PROVINCIAL PEOPLE'S COMMITTEE OF DAKLAK

ASIAN DEVELOPMENT BANK

SECONDARY CITIES DEVELOPMENT PROJECT
BUON MA THUOT SUBPROJECT

ENVIRONMENTAL MANAGEMENT PLAN
CIVIL WORK PACKAGE BMT01

(FINAL DRAFT REPORT)

September 2015

SECONDARY CITIES DEVELOPMENT PROJECT
BUON MA THUOT SUBPROJECT

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ENVIRONMENTAL MANAGEMENT REPORT

FOR

PACKAGE BMT 01

HOA PHU SOLID WASTE TREATMENT PLANT SUBCOMPONENT

ABBREVIATIONS

ADB	Asian Development Bank
AH	Affected Household
BOD5	Biological Oxygen Demand
CEMP	Contractor's EMP
COD	Chemical Oxygen Demand
CPC	Commune People Committee
CSC	Construction Supervision Consultant
DAKURENCO	DakLak Urban Environmental Company
DED	Detailed Engineering Designing
DONRE	Department of Environment and Natural Resources
EIA	Environment Impact Assessment
EMC	Environmental Monitoring Consultant
EMP	Environment Management Plan
ES	Environmental Staff
FS	Feasibility Study
GHG	Greenhouse Gases
GoV	Government of Viet Nam
h	Hour
IEE	Initial Environmental Examination
NOL	No Objection Letter
O&M	Operation and Maintenance
PMU	Buon Ma Thuot City projects Management Unit
PPC	Provincial People Committee
QCVN	National Technical Standards
RAP	Resettlement Action Plan
ROW	Rights of Way
SCDP	Secondary Cities Development Project
SPS	Social Policy Safeguard
SWTP	Solid Waste Treatment Plant
TSP	Total Suspended Particles
UXO	Unexploded Ordinance

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WEIGHTS AND MEASURES

cm	*Centimetter*
m	*Metter*
km	*Kilometre*
m^2	*Square metter*
m^3	*Cubic metter*
Ha	*Hectare*

CURRENCY EQUIVALENTS

(As of 1 July 2015)

Currency unit	*–*	*Vietnamese Dong (D)*
$1.00	*=*	*D21,830*

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I. INTRODUCTION

A. Project Overview

1. The Secondary Cities Development Project (SCDP or, the "Project") set up objectives to address the development issues of Buon Ma Thuot (Dak Lak Province), Ha Tinh (Ha Tinh Province) and Tam KY (Quang Nam Province) to develop these cities as regional economic growth centers to foster balanced regional development. The project will enhance implementation of the Government of Viet Nam (GoV) policy context with specific reference to: (i) the overarching policies contained in the Socio-Economic Development Strategy (SEDS) 2011-2020 and the Socio-Economic Development Plan (SEDP) 2011-2015; (ii) the sector policies contained in Orientation Plans relevant to this Project, and other recent policy advice and guidelines on climate change resilience and green city development for instance. The selected subprojects considered the policies and sector priorities contained in the Asian Development Bank (ADB) Country Partnership Strategy (2012-2015). The subprojects are also aligned to other ADB priorities in terms of climate change considerations, social inclusion and stakeholder participation. At a local level, the individual Project subcomponents are in compliance with the relevant Master Plans in each of the cities.

   The selected subprojects are prepared to ensure compliance with the needs of climate change and disaster management. Here, emphasis is placed on better flood protection measures in Ha Tinh and Tam Ky, where new and upgraded flood dykes in Tam Ky will be in compliance with the climate resilience standards of the Ministry of Agriculture and Rural Development (MARD). Similarly, new road construction in Tam Ky (Dien Bien Phu Road), once fully completed, will contribute significantly to the city's capability to evacuate the coastal populations in the event of tidal inundation. Further innovations incorporating provision for better environmental planning and technologies will be considered and incorporated in the detailed design of each subproject.

2. Each of the subprojects includes a subcomponent for capacity building, geared mainly to the consulting services in project management and technical support to the PMUs. It will also strengthen the Women's' Unions (WU) in each of the cities to design and deliver training and awareness programs and to deliver projects across the wider community.

3. Buon Ma Thuot subproject consists of three components (i) Solid waste management, (ii) Urban roads improvement and (iii) Capacity building and implementing support, and each component will deliver the following outputs:

   (i) Component 1: Solid Waste Management
   - Output 1.1: improved solid waste disposal
   - Output 1.2: remediated open dumpsite
   - Output 1.3: a pilot project for community waste at source segregation and a supporting information and education campaign;

   (ii) Component 2: Urban Road Development
   - Output 2.1 improved/complete major roads

   (iii) Component 3: Capacity Building and Subproject Implementation Support
   - Output 3.1: increased efficiency and management capacity of relevant government
   - Output 3.2: agencies in project management, particularly in financial management, procurement, project performance monitoring and evaluation

4. Under the solid waste management component, a part of phase 1 of City's SWTP in Hoa Phu commune is proposed to be constructed and the existing dumpsite in Cu EBur commune will be closed. The urban road component will focus on improving and widening Tran Qui Cap and Mai Thi Luu roads. DAKURENCO is the implementing agency for three

subcomponents of Tran Qui Cap road, Hoa Phu SWTP and Cu EBur landfill closure, while PMU is implementing agency for Mai Thi Luu road subcomponent.

5. Currently, except the EIA of closure of existing dumpsite in Cu EBur commune has not been prepared, the approvals of the remaining three EIAs of urban roads and Hoa Phu SWTP have been done. Concretely, the EIA of Tran Qui Cap, Mai Thi Luu Urban Road subcomponent was approved at Decision No. 1144/QD-UBND dated 17 June 2013 and the EIA of Hoa Phu SWTP subcomponent was also approved by DaKLAK PPC on June 06, 2014 at Decision No.1213/QĐ-UBND.

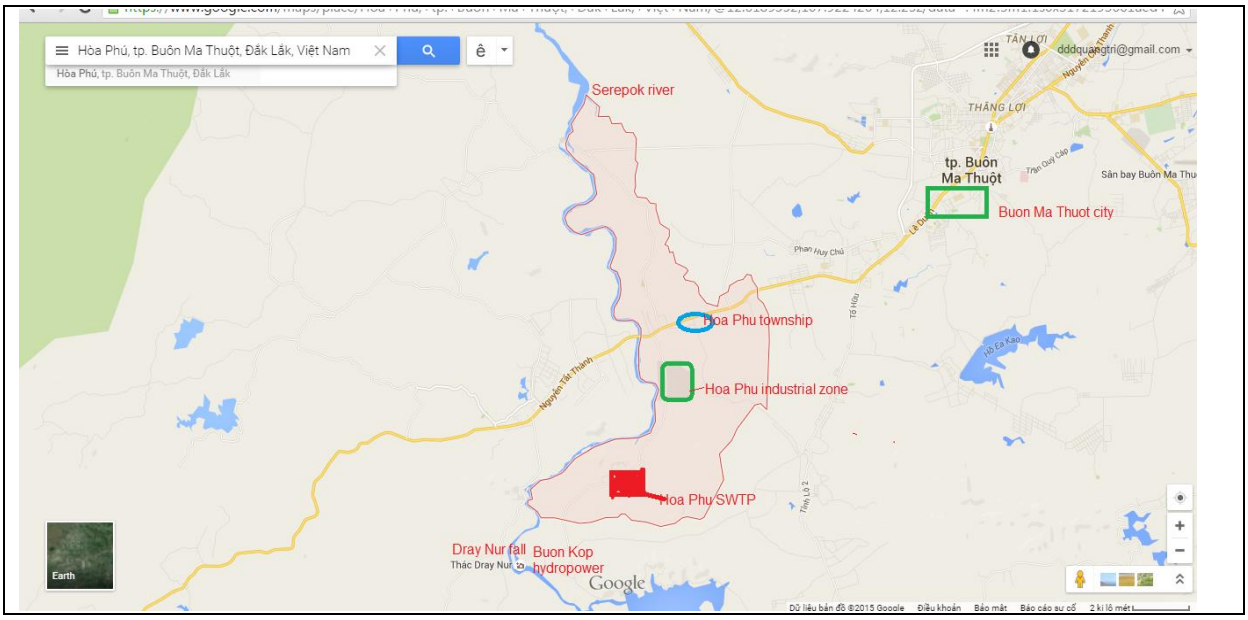
6. Thus, four separate subcomponent EMPs that include EMP of Tran Qui Cap Urban Road Subcomponent (under the package of BMT2); EMP of Mai Thi Luu Urban Road (package of BTM3); EMP of Hoa Phu SWTP (Package of BMT1A) and EMP of Cu EBUR dumping site closing (Package of BMT1B) will be updated and submitted as separate documents to ADB.

7. This document is the update of EMP of Hoa Phu SWTP Subcomponent package (BMT01);

B. General subcomponent description

8. The subproject position: Hoa Phu SWTP that is located at village 11, Hoa Phu commune, Buon Ma Thuot city is 15km from the Buon Ma Thuot centre to the North East and is 3.5km from Hoa Phu commune center to the North. It total area is 103 ha and the first phase will use 50ha. This is a private land being used for growing cashers and cassava. The SWTP is about 2km from residential area of Hoa Phu commune, about 1.5km from Hoa Phu industrial zone and 1km from Buon Nop hydropower plant to the southwest and 1km from Serepok river to the West. The position layout presents at Figure 1.

Figure 1: Position of Hoa Phu SWTP



9. The site is a valley shape to the north with a large flat central area where the cells will be developed overtime. The site flattens out to the east especially in the area of the second phase. At the downstream of the vicinity, there is Ea Goi stream, its flow is so small that the flow dries up with 50m of the spring. This spring will be outside the cell footprint and the flow diverted by the perimeter storm water drain. Other water resources on site are ephemeral. However, in raining season, Ea Goi shallow stream may function as a low area to receive all runoff water from the upper area, including the landfill wastes then discharging to Ea Goi bigger stream and to Serepok River located about 20km from the site.


EA Goi bigger stream

SEREPOX River

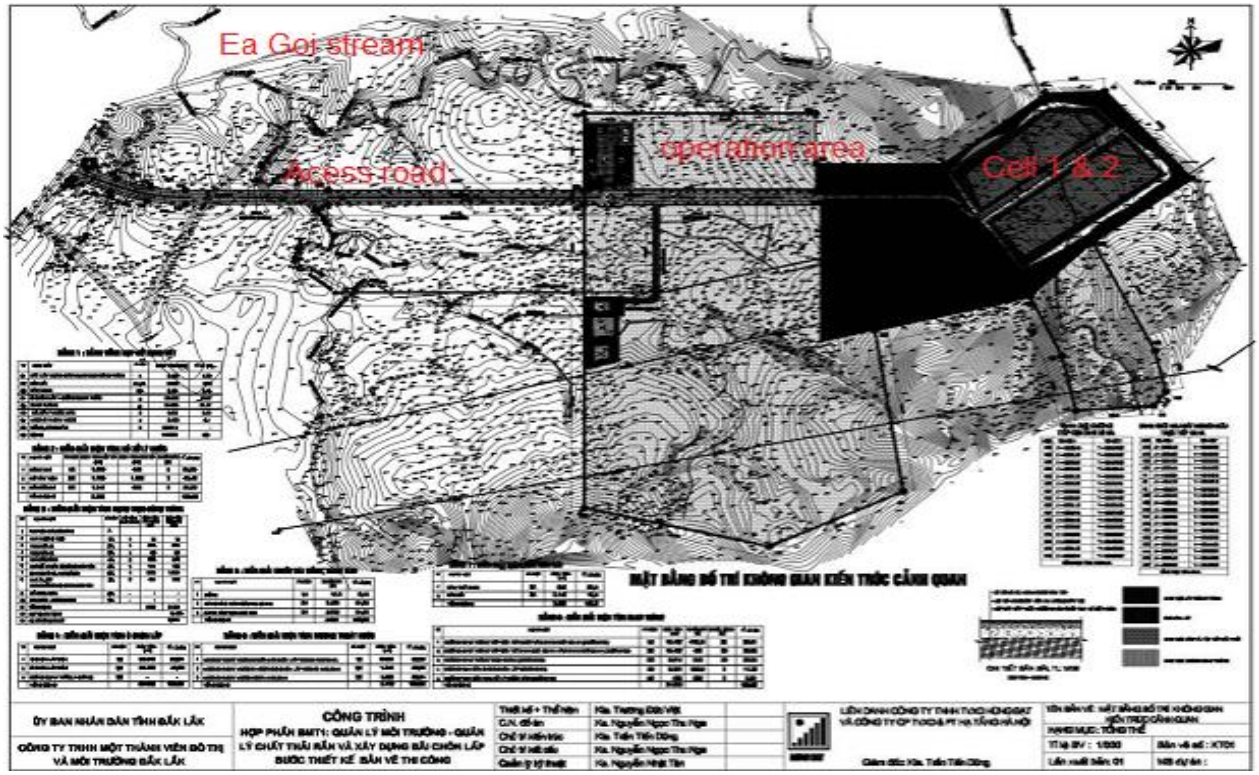
10. The local soil has a suitable amount of clay such that the soil will remain trafficable in wet weather and not crack excessively in dry weather due to excessive plastic clay shrinkage. It also will be suitable in terms of generally limiting rainwater infiltration during wet weather given its silt and clay content, which is ideal for landfill covered materials.

11. The site is presently a mix of farming mainly cashews with low productivity and open grasslands with only four houses on the site, which can contribute to reducing negative impact on social issues such as resettlement and loses of assets/incomes. The terrain and environmental status of the proposed landfill is reflected in Figure 2.

Figure 2: Topography and environmental status of the landfill site


12. The total area is proposed for Hoa Phu SWTP is 11,254.3 m^2, of which 2,599 m^2 used for constructing the operation building and other subordinate works; the area reserved for making yard growing green trees is 6,740m^2; the land with a lower terrain located near the mountain to the West (back of the landfill) is prioritized for constructing waste burying cells including stockpiles and monitoring wells with an area of 60,032m^2; Land area for transportation purpose being 35,419m^2, leachate treatment plants with 3,792m^2 and the remaining 3,792m^2 used for constructing drainage system. The ground layout is presented in Figure 3.

Figure 3: Ground layout of the landfill



13. The proposed facilities

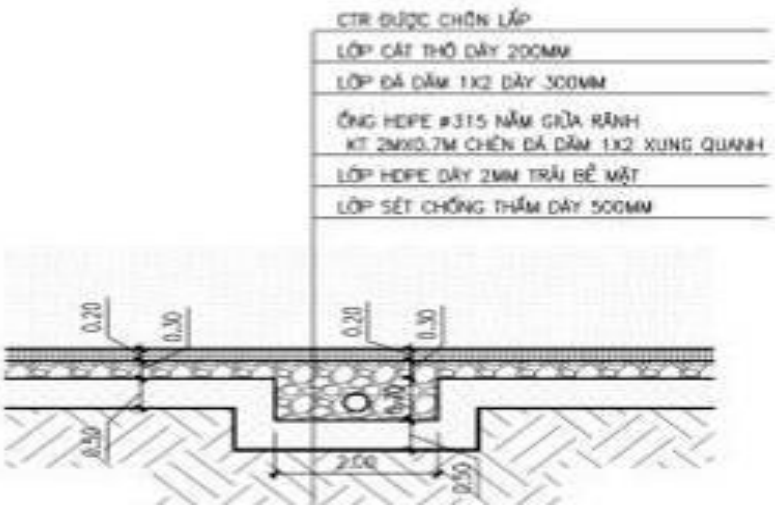
- Cell 1 and 2 including bulk earthworks, liner and protective gravel blanket, area to allow stockpiling of recycles; and Groundwater monitoring wells;
- Excess roads both external and internal to the site necessary to reach Cell 1 and 2;
- Leachate pipe collection system and pumping stations, together with re – injection and irrigation system;
- Storming drainage;

- Gas vents;
- Potable and non-potable water supply;
- Ancillary works such as landscaping, weighbridge, lighting and fencing;
- Various buildings for ablution blocks, meeting rooms, laboratory etc.

C. Detail description of each facility and discussion

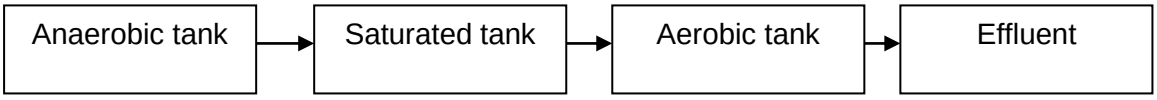
14. Cell is divided into two separate cells named Cell 1 & 2 with the respective areas of 26,200m2 and 27,700m2. The bottoms and walls of cells are reinforced with a HDPE membrane thick 2mm covered with a natural clay layer thick 60cm from the bottom to top banks of the cells, aiming to prevent leachate leaking out and gases migration to its buffer zones. According to the DED document, the structure of cell bottom from the bottom to top is described that Layer 1: impermeable clay liner of 60cm compacted, layer 2 is HDPE membrane of 2mm; over the layer 2, HDPE pipe D200 thick 14.7mm with holes D 10mm will be installed to collect leachate; Layer 3 is a stone layer of 30cm, and layer 4: coarse sand of 20cm functioning as a leachate filter. The overall slope of cell bottom is 5% (Figure 4);

Figure 4: Cross layout of the bottom of landfill



Discussion: Structure of bottom layer is considered strong enough on the natural base of the landfill.

15. System collecting and treating leachate includes pipes of collecting leachate, pumping stations and leachate treatment plant. The collecting pipes consist of main pipes with D 315mm and branch pipes with D 160mm with holes of 10 -15cm designed on the pipes. Total area of holes on the pipes accounts for 10 -15% of the total of pipe area. Leachate pumping station is located at a depth of 11.7m with a submerged pumper capacity of 5 L/s, which can pump water up to a height of 20m. A string with D 10mm hangs the pump and a concrete lid covers the hole to ensure safety is designed. The leachate is pumped to the leachate treatment plant for treatment before discharging to the environment. The technology used for treating the leachate is biological, including three separate tanks of aerobic, anaerobic and arbitrary tanks. Effluent wil be discharged to Ea Goi shallow stream.

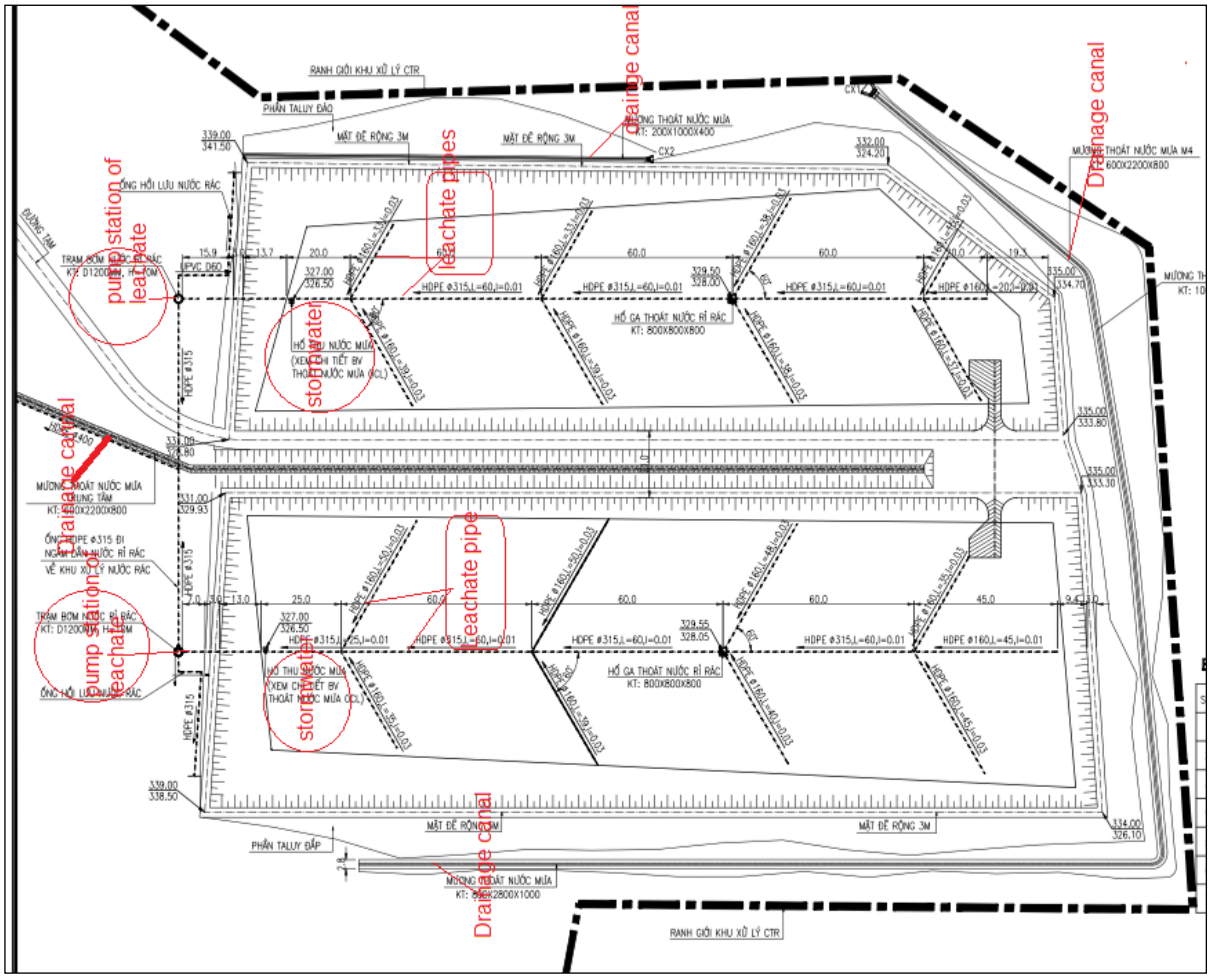


Discussion: It has been experienced that leachate could be hard to be decomposed by simply biological treatment system. In addition, the DED document has not mentioned any quality of leachate influent, process of treatment and quality of effluent after treatment. Therefore, no further comments release in this time. It is suggested that DED consultant should add further information to the leachate treatment plant to demonstrate that the effluent will meet QCVN 25/2009/BTNMT (column B2) and QCVN 40/2011/BTNMT (column B) before discharging to the environment..

16. Strategy of leachate management is clearly described in the detail design. Seepage of leachate from beneath the site will be eliminated by installing a HDPE liner. The movement of leachate is directed to leachate pumping station by grading the base of the site to the central area and intercepting this seepage on interceptor/collector drains. Reducing the volume of leachate generated by (i) using staging, filling, compaction, shaping and covering procedures, which severely inhibit direct rainfall entry; (ii) intercepting and by-passing all upstream and external surface water catchment areas around the fill area utilizing surface drainage channels; and (iii) segregating rain falling directly into the cells from the leachate systems, and draining this clean storm water to the central storm water drain. Progressively leachate will be recycled by pump it from the pumping station through the waste mounds by means of “reinjection dry wells”, irrigating previously worked areas to sustain grass and plant growth on the batters, using for dust suppression and irrigating future cell areas if required. Dedicated wells for monitoring quality of groundwater at site will be installed within and adjoining the vicinity.

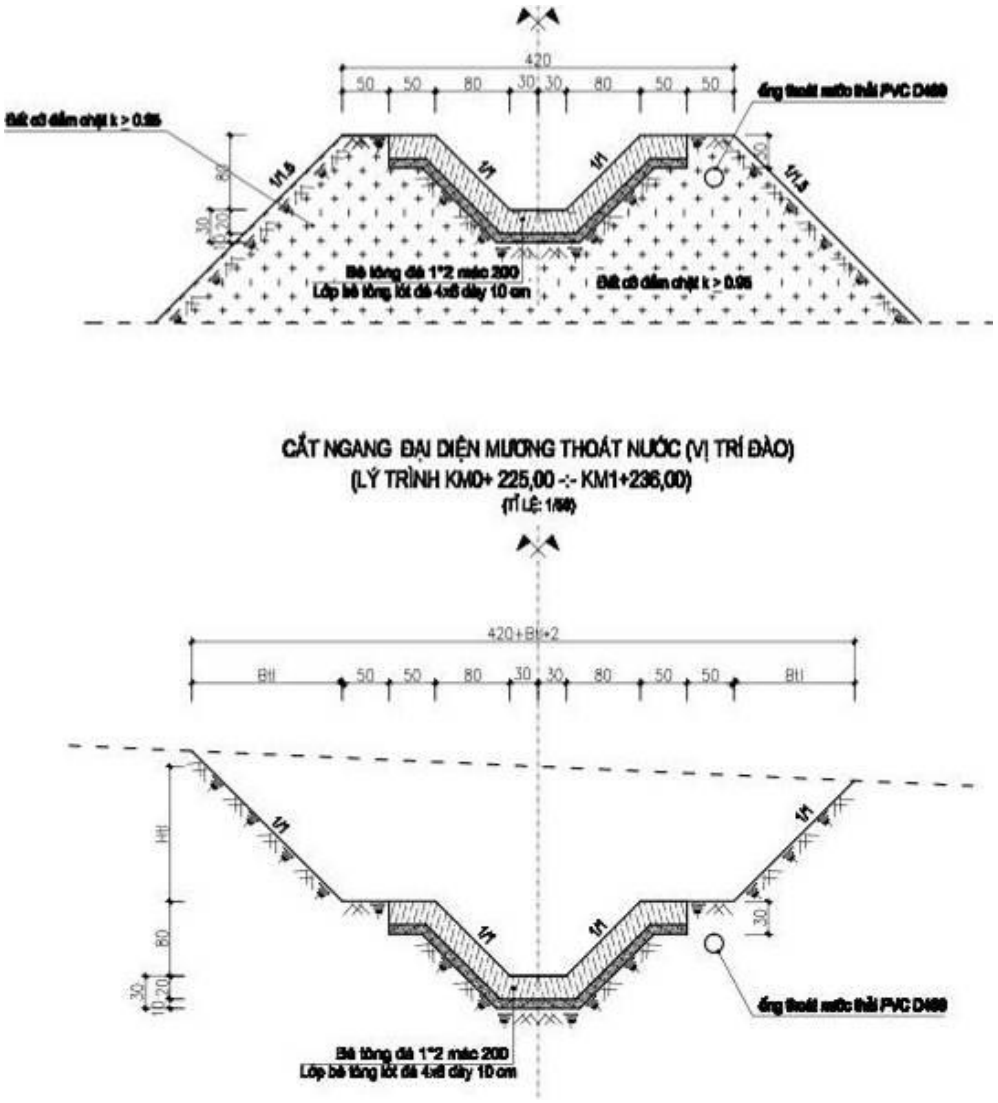
17. The drainage management is illustrated in the detail design. Storm water runoff will be managed by a central drain through the middle of the landfill to convey external storm water away from the site. At the time of over-topping Cell 1 & 2 to provide a consolidated single mound, external flows will be conveyed in diversion drains constructed around the cell perimeter. A key element of site drainage will include management of storm water impounded in the active cells following a significant rain event. A pipe penetrating the liner from the lowest area in the cell going directly into the central storm water drain will drain away uncontaminated storm water. Storm water and leachate management is reflected in Figure 5

Figure 5: Layout of landfill runoff and leachate collection



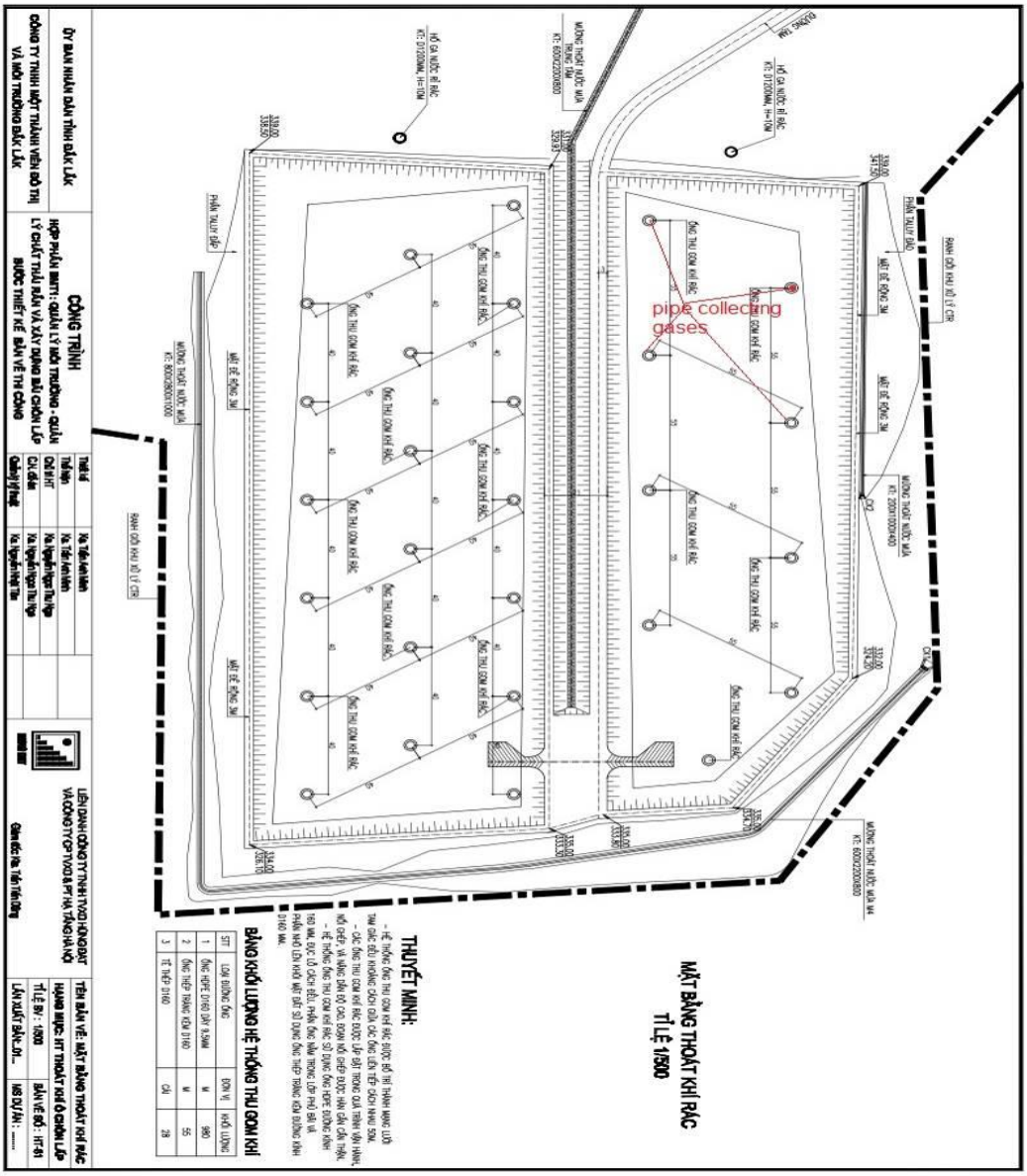
18. The drainage canal surrounding the cells has structure of trapezoid figure with the dimensions of 800x2800x1000, 1000x3000x1000, 600x2200x800, 200x1000x400. The figure 5 &6 shows the shape.

Figure 6: Cross layout of landfill drainage canal



19. Gas collection wells will progressively be installed at the site as it develops (in accordance with Vietnamese requirements). The standard design for these vertical wells is to have them at a 50 m grid pattern spaced over the site. The vents are slotted pipes 150 to 200 mm in diameter placed vertically in a 600 mm diameter gravel wick. These are usually installed when there is sufficient waste on site to generate useful quantities of gas and the earlier acid forming stages of the aerobic and anaerobic breakdown have finished and methane forming bacteria dominate. Gas wells will be installed when the over-topping stage is underway linking Cells 1 and 2. If methane is later required to be oxidized to reduce greenhouse impact, then a gas flaring system could be installed to convert the methane component (CH4) to carbon dioxide (CO2). In future methane gas could be used for generating energy for incineration of medical wastes or whatever. The layout of gas collection system is present in Figure 7.

Figure 7: Layout of landfill gas collection system



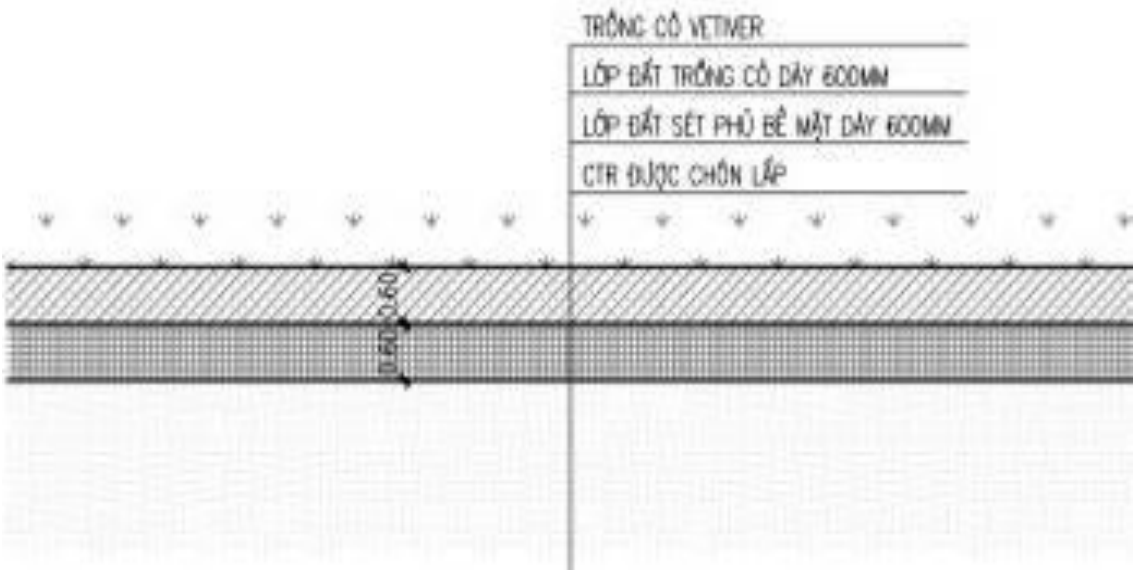
20. The life span of landfill is 7 years from 2016 to 2022. Wastes generated and soil required to cover the wastes is listed as the following Table 1

Table 1: Tentative quantity of wastes and cover soil in period of 2016 - 2022

Year	Average quantity of waste (Ton/day)	Average volume of waste (m^3/day)	Cover soil (m^3/day)	Total waste volume (m^3/year)	Total cover soil volume (m^3/year)
2016	200	240	60	87,444	21,861
2017	207	249	62	90,750	22,688
2018	215	258	65	94,182	23,545
2019	223	268	67	97,743	24,436
2020	232	278	69	101,439	25,360
2021	240	288	72	105,275	26,319
2022	249	299	75	109,255	27,314
	Total			**686,087**	**171,522**

21. Waste is covered and compacted daily by soil with 25% of the total wastes, which is intermediate layer thick about 20cm. when the cell that is full up with wastes it will be covered with three main layers. It can be seen from the top to bottom layer (1): Grass vetiver; layer (2): Soil for growing grass thick 60cm; and layer (3): Clay layer thick 60cm compacted, which reflects in Figure 8.

Figure 8: Cross layout of the landfill top

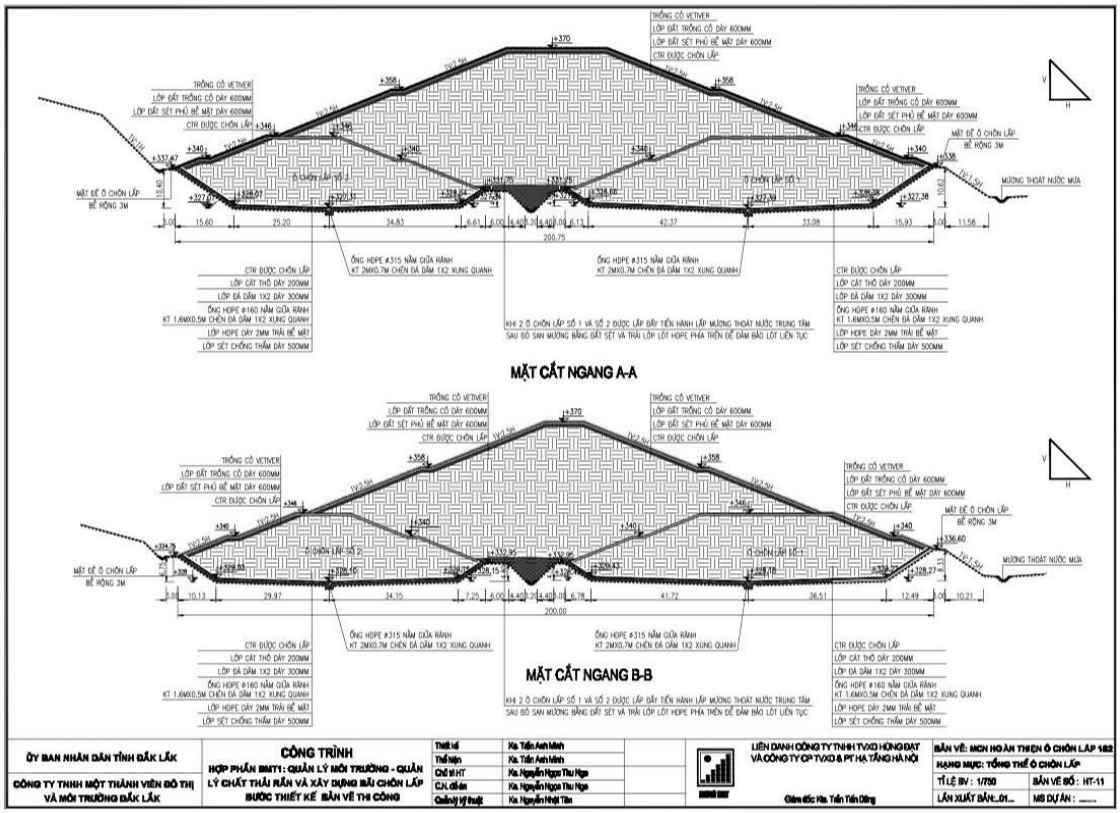


22. The slope of landfill at the slope of 1: 2.5, other parameters of the landfill is in Table 2 and the shape of cells when completed is as Figure 9.

Table 2: Parameters of the landfill Cells

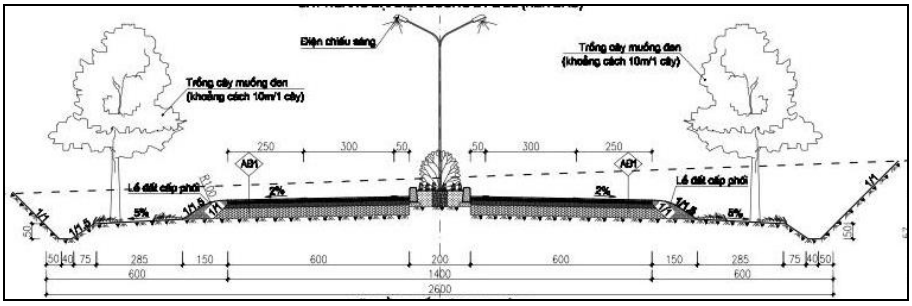
Cells	**Stage** *(year)*	**Bottom area** *(m^2)*	**Top area** *(m^2)*	**Average height** *(m)*	**Cell volumes** *(m^3)*	**Volume of Waste dumped** *(m^3)*	**Volume of Total waste plus 25% cover soil** *(m^3)*
Cell I	2016 - 2018	20,7	26,2	5	280,77	209,94	262,43
Cell 2	2019 - 2020	16,8	23,7	5	266,93	194,79	243,48
1 &2	2021 - 2022			40	413,43	282,83	353,53
	Total				**961,13**	**687,56**	**859,44**

Figure 9: Layout of landfill shape after finally covered



23. The access road has slope of 10 -20% belong to urban road class 1 grade III, velocity of 50km/h. It is a two – way road, each side is 06m, two lanes and a central divider width of 2m. The road is covered with asphalt. Each side of the sidewalk that is 3.6 m, being covered with Terrazzo bricks, tree pots designed along the sidewalk and Black Sienna species tolerant to dry will be planted. The drainage canal is designed both sides of the sidewalk to discharge storm water to Ea Goo stream via its discharging gates. The road cross layout is presented in Figure 10.

Figure 10: Cross layout of access road of the landfill



24. Operation house including water supply and other works such as weight station, truck-washing station is located near the gate of landfill on an area of 2,599m2, which is provided with adequacy of space for operating landfill and environmental sanitation for workers. Detailed area allocation is described in Table 3.

Table 3: Construction items of the landfill operation area in phase I

No	Items	Storey	Constructed Area	Used area
1	Standing house	1	21	18
2	Truck washing station	1	375	375
3	Weight station	1	60	60
4	Operation house	2	286	572
5	Motorcycle park	1	144	126
6	Car park and stores	1	1.229	1.250
7	Kitchen and shift house	2	484	732
8	Groundwater tanks	-	-	-
9	Drilled well and fountain	-	-	-
	Total area		**2.599**	**3.133**
	Construction area			**0,49%**

25. Wastewater from operation house is collected and treated by latrine with three compartments before discharging into the proposed drainage system. Wastewater from truck washing station is collected and pumped to the leachate treatment plant.
Discussion: wastewater coming from truck washing station contains hazardous compounds such as oil, petrol and lubricants from the truck machines, which is considered hard to be biologically decomposed. If it is collected and pumped to leachate treatment plant, there will be a further difficulty in treatment of the waste under the capacity of proposed leachate treatment plant. It is recommended that the wastewater of truck washing station should be separately treated.

D. Related Materials, Fuel, Disposals and Machines

1. Construction Materials and Disposals

26. Summary of materials will be supplied to sites for the construction of Hoa Phu SWTP is in Table 4.

Table 4: Main kinds of materials to site for construction of SWTP

No	Materials	Unit	Volume	Specific weight (Ton/unit)	Quantity (ton)
1	Various stones	m^3	7,106.00	1.50000	10,659.00
2	Various sand	m^3	10,765.35	1.45000	15,609.76
3	Various steels	kg	669,142.52	0.00100	669.14
4	Bricks	unit	207,786.23	0.00196	407.26
5	Matit	kg	32,586.58	0.00100	32.59
6	Cement PC40	kg	2,770,718.19	0.00100	2,770.72
	Total				**30,148.47**

Source: Detailed engineering design document

27. According to the Survey Profile of construction materials quarries by the detailed designer, sources of construction materials include sand, leveling soil, stone materials, which are extracted from mines in the area surrounding construction area and transported to the site by 10-ton trucks. Location of quarries and transport routes are described in the Table 5

Table 5: Construction Material Demand and Its Sources

No.	Parameter	Quarries	
		Soil and sand	Rock and stone
		Quynh Ngoc commune, Krong Ana district	Hoa Phu commune, BMT city
2	Transport distance	24 Km	07 Km
3	Quality	Qualified	Qualified
4	Operation condition	Operating	Operating
5	Exploitation capacity	> 100,000 m^3	> 100,000 m^3
6	License	Managed by private company	Decision No.1185/QD-UBND issued by DakLak

Source: Detailed designing consultant

2. Sites for Disposals

28. The quantity of debris and waste will be disposed to Hoa Phu commune to rehabilitate the environment (Decision No. 1287/QD-UBND issued by Daklak PPC on 27 May 2010).

3. Mobilized Machines

29. List of equipments and machines used for construction of subcomponent is in Table 6.

Table 6: List of machines mobilized to site

No	Machines	Quantity
1	Bulldozer Caterpillar D826	1
2	Bulldozer Caterpillar D7	1
3	Crane Caterpillar 336D	1
4	Trucks	1
5	Water sprinkler truck 8m^3 with pump HINO FG8JJSB-TVHN	1
6	Weight station 60Ton	1
7	Substation 560KVA	560

Source: Detailed Design Document

4. Fuels

30. Fuel that will be supplied for the operation of machines at site is estimated that the quantity of diesel is about 16,332.8 Litters

E. Construction schedule

31. Total construction time will be around 12 months.

F. Main Activities relevant to environmental aspect

(i) Pre-construction activities:
- (a) Detailed design
- (b) Land clearance mostly agricultural land

(ii) Construction activities:
- (a) Setting worker's camps
- (b) Gathering workers, materials, machines and equipment
- (c) Leveling road, operation buildings and landfills
- (d) Installation of drainage system
- (e) Construction of leachate treatment plant

(f) Installation of light system
(g) Construction of access roads
(h) Construction of operating houses

(iii) Activities during Operational Phase:
(a) Collecting wastes
(b) Transporting wastes to the landfills
(c) Classifying, recovering wastes
(d) Dumping wastes
(e) Leachate management

G. Reviewing and updating from IEE of the subcomponent

Table 7: Reviewing and updating from IEE of the project

Major environmental impact consideration	Included in IEE report	Update status in EMP
Pre- construction phase		
Inadequate incorporation of climate change and seismicity in design	Yes	Yes
Inadequate attention on unsustainable supply of gravel, sand, soil or unsustainable exploitation of these materials meet construction demand	Yes	Yes, updated
Inadequate of consideration of technical and financial capacity of DAKURENCO in waste disposal operation	Yes	Yes updated
Loss of assets/ income	Yes	Yes updated
Construction phase		
Dust/ suspended particles	Yes	Yes updated
Gases emission	Yes	Yes updated
Noise	Yes	No
Vibration	Yes	No
Impacts associated with quarrying for construction aggregates (dust, noise, vibration, visible impacts on landscape, groundwater, surface water contamination, traffic, smoke, accident etc,	Yes	Yes
Generation of spoils/ solid waste/soil	yes	Yes updated
Traffic road blocking	yes	Yes updated
Assess blocking	yes	No
Local flooding due to obstructed surface drainage or damage to existing drainage system	yes	No
Accidental damage to utilities, resulting in service interruption	yes	No
Disruption of socio- economic activities	yes	Yes updated
Accidental damage to properties/structures	Yes	Yes updated
Community health and safety hazard	yes	Yes updated
Worker health and safety hazard	yes	Yes updated
Operation phase		
Dust	yes	Yes updated
Landfill gas emission	yes	Yes updated
Odor/ population of vermin/rodents/insects/pests	yes	Yes updated
Noise	yes	Yes updated
Wind blow litter	yes	Yes updated
Mud spread	Yes	Yes updated
Groundwater and surface water contamination	Yes	Yes updated

from leachate		
Sedimentation/pollution of creek/channel from borrowing activities for/ stockpile of soil cover materials	Yes	Yes updated
Leachate dripping from trucks hauling wastes, odor/litters from open garbage trucks	Yes	Yes updated
Fire, explosion from gas/heat build up	Yes	Yes updated
Community health and safety hazard	Yes	Yes updated
Worker health and safety hazard	Yes	Yes updated
Unsustainable sanitary operation due to insufficient operational/financial capacities	Yes	Yes updated
Damages during seismic extreme weather events	Yes	Yes updated

H. EMP Aims and Structure

32. This Environmental Management Plan (EMP) has been prepared to document the environmental management commitments and obligations that will be implemented throughout the pre-construction, construction and operational phases of the Subproject. The EMP specifies the commitments and obligations, documents the responsibilities and timing for implementation and provides detailed costs estimates for implementation.

33. The EMP has been structured in accordance with the ADB's Environmental Assessment Guidelines (2009) as follows:

(i) Section 1 Introduction

(ii) Section 2 provides a summary of the potential environmental impacts due to subproject's activities based on the findings of the IEE and environmental assessment documents as Vietnam Government's requirements.

(iii) Section 3 describes the proposed mitigation measures

(iv) Section 4 describes the proposed environmental monitoring measures

(v) Section 5 describes the Public Consultation Process and Information Publicity

(vi) Section 6 describes the proposed institutional strengthening and training activities

(vii) Section 7 describes the responsibilities and authorities for implementation of mitigation and monitoring requirements

(viii) Section 8 provides a description of the responsibilities for reporting and review

(ix) Section 9 guidelines on procurement noted in environment part.

(x) Section 10 contains the detailed cost estimates

(xi) Annex

Annex 1: present the proposed environmental reporting formats

Annex 2: contains the cost estimates for environmental monitoring

II. SUMMARY OF POTENTIAL ENVIRONMENTAL IMPACTS

34. Study and assessment of environmental impacts have predicted a series of potential impacts due to the Subcomponent activities. Selection of the potential impacts for assessment is based on analyzed impacts in IEE report which prepared during FS preparation, site investigation, discussions with PMU, Provincial DONRE and reference to the relevant documents including ADB's Environmental Impact Assessment Guidelines (2009), the Detail Engineering Design (DED) Report, the environmental impact assessment report specifically prepared for the Subcomponent and references. Table 6 below provides a summary of potential environmental impacts that can be occurred due to the Subcomponent's activities which are described in detailed in the environmental assessment report.

Table 8: Summary of Potential Environmental Impacts

Potential Environmental Impacts	Significance of Impacts	Discussion of Impacts
Pre-construction phase		
Inadequate incorporation of climate change and seismicity in design	Moderate negative	**Climate change**: According to the National Climate Change Strategy, over the past 50 years, Viet Nam experienced average temperature rise of 0.5-0.7^{o}C, more extreme El Niño & La Niña events, worsening storms and droughts. By the end of the 21st century: (i) annual average temperature will rise by 2-3^{o}C; (ii) total rainfall and rainy season rainfall will increase, while dry season rainfall will decrease. The concern of climate change impacts to Buon Ma Thuot City as a whole including increasing/intensifying precipitation, increasing temperature and drought (IEE, 2013). **Seismicity**: Dak Lak province is forecasted to be within the zone with a probabilistic seismic hazard of 0-0.06 gal (MSK-64 V-VI); Buon Ma Thuot city appears to be within the zone of 0 – 0.03 gal (MSK-64 V) zone (IEE, 2013) Inadequate incorporation of climate change and seismicity in design would pose to several unexpected results such as, heavy and consecutive rain may lead to increase leachate, or long dry period will lead to harm grasses, trees, cracking top waste covers, which will result in firing and generating much odor, vermints. Seismicity will cause breaking bottom lines, which results in penetrating leachate into groundwater. All could affect life span of the landfill and the environment.
Inadequate attention on unsustainable supply of gravel, sand, soil or unsustainable exploitation of	Minor negative	The quality of construction material becomes very importance factor to ensure the lifetime of landfill sites and reducing environmental risks during operation phase. The inadequate concern on sources and plan of construction material (such as gravel, sand, soil) could lead to high risk of low quality material, illegal suppliers, impacts due to unnecessary stockpiling outside the

Potential Environmental Impacts	Significance of Impacts	Discussion of Impacts
these materials meet construction demand		project site and environmental issues/risks related to uncontrolled mine exploitation such as dust, noise, traffic problems, accidents
Inadequate of consideration of technical and financial capacity of DAKURENCO in waste disposal operation	Moderate negative	It is experienced that development of an O&M manual including safety and health of workers, nearby communities before operating a landfill is very necessary. However, technical and financial capacity of DAKURENCO will need to consider to ensure the resources an capacity to implement EMPs during both construction and operation phases. The DAKURENCO will take responsibility to review DED, EMP, incorporate the EMP into bidding document, selecting contractors who are capable of implementing technical measures and environmental mitigation measures during construction phase. The company will also has responsibility for all environmental protection requirements and all proposed mitigation measures in EMP during operation phase when it requires higher professional skills. Such as, classifying waste, covering and compacting wastes daily; management of runoff water and leachate; applying modern technical measure of reinjecting leachate to the waste mound in raining season to reduce leachate volume and using leachate to sustain grasses in summer time; operating leachate treatment plant; balancing stockpiles of soil cover to reduce dust generation and sedimentation ect. Therefore, technical and financial requirements take into account in O &M manual which could help to ensure the professional skills and available adequate budget for sustainable operation of environmental management system and implementing the EMP. .
Loss of assets/ income	Minor Negative	Hoa Phu landfill is located in the agricultural land being cultivated with industrial trees such as Cashew, Eucalyptus about 02 – 03 years old, which is evaluated as low productivity and value. The land is far from residential area and other structures. lAbout516,901m^2 of agricultural land will be acquired, and about 477 persons of 90 households will be affected due to land acquisition. . A RP have been prepared to manage impacts of land acquisition and meet the requirements of ADB policies and Vietnam regulations. Therefore, the impact on loss of assets/income could be evaluated as minor.
Construction phase		
Dust/suspended particles and gas emissions	Minor Negative	In construction phase, dust/ suspended particles are mainly generated from leveling the area for building the operation house, constructing cells of 1 & 2 with a total earthwork of 8,269.88 m^3, 33,213.9 m^3 and 29,681m^3 respectively. Gases emissions mainly come from vehicles and trucks

Potential Environmental Impacts	Significance of Impacts	Discussion of Impacts
		carrying materials/ disposals in/out of sites (average one 10 ton- truck per day) and operation of construction machines. The impact is considered minor because the site is located about 15km from Buon Ma Thuot city, 3.5 km from Hoa Phu township and less people activities occur surrounding the sites.
Noise and Vibration	Minor Negative	The impact of noise and vibration caused by constructing the SWTP is minor because the machines mobilized at site mainly are cranes, bulldozers, trucks for excavating and carrying out simple constructions such as building operation houses, planting ect. In addition, the site is located in a large area and far from residential areas and living activities of residents.
Use of hazardous substances and hazardous waste disposal	Minor negative	Hazardous substances could be listed in TCVN 5507:2002 as petrol, fuels, paints… that will be used during construction phase. Toxic waste are mostly oil contaminated waste as regulated in the Circular No. 12/2011-BTNMT dated on 14/04/2011 of MONRE, they include boxes, cans contain petrol, fuels, paints and discharged oils. This kind of waste need to be collected, transported, and treated to avoid polluting air, water and soil quality in the surrounding areas.
Exploitation of soil, sand, stone and asphalt concrete for construction material	Minor Negative	Commonly, exploring and processing soil, sand, stone for construction materials and operation of asphalt concrete mixing stations would generate much dust, toxic gases and wastewater, which causes negative impacts on environment. However, according to the detailed design documents, contractors will contract with legal companies/agencies (Hoang Nam Company for examples) as material suppliers to sites and the material supplying companies will bear all responsibilities for environmental protection related to the process of exploitation and transportation to sites. Nevertheless, their environmental safety compliance should be monitored during construction phase.
Generation of spoils/solid wastes	Minor Negative	Solid waste from construction activities includes: i)Construction refuse such as soil, sand, stone, iron scraps, debris with the estimated quantity of 6,030 ton, these wastes which are usually non-toxic able to be recycled and used for leveling grounds at sites; total excavated soil of 62,894.9 m^3 will be stockpiled at the site to use for covering waste in operation phase ii) Domestic waste and garbage such as organic waste, paper, carton box, fecal waste generated from workers' camps (about 60kg per day coming from 100 workers/day mobilized to work at site at the peak construction time). The wastes in an improper management would cause unhygienic conditions and good habitats for proliferating insects/rodents/flies, which is affecting potentially to health of workers and the city landscape. This kind of waste need to be collected, classified,

Potential Environmental Impacts	Significance of Impacts	Discussion of Impacts
		transported, and treated to avoid polluting air, water, soil quality and landscapes in the surrounding areas (Decree 59/2007/ND-CP)**;**
Surface water quality	Minor negative	Water quality of surrounding areas would be affected by construction activities. Runoff water can wash wastes from workers 'camps, construction sites to water body nearby and deteriorate its quality. The impact is assessed as minor because the site is far from main watercourse. The nearest water body is a small tributary of Ea Goi stream about 500m to the west of site, which is often dry during the dry season, in raining season they receive runoff water to Ea Goi stream then discharged into Serepok river. The watercourse in the downstream is ephemeral.
Physical cultural resources	Minor negative	Human relics may be found from the earthworks.
Traffic & road blocking	Minor Negative	There is only one soil path that may be formed by farmers to access their farms that is bordering the landfill site. In addition, some external roads are planning to be upgraded, which link the SWTP with outsides. One communes linking road, which is located about 402m from the landfill being 6m wide with asphalt connects to Hoa Phu industrial zone and Buon Kuop hydropower plant. Another road that is the rural one with soil on surface (15m in planning), located about 183m to the west of site. Currently the roads are quiet with low density of traffic. No heavy trucks are found on the roads. Constructing the landfill will not affect much on traffic and road blocking.
Access blocking	Minor Negative	A small farm who are cultivating the cashews at the west border of the site could be affected due to temporarily block the existing access. Therefore, the alternative access should be provided to ensure the travel demand of the households.
Accidental damage to utilities, resulting in service interruptions	Minor Negative	Accept a low voltage line crossing the site, no other facilities is found in the vicinity. Therefore, the negative impact caused by accidental damage to utilities is minor.
Disruption of socio-economic activities	Minor Negative	There are no business shop have been found in the project areas, but agricultural activities are presented in the surrounding area. Thus, any blocking access to their farms may affect temporarily on their socio – economic activities such as transporting products and fertilizes to farms.

Potential Environmental Impacts	Significance of Impacts	Discussion of Impacts
Community health and safety hazard	Minor Negative	The key environmental issues would create high risk of safety and health of communities which includes social conflict between locals and workers and community accidents. Concentration of worker on the sites who may have different cultural, behaviors could lead to social and transmission social diseases such as HIV/AIDS increase; Risks of community accidents may potentially increase but they will be minor because machines and equipments would be mobilized to site. However, all construction activities will be required to be within ROW, and people who want to enter the site need to present their permission. .
Workers' health & safety hazard	Moderate Negative	The key worker's health and safety hazard are labor accidents, social disease HIV/AIDS and other infected disease transmission related to worker's camp hygienic sanitation, and using alcohol within working time. Labor accident is one of the concerning issues. Commonly, to reduce social impacts caused by migrant workers, local laborers would be recruited for simple works and most of them are farmers or free laborers with an inadequate awareness on labor safety. They are often not getting used to working with modern machines and using personal protective equipment when working at sites. This may pose to a risk of accident Transmission of HIV/AIDS is other potential risks of migrant workers due to their behaviors and inadequate awareness on safety in sexual activities, generate; several common diseases such as diarrhea, fever due to unhygienic workers' camps. Moreover, those who use alcohol when working may lose control their behavior, which would lead to negative impacts on their health and labor safety. In sum, there are many potential risks for workers in general and for local workers in particular in terms of labor accidents, HIV/AIDS transmission, other infected diseases and other adverse effects on health & safety, mitigation measures should be strictly carried out and monitored to prevent workers from any health effects and accidents.
Operation phase		
Dust	Minor negative	Dust will generate from stockpile soil for covering land on wastes daily, intermediate and final cover with total quantity is estimated as 420,440.1m^3, uploading wastes volume is estimated as 249 ton/day in 2022 which require 76 rounds of 12 ton-trucks. The landfill site is located in a large area and far from residential areas thus , generated dust may be quickly diluted and only affect temporarily on workers who are working at the downwind of the site. In addition, the

Potential Environmental Impacts	Significance of Impacts	Discussion of Impacts
		landfill site is designed to be fenced by concrete wall 2.5m high plus with green trees to be grown along the wall to separate it with outside environment and prevent pollutant release from the surface of the site.
Landfill gas emission	Moderate negative	Gases produced within landfill site are mainly from naturally decomposing organic wastes under aerobic and anaerobic conditions. The gases may consist of NH3, CH4, H2S, CO2, N2 which are considered as main GHGs. They are formed and released freely into the air during the time the gases collecting system has not been put into effect. In addition, the exhausted smoke of operating machines such as trucks, bulldozers, cranes, and levelers may contain CO2, CO, NOx, SO2. Which may adversely affect health of about 80 workers working full time in the landfill notably those working close to the cells under moist and hot weather and less wind.
Odor/ population of vermin/rodents/insects/pests	Moderate negative	Apart from mercaptan, odor always appears in surrounding areas of landfill site due to the fermentation of organic wastes under warm and moist conditions. Which will creates an annoyed smell with people. Landfill site is also a good habitat of vermin/rodents/insects/pests that can be considered as sources of transmitting infective diseases to people. The population of vermin/rodents/insects/pest could increase in the landfill site unless the wastes are properly covered with designed layers of clay and soil for growing grasses. In addition, duration for a cell filled up with wastes and covered is taken time so that the negative impact of odor and vermin/rodents/insects/pests to workers who work and live within the landfill is moderate. Odor and population of vermin/rodents/insects/pets could be suppressed with a condition that insects/vermin/rodents/pest control is applied and cells would be covered daily with soil layer of 20cm under a careful compaction. The top cell would be covered with a clay 0.6m thick and 0.6m thickness of soil for growing Vetiver grass, which creates a mountainous shape with its inclination 1: 2.5. This is a good mound to prevent rodents from making caves, exposing wastes to be scattered by wind.
Noise	Minor negative	Noise comes from machines operation in the landfill site include trucks, pumpers, cranes, bulldozers. The impact is considered minor because the sources of generating noise are not remarkable and in a large space of more than 11,000 m^2 without impediment.
Litters	Minor negative	Wastes exposed in dry season could be spread without controllable by the wind, which would

Potential Environmental Impacts	Significance of Impacts	Discussion of Impacts
		litter the surrounding ground of landfill site and generate the insanitation environment. However, according to the DED, the landfill site is encircled by brick wall of 2.5m high and trees will be grown along the wall and access roads, which could help to prevent partly the litters carried by the wind. Furthermore, the wastes are covered and compacted with soil everyday and final covered with a thickness of 1.2 m to shape as a high mount with grass grows sustainably on, which could prevent wastes from exposing to the wind to be flown out.
Mud spread	Minor negative	Sludge forms from the leachate treatment plant with a capacity of 87m^3/day is not much but system of treating sludge is not available in the treatment plant according to the detail design. Using the mud for spreading on the waste before covering by soil daily or using for processing composts is an alternative way. Nevertheless, risk of spreading mud within the site will be possible if it is improperly managed, which could be washed out with runoff water to the downstream causing pollution of water bodies and negative impact on health of workers in the landfill due to pathogens.
Groundwater	Minor negative	The survey results showed that groundwater is available at average depth of 40 - 60m and its quality meets requirements in QCVN 09/2009/BTNMT. This water is being used for drinking purposes by residents living surrounding the area and will be the recreational water source for operational workers in future. Groundwater quality may be affected by cracking bottom of landfill, resulting in that leachate would penetrate into a deep layer where shallow aquifer of the groundwater is available. It is assessed to be minor because the detailed design covers the bottom of landfill site with a combination of a membrane layer of HDPE 2mm combined and a clay liner of 0.5m, which is considered very strong to support the bottom in preventing it from cracking in case of extreme weather.
Surface water	Moderate negative	Watercourse existing surrounding the site is considered ephemeral because it is very small and often dried during summer time, therefore it is quite difficult to dilute polluted water from leachate or contaminated storm water with discharging into these water bodies. In raining season, the stream can bring polluted water to Ea Goi stream to Krong Ana river and finally to Serepok river, one of the biggest river running through DakLak province providing irrigation and aquaculture benefit for the province, and simultaneously it is a large tributary of Mekong river providing huge benefit to Mekong Delta Region.

Potential Environmental Impacts	Significance of Impacts	Discussion of Impacts
		According to the DED document, leachate will be collected by its collecting system installed beneath the 20cm sand and 30cm stone (Figure 4). The leachate will run to its pumping station due to the slope of 5% then pumped to the leachate treatment plant. Although a leachate treatment plant is constructed, each cell has a system of reinjecting the leachate to a month designed at the upper of landfill site. In rainy season, the leachate will be reinjected into the landfill site to reduce its volume, while in summer time, leachate will be used for irrigating to sustain grass-surrounding landfill site and to reduce risk of fire and the left will be discharged into Ea Goi stream. Runoff water is designed to be collected and discharged to Ea Goi stream, which is able prevent it from diluting leachate. Storm water surrounding the site will be collected by a system of open culverts with its dimensions of 800x2800x1000, 1000x3000x1000, 600x2200x800, 200x1000x400 to directed to discharging gates of No1&2 to Ea Goi stream. In case rain drops into the space of landfill site that is being waiting for filling up with wastes, the rainwater will be collected through holes of 800x1200x1200 installed at the lowest location of each cell then pumped to the central draining pipe to Ea Goi stream. During period of pouring waste into its cells, each layer of waste will be covered with 20cm soil and compacted and the final layer will be covered with 60cm clay layer, and 60cm of soil layer for growing grass with slope 1: 2.5 creating a shape like a mount to prevent raining water from getting into the cells. Thus, leachate is under the management according to the DED. Nevertheless, one issue needs to be further considered is that wastewater from truck washing station constructed on area of 375m^2 located at the gate of landfill will be collected then run to the leachate pumping station, according to the DED document. Although its volume is not much just about 3m^3/day, this needs reconsidering because the wastewater contains hazardous wastes such as petrol, oil and lubricant that are toxic to microorganisms in the leachate treatment plant. The wastewater will not be allowed to be reinjected into the mound and to be used for irrigating grass in summer time because its toxicity will be harmful to all biological system. So it is suggested that the wastewater should be separately treated, which will afterwards be used for sustaining grasses in the landfill or its buffer zone.

Potential Environmental Impacts	Significance of Impacts	Discussion of Impacts
		In sum, commonly all landfills, leachate is a leading risk of environmental pollution, especially to surface water downstream because of improper management of runoff water and leachate. In this case, DED has shown how to manage the leachate better to cope with the risks. However, discharging wastewater from truck washing station directly to the leachate treatment plant needs to be reconsidered to ensure efficiency in the leachate treatment plant;
Sedimentation/pollution of creek/channel from borrowing activities for/ stockpile of soil cover materials	Minor negative	Soil quantity required for covering materials accounts for 20% of the total wastes, equivalent to 30m^3 soils required per day (149m^3/day in 2022). According to DED, the redundant soil from excavated activities will be reserved as stockpile within the site near the cell to make it convenient for covering the waste daily. The stockpile of soil may be washed off by runoff water to cause sedimentation at nearby low lands in case of no roof provided.
Leachate dripping from trucks hauling wastes, odor/litters from open garbage trucks	Minor negative	Solid wastes will absorb water in wet season and could leak out on trucks during the time of transporting to the landfill site which could create unpleasant smell due to decomposing the organic wastes by aerobic and anaerobic microorganisms under warm and moist conditions. The leachate, odor and wastes would release to the surrounding environment when waste are transported by open trucks to the sites, which could cause environmental pollution and effects on health of those who expose to them.
Fire, explosion from gas/heat build up	Minor negative	Fire, explosion caused by gases is one of the environmental risks often occur in landfill site. In dry season, wastes and grass become dry that are easy to catch fire in case careless people who drop cigarette end on sites or natural phenomenon of gases explosion. However, DED has shown that gas-collecting system will be installed and actively fired to turn CH_4 to CO_2 to reduce Green House Effects, grasses will be sustained during the dry season by using leachate for irrigating them. All measures applied will reduce risks of fire and explosion from gas/heat buildup.
Community health and safety hazard	Moderate negative	As mentioned above, open trucks carrying waste may leak leachate and litter waste on roads during the time of collecting and transporting wastes to landfill site, which will negative impact on health of communities in which the trucks passing by. Overload leachate and improper management of leachate will affect the quality of receiving watercourses such as Ea Goi bigger stream, Serepok river that may contribute raw water resources for drinking water plants, aquaculture benefits and environmental landscape for a large population not only from Daklak province but also from Mekong River Region.

Potential Environmental Impacts	Significance of Impacts	Discussion of Impacts
		Unpleasant smell, rodents/insects/vermin from landfill is another concern of people who are living around the landfill because of long time exposure even though their residents are about 4 – 15km far from the landfill. Nevertheless, the smell and insects could be flown by wind to downwards and affect those who expose to them so measures applied to suppress odors and insects should be effectively done during operation phase.
Worker health and safety hazard	Moderate negative	More than 80 workers will work full time in the landfill site. They are considered the most susceptible to harmful substances coming from the landfill because of the long time exposure. Firstly, an accident at place of classifying wastes may occur, in case trucks and workers working in a same space without transportation rules and no instructors available when trucks carrying wastes to the landfill. Secondly, the workers have to use groundwater for living instead of tap water because no tap water system available in the project area. Risk of contaminating groundwater is less but possible. Thirdly, those who are exposing to wastes everyday without a proper use of personal protective equipment will be at a risk of infective diseases caused by pathogens born from the wastes. Finally, insects/rodents/vermin from landfill that may go to worker's camps for finding other food and shelter will transmit pathogens to workers.
Unsustainable sanitary operation due to insufficient operational/financial capacities	Moderate negative	O & M system including personnel and financial capacity of operator is considered very important during operation phase aiming to ensure environmental safeguards and human health and safety. Although, DAKURENCO is an experience operator, institutional arrangement must be established, built capacity with financial provision to run the landfill. An manual book should be prepared and used for training staff who are responsible for operating the landfill at each separate section such as how to operate the leachate treatment plant, reinjection of leachate to the mound every day, irrigating grasses daily, death with environmental risks such fires, explosion, leachate blocked to its collecting system, overload of leachate treatment plant;
Damages during seismic extreme weather events	Minor negative	Damages during seismic or extreme weather events may occur, which needs assessing and repairing in time to prevent further induced damages;

III. MITIGATION MEASURES

35. Mitigation measures proposed for negative impacts identified in Table 8 will be summarized in Table 9 below. Mitigation measures for construction phase shall be included in the bidding documents for the Contractor to implement. The related costs that would be borne by the Contractor are not presented in this table - these costs will become part of the civil works contracts.

Table 9: Summary of the proposed mitigation measures

Sub-component activities	Potential impacts	Proposed Mitigation Measure	Responsibility	Cost Estimate
Pre-construction phase				
Inadequate incorporation of climate change and seismicity in design	Completed works unable to cope during extreme weather events & earthquakes	▪ Design to seismic design criteria as regulated in Viet Nam ▪ Take the necessary geo-technical & geological investigations for basis in detailed design ▪ Use of materials with high resistance to dry conditions and adapt to increased precipitation as appropriate; ▪ Specify optimum degree of compaction to reduce sedimentation; capacity of drains and leachate management; ▪ Include emergency response and contingency plans in the SWTP Operation Manual	Detailed designer	Included in designing contract cost
Inadequate attention on potential unsustainable supply of gravel, sand, soil; or unsustainable extraction of these materials to meet construction demand	Illegal material suppliers; Uncontrolled quality of supplied materials; Incompliance of environmental safeguard at borrow pits.	Prepare a Subcomponent Aggregates Management Plan (AMP), confirming location of sources, estimating supply of, & demand for, aggregates during construction. This will form basis for Contractor's AMP. The material for project will be taken from the existing mines as stated in the Table 5, In case that, above material source will be changed, an appropriate material management plan should include the following: ▪ Required materials, potential sources and estimated quantities available; ▪ Material supply manners: preferring to purchase from existing material quarries. ▪ Agreement with the local authorities ▪ Check with environmental permission/certification of the quarries to ensure that environmental impacts and mitigation measures have been considered by owners. ▪ Environmental recovery plan	Detailed designer	Included in designing contract cost

Sub-component activities	Potential impacts	Proposed Mitigation Measure	Responsibility	Cost Estimate
		▪ Material transportation manner plans and schedules ▪ Specify in bidding documents Contractor's obligation to obtain aggregates only from quarries & crushing plants still operating within allowed extraction threshold as per environmental permit.		
Inadequate consideration of the technical & financial capacity of DAKURENCO in waste disposal operations.	Incompliance of environmental safeguards at sites, health and safety of workers and communities	The technical and financial considerations should take into account in design phase to ensure sustainable operation of project during its lifetime which included: ▪ Preparation of O&M Manual that will provide for continuous capacity development & specify the financial requirements for efficient O&M; ▪ Provide adequate training for DAKURENCO and other relevant operation units before handing over for operations;	Detailed designer	Included in designing contract cost
Land acquisition	Displacement of people, loss of assets & income	Strictly follow the approved RAP	PMU	Included in RP
Construction phase				
Excavation and transportation of construction materials/wastes	Dust and exhaust generation	▪ All excavated soil should be reused for leveling lower places and stockpiled at sites for waste cover in operation phase. ▪ Excavation and stockpiles at site will be watered to maintain certain moisture levels in order to prevent or minimize dust dispersion. ▪ The construction machineries and equipment have to comply with Decision No. 249/2005/QĐ-TTg dated 10/10/2005 of Prime minister, Regulation on Emission for road transportation vehicles. ▪ Trucks carrying construction materials/wastes are covered to avoid dropping on roads. ▪ Speed limitation signs shall be adequately installed within construction site and its regulation shall be reminded to each driver by contractor. ▪ Soil scattered on the paved road and public road shall be removed immediately.	Contractor	Included in construction contract cost

Sub-component activities	Potential impacts	Proposed Mitigation Measure	Responsibility	Cost Estimate
		▪ Prioritize to use grid power/renewable energies instead of fossil energy using generators		
Operation of construction machineries, trucks	Noise /vibration	▪ Use modern and new construction machines and equipment to meet standards of exhaust, noise, and vibration as regulated by the Government. The Contractor needs to submit the Engineer documents proving that all construction vehicles, equipment, and machines are checked and meet requirements concerning noise and vibration generation of the current Vietnam standards as QCVN 26: 2010 for noise level and QCVN 27:2010 for vibration emitted by construction works; ▪ Transport vehicles shall be restricted to the hours of 22h – 6h at the location crossing the residential areas; ▪ Regularly maintenance of construction machines. ▪ Provision noise protection equipment for worker;	Contractor	Included in construction contract cost
Use of hazardous substances and hazardous waste disposal	Air, soil and water contamination	▪ Ensure that safe storage of fuel, other hazardous substances are agreed by PMU and have necessary approval/permit from DONRE and local authorities; ▪ Equipment/vehicle maintenance and refueling areas will be confined to a special designed area to collect any fuels spilled out; ▪ Fuel and other hazardous substances shall be stored in areas provided with roof as stated in TCVN 5507:2002- Hazardous chemicals − Code of practice for safety in production, commerce, use, handling and transportation; ▪ Segregate hazardous wastes (oily wastes, fuel drums) and ensure that storage, transport and disposal shall not cause pollution; ▪ Ensure all storage containers are in good condition with proper labelling; ▪ Collected, transported and treated by contracting with a company which has a work permit for treating hazardous waste disposal according to the Circular No. 12/2011/TT-	Contractor	Included in construction contract cost

Sub-component activities	Potential impacts	Proposed Mitigation Measure	Responsibility	Cost Estimate
		BTNMT on 14 April, 2011 of MONRE.		
Inappropriate soil pit practices and concrete station operation	Soil erosion, vegetation clearance and runoff water at soil pit	▪ Prioritize the use of existing quarries with suitable materials and update the list of quarries monthly and report to PMU and minimize impacts on other local resources; ▪ Procure materials only from DONRE authorized soil pit and borrow sites; ▪ Extraction of sand and gravel in river beds shall be prohibited except: (i) where this is no technically and economically feasible alternatives and (ii) provided specific mitigation measures are implemented to minimize impact on river morphology, water quality (e.g., turbidity) and aquatic ecosystems (e.g., reduced extraction during fish spawning period); ▪ Checking the environmental protection commitment documents of material quarries, asphalt concrete stations of suppliers who supply materials to the project. ▪ Monitoring the implementation of environmental protection measures at the material quarries and hot asphalt stations.	Contractor	Included in construction contract cost
Inappropriate stockpile of soil management	Soil and surface water and landscape impacts	▪ All solid waste should be reused for leveling low areas where applicable; ▪ Stockpile on flat grounds and not obstructing existing surface drainage routes; ▪ Avoid stockpiling on site more than what is needed ▪ Use sediment basins/traps surrounding stockpiles of soil	Contractor	Included in construction contract cost
Inappropriate worker camp' wastes	Surface water impacts	▪ Provide adequate facilities in the site including latrines, holding areas and garbage cans. Waste from latrines will be collected and treated properly through an economic contract with local environmental co-operatives/companies; ▪ Cover material storage areas when raining is needed. Temporary storage of construction and domestic waste on the sites will be no longer than 24 hours. ▪ Equipping the dustbins and mobility septic tanks to work sites (it is proposed that there will be 4 dustbins and 2 mobility	Contractor	Included in construction contract cost

Sub-component activities	Potential impacts	Proposed Mitigation Measure	Responsibility	Cost Estimate
		septic tanks provided at each construction site) ▪ Burning of construction and domestic wastes shall be prohibited;		
All construction activities	Cultural heritage impacts	▪ Where grave is found during construction, coordinate with local authorities to arrange for relocation and mapping the location of the grave before and after relocation; ▪ Halt construction activities, protect the site and inform construction supervision for guidance if artifacts are found at construction site.	Contractor	Included in construction contract cost
Increased transportation carrying materials to sites	Traffic disturbance	▪ Inform the community about construction time and schedule through informal public consultation or any local people meetings and notice board; ▪ Post traffic flags/light signal during entire working hours and night time. ▪ Regulating the transport vehicle speed will not be over 20km when passing the residential areas ▪ Providing alternative access for farmers to their farms	Contractor	Included in construction contract cost
Concentration of workers and Construction activities;	Community health and safety hazard	▪ Construction workers who are not local people must register temporary residents and obtain temporary residential certificate from local authority ▪ Use as many local workers as possible in order to reduce the migrant workers at sites; ▪ Educate workers on appropriate behavior for interactions with local community and risks of communicable diseases ▪ Develop leaflets on propagandizing the ways of prevention and avoidance of the social diseases HIV/AIDS for both workers and host communities; ▪ Excavated cells will be dewatered and fenced to reduce high risk for local peoples; ▪ The local people shall not be allowed in high-risk areas (excavation sites and areas where heavy equipment is in operation);	Contractor	Included in construction contract cost
Poor	Workers' health &	▪ Worker camps should be located at high and ventilated places		Included in

Sub-component activities	Potential impacts	Proposed Mitigation Measure	Responsibility	Cost Estimate
management at worksites and worker's camps;	safety hazard	with provisions of separate dustbins, hygienic toilets; ▪ Constructor needs to work with PMU and CSC to establish labor safe regulations on the sites required by law and by good engineering practice, which include electric safety, operating equipment -general safety requirements, general safety requirements. ▪ Workers shall be provided with appropriate personal protective equipment (PPE) such as safety shoes, hard hats, safety glasses, ear plugs, gloves, etc. at no cost to the employee.. ▪ A first aid kit will be provided at each construction site to ensure patients can receive first aid timely before transporting them to the medical station/hospital ▪ It is mandatory for workers to attend training courses on labor safety before they are recruited to work for the project; ▪ Supervise period on compliance to labor safe measures of workers at project sites. ▪ Contractors ensure to provide safe drinking water to workers for daily uses. ▪ In case of finding UXO, immediately to inform competent agency for solving; ▪ Using alcohol within working time both at camps and sites must be banned;	Contractor	construction contract cost
Operation phase				
Dust generated from: Stockpile of soil for covering wastes; Covering soil on wastes Movement of trucks	Air pollution, worker health	▪ During dry season watering stockpile of soil cover, twice a day or more as necessary. ▪ Spray water when spreading soil cover on the wastes; ▪ Protect stockpile soil cover with a wind break/shield (artificial or natural or combination); ▪ All open trucks hauling garbage, aggregates, soil cover should be properly covered; ▪ Limit vehicle speed inside facility to maximum of 5km/h ▪ Minimize drop heights when loading/uploading soil onto	Operator unit	Included in operation cost

Sub-component activities	Potential impacts	Proposed Mitigation Measure	Responsibility	Cost Estimate
Unloading wastes		trucks/waste cell and when uploading wastes.		
Production of landfill gas, gas migration, potential explosion & loss of deep-rooted vegetation	Air pollution, worker health, fire and explosion	▪ Apply soil/alternative cover daily. ▪ Install appropriate bottom layer, sides liner to avoid gases migration; ▪ Provide and proper operate gas collection & vents; ▪ In case of having no condition of collecting and using gases for energy purposes, blaming gases at site should be applied to turn CH4 to CO2 to reduce green house effect caused by gases emission from landfill. ▪ Implement landfill gas monitoring to evaluate effectiveness of system. (Gas is expected to be generated after 5 years from start of operation) ▪ Set up monitoring well within buffer area after the wall & implement continuous monitoring.	Operator unit	Included in operation cost
Odor, vermin/pests/insects/rodents, birds & animal attraction	Community and worker health	▪ Apply soil/alternative cover daily. ▪ Pest/ vermin/rodent control should be applied to reduce them from proliferation. ▪ Movable perimeter (litter) fence around active cell to prevent stray animals from feeding on wastes prior to soil cover. ▪ Reduce insects by planting in the landfill peripheral with species of trees & shrubs able to repel insects in the landfill peripheral such as eucalyptus, citronella (Pelargonium citrosum), neem (Azadirachta indica); trees and shrubs that bear sweet smelling flowers, e.g., ylang-ylang (Cananga odotara), champaca (Michelia champaca), sampaguita (Jasminum sambac), champasak. (Plumeria rubra or Plumeria alba), among others.	Operator unit	Included in operation cost
Noise from truck movements/equipment operation	Hazard to workers	▪ Limit speed inside facility to maximum of 5km/h ▪ Spread out arrivals of trucks and provide instructors at site; ▪ No blowing of horns inside the facility. ▪ Use low-noise landfill equipment & to be turned off when idle;	Operator unit	Included in operation cost
Wind-blown	Environmental	▪ Open garbage trucks (dump trucks) will be covered;		

Sub-component activities	Potential impacts	Proposed Mitigation Measure	Responsibility	Cost Estimate
litters	pollution and public health	▪ Apply soil/alternative cover daily and capping to complete cells;		
Mud spread	Environmental pollution and public health	▪ Trucks to have washed/wet tires prior to leaving SWTP ▪ Sludge from the leachate treatment plant should be properly used for produce compost or spreading on landfill.		
Ground water & (potential) surface water contamination from leachate	Environmental pollution and public health	▪ Apply soil/alternate cover daily; ▪ Apply capping to complete cells; ▪ Undertake monitoring of groundwater every 06 months ▪ Treat wastewater from truck washing station separately before mixing with leachate; ▪ Reinject leachate into designed mound in rainy season and irrigating grasses in dry season to reduce leachate volume; ▪ In case of applying leachate treatment plant, monitoring effluent of leachate must be undertaken to ensure the effluent meeting QCVN 25/2009/BTNMT and QCVN40/2009/BTNT before discharging it into surrounding environment. ▪ Ensure landfill liner, pipelines, and leachate collection &management facilities stay in good working order; ▪ Implement engineering and management systems to prevent and manage emergency leachate spills and discharge situations;	Operator unit	Included in operation cost
Sedimentation/pollution of creek/channel from borrowing activities & associated stockpiles	Environmental pollution and public health	▪ Stockpile at least 50 m away from main surface drainage routes, prepare sediment traps, sandbags, barrier nets, to prevent soil cover from being eroded/blown away by wind/rain: ▪ Limit stockpile to a maximum height of 2 m. ▪ Limit amount of hazardous substances stored and maintain equipment at landfill. ▪ Identify and vehicles/equipment leaking oil repaired immediately out of landfill. ▪ Plant trees in the periphery buffer area or vicinity of creek/channel to prevent sedimentation; ▪ Do not stockpile more than the cover need to reduce soil	Operator unit	Included in operation cost

Sub-component activities	Potential impacts	Proposed Mitigation Measure	Responsibility	Cost Estimate
		erosion and sedimentation;		
Leachate dripping from trucks hauling wastes, odors & litters from open garbage trucks	Environmental pollution and public health	▪ Require waste trucks to ensure no leachate drippings during transport; ▪ Require open waste trucks to provide the appropriate cover. ▪ Require trucks to wash body & tires prior to exit from landfill	Operator unit	Included in operation cost
Fire/explosion from gas build, build up, heat, ect	Environmental pollution and public health	▪ Equip SWTP with adequate/appropriate fire-fighting equipment; ▪ Set up trained Safety Team (as initial responders) linked to the fire department & other ultimate responders, ▪ Install gas collection & treatment. Monitor landfill gas. ▪ Conduct regular fire/explosion/emergency drills; ▪ Enforce a “No Smoking” Policy within the SWTP premises	Operator unit	Included in operation cost
Community health/safety hazard from dust, gas, water resource contamination, pests/insects/rodent, fire/explosion	Environmental pollution and public health	▪ Install sufficient warning signs against unauthorized entry; ▪ Implement measures to mitigate dust, gas leachate, pests/insects/rodents, incidence or fire/explosion; ▪ Secure premises against unauthorized entry by public; ▪ Coordinate with local public health officials to monitor incidence of water and air-borne sickness or disease in the local community and worker force that could be caused by the landfill & treated leachate disposal; ▪ Coordinate with DONRE for regular monitoring of the down-basin surface water quality, and also the quality of local groundwater and ambient air that potentially are influenced by landfill & leachate management;	Operator unit	Included in operation cost
Workers’ health and safety hazard	Environmental pollution and public health	▪ Develop and implement the O&M Manual including health and safety risks & mitigation measures. ▪ Set up emergency response mechanism & train workers of their roles & responsibilities in the mechanism. ▪ Support workers in undergoing semi-annual physical examinations and being provided with appropriate vaccinations. Establish & update workers’ health baseline	Operator unit	Included in operation cost

Sub-component activities	Potential impacts	Proposed Mitigation Measure	Responsibility	Cost Estimate
		data; ▪ Provide workers with required protective wear, i.e., clothing, cap, hand glove, ear muffle, nose/mouth mask, eye wear, footwear (boot) for workers' compliance; ▪ Provide workers with adequate sanitation facilities and potable water; ▪ Observance of good sanitation practices;		
Unsustained sanitary operations due to insufficient operational & financial capabilities	Environmental pollution and public health	▪ O&M Manual to specify capacity development, budget requirements for O&M and implementing regular capacity development;	Operator unit	Included in operation cost
Natural hazard without timely repaired	Damages during seismic or extreme weather events	▪ After every seismic or extreme weather event, conduct engineering investigation of built structures & implement corrective measures immediately.	Operator unit	Included in operation cost

IV. ENVIRONMENTAL MONITORING

36. Environmental monitoring activities of the civil work package 01 include: (1) monitoring the EMP compliance, and (2) monitoring of environmental impacts caused by the Sub-project activities. Environmental impact monitoring will be implemented with major concentration on the construction phase.

    (i) Environmental Performance Monitoring is conducted to evaluate compliance with standard operating procedures, national standards on environment and technical specifications. The main purpose of environmental performance monitoring to ensure that all proposed mitigation measure will be complied by contractors during the construction time.
    (ii) Environmental impact monitoring is conducted to evaluate the impacts by the sub-project activities on ambient environmental quality.

37. Responsibilities and budget for environmental impact monitoring during the construction and operation phases are identified as follows.

    - During the construction phase: All mitigation measures that belong to the Contractor's responsibilities shall be implemented by the Contractor. The costs are included in the contract between Construction Contractor and DAKURENCO. Monitoring environment quality is proposed in this EMP, see Annex 2 for details. The Employer's representative (DAKURENCO) shall bear all costs for environmental monitoring during the construction phase, including sample taking and analysis, and preparing reports. If DAKURENCO does not have sufficient capacity of environmental monitoring, it can assign the full or partial task under a lump sum contract for monitoring activities called Environmental Monitoring Consultant.

    - Operation phase: During the operation and maintenance phase, the works operation and management unit will provide budget for implementing mitigation measures, capacity strengthening training, and staff salary.

38. Obligations and responsibilities to undertake mitigation measures and monitoring activities are presented in Section 7 of the EMP.

39. The environmental monitoring plan for the EMP is provided in Table 10. The monitoring plan focuses on all three phases (pre-construction, construction, post-construction operation) of the subcomponent and consists of environmental indicators, the sampling locations & frequency, method of data collection, responsible parties, and estimated costs. The purpose of the monitoring plan is to determine the effectiveness of the impact mitigations, and to document any unexpected positive or negative environmental impacts of the subproject

Table 10: Environmental Performance Monitoring

Mitigation Measure	Monitoring parameters	Location	Method	Frequency	Responsibility	Cost
Pre-construction phase						
DAKURENCO to carry out full EIA as requested by Vietnam regulation and obtain environmental approval from local authorities	Environmental certifications issued by local authority		Check document	Once, before construction phase	Environmental monitoring consultant	In a contract between DARURENCO and EMC
Inadequate incorporation of climate change and seismicity in design						
Design to seismic design criteria as regulated in Viet Nam Undertake the necessary geo-technical & geological investigations for basis in detailed design Use of materials with high resistance to dry conditions and adapt to increased precipitation as appropriate; Specify optimum degree of compaction to reduce sedimentation; capacity of drains and leachate management; Include emergency response and contingency plans in the SWTP Operation Manual	Including and considering of environmental and technical standards in the design documents Check with technical parameters		Check documents	Once, before construction phase	Environmental monitoring consultant	In a contract between DAKURENCO and EMC
Borrow pits/quarries						
Prepare a Subcomponent Aggregates Management Plan (AMP), confirming location of sources, estimating supply of, & demand for, aggregates during construction, linked to cut-&-fill management plan. This will form basis for Contractor's AMP. Specify in bidding documents Contractor's obligation to obtain aggregates only from quarries & crushing plants still operating within allowed extraction threshold as per environmental permit.	Selected Contractor its CEMP, their performance compliance;		Verifying existence of CEMP. Evaluating CEMP against EMP.	Once prior to mobilization	Environmental monitoring consultant	In a contract between DAKURENCO and EMC

Mitigation Measure	Monitoring parameters	Location	Method	Frequency	Responsibility	Cost
Inadequate consideration of the technical & financial capacity of DAKURENCO in waste disposal operations.						
Design to include the preparation of O&M Manual that will provide for continuous capacity development & specify the financial requirements for efficient O&M;	O&M Manual prepared		Check design document	Once, before construction phase	Environmental monitoring consultant	In a contract between DAKURENCO and design consultant
Compensation and resettlement						
Strictly follow the approved RAP	Compensation progress and satisfaction of affected persons Properly relocation of all affected facilitates	In the sub project areas	Survey by questionnaires and direct interview	Before construction phase	RAP monitoring consultant	In a separated contract between DAKURENCO and RAP monitoring consultant
Construction phase						
At the pre-mobilization meeting with contractors and DAKURENCO will underscore the need for contractors to understand and adhere to EMP (additional copies in Vietnamese to be provided at that time)	Confirm that contractor understands the environmental responsibility and has the technical capacity to undertake the work	Once per contractor before contractor mobilization	Direct interview	4 weeks before contractor starts	DAKURENCO and EMC	In a contract between DAKURENCO with contractor
Dust and exhaust generation						
All excavated soil should be reused for leveling low areas where applicable and stockpiled for waste covers during operation phase.	Check with reuse of construction waste at the site Volume of reused soil	In all construction sites	Observation and interview worker	Every week	CSC and EMC	In a contract between DAKURENCO with contractor
Excavation and stockpiles at site will be watered to maintain certain moisture levels, and to prevent or minimize dust dispersion.	Frequency of watering on excavation	In all construction sites	Observation and interview	Every week	CSC and EMC	In a contract between DAKURENC

Mitigation Measure	Monitoring parameters	Location	Method	Frequency	Responsibility	Cost
	surface;		worker			O with contractor
The construction machineries and equipment have to comply with Decision No. 249/2005/QĐ-TTg dated 10/10/2005 of Prime minister, Regulation on Emission roadmap for road transportation vehicles	Check with register document of vehicles	In all constructi on sites	Observation and document reviewing	Every 3 months	CSC and EMC	In a contract between DAKURENC O with contractor
Trucks carrying construction waste are covered. All trucks used should have well fitted bodies and not be overtopped in loading to avoid soil scattering.	Covering status of transportation vehicles; soil scattering condition; dust generation;	In all constructi on sites	Observation and public consultation	Every week	CSC and EMC	In a contract between DAKURENC O with contractor
Speeds shall be limited when the trucks pass residential areas to constrain dust flying in the wind, which affect health and daily activities of the people living along the roads. Speed limitation signs shall be adequately installed within construction site and its regulation shall be reminded to each driver by contractor.	Speed of vehicles passing by residential areas	In all constructi on sites	Observation and public consultation and document inspection in cooperation with transport inspectors (DoT)	Every week	CSC and EMC	In a contract between DAKURENC O with contractor
Soil scattered on the paved road and public road shall be removed immediately.	Soil scattering and response of contractors	Along the transportat ion routes	Observation and public consultation	eekly	CSC and EMC	In a contract between DAKURENC O with contractor
Prioritize to use grid power/renewable energies instead of fossil energy using generators	Sources of powers being used at sites	All working sites	Observation and worker Interview	eekly	CSC and EMC	In a contract between DAKURENC O with

Mitigation Measure	Monitoring parameters	Location	Method	Frequency	Responsibility	Cost
						contractor
Noise /vibration						
Use modern and new construction machines and equipment to meet standards of exhaust, noise, and vibration as regulated by the Government. The Contractor needs to submit the Engineer documents proving that all construction vehicles, equipment, and machines are checked and meet requirements concerning noise and vibration generation of the current Vietnam standards as QCVN 26: 2010 for noise level and QCVN 27:2010 for vibration emitted by construction works;	Current status of machines, equipment, and vehicles used for construction; Quality certification of machines; noise level generation	In all construction sites	Observation and public consultation	Every week	Construction Supervision Consultant (CSC); Environmental Monitoring Consultant (EMC)	In a contract between DAKURENCO with contractor
Use of hazardous substances and hazardous waste disposal						
Ensure that safe storage of fuel, other hazardous substances are agreed by DAKURENCO and have necessary approval/permit from DONRE and local authorities	Status of hazardous storage	In all construction sites	Observation and document inspection	Every week	CSC and EMC	In a contract between DAKURENCO with contractor
Equipment/vehicle maintenance and refuelling areas will be confined to areas in a specialized designed site to contain spilled lubricants and fuels;	Status of hazardous storage and fuel filling activities	In all construction sites	Observation and document inspection	Every week	CSC and EMC	In a contract between DAKURENCO with contractor
Fuel and other hazardous substances shall be stored in areas provided with roof as stated in TCVN 5507:2002- Hazardous chemicals − Code of practice for safety in production, commerce, use, handling and transportation;	Status of hazardous storage	In all construction sites	Observation and document inspection	Every week	CSC and EMC	In a contract between DAKURENCO with contractor
Segregate hazardous wastes (oily wastes, fuel drums) and ensure that storage, transport and disposal shall not cause pollution;	Status of containers	In all construction sites	Observation and document	Every week	CSC and EMC	In a contract between DAKURENC

Mitigation Measure	Monitoring parameters	Location	Method	Frequency	Responsibility	Cost
			inspection			O with contractor
Ensure all storage containers are in good condition with proper labelling;	Status of containers	In all constructi on sites	Observation and document inspection	Every week	CSC and EMC	In a contract between DAKURENC O with contractor
Collected, transported and treated by contract with company which has a work permit for treating hazardous waste disposal according to the Circular No. 12/2011/TT-BTNMT on 14 April, 2011 of MONRE.	Status of hazardous waste collected, transported and treated	In all constructi on sites	Observation and document inspection	Every week	CSC and EMC	In a contract between DAKURENC O with contractor
Inappropriate soil pit practices and concrete station operation						
Prioritize the use of existing quarries with suitable materials and update the list of quarries monthly and report to DAKURENCO and minimize impacts on other local resources;	Operation status Documents, reports Approval letter, operation License,	Soil pit Asphalt concrete Sand mines	Observation interview worker, public consultation Document review	onthly	CSC and EMC	In a contract between DAKURENC O with contractor
Procure construction materials that are legally exploited under DONRE's authorization;	Environmental Approval Letters from relevant local authorities	Soil pit Asphalt concrete Sand mines	Document review	Once at the beginning of the civil construction phase	CSC and EMC	In a contract between DAKURENC O with contractor
Extraction of sand and gravel in river beds shall be prohibited except: (i) where this is no technically and economically feasible alternatives and (ii) provided specific mitigation measures are implemented to minimize impact on river morphology, water quality (e.g., turbidity) and aquatic ecosystems (e.g., reduced extraction during fish spawning period);	Appropriate locations of sand supply sources The technical and economic specifications of supply sources	Soil pit Sand mines	Observation public consultation Document review	Once at the beginning of the civil construction phase	CSC and EMC	In a contract between DAKURENC O with contractor

Mitigation Measure	Monitoring parameters	Location	Method	Frequency	Responsibility	Cost
Checking the environmental protection commitment documents of material quarries, asphalt concrete stations where project is purchasing these materials.	Environmental Approval Letters from relevant local authorities	Soil pit Asphalt concrete Sand mines	Document review	Once at the beginning of the civil construction phase	CSC and EMC	In a contract between DAKURENCO with contractor
Monitoring the implementation of environmental protection measures at the material quarries and concrete stations;	Performance of environmental protection measures Appropriate measures Effectiveness of implemented measures	Soil pit Asphalt concrete Sand mines	Observation public consultation Document review	Monthly	CSC and EMC	In a contract between DAKURENCO with contractor
Inappropriate worker camp's wastes management						
Provide adequate facilities in the site including latrines, holding areas and garbage cans. Waste from latrines will be collected and treated properly through an economic contract with local environmental co-operatives/companies.	Check with waste generation, collected, transported and treated manners and documents	In all construction sites	Observation and public consultation	Every week	CSC and EMC	In a contract between DAKURENCO with contractor
Cover material storage areas when raining is needed. Temporary storage of construction and domestic waste on the sites will be no longer than 24 hours.	Check with waste generation, collected, transported and treated manners and documents	In all construction sites	Observation and public consultation	Every week	CSC and EMC	In a contract between DAKURENCO with contractor
Equipping the dustbins and mobility septic tanks to work sites (it is proposed that there will be 4 dustbins and 2 mobility septic tanks provided at each construction site)	Check with waste generation, collected, transported and treated manners and documents	In all construction sites	Observation and public consultation	Every week	CSC and EMC	In a contract between DAKURENCO with contractor

Mitigation Measure	Monitoring parameters	Location	Method	Frequency	Responsibility	Cost
Burning of construction and domestic wastes shall be prohibited;	Check with any Burning of wastes	In all constructi on sites	Observation and public consultation	Every week	CSC and EMC	In a contract between DAKURENC O with contractor
Inappropriate construction wastes management						
All solid waste should be reused for leveling low areas where applicable;	Check with waste reuse for leveling at the site	In all constructi on sites	Observation and public consultation	Every week	CSC and EMC	In a contract between DAKURENC O with contractor
Stockpile on flat grounds and not obstructing existing surface drainage routes and avoid stockpiling on site more than what is needed	Check with the location of worksites	In all constructi on sites	Observation and interview worker	Every week	CSC and EMC	In a contract between DAKURENC O with contractor
Use sediment basins/traps surrounding stockpiles of soil;	Performance of contractors during rainy times	In all constructi on sites	Review Document and interview worker	Every week	CSC and EMC	In a contract between DAKURENC O with contractor
Cultural heritage impacts						
Where grave is found during construction, coordinate with local authorities to arrange for relocation and mapping the location of the grave before and after relocation;	Check any cases and performance of contractors	In all constructi on sites	bservation and public consultation and document review	eekly	CSC and EMC	In a contract between DAKURENC O with contractor
Halt construction activities, protect the site and inform construction supervision for guidance if artifacts are found at construction site.	Check any cases and performance of contractors	In all constructi on sites	bservation and public consultation and document	eekly	CSC and EMC	In a contract between DAKURENC O with contractor

Mitigation Measure	Monitoring parameters	Location	Method	Frequency	Responsibility	Cost
			review			
Traffic disturbance						
Install traffic poles/lines with flags/lights surrounding construction sites during entire working hours and nigh time.	Availabilities of traffic poles/lines with flags/lights surrounding sites	In all construction sites	Observation and public consultation	Every week	CSC and EMC	In a contract between DAKURENCO with contractor
Regulating the transport vehicle speed will not be over 20km when passing the residential areas	Status of regulation and notices Speed of transport vehicles	In all construction sites	Observation and public consultation	Every week	CSC and EMC	In a contract between DAKURENCO with contractor
Provide alternative access for farmers to their farms adjacent to sites	Availability of alternative access road	In all construction sites	Observation and public consultation	Every week	CSC and EMC	In a contract between DAKURENCO with contractor
Community health and safety hazard						
Construction workers who are not local people must register temporary residents and obtain temporary residential certificate from local authority	Status of workers: Registration to local authorities and conflicts available in the areas between local residents and workers	In all construction sites	Observation and public consultation	Every week	CSC and EMC	In a contract between DAKURENCO with contractor
Use as many local workers as possible in order to reduce the migrant workers at sites;	Number of local workers at sites		Document review and observation	Every week	CSC and EMC	In a contract between DAKURENCO with contractor
Educate workers on appropriate behavior for interactions with local community and risks of communicable diseases	Understandings of workers on local cultures and	In all construction sites	Observation and public consultation	Every week	CSC and EMC	In a contract between DAKURENC

Mitigation Measure	Monitoring parameters	Location	Method	Frequency	Responsibility	Cost
	behaviors; time of training held by construction contractor;					O with contractor
Develop leaflets on propagandizing the ways of prevention and avoidance of the social diseases HIV/AIDS for both workers and host communities;	Availability of leaflets and method of information dissemination		Document review and observation	4 weeks before worker mobilization	CSC and EMC	In a contract between DAKURENCO with contractor
Excavated cells will be dewatered and fenced to reduce high risk for local peoples	Any excavated open ponds Performance of contractors	In all construction sites	Observation and public consultation	eekly	CSC and EMC	In a contract between DAKURENCO with contractor
The local people shall not be allowed in high-risk areas (excavation sites and areas where heavy equipment is in operation);	Provision of any warning signals in the sites	In all construction sites	Observation and public consultation	Every week	CSC and EMC	In a contract between DAKURENCO with contractor
Worker ' health & safety hazard						
Temporary worker camps at sites should be located at high and ventilated places with provided separate dustbins, hygienic toilets	Locations of worker's camps and availabilities of facilities	All construction sites	Observation and worker interview	Once before civil work starts	EMC	In a contract between DAKURENCO with contractor
Constructor need to work with PMU and CSC to establish labor safe regulations on the sites required by law and by good engineering practice, which include: electric safety, operating equipment -general safety requirements, general safety requirements	Safety measures Relevant standards Performance of contractors	In all construction sites	Observation and public consultation	Every week	CSC and EMC	In a contract between DAKURENCO with contractor
Workers shall be provided with appropriate personal protective equipment (PPE) such as safety shoes, hard hats, safety glasses, ear	Equipment available; percent of workers	In all construction sites	Observation and worker interview	Every week	CSC and EMC	In a contract between DAKURENC

Mitigation Measure	Monitoring parameters	Location	Method	Frequency	Responsibility	Cost
plugs, gloves, etc. at no cost to the employee..	equipped with;					O with contractor
A first aid kit will be provided at each construction site to ensure patients can receive first aid timely before transporting them to the medical station/hospital	Availability of first aid kit Accessibility of workers Any accident cases	In all construction sites	Observation and worker interview	Every week	CSC and EMC	In a contract between DAKURENCO with contractor
It is mandatory for workers to attend training courses on labor safety before they are recruited to work for the project;	Number, type and frequency of safety training Attendance of workers	In all construction sites	Observation and worker interview	Every week	CSC and EMC	In a contract between DAKURENCO with contractor
Supervise period on compliance to labor safe measures of workers at project sites	Availability of the facilities; requirement of local residents; dangerousness status	In all construction sites	Observation and worker interview	Every week	CSC and EMC	In a contract between DAKURENCO with contractor
Contractors ensure to provide safe drinking water to workers for daily uses.	Water source provided to the sites; water quality status	In all construction sites	Observation and worker interview	Every week	CSC and EMC	In a contract between DAKURENCO with contractor
In case of finding UXO, immediately to inform competent agency for solving;	Number of findings UXO and process of solving the issues	In all construction sites	Observation and public consultation	Every week	CSC and EMC	In a contract between DAKURENCO with contractor
Using alcohol within working time both at camps and sites must be inhibited	Availability of labor regulation	In all construction sites	Observation and public consultation	Every week	CSC and EMC	In a contract between DAKURENCO with contractor

Mitigation Measure	Monitoring parameters	Location	Method	Frequency	Responsibility	Cost
Operation phase						
Dust						
During dry season watering stockpile of soil cover, twice a day or more as necessary.	Check with the location of worksites	Soil stockpile area	Observation and interview worker	Every week	Environmental staffs of Operator Units	Operation cost
Spray water when spreading soil cover on wastes daily. Protect stockpile soil cover with a wind break/shield (artificial or natural or combination);	Check with the location of worksites	Cells	Observation and interview worker	Every week	Environmental staffs of Operator Units	Operation cost
All open trucks hauling garbage, aggregates, soil cover should be properly covered;	Check with the location of worksites	Landfill and along the route	Observation and interview worker	Every week	Environmental staffs of Operator Units	Operation cost
Limit vehicle speed inside facility to maximum of 5km/h	Check with the location of worksites	Landfill	Observation and interview worker	Every week	Environmental staffs of Operator Units	Operation cost
Minimize drop heights when loading/uploading soil onto trucks/waste cell and when uploading wastes	Check with the location of worksites	Landfill, and along the route	Observation and interview worker	Every week	Environmental staffs of Operator Units	Operation cost
Production of landfill gas, gas migration, potential explosion & loss of deep-rooted vegetation						
Apply soil/alternative cover daily.	Check with the location of worksites	Cells	Observation and interview worker	Every week	Environmental staffs of Operator Units	Operation cost
Provide and proper operate gas collection & vents;	Check with the location of worksites	Cells	Observation and interview staff, workers	Every week	Environmental staffs of Operator Units	Operation cost
In case of having no condition of collecting and	Check with the	Cells	Observation	Every week	Environmental	Operation

Mitigation Measure	Monitoring parameters	Location	Method	Frequency	Responsibility	Cost
using gases for energy purposes, blaming gases at site should be applied to turn CH4 to CO2 to reduce green house effect caused by gases emission from landfill.	location of worksites		and interview staff		staffs of Operator Units	cost
Implement landfill gas monitoring to evaluate effectiveness of system. (Gas is expected to be generated after 5 years from start of operation)	Check with the location of worksites	Landfill	Check environmental report	Every six months	Environmental staffs of Operator Units	Operation cost
Set up monitoring well within buffer area after the wall & implement continuous monitoring;	Check with the location of worksites	Buffer zone of landfill	Check environmental report	Every six months	Environmental staffs of Operator Units	Operation cost
Odor, vermin/pests/insects/rodents, birds & animal attraction						
Apply soil/alternative cover daily.	Check with the location of worksites	Cells	Observation and interview worker	Every week	Environmental staffs of Operator Units	Operation cost
Pest/vermin/rodents control by permissible and non-resistant substances should be applied to prevent them from much proliferation.	Check with the location of worksites	landfill	Observation and interview staff	Every week	Environmental staffs of Operator Units	Operation cost
Use movable perimeter (litter) fence around active cell to prevent stray animals from feeding on wastes prior to soil cover.	Check with the location of worksites	landfill	Observation and interview worker, staff	Every week	Environmental staffs of Operator Units	Operation cost
Plant green trees in its buffer area and periphery with species that repel insects such as eucalyptus, citronella (Pelargonium citrosum), neem (Azadirachta indica); trees and shrubs that bear sweet smelling flowers, e.g., ylang-ylang (Cananga odotara), champaca (Michelia champaca), sampaguita (Jasminum sambac), champasak. (Plumeria rubra or Plumeria alba), among others.	Check with the location of worksites	Access road, around landfill	Observation and interview worker	Every week	Environmental staffs of Operator Units	Operation cost

Mitigation Measure	Monitoring parameters	Location	Method	Frequency	Responsibility	Cost
Noise from truck movements/equipment operation						
Limit speed inside facility to maximum of 5km/h	Check with the location of worksites	Landfill	Observation and interview worker	Every week	Environmental staffs of Operator Units	Operation cost
Spread out arrivals of trucks and provide instructors at site;	Check with the location of worksites	Landfill	Observation and interview worker	Every week	Environmental staffs of Operator Units	Operation cost
No blowing of horns inside the facility.	Check with the location of worksites	Landfill	Observation and interview worker	Every week	Environmental staffs of Operator Units	Operation cost
Use low-noise landfill equipment & to be turned off when idle	Check with the location of worksites	Landfill	Observation and interview worker	Every week	Environmental staffs of Operator Units	Operation cost
Wind-blown litters						
Open garbage trucks (dump trucks) will be covered;	Check with the location of worksites	In all construction sites	Observation and interview worker	Every week	Environmental staffs of Operator Units	Operation cost
Apply soil/alternative cover daily.	Check with the location of worksites	In all construction sites	Observation and interview worker	Every week	Environmental staffs of Operator Units	Operation cost
Mud spread						
Trucks to have washed/wet tires prior to leaving SWTP	Check with the location of worksites	Truck washing station	Observation and interview worker	Every week	Environmental staffs of Operator Units	Operation cost
Sludge from the leachate treatment plant should be properly used for produce compost or	Check with the location of	Leachate treatment	Observation and	Every week	Environmental staffs of	Operation cost

Mitigation Measure	Monitoring parameters	Location	Method	Frequency	Responsibility	Cost
spreading on landfill.	worksites	plant	interview worker		Operator Units	
Ground water & (potential) surface water contamination from leachate						
Apply soil/alternate cover daily;	Check with the location of worksites	Cells	Observation and interview worker	Every week	Environmental staffs of Operator Units	Operation cost
Apply capping to complete cells;	Check with the location of worksites	Cells	Observation and interview worker	Every week	Environmental staffs of Operator Units	Operation cost
Undertake monitoring of underground quality at proposed wells located in its buffer zone every six months	Check with the location of worksites	Monitoring wells	Observation and interview worker	Every week	Environmental staffs of Operator Units	Operation cost
Treate wastewater from truck washing station separately before mixing with leachate;	Check with the location of worksites	Truck washing station	Observation and interview worker	Every week	Environmental staffs of Operator Units	Operation cost
Reinject leachate into designed mound in rainy season and use leachate to irrigate grasses in dry season to reduce leachate volume;	Check with the location of worksites	Landfill	Observation and interview worker	Every week	Environmental staffs of Operator Units	Operation cost
in case of applying leachate treatment plant, monitoring leachate after treatment must be regularly undertaken to ensure the effluent meets QCVN 25/2009/BTNMT and QCVN 40/2009/BTNMT before discharging into water body.	Check documents	Leachate treatment plant	Check documents, environmental report	Every six months	Environmental staffs of Operator Units	Operation cost
Ensure landfill liner, pipelines, and leachate collection &management facilities stay in good working order	Check documents	Leachate treatment plant	Check documents, environmental report	Every six months	Environmental staffs of Operator Units	Operation cost
Implement engineering and management systems	Check documents	Leachate	Check	Every six	Environmental	Operation

Mitigation Measure	Monitoring parameters	Location	Method	Frequency	Responsibility	Cost
to prevent and manage emergency leachate spills and discharge situations		treatment plant	documents, environmental report	months	staffs of Operator Units	cost
Sedimentation/pollution of creek/channel from borrowing activities & associated stockpiles						
Stockpile at least 50 m away from main surface drainage routes, prepare sediment traps, sandbags, barrier nets, to prevent soil cover from being eroded/blown away wind/rain:	Check with the location of worksites	Landfill	Observation and interview worker	Every week	Environmental staffs of Operator Units	Operation cost
Limit stockpile to a maximum height of 2 m.	Check with the location of worksites	Stockpile area	Observation and interview worker	Every week	Environmental staffs of Operator Units	Operation cost
Place of storing hazardous substances, maintenance and repair of machines should be confided so that all hazardous wastes shall be collected and treated by competent agencies;	Check with the location of worksites	Landfill	Observation and interview worker	Every week	Environmental staffs of Operator Units	Operation cost
Plant trees in the periphery buffer area or vicinity of creek/channel to prevent soil erosion and sedimentation.	Check with the location of worksites	Buffer zone of landfill	Observation and interview worker	Every week	Environmental staffs of Operator Units	Operation cost
Leachate dripping from trucks hauling wastes, odors & litters from open garbage trucks						
Require waste trucks to ensure no leachate drippings on roads during transport;	Check with the location of worksites	Landfill	Observation and interview worker	Every week	Environmental staffs of Operator Units	Operation cost
Require open waste trucks to provide the appropriate cover.	Check with the location of worksites	Landfill	Observation and interview worker	Every week	Environmental staffs of Operator Units	Operation cost
Require trucks to wash body & tires prior to exit from landfill	Check with the location of worksites	Landfill	Observation and interview worker	Every week	Environmental staffs of Operator Units	Operation cost
Fire/explosion from gas build, build up, heat,						

Mitigation Measure	Monitoring parameters	Location	Method	Frequency	Responsibility	Cost
ect						
Equip SWTP with adequate/appropriate fire-fighting equipment;	Check with the location of worksites	Landfill	Observation and interview worker/staff	Every week	Environmental staffs of Operator Units	Operation cost
Set up trained Safety Team (as initial responders) linked to the fire department & other ultimate responders,	Check with documents	Landfill	Check documents and interview staff	Every week	Environmental staffs of Operator Units	Operation cost
Install gas collection & treatment. Monitor landfill gas.	Check with the location of worksites	Landfill	Observation and interview worker	Every week	Environmental staffs of Operator Units	Operation cost
Conduct regular fire/explosion/emergency drills; Enforce a “No Smoking” Policy within the SWTP premises	Check with the location of worksites	Landfill	Check documents, observation, interview worker	Every week	Environmental staffs of Operator Units	Operation cost
Community health/safety hazard from dust, gas, water resource contamination, pests/insects/rodent, fire/explosion						
Install sufficient warning signs against unauthorized entry;	Check with the location of worksites	Landfill	Observation and interview worker	Every week	Environmental staffs of Operator Units	Operation cost
Implement measures to mitigate dust, gas leachate, pests/insects/rodents, incidence or fire/explosion;	Check with the location of worksites	Landfill	Observation and interview worker	Every week	Environmental staffs of Operator Units	Operation cost
Secure premises against unauthorized entry by public;	Check with the location of worksites	Landfill	Observation and interview worker	Every week	Environmental staffs of Operator Units	Operation cost
Coordinate with DONRE for regular monitoring of the down-basin surface water quality, and the	Regular monitoring		check document	Every six months		

Mitigation Measure	Monitoring parameters	Location	Method	Frequency	Responsibility	Cost
quality of local groundwater and ambient air that potentially are influenced by landfill & leachate management.	documents					
Workers' health and safety hazard						
Prepare and implement the O&M Manual including health and safety risks & mitigation measures.	Check with the location of worksites	Landfill	Check document, interview staff	Every week	Environmental staffs of Operator Units	Operation cost
Set up emergency response mechanism & train workers of their roles & responsibilities in the mechanism	Check with the location of worksites	Landfill	Observation and interview worker	Every week	Environmental staffs of Operator Units	Operation cost
Provide workers with semi-annual physical examinations and appropriate vaccinations to prevent any diseases related to landfill operation, establish & update workers' health baseline data;	Check with the location of worksites	Landfill	Observation and interview worker	Every week	Environmental staffs of Operator Units	Operation cost
Equip workers with personal protective wear such as clothing, cap, hand glove, ear muffle, nose/mouth mask, eye wear, footwear (boot);	Check with the location of worksites	Landfill	Observation and interview worker	Every week	Environmental staffs of Operator Units	Operation cost
Provide workers with access to adequate sanitation facilities and potable water;	Check with the location of worksites	Landfill	Observation and interview worker	Every week	Environmental staffs of Operator Units	Operation cost
Support workers in good sanitation practices	Check with the location of worksites	Landfill	Observation and interview worker	Every week	Environmental staffs of Operator Units	Operation cost
O &M						
Provide sufficient budget and technical capacity for operation, maintenance and repair.	Maintenance activities in all construction items	In all construction sites	Observation and public consultation	Quarters	Environmental staffs of Operator Units	Operation cost
After every seismic or extreme weather event,	Maintenance	In all	Observation	After any	Environmental	Operation

Mitigation Measure	Monitoring parameters	Location	Method	Frequency	Responsibility	Cost
conduct engineering investigation of built structures & implement corrective measures immediately.	activities in all construction items	constructi on sites	and public consultation	event occurs	staffs of Operator Units	cost

40. Because the landfill is located in the remote area, on a large agricultural land and far from water sources, constructing the landfill causes minor impacts on both natural and man – made environments. The environmental issues are only related to the operation phase of the landfill such as management of landfill runoff and leachate, generation of poisonous gases and mercaptan smell coming from gases of H2S, NH3, CO2 and reproduction of rodents/insects/vermin. These will impact on water quality, air quality, health, and safety of workers and communities. Therefore, during construction phase, there is no need of conducting environmental effect monitoring but concentrating on monitoring the compliance of contractors in implementing the mitigation measures proposed in Table 10. During operation phase, both effect and compliance monitoring must be taken to cope with any environmental issues found to ensure that the landfill operation do not cause any negative impacts on environment. Parameter and positions of environmental monitoring are presented in Table 11.

Table 11: Monitoring of environmental impacts [1]

Mitigation Measures	Monitoring parameters	Location	Method	Frequency	Responsibility	Cost
Pre-construction phase						
No need to implement monitoring except for land acquisition and resettlement monitoring. Monitoring requirements relate to resettlement is provided in Resettlement Action Plan of Subproject.						
Construction phase						
No need to implement effect monitoring but compliant monitoring should be carried out regularly.						
Operation phase						
Air quality	TSP, NH3, H2S, CO2.	02 positions (01 operation house play yard and 01 at waste classifying area)	Sampling , analysis and results against QCVN 05/2013/BTNMT	Every six months	Environmental staffs of Operator Units	As specified in Annex 2
Surface water quality	pH, TSS, DO, COD,	02 positions (01 at small Ea Goi	Samplings, lab	Every six	Environmental	As specified in

[1] Environmental effects monitoring is conducted to estimate the impacts of the sub-project on ambient environmental conditions

Mitigation Measures	Monitoring parameters	Location	Method	Frequency	Responsibility	Cost
	BOD 5, ammonium (NH 4) by N, nitrite, nitrate (NO 3 -), Phosphate, Floating oil Coliform	stream and 01 at Krong Ana river mouth receiving landfill - runoff	analysis and results against QCVN 08:2008/BTNMT	months	staffs of Operator Units	Annex 2
Underground water quality	pH, TSS, DO, COD, BOD5, ammonium (NH4) by N, Nitrite, nitrate (NO3-), Hg, Cd, As Coliform, E.Coli	02 positions (02 monitoring wells in its buffer area)	Samplings, lab analysis and results against QCVN 01:2009/BYT	Every six months	Environmental staffs of Operator Units	As specified in Annex 2
Leachate effluent	*pH, TSS, DO, COD, BOD5, ammonium (NH4) by N, Nitrite, nitrate (NO3-), Hg, Cd, As Coliform, E.Coli*	*01 position (discharging gate of effluent)*	*samplings, lab analysis and results against QCVN 25/2009/BTNMT & QCVN 40/2009/BTNMT*	*Every six months*	Environmental staffs of Operator Units	*As specified in Annex 2*

Note: Monitoring requirements related to resettlement are provided in Resettlement Plan of Sub-project.

V. PUBLIC CONSULTATION PROCESS AND INFORMATION PUBLICATION

Activity	Participant	Expected Result	Schedule	Cost
Pre-construction phase				
Consult local managerial levels about conditions of construction sites	DAKURENCO local affected people, local authorities and relevant agencies	Information about the potential impacts on environment and proposed mitigation measures	During design updating period	Under these Sub-project, costs are covered in the survey cost

Construction phase				
Disseminate information to local community via public loudspeakers, announcements on newspapers	Community, DAKURENCO, local environmental officers, Contractors	Informing communities about construction activities, works schedules, potential negative impacts on environment, environmental management measures and how to use the community grievance line	During the construction phase	Covered by the counterpart fund (DAKURENCO is responsible for payment). Estimated costs for four times of publication through louder speakers and in the newspapers is: VND 24.000.000
Community redress mechanism is established by the DAKURENCO	Community, DAKURENCO, Contractors	PMU and Contractors shall have to reply to all complaints, questions or concerns of local communities, faculties and students about the works.	During the construction phase	
Operation phase				
Community redress mechanism is established by DAKURENCO	DAKURENCO, local affected people, local authorities and relevant agencies	DAKURENCO shall have to reply to all complaints, questions or concerns of local communities and competent agencies;	During operation phase	Conveyed by counterpart fund (DAKURENCO is responsible for payment)

VI. INSTITUTIONAL STRENGTHENING AND TRAINING

A. Activities during construction phase

41. Experiences in other projects in Vietnam indicate that appointment of an Environmental Staff (ES) whose role is to monitor and coordinate environmental management activities with the Project activities would be beneficial.

42. Environmental staff should be assigned by DAKURENCO to be responsible for co-ordination of environmental activities of all components of the subproject under its management. It is therefore proposed that such a position should be mobilized at DAKURENCO. The main activities of this Environmental Specialist would be as follows:

    (i) To ensure that DAKURENCO is in compliance with the guidelines included in the Sub-projects' Environmental Management Plans

    (ii) To ensure that all the involved parties will prepare and submit environmental monitoring reports to DAKURENCO. These environmental reports shall be maintained and consolidated for submission to ADB and other authorities on request.

    (iii) To act as the liaison between DONRE and other governmental authorities in terms of environmental issues

    (iv) To ensure that all environmental considerations will be DAKURENCO's fully understand their roles in integrating environmental concerns into procurement processes.

43. The Environmental Staff shall be trained with environmental qualifications and having experience in the environmental sector. Dependent on his/her skills, the assigned ES can be further trained by attending external training events. Expenses for these training activities are taken from the overall environmental management budget allocated for the Sub-project. An on-the-job training will be provided to the ES by the international and national Environmental Specialists at the initial implementation stage.

B. Activities during operational phase

44. Building of suitable capacities for the landfill operator is very important to continuously act environmental management during operation phase. Training programs should focus on update of the landfill operation manual proposed by DED including process of operation, EMP, job description, institutional arrangement and technical & financial requirements for operation and monitoring.

VII. RESPONSIBILITIES AND AUTHORITIES FOR IMPLEMENTATION OF MITIGATION MEASURES AND MONITORING REQUIREMENTS

Agency	Responsibilities for implementation of environmental management
DAKURENCO	Overall responsibility for EMP implementation during the pre-construction and construction phases; Ensure that contract documents include environmental requirements; Ensure that sufficient funds are available in project budget for EMP implementation; Undertake inspections and monitoring of environmental issues during construction phase; Assist Contractors in EMP implementation;

Agency	Responsibilities for implementation of environmental management
	Make environmental report to summarize sub-project activities as required; Allocate adequate resources for environmental requirements; Periodical reports send to ADB as well as DaKLak DONRE;
Environmental Monitoring Consultant	Assist DAKURENCO in grafting: (i) environmental mitigation measures in the contract with Construction Contractor; (ii) environmental compliance criteria in the contract with Construction Supervision Consultant (CSC) to ensure Contractor and CSC's responsibility and their participation in the Environmental Monitoring System. Periodical implementation of compliance monitoring to CSC and Construction Contractor by checking documentation and field site survey;
Design consultant	Ensure that all designs and contract documents comply requirements under EMP; Ensure that construction supervision activities are incorporated with environmental issues;
Construction Supervision Consultant	Periodical implementation of onsite compliance monitoring to Construction Contractor; Periodically complete snapshot reports on site EMP and send to Environmental Monitoring Consultant as well as DARURENCO, giving proposals for improvement.
Construction contractor	Prepare detailed Site EMP (SEMP) to meet general requirements in EMP and train workers in environmental issues. Fulfill assigned tasks under the SEMP and other issues related to EMP of the Sub-component. If the Contractors find that mitigation measures in SEMP have been ineffectively implemented, they should recommend new or improved mitigation measures. Allocate adequate resources to meet the requirements and obligations of Sub-component's EMP. The Site EMP must be approved by the Monitoring Engineer and DAKURENCO's environmental staff before construction commencement.
DakLak DONRE	Provide consultancy service and inform the sub-project about any violation related to environmental management and protection policy of Vietnam, and provide technical support as required during Sub-project implementation.
Works Ownership and Operation Unit	Be responsible for environmental activities in operation phase including EMP implementation during operation Undertake inspections and monitoring of environmental issues during operation;
Buon Ma Thuot city Level	Provide consultants and support as requested during the process of sub-project implementation.

Agency	Responsibilities for implementation of environmental management
Environment Staff[2]	Implement monitoring and reporting as internal requirements.

VIII. MECHANISM OF INCOMPLIANCE REDRESS

45. A compliance framework, based on the environmental requirements established by the EMP and Environmental Specifications included in bidding documents, will be strictly enforced by Supervision engineers. The minor infringements will be identified as an incident which causes temporary but reversible damage, where the contractor will be given a reasonable period of time to remediate the problem and to restore the environment. If restoration is done satisfactorily during this period, no further actions will be taken. If it is not done during this period, the PMU will immediately arrange for another contractor to do the restoration, and deduct the cost from the offending contractor's next payment. The major infringements will be identified as an incident where there is long-term or irreversible damage, there will be a financial penalty in addition to the cost for restoration activities. To minimize the damage, the restoration activities will be implemented without delay.

46. The compliance framework will be applied as follows:
    - The CSC will identify or be notified of an infringement (community member, local government)
    - The CSC in consultation with the EMC will assess whether it is a minor or major infringement.
    - For minor infringements:
        - The EMC will establish the required mitigation measures, and the time, which is a maximum of five days to remedy the situation.
        - The EMC will review the recommendation and confirm (i) the level of infringement (minor/major); (ii) the mitigation measures; and (iii) the mitigation time. If they do not agree, they will work with DAKURENCO to reach mutually acceptable recommendations.
        - The Contractor will be informed of the infringement, the required mitigation measures, and time for resolution.
        - The Contractor shall remedy the infringement in accordance with the recommendations within the agreed time.
        - The EMC shall confirm the infringement is satisfactory remedied in the time.
        - If the infringement is not satisfactorily remedied in the time, the CSC shall inform the EMC and DAKURENCO. It shall immediately arrange for a separate contractor to undertake the necessary works and the cost of this shall be deducted from the next payment to the offending contractor.

    - For major infringements:
        - The CSC shall immediately inform DAKURENCO and the EMC of the incident
        - The PMU shall inform the appropriate provincial authorities if appropriate
        - The PMU, in consultation with the CSC, EMC and other provincial authorities as appropriate, shall agree upon mitigation and clean up measures to be undertaken immediately by the contractor or by specialists to be procured at the contractor's expense. To minimize the environmental impacts the restoration activities should be completed within ten days.
        - The Project Office shall apply a financial penalty, not to exceed 1% of the contract cost, for each major infringement, in addition to any costs associated with the infringement not borne by the contractor.

[2] Environmental Protection Law and regulations related to enhance roles of District level by taking part in verifying documents of "Commitment to environmental protection" and continuously monitor environmental aspects.

IX. RESPONSIBILITIES FOR REPORTING AND REVIEW

Subproject phases	Type of report	Frequency	Responsibility	Submitted to whom
Pre-construction phase	No report is required.			
Construction phase	Site Environmental Performance Report indicating the compliance with Site EMP (Refer to Annex 1 for content)	Quarterly	Civil Works contractor	DAKURENCO
	EMP Compliance Report indicating the compliance with sub-component's EMP (Refer to Annex 1 for content)	Quarterly during construction time depending on construction duration	EMC	DAKURENCO
	The Sub-component's Environmental Report describing overall sub-component environmental performance and EMP compliance (Refer to Annex 1 for content)	Twice a year during construction time and the completion of work construction	DAKURENCO	ADB, DONRE,
Operation phase	EMP Compliance Report: Work operation must comply with sub-component's EMP commitments.	Once a year for the first two years of operation. Ongoing frequency is to be determined basing on evaluation results after 2 years.	Work management and operation unit	ADB, DONRE

X. ENVIRONMENTALLY RESPONSIBLE PROCUREMENT PLAN

A. Procurement of Equipment for EMP Implementation

47. No purchase of equipment for EMP implementation is needed.

B. Integration of Environmental Considerations into the Procurement/Bidding Process

48. Procurement for civil works and equipment and vehicle for the Sub-component will be carried out in accordance with Procurement Guidelines (2007). A combination of International Competitive Bidding, National Competitive Bidding, Shopping and Direct Purchasing/ Contracting methods will be implemented depending on costs and work items/

equipment being procured. The method for ensuring integration of environmental considerations into each of these procurement processes are described below.

International Competitive Bidding / National Competitive Bidding [3]		**Shopping Procedure [4]**	
Steps in Procurement Process [5]	**Integration of Environmental Considerations**	**Steps in Procurement Process**	**Integration of Environmental Considerations**
1. Draft bidding documents prepared by DAKURENCO	DAKURENCO incorporates relevant environmental requirements from EMP and standard environmental bidding clauses into draft bidding documents.	1. Draft submission requirements of quotations as well as specifications prepared for utilities/ goods supply.	DAKURENCO incorporates relevant environmental requirements from EMP and standard environmental bidding clauses into draft requirement of quotation submission.
2. Draft bidding 1. documents submitted to ADB/PPC	ADB verifies that environmental requirements adequately and appropriately incorporated into bidding documents.	2. Draft requirement submitted to ADB/Provincial People's Committee, cc.	ADB verifies that environmental requirements adequately and appropriately incorporated.
3. DAKURENCO issues bidding documents, receives and evaluates bids. DAKURENCO prepares bid evaluation report and submit to ADB/ PPC.	DAKURENCO's bid evaluation process includes consideration of environmental criteria	3. Quotations are submitted and evaluated. Bid evaluation report must be submitted to ADB.	DAKURENCO's bid evaluation process includes consideration of environmental criteria
4. ADB issues NOL	ADB verifies that environmental requirements have been considered in evaluation process	4. ADB issues NOL	ADB verifies that environmental requirements have been considered in evaluation process
5. Contract awarded	DAKURENCO prepares draft contract that contains relevant environmental requirements/specifications	5. Contract awarded	DAKURENCO prepares draft contract that contains relevant environmental requirements/specifications

[3] Competitive bidding applied for high cost items.

[4] Shopping is a procurement method based on comparison of price quotations from several suppliers or contractors. It is generally used for lower cost items.

[5] Above procurement method applied for the first NCB only, it is not necessary for ADB submission with the following NCB.

XI. PRELIMINARY COST ESTIMATES FOR ENVIRONMENTAL MONITORING

49. This section provides cost estimate for EMP implementation, including costs for mitigation measures, environmental monitoring. Costs for implementation of other project components (e.g. resettlement monitoring) will be not presented here.

A. During the construction phase

1. Mitigation implementation

50. All mitigation measures that belong to the Contractor's responsibilities shall be implemented by the Contractor. The costs are included in the contract between Construction Contractor and DAKURENCO;

2. Community consultation and information publication

51. DAKURENCO bears costs for these activities and the funds are covered by the project loan.

B. During the operation phase

52. During the operation and maintenance phase, the works operation and management unit will provide budget for implementing mitigation measures. Therefore, no cost estimate for environmental monitoring during the operation and maintenance phase is not included in this EMP.

Monitoring environment quality (see Annex 2 for details)

53. The operation unit shall bear all costs for environmental monitoring during the operation phase, including site survey, sample taking and analysis, and preparing reports. The fund for this task is estimated for each year of monitoring will be included in operation cost of the project. This will be used as reference for operation unit during operation phase.

C. Summary of expenditures for EMP implementation:

54. Costs for implementation of the sub-projects EMP include:

I. Costs for implementation of mitigation measures during the construction phase will be the responsibility of the Contractor. These costs are included in the contract between Construction Contractor and DAKURENCO.

II. Costs for community consultation and information publication: pre-construction phase has implemented and included in the cost of EPC report; cost for community consultation and information in the construction phase is estimated at VND 24,000,000 and will be covered in the direct cost of EMP.

APPENDIX

Annex 1: Proposed formats for environmental reporting

SITE ENVIRONMENTAL PERFORMANCE REPORT (SEMP)

Introduction and Project Review

Name of sub-project:	
Location of sub-project:	
Reporting period:	
Last report date:	
Key sub-project activities since last report:	

Summary of Compliance with Site EMP Requirements

Site EMP Requirements	*Compliance Attained (Yes, No, Partial)*	*Comments on Reasons for Non-Compliance*	*Issues for Further Action*
1.			
2.			
3.			

Environmental Monitoring Results

Monitoring Parameters	*Comparison to Relevant Standards/ Criteria*	*Comments on Incidences of Exceeded*	*Issues for Further Action*
1.			
2.			
3.			

Issues for Further Action

Issue	*Cause*	*Required Action*	*Responsibility*	*Timing*	*Resolution*
Old Issues from Previous Reports					
1.					
2.					
New Issues from this Report					
1.					
2.					

Appendices

1. Correspondence
2. Monitoring Results
3. Etc.

EMP COMPLIANCE REPORT – CONSTRUCTION

Introduction and Project Overview

Name of sub-project:	
Location of sub-project:	
Reporting period:	
Last report date:	
Key sub-project activities since last report:	

Summary of Contractor's Site Environmental Performance Reports

Report No. and Date	*Key issues Raised in Report*	*Comments on How Issues are addressed*	*Issues for Further Action*

Compliance with Sub-Project EMP

Sub-Project EMP Requirements	*Compliance Attained (Yes, No, Partial)*	*Comments on Reasons for Non-Compliance*	*Issues for Further Action*
1.			
2.			
3.			

Environmental Inspection and Monitoring Results

Monitoring Parameters	*Comparison to Relevant Standards/ Criteria*	*Comments on Incidences of Exceeded*	*Issues for Further Action*
1.			
2.			

Issues for Further Action

Issue	*Cause*	*Required Action*	*Responsibility*	*Timing*	*Resolution*
Old Issues from Previous Reports					
1.					
2.					
New Issues from this Report					
1.					
2.					

Appendices

1. Correspondence;
2. Monitoring Results;
3. Etc.

SUB-PROJECT ENVIRONMENTAL REPORT – CONSTRUCTION COMPLETION

Introduction and Project Overview

Name of sub-project:	
Location of sub-project:	
Reporting period:	
Last report date:	
Key sub-project activities since the last report:	

Summary of EMP Compliance Reports

Report No. and Date	*Key Issues Raised in Report*	*Comments on How Issues are addressed*	*Issues for Further Action*
1.			
2.			

Issues for Further Action

Issue	*Cause*	*Required Action*	*Responsibility*	*Timing*	*Resolution*
1.					
2.					

Summary of Sub-Project Environmental Performance and Recommendations/ Lessons Learnt

1._____

2._____

3._____

Appendices

1. Correspondence
2. Supporting information
3. Etc.

EMP COMPLIANCE REPORT - OPERATION

Summary and Project Overview

Name of sub-project:	
Location of sub-project:	
Reporting period:	
Last report date:	
Key sub-project activities since the last report:	

Compliance with Sub-Project EMP

Sub-Project EMP Requirements	*Compliance Attained (Yes, No, Partial)*	*Comments on Reasons for Non-Compliance*	*Issues for Further Action*
1.			
2.			
3.			

Environmental Inspection and Monitoring Results

Monitoring Parameters	*Comparison to Relevant Standards/ Criteria*	*Comments on Incidences of Exceedance*	*Issues for Further Action*
1.			
2.			
3.			

Issues for Further Action

Issue	*Cause*	*Required Action*	*Responsibility*	*Timing*	*Results*
Old Issues from Previous Reports					
1.					
2.					
New Issues from this Report					
1.					
2.					

Appendices

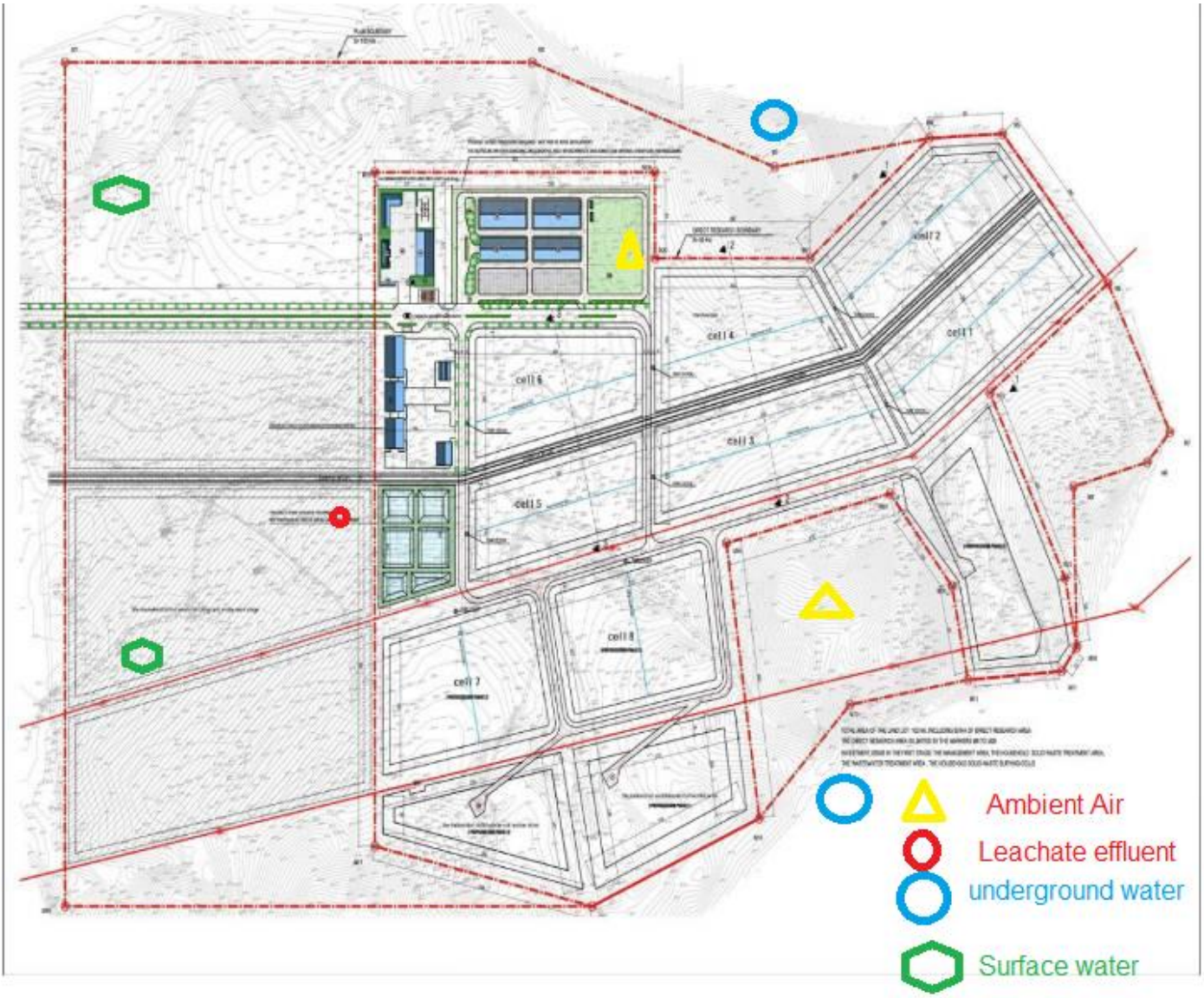
1. Correspondence
2. Supporting information
3. Etc.

Appendix 2: Cost estimation for environmental supervision monitoring – civil work package BMT01

A1	Analysis in Laboratory	Criteria	Unit price	No. of location	No of sample	Amount	
	Air quality	*TSP*	*700,000*	*2*	*4*	*5600000*	
		CO2	*140,000*	*2*	*4*	*1120000*	
		NH3	*140,000*	*2*	*4*	*1120000*	
		H2S	*140,000*	*2*	*4*	*1120000*	
		Sub Total				***8960000***	
	surface water quality	*pH*	*56,000*	*2*	*4*	*448000*	*Circular 08/2014/BTC*
		TSS	*80,000*	*2*	*4*	*640000*	
		DO	*104,000*	*2*	*4*	*832000*	
		COD	*120,000*	*2*	*4*	*960000*	
		BOD_5	*200,000*	*2*	*4*	*1600000*	
		Amoni (NH4) to N	*150,000*	*2*	*4*	*1200000*	
		Clorua (Cl-)	*70,000*	*2*	*4*	*560000*	
		Nitrit (NO2-)	*100,000*	*2*	*4*	*800000*	
		Nitrat (NO3-)	*140,000*	*2*	*4*	*1120000*	
		Floating oil	*400,000*	*2*	*4*	*3200000*	
		Ecoli	*112,000*	*2*	*4*	*896000*	
		Coliform	*103,000*	*2*	*4*	*824000*	
		Hg	*180,000*	*2*	*4*	*1440000*	
		As	*150,000*	*2*	*4*	*1200000*	
		Subtotal				***15,720,000***	
	underground water	***pH***	***56,000***	***2***	***4***	***448,000***	*Circular*

		TSS			***80,000***	***2***	***4***	***640,000***	*08/2014/BTC*
		DO			***104,000***	***2***	***4***	***832,000***	
		COD			***120,000***	***2***	***4***	***960,000***	
		BOD5			***200,000***	***2***	***4***	***1,600,000***	
		Amoni (NH4) to N			***150,000***	***2***	***4***	***1,200,000***	
		Clorua (Cl-)			***70,000***	***2***	***4***	***560,000***	
		Nitrit (NO2-)			***100,000***	***2***	***4***	***800,000***	
		Nitrat (NO3-)			***140,000***	***2***	***4***	***1,120,000***	
		Floating oil			***400,000***	***2***	***4***	***3,200,000***	
		Ecoli			***112,000***	***2***	***4***	***896,000***	
		Coliform			***103,000***	***2***	***4***	***824,000***	
		Hg			***180,000***	***2***	***4***	***1,440,000***	
		As			***150,000***	***2***	***4***	***1,200,000***	
		Subtotal						***15,720,000***	
	leachate effluent	***pH***			***56,000***	***2***	***4***	***448,000***	
		TSS			***80,000***	***2***	***4***	***640,000***	
		DO			***104,000***	***2***	***4***	***832,000***	
		COD			***120,000***	***2***	***4***	***960,000***	
		BOD5			***200,000***	***2***	***4***	***1,600,000***	
		Amoni (NH4) to N			***150,000***	***2***	***4***	***1,200,000***	
		Clorua (Cl-)			***70,000***	***2***	***4***	***560,000***	
		Nitrit (NO2-)			***100,000***	***2***	***4***	***800,000***	
		Nitrat (NO3-)			***140,000***	***2***	***4***	***1,120,000***	
		Floating oil			***400,000***	***2***	***4***	***3,200,000***	
		Ecoli			***112,000***	***2***	***4***	***896,000***	
		Coliform			***103,000***	***2***	***4***	***824,000***	
		Hg			***180,000***	***2***	***4***	***1,440,000***	

		As		***150,000***	***2***	***4***	***1,200,000***	
		Subtotal					***15,720,000***	
		total A1					***56,120,000***	
A2	***Equipment Rental/Quick analysis***	***Take air sample at site***		***500,000***	***1***	***1***	***500,000***	
		Take surface water at site		***500,000***	***1***	***1***	***500,000***	
		Take undergroundwater		***500,000***	***1***	***1***	***500,000***	
		take leachate sample		***500,000***	***1***	***1***	***500,000***	
		total A2					***2,000,000***	
	wages for environmental specialist		***team leader***	***18,000,000***	***1***	***1***	***18,000,000***	*219/2009/TT-BTC 957/QDD-BXD*
			consultant	***12,000,000***	***1***	***1***	***12,000,000***	
			management	***50% of net consultant wages***			***15,000,000***	
B			*Travel cost*	*lump sum*			*10,000,000*	
	Total B						*55,000,000*	
C	*Public consultation*						*5,000,000*	
D	*Contact and stationary cost*						*5,000,000*	
E	*Translating, Printing and copy*			*price*	*unit*	*no*		
				3,120,000	*reports*	*2*	*6240000*	
F	*total*						*129,360,000*	
G	***Contingency cost (10% of (total cost and management cost***						*12,936,000.0*	
H	***Total cost before VAT***						*142,296,000.0*	
I	***VAT (10% of cost before VAT)***						*14,229,600.00*	
	TOTAL						*156,525,600.00*	
	TOTAL IN USD						*7,170.21*	



Appendix 3: Environmental quality monitoring locations