safety Officer who is a qualified engineer.</p> <p>53. Worker education and awareness seminars for landfill-related hazards will be given. A site safety program will be developed by the operator and workers shall be trained regularly.</p> <p>54. The site operator HSE supervisor should conduct daily toolbox meetings (safety briefings)</p> <p>55. An accident record book will be maintained where all major or minor accidents and incidents are recorded with actions taken.</p> <p>56. Access to site will be prevented through appropriate fencing, protective barriers, and buffer zones for all non-authorized personnel. All entrances should be recorded. Video cameras should also be put in place around the perimeter of the site.</p> <p>57. Sufficient signage giving health and safety warnings and information disclosed at the entrance of all sites.</p> <p>58. Avoid aerosolizing leachate during recirculation.</p> <p>59. Avoid direct contact with waste.</p> <p>60. Undertake regular health checks of workers/staff.</p> <p>61. Ensure that all workers and informal recyclers are equipped with and use Personal Protective Equipment. This includes use of appropriate protective clothing at work (coveralls) and hard hat, safety boots, gloves, goggles and, where required respiratory protective equipment.</p> <p>62. Adequate first aid equipment will be made available on site for landfill operators and informal recyclers.</p> <p>63. Potential impacts to workers due to COVID-19 will be mitigated through specific measures set out in items 69-79 and in Annex 7.</p> <p>64. Firefighting equipment and a trained firefighting team will be present on site.</p> <p>65. The operator will prepare an Emergency Response Plan.</p>	Operator	MPWT MoE	Included in operational costs
Landfill Operation	Community Health and Safety	<p>66. The operator will install a sign board with relevant contact details and operating hours at the entrance to the landfill site. It will state contact details for raising complaints.</p>	Operator	MPWT MoE	Included in operational costs

Sub-Project Activity	Environmental Risk or Impact	Operational Phase Mitigation Measures	Implemented by	Supervised by	Cost (\$)
		<p>67. The contractor will record all public complaints and deal with them within a timeframe agreed with MPWT.</p> <p>68. The operator will develop a Traffic Management Plan for movement of vehicles within the landfill site, and to and from the landfill site. Traffic management must include regular monitoring of traffic safety both within construction site and on public road.</p>			
Protection against the COVID-19 disease	Transmission of SARS-CoV-2 virus	<p>69. Conduct workplace risk assessment to identify low, medium or high exposure risk to COVID-19. Prepare an action plan for prevention and mitigation of the spreading of COVID-19.</p> <p>70. Conduct Risk communication, training, and education. Training of workers in infection prevention and control practices</p> <p>71. Adopt engineering, organizational and administrative measures, plan work so employees can keep distance from each other and minimise contact.</p> <p>72. Provide clear and visible guidelines on how to prevent infection at the construction site and initiatives taken.</p> <p>73. Regularly clean and disinfect toilet and bathrooms</p> <p>74. Promote personal hygiene (including hand and respiratory hygiene), make wash basins and sanitizers available</p> <p>75. Screen on entry the temperature of each person entering the work site and record their contact details to facilitate tracking of infected persons should there be a need.</p> <p>76. Individuals who have been potentially exposed to the virus, or who are exhibiting flu-like symptoms such as fever, tiredness, coughing, or congestion are instructed to: Not come to work; Contact their supervisor and/or human resources department; Stay at home and self-isolate; and contact local health authorities for further direction.</p> <p>77. Such individuals are required to follow the directions of the local health authority and may not return to work until given approval by the proper health authorities.</p> <p>78. Individual who begins to display flu-like symptoms on site are instructed to avoid touching anything, take extra care to contain coughs and sneezes, and return home immediately to undergo self-isolation as directed by the local health authority.</p> <p>79. All areas on site potentially infected by a confirmed or probable case are barricaded to keep individuals two meters away until the area is properly cleaned and disinfected.</p>	Operator	MPWT MoE	Included in operational costs

## 5. Closure of the Dumpsites

### 5.1. Overview

34. The Subproject includes closure of the two waste dumpsites in Kratie City. The location of the dumpsites is shown in **Figure 3 (Section 1.4.1)**.
35. The two dumpsites are considered existing facilities under the wider CTDP4 Project and as such an Environmental Compliance Audit (ECA) is required the dumpsites. An ECA for the two dumpsites has been prepared and is annexed to the IEE (July 2021). The results of the ECA have been incorporated in relevant sections of the IEE and this EMP. In accordance with the Terms of Reference for the ECA (**Annex 5**), the ECA has two phases, where phase 1 is an initial assessment of the risks, possible solutions and Phase 2 is an optional phase in case a permanent solution has not been found under the first phase.
36. For the existing dumpsite at the new landfill site, the findings of phase 1 were sufficient to determine the closure method.
37. In terms of the old dumpsite, there are still significant gaps and uncertainties in the information, which as discussed in following sections will require Phase 2 investigations (elaborated under **Para 67**) to be undertaken before a permanent solution can be developed.

### 5.2. Informal Recyclers

38. The closure of the two dumpsites will affect the livelihood of the informal recyclers operating at the sites. Compensation and livelihood restoration measures will be set out in the relevant social safeguard documents (detailed resettlement plan, income restoration plan) following consultations with the informal recyclers to be carried out by the General Department of Resettlement with assistance from the Project's social safeguards specialist prior to start of construction work. The general livelihood options for consideration include one or a combination of the following measures (more options may be developed in the course of preparing the social safeguard documents):
  - Continue recovering waste at the new landfill
  - Opportunity to work for the landfill contractor during the construction phase
  - Opportunity to work at the Materials Recovery Facility during the landfill operation
  - Opportunity to be involved in livelihood improvement programmes
  - Provide compensation.
39. It is anticipated that the informal recyclers at the old dumpsite will be allowed to continue recovering recyclables until the dumpsite remediation and closure activities kick-off. When the closure work starts, they will lose the site as a source of income. In the meantime, they will be provided with appropriate PPE and given training on health and safety to ensure safe working conditions.
40. It is planned that the informal recyclers operating at the existing dumpsite will be allowed to collect recyclables from the dumpsite until the waste relocation work starts. During the relocation of waste, they will not be allowed to work at the dumpsite but will be allowed to recover recyclables at the new landfill cell 1 under strict safety rules. These recyclers will also be provided with appropriate PPE and be instructed in health and safety measures.

### 5.3. Impacts and Closure Objectives

41. The type of potential impacts caused by the old dumpsite and the existing dumpsite are similar and mainly affect the surrounding environment, informal recyclers collecting and sorting waste at the sites and any nearby residents or productive use of adjacent land. However, the impacts of the old dumpsite are more significant than the impacts from the existing dumpsite due to much larger amounts of waste and proximity to residents.
42. The key impacts associated with both dumpsites are summarized below:
- a) generation and discharge of leachate affecting surface water and possibly groundwater;
  - b) contamination of land with decomposing waste and chemicals;
  - c) air pollution including with toxic substances such as Persistent Organic Pollutants from open burning of waste;
  - d) spread of infectious diseases by vectors.
43. The objectives of closing and remediating the dumpsites include to:
- minimise the risk that leachate from the waste dump may infiltrate groundwater resources that are or may in the future be used as a source of drinking water;
  - minimise the risk of contamination of nearby waterways;
  - minimise the risk to public health from spread of infections;
  - eliminate the generation of harmful air emissions from open burning of waste;
  - control migration of landfill gasses;
  - eliminate generation and odour and windblown waste;
  - create an area that can be safely used for predetermined purposes;
  - improve the livelihoods and living conditions of informal recyclers.

## **5.4. Closure of the Existing Dumpsite**

### **5.4.1. Overview of Baseline Information**

44. The existing dumpsite is located on State Land. The total land area of the existing dumpsite is approximately 3.6 ha. A satellite image of the dumpsite (November 2018) is displayed in **Figure 5**.
45. A pre-screening site survey in 2020 has identified eleven households that occasionally collect waste for recycling at the site.<sup>4</sup> When the dumpsite closes, these informal recyclers will be affected by economic displacement. Compensation and livelihood restoration will be addressed in the relevant social report of the Subproject.

**Figure 5: Existing Dumpsite at the New Landfill Site**

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<sup>4</sup> PMC Pre-screening Note, 28 January 2020





46. The dumpsite has four cells. The cells are neither lined nor do they have any leachate collection systems. To date, only three of the cells have been utilised, with the bottom right cell so far unused entirely (this is the area where the landfill buildings will be located). Waste has been deposited to varying depths, from a visually estimated 1 m to 2.5 m depth.
47. The exact volume of waste on this site is unknown. A rough estimate suggests that there may be between 3,525 to 5,875 tonnes of waste, depending on the level of compaction/ settlement. Due to the high level of uncertainty, a 25% contingency on the maximum value is added. Therefore, it is assumed that there may be up to 7,344 tonnes of waste.
48. A small pond is located at the dumpsite. This is probably a former borrow pit.
49. The composition of the waste disposed at the existing dumpsite is unknown but based on various solid waste management studies in Cambodia, at the time of disposal, the waste is likely to have contained about 60% biodegradable components and the remaining 40% would include potentially recyclables and non-biodegradable waste. The biodegradable content has most likely already decomposed to a certain extent and only the most recently disposed waste will still contain significant amounts of biodegradable components. There are no major industries or other generators of any significant amounts of hazardous waste in Kratie City, and the content of hazardous substances in the dumpsite waste is therefore likely rather limited and will mainly include the types and amounts commonly found in household waste from low-income areas. The possible content of infectious waste from health care facilities is unknown but cannot be ruled out. However, as pathogenic micro-organisms have a limited capacity of survival in the environment, these organisms are unlikely to have survived in waste that is older than 1-2 months<sup>5</sup>.

#### 5.4.2. Remediation and Closure

50. The options<sup>6</sup> considered for the closure of the existing dumpsite included:
  - a) In-place closure by capping the waste,

<sup>5</sup> ICRC 2011, Medical Waste Management, International Committee of the Red Cross, November 2011

<sup>6</sup> A Roadmap for closing Waste Dumpsites, The World's most Polluted Places, ISWA, 2016, [https://www.iswa.org/fileadmin/galleries/About%20ISWA/ISWA\\_Roadmap\\_Report.pdf](https://www.iswa.org/fileadmin/galleries/About%20ISWA/ISWA_Roadmap_Report.pdf)



- b) Closure by upgrading into a controlled engineered landfill, or
  - c) Closure by removing the waste from the dump and disposing it at the new landfill.
51. It is recommended to implement option c) *closure by removing the waste from the dump and disposing it at the new landfill* on the following grounds:
- a) Option b) is irrelevant;
  - b) The amount of waste (the existing waste is estimated to 7,344 tonnes and a similar amount of incoming waste will be added during the construction of cell 1 is relatively small, and the waste can easily be accommodated in the new landfill cell;
  - c) Option c) provides the best environmental protection;
  - d) Option c) is the least costly<sup>7</sup>;
  - e) Option c) ensures that the dumpsite area can be used for other purposes.
52. The closure and remediation measures for the existing dumpsite include to remove the existing waste including any later incoming waste and deposit it in the newly constructed waste cell 1 as soon as it is ready to receive waste.
53. Temporary measures will be implemented in preparation for the relocation of the waste and to mitigate any ongoing environmental impacts:
- a) the dumpsite area will be fenced off;
  - b) any existing fires will be extinguished;
  - c) the vegetation will be cleared and removed without mixing it with waste;
  - d) water in the small pond will be tested and then reused for dust suppression or treated, if necessary, before being discharged to the environment;
  - e) the existing waste will be bulldozed into low waste cells, increasing compaction and waste density, and covered with soil to minimise nuisances;
  - f) narrow trenches may be excavated to determine the depth of the waste deposits;
  - g) incoming waste will be deposited and compacted into waste cells adjacent to existing waste and covered with soil;
  - h) if necessary, ditches and bunds will be constructed to control leachate and manage surface runoff;
  - i) if necessary, leachate will be conveyed to a small pond/tank for temporary storage until the leachate treatment system is ready to receive leachate;
  - j) the informal recyclers will be trained in health and safety precautions and provided with appropriate PPE;
  - k) a registration process will be established so only licensed adult recyclers will be allowed on site.
54. The excavation and disposal of the dumpsite waste will be carried out under constant supervision by trained foremen/supervisors. The supervisors will visually inspect the work to identify and remove any hazardous waste or bulky items (bulky items could damage the drainage pipes or the geomembrane in Cell 1). If hazardous waste is discovered, it will be temporarily stored in accordance with the relevant procedures outlined in **Table 8** for subsequent disposal in the Hazardous Waste Cell.
55. When disposing the dumpsite waste in Cell 1, the waste will not be compacted as this waste will likely be the first waste disposed of in the landfill cell. This waste will provide the

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<sup>7</sup> The Detailed Engineering Design estimates the costs of option a) to 80,000 USD and option c) to 22,000 USD

operational layer ('fluff' layer) that provides protection to the drainage layer, HDPE pipes, and the geomembrane.

56. The dumpsite waste is not expected to contain any significant quantities of recyclables as such materials most likely have already been collected by the informal recyclers during the time when the dumpsite was in operation. However, the duly registered informal recyclers will be allowed to collect recyclables under strict safe working practices. These practices are summarised below:
- The Contractor shall train the informal recyclers in the health and safety procedures;
  - The supervisor shall mark zones where at certain times, the informal recyclers are prohibited from picking waste and inform the informal recyclers;
  - The supervisor shall control and signal to the driver of truck/bulldozer/excavator or other heavy equipment that the workface is clear with no people in the work zone.
  - The supervisor shall control and inform the informal recyclers when and where they are allowed to enter a zone for collection of recyclables. The supervisor shall clearly mark out such zones.
  - The Contractor shall provide the informal recyclers with appropriate PPE including hard hats, reflective safety vests, cut resistant gloves and protective footwear, particle masks, safety glasses and earplugs or earmuffs if the noise level is suspected to exceed 85 dB(A);
  - During the waste relocation operation, for safety reasons, the informal recyclers will not be allowed to enter the dumpsite area;
  - Children will not be permitted to enter the landfill site.
  - The Contractor shall provide appropriately stocked first aid kits at the site.
57. The relocation of the waste will start as soon as cell 1 is ready to receive waste and may extent into the Contractor's three months operations and maintenance period during which the Contractor is required to train the Operation and Maintenance Operator. The work is estimated to require a total of 29 workdays and involve the use of an excavator and a small dump truck.
58. After all waste has been disposed at the new cell 1, the former dumpsite area will be rehabilitated. Voids will be backfilled with clean materials and the site will be shaped in accordance with the detailed engineering design.
59. The closure measures including the temporary measures are included in **Table 8: Construction Phase Mitigation Measures, Items 67-79.**

## 5.5. Closure of the Old Dumpsite

### 5.5.1. Overview of Baseline Information

60. The old dumpsite is located on State Land. **Figure 6** is a satellite image of the old dumpsite from November 2018. The demarcation on the image is only indicative and is not intended to show the boundary of the future clean-up and closure.
61. The dumpsite is left open, without fence. The dumpsite is about 4.5 km from the runway of Kratie Airport which is still operational. There are buildings next to the dumpsite and housing structures along the access road. The closest water body is a wetlands 1.3 km to the southeast and a small pond 0.3 km south of the site. A big buddha statue is located near to the dumpsite access road. Surrounding the site are agricultural land with shrub/grasslands and forested areas in between.

**Figure 6: Satellite Image of the Old Dumpsite, November 2018**



62. The old dumpsite is located on slightly higher ground (elevation about 38 m asl. to 40 m asl. sloping toward the south) than the surrounding area. The site appears not to be managed and operated properly. There is open burning and waste is not covered with soil. It appears that waste is being pushed downslope. Earlier surveys have found that a number of informal recyclers operate at the old dumpsite – this needs to be confirmed.

#### **5.5.2. Remediation and Closure**

63. The options under consideration for the closure of the old dumpsite are the same as for the existing dumpsite and include:
- a) Closure by removing the waste from the dump and disposing it at the new landfill.
  - b) In-place closure by capping the waste,
  - c) Closure by upgrading into a controlled engineered landfill, or
  - d) Isolation of waste from groundwater, using drainage/ engineered containment.
64. The closure options are discussed here below, with the first option involving relocation of wastes and the final three options remediation in-situ:
- (i) **Closure by removing the waste from the dump and disposing it at the new landfill.**  
This alternative will be dependent on an economic feasibility assessment (this is part of

the Phase 2 investigations - see **Para 67**). The approach could be combined with sorting the waste for recyclable materials and separation of hazardous waste. In principle, deposition of the waste at the new landfill would inevitably reduce the design-life of the new landfill. It has been reported that the amount of waste could be as much as 144,000 m<sup>3</sup>; however, the basis for this estimation has not been verified and must be taken with caution. Such an amount would occupy almost two waste cells (as designed for the new landfill). The excavated void should be backfilled with suitable locally available materials. This would in principle ensure that there would not be any land use restrictions and no need for monitoring and aftercare. However, if the groundwater underneath the waste dump has already been contaminated, there may be a need for additional mitigation measure and/or monitoring activities.

- (ii) **In-place closure by capping the waste.** This preferred in-situ method includes a low permeability cap and a topsoil layer (typically comprised of 4 layers: (1) gas drainage, (2) low permeable clay layer, (3) soil drainage layer and (4) a topsoil layer). The final grading of the closed dump should be designed to ensure slope stability and proper drainage that prevents ponding of water and which is not causing erosion. Seepage of polluted leachate on side slopes would have to be collected and treated. Installation of landfill gas vents would also be considered, retrofitted into the waste. The site would likely be suitable for sport activities, park or recreation, agriculture (cropland, plantation, grazing land), but not for buildings or installations or infrastructure that require good foundation.

Long-term aftercare and monitoring would be required, and this would likely include groundwater monitoring (monitoring wells would have to be established), monitoring of seepage /leachate, landfill gas monitoring. Aftercare would consist of regular cleaning and repairs as required to the leachate collection and disposal systems, reinstatement of eroded batters, replacement of soils that are eroded, replanting any vegetation that dies back, filling any depressions that occur on site due to differential settlement, reparation of access roads to allow access at all times, and repairs to the perimeter and internal fences as needed.

The remediation costs mainly depend on the size of the area as opposed to the total amount of waste. The area could potentially be reduced by bulldozing and compacting the waste to form one “cell”.

The implementation of this option could be done independently of the new landfill construction.

- (iii) **Closure by upgrading into a controlled engineered landfill.** If surveys show that there is contamination of groundwater and there is sufficient available space at the dumpsite, a controlled waste cell could be constructed at the site. The waste would be excavated and disposed in the cell with proper compaction of the waste in thin layers thereby potentially reducing the area or the footprint and thus also the generation of leachate. Ideally, the waste would be encapsulated in a cell with liner, leachate collection system, and landfill gas venting. The cell would be provided with a cap as in the ‘in-place closure’. Leachate could be treated (possibly also recirculated) onsite or trucked to the new landfill or the future wastewater treatment plant for treatment. Segregating recyclable materials from the excavated waste could be part of the remediation. The future land use of the capped cell would be restricted similar to the ‘in-place closure’ alternative, but it may be possible to free-up some land that would be free of waste and that would not have any land use restrictions. The excavated void should be backfilled with suitable locally available materials. Monitoring and aftercare would likely be similar to the ‘in-place closure’ alternative.

The implementation of this option could be done independently of the new landfill construction.

- (iv) **Isolation of waste from groundwater.** If waste is leading to the contamination of groundwater, it may be possible to isolate the waste without the need to construct a full controlled landfill cell, as per option iii. Depending on the results of the hydrogeological survey, it may be possible to construct engineered approaches to isolate the waste from the groundwater. These may include enhanced drainage, which relocates the groundwater flows and bypasses the waste area; or the use of vertical cut-off barriers of low permeability to prevent the lateral spread of contaminated groundwater beneath the base of the dumpsite.

### 5.5.3. Environmental Compliance Audit Phase 2 Investigations

65. The objectives of the Phase 2 investigations are to fill-in information gaps identified in Phase 1 and to determine the long-term solution to the remediation of the dumpsite and to provide information for the preparation of the detailed remediation design.
66. The significant gaps and uncertainties in the information about the dumpsite mentioned in **Para 37** include:
- a) Amount of waste and size of the area with waste dumped
  - b) Potential risk to groundwater
  - c) Potential risk to surface water from runoff with polluted leachate
  - d) Planned future land use.

### 67. Phase 2 Activities

1. Interviews with waste management personnel and government officials with knowledge about the dumpsite:
  - a. Preferred future land use (ranking of alternatives)
  - b. the number and depth of waste cells;
  - c. underlying waste cell lining material if any;
  - d. extent of active surface runoff collection and drainage;
  - e. extent of leachate and gas collection and treatment;
  - f. extent of septage disposal and management;
  - g. waste recycling process used by local waste pickers; and
  - h. scheduling of transport of solid waste to dumpsite.
2. Obtain existing data on groundwater quality near the dumpsites from PDoE (if available).
3. Obtain existing surface water quality data for potentially impacted water bodies.
4. Determine number of full-time and part-time informal recyclers that work (and live) at the dumpsite
5. Identify any other use of the dumpsite area.
6. Consult with the surrounding community and the informal recyclers to determine if there are past or present environmental, social, or human health issues associated with the operation of the existing dumpsite.
7. **Waste Surveys:** It is critical to determine the volume and nature of the waste on the site. A mapping exercise is required, which details the extent of waste coverage and depths of waste in different localities. This will require excavating pits into the waste piles in order to determine the depth of waste. It is also important to understand the typical waste density of the waste, which will help assess tonnages. This will require undertaking waste density tests in a number of locations (kilograms per square metre). It will also be useful to provide further details on the typical composition of the waste and the degree of degradation that has occurred (i.e., an estimation of the length of time the waste has been on-site and the degree of decomposition of organic material). The presence of any problem or hazardous

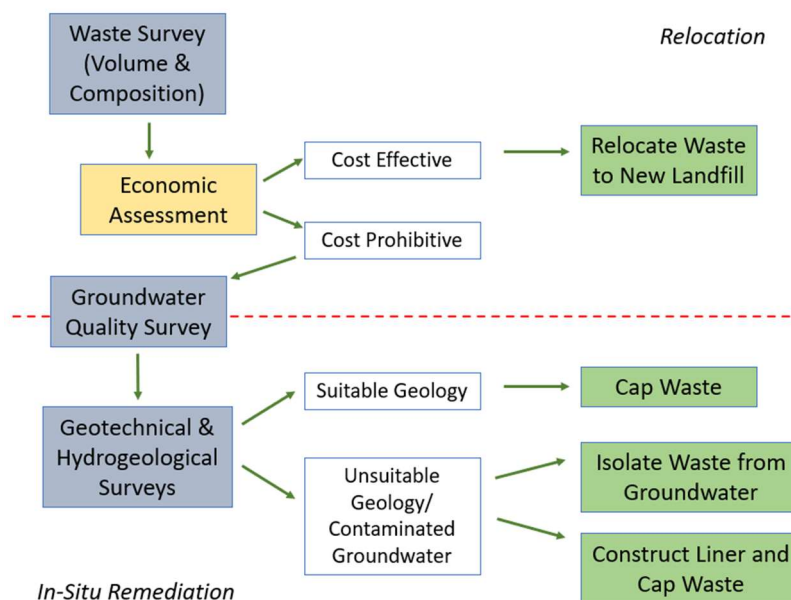
waste (e.g., medical wastes) should be recorded, including details and locations of these wastes.

8. *Groundwater Quality Survey:* It is critical to determine the impact that the waste dump has on water quality in underlying groundwater. It is highly recommended that this is undertaken even if the waste is relocated, since it will be important to determine the legacy impacts of this dumpsite.
9. Following the completion of the above surveys, an economic feasibility assessment will be undertaken to determine the viability of transferring the old waste to the new landfill. If this option is deemed viable, then further geotechnical surveys are not required. If relocation of waste is not economically viable, then in-situ remediation will clearly be the only option, and in will then be necessary to undertake the geotechnical survey outlined below, and possibly also the hydrogeological survey, if the groundwater has been shown to be polluted.

#### **68. Additional Optional Activities**

10. *Geotechnical and Hydrogeological Surveys:* For in-situ remediation measures, it will be critical to understand the site geology and hydrology. This will involve developing an understanding of the underlying geology, particularly in terms of permeability and the potential for transferring leachate into groundwater. Hydrogeological surveys will be necessary if water quality surveys show that the groundwater is polluted from the waste. This survey will involve an examination of groundwater flow and connectivity, in order to determine if polluted water is being used by neighbouring activities, with particular concerns where it is being used as human or livestock drinking water sources.
11. The choice of in-situ remediation options will depend on the results of the surveys. The ideal and default option for in-situ remediation will be closure through capping the waste (see below for details). However, if there is existing pollution of groundwater and the geology is not suitable then more complex engineering options will need to be considered. This would include the construction of an engineered landfill cell, complete with an underlying liner; or may include other approaches that isolate the waste from the groundwater, such as cut-off barriers.
12. The overall decision tree for remediation options is detailed below:

**Figure 7: Remediation Decision Approach**



69. In addition, temporary mitigation measures similar to the temporary measures for the existing dumpsite should be implemented (see **Para 53**) including:
- e) Fencing off the dumpsite and controlling access
  - f) Extinguishing fires
  - g) Covering the waste with soil
  - h) Temporary leachate management such as diversion of leachate to a temporary pit
  - i) Training of informal recyclers and providing them with PPEs.

## 6. ENVIRONMENTAL MONITORING PLAN

### 6.1. Overview

70. The project monitoring conducted under the EMP includes:

- (i) **Subproject readiness monitoring.** Monitoring to follow up progress on project readiness and close gaps through corrective actions (**Table 10**).
- (ii) **Environmental quality monitoring.** To be conducted by a competent authority and/or persons or agency/organization approved by the Project Owner, involving the collection and analyses of air quality, noise and water quality data at designated monitoring locations for assessing compliance with applicable ambient environmental quality standards and emission standards during construction and operation (**Table 11** and **Table 12**).
- (iii) **EMP compliance monitoring.** To be conducted by the PMC-NES (contracted via the Project Management Consultants) to verify EMP compliance during project implementation (**Table 13**).
- (iv) **Affected People monitoring (consultation).** To be conducted by the PIU-SFP by consulting affected people on the impacts during construction and operation (**Table 13**).
- (v) **Operational monitoring.** This is required as part of the operations of the subproject and will be undertaken by the relevant government departments or a nominated private sector operator (**Table 12**).

71. The engagement of a National Environmental Specialist for some months will be critical to ensuring the capacity and monitor of the PIU and contractor staffs and to ensuring monitoring is effective and that corrective actions are promptly identified and implemented.

### 6.2. Subproject Readiness Monitoring

72. Before construction, the Project Management Consultant (PMC) will monitor the project readiness on environmental management based on a set of indicators as shown in **Table 10** and report it to ADB and PMU. This assessment will formally demonstrate that environmental commitments are being carried out and environmental management systems are in place before construction starts or suggest corrective actions to ensure that all requirements are met.

**Table 10: Subproject Readiness Assessment Indicators**

Indicator	Criteria	Are the Criteria met?	If No, What Corrective action is needed?	Date for Corrective Action Completion
		Yes/No		
1. EMP update	EMP updated after detailed design & approved by ADB	Y/N		
2. Compliance with loan covenants	The borrower complies with loan covenants related to project design and environmental management	Y/N		
3. Public involvement effectiveness	Meaningful consultation completed	Y/N		
	GRM established with entry points	Y/N		



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

## 6.3. Environmental Quality Monitoring

### 6.3.1. Environmental Quality Monitoring Programme

73. During construction, the impact on the sensitive environmental receptors will be monitored and compared against the relevant national or international recognized environmental standards. The environmental quality monitoring programme for the construction phase is outlined in **Table 11**.
74. During operation, the PIU and the operator are expected to allocate an adequate budget to ensure environmental monitoring. The environmental quality monitoring programme for the operational phase is summarised in **Table 12**.
75. The applicable ambient environmental quality standards and effluent standards are referenced in **Annex 4**. Note that the applicable effluent standard refers to Sub-decree No. 27 ANRK.BK on Water Pollution Control, MoE, 1999, for discharge to “*Public water area and sewer*”.
76. The leachate management system is designed to ensure zero discharge under most rain events and with proper management of the leachate recirculation system it should be possible to avoid any discharge of leachate. Throughout the operational phase the generation and strength of the leachate will be monitored. In case discharge of leachate occurs whether accidentally or as an operational necessity, the leachate will be discharged into the buffer zone along with stormwater in the north-eastern corner of the site. This buffer zone is 200 metres from the small stream that flows into Or Kantuot Stream and is heavily vegetated and, therefore, it is highly unlikely that this will lead to any pollution of the Or Kantuot Stream. Nevertheless, in such situations, the Operator will take samples of the leachate and in the receiving water bodies, document the entire incident and report it to the MPWT and the MoE.
77. Regular physical inspection of the landfill site and its buildings, waste cells, leachate treatment ponds other facilities and the buffer zone is part of the routine inspection and maintenance programme during operations. The results of these inspections will be systematically recorded and documented in a logbook – preferably as a proper electronic database.



**Table 11: Construction Phase Environmental Quality Monitoring**

Environmental Indicators	Location	Frequency	Responsibility		Estimated Costs (USD)	
			Supervision	Implementation	Per Sample	Total
Air Quality: PM10, NO <sub>2</sub> , SO <sub>x</sub>	Nearest residential receptors (2 locations)	1 day (24-hr) per 6 months. More often if standards are exceeded or complaints are filed, or site inspections indicate air pollution	CSC/PIU	Contractor	\$1000	\$6000
Baseline Noise: 1. LAeq(1-hour) 2. L <sub>Amax</sub> 3. LAeq(daytime) 4. LAeq(evening) 5. LAeq(night-time)	Nearest residential receptors (2 locations)	Once prior to start construction work: 72 consecutive hours on weekdays	CSC/PIU Consultant	Contractor	\$500	\$1000
Construction Noise: 1. LAeq(1-hour) 2. L <sub>Amax</sub> 3. LAeq(daytime) 4. LAeq(evening) 5. LAeq(night-time)	Nearest residential receptors (2 locations)	1 day (24 hours) per 6 months. More often if standards are exceeded, complaints are filed, or site inspections indicate high noise emissions	CSC/PIU	Contractor	\$300	\$1800
Ambient Surface Water Quality: - Temp, pH, DO, BOD, COD, EC, TSS, NH <sub>3</sub> -N, Total nitrogen, Total Phosphorus, Oil and Grease, <i>E.coli</i> - Stream flow: estimated m <sup>3</sup> /s - Visual observations: water colour, signs of algae growth	In Or Kantuot Stream upstream and downstream the landfill site	Every 6 months during the construction phase More often if standards are exceeded, complaints are filed, or site inspections indicate water pollution Probe for temp, pH, DO and EC. Other parameters by laboratory standard methods	CSC/PIU	Contractor	\$100	\$600
Groundwater: Standing water table (depth and elevation in m asl.) Temp, pH, TDS, TSS, major cations and anions (calcium, magnesium, potassium, sodium, chloride, fluoride and sulphate),	Five (5) monitoring wells on the landfill site Nearest two existing water supply wells representing the same aquifer as under the landfill. One upstream	Every 6 months with the first round of sampling not later than 6 months after start of construction Probe for temp, pH, and EC. Other parameters by laboratory standard methods	CSC/PIU	Contractor	\$500	10,500

Environmental Indicators	Location	Frequency	Responsibility		Estimated Costs (USD)	
			Supervision	Implementation	Per Sample	Total
Total Organic Carbon, ammonia and nutrients (nitrate, nitrite, and phosphorus), total petroleum hydrocarbons, monoaromatic hydrocarbons, metals (aluminium, arsenic, barium, cadmium, chromium, cobalt, copper, lead, manganese, mercury, nickel, zinc), <i>E.coli</i>	and one downstream the landfill					

**Table 12: Operational Phase Environmental Quality Monitoring**

Environmental Indicators	Location	Method and Frequency	Responsibility		Estimated Costs (USD)	
			Supervision	Implementation	Per Sample	Total per site/yr
Leachate quality: Inlet and outlet flow rates, Temp, pH, EC, BOD, COD, TSS, NH4-N, Total Nitrogen, Total Phosphorus, Oil and grease, Coliform	Raw and treated leachate	Quarterly Probe for temp, pH, and EC. Other parameters by laboratory standard methods	MPWT, MoE	Operator	Included in operational costs – O&M Budget	
Leachate quality: Inlet and outlet flow rates, TSS, major cations and anions (calcium, magnesium, potassium, sodium, chloride, fluoride and sulphate), Total Organic Carbon, BOD5, COD, ammonia and nutrients (nitrate, nitrite, and phosphorus), total petroleum hydrocarbons, metals (aluminium, arsenic, barium, cadmium, chromium, cobalt, copper, lead, manganese, mercury, nickel, zinc), <i>E.coli</i>	Treated leachate	Annually Probe for temp, pH, and EC. Other parameters by laboratory standard methods	MPWT, MoE	Operator	Included in operational costs – O&M Budget	
Ambient Surface Water Quality:	In Or Kantuot Stream upstream and	Every 6 month and in case of discharge of leachate or if	MPWT, MoE	Operator	Included in operational costs – O&M Budget	

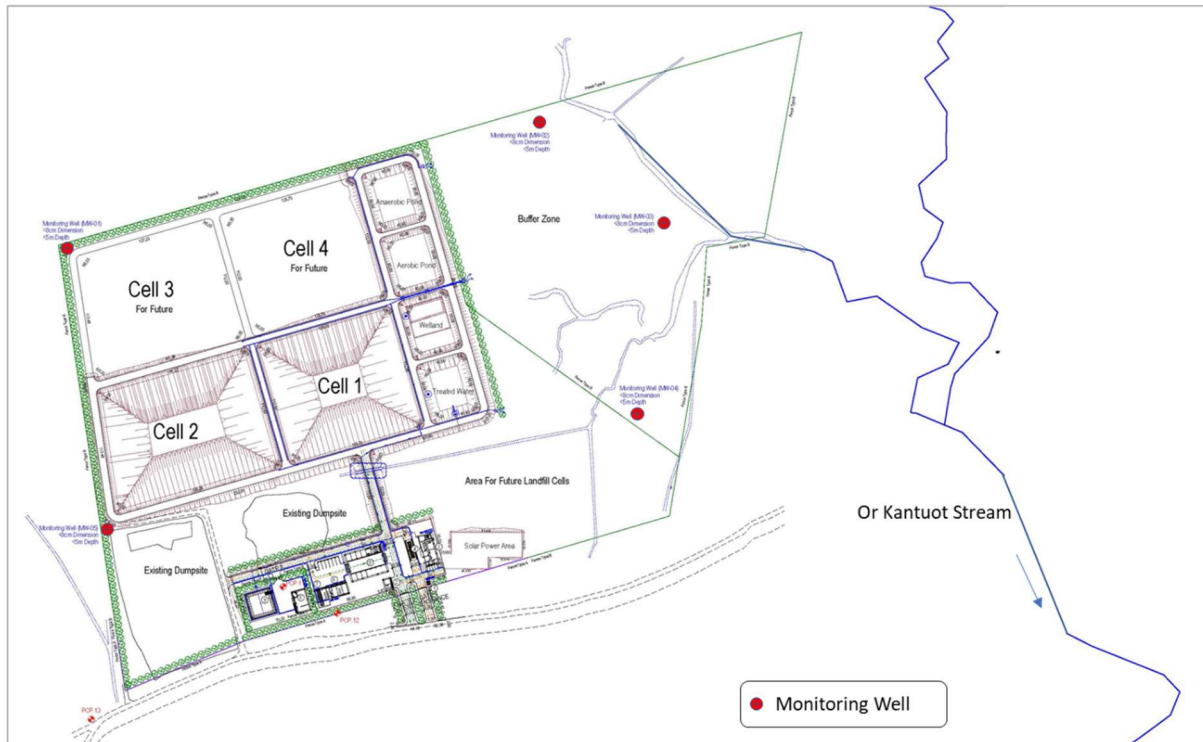
Environmental Indicators	Location	Method and Frequency	Responsibility		Estimated Costs (USD)	
			Supervision	Implementation	Per Sample	Total per site/yr
Temp, DO, pH, Colour, Odour, TSS, major cations and anions (calcium, magnesium, potassium, sodium, chloride, fluoride and sulphate), Total Organic Carbon, BOD5, COD, ammonia and nutrients (nitrate, nitrite, and phosphorus), total petroleum hydrocarbons, metals (aluminium, arsenic, barium, cadmium, chromium, cobalt, copper, lead, manganese, mercury, nickel, zinc), <i>E.coli</i> Stream flow: estimated m <sup>3</sup> /s Visual observations: water colour, signs of algae growth Inspection of the small stream in the buffer zone	downstream the landfill site	complaints are filed  Probe for temp, pH, DO and EC. Other parameters by laboratory standard methods				
Groundwater: Standing water table (depth and elevation in m asl.) Temp, pH, TDS, TSS, major cations and anions (calcium, magnesium, potassium, sodium, chloride, fluoride and sulphate), Total Organic Carbon, ammonia and nutrients (nitrate, nitrite, and phosphorus), total petroleum hydrocarbons, monoaromatic hydrocarbons, metals (aluminium, arsenic, barium, cadmium, chromium, cobalt, copper, lead, manganese, mercury, nickel, zinc), <i>E.coli</i>	Five (5) monitoring wells on the landfill site  Nearest two existing water supply wells representing the same aquifer as under the landfill. One upstream and one downstream the landfill	Every 6 months  Probe for temp, pH, and EC. Other parameters by laboratory standard methods	MPWT, MoE	Operator	Included in operational costs – O&M Budget	
Odour	Site boundary (upwind and downwind)	Monthly or more often in case of complaints. Systematic use of the human nose (summary of procedures in <b>Annex 6</b> )	MPWT, MoE	Operator	Included in operational costs – O&M Budget	
Inspection of the site and its facilities	The Landfill Site, including buffer zone	Weekly visual inspection and after	MPWT	Operator	Included in operational costs – O&M Budget	

Environmental Indicators	Location	Method and Frequency	Responsibility		Estimated Costs (USD)	
			Supervision	Implementation	Per Sample	Total per site/yr
<ul style="list-style-type: none"> <li>- Physical integrity and stability of waste piles, bunds, liners, leachate ponds, drainage canals, pipes, internal roads, fencing and gates</li> <li>- Signs of erosion</li> <li>- Unwanted accumulation of water in the cells</li> <li>- Leachate level in the cells</li> <li>- Accumulation of debris or sediments</li> <li>- Signs of spillage with hazardous substances</li> <li>- Signs of disturbance of vegetation or erosion in the buffer zone</li> <li>- Regrowth of vegetation</li> </ul>	Access Road	heavy rain event				
<p>Workers' health</p> <p>Worker &amp; public injury associated with landfill operations</p>	The landfill site	<p>Annual health check of workers</p> <p>Accident and injury records</p>	MPWT Ministry of Labour and Vocational Training (MLVT)	Operator	Included in operational costs – O&M Budget	

### 6.3.2. Environmental Quality Monitoring Stations

78. The groundwater quality monitoring wells are indicated in **Figure 8**. The Contractor shall install the monitoring wells not later than 6 months after start of construction work.
79. In addition to the monitoring wells on the landfill site, the nearest existing upstream and downstream domestic water supply well will be monitored; however, only if an assessment indicates that these wells represent the same aquifer and that that aquifer is hydraulically connected to the aquifer that the monitoring wells on the landfill site represent.

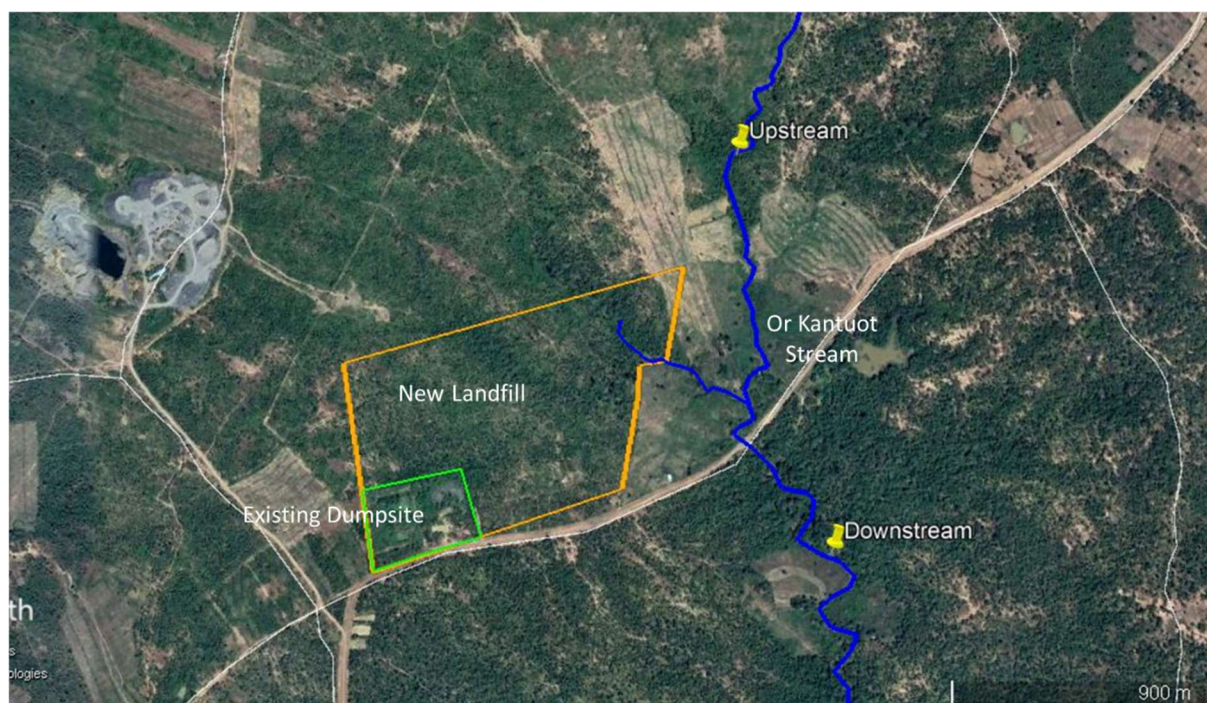
**Figure 8: Groundwater Quality Monitoring Wells**



80. The surface water quality monitoring stations are indicated in **Figure 9**.



**Figure 9: Surface Water Quality Monitoring Stations**



## **6.4. Recommended Field Monitoring Standards**

### **6.4.1. Noise**

- IEC 61672-1 Electroacoustics - Sound Level Meters - Part 1: Specifications
- IEC 61672-2 Electroacoustics - Sound level meters - Part 2: Pattern evaluation tests
- IEC 60942 IEC 60942 - Electroacoustics - Sound calibrators

### **6.4.2. Odour**

- Environmental Protection Agency (Ireland), Office of Environmental Enforcement, Odour Emissions Guidance Note (Air Guidance Note AG9), September 2019<sup>8</sup>. See also **Annex 6** with a summary of the odour impact assessment procedures

### **6.4.3. Leachate Sampling**

- New South Wales Environmental Protection Authority, Environmental Guidelines, Solid Waste Landfills, Second edition, 2016, [www.epa.nsw.gov.au](http://www.epa.nsw.gov.au)

### **6.4.4. Surface Water Quality**

- USGS National Field Manual for the Collection of Water-Quality Data<sup>9</sup>
- ISO 5667-3:2018, Water quality — Sampling — Part 3: Preservation and handling of water samples
- ISO 5667-4:2016, Water quality — Sampling — Part 4: Guidance on sampling from lakes, natural and man-made

<sup>8</sup> <https://www.epa.ie/pubs/advice/air/emissions/Odour%20Emissions%20Guidance%20Note%20AG09.pdf>

<sup>9</sup> [https://www.usgs.gov/mission-areas/water-resources/science/national-field-manual-collection-water-quality-data-nfm?qt-science\\_center\\_objects=0#qt-science\\_center\\_objects](https://www.usgs.gov/mission-areas/water-resources/science/national-field-manual-collection-water-quality-data-nfm?qt-science_center_objects=0#qt-science_center_objects)

#### 6.4.5. Groundwater Monitoring

- USEPA Region 4, Operating Procedures, SESDPROC-301-R4, Groundwater Sampling, 26 April 2017<sup>10</sup>

### 6.5. EMP Compliance Monitoring

81. In order for the EMP implementation to be effective, all its mitigation measures must be monitored to ensure they are implemented. Note that this monitor applies to construction period only. During operation, it is the responsibility of the appropriate ministry or its line department to ensure monitoring of operational facilities is incorporated in the operations and maintenance manual and carried out routinely. The compliance monitoring requirements are summarized in **Table 13**.
82. The applicable ambient environmental quality standards and effluent standards are attached in **Annex 4** for reference. These quality standards relate to i) air quality and noise, ii) ambient surface water quality, iii) groundwater quality, vi) soil quality, v) effluent quality

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<sup>10</sup> [https://www.epa.gov/sites/production/files/2017-07/documents/groundwater\\_sampling301\\_af.r4.pdf](https://www.epa.gov/sites/production/files/2017-07/documents/groundwater_sampling301_af.r4.pdf)

**Table 13: EMP Compliance Monitoring**

Environmental Indicators	Location	Method & Frequency	Responsibility		Estimated Costs (USD)
			Verification	Implementation	
Air Quality	Construction site and surroundings	Monthly checking against mitigation measures specified in this EMP	PMC-NES	CSC	Included in CSC contract
Noise	Construction site and surroundings	Monthly checking against mitigation measures specified in this EMP	PMC-NES	CSC	Included in CSC contract
Flora	Construction site	Monthly checking against mitigation measures specified in this EMP	PMC-NES	CSC	Included in CSC contract
Water Quality	Construction site and recipients	Monthly checking against mitigation measures specified in this EMP	PMC-NES	CSC	Included in CSC contract
Soil and land resources	Quarries, Borrow and Spoil Disposal Sites and their surroundings	Monthly checking against mitigation measures specified in this EMP	PMC-NES	CSC	Included in CSC contract
Resource use and natural resource contamination	Construction site	Monthly checking against mitigation measures specified in this EMP	PMC-NES	CSC	Included in CSC contract
Human health and safety	Construction site Labour camp	Monthly checking against mitigation measures specified in this EMP	PMC-NES	CSC/Contractor H&S engineer	Included in CSC contract
Contamination of water, soil, waste production and social issues	Construction site Labour camp	Monthly checking against mitigation measures specified in this EMP	PMC-NES	CSC	Included in CSC contract
Community Issues <ul style="list-style-type: none"> <li>• Environmental impacts of civil works (e.g., solid &amp; liquid waste, erosion, local flooding, pollution).</li> <li>• Any unforeseen impacts caused by accidentally e.g. through spillages</li> <li>• Civil nuisance (e.g., noise, odour, disrupted business &amp; farming activity, social issues, community health and safety).</li> </ul>	Construction site	Consultation interview with Affected People Using the form in Annex 1 . 4-6 weeks after construction starts Every 2 months until end of construction	PMU-ESO	PIU-SFP	Included in PIU staff/travel budget

Environmental Indicators	Location	Method & Frequency	Responsibility		Estimated Costs (USD)
			Verification	Implementation	
<ul style="list-style-type: none"> <li>• Impaired use of access roads (e.g. traffic issues and access).</li> <li>• GRM and its procedures &amp; key contacts</li> </ul>					

## 7. PUBLIC CONSULTATIONS

83. The IEE for this subproject contains details of the consultations undertaken during preparation of the subproject. In addition, consultation will take place during implementation. The PIU Safeguard Focal Point (PIU-SFP) 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 Environmental Management Plan for each sub-project.
84. Informal monitoring interviews with affected people will focus on complaints about community disturbance from construction activities, such as construction noise, dust, odor, increasing flies, and solid waste, as well as public concerns about ecological protection, soil / land concerns and access issues. A sample Environmental Monitoring Interview Form is given in **Annex 1**. This will contribute to project monitoring.
85. The IEE for this sub-project also includes information on consultation undertaken during preparation of this EMP and can be consulted for reference.

## 8. GRIEVANCE REDRESS MECHANISM

### 8.1. GRM Objective

86. A grievance redress mechanism (GRM), consistent with the requirements of the ADB Safeguard Policy Statement (2009) has been 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.

### 8.2. Proposed GRM System

87. In Cambodia, there is currently no existing legally established system to resolve environmental concerns and complaints. The MPWT, as the EA of the Tonle Sap II will establish the GRM. The establishment shall be made before commencement of site works and have members from the PMU, district authority and commune councils. Grievances can be filed in writing or verbally with any entry point of the GRM. The committee will have 15 days to respond with a resolution. The PMU's Environment Safeguards Officer (PMU-ESO) will oversee/manage the implementation/observance of the mechanism and will be responsible for keeping the PMU informed. The PIU Safeguards Focal Point (PIU-SFP) will be responsible for ensuring GRM implementation at the sub-project level.
88. The GRM will accommodate both informally and formally lodged eligible, grievances. Informally lodged grievances are those received by the contractor during construction.

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

#### **8.2.1. Access to the Mechanism**

89. Any person who has environmental issues pertaining to the subproject during detailed design, construction and operation phases will have access to the mechanism free of charge. The PMU, through its Environment Safeguards Officer (PMU-ESO) and staff in the MPWT, will ensure that:
- (i) The public and all stakeholders are aware of their rights to access, and will have access to, the GRM free of administrative and legal charges; and
  - (ii) The GRM is fully disclosed prior to construction: (a) in public consultations, (b) through posters displayed in the commune office (posters to include names and contact details of the PIU-SFP).
90. The Access Points to the GRM are critical for ensuring it is useable for affected people (APs). The GRM Access points for this project, as set out in this GRM Mechanism will be:
- The Contractors
  - District and Commune Councils
  - The PIU office
  - The Provincial Department of Public Works and Transport (PDWT).

#### **8.2.2. GRM Steps and Timeframe**

91. Grievances raised on environmental impacts are critical to the health and safety of APs. Hence, the proposed mechanism intends to be easily accessible and promptly responsive to APs' complaints.

### **8.3. Informal Approach**

92. Informally, APs can lodge complaints directly to the contractor during construction. PMU to provide contractor with GRM contact details which the contractor will use to print 'GRM Contact Cards' for its staff to hand to complainants and will keep cards with all vehicles, machinery and site managers/foremen.
93. Contractor to raise awareness of all workers on how to respond when an AP or member of the public has a complaint i.e. direct the person to the most senior site manager present at the time and/or Contractor GRM focal point and prepare a 'GRM Contact Card'.
94. The contractor shall document and assess the complaint immediately. If assessment validates the complaint as within the scope of the GRM/eligible, the contractor shall act on the complaint within three days from receipt of complaint. MPWT shall obtain a written confirmation of satisfaction from the AP after 7 days from completion of resolution by the contractor
95. If assessment invalidates the complaint (i.e., reveals the complaint as ineligible or not associated with the project's environmental performance), the contractor shall direct the AP

to the Commune Council and shall report the complaint to MPWT within 2 days from receipt of complaint, stating reasons for ineligibility.

## 8.4. Formal Approach

96. If complaint is eligible but is not acted on within three days from receipt of complaint, or if AP is not satisfied with the resolution undertaken by the contractor, he/she can access the formal mechanism, as shown in **Table 14**.

**Table 14: GRM Steps**

Step	Action
Step 1: Lodging a Complaint (Day 1)	AP lodges complaint, by him/herself or with assistance from the village chief or district council, at the access point with the Commune Council. The complaint may also be lodged with the PIU or PDPWT,
Step 2: Documentation & Registration of Complaint (Day 1)	Commune Council, PIU/PMU or PDPWT documents/registers lodged complaint, makes sure these are referenced and provides AP with a copy of referenced complaint. The commune forwards complaint document to the MPWT. A copy of a proposed GRM Complaint Form is in <b>Annex 2</b>
Step 3: Assessment and Discussion (Day 1 to 3)	AP shall be informed if the grievance is eligible or ineligible. If it is ineligible, AP shall be directed to the district. If complaint is eligible, AP shall be informed of the expected action timelines as set out in the established mechanism
	If both of the AP and contractor/operator are available, the complaint shall be immediately reviewed, investigated and discussed. If not, both parties should agree to undertake the review, investigation and discussion within 3 days. The discussion will centre on the cause and action/measure to implement and will engage the PIU/PMU. After review and investigation, agreement on actions and measures and time involved shall be made with the AP. Agreement shall be properly documented and filed; MPWT, PIU/PMU, Commune Council and AP shall have copies
Step 4: Implementing the Agreed Resolution	(Day 3 to Day 4) If complaint is minor, i.e., not requiring further investigation and would be easy to resolve, the contractor/operator shall immediately implement agreed on action/resolution. (To be implemented by Day 8)
	If further investigation and/or procurement of supplies/parts would be necessary, the contractor/operator shall: (i) immediately provide the most suitable interim measure to reduce the magnitude of the impact; and (ii) start work on the final measure within 15 days from the day the complaint is lodged.
Step 5: Acceptance of Resolution (1 week after completion of action/measure taken)	If, according to the AP, the impact has been resolved satisfactorily, MPWT shall obtain a written confirmation of satisfaction from the AP. This confirmation will signify closure of grievance and will form part of the grievance documentation. The PIU, Commune Council and AP shall retain their copies of the confirmation.
Step 6: Monitoring and Evaluation (for 1 week after closure of grievance)	The MPWT shall monitor the effectiveness of the resolution for at least a week after closure of grievance (that is, when action implemented has been satisfactorily confirmed in writing by the complainant). Monitoring and evaluation shall be properly documented and included in the Environmental Monitoring Report
Step 7: Appeal for Dissatisfied AP	When dissatisfied (or, in the event the issue/impact persists despite actions undertaken), AP can appeal for assistance from the district in the elevation of his/her complaint to the provincial authority. The provincial authority shall call all



Step	Action
	parties concerned to review the history of the grievance and resolution process taken and assess the validity of the appeal.

97. **Appeals.** If appeal is found not valid, the provincial authority shall write the AP and declare the grievance closed. In the event of an appeal, the MPWT shall immediately report to the PMU. The PMU shall ensure that the ADB is immediately informed.
98. If appeal is assessed to be valid, provincial authority and the parties discuss and agree on the quick resolution of the issue. The PMU requires the contractor and operator to implement the agreed resolution. Should the issue continue to persist despite the second action, or the AP remain dissatisfied, the following steps will be taken:
99. **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.
100. **Accountability Mechanism of the ADB.** In addition, affected people may always contact the Complaints Receiving Officer of the ADB via the following addresses which will be included in the sub-project signboard:
- Complaints Receiving Officer, Accountability Mechanism  
Asian Development Bank  
ADB Headquarters, 6 ADB Avenue, Mandaluyong City 1550, Metro Manila, Philippines  
(+632) 632-4444 loc. 70309, (+632) 636 2086, amcro@adb.org  
Instructions available here: <http://www.adb.org/site/accountability-mechanism/how-file-complaint>.
101. Sufficient communication on the GRM including signs containing contact details of the GRM access points will be displayed at strategic locations to sustain the effective implementation of the mechanism.

## 8.5. Reporting

102. Environmental monitoring reports will be prepared semi-annually for the EA by the Project Management Consultants in collaboration with PMU-ESO and sent to the MoE and ADB. The reports will table all indicators measured with the monitoring plan of EMP including performance monitoring indicators and will include relevant national environmental quality standards. The reporting requirements are summarised in **Table 15**.

**Table 15: Reporting Requirements**

Report	Frequency	Purpose	From	To
Contractors' Progress Report	Monthly	EMP Implementation Progress and Monitoring Results	Contractor	PMU
EMP Progress and Compliance Report	Monthly	Confirm Mitigation Measures	International National Env Specialists with PIU-SFP	PMU
Environmental Monitoring	Quarterly	Relevant environmental parameters	PMU-ESO	EA

Report	Frequency	Purpose	From	To
Environmental Monitoring Report	Semi-Annual	Full EMP Implementation and Adherence to Environmental Covenants/Conditions	PMU	ADB
Landfill Operation	Quarterly	Records of waste disposal, surface and groundwater quality, health and safety, grievances	Operator	EA

## 8.6. Mechanisms for Feedback and Adjustment

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

## 9. ESTIMATED COST OF EMP IMPLEMENTATION

104. The total cost for EMP implementation comprises the following:

- The costs of mitigation measures (**Table 7**, **Table 8** and **Table 9**) shall be included in the construction contract and the operations budget.
- Environmental quality monitoring during the estimated 14 months long construction phase (**Table 16**) is estimated to \$19,900.
- The budget for environmental quality monitoring during the operational phase (**Table 12**) shall be determined under the Operation and Maintenance budget.
- EMP Compliance Monitoring (including public consultation) (**Table 13**), no additional cost.

**Table 16: Construction Phase Environmental Quality Monitoring Cost Estimate**

	Number of stations	Frequency	Total monitoring missions	Unit price [USD]	Total Cost [USD]
Air quality	2	every 6 month	3	1,000	6,000
Baseline noise	2	once	1	500	1,000
Construction noise	2	every 6 month	3	300	1,800
Surface water quality	2	every 6 month	3	100	600
Groundwater	7	every 6 month	3	500	10,500
<b>Total</b>					<b>19,900</b>

Total monitoring missions = Total number of monitoring rounds over the course of the pre-construction and construction phase

Total cost = Number of stations x Total monitoring missions x Unit price

105. Excluded from the EMP budget as separate items are measures required as part of good construction practice. This includes provision of PPE for workers working at site. Cost estimate for such provision for 100 workers are as follows:

- Hard hat(@ 3 USD) 300 USD
- Glove( @ 0.25USD) 25USD for 10 units/person/year =250 USD/year
- Mask (50 pcs) @7 USD for 20 units/person/year=280 USD/year
- Ear plug @1 USD for 5 units/person/year= 500USD
- Safety Glass @ 1.5 USD for 5 units/person/year =750 USD/year
- Boot @ 13 USD for 2 pairs/person/year =2600 USD/year
- Total = 4680 USD/year with 15% contingency then= 5382 USD/year

106. The annual machinery maintenance cost is, in general, 10 % of machinery cost while mobile noise barriers can be custom designed and built on site for temporary use.

- Remuneration and associated costs for Project Management Consultants and staff within PMU and PIU is covered elsewhere in the project budget.
- The cost for Project Management Consultant includes a National and an International Environmental Safeguards specialist.
- Training covered elsewhere including Landfill operator training which is covered under the feasibility study for each specific subproject.

107. Contractors will bear the costs for all mitigation measures during construction, including those specified in the tender and contract documents as well as those to mitigate unforeseen impacts due to their construction activities.

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

## 10. CONCLUSION

109. The EMP, if implemented as directed, will mitigate impacts on the natural environment and affected people to an acceptable level. The key parties responsible for the implementation of the mitigation measures are for the construction contractors for the construction phase, and the landfill operator for the operational phase of the project. The most important impacts are those that may arise during landfill operations including risks to surface water and groundwater, and generation of nuisance odour and pests. The implementation of this EMP will be closely monitored and reported by the contractor and the project consultant team in collaboration with the relevant project stakeholders.

110. A comprehensive training and capacity building component is included in the project. This is essential for ensuring that the investment is both financially and environmentally sustainable and beneficial.

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

112. Overall, the project is anticipated to bring environmental benefits to the population in the project cities. It will serve to improve the current waste management situation and will provide long term environmental improvements.

## Annex 1: Affected Person Monitoring Form

### Consultation / Interview Form

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

## Interview Discussion Points:

1. NOISE	Record of Discussion
<p><b>Before the project started, was the person disturbed by noise? If yes, explain how and when.</b>  <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></p>	
<p><b>During the construction, is the person disturbed by noise from the project? If yes, explain how and when.</b>  <i>What type of noise and where did the noise come from?</i>  <i>All day, at night, intermittently?</i></p>	
<p><b>If noise from construction is a problem, what changes does the person suggest are made?</b></p>	
2. AIR QUALITY	Record of Discussion
<p><b>Before the project started, was the person affected by air pollution or dust? If yes, explain how and when.</b>  <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></p>	
<p><b>During the project, is the person disturbed by dust or pollution? If yes, explain how and when.</b>  <i>What type of noise and where did the noise come from?</i>  <i>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></p>	
<p><b>If dust or air pollution from the construction is a problem, what changes does the person suggest are made?</b></p>	
3. VEGETATION AND LAND USE	Record of Discussion
<p><b>Before the project started, what was the vegetation like in the project area?</b>  <i>E.g. pasture land, trees, shrubs, rice fields.</i></p>	
<p>During the project, has the person found the vegetation situation has changed? If yes, explain how and when.</p>	
<p>If impact on vegetation is unacceptable, what changes does the person suggest are made?</p>	
4 COMMUNITY SAFETY	Record of Discussion
<p><b>Before the project started, can you describe the community safety situation in the project area?</b>  <i>E.g. no problems, some accidents, difficulty crossing the roads</i></p>	

<p><b>During the project, has the person found the community safety situation has changed? If yes, explain how and when.</b></p> <p><i>Slower traffic so easier to cross the roads, construction vehicles are making a crossing harder / easier, more accidents / less accidents, construction site dangers</i></p>	
<p><b>If change in road safety is unacceptable, what changes does the person suggest are made?</b></p>	
<p><b>5. WATER QUALITY</b></p>	<p><b>Record of Discussion</b></p>
<p><b>Before the project started, was the person affected by poor water quality? If yes, explain how and when.</b></p> <p><i>Ground water? Surface Water? which Water source? How was it polluted?</i></p>	
<p><b>During the project, is the person affected by water pollution? If yes, explain how and when.</b></p> <p><i>Ground water? Surface Water? which Water source? How is quality being affected?</i></p>	
<p>If water quality from the construction is a problem, what changes does the person suggest are made?</p>	
<p><b>6. ACCESS</b></p>	<p><b>Record of Discussion</b></p>
<p>During the project, is the person affected by reduced access to their business, home or land?</p> <p>Access to what is limited, and how?</p>	
<p>If access limitations are not acceptable, please suggest changes which can be made?</p>	
<p><b>7. OTHER ISSUES</b></p>	<p><b>Record of Discussion</b></p>
<p><b>Any other issues about the construction sites that the person wants to discuss?</b></p> <p><i>E.g. wastewater concerns, waste disposal, other concerns, labour force,</i></p>	



## Annex 2: GRM- Complaint Recording Form

<b>PIU Staff Responsible:</b> (name and role)	
<b>Date:</b> (of this record)	

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

### **Annex 3: Particular Conditions (For Bidding Documents)**

1. The following clauses shall be added to the Bidding Document, Section 8 Particular Conditions in relation to the Environmental Safeguards for the Project:
2. The contractor will undertake to develop and submit to the PMU/CSC for approval, a site specific Construction Environmental Management Plan with the following management sub-plans:
  - A. Spoil and Borrow Site Management;
  - B. Solid and Liquid Waste Management;
  - C. Community and Occupational Health and Safety and Emergency Response;
  - D. Construction Workers' Camp Management (if required).
  - E. Air emissions management and monitoring
  - F. Noise and vibrations management and monitoring
  - G. Hazardous materials management
  - H. Management of incoming solid waste
  - I. Relocation of existing waste and clean-up of the existing waste dump
  - J. Erosion and sediment control
  - K. Surface water and groundwater monitoring
  - L. Traffic Management
  - M. COVID-19 health and safety subplan in accordance with national COVID-19 instructions and regulations.
3. The management sub-plans will be sufficiently detailed as to allow a clear understanding of the approach the contractor will take to mitigate environmental impacts during construction. The contractor will adhere to the management sub-plans at all times unless prior agreement has been given by the PMU under extenuating circumstances.
4. The Contractor will commit to ensuring a full time environmental health and safety officer on site who is competent, nominated to manage health and safety risks and who can implement the EMP requirements for occupational health and safety and ensure relevant health and safety legislation is followed.
5. The Contractor will commit to enabling the project staff or consultants tasked with monitoring, full access to all information and data required in order that the Environmental Management Plan can be fully monitored.

## Annex 4: Environmental Quality Standards

### (1) Ambient Air Quality Standards

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

Parameter	Averaging Period	Standard	
		Unit	Value
Nitrogen Dioxide (NO <sub>2</sub> )	24 hours	mg /m <sup>3</sup>	0.1
Sulfur Dioxide (SO <sub>2</sub> )	24 hours	mg /m <sup>3</sup>	0.3
Carbon Monoxide (CO)	24 hours	mg /m <sup>3</sup>	20
PM 2.5	24 hours		-
PM 10	24 hours		-

### (2) Ambient Noise Standards

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

Area	06:00-18:00 dB(A)	18:00-22:00 dB(A)	22:00-06:00 dB(A)
Quiet area (hospital, school)	45	40	5
Residential area	60	50	45
Commercial area	70	65	50
Area with factories mixed with housing	75	70	50

### (3) Surface Water Quality Standard

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

#### Annex 2 of Sub-decree on Water Pollution Control

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

No	Parameters	Unit	Allowable limits for pollutant substance discharging to	
			Protected public water area	Public water area and sewer
1	Temperature	0C	< 45	< 45
2	pH		6 – 9	5 - 9
3	BOD <sub>5</sub> ( 5 days at 200 C )	mg/l	< 30	< 80
4	COD	mg/l	< 50	< 100
5	Total Suspended Solids	mg/l	< 60	< 120
6	Total Dissolved Solids	mg/l	< 1000	< 2000
7	Grease and Oil	mg/l	< 5.0	< 15
8	Detergents	mg/l	< 5.0	< 15

No	Parameters	Unit	Allowable limits for pollutant substance discharging to	
			Protected public water area	Public water area and sewer
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 Byphenyl	mg/l	<0.003	<0.003
37	Calcium	mg/l	<150	<200

No	Parameters	Unit	Allowable limits for pollutant substance discharging to	
			Protected public water area	Public water area and sewer
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**

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

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

##### **a) River**

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

**b) Lakes and Reservoirs**

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

**Annex 5 of Sub-decree on Water Pollution Control:**

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

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

No	Parameter	Unit	Standard Value
22	Arsenic	µg/l	< 10
23	Selenium	µg/l	< 10
24	Polychlorobiohenyl	µg/l	0
25	Cyanide	µg/l	< 0.005

#### Drinking Water Quality Standard

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

#### (6) Soil Quality Standard

Source: Cambodia National Quality Standards for Agriculture, Ministry of Agriculture, Forest, and Fishery (MAFF).

Parameter	Standard	
	Unit	Value
pH		
Salinity	ppt	6-8
Oil & Grease	mg/kg	-
Chloride	mg/kg	-



Parameter	Standard	
	Unit	Value
Petroleum Hydrocarbons		
Kerosene hydrocarbons (c10-c14)	mg/kg	-
Diesel hydrocarbons (c15-c28) (mg/L)	mg/kg	-
Heavy oil hydrocarbons (c29-c36) (mg/L)	mg/kg	-
BTEX		
Ethylbenzene	mg/kg	0.018
Benzene	mg/kg	0.0068
Toluene	mg/kg	0.08
Xylene	mg/kg	2.4
Metals		
Nickel	mg/kg	50
Copper	mg/kg	63
Zinc	mg/kg	200
Arsenic	mg/kg	12
Cadmium	mg/kg	1.4
Lead	mg/kg	70
Iron	mg/kg	-
Chromium	mg/kg	64
Mercury	mg/kg	6.6

## **Annex 5: Terms of Reference for Environmental Compliance Audit of Waste Dumpsites in Kratie City**

### **Background**

The Fourth Greater Mekong Subregion Corridor Towns Development Project (GMS4 or CTD-4 Project) will support the Governments of Cambodia and the Lao People's Democratic Republic (PDR) in enhancing the competitiveness of selected towns located along the Central Mekong Economic Corridor in the Greater Mekong Subregion (GMS).

In Cambodia, the project will improve urban environmental services in Kampong Cham, Kratie and Stung Treng, three of Cambodia's provincial cities located on Mekong River. The project will also improve institutional effectiveness to provide sustainable services and support an improved policy and planning environment for wastewater and solid waste management

The project will construct controlled landfills in all three cities with sufficient volume capacity to accommodate waste from the existing dump sites as well as new waste for the next 10 years.

### **Purpose and requirement of Environmental Compliance Audit**

There are two dumpsites in Kratie City (the old dumpsite and the existing dumpsite) which are considered *Existing Facilities*<sup>11</sup> of the wider CTD-4 Project and the closure and remediation of the dumpsites require that an Environmental Compliance Audit (ECA) is conducted of the facilities pursuant to the SPS (2009), para 10 of Appendix 1 and para 12 of Appendix 4.

The closure and remediation of the dumpsites are part of the Kratie Solid Waste Management Subproject.

### **Scope of the ECA for the dumpsite**

The ECA is divided into two phases, where phase 1 is an initial assessment of the risks, possible solutions and the need for immediate mitigation measures at the dumpsite to minimise any on-going pollution and risks to human health and the environment as much as practical until the long-term solution can be implemented. Phase 2 is an optional phase in case a permanent solution has not been found under the first phase. Phase 2 will then include more detailed site investigations and analyses as may be necessary to make a decision on the long-term solution and to provide information for the preparation of the detailed remediation design

### **Phase 1**

#### **Activities**

Phase 1 includes the following activities:

1. Site visit(s) to identify existing activities or conditions that may cause or contribute to pollution or spread of infections:
  - a. Current land use and vegetation cover of the dumpsite and surrounding areas
  - b. Evidence of open burning
  - c. Evidence of vectors (e.g. rats, insects, birds)
  - d. Evidence of windblown waste
  - e. Direct field assessment of odours
  - f. Drainage and waterbodies
  - g. Leachate seepage
  - h. Mapping of waste piles (active and non-active) and the dumpsite boundary
  - i. Inspect incoming waste or recently dumped waste to characterize the waste types
  - j. Presence of informal recyclers
  - k. Distance to sensitive receptors
  - l. Review of any existing permits or authorizations for the dumpsite

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<sup>11</sup> *Existing Facilities* 12. For projects involving facilities and/or business activities that already exist or are under construction, the borrower/client will undertake an environment and/or social compliance audit, including on-site assessment, to identify past or present concerns related to impacts on the environment, involuntary resettlement, and Indigenous Peoples.

- m. Documentation may include drone photos, videos, onsite photos, field observation notes, GPS tracks and waypoints.
2. Interviews with waste management personnel, government officials, informal recyclers, and farmers owning adjacent land:
  - a. Date dumpsite was commissioned (became operational);
  - b. Current operator and responsible authority of dumpsite
  - c. Current disposal practices;
  - d. Types of solid waste disposed in dumpsite (e.g. domestic, hospital, construction, industrial);
  - e. Rate of solid waste disposal at dumpsite (tonne/day or tonne/month);
  - f. Local water management, water use, flood risk;
  - g. Existing groundwater wells;
  - h. Relevant water quality data.

Site visits and interviews may be combined.

## **Analyses**

Phase 1 includes the following analyses:

1. Analysis of historical Google Earth images to identify the approximate spatial extent of the dumpsite, changes in land use and land cover, proximity to water bodies, and residents, and other sensitive receptors.
2. Preparation of preliminary drawings and maps with Google Earth backdrop approximately to scale and elevations from onsite GPS data based on the above documentation identifying waste pits or trenches, waterbodies, vegetation, surrounding land use, sensitive receptors, and groundwater wells.
3. IBAT proximity assessment.
4. Rough estimation of the spatial extent of the waste dump and total volume of waste.
5. Identification of landownership
6. Analysis of applicable government laws and regulations (non-exhaustive list below, missing regulations will be identified and included in the analysis) to clarify whether the design and operation of the existing dumpsite is in compliance and to clarify requirements applicable to the closure of the dumpsite.
  - a. Sub-decree on Water Pollution Control (Sub-decree No. 27 ANRK/BK) 2009;
  - b. Guidance on Selection of Landfill Sites (2016);
  - c. Sub-decree on Solid Waste Management (Sub-decree No. 36 ANK/BK) 1999;
  - d. Environmental Guidelines on Solid Waste Management in Kingdom of Cambodia, Ministry of Environment, 2006.
7. Preliminary identification and assessment of existing pollution and other health risks and development of practical and affordable immediate actions to eliminate or minimise the risks including cost estimates for such actions.
8. Preparation of a simple Environmental Management Plan covering the immediate mitigation measures at the dumpsite.
9. Analysis of alternative long-term solutions and develop recommendations. If the results of the investigations are conclusive or if the most advantageous solution (environmental impacts, costs, future land use, landownership, technical feasibility) can reasonably be determined, then recommend the preferred remediation and closure method. If the results are inconclusive, then the critical information gaps should be identified, and Phase 2 investigations should be initiated.

## **Expected Results**

**Phase 1** is designed to provide the following results:

1. Legal requirements to dumpsite closure
2. Analysis of alternative long-term solutions, and either
  - a. Determination of the preferred solution (if the findings are sufficiently conclusive); or
  - b. Phase 2 investigation programme

The results will be documented and incorporated in the IEE and EMP.

## Phase 2

The objectives of the Phase 2 investigations are to fill-in information gaps identified in Phase 1 and to determine the long-term solution to the remediation of the dumpsite and to provide information for the preparation of the detailed remediation design.

The scope of the Phase 2 investigations consists of the activities listed below and possibly additional activities as may have been determined in Phase 1.

### Activities

13. Interviews (continued from Phase 1) with waste management personnel and government officials with knowledge about the dumpsite:
  - a. Preferred future land use (ranking of alternatives)
  - b. the number and depth of waste cells;
  - c. underlying waste cell lining material if any;
  - d. extent of active surface runoff collection and drainage;
  - e. extent of leachate and gas collection and treatment;
  - f. extent of septage disposal and management;
  - g. waste recycling process used by local waste pickers; and
  - h. scheduling of transport of solid waste to dumpsite.
14. Obtain existing data on groundwater quality near the dumpsites from PDoE (if available).
15. Obtain existing surface water quality data for potentially impacted water bodies.
16. Determine number of full-time and part-time informal recyclers that work (and live) at the dumpsite
17. Identify any other use of the dumpsite area.
18. Consult with the surrounding community and the informal recyclers to determine if there are past or present environmental, social, or human health issues associated with the operation of the existing dumpsite.
19. *Waste Surveys*: It is critical to determine the volume and nature of the waste on the site. A mapping exercise is required, which details the extent of waste coverage and depths of waste in different localities. This will require excavating pits into the waste piles in order to determine the depth of waste. It is also important to understand the typical waste density of the waste, which will help assess tonnages. This will require undertaking waste density tests in a number of locations (kilograms per square metre). It will also be useful to provide further details on the typical composition of the waste and the degree of degradation that has occurred (i.e., an estimation of the length of time the waste has been on-site and the degree of decomposition of organic material). The presence of any problem or hazardous waste (e.g., medical wastes) should be recorded, including details and locations of these wastes.
20. *Groundwater Quality Survey*: It is critical to determine the impact that the waste dump has on water quality in underlying groundwater. It is highly recommended that this is undertaken even if the waste is relocated, since it will be important to determine the legacy impacts of this dumpsite.
21. Following the completion of the above surveys, an economic feasibility assessment will be undertaken to determine the viability of transferring the old waste to the new landfill. If this option is deemed viable, then further geotechnical surveys are not required. If relocation of waste is not economically viable, then in-situ remediation will clearly be the only option, and in will then be necessary to undertake the geotechnical survey outlined below, and possibly also the hydrogeological survey, if the groundwater has been shown to be polluted.

### Additional Optional Activities

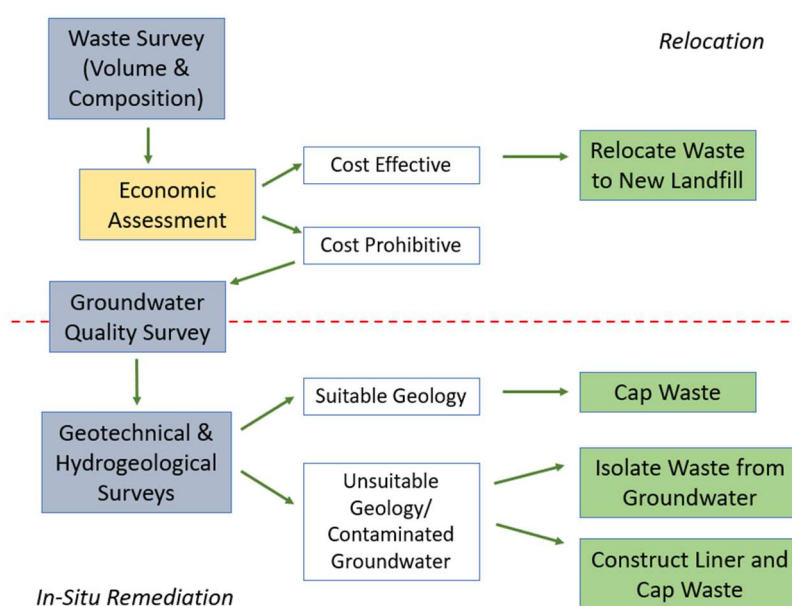
22. *Geotechnical and Hydrogeological Surveys*: For in-situ remediation measures, it will be critical to understand the site geology and hydrology. This will involve developing an understanding of the underlying geology, particularly in terms of permeability and the potential for transferring leachate into groundwater. Hydrogeological surveys will be necessary if water quality surveys show that the

groundwater is polluted from the waste. This survey will involve an examination of groundwater flow and connectivity, in order to determine if polluted water is being used by neighbouring activities, with particular concerns where it is being used as human or livestock drinking water sources.

23. The choice of in-situ remediation options will depend on the results of the surveys. The ideal and default option for in-situ remediation will be closure through capping the waste (see below for details). However, if there is existing pollution of groundwater and the geology is not suitable then more complex engineering options will need to be considered. This would include the construction of an engineered landfill cell, complete with an underlying liner; or may include other approaches that isolate the waste from the groundwater, such as cut-off barriers.

24. The overall decision tree for remediation options is detailed below:

### Remediation Decision Approach



### Expected Results

Phase 2 is designed to provide the following results:

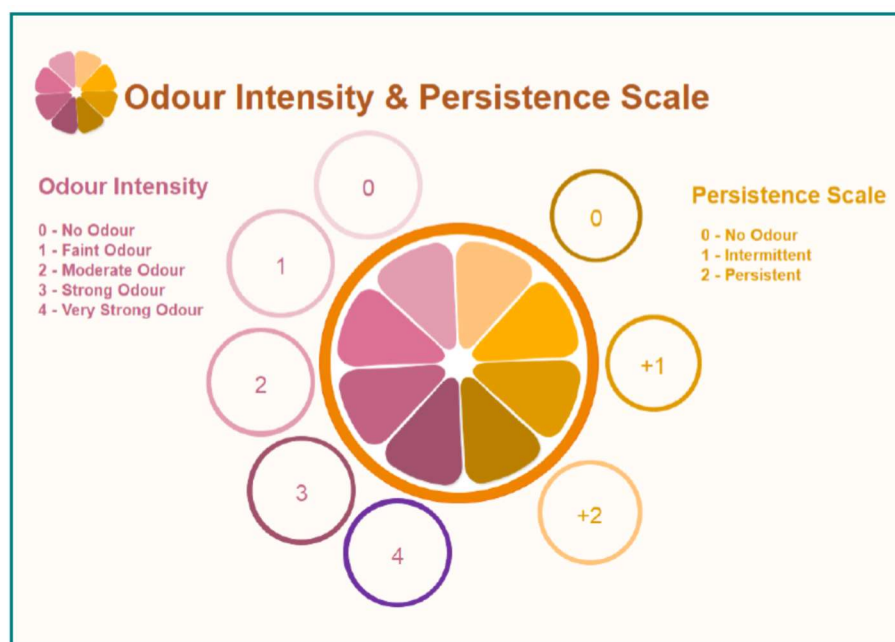
1. Recommendations on the future land use of the remediated dumpsite
2. Analysis and ranking of alternative long-term solutions
3. The preferred long-term solution including monitoring and aftercare.
4. Cost estimate

The results will be documented in a concise report and presented to the PMU and ADB for their decisions on the recommended remediation and closure method.

## Annex 6: Odour Impact Assessment Procedures

The odour impact assessment at nearby sensitive receptors will be performed in accordance with the following standard procedures<sup>12</sup>:

- Staff will only undertake the odour impact assessment prior to coming to work as staff are likely to be desensitised to the odour generated onsite, termed odour adaptation, and thus might be unable to objectively assess odour in the surrounding environment.
- Prior to the test, the wind conditions will be confirmed, and an initial odour impact assessment taken upwind of the facility prior to moving to downwind locations.
- The surveyors will record both the intensity of the odour and its persistence at each location assessed using the terminology outlined in the Figure below.
- The surveyors should not smoke, chew gum, drink coffee / tea nor be experiencing a medical condition (such as a cold / flu) which could interfere with the test.
- Surveys will be conducted on at least several occasions over varying days of the week. The time of day when odour complaints are made and the wind direction which leads to most complaints should be considered also.
- Where an odour is detected, an inspection of the facility must be carried out directly by the odour investigator, to determine whether any observed odour can be linked to the site and to evaluate any potential odour producing activities or locations. Understanding the actual process conditions onsite at the time of the complaint will help to locate the issue and isolate the problem.



<sup>12</sup> Adapted from Environmental Protection Agency (Ireland), Office of Environmental Enforcement, Odour Emissions Guidance Note (Air Guidance Note AG9), September 2019  
<https://www.epa.ie/pubs/advice/air/emissions/Odour%20Emissions%20Guidance%20Note%20AG09.pdf>

## Annex 7: COVID-19 Monitoring Checklists

### 1. Prevention Measures

Below is a checklist for prevention measures.

No.	COVID-19 Preventive Measures	Yes	No
1	Dissemination of COVID-19 prevention measures to staff and workers through orientation or distributing leaflet/poster at information/safety board at each construction and camp site		
2	Daily checking temperature of staff and workers prior to start working		
3	Staff and workers are wearing masks all the time		
4	Do not share personal items or supplies such as phones, pens, notebooks, tools, etc.		
5	Avoid common physical greetings, such as handshakes		
6	Maintain a minimum physical distance of one metre from others if possible		
7	Wash hands often with soap and water for at least 20 seconds after using the washroom, before handling food, after blowing nose, coughing, or sneezing, and before smoking. If hands are not visibly soiled, and soap and water are unavailable, alcohol-based hand sanitizer can be used		
8	All offices and jobsites implement additional cleaning measures of common areas. All door handles, railings, ladders, switches, controls, eating surfaces, shared tools and equipment, taps, toilets, and personal workstation areas are wiped down at least twice a day with a disinfectant, such as disinfectant wipes. Individuals are responsible for cleaning and disinfecting their workstations		
9	Commonly touched surfaces on vehicles and equipment are thoroughly cleaned and disinfected at the end of shifts and between users		
10	Coughing or sneezing into a tissue or the bend of your arm, not your hand; dispose of used tissues you have as soon as possible in a lined waste basket and wash your hands afterwards		
11	Complying with any instructions announced by the Ministry of Health		

### 2. Response to Possible Cases of COVID-19

Below is a checklist on proper response to possible cases of COVID-19 disease.

No.	Measures in case of COVID-19	Yes	No
1	Individuals who have been potentially exposed to the virus, or who are exhibiting flu-like symptoms such as fever, tiredness, coughing, or congestion are instructed to: <ul style="list-style-type: none"> <li>▪ Not come to work;</li> <li>▪ Contact their supervisor and/or human resources department;</li> <li>▪ Stay at home and self-isolate; and</li> </ul>		



No.	Measures in case of COVID-19	Yes	No
	▪ Contact local health authorities for further direction.		
2	Such individuals are required to follow the directions of the local health authority and may not return to work until given approval by the proper health authorities;		
3	Individuals who begin to display flu-like symptoms on site are instructed to avoid touching anything, take extra care to contain coughs and sneezes, and return home immediately to undergo self-isolation as directed by the local health authority;		
4	All areas on site potentially infected by a confirmed or probable case are barricaded to keep individuals two meters away until the area is properly cleaned and disinfected.		

Note: Additional COVID-19-related checklist/form, please go to this link:

<http://www.cdcmoh.gov.kh/resource-documents/covid-19-documents/494-2019-ncov-documents-management>