Supplement 3

(Appendices for Xayabouri District)

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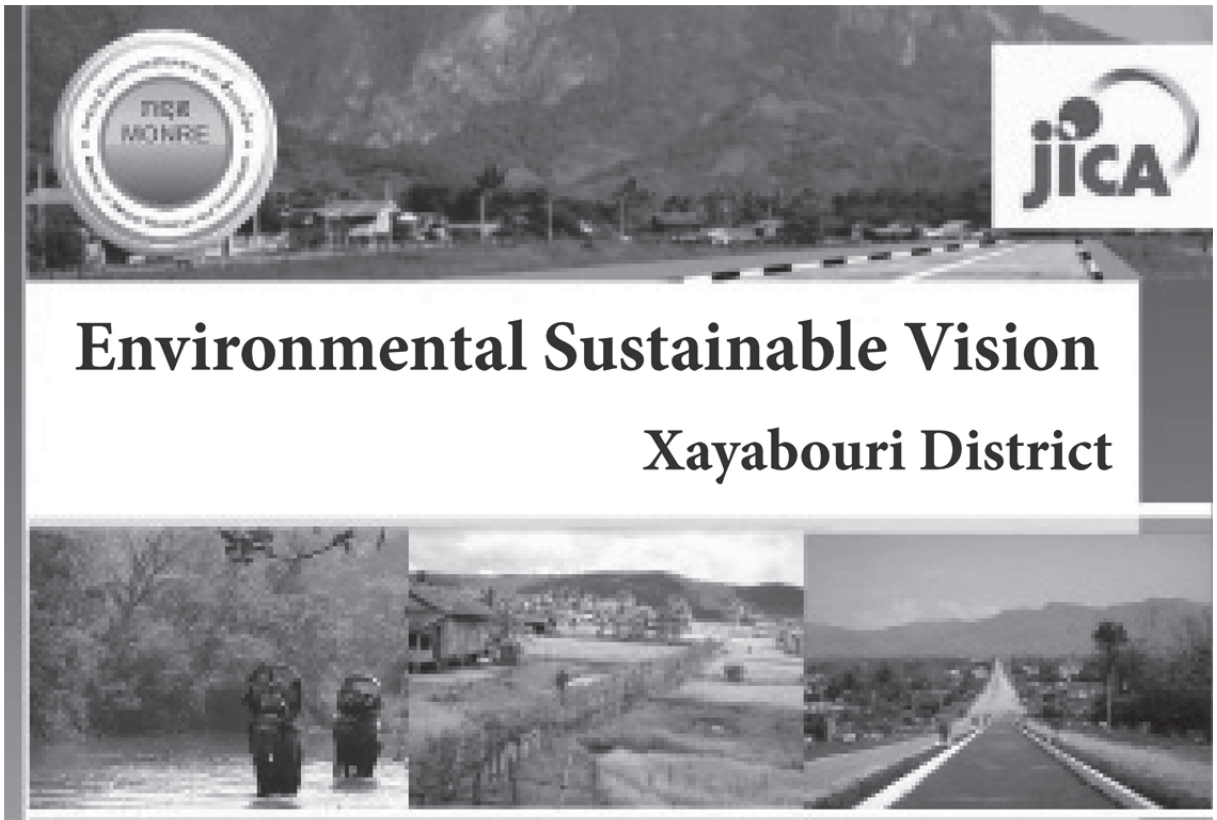
Appendix 1. ESC Vision

ESC Vision of XYB was printed in a 4-page brochure of A3 size shown as below.



Environmental Sustainable Vision

Xayabouri District

Background

MONRE intends to encourage the cities in Laos to be clean, green and beautiful so that they become environmentally sustainable without compromising the quality of living of the next generation.

Japan International Cooperation Agency (JICA) has commenced the Laos Pilot Program for Narrowing the Development Gap towards ASEAN Integration-Environmental Management Component (LPPE) in August 2011. The LPPE has established the promotion of environmentally sustainable cities (ESC), one of the areas advocated in "Ensuring Environmental Sustainability" in the blueprint for the ASEAN socio-cultural community (ASSC), as the primary objective of the project.

The LPPE has conducted the baseline survey on urban environmental management (UEM) in 3 pilot sites (Vientiane Capital, Luang Prabang and Xayabouri) from the beginning of September 2011 by the short-term JICA expert team (SJET) in cooperation with Lao counterparts (C/P).

Based on the results of the survey, Department of Natural Resources and Environment (DONRE) and Urban Development Administration Authority (UDAA) of Xayabouri Province has prepared this Vision by supporting from LPPE in March 2012. DONRE and UDAA have finalized the Vision in March 2013 reflecting the public comments received by the end of 2012.

Environmental Sustainable Vision of Xayabouri District

Environmental sustainable vision includes an overarching goal, sector-specific goals and strategies with a view of environmental sustainability.

Xayabouri District is part of the ASEAN Environmentally Sustainable Cities (ESC) Network. As such, the authority is expected to lead the way in environmentally activities in the district while ensuring economic and social development and healthy and comfortable urban lives for all its citizens.

This Vision was thus drafted to stimulate and integrate urban activities, and to involve all stakeholders, from both public and private sectors and individuals, in the movement towards an environmentally sustainable Xayabouri district.

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Vision for an Environ

With foremost appreciation for ab
responsibility to c

SOCIO-ECONOMIC ENVIRONMENT

Sub-sector	Goal 2020	Strategy
1. Land Use	● Regulation of land-use is enforced according to urban development plan and illegal construction is controlled.	→ Authorization of land use plan. → Enforcement of land use regulation. → Control and revelation of illegal construction
2. Traffic and Road Condition	● Road network in rural area is improved for local people to access the main road even in rainy season.	→ Survey of current road condition in rainy season by DPWT and UDAA → Allocation of government budget
3. Urban Environmental Management Policy Implementation	● Effective and practical capacity development (capacity building) is conducted to promote urban environmental management by implementation of 5-year Environmental Management Action Plan.	→ 5-year Environmental Management Action Plan is realized. → Capacity development is carried out continuously since capacity development is prioritized in each environmental action plan of MONRE and DONRE of XYB.
4. Poverty	● Millennium Development Goal is achieved according to poverty eradication program.	→ Review of poverty eradication program. → The situation of poverty is studied in rural area of XYB District.
5. Ethnic People	● The effort of eliminating discrimination is conducted continuously.	→ Living condition of ethnic group is improved.
6. Tourism Resources	● Tourism resources are promoted and managed well by XYB Provincial Department of Tourism.	→ Tourism resources are developed and maintained.
7. Landscape	● Current aesthetic urban landscape is conserved according to urban development plan to be "Clean, Green and Beautiful" town.	→ Review of urban development plan from the viewpoint of landscape.
8. Gender	● Traditional gender roles are understood and respected to succeed the millennium development goal.	→ Awareness of gender is enhanced through activities of Women's Union.
9. Children's Right	● Children can go to school and continue to study for more than five years.	→ Primary schools are constructed in some of the villages who have no school. → Some elementary schools are promoted to primary schools. → Allocation of government budget for school teachers
10. Environmental Awareness	● People follows rules and regulations to make the city clean and beautiful.	→ Rules and regulations are clearly explained to people. → Useful educations tools are developed and utilized.

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ımentally Sustainable Xayabouri District

ɔundant natural resources and scenic mountains, we all take create clean, green and beautiful Xayabouri

	Sub-sector	Goal 2020	Strategy
NATURAL ENVIRONMENT	11. **Stormwater Management**	● Flood area is managed according to the urban development plan to reduce impact on environment.	→ Review of urban development plan from the viewpoint of flood control → Flood management plan is formulated newly.
	12. **Biodiversity**	● Natural environment abundant in biodiversity to be protected is conserved positively.	→ Provincial Biodiversity Conservation Area in XYB District is monitored strictly to prevent illegal cutting.
	13. **Forest Resources**	● Illegal felling is monitored and controlled regularly.	→ Budget allocation and staff training are urgently implemented to monitor and control illegal cutting.
	14. **Urban Green Area**	● The green areas are expanded and managed properly for citizens to enjoy them.	→ The area of public urban parks is expanded so that citizens can enjoy accessible green.
	15. **Nature Reserve**	● Conservation Forest (Biodiversity Conservation Area) is managed according to the fundamental rule.	→ The protected areas are strictly protected by management of relevant organization.
	16. **Global Warming**	● Concrete action plan is prepared and implemented.	→ Concrete action plan is prepared and implemented.
SOCIO-LIVING ENVIRONMENT	17. **Safe Drinking Water**	● The target concerned with water supply in the Socio-economic Development Plan is achieved.	→ Water supply service area is expanded according to the Socio-economic Development Plan year by year.
	18. **Sanitation**	● Latrines are introduced as needed. ● Wastewater treatment is improved.	→ Survey of actual sanitary condition in rural area and in ethnic groups → Improvement of wastewater treatment system
	19. **Soil Contamination**	● The system of monitoring and controlling pesticide and chemical fertilizer according to the new regulation is strengthened and proper amount of them is utilized in agricultural land and also in factories.	→ Personnel, equipment and budget are prepared to monitor and control pesticide and chemical fertilizer according to the new regulation. → Capacity development of staff → Procurement of equipment → Allocation of government budget
	20. **Solid Waste Management**	● A sustainable solid waste management system is established in harmony with the urban development.	→ "3Rs" are promoted at generation sources. → Waste collection system is gradually improved to keep the city clean. → Final disposal system is gradually improved in accordance with the increase of waste collection amount. → An official document that defines the solid waste management system is drafted.
	21. **Accident**	● Traffic accidents decrease year by year.	→ Traffic control, vehicle maintenance, safety education and training of drivers and campaign of traffic safety for students are conducted continuously.

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How the Vision was made

The first step was gaining an overall understanding of the current urban environmental status by baseline survey related to urban environment conservation. During survey period from September to December 2011 by DONRE, UDAA of Xayabouri District and experts dispatched by JICA, the information was collected and analyzed to present conditions of urban environment management according to the 29 sector categories as shown below.

Social Environment
1. Local economy
2. Land use
3. Traffic and road condition
4. UEM policy
5. Poverty
6. Ethnic people
7. Landscape
8. Gender
9. Children's rights
10. Cultural heritage
11. Health
12. Environmental awareness

Natural Environment
1. Stormwater Management
2. Biodiversity
3. Forest resources
4. Urban green area
5. Nature reserve
6. Global warming
7. Mineral resources development

Socio-Living Environment
1. Air quality
2. Water quality
3. Safe drinking water
4. Sanitation
5. Soil contamination
6. Solid waste management
7. Noise/vibration
8. Land subsidence
9. Odor
10. Accident

The second step was "scoping" based on the results of the current status assessment of each sector and a checklist for issue finding, 21 sectors were selected as those which require further actions in light of environmental sustainability.

The next step was to define a vision. As mentioned earlier, a vision is a short statement to express the future desired image of Xayabouri District. It should be concise and impressive, but also narrative and self-explanatory. In setting the Vision, we took due account of the characteristics of Xayabouri which enjoys rich water and forest resources and scenic and calm landscape. Under the Vision, goals were set for each sector and strategies were proposed to achieve the goal. The Vision, Goal and Strategies were continuously discussed by DONRE, UDAA of Xayabouri province and JICA under LPPE's project.

Procedure Afterward

Submitted comments and our responses through website: http://bit.ly/zBcoML.
The vision will serve as a foothold to develop further action plans and projects in Xayabouri district, although it will not be a binding document for any plans or project.

Under the LPPE project, several pilot projects will be developed from the Vision and implemented until year 2015. Although LPPE's projects are mostly for the waste sector, the Xayabouri district intends to plan and carry out pilot projects for other sectors by making the best lessons learnt from the LPPE.

For details of the LPPE, please contact at:
lppepcdteam@hotmail.com

Department of Pollution Control
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Appendix 2. Action Plan for Improvement of Solid Waste Management in XYB

1 Introduction of Action Plan Formulation

1.1 Formulation Procedure

The national guidelines for environmentally sustainable cities (ESC_GL) states that an action plan (A/P) is to be formulated through the process flow as shown in the figure below.

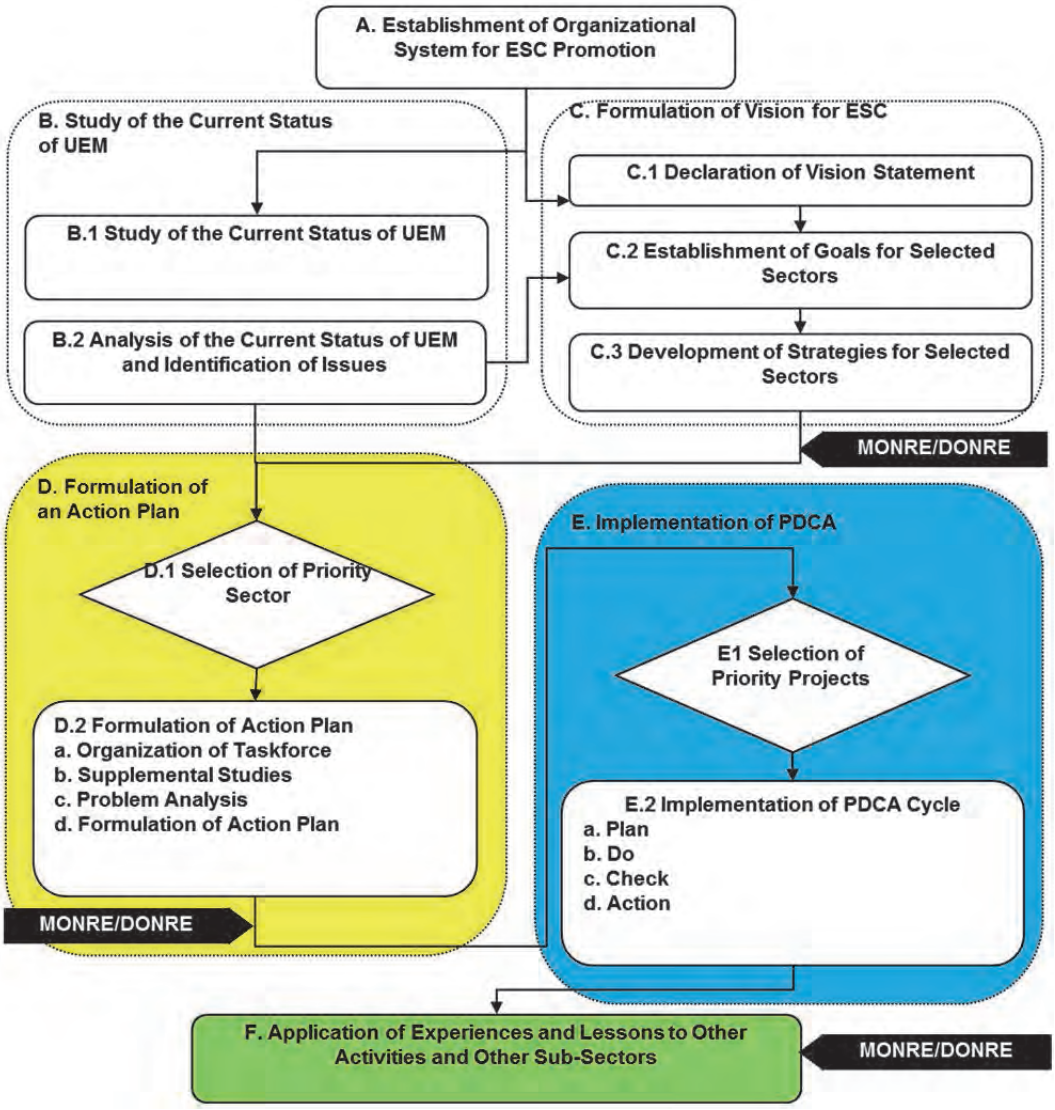


Figure 1: Process Flow for ESC and Action plan

1.2 Structure of the A/P

As shown in the figure above, the A/P is the final output of Process Flow D, and only priority projects in the A/P will proceed to Process Flow E. In other words, the projects in the A/P which are not given priority will be suspended without any clear commitment of implementation. Therefore,

practically speaking, the A/P as an output of Process Flow D can be a simple framework leaving the detailed planning work to Process Flow E.

Accordingly, in case of A/P formulation for XYB by LPPE, the output of Process Flow D is rather a framework of the A/P. On the contrary, taking account of technical and financial input available through the LPPE, most of the activities that were able to start by LPPE were considered to be the priority projects and all their plans were formulated. Consequently, the A/P Framework and a package of plans of individual priority projects compose the A/P (see Figure 2).

Chapter 2 is going to show the A/P Framework after describing how it was formulated according to the Process Flow of D. Chapter 3 is a series of plans of priority projects, for which LPPE's assistance is available by 2015.

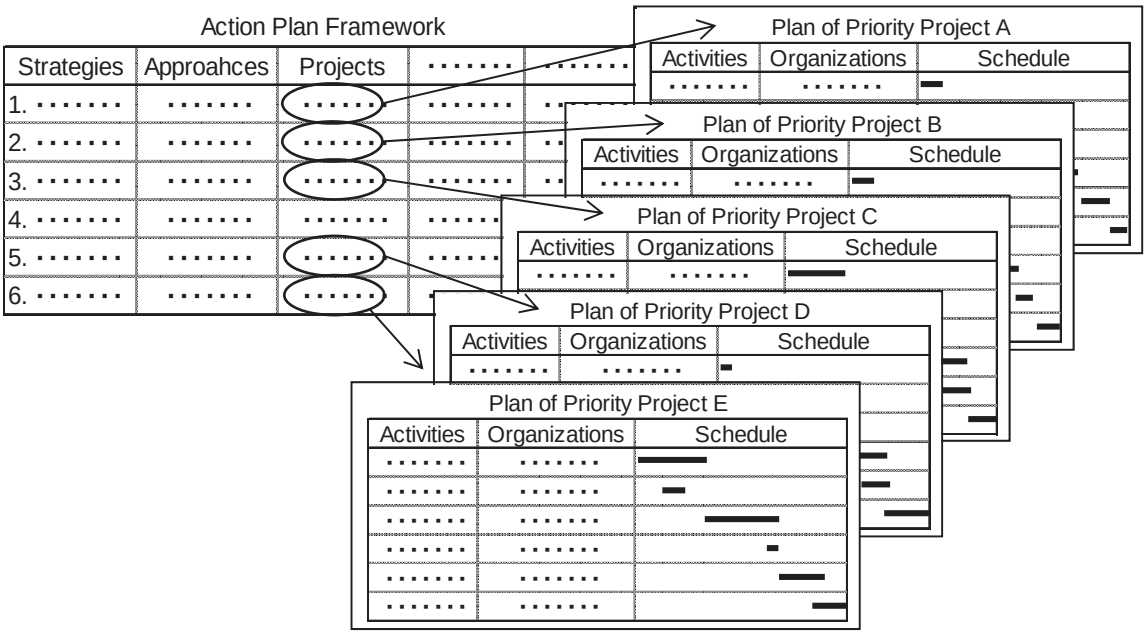


Figure 2. Structure of the Action Plan

2 The Framework of the A/P

2.1 Selection of Priority Sector (D.1 of ESC_GL)

After the formulation of the ESC vision of XYB, the ESC promotion team, which consisted of DONRE, UDAA and DPWT of XYB, selected SWM as a priority sector for ESC promotion by February 2012.

2.2 Organization of Taskforce (D.2a of ESC_GL)

After the SWM sector was selected as the priority sector of ESC promotion for XYB, the ESC promotion team organized a taskforce for the improvement of SWM in XYB consisting of DONRE, DPWT, UDAA and SJET, considering their roles and responsibilities in the area of SWM. The taskforce was chaired by the deputy director general of DONRE.

2.3 Implementation of Supplemental Studies (D.2b of ESC_GL)

The taskforce decided to conduct supplemental studies to understand the current SWM for formulation of the A/P. The supplemental studies included waste collection study, final disposal site study, recyclables dealer study and healthcare waste management study.

Waste Amount and Composition Survey was not conducted in XYB. From the observation of economic activities and lifestyles, waste generation amount per capita in XYB was assumed as 70% of that of Luang Prabang District and waste composition was assumed as the same as that of Luang Prabang. Under such assumptions, the main features on SWM identified by the studies are shown below. Further details about the study results were shown in the Supplemental Report of March 2012.

Table 1. Assumed Waste Generation Rate in XYB

Area	Waste Generation Rate (g/capita/day)
Urban Area	398
Suburban Area	536
Weighted average	477

Table 2. Assumed Waste Composition in XYB

Waste Types	Composition (%)
Kitchen Waste	39
Wood	30
Paper	6
Plastics	8
Glass	2
Textile	4
Metal	1
Leather, rubber	1
Inert (sand and stone)	4
Others	5
Total	100

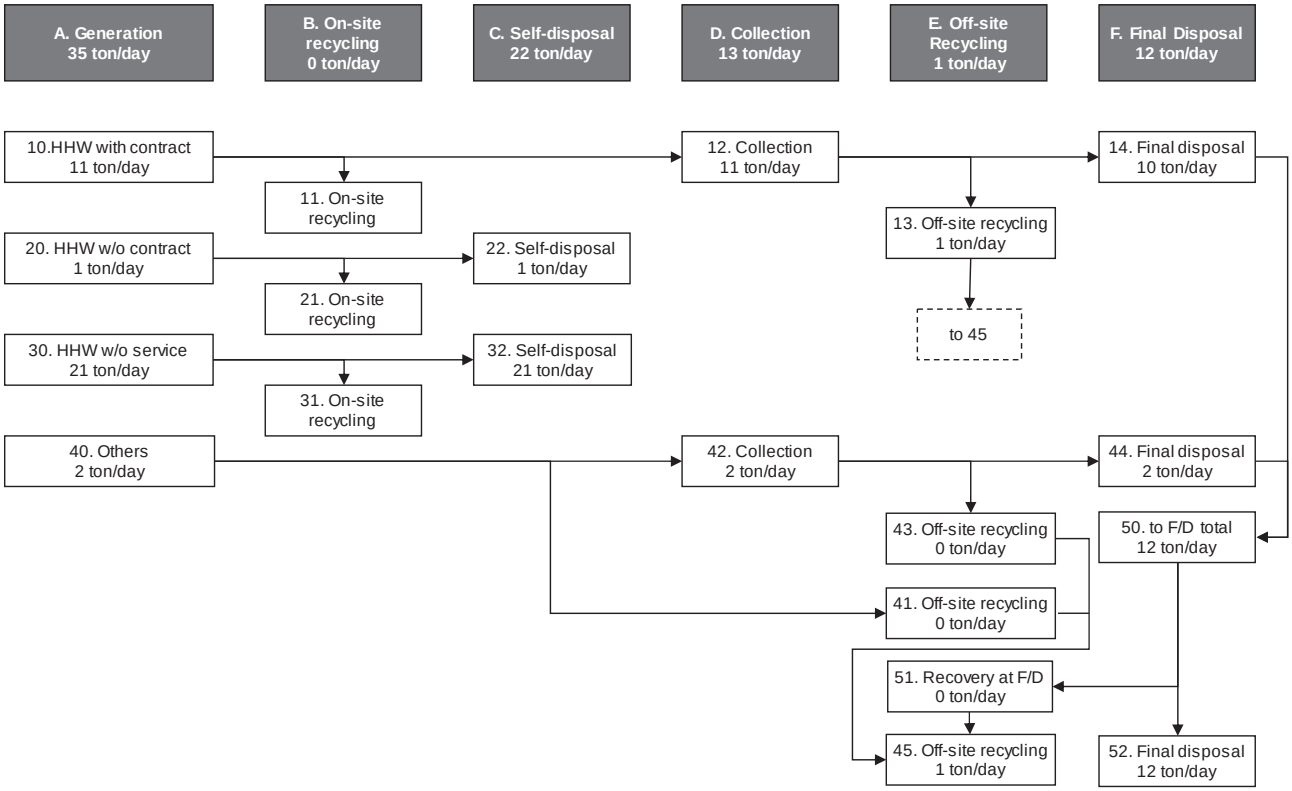


Figure 3. Waste Stream in XYB

2.4 Problem Analysis (D.2c of ESC_GL)

Results of the supplemental studies were analyzed to identify the current problems. Proper understanding of the problems is significantly effective to make a feasible plan. The specific problems related to the Goal of the SWM sector, "A Sound SWM is established in harmony with the city environment", were identified as shown below.

- ✓ Low recycling rate: Only 2.9 (1/35) % of the total waste generation was recycled. The waste recycled at households was almost zero. This could be raised more with the fact that as much as 69% of waste generated at households was kitchen waste and garden waste, which were organic and compostable.
- ✓ Insufficient coverage of waste collection service: The waste collection contract covered only 31.4 (11/35) % of waste generated at households. As a result, as much as 62.9 (22/35) % of waste was disposed of by households (self-disposal).
- ✓ Open dumping operation: The final disposal site was almost a simple waste dump without proper management. The site was giving serious adverse impacts on surrounding area and difficult to manage during the rainy seasons. The existing treatment facility for sludge from septic tanks was not functioning well and needed improvement to allow appropriate operation and maintenance.
- ✓ Improper healthcare waste management: Infectious waste is disposed of at the final disposal site without proper treatment and posing health risks to the staff of site operation and the waste pickers.

2.5 Formulation of Action Plan (D.2d of ESC_GL)

Upon consideration of the results of the supplementary studies and the Goal of SWM sector, the strategies developed in Process Flow C were reviewed and 5 strategies were re-established. Also, the condition of the A/P was set as below.

Goal: A sustainable solid waste management system is established in harmony with the urban development.

Target Year: 2020

In view of these goal and target year, necessary approaches were proposed under the each strategy so as to facilitate the formulation of the specific projects.

Strategy 1: ”3Rs” are promoted.

Approach 1.1: “3Rs” are promoted at on-site to reduce waste generation amount.

The methodology to promote 3Rs varies and this approach aims to integrate 3R activities into the daily waste management practices at households. A household is a source of waste, but it has an important role before waste discharging; 3Rs. 3Rs at households are also important as they are essential forms of community-based waste management.

Strategy 2: Waste collection system is improved through the strengthening of collection service capacity and enhancement of public cooperation.

Approach 2.1: Existing collection and discharge system is improved.

Approach 2.2: Waste collection service area is expanded.

The issue regarding waste collection is different depending on whether the area has collection service or not. In the area with collection service, the issue is the inconvenience in waste discharge for the families along narrow alleys, which is then causing improper behavior of household waste management. In the area without collection service, how to extend the service is the concern.

Strategy 3: Final disposal system is improved to mitigate adverse impacts on the surrounding areas.

Approach 3.1: The final disposal site is managed properly to dispose of waste properly.

Approach 3.2: Sludge from septic tanks is treated properly to mitigate impacts to surrounding aquatic environment.

The final disposal site in XYB receives general waste and sludge from septic tanks and those requires respective technical procedures and facility. Two approaches listed above are to improve the management of both kinds of waste.

Strategy 4: Healthcare waste management (HCWM) is improved.

Approach 4.1: Healthcare waste (HCW) is transferred properly to prevent the expansion of infectious pathogen in the town.

Approach 4.2: HCW is disposed of properly to prevent the expansion of infectious pathogen at the disposal site.

Due to the presence of infectious items, HCW must be disposed of in a safe manner and the safe disposal in turn requires appropriate collection and transfer of HCW. In this light, HCWM is considered to have a transfer stage and a disposal stage, both of which are addressed by individual approaches.

Strategy 5: Institutional system to support the above improvements be established.

Approach 5.1: The responsibilities that the relevant stakeholders should bear to achieve a goal of solid waste management are clarified.

Approach 5.2: Financial system necessary for proper SWM is improved.

SWM involves wide range of stakeholders including governmental organizations, private sectors, and the general public. Approach 5.1 is to ensure their collaboration and to optimize their coordination. Further, Approach 5.2 attempts to strengthen the financial basis for SWM, as any technical solutions of SWM are only effective when they are sustainably operated and maintained with a financial background.

In order to materialize these approaches, specific projects are proposed for each of the approaches. The A/P Framework, consisting of strategies, approaches and projects, is thus produced as shown in Table 2.

Table 3. A/P for the Improvement of SWM in XYB for Year 2020

Strategies	Approaches	Projects		Activities	Local Responsible Organizations	Time Schedule
1."3Rs" are promoted.	1.1 "3Rs" are promoted at on-site to reduce waste generation amount.	1.1.1. Reduction of kitchen waste and garden waste at households		Project planning	DONRE, UDAA	By June 2012
				Planning of PP	DONRE, UDAA	By June 2013
				Implementation of PP	DONRE, UDAA	By October 2015
				Dissemination of PP	DONRE, UDAA	Nov 2015 to 2020
		1.1.2. Recyclable waste separation at generation sources	a. Waste separation project	Integrated in the "Primary Collection System", 2.1.1 and 2.1.2, Strategy 2		
			b. School recycling project	Project planning	DONRE, UDAA	By July 2014
				Planning of PP	DONRE, UDAA	By September 2014
				Implementation of PP	DONRE, UDAA	By October 2015
				Dissemination of PP	DONRE, UDAA	Nov 2015 to 2020
		1.1.3 Avoidance of the use of excess packages such as plastic shopping bags		Project planning	DONRE, UDAA	By June 2012
				Planning of PP	DONRE, UDAA	By June 2013
				Implementation of PP	DONRE, UDAA	By October 2015
				Dissemination of PP	DONRE, UDAA	Nov 2015 to 2020
2. Waste collection system is improved through the strengthening of collection service capacity and enhancement of public cooperation.	2.1 Existing collection and discharge system is improved.	2.1.1 Improvement of exiting collection system	a. Primary collection system project	Project planning	UDAA, DONRE	By December 2012
				Planning of PP	UDAA, DONRE	By August 2013
		2.1.2 Improvement of existing waste discharge system		Implementation of PP	UDAA, DONRE	By October 2015
				Dissemination of PP	UDAA, DONRE	Nov 2015 to 2020
	2.2 Waste collection service area is expanded.	2.2.1 Waste collection service planning		Baseline Survey	UDAA, DONRE	By December 2012
				Drafting the Plan	UDAA, DONRE	By August 2013
				Review and Detail Planning	UDAA, DONRE	By October 2015
				Implementation of Plan	UDAA, DONRE	Nov 2015 to 2020
		2.2.2 Waste collection using 5m3 containers		Project planning	UDAA	By December 2012
				Planning of PP	UDAA	By August 2013
				Implementation of PP	UDAA	By October 2015
				Dissemination of PP	UDAA	Nov 2015 to 2020
		2.2.3 Waste collection using collection vehicles		Project planning	UDAA	By Oct 2015
				Vehicle procurement	UDAA	By Nov 2015
				Contract negotiation	UDAA	Oct 2015
				Collection service provision	UDAA	Dec 2015
3. Final disposal system	3.1 The final disposal site is managed to dispose of	3.1.1 Proper management of existing final disposal site.		Project planning	UDAA, DONRE	By June 2012
				Planning of PP	UDAA, DONRE	By December 2012

is improved to mitigate adverse impacts on the surrounding areas.	waste properly.		Implementation of PP	UDAA, DONRE	By October 2015
			Operation and Maintenance	UDAA, DONRE	Nov 2015 to 2020
		3.1.2. Proper management of waste pickers and improvement of their working conditions	Project planning	UDAA, DONRE	By June 2012
			Planning of PP	UDAA, DONRE	By December 2012
			Implementation of PP	UDAA, DONRE	By October 2015
			Management of waste pickers	UDAA, DONRE	Nov 2015 to 2020
	3.2 Sludge from septic tanks is treated properly to mitigate impacts to surrounding aquatic environment.	3.2.1. Development and management of the treatment facility for the sludge from septic tanks	Project planning	UDAA, DONRE	By June 2012
			Planning of PP	UDAA, DONRE	By December 2012
			Implementation of PP	UDAA, DONRE	By October 2015
			Operation and Maintenance	UDAA, DONRE	Nov 2015 to 2020
4. Healthcare waste management (HCW) is improved.	4.1 Health care waste (HCW) is transferred properly to prevent the expansion of infectious pathogen in the town.	4.1.1. HCW collection system establishment	Project planning	UDAA, DONRE, DOH,	By May 2012
			Planning of PP	UDAA, DOH, DONRE	By April 2013
			Implementation of PP	UDAA, DOH, DONRE	By October 2015
			Dissemination of PP	UDAA, DOH, DONRE	Nov 2015 to 2020
	4.2 HCW is disposed of properly to prevent the expansion of infectious pathogen at the disposal site.	4.2.1. HCW treatment and disposal system establishment	Project planning	UDAA, DONRE, DOH,	By May 2012
			Planning of PP	UDAA, DOH, DONRE	By April 2013
			Implementation of PP	UDAA, DOH, DONRE	By October 2015
			Dissemination of PP	UDAA, DOH, DONRE	Nov 2015 to 2020
5.Institutional system to support the above improvements be established	5.1 The responsibilities that the relevant stakeholders should bear to achieve a goal of solid waste management are clarified.	5.1.1 Consensus building among stakeholders	Project planning	UDAA, DONRE, DOH	By May 2012
			Planning of PP	UDAA, DONRE, DOH	By April 2013
			Implementation of PP	UDAA, DONRE, DOH	By October 2015
			Dissemination of PP	UDAA, DONRE, DOH	Nov 2015 to 2020
	5.2 Financial system necessary for proper SWM is improved.	5.2.1 Financial System Improvement	Project planning	UDAA, DONRE, DOH	By May 2012
			Planning of PP	UDAA, DONRE, DOH	By April 2013
			Implementation of PP	UDAA, DONRE, DOH	By October 2015
			Dissemination of PP	UDAA, DONRE, DOH	Nov 2015 to 2020

PP: Pilot Project

3 Plans of the Priority Projects of the Action Plan

According to the Process Flow, the next process is to select priority projects from the A/P. Taking account of the availability of assistance from LPPE, most of the projects were considered to be the priority projects. The exception was Project 2.2.3 “waste collection by collection vehicles”, as this project was only possible with additional collection vehicles. Nevertheless, it was put into practice with the grant assistance by the Government of Japan.

The following sections describe the plans of the priority projects, which comprise the A/P together with the A/P Framework.

3.1 Strategy 1: 3Rs Promotion

Approach 1.1: "3Rs" are promoted at on-site to reduce waste generation amount.

Project 1.1.1: Reduction of kitchen waste and garden waste at households

Because of the large proportion of organic component, composting is deemed to be a plausible solution to reduce waste to be discharged from the generation sources. Project 1.1.1 is to promote composting at the generation sources and is called **On-site Composting Project**. The plan of the project is shown in the table below and the activities up to 2015 of LPPE are considered to be a PP.

Area of PP: B. Natonoi, B. Thin, B. Phapoon, B. Boung (271 households, estimated 1,463 people)

Target of PP: The rate of the households that continue on-site compost to all the households that started on-site compost in all the pilot villages is 50%.

After the completion of the PP by LPPE, DONRE and UDAA shall disseminate the PP to other area of XYB based on the lessons learned from the PP.

Table 4. Plan of On-site Composting Project

Activities	Detailed Activities	Allocation of Roles	Time Schedule				
			2012	2013	2014	2015	2020
Project Planning	Set up project management system	DONRE, UDAA, SJET					
	Set up concept	DONRE, UDAA, SJET					
Planning of PP	Study and selection of pilot area	DONRE, UDAA, SJET					
	Study of composting method	SJET					
	Procurement of equipment	SJET					
	Preparation of education tools	DONRE, UDAA, SJET					
Implementation of PP	Delivery of equipment and instruction of method	DONRE, UDAA, SJET					
	Monitoring and awareness raising	DONRE, UDAA, SJET					
	Evaluation of the PP	DONRE, UDAA, SJET					
	Suggestion for dissemination	SJET					
Dissemination of PP	Planning of dissemination	DONRE, UDAA					
	Dissemination to other area	DONRE, UDAA					

Project 1.1.2: Recyclable waste separation at generation sources

Recyclable waste that has trading market can be diverted from waste management provided that it is separated from waste. The project to promote recyclable waste separation at generation sources is further divided into two pilot projects called **Waste Separation Project** and **School Recycling Project**.

a. **Waste Separation Project**

It promotes the separation of recyclable waste at households in connection with the introduction of a primary collection system described in the later section of Strategy 2, waste collection system. Refer to the section of "Primary collection system" for more detail.

b. **School Recycling Project**

The plan of the school recycling project is shown in the table below and the activities up to 2015 are considered to be a PP of LPPE.

Area of PP: Xayabouri Secondary School, Mittapharp Secondary School (59 classes in total)

Target of PP: The cooperation rate of the school recycling at the pilot schools is more than 50% of total numbers of classes.

After the completion of the PP by LPPE, DONRE and UDAA shall disseminate the PP to other area of XYB based on the lessons learned from the PP.

Table 5. Plan of School Recycling Project

Activities	Detailed Activities	Allocation of Roles	Time Schedule				
			2012	2013	2014	2015	2020
Project planning	Set up project management system	DONRE, UDAA, SJET					
	Set up concept	DONRE, UDAA, SJET					
Planning and prepration of PP	Study and selection of pilot area	DONRE, UDAA, SJET					
	Study of separation, collection and selling method	DONRE, UDAA, SJET					
	Procurement of equipment	SJET					
	Preparation of education tools	SJET					
Implementation of PP	Delivery of equipment and instruction of method	SJET					
	Monitoring and awareness raising	DONRE, UDAA, SJET					
	Evaluation of the PP	DONRE, UDAA, SJET					
	Suggestion for dissemination	SJET					
Dissemination of PP	Planning of dissemination	DONRE, UDAA					
	Dissemination to other area	DONRE, UDAA					

Project 1.1.3: Avoidance of the use of excess packages such as plastic shopping bags

The most favorable waste management will be to cut the possibility to generate waste in the first place. This does not require not only waste disposal but also waste reuse or waste recycling. What the general public can do for this is, however, not many, but one approach that is relatively easy to try is

to avoid using excess packages such as plastic shopping bags. Project 1.1.3 is therefore selected as a priority project called **Eco-basket Project**.

For the general households, baskets are preferred than bags as the baskets can be washed and cleaned. The plan of the eco-basket project is shown in the table below. The activities up to 2015 are considered to be a PP of LPPE.

Area of PP: B. Thin, B. Phapoon, B. Boung, Simungkhun Market (723 households, estimated 3,904 people+ 500 people in the market + 800 people in other areas for phase II)

Target of PP: The rate of the households that refuse plastic bags as many as possible to all the households in all the pilot villages is 25%.

After the completion of the PP by LPPE, DONRE and UDAA shall disseminate the PP to other area of XYB based on the lessons learned from the PP.

Table 6. Plan of Eco-basket Project

Activities	Detailed Activities	Allocation of Roles	Time Schedule				
			2012	2013	2014	2015	2020
Project Planning	Set up project management system	DONRE, UDAA, SJET					
	Set up concept	DONRE, UDAA, SJET					
Planning of PP	Study and selection of pilot area	DONRE, UDAA, SJET					
	Procurement of equipment	SJET					
	Preparation of education tools	DONRE, UDAA, SJET					
Implementation of PP	Delivery of equipment and instruction of use	DONRE, UDAA, SJET					
	Monitoring and awareness raising	DONRE, UDAA, SJET					
	Evaluation of the PP	DONRE, UDAA, SJET					
	Suggestion for dissemination	SJET					
Dissemination of PP	Planning of dissemination	DONRE, UDAA					
	Dissemination to other area	DONRE, UDAA					

3.2 Strategy 2: Waste Collection System

Approach 2.1: Improvement of existing collection and discharge system

Project 2.1.1: Improvement of existing collection system

Project 2.1.2: Improvement of existing waste discharge system

Approach 2.1 has two projects: one is for waste collectors and the other for waste generators. These two are combined to one priority project called **Primary Collection System Project**, and its activities up to 2015 of LPPE are planned as a PP.

Wheeled waste bins are provided to the groups of households who live along streets inaccessible for the waste collection vehicles. The bins are managed by those households on a rotating basis. The

household on duty during a particular period collects waste from other households of the group and brings the bin to the nearest waste discharge point on a collection day.

Besides, a discharge rule which is set up by the project promotes the households to separate recyclable waste in order to minimize the amount of waste to be collected and transported to the disposal site. The residents shall separate the recyclables to sell it to dealers so as not to discharge them on regular waste collection service.

Area of PP: B. Boung, B. Keng, B. Semuaeng, B. Donemai, B. Natonoy, (276 households and one temple, about 1490 people)

Target of PP:
1. The activities of the existing collection improvement and the promotion of recyclables discharge PP are implemented in one or more new villages under the instruction of the UDAA and DONRE.
2. Waste management groups are established in the pilot villages of the primary collection system project.
3. The rate of the cooperating households to all the households covered by the existing primary collection system project is more than 70%.
4. The rate of the households that separately discharge recyclable waste to all the households covered by primary collection service project is more than 70%.

After the completion of the PP by LPPE, UDAA shall extend the primary collection system based on the lessons learned from the PP.

Table 7. Plan of Primary Collection System Project

Activities	Detailed Activities	Allocation of Roles	Time Schedule				
			2012	2013	2014	2015	2020
Project Planning	Set up project management system	SJET, UDAA, DONRE					
	Set up concept	SJET, UDAA, DONRE					
Planning and Preparation PP	Study and selection of pilot area	SJET, UDAA, DONRE					
	Collection system determination	SJET, UDAA, DONRE					
	Procurement of equipment	SJET					
	Preparation of education tools	SJET, UDAA, DONRE					
Implementation of PP	Delivery of equipment and instruction of method	UDAA, DONRE, SJET					
	Monitoring and awareness raising	UDAA, DONRE, SJET					
	Pre-dissemination	UDAA, DONRE					
	Evaluation of the PP	UDAA, DONRE, SJET					
	Suggestion for dissemination	SJET					
Dissemination of PP	Planning a roadmap to 2020	UDAA					
	Dissemination to the priority area	UDAA					
	Dissemination to the other area	UDAA					

Approach 2.2: Expansion of waste collection service area

Project 2.2.1: Waste collection service planning

Waste collection service plan is indispensable to expand waste collection service from the mid to long term viewpoint. Starting from the analysis of present situation such as the waste collection service coverage status, waste collection amount and others, the project should stipulate the policy regarding where to be covered by the target year. The activities up to 2015 are considered to be a PP of LPPE.

Target Area: Whole Xayabouri district, 83 villages (14,851 households, predicted about 80,200 people in 2020)

Target of PP: A waste collection and transportation plan is formulated

After the completion of the PP by LPPE, UDAA shall regularly review and update the plan in case on necessary based on the lessons learned from the PP.

Table 8. Plan of Waste Collection Service Planning Project

Activities	Detailed Activities	Allocation of Roles	Time Schedule				
			2012	2013	2014	2015	2020
Baseline Survey	The first determination of present waste stream flow-chart	SJET, UDAA, DONRE					
	Detailed survey	SJET, UDAA, DONRE					
Drafting the Plan	Sharing the survey result among stake holders	SJET, UDAA, DONRE					
	Discussion and consideration internally by the local authority	UDAA					
	Drafting the plan in rough scale	SJET, UDAA, DONRE					
Review and Updating the Plan	Monitoring and watching the progress concerned about solid waste management	UDAA					
	Reviewing and detail planning comparing between the draft and latest situation	UDAA					

Project 2.2.2: Waste collection using 5m3 containers

Waste collection using 5m3 containers is one of the effective ways to extend the collection service, if the service provider already possesses a container transporter (skip loader). It is effective to provide the service in remote area where frequent collection service using collection vehicles is not feasible due to long distance and less waste amount. In the city center, it is also convenient both for institutions that generate large volume of waste and for the collection service providers. Substituting the existing collection service using the collection vehicles with container collection service can indirectly contribute to service expansion since the collection vehicles can be used for other new areas.

Project 2.2.2 therefore aims to expand the collection service by UDAA using 5m3 waste containers. The activities up to 2015 are considered as a PP of LPPE.

Number of Pilot Containers: 10

Target of PP: 10 units of 5m3 waste containers are assembled and they are placed in accordance with the container placement plan.

After the completion of the PP by LPPE, UDAA shall disseminate the PP to other area of XYB based on the lessons learned from the PP.

Table 9. Plan of project of waste collection using 5m3 containers

Activities	Detailed Activities	Allocation of Roles	Time Schedule				
			2012	2013	2014	2015	2020
Project Planning	Set up project management system	SJET, UDAA, DONRE					
	Set up concept	SJET, UDAA, DONRE					
Planning and Preparation PP	Procurement of equipment	SJET					
	Construction the facility	SJET					
	Study and training of assembling	SJET					
	Drafting the container placement plan	SJET, UDAA, DONRE					
Implementation of PP	Assembling the 10 containers	UDAA					
	Negotiation and contract with the customers	UDAA					
Dissemination of PP	Planning a roadmap to 2020	UDAA					
	Dissemination to the priority area	UDAA					
	Dissemination to the other area	UDAA					

3.3 Strategy 3: Final disposal system is improved to mitigate adverse impacts on the surrounding areas

Approach 3.1: The final disposal site is managed to dispose of waste properly.

Project 3.1.1: Proper management of existing final disposal site

The project to conduct the proper management of existing final disposal site is selected as a priority project and its activities up to 2015 is planned as a pilot project.

Target Area: KM9 existing disposal site

Target of PP:
1. An operation plan of the final disposal site is formulated.
2. The final disposal site is operated in accordance with the operation plan.
3. The final disposal site is monitored by the final disposal site monitoring committee once a year.

After the completion of the PP by LPPE, UDAA shall carry out operation and maintenance of existing final disposal site while DONRE shall continue site monitoring based on the lessons learned from the PP.

Table 10. Plan of the Project for the Proper Management of Existing Final Disposal Site

Activities	Detailed Activities	Allocation of Roles	Time Schedule				
			2012	2013	2014	2015	2020
Project Planning	Set up project management system	UDAA, SJET,					
	Set up concept	UDAA, SJET,					
Planning of PP	Identify and study the pilot area at KM9 existing final disposal site	UDAA, SJET,					
	Formulation of improvement plan of infrastructure at KM9 existing final disposal site	UDAA, SJET,					
	Formulation of draft operation plan at KM9 existing final disposal site	UDAA, SJET,					
	Formulation of operation plan reflecting the Grant aid project	UDAA, SJET,					
Implementation of PP	Improvement of KM9 existing final disposal site and procurement of heavy machinery	SJET					
	Proper operation of KM9 existing final disposal site	UDAA, SJET					
	Monitoring	DONRE, SJET	▲	▲	▲	▲	
	Evaluation of the PP	SJET					
	Suggestion for continuation	SJET					
Operation and maintenance	Operation and maintenance of existing final disposal site	UDAA					
	Site monitoring	DONRE					▲

Project 3.1.2: Proper management of waste pickers and improvement of their working conditions

The project to manage waste pickers and improve their working conditions is selected as a priority project. As they often work nearby the heavy machinery operating at the waste dumping point, the management of their activities is important for their safety and for proper site operation.

The project plan is shown in the table below and the activities up to 2015 were considered to be a PP of LPPE.

Target Area: KM9 existing disposal site

Target of PP:
1. A management plan of waste pickers is formulated.
2. The waste pickers working conditions is improved in accordance with the management plan.
3. The management of waste pickers is monitored by waste pickers meeting.

After the completion of the PP by LPPE, DONRE and UDAA shall continue the activities of the PP based on the lessons learned from the PP.

Table 11. Plan of the Project for the Proper Management of Waste Pickers and Improvement of their Working Conditions

Activities	Detailed Activities	Allocation of Roles	Time Schedule				
			2012	2013	2014	2015	2020
Project Planning	Set up project management system	UDAA, SJET	▬				
	Set up concept	UDAA, SJET	▬				
Planning of PP	Identify the waste pickers	UDAA, SJET	▬				
	Formulation of management and improvement plan	UDAA, SJET	▬				
Implementation of PP	Management of Waste Pickers and Improvement of their Working Conditions	UDAA, SJET	▬	▬	▬	▬	
	Waste pickers meeting	UDAA, DONRE, SJET	▲	▲		▲	
	Evaluation of the PP	SJET				▬	
	Suggestion for continuation	SJET				▬	
Management of waste pickers	Management of Waste Pickers and Improvement of their Working Conditions	UDAA					▬
	Waste pickers meetings	DONRE, UDAA					▲ ▲ ▲

Approach 3.2: Sludge from septic tanks is treated properly to mitigate impacts to surrounding aquatic environment

Project 3.2.1: Development and management of the treatment facility for the sludge from septic tanks

The project to introduce and manage the proper treatment facility for the sludge from septic tanks is selected as a PP of LPPE. The project plan is shown in the table below. The activities up to 2015 are considered to be a PP of LPPE.

Area of PP: KM9 existing disposal site

Target of PP:
1. An operation plan of the treatment facility for the sludge from septic tanks is formulated.
2. The treatment facility for the sludge from septic tanks is operated in accordance with the operation plan.
3. The treatment facility for the sludge from septic tanks is monitored by the final disposal site monitoring committee once a year.

After the completion of the PP by LPPE, UDAA shall carry out operation and maintenance of the sludge from septic tanks while DONRE shall continue site monitoring based on the lessons learned from the PP.

Table 12. Plan of the Project for the Development and Management of the Treatment Facility for the Sludge from Septic Tanks

Activities	Detailed Activities	Allocation of Roles	Time Schedule				
			2012	2013	2014	2015	2020
Project Planning	Set up project management system	UDAA, SJET	▬				
	Set up concept	UDAA, SJET	▬				
Planning of PP	Identify and study the pilot area at KM9 existing final disposal site	UDAA, SJET	▬				
	Formulation of improvement plan of infrastructure	UDAA, SJET	▬				
	Formulation of draft operation plan of treatment facility for the sludge from septic tanks	UDAA, SJET		▬			
	Formulation of operation plan reflecting the Grant aid project	UDAA, SJET		▬	▬	▬	
Implementation of PP	Establishment of treatment facility for the sludge from septic tanks	SJET	▬	▬			
	Proper operation of treatment facility for the sludge from septic tanks	UDAA, SJET		▬	▬	▬	
	Monitoring	DONRE, SJET	▲	▲	▲	▲	
	Evaluation of the PP	SJET				▬	
	Suggestion for continuation	SJET				▬	
Operation and maintenance	Operation and maintenance of treatment facility for the sludge from septic tanks	UDAA					▬
	Site monitoring	DONRE					▲

3.4 Strategy 4: Improvement of Healthcare Waste Management (HCWM)

Approach 4.1: Healthcare waste (HCW) is transferred properly to prevent the expansion of infectious pathogen in the town.

Project 4.1.1: HCW collection system establishment

The project to establish the collection and transportation system of HCW and monitoring system is selected as a priority project. The plan of the project is shown in the table below. The activities up to 2015 are considered to be a PP of LPPE.

Target hospitals of PP: 2 Main hospitals of XYB, namely Provincial Hospital and Military Hospital

Target of PP:
1. A healthcare waste collection, treatment and disposal plan for the target hospitals is formulated.
2. Healthcare waste from the target hospitals is collected, treated and disposed of in accordance with the aforementioned plan.

After the completion of the PP by LPPE, UDAA, DOH and DONRE shall extend the system to receive HCW from other hospitals based on the lessons learned from the PP.

Table 13. HCW Collection System Establishment Project

Activities	Detailed Activities	Allocation of Roles	Time Schedule				
			2012	2013	2014	2015	2020
Project Planning	Set up project management system	UDAA, DOH, DONRE, SJET					
	Set up concept	SJET, UDAA, DOH, DONRE,					
Planning of PP	Study and selection of pilot hospitals	UDAA, DOH, DONRE, SJET,					
	Preparation of collection and transportation PP plan	SJET, UDAA, DOH, DONRE					
Implementation of PP	Procurement of a HCW collection equipment	SJET					
	Negotiation of HCW contract	UDAA, DOH, DONRE,					
	Implementation of separated HCW collection	UDAA, DOH, DONRE, SJET					
	Monitoring and awareness raising	DOH, DONRE, UDAA, SJET					
	Evaluation of the PP	SJET, UDAA, DOH, DONRE					
	Formulation of collection and transportation plan	SJET, UDAA, DOH, DONRE					
	Suggestion for expansion	SJET, UDAA, DOH, DONRE					
Dissemination of PP	Instruction to medical institutions	DOH, DONRE, UDAA					
	Implementation of separated HCW collection	UDAA, DOH, DONRE,					

Approach 4.2: HCW is disposed of properly to prevent the expansion of infectious pathogen at the disposal site

Project 4.2.1: HCW Treatment and Disposal System Establishment

The project to establish the treatment and disposal system of HCW and monitoring system is selected as a priority project. The plan of the project is shown in the table below. The activities up to 2015 are considered to be a PP of LPPE.

Target hospitals: 2 main hospitals of XYB, namely Provincial Hospital and Military Hospital

Target of PP:
1. A healthcare waste collection, treatment and disposal plan for the target hospitals is formulated.
2. Healthcare waste from the target hospitals is collected, treated and disposed of in accordance with the aforementioned plan.

After the completion of the PP by LPPE, UDAA, DOH and DONRE shall extend the system to receive HCW from other hospitals based on the lessons learned from the PP.

Table 14. HCW Treatment and Disposal System Establishment PP

Activities	Detailed Activities	Allocation of Roles	Time Schedule				
			2012	2013	2014	2015	2020
Project Planning	Set up project management system	UDAA, DOH, DONRE, SJET					
	Set up concept	SJET, UDAA, DONRE, DOH,					
Planning of PP	Study and selection of pilot hospitals	UDAA, DOH, DONRE, SJET,					
	Preparation of treatment and disposal PP plan	SJET, UDAA, DOH, DONRE					
Implementation of PP	Construction of a HCW pit	SJET					
	Instruction of the HCW pit operation	SJET, UDAA					
	Implementation of HCW disposal	UDAA, DOH, DONRE, SJET					
	Monitoring and awareness raising	DOH, DONRE, UDAA, SJET					
	Evaluation of the PP	SJET, UDAA, DOH, DONRE					
	Formulation of treatment and disposal plan	SJET, UDAA, DOH, DONRE					
	Suggestion for expansion	SJET, UDAA, DOH, DONRE					
Dissemination of PP	Instruction to medical institutions	DOH, DONRE, UDAA					
	Implementation of separated HCW collection	UDAA, DOH, DONRE,					

3.5 Strategy 5: Establishment of Institutional System to Support PPs Implementation

Approach 5.1: The responsibilities that the relevant stakeholders should bear to achieve a goal of solid waste management are clarified.

Project 5.1.1: Consensus building among stakeholders

The project to codify the responsibilities of each stakeholder and build consensus is selected as a priority project. The plan of the project is shown in the table below. The activities up to 2015 are considered as a pilot project of LPPE, whereby roles and responsibilities in other PPs for Strategies 1 to 4 are clarified.

Area of PP: XYB

Target Activities: Codification of the responsibilities of each stakeholder regarding PPs of LPPE for Strategies 1 to 4.

Target of PP: Regulation on the responsibilities of stakeholders for improved SWM is prepared and/or drafted.

After the completion of the PP by LPPE, DONRE together with UDAA shall apply the lessons learned from the PP to other consensus building activities for the improvement of SWM in XYB.

Table 15. Plan of the Project for Consensus Building among Stakeholders

Activities	Detailed Activities	Allocation of Roles	Time Schedule				
			2012	2013	2014	2015	2020
Project Planning	Set up project management system	DONRE, UDAA, DOH, SJET					
	Set up concept	SJET, UDAA, DONRE, DOH					
Planning of PP	Study on the needs of consensus building for PPs	SJET, UDAA, DONRE, DOH					
	Preparation of draft consensus building plan	SJET, UDAA, DONRE, DOH					
Implementation of PP	Implementation of PPs	UDAA, DONRE, DOH, SJET					
	Monitoring and awareness rising	DONRE, UDAA, DOH, SJET					
	Evaluation of the PP	SJET, UDAA, DONRE, DOH					
	Suggestion for expansion	SJET, UDAA, DOH, DONRE					
Dissemination of PP	Study on the needs of consensus building	DONRE, UDAA, DOH					
	Preparation of draft consensus building plan	DONRE, UDAA, DOH					
	Implementation of the plan	DONRE, UDAA, DOH					
	Completion of the consensus building plan	DONRE, UDAA, DOH					

Approach 5.2: Financial system necessary for proper SWM is improved.

Project 5.2.1: <u>Financial System Improvement</u>

The project to improve the financial system necessary for SWM improvement is selected as a priority project. The plan of the project is shown in the table below. The activities up to 2015 are planned as a pilot project as below.

Target Area: XYB

Target Activities: Financial system improvement proposals regarding PPs of LPPE for Strategies 1 to 4.

Target of PP: Proposal for financial system improvement necessary for SWM improvement is prepared.

After the completion of the PP by LPPE, the administrative organizations that need its financial system improvement shall apply the lessons learned from the PP to other financial system improvement for SWM in XYB.

Table 16. Plan of the Financial System Improvement Project

Activities	Detailed Activities	Allocation of Roles	Time Schedule				
			2012	2013	2014	2015	2020
Project Planning	Set up project management system	DONRE, UDAA, DOH, SJET					
	Set up concept	SJET, UDAA, DONRE DOH					
Planning of PP	Study on the needs of financial system improvement for PPs	SJET, UDAA, DONRE, DOH					
	Preparation of draft financial system improvement plan	SJET, UDAA, DONRE, DOH					
Implementation of PP	Implementation of PPs	UDAA, DONRE, DOH, SJET					
	Monitoring and awareness raising	DONRE, UDAA, DOH, SJET					
	Evaluation of the PP	SJET, UDAA, DONRE, DOH					
	Suggestion for expansion	SJET, UDAA, DOH, DONRE					
Dissemination of PP	Study on the needs of financial system improvement	UDAA, DONRE, DOH					
	Preparation of draft financial system improvement plan	UDAA, DONRE, DOH					
	Implementation of the plan	UDAA, DONRE, DOH					
	Completion of the financial system improvement plan	UDAA, DONRE, DOH					

Appendix 3. Pilot Projects (PPs)

Table 3-1. Pilot Projects in XYB

Strategy 1. “3Rs” are promoted.	
Approach 1.1 “3Rs” are promoted on-site to reduce waste generation amount.	
1.1.1 Reduction of kitchen waste and garden waste at households	
1.1.2 Recyclable waste separation at generation sources	a. Waste separation project
	b. School recycling project
1.1.3 Avoidance of the use of excess packages such as plastic shopping bags (Eco-basket)	
Strategy 2. Waste collection system is improved.	
Approach 2.1 Improvement of existing collection and discharge system	
2.1.1/2.1.2 Primary collection system	
Approach 2.2 Expansion of waste collection service area	
2.2.1 Waste collection service planning	
2.2.2 Waste collection using $5m^3$ containers	
Strategy 3. Final disposal system is improved.	
Approach 3.1 The final disposal site is managed to dispose of waste properly.	
3.1.1 Proper management of existing final disposal site	
3.1.2 Proper management of waste pickers and improvement of their working conditions	
Approach 3.2 Sludge from septic tanks is treated properly to mitigate impacts to surrounding aquatic environment.	
3.2.1 Development and management of the treatment facility for the sludge from septic tanks	
Strategy 4. Health care waste management (HCW) is improved.	
Approach 4.1 HCW is collected properly.	
4.1.1 HCW collection system establishment	
Approach 4.2 HCW is disposed of properly.	
4.2.1 HCW treatment and disposal system establishment	
Strategy 5. Institutional system to support the above improvements is established.	
Approach 5.1 The responsibilities that the relevant stakeholders should bear to achieve a goal of solid waste management are clarified.	
5.1.1 Consensus building among stakeholders	
Approach 5.2 Financial system necessary for proper SWM is improved.	
5.2.1 Financial system improvement	

Strategy 1. "3Rs" are promoted.

Approach 1.1: "3Rs" are promoted on-site to reduce waste generation amount.

1.1.1 Reduction of kitchen waste and garden waste at households

1. Project Purpose and Summary

The objective of this project is to reduce household's organic waste such as kitchen and garden waste at generation source in XYB.

After pilot households were selected from 4 pilot villages, home composting was introduced to the households in order to encourage them to reduce the amount of discharged waste at home.

2. General Concept

DONRE and UDAA were selected as a main C/P and had discussions with SJET in order to design the project plan. Since the main actor of promotion and expansion of on-site composting should be transferred from SJET to C/P transitionally, project's phase was decided to be divided into two: Phase I, which is mainly managed by SJET with a purpose of OJT to C/P and Phase II, which is mainly managed by C/P.

Table 3-2. Outline of the Plan for Reduction of kitchen waste and garden waste at households PP

Activities	Detailed Activities	Allocation of Roles	Time Schedule				
			2012	2013	2014	2015	2020
Project Planning	Set up project management system	DONRE, UDAA, SJET					
	Set up concept	DONRE, UDAA, SJET					
Planning of PP	Study and selection of pilot area	DONRE, UDAA, SJET					
	Study of composting method	SJET					
	Procurement of equipment	SJET					
	Preparation of education tools	DONRE, UDAA, SJET					
Implementation of PP	Delivery of equipment and instruction of method	DONRE, UDAA, SJET					
	Monitoring and awareness raising	DONRE, UDAA, SJET					
	Evaluation of the PP	DONRE, UDAA, SJET					
	Suggestion for dissemination by C/P	SJET					

3. Planning

a. Study and selection of pilot area

a.1 Study of kitchen and garden waste at households

The Waste Amount and Composition Survey (WACS) was not conducted in XYB. SJET assumed that the waste generation amount (g/capita/day) of XYB was 70% of that of LPB. Under this assumption, the XYB's waste generation amount was estimated as below.

Table 3-3. Waste Generation Rate in XYB

Area	Waste Generation Amount (g/capita/day)
Urban Area	398
Suburban Area	536
Weighted average	477

Most of the households did not separate their organic waste and discharged them together with other waste. However, some of the households separated their kitchen waste and fed their domestic animals with it.

a.2 Selection of pilot area

After the consideration, four pilot villages below were selected by C/P because those villages have land large enough to place composting containers.

1. Natonoi village
2. Thin village
3. Phapoon village
4. Boung village

b. Study of composting method

After SJET considered the pilot households' living environment, life style, discharged waste types, maintenance method of compost and so on, two methods of composting were chosen: one using barrels with holes called "barrel composting" and the other using worms called "worm composting". The chart below shows differences of the two methods.

	Pros	Cons
Barrel composting	・ Almost all organic waste can be used. ・ Without special equipment is; it can be easily started.	・ As water does not drain well; moisture adjustment is required. ・ Odor and maggot often occurs. ・ In order to promote aerobic fermentation, air should be taken into the barrel by mixing inside of the barrel regularly.
Worm composting	・ Hardly smells. ・ Worm itself or liquid that comes from the compost can be fed to domestic animals.	・ Waste that can be used is limited. ・ Temperature adjustment and dryness prevention are needed; it cannot be left for a long time. ・ Once all worms die, it would be difficult to restart composting unless the worms are procured again.

c. Procurement of equipment

In April 2013, SJET procured 247 barrels and 102 worm bins. Since the same type of barrels procured for VTE and LPB could not be found in XYB, another type of plastic barrels were procured instead. For good drainage and ventilation, holes were drilled at the side and the bottom of barrels. As for the worm bins, the same plastic baskets and washtubs as those in LPB were procured according to the instructions of the worm composting expert.

d. Preparation of equipment

In May 2013, SJET made two kinds of composting handbook: barrel composting handbook and worm composting handbook.

4. Implementation

a. Delivery of equipment and instruction of method

In May 2013, kick-off ceremony of the on-site composting PP was held by DONRE and UDAA and composting lessons for the pilot households were given at the parking space of Simungkhun Market. After the demonstration of composting was given by SJET, equipment and the handbooks of Phase I were delivered to the pilot households.

The handbooks were revised in accordance with the households' opinion and monitoring results. The revision of the barrel composting handbook was completed in February 2014 and the worm one was completed in March 2014.

By using the revised handbooks aforementioned, composting lessons for the pilot households of Phase II were provided at each pilot village in March 2014. C/P acted as the main instructor. After the lessons, equipment and the handbooks for Phase II were delivered to the pilot households.

b. Monitoring and awareness raising

After the delivery of the equipment, DONRE and UDAA conducted monitoring regularly. For publicizing and raising people's awareness, households' implementation of the composting was reported and aired by Lao National TV.

In January 2015, a worm composting video was produced so that C/P could continue dissemination activities after the completion of the project.

5. Evaluation and Achievements

Achievement status of the PP is shown in the chart below.

Indicator	Means of Verification	Achievement Status
Indicator 2.1. 3Rs are promoted.		
1. All barrels and bins are disseminated by Dec 2014 and kept monitored until the end of the project by C/P.	1. LPPE Progress Report and Monitoring Report	Achieved. All composting equipment was delivered by December 2014, and has been monitored by C/P continuously.
Indicator 3.2. The residents participate the 3Rs activities.		
1. The rate of the households that continue on-site compost to all the households that started on-site compost in all the pilot villages: **50%**	1. MONRE Monitoring Report and Information from the chief of the village	Achieved. As of March 2015, 52% of the households still continue on-site composting.

In addition to the achievement above, some people who visited the pilot households from other villages because they found an interest in the composting after they had watched the news about the PP aired by Lao National TV. The pilot households gave instructions to them directly, so the on-site composting was disseminated to other areas. Some people also visited the worm composting pilot households to get the worms.

6. Suggestion for the Post-Project Activities

a. Characteristics of the households that tend to continue the composting

According to the monitoring results, characteristics of the households that have high opportunity

for continuing the composting were considered as follows:

- Barrel composting

  - Households that have gardens.
  - Households that like to grow plants.
  - Households that can easily get some materials for moisture adjustment, such as rice bran, saw dust, dry leaves, etc.

Since the barrel composting doesn't require any special equipment, people can easily get started. However, some households had to stop the composting because they didn't control moisture and then maggots appeared inside the barrel. Therefore, it would be necessary for C/P to explain the importance of moisture control to the households and let them drain water out from the waste before putting it into the barrel and put some materials for moisture adjustments properly.

- Worm composting

  - Households that have gardens.
  - Households that like to raise animals.
  - Households that have domestic animals or fishes.
  - Someone in the households likes fishing.

Since the worm itself and the liquid coming from the compost can be fed to animals, households that have domestic animals tend to keep their motivation for composting. Hence, having domestic animals should be considered as one of criteria for the selection of new pilot households.

On the other hand, some households had to stop the composting because they consumed too much worms for feeding their domestic animals or for fishing and the number of worms was drastically decreased. Therefore, it would be necessary for C/P to explain the objectives of the composting clearly during the instruction and even after the implementation, C/P is recommended to remind the households of the objectives again when they go monitoring.

Characteristics of the households that can be applied for both composting methods is that the person who raised his/her hands to join the PP usually stays in the house and has enough time to take care of the compost. In case that the person who is interested in composting is usually out of his/her house in the daytime, the compost tends to be left for long unless there is other family member who can look after it instead. This situation made some households' composts become too wet or too dry.

When C/P disseminates the on-site composting to new households, the households' occupation or lifestyle should be considered. The households also have to make the following conditions clear before they begin the composting.

- Where the compost shall be placed in the house? Is the place suitable for the composting?
- Who will be in charge of the composting in the family?
- When and how will that person take care of the compost?

b. Making a monitoring system by households

In order to keep the household composting, it is necessary to monitor regularly and give right advices to the households before or after problems happen. However, as the number of C/P and their budget is limited, it would be very difficult for C/P to visit every pilot household frequently. Especially in XYB, the number of the pilot households is many, so C/P couldn't go to the

monitoring as frequent as the other pilot cities and the rate of the households that continue the composting became lower than the other pilot cities. One of the solutions of this problem is as follows:

1. Several neighboring composting households are grouped.
2. Participant who manages compost very well, or who is very eager in the composting is selected as a group leader.
3. C/P instructs the group leader on the maintenance and monitoring method.
4. The group leader checks the condition of other members' compost and instructs them directly if there is any problem.

1.1.2 a. Waste separation project

This PP was carried out as part of the PP "**2.1.1/2.1.2 Primary collection system",** thus described together with it.

1.1.2 b. School recycling project

1. Project Purpose and Summary

The objective of this project is to promote recycling by separating and collecting recyclable waste in school in XYB.

After two pilot schools were selected, those schools were instructed to collect recyclabe wastes separately in each class and keep them inside the storages in the schools. After the storages are full, the schools sell the recyclables to collection company in order to promote recycling.

2. General Concept

DONRE and UDAA were selected as a main C/P and had discussion with SJET in order to design the project plan. After that, DONRE and UDAA had discussion with the two pilot schools and made a suitable plan for each school.

Table 3-4. Outline of the Plan for School Recycling PP

Activities	Detailed Activities	Allocation of Roles	Time Schedule				
			2012	2013	2014	2015	2020
Project planning	Set up project management system	DONRE, UDAA, SJET			▬		
	Set up concept	DONRE, UDAA, SJET			▬		
Planning and preparation of PP	Study and selection of pilot area	DONRE, UDAA, SJET			▬		
	Study of separation, collection and selling method	DONRE, UDAA, SJET			▬		
	Procurement of equipment	SJET			▬		
	Preparation of education tools	SJET			▬		
Implementation of PP	Delivery of equipment and instruction of method	SJET			▬		
	Monitoring and awareness raising	DONRE, UDAA, SJET				▬	▬

	Evaluation of the PP	DONRE, UDAA, SJET				▬	
	Suggestion for dissemination by C/P	SJET				▬	

3. Planning

a. Study and selection of pilot area

a.1 Study of current situation of recycling

In May in 2014, SJET visited candidate sites and found as follows:

1. Most of students tend not to bring water bottle from their house. They buy drinks in plastic bottles (PET bottles) at their schools and drink them inside the schools, and finally just throw away the bottles as not recyclable waste but general waste.
2. Schools would like to decrease the amount of their waste. They think that the promotion of recycling in the school would be very effective because students can learn about environment, and the schools can utilize the money by selling the recyclables.
3. There are only two recyclables collection companies in XYB. One of the companies has just started the business and not yet collected the recyclable waste. Both companies would be happy if the school recycling PP starts, because they are able to get a large amount of recyclable waste at once without increasing their collection cost.

a.2 Selection of pilot school

Two pilot schools below were nominated by C/P. SJET had visited those schools with C/P and agreed to choose them as pilot schools.

1. Xayaboury Secondary School (1,745 students, 41 classes)
2. Mittaphab Junior High School (about 600 students, 16 classes)

- Neither school implements the recycling activity, but the school teachers are keen to start, because they think the activity would be important for the students' education.
- There is no room for storage. Both schools request for the construction of storage so that the recyclable waste will not be stolen.

b. Study of separation, collection and selling method

After the discussion with C/P and the pilot schools, separation, collection and selling method for each school was decided as follows.

Table 3-5. Outline of the School Recycling PP in LPB

	Xayaboury Secondary School, Mittaphab Junior High School
Target waste	PET bottles
Methods	The students store PET bottles in the class rooms. On a designated day of the week, the responsible students of each class bring the PET bottles to a certain place and hand over them to a responsible teacher. The PET bottles are then stored in a storage facility and when the facility is full, a buyer will be called.
Payment rate	・At the handing over from the students to the teachers: No payment. ・At the sale to the collector: 1200kip/kg in expectation, to be saved for the school

c. Procurement of equipment

In August 2014, SJET procured the following equipment.

- Xayaboury Secondaly School
  2 storages for recyclable wastes (with net capacity of 8m3)
- Mittaphap Junior High School
  A storage for recyclable wastes (with net capacity of 8m3)

d. Preparation of education tools

In August 2014, SJET made posters for explaining the separation and collection methods of recyclable waste for each school and delivered them to the classes.

4. Implementation

a. Delivery of equipment and instruction of method

On September 18, 2014, handing over ceremony of the storages was held at Xayaboury Secondary School with the attendance of people concerned from both pilot schools. Instructions of the PET bottle's separation and collection methods were given to the teachers and students together with the delivery of the posters.

b. Monitoring and awareness raising

After the delivery of the equipment, DONRE and UDAA conducted monitoring regularly.

At the request of the pilot schools, lessons of the recyclable waste separation and awareness raising education of waste were given at Xayaboury School on February 4, 2015 and at Mittaphap School on Februray 5, 2015.

A handbook for explaining waste problems was printed so that the teachers could continue to educate students even after the completion of the project. A video which explains the objectives and the contents of the school recycling activity was also made for further dissemination by C/P.

5. Evaluation and Achievements

Achievement status of the PP is shown in the chart below.

Indicator	Means of Verification	Achievement Status
Indicator 2.1. 3Rs are promoted.		
1. The school recycling activities continue at the two pilot project schools.	1. LPPE Progress Report	Achieved. As of June 2015, both pilot schools still continue the project.2
Indicator 3.2. The residents participate the 3Rs activities.		
1. The cooperation rate of the school recycling at the PP schools is more than 50% of total numbers of classes.	1. Information from the schools	Achieved. As of June 2015, 100% of the classes cooperates the project.

In addition to the achievements above, Xayaboury School started to collect papers and cardboards besides PET bottles.

6. Suggestion for the Post-Project Activities

a. Plus factor for the successful implementation of the PP

The reasons why this PP was successfully implemented are considered as follows:

1. School was chosen as a pilot site.
2. The project didn't make students to bring their recyclable wastes from home.

Since there are informal collectors who push a cart to collect recyclable wastes from house to house, people tend to separate their recyclable wastes at home and sell them to the collectors in order to get small amounts of money. If the project ignored this current recycling system and tried to disturb it by forcing the students to bring their recyclable wastes from home, this PP would not continue. Though some donors or international organizations had built Waste Bank at village offices or schools in order to promote community based recycling, none of those activities is still active, as far as SJET knows. School seems to be an ideal place for this recycling project because the money generated through the project can be easily managed; the money goes for Class Fund or school's common budget for buying school's equipment or organizing school's activities.

b. Criteria for the selection of new school

For further dissemination of the project, new pilot schools should be selected in accordance with the criteria as follows:

1. Is there enough recyclable waste generated at the school? Some schools especially in the rural area don't have a large amount of recyclable waste.
2. Is there any collection company that will come to the school to buy the recyclable waste?
3. Is there any teacher who is active in the environmental beautification activity? Careful instructions and leadership of the teacher are needed at the beginning of the project.

c. Cooperation with CSR activity of private company

Some schools don't have place for storing recyclable waste or budget for the construction of the storage, even though they would like to implement school recycling. With regards to the budget for the storage construction, not only donors but private companies who are interested in CSR activities also have high opportunity to support the budget. Therefore, it is recommended to ask those companies for the budget of the storage. A video produced by SJET in order to introduce the school recycling project will be useful for this purpose.

d. Importance of teaching "Reduce"

This PP was realized by the current situation that students consume a large amount of PET bottles at the schools. However, it is important to teach the students not only recycling but also reducing waste. Unlike in Japan, students cannot drink tap water in the schools, so it would be difficult for students to refuse the PET bottles totally. However, behavior toward reducing the amount of waste in the daily life needs to be taught to the students.

1.1.3 Avoidance of the use of excess packages such as plastic shopping bags (Eco-basket)

1. Project Purpose and Summary

The objectives of this project is to encourage households and stalls in XYB to refuse unnecessary use of plastic bags in order to reduce the number of plastic bags discharged as waste.

Three villages were selected as a pilot village. Project delivered eco-baskets to every household

in the two villages. The objectives of the PP and instructions on the use of the baskets were explained to the households. The eco-baskets were also delivered to some of the shoppers and sellers in the pilot market. Awareness raising activity was also carried out in order to facilitate the attention of the basket users on reducing the use of excess plastic bags.

2. General Concept

DONRE and UDAA were selected as a main counterpart and had discussions with SJET to design the project plan. Since the main actor of promotion and expansion of eco-basket PP should be transferred from SJET to C/P transitionally, project's phase was decided to be divided into two; Phase I, which is mainly managed by SJET with a purpose of OJT to C/P and Phase II, which is mainly managed by C/P.

Table 3-6. Outline of the Plan for Eco-basket PP

Activities	Detailed Activities	Allocation of Roles	Time Schedule				
			2012	2013	2014	2015	2020
Project Planning	Set up project management system	DONRE, UDAA, SJET					
	Set up concept	DONRE, UDAA, SJET					
Planning of PP	Study and selection of pilot area	DONRE, UDAA, SJET					
	Procurement of equipment	SJET					
	Preparation of education tools	DONRE, UDAA, SJET					
Implementation of PP	Delivery of equipment and instruction of use	DONRE, UDAA, SJET					
	Monitoring and awareness raising	DONRE, UDAA, SJET					
	Evaluation of the PP	DONRE, UDAA, SJET					
	Suggestion for dissemination by C/P	SJET					

3. Planning

a. Study and selection of pilot area

a.1 Study of current situation of plastic shopping bag

According to the Public Opinion Survey (POS) conducted before the implementation of the PP, in May 2013, 4% of interviewees answered "Yes, often" to the question of "Have you ever refused plastic shopping bags at shops?", and 15 % of interviewees answered "Yes" to the question of "Do you usually bring a shopping bag with you when you go shopping?". The details are shown in the chart below.

a.2 Selection of pilot area

In the four pilot villages of the "PP for Reduction of kitchen waste and garden waste at households", three villages namely Thin village, Phapoon village and Boung village were selected as a pilot village because those villages are located in the center of the town. As for the pilot market, criteria for the selection were as follows:

1. Market which is located near the two pilot villages
2. Market whose size is comparatively big.
3. Market's owner is cooperative for the reduction of plastic bag use.

After the consideration, Simungkhun Market was selected to be a pilot market as it met the criteria above.

b. Procurement of equipment

SJET was supposed to promote eco-bags as a substitution of plastic shopping bags, but "eco-baskets" instead of eco-bags were chosen as a tool for reducing plastic bags, because most of the participants prefered eco-baskets rather than eco-bags for its convinience to put wetty fresh foods.

In May 2013, SJET delivered 2,023 eco-baskets. Each basket was tagged with logos of LPPE and JICA.

c. Preparation of education tools

In May 2013, SJET made a leaflet for explaining the objectives and the methods of plastic bag reduction.

4. Implementation

a. Delivery of equipment and instruction of use

In May 2013, opening ceremony for the awareness-raising signboard at the pilot market was held. The eco-baskets and leaflets were delivered to some of the shoppers and the sellers in the market at the same time. Instruction and awareness raising activity for plastic bag reduction were also given in the three pilot villages. The eco-baskets and leaflets were delivered to every household.

As for Phase II, a total of 800 eco-baskets were delivered at 26 new places by C/P since July 2014. C/P also gave instructions and carried out awareness raising activities to the participants.

b. Monitoring and awareness raising

Since the delivery of equipment, DONRE together with UDAA had conducted monitoring regularly. As a tool for raising awareness, publicizing stickers were produced and script for broadcasting through the market's public-address system was prepared.

5. Evaluation and Achievements

Achievement status of the PP is shown in the chart below.

Indicator	Means of Verification	Achievement Status
Indicator 2.1. 3Rs are promoted.		
1. Plastic shopping bag reduction activities are started at one or more new places under the instruction of the C/P.	1. LPPE Progress Report	Achieved. C/P delivered eco-baskets at 26 new places with giving instructions and raising awareness.
Indicator 3.2. The residents participate the 3Rs activities.		
1. The rate of the households that refuse plastic bags as many as possible to all the households in all the pilot villages: **25%**	1. MONRE Monitoring Report and Information from the chief of the village	Achieved. As of March 2015, 79% of the households try to refuse plastic bags.
2. The rate of the stalls that cooperate plastic bag reduction to all the stalls in all the pilot markets: **25%**	2. Information from the stalls	Achieved. As of March 2015, 40% of the stalls cooperate plastic bag reduction.

6. Suggestion for the Post-Project Activities

a. Importance of raising stalls' awareness

According to an informal interview with the participants, it was found that some stalls automatically put their goods into plastic bags before the participants refuse, even though the participants bring their eco-baskets. It shows that the reduction of plastic bag will not succeed if there is no cooperation not only from the shoppers but also from the sellers. Therefore, it is important to raise stall's awareness enough to enable the shoppers to avoid using unnecessary plastic bags.

b. Continuous awareness raising

The participants who said "I rarely use the eco-basket" explained their reasons as follows:

- I always forget to take the eco-basket when I go shopping.
- I usually go to market directly from my office after I finish work, but I don't take the eco-basket to my office when I go to work in the morning.

Though they don't use their eco-baskets, they replied that they understand the importance of the plastic bag reduction. It shows that many people "understand but do not make action". Since changing people's behavior would take time, it is important for C/P to raise people's awareness continuously.

c. Priority stores for post-project activities

During the planning of the PP, SJET introduced some examples of plastic bag reduction in Japan: Shops charge their customer for the plastic bags, shoppers can get some rewards or discounts from the store when they refuse plastic bags, etc. However, the owner of the pilot

market refused to make those trials because he said it would be very difficult to control stalls as the market is made up of more than 100 of the stalls and the turnover of the stalls is quite high. Therefore, this PP only carried out awareness-raising activities for the shoppers and the sellers. If C/P would like to attempt the new approach rather than simple awareness raising, it might be effective to start from the shops of daily commodities, because most of their goods are those which are already packaged and do not need to be put into plastic bags.

If the new method for reducing the plastic bags is successfully established at the stores aforementioned, it can be applied to other shops.

Strategy 2. Waste collection system is improved.

Approach 2.1: Improvement of existing collection and discharge system

2.1.1/2.1.2 Primary collection system

1. Project Purpose and Summary

This PP aims to improve a discharge and collection system for general waste which generates from households in XYB.

The PP, after selecting 5 pilot villages, introduced a primary collection system, using wheeled waste bins, to households who live on inaccessible streets for waste collection vehicle, so that it could lead 1) To make waste collection service more efficient, 2) To make a waste discharge rule more convenient for people, and 3) To keep the collection points clean.

Also the project aimed to promote the separation of recyclables so that they were diverted from the waste collection system as much as possible.

2. General Concept

Even though the collection service has been provided in the central area of the city, UDAA had been concerned about inconvenience and inefficiency found along the narrow alleys, which are inaccessible for collection vehicles.

In such a situation, 5 villages which seemed to be facing such problems were invited to a meeting. As a result of the discussion, 3 villages were selected as the pilot sites for Phase I.

The implementation was planned to be conducted in 2 phases considering technical transfer. As for Phase I, pilot project was implemented by SJET's initiative in the 3 villages. As for Phase II, the implementation was conducted by UDAA's initiative in other 2 villages which were selected by UDAA based on the experience of Phase I.

Table 3-7. Outline of the Plan for Introduction of Primary Collection System PP

Activities	Detailed Activities	Allocation of Roles	Time Schedule			
			2012	2013	2014	2015
Project Planning	Set up project management system	SJET, UDAA, DONRE				
	Set up concept	SJET, UDAA, DONRE				
Planning and Preparation PP	Study and selection of pilot area	SJET, UDAA, DONRE				
	Collection system determination	SJET, UDAA, DONRE				
	Procurement of equipment	SJET				
	Preparation of education tools	SJET, UDAA, DONRE				
Implementation of PP	Delivery of equipment and instruction of method	UDAA, DONRE, SJET				
	Monitoring and awareness raising	UDAA, DONRE, SJET				
	Pre-dissemination by C/P	UDAA, DONRE				
	Evaluation of the PP	UDAA, DONRE, SJET				
	Suggestion for dissemination by C/P	SJET				

3. Planning

a. Baseline Survey

In connection with the PP on waste collection service planning to be described later, the PP decided to carry out a baseline survey and to take an overview of all the 83 viilages in XYB district to gain a hint for a direction of improvement. This contributed to show how to select pilot villages and figure out the form of pilot project.

As a result of the baseline survey, the overview of 83 villags in XYB district is summarized as follows. The primary collection PP is supposed to be conducted in some of 24 villages which is classified "*Urban*", for those villages are suppoesd to be provided waste collection service.

Table 3-8. Overview for waste collection improvement in XYB

Classified	Number of Villages	Feature
Urban	24	Located in central area. Every village is covered with collection service. Basically roads are wide, and the town is organized in simple structure. Primary roads are mainly paved. Sideways are generally not in far distance.
Sub-urban	42	Although it is far and remote from central, those villages have relatively easy access to central. They are not provided waste collection service.
Rural	17	It is far and remote. Moreover those villages have so difficult access to central. They are not provided waste collection service.

b. Determination of waste collection method

Waste bins with wheels will be provided to the groups of residents who live along streets inaccessible to the waste collection vehicles and managed by them on a rotating basis. The

household on duty during a particular period will collect waste from other households of the group and bring it to the nearest waste discharge point on the collection day. This will establish a primary waste collection system, whereby the convenience and efficiency of waste collection will be improved.

c. Selection of pilot area

As above-mentioned, it is possible that the problem exists in *urban* villages (24 villages), for only those villages have waste collection service. According to the C/P who is familiar with practical information on this area, only 5 villages might be candidates for PP as below.

Table 3-9. Villages first selected

Classified	Name of village	Number of household	Population	Service provider
Urban	Si Meuang	381	2180	UDAA
	Done Mai	220	1226	UDAA
	Boung	269	1356	UDAA
	Kaeng	263	1450	UDAA
	Na Tor Noi	234	1233	UDAA

*Source: Village Statistics of Xayabouly District, Year 2010

The representatives of these villages gathered at a workshop, where the content of the pilot project was explained and group discussion was facilitated by UDAA. As a result, the following three villages were finally selected as pilot villages in phase Ⅰ.

Table 3-10. Pilot 3 villages in Phase I

Classified	Name of village	Number of household	Population	Service provider
Urban	Si Meuang	381	2180	UDAA
	Boung	269	1356	UDAA
	Kaeng	263	1450	UDAA

Basically remaining 2 villages was decided as pilot villages in phase Ⅱ. UDAA would initiatively decide the villages after certain progress of phase I in a proper period.

d. Preparation and implementation survey

After target area being selected, preparation and a fact finding survey were conducted prior to the actual improvement. The procedure is outlined in following table.

Table 3-11. Procedure for preparation and implementation survey

---Prerequisite		Completed/ Year 2013
1	To re-explain outline of the pilot project/What is Community base Primary collection/	April
2	To ask the village chives to nominate the person responsible for the project on voluntary base in order to educate households	April
3	To ask village chives to provide the village map	Skipped
---On-site survey, interview		
4	To take GPS data	April
5	To ask general information such as current collection schedule, point and system.	April

6	To determine the unit boundary on the map	April
7	To ask filling out household list to be participated in the project	April
8	To divide into "Group" based on above information	April

e. Procurement of material

155 wheeled waste bins with 120L capacity were procured for being used in primary collection based on the fact finding survey.

f. Leaflet for discharging rule

The residents are divided into groups and one group is basically composed of about 5 households. Every group must manage their wheeled garbage bin of 120L distributed by the PP. The groups decide how to manage garbage bins based on the discussion among the group. For instance, each household of a group manages the bin by a weekly rotation; divide the group into two sub-groups to manage the bin alternatively; or, in case where a proper place is available, the group can place the bin there. Each group has to bring the bin to the collection point by specified time on twice-a-week collection days in a manner of separation and discharge described in a leaflet.

The rules and manner of separation and discharge applied in the PP are listed as below.

Table 3-12. Discharging rule described in leaflet which is distributed for primary collection

Collected	1.	General Waste	To be discharged at specified collection point on the collection date being put in the garbage bin provided by the project
	2.	Green Waste	Large trees must be cut into separate pieces and be tied up to discharge at specified collection point on the collection date
	3.	Fragment of Glass or Ceramic	To be discharged at specified collection point on the collection date being put in a plastic bag
Not collected	4.	Recyclables (Glass-Bottle, Can or Pet-bottle)	To be stored for certain period at home to sell it to recycling dealers who periodically visit around villages.
	5.	Construction Waste (Brick or Block)	Not collected by the ordinary waste collection service. They must be discarded with extra service charge or be individually carried to the disposal site.

* Garbage of #1. to #3. is be collected in the same schedule, and #4. and #5. are basically not collected.

Table 3-13. Primary items described in leaflet

1.	Name of group leader	4.	Waste collection point
2.	Contact number of the leader	5.	List of group member
3.	Location and method for managing the garbage bin	6.	How to separate and discharge the waste

As shown above, UDAA showed its policy not to collect the recyclables and to encourage the households to sell them to the dealers. It aims to raise the public awareness of 3Rs.

4. Implementation

a. Dissemination of the rule, public meeting

In June 2013, after the public meetings for each target household, wheeled waste bins and leaflet were distributed to commence the primary collection from August.

b. Monitoring

After the introduction of primary collection, monitoring by MONRE and the third parties such as a project evaluation team and the PP workshop members was carried out. Particularly MONRE

monitored the progress in regular monitoring tour every three months.

As a result of monitoring, it was observed that the primary collection is being conducted with no particular problem.

Moreover, MONRE in cooperation with UDAA held an awareness raising meeting in Mar 2014 in order to secure the discharging rule once again in accordance with the opportunity of that in LPB.

c. Result of implementation

During the planning period, pilot villages for phase Ⅱ had not been obviously decided. Considering the progress in Phase I, UDAA selected other streets on one village of phase I as well as 2 villages which are not selected in phase I. UDAA introduced the primary collection system on these villages following the implementation procedure of phase I. Below table illustrates the result of implementation of each phase.

Table 3-14. The status of introduction of primary collection in XYB

	Village	Alley street	Total HH living in alley street	Population	Number of groups	Number of garbage bins provided
Phase 1	Boung	3	47	189	9	18
	Keng	3	31	152	8	16
	Semuaeng	2	44	231	11	22
Phase 2	Donemai	3	61	307	13	26
	Natonoy	5	39	179	12	24
	Boung	10	54	-	10	25
Total		26	276	1058	63	131

Remaining waste bins have been used for UDAA and DONRE officers so that they would demonstrate the proper discharging manner and primary collection to show surrounding villagers.

5. Evaluation and Achievements

Table 3-15. Evaluation and Achievements of PP for Introduction of Primary Collection System in XYB

Indicator	Means of verification	Achievement status
Indicator 2.2. The solid waste collection system is improved.		
1. The activities of the existing collection improvement and the promotion of recyclables discharge PP are implemented in one or more new villages under the instruction of the UDAA and DONRE.	1. LPPE Progress Report	UDAA has already introduced primary collection service in the new 3 villages (2 new villages and new streets in a previous village).
Indicator 3.2. The residents participate the 3Rs activities.		

1. The rate of the cooperating households to all the households covered by the existing primary collection system project is more than 70%	1. MONRE Monitoring Report and Information from the chief of the village	It is almost achieved. 68%
Indicator 3.3. The residents cooperate with the waste collection system.		
1. Waste management groups are established in the pilot villages of the primary collection system project.	1. Group member list	Primary collection share groups have been established in the previous 3 villages and the new 3 villages respectively.
2. The rate of the cooperating households to all the households covered by the existing primary collection system project is more than 70%	2. MONRE Monitoring Report and Information from the chief of the village	Achieved. 99%.

6. Suggestion for the Post-Project Activities

Although the primary collection is an effective way to increase the waste collection contract, it necessitates initial investment as it requires waste containers.

Therefore it is important to emphasize the effect and importance of the primary collection which were recognized through the pilot project. By doing so, it is expected that the village leaders and/or the residents would be willing to buy the waste bins.

Approach 2.2: Expansion of waste collection service area

2.2.1 Waste collection service planning

1. Project Purpose and Summary

This PP aims to formulate a waste collection service plan in XYB district in order to expand the waste collection service area.

The plan is formulated based on the situation in 2013 for whole XYB with around 83 villages toward target year 2020.

2. General Concept

UDAA had been concerned about the villages not covered by collection service in XYB, and intended to expand waste collection service to improve it in future. While it is indispensable to formulate a plan from a long-term point of view, it was difficult to do so since information was not organized quantitatively and visually.

Therefore, firstly the situation of collection service in 2013 was studied. This information was visualized by using GIS application. Based on the situation in 2013 and visualized data, UDAA set the target figure about coverage of collection service in 2020. This was also visualized by GIS.

Table 3-16. Outline of Waste Collection Service Planning

Activities	Detailed Activities	Allocation of Roles	Time Schedule				
			2012	2013	2014	2015	2020
Baseline Survey	The first determination of present waste stream flow-chart	SJET, UDAA, DONRE					
	Detailed survey	SJET, UDAA, DONRE					
Drafting the Plan	Sharing the survey result among stake holders	SJET, UDAA, DONRE					
	Discussion and consideration internally by the local authority	UDAA					
	Drafting the plan in rough scale	SJET, UDAA, DONRE					
Review and Updating the Plan	Monitoring and watching the progress concerned about solid waste management	UDAA					
	Reviewing and detail planning comparing between the draft and latest situation	UDAA					

3. Current situation survey

a. Calculation and prediction of population and household

Since proper statistical population data of 2013 was not available, population up to 2020 was estimated based on existing information of 2012 population sourced XYB provincial governor and the annual population growth rate at 1.66% which is figured out between 2006 census and above 2012 population.

It was assumed that the ratio of population in each village would not change even though population increased. This means that the population of each village would increase in proportion to total population increase. The value of year 2010 from "Village Statistics of Xayabouly District, Year 2010" was applied as basic information for population ratio of each village.

As for the number of household, for the information of average size of household was obtained from census 2006. It was also assumed not to change until 2020.

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Population	70279	71449	72638	73847	75076	76326	77596	78887	80200

Source:Census 83villages (2005)
Provincial governnor office (2012)

Table 3-17. Population predict of each year

Classified	Number of Village	2013	2020
urban	24	31,099	34,908
sub-urban	42	34,853	39,122
rural	17	5,497	6,170
Total	83	71,449	80,200

b. Situation of waste collection service coverage in 2013

SJET and UDAA cooperated to summarize the situation in 2013 into the table below.

Table 3-18. Waste Collection Coverage Status in 2013, XYB (the number of villages and households by service providers)

Number of village	Number of Villages				Number of Households			
Type of village	UDAA	Private	No Service	Total	UDAA	Private	No Service	Total
[1] Urban	24			24	5980			5980
[2] Sub-urban		3	39	42		1156	5029	6185
[3] Rural			17	17			994	994
Total	24	3	56	83	5980	1156	6023	13159

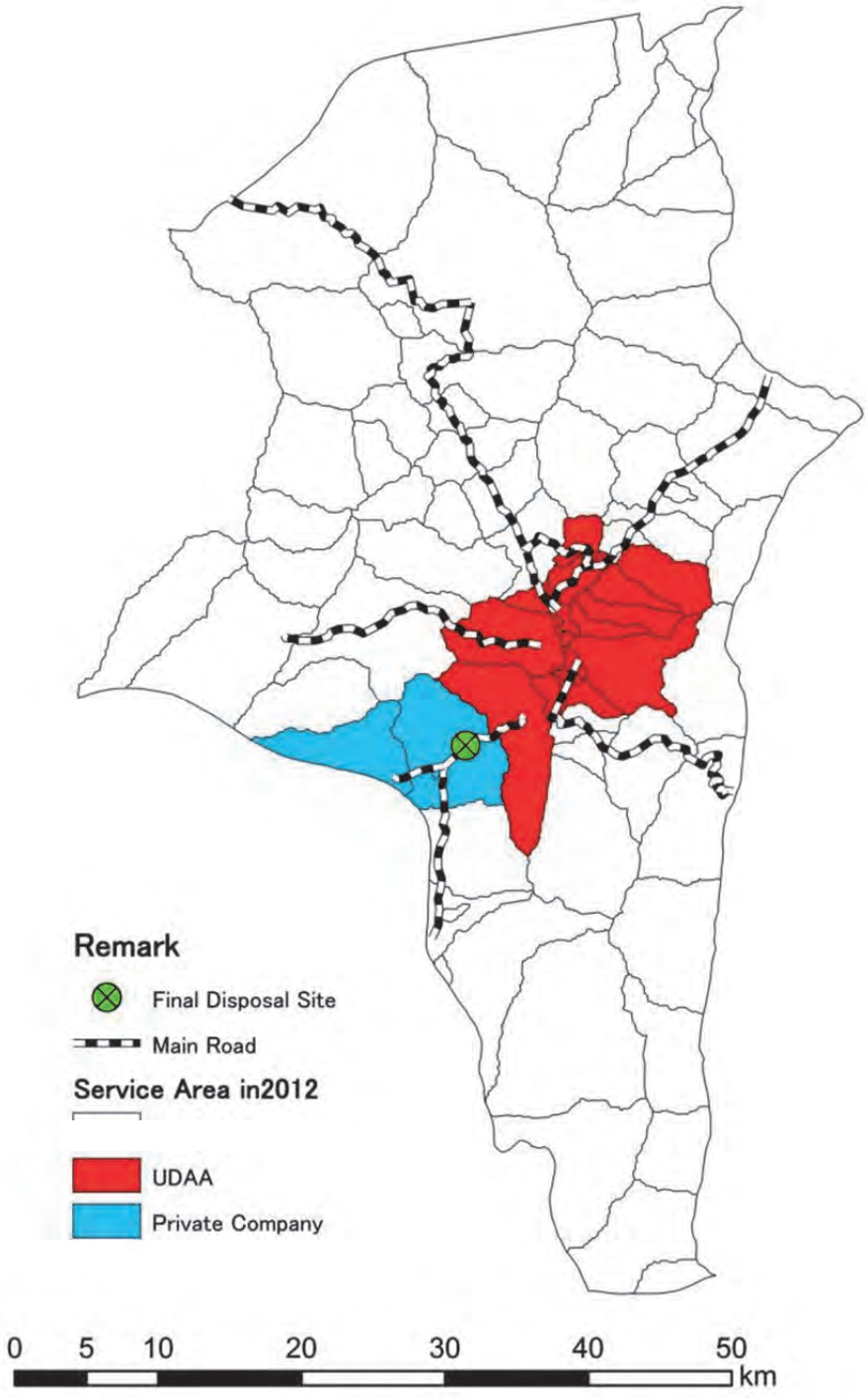


Figure 3-1 Waste Collection Coverage Status Map in 2013

4. Implementation (Determination of waste collection service plan)

a. Target of waste collection coverage in 2020

The target figures for the year 2020 were set as follows.

Table 3-19. Target of Waste Collection Coverage in 2020, LPB (the number of villages and households by service providers)

Number of village	Number of Villages				Number of Households			
Type of village	UDAA	Private	No Service	Total	UDAA	Private	No Service	Total
[1] Urban	24			24	6709			6709

[2] Sub-urban	13	3	26	42	2093	1298	3551	6942
[3] Rural	2		15	17	222		893	1115
Total	39	3	41	83	9024	1298	4444	14766

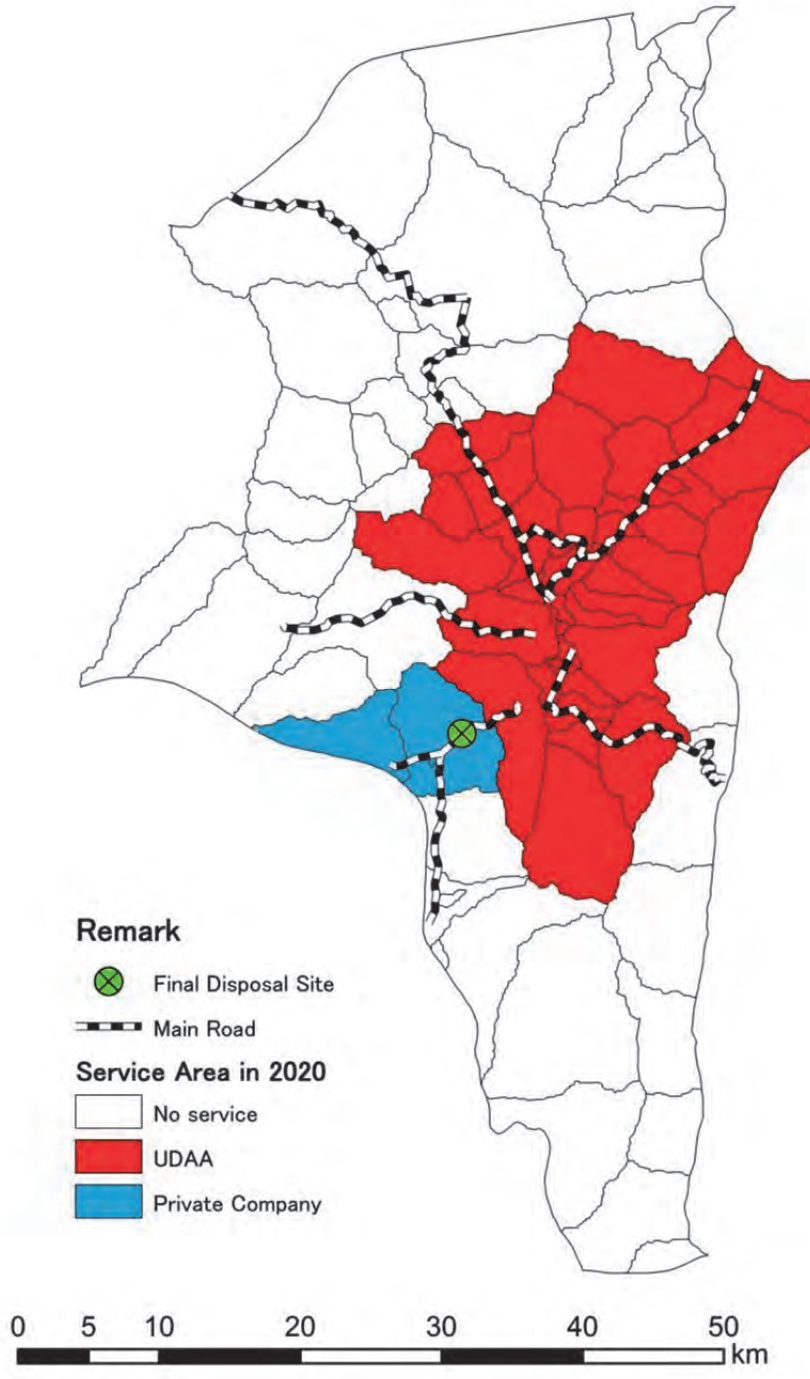


Figure 3-2 Map indicating objective for waste collection coverage in 2020

b. Situation in 2015

The latest information taken as of the end of Jul 2015 is summarized in following table. The number of villages, which are covered by waste collection service by UDAA, is still unchanged 24 villages from 2013. The number of villages which the private company provides collection service reached 7, which means it has exceeded 3 villages, the target for 2020. Totally 31 villages are covered with collection service in 2015 while it was 27 villages in 2013. Although

UDAA had been depending on the private service provider for collection coverage expansion since their own collection vehicles are limited, UDAA intends to achieve the 2020 target value using collection vehicles to be provided by the grant aid project.

Table 3-20. Number of village which is covered or not covered with collection service

		2013	2015	2020
UDAA	Urban	24	24	24
	Sub-urban	0	0	13
	Rural	0	0	2
UDAA total		24	24	39
Private	Sub-urban	3	7	3
Private total		3	7	3
No Service	Sub-urban	39	35	26
	Rural	17	17	15
No Service Total		56	52	41
Service Total		27	31	42
Total		83	83	83

* 2013 and 2015 are actual figure, planned value for 2020

5. Evaluation and Achievements

Table 3-21. Evaluation and Achievements of Waste Collection Service Planning in XYB

Indicator	Means of verification	Achievement status
Indicator 2.2. The solid waste collection system is improved.		
1. A waste collection and transportation plan is formulated.	1. Waste collection and transportation plan	Achieved. The plan was formulated in March 2014

In addition to the abovementioned achievement of PP indicator, PP implementation resulted in following outcomes.

- The draft future plan proposed in this project was used as basic data in the grant aid project to make a plan for provision of equipment for waste collection.

6. Suggestion for the Post-Project Activities

Basically, collection service is well provided in the central area while it is not provided enough in the remote area. The service distribution is determined by a lot of factors such as accessibility, population density, waste discharge amount and so on. Considering those factors, the methods and frequency of waste collection must be planned properly. For instance, dump trucks can be used for the general waste collection. In areas where dump truck can't access, 5 m^3 containers might be applicable.

The review in 2015 shown above tells that the private company already exceeded the target for 2020 while UDAA should additionally provide 15 villages with collection service. In order to accomplish the plan, UDAA is expected to widely mobilize waste collection vehicles of grand aid and employ the capability of collection service using 5m^3 containers which is acquired through the PP.

2.2.2 Waste collection using 5m^3 containers

1. Project Purpose and Summary

This PP aims to improve UDAA's waste collection service capability using $5m^3$ containers in order to expand the waste collection service area.

Placing a container to an area without collection service will directly contribute to extend the collection service. Placing a container to an area with dump truck collection service will indirectly contribute to extend the collection service, because the dump truck, which used to serve this area, can be used in other area without collection service.

The project strengthens the UDAA's capability for making containers which is applicable for its skip loader and for maintenance through practical operation. The pilot containers are also installed at places of each customer, and transported for waste collection.

2. General Concept

UDAA has recognized the importance of waste container collection since a couple of years ago. It particularly focuses on securing the revenue source from generation sources of large volume of waste.

The PP implementation was decided in order to develop a comprehensive system in UDAA including container manufacturing, collection and maintenance so as to make the container collection system sustainable.

Table 3-22. Outline of Waste collection using $5m^3$ container PP

Activities	Detailed Activities	Allocation of Roles	Time Schedule			
			2012	2013	2014	2015
Project Planning	Set up project management system	SJET, UDAA, DONRE				
	Set up concept	SJET, UDAA, DONRE				
Planning and Preparation PP	Procurement of equipment	SJET				
	Construction the facility	SJET				
	Study and training of assembling	SJET				
	Drafting the container placement plan	SJET, UDAA, DONRE				
Implementation of PP	Assembling the 10 containers	UDAA				
	Negotiation and contract with the customers	UDAA				

3. Planning

a. Context

There mainly are two types of waste dischargers; one is small such as ordinary households, another is larger such as markets, hotels, schools and so on. Currently two types of collection methods have been taken in XYB; collection by ordinary dump trucks and another using a skip loader and $5m^3$ containers. Those conditions are summarized in the following table.

Table 3-23. Features of each waste collection method

	Small dischargers	Large dischargers	UDAA's status

	(Households)		
Dump truck collection	xxx Very suitable.	xx Applicable.	Fully operated and not available.
Container collection	x Depending on situation; applicable when households are closely located in the village center or in other situation.	xxx Very suitable.	Without enough number of containers, the skip loader is not fully used. UDAA's capability for procurement of new containers is not sufficient while containers are easily corroded by acid from garbage.

Considering the current status of XYB and resources available from LPPE, it is decided to expand the waste collection service by strengthening the capability of container collection.

In practice, the PP firstly assisted UDAA to manufacture $5m^3$ containers by itself. The next step will be negotiation and agreement concerned about waste collection manner and service charge between UDAA and potential container users prior to container installation. Finally the proper operation of waste collection service will follow. These make one cycle of procedure. The PP intends to develop the capacity of UDAA to independently expand waste collection service in the area applied with $5m^3$ containers even after the project finishes.

b. Content of the Plan

- SJET procures equipment and tools, and constructs the workshop.
- UDAA produces containers after the engineers were trained by VUDAA in Vientiane.
- The draft of a placement plan of containers produced is prepared, and UDAA implements waste collection using the containers as per the plan.

Table 3-24. Role and Responsibility for Relevant Organization

	SJET	C/P(DONRE/UDAA)
Making Container	✓ To provide materials equivalent of 10 containers	✓ To perform making 10 containers
Running waste collection service with container	✓ To make container placement plan in cooperation with DONRE/UDAA	✓ To make container placement plan in cooperation with JET ✓ To negotiate and agree with 10 container users such as villagers , hospitals, hotels and so on according to the plan; in terms of that service fee and waste collection system ✓ To perform properly waste collection service

c. $5m^3$ Container Placement Plan

Table 3-25. $5m^3$ Container Placement Plan

No.	Name	Frequency of Collection expected (times/week)	Location
1	Friendship School	1	Semueng Village
2	Union School	1	Naloa Village
3	Phongsavanh Bank	1	Semueng Village
4	BCEL Bank	1	Semueng Village
5	Provincial office	1	Semueng Village
6	Houng river Restaurant	1	Semueng Village

7	Salongsay Restaurant	1	Phong Village
8	Salakamhoung Restaurant	1	Phong Village
9	Night market	1	Semueng Village
10	Grand palace	2	Nahai Village

d. Procurement and Construction

d.1 Procurement of equipment:

- A welding machine, an iron cutting machine, an electric sander, different gas tanks, a hanging crane and so on

d.2 Procurement of material:

- Steel plate, steel square bar, hinge, oxygen and acetylene gas, welding rod, paint, anti-rust

d.3 Construction of facility:

- Workshop for producing containers; 1 (in the premise of existing KM9 waste disposal site)

4. Implementation

a. Technical training

In Mar 2013, two engineers of UDAA visited KM7 workshop of VUDAA in VTE to be technically trained in making 5m^3 containers for 3 days.

b. Producing containers

In Mar 2014, it was observed that UDAA engineers had finished producing 10 units of 5m^3 containers.

c. Result of implementation

Table 3-26. Installation status of 5m^3 containers in XYB

	Place	Number of Container installed	Location (village)	Collection Frequency (Monthly)	Income of container fee (Million kip/month)
1	Complex sport stadium	1	B.Semueng	5	1.25
2	Longpor market	1	B.Longpor	8	2.00
3	Chinese market	1	B.Nahai	5	1.25
4	Sloughter house	1	B.Vangkham	3	0.75
5	Semongkhoun market	1	B.Semongkhoun	31	7.75
6	Kubota center	1	B.Thana	2	0.50
7	Provincial hospital	1	B.Nalao	5	1.25
8	Prison	1	B.Soun	2	0.50
9	Tammee Shop (Monument park)	1	B.Semueng	2	0.50
10	UDAA	1			

	(Substitutional spare)				
	Total	10		63	14.5

※"Collection Frequency" and "Income of Container fee" are based on actual performance in July

5. Evaluation and Achievements

Table 3-27. Evaluation and Achievements of PP for Waste collection using 5m^3 container in XYB

Indicator	Means of verification	Achievement status
Indicator 2.2. The solid waste collection system is improved.		
1. 10 units of 5m^3 waste containers are assembled and they are placed in accordance with the container placement plan.	2. LPPE Progress Report, 10 units of public containers (5m^3) and container placement plan	UDAA has already completed the production of 10 containers. 9 containers were installed in each organization, and one has been utilized as a substituting spare.

In addition to the abovementioned achievement of PP indicator, PP implementation resulted in following outcomes.

- UDAA's own workshop was constructed. Thus, in addition to producing and repairing the 5m^3 containers, they can carry out various mechanical works for the urban maintenance, which is UDAA's important duty, e.g. producing the foundation part of flags standing along public roads.
- It was decided to collect waste bins of health care waste generated at the provincial hospital at the same time of the container collection for general waste. The skip loader needed modification for this purpose, and the modification work was conducted by UDAA in the workshop.

6. Suggestion for the Post-Project Activities

All the 5m^3 containers provided by the PP are under regular operation in each generation source. The next challenge within the a coming couple of years will be how to manufacture new containers with UDAA's own budget to get new customers while properly maintaining and repairing the existing containers. Therefore, UDAA should simulate the balance of income based on the information acquired through the PP implementation, including the cost of production and maintenance of 5m^3 containers, transportation cost, and actual income from customers. Based on the simulation result, C/P should consider the actions such as the adjustment of container production price (e.g. saving unnecessary cost by using cheaper material) or the revision of the container collection fee.

Strategy 3. Final disposal system is improved.

Approach 3.1: The final disposal site is managed to dispose of waste properly.

3.1.1 Proper management of existing final disposal site

1. Project Purpose

The purpose of this PP is to improve the final disposal site, to dispose of waste properly and to mitigate adverse impacts on the surrounding area.

2. Concept

The proper operation and maintenance of KM9 existing final disposal site is conducted in accordance with the formulated operation plan of final disposal site by deputy director and staff of UDAA to improve the existing final disposal site. The implementation schedule is shown as follows;

Table 3-28. Implementation schedule of Proper management of existing final disposal site PP

Activities	Detailed Activities	Allocation of Roles	Time Schedule				
			2012	2013	2014	2015	2020
Project Planning	Set up project management system	UDAA, SJET,					
	Set up concept	UDAA, SJET,					
Planning of PP	Identify and study the pilot area at KM9 existing final disposal site	UDAA, SJET,					
	Formulation of improvement plan of infrastructure at KM9 existing final disposal site	UDAA, SJET,					
	Formulation of draft operation plan at KM9 existing final disposal site	UDAA, SJET,					
	Formulation of operation plan reflecting the Grant aid project	UDAA, SJET,					
Implementation of PP	Improvement of KM9 existing final disposal site and procurement of heavy machinery	SJET					
	Proper operation of KM9 existing final disposal site	UDAA, SJET					
	Monitoring	DONRE, SJET	▲	▲	▲	▲	
	Evaluation of the PP	SJET					
	Suggestion for continuation by C/P	SJET					

3. Plan

a. Identify and study the pilot area

A topographic survey was conducted to identify the boundary of pilot area at KM9 existing final disposal site.

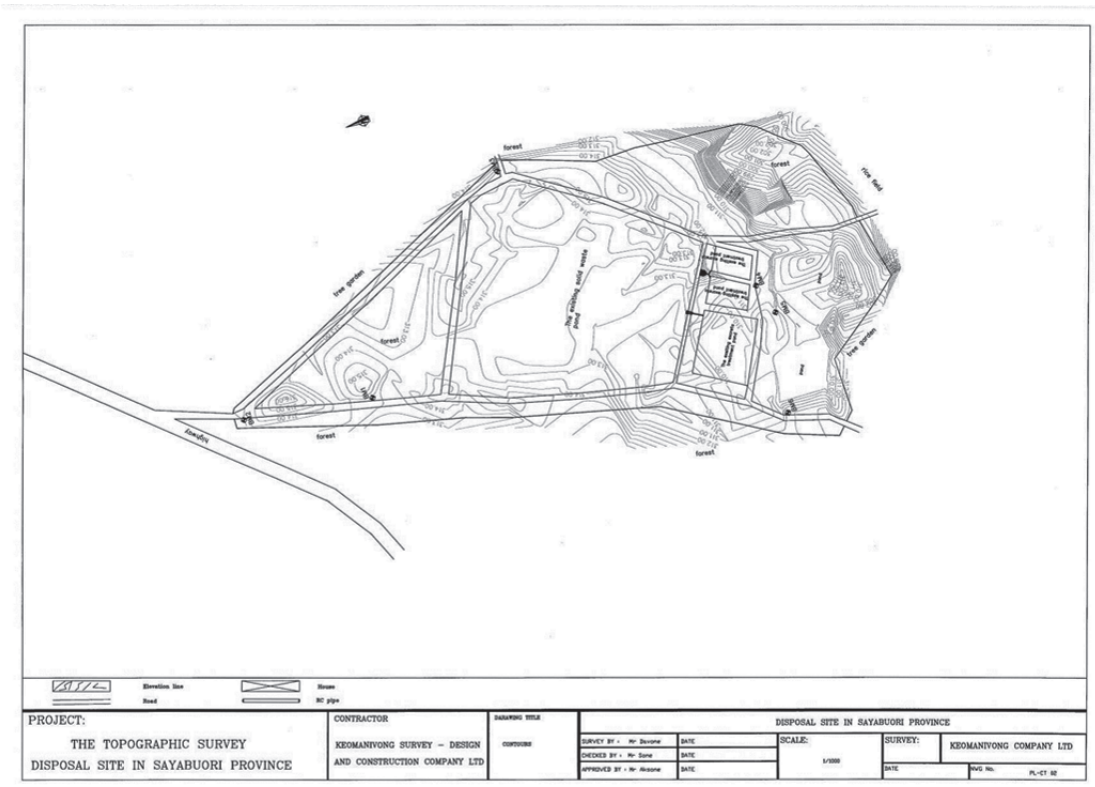


Figure 3-3. The boundary of pilot area at KM9 existing final disposal site

b. Formulation of improvement plan

The improvement plan of KM9 existing final disposal site is shown as following table and figure.

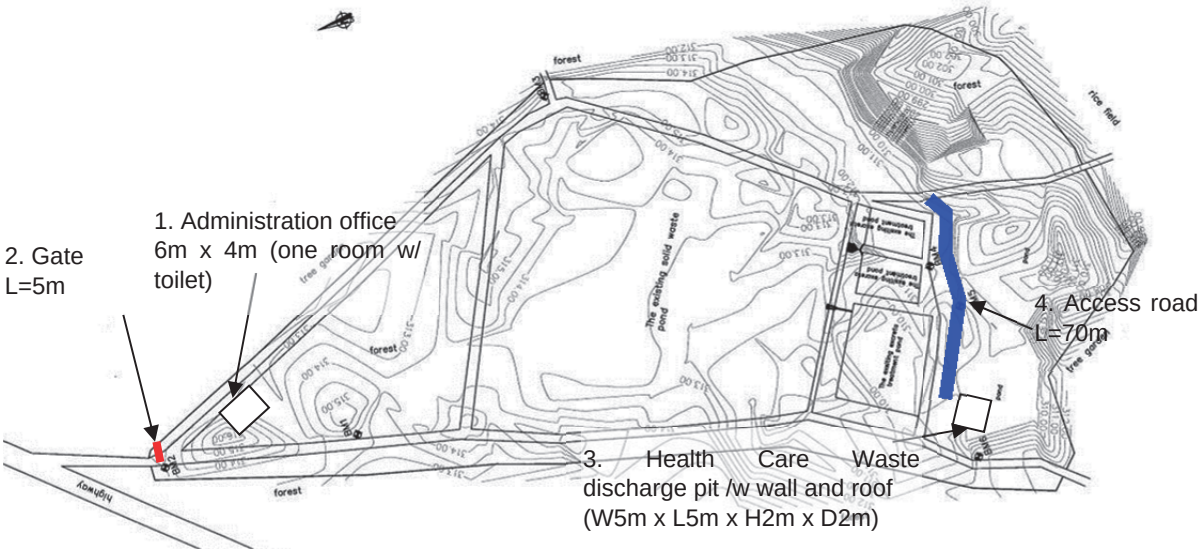


Figure 3-4. Improvement plan of infrastructure at KM9 existing final disposal site

Table 3-29. Improvement plan of infrastructure at KM9 existing final disposal site

No.	Items	Qty.	unit
1	Administration office	1	unit
2	Gate	1	unit

3	Access road	70	m
4	Concrete plate	50	plate

b.1 Administration office

The function of administration office is to manage the landfill site operation. Structure of administration office is office room (6m x 4m) and toilet with facility of water well pumping and installation of electricity.

b.2 Gate

The function of gate is to control the entering of collection vehicle without permission and security reason.

b.3 Access road

The function of access road is to access to active cell from main road for waste discharging. Structure of access road consists of gravel(t=200mm,w=5,000mm) and leveling. The distance of access road improvement is 70m.

b.4 Concrete plates

The concrete plates are used on a muddy access road in order to allow the waste trucks to run in the rainy season. The size of a concrete plate is 2,000mm (length) x1,000mm (width) x 200mm (height). 50 plates are used.

c. Formulation of draft operation plan

The collected waste is disposed of at the designated disposal area in the improved KM9 final disposal site. The collection vehicles can approach to the designated disposal area on the concrete plate in the rainy season although the access road becomes muddy.

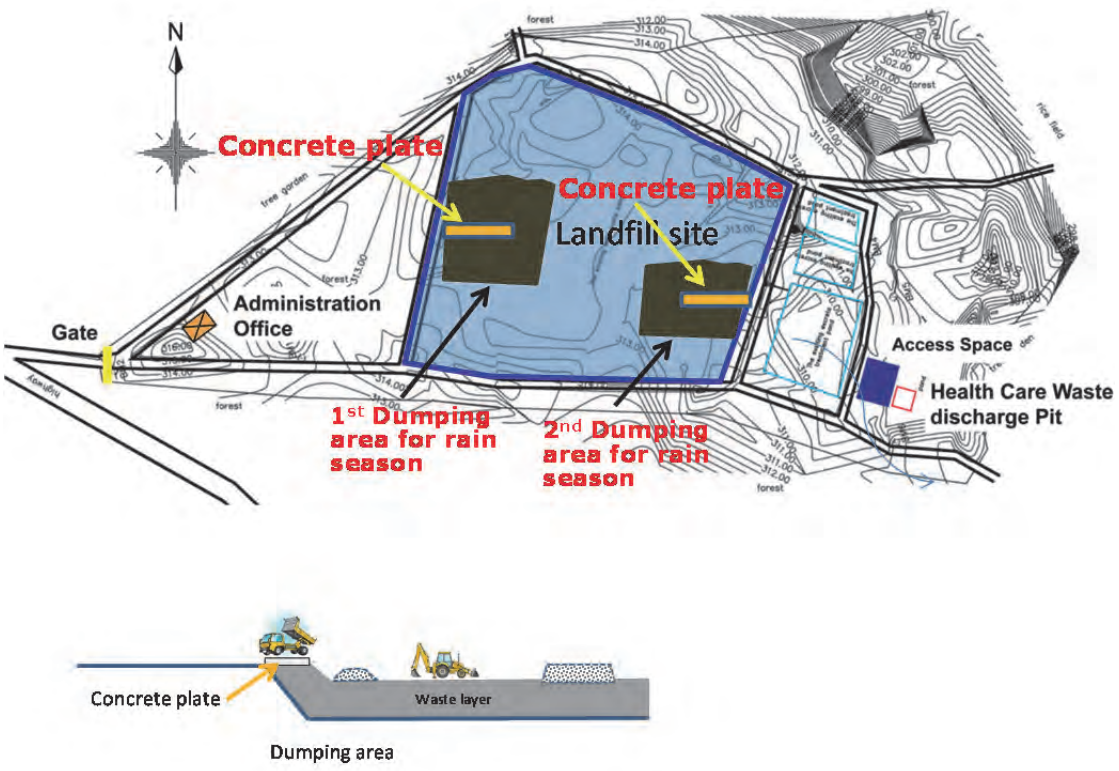


Figure 3-5. The operation plan at KM9 existing final disposal site

d. Formulation of operation plan reflecting the grant aid project

The draft operation plan was continuously implemented and examined at the improved KM9 final disposal site since 2012. And the operation plan was finalized in August 2015 by UDAA and SJET. Operation plan reflecting the grant aid project by the Japanese Government is described in Appendix 4

4. Implementation

a. Procured equipment and implementation of improved work

a.1 Procured equipment

A back-hoe loader was procured by JICA in May 2012 to move the disposed waste.

a.2 Implementation of Improved work at existing KM9 disposal site

SJET supported JICA to put out the tender for improvement work at existing KM9 disposal site in November 2013. The improvement work started in November 2013, completion inspection was conducted and the operation started on March 2013.

Table 3-30. Improvement work at existing KM9 disposal site

No.	Items	Qty.	unit
1	Administration office	1	unit
2	Gate	1	unit
3	Access road	70	m
4	Concrete plate	50	plate

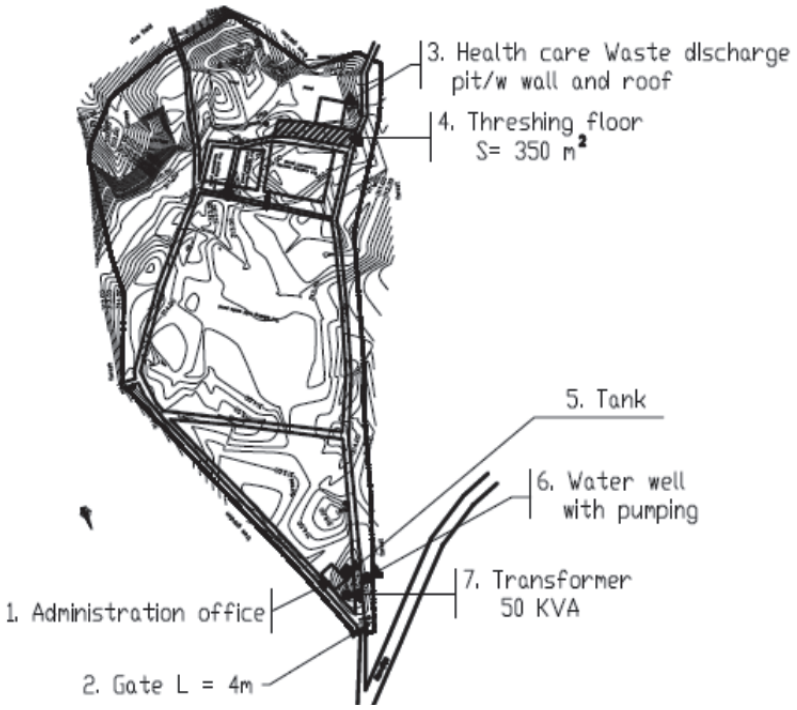


Figure 3-6. Layout of existing disposal site after improvement

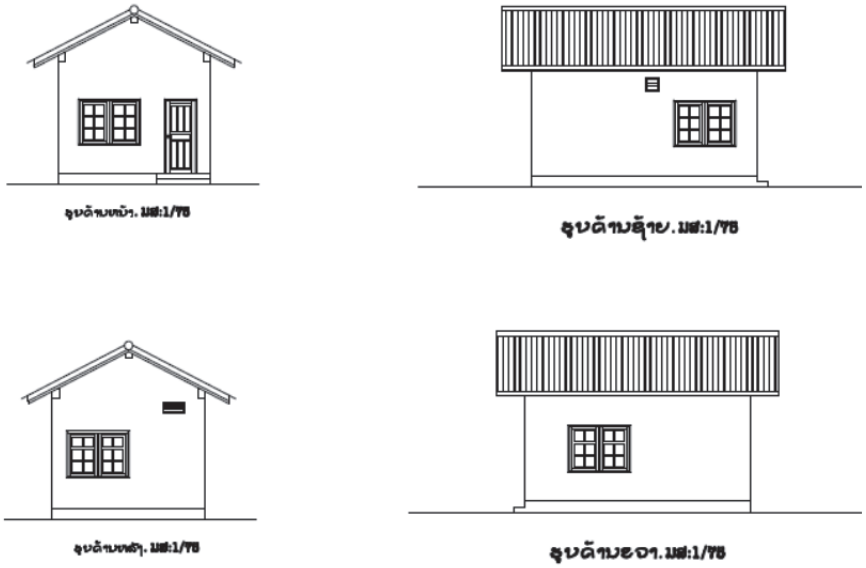


Figure 3-7. As built drawing of administration building

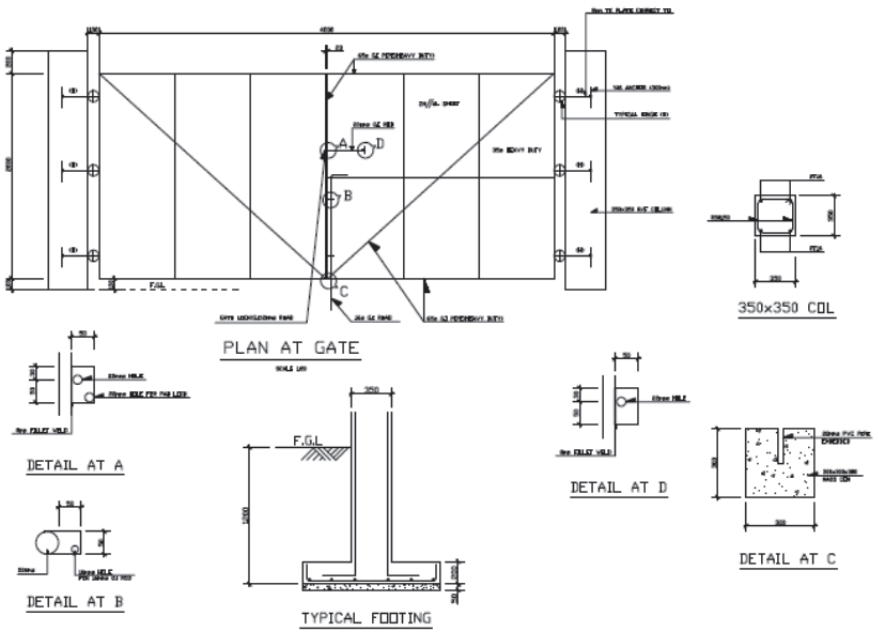


Figure 3-8. As built drawing of gate

b. Operation after the improvement work

b.1 Incoming waste data

The incoming amount of collected waste was measured at the weight bridge since June 2013 and is shown in the following table.

Table 3-31. Incoming amount of collected waste

Month	2013	2014	2015
	ton/month	ton/month	ton/month
1	(528)	-	788
2	(597.5)	596	684
3	(532.5)	656	933
4	(609)	623	784
5	(547.5)	612	767
6	565	629	783
7	550	607	
8	558.5	672	
9	567.5	703	
10	610	601.5	
11	593	660	
12	588	706.5	
Total	6,828.5 ton/year	7,611 ton/year	

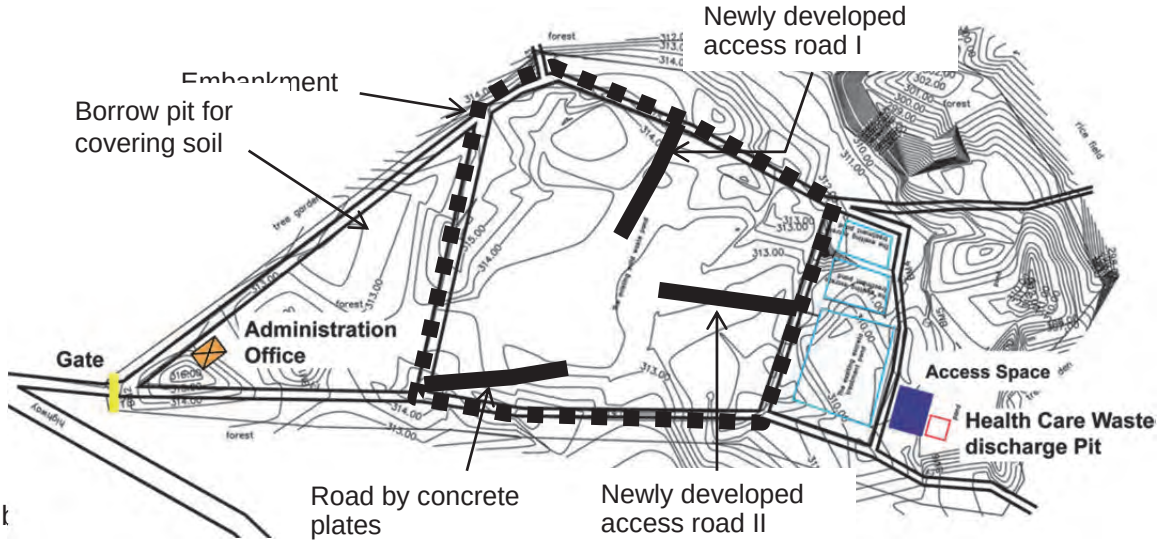
Note: figure in ( ) described the data obtained from direct interview to the driver of collection vehicles

b.2 Waste dumping

The new staff at the administration office assigned by UDAA manages site operation: he gives directions to the waste truck drivers about the location of waste dumping, makes sure that the

waste picking rule is observed and maintains security at the gate.

There is an embankment surrounding the dumping cell area and the concrete plates have been installed in the site so that collection vehicles can easily go into the site. Since the dumped waste including broken glass on the embankment often causes the puncture of the back-hoe loader provided by JICA, It has been instructed by SJET that the waste should not be dumped on the embankment, and back-hoe loader should not go into the cell area. UDAA attempted to prepare the budget to maintain vehicle access for proper waste disposal at the cell area in the rainy season (see the next section).



UDAA has installed the concrete plates in the sell area for vehicle access into there. Next UDAA developed Access Road I (see Figure 3-9) by its budget, this was not high enough to be used in the rainy season. UDAA then constructed Access Road II and backfilled the soil on it to maintain accessibility in the rainy season using the back-hoe loader following the instruction of SJET.

b.4 Soil coverage

UDAA will conduct soil coverage to prevent problems of fire, smoke, offensive odor and waste scattering with soil material excavated at a borrow pit behind the administration office by heavy machinery which is to be provided by the Japan grant aid project.

c. Monitoring

After the commencement of the pilot project, on-site monitoring was carried out approximately once a year. The number of participants and date of monitoring were 44 persons in May 2012, 45 persons in July 2013, 45 persons in August 2014 and 40 persons in June 2015. The participants were those from governmental agencies at the national, provincial and district levels, social organizations (Labor Union, Women's Union and Youth Union) and schools. The participants were given a lecture about the facility and operation of the disposal site, observed the facility operation and answered prepared questionnaires.

The questionnaire had a structure and questions shown below. The questions of Category A were asked every time of the monitoring, while the questions of Category B were asked at the 2nd monitoring and onwards as they were related to the operation of facility developed by the civil works in 2013.

Category A (regarding environmental aspects)	Category B (regarding facility operation)

• Offensive odor • Fire and smoke • Waste scattering • Vermin (flies and other smll animals) • Wastewater stagnation, etc.	• Access road • Drainage system • Landfill operation • Septage treatment facility • Healthcare waste management, etc.
Three answer options: acceptable, medium, not acceptable	Three answer options: fundtioning, medium, not functioning

The answers were compiled according to the year of monitoring and questions. The results across the years were shown below.

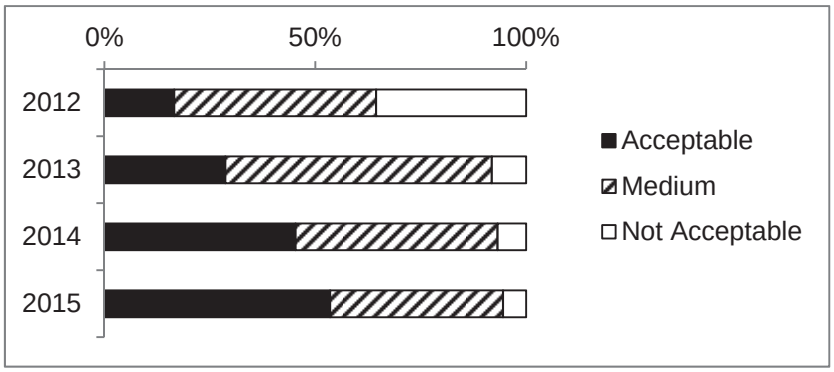


Figure 3-10. Results of Category A

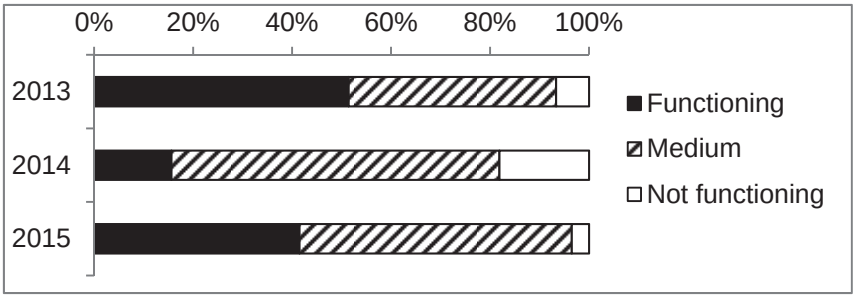


Figure 3-11. Results of Category B

Category A had a trend of improvement year by year. Particularly, the answers of smoke, flies, waste scattering, and animals were improved.

As for Category B, it should be noted that the improvement works completed in the previous month of the monitoring in 2013, whereby overall landscape was particularly upgraded, hence the participant might mainly observe the new facility rather than the operation of disposal site.

There is a similar symptom of monitoring result of the health care waste management which had a high score just after the completion of facility in the previous month, even though the contract of health care waste treatment was not yet made between UDAA and hospitals and the facility was not yet used in 2013. In 2014, the score of management of health care waste management was low because of poor management and the water licking at the health care waste pit. In 2015, the intention of UDAA to seriously improve manage health care waste contributed the good score.

5. Evaluation and output

The status of the indicators is as shown below and the project purpose is achieved.

Table 3-32. Evaluation of Proper management of existing final disposal site

Objectively verifiable Indicator	Means of verification	Achievement
Indicator 2.3. The operation of the final disposal site is improved		
1. An operation plan of the final disposal site is formulated.	1. Final disposal operation plan	Achieved. An operation plan of the final disposal site was formulated after discussion between UDAA and SJET.
2. The final disposal site is operated in accordance with the operation plan.	2. Final disposal operation record	Achieved. The final disposal site is operated in accordance with the operation plan and the waste amount of incoming waste was properly recorded. .
3. The final disposal site is monitored by the final disposal site monitoring committee once a year.	3. The monitoring report of the committee	Achieved. The final disposal site is monitored by the final disposal site monitoring committee once a year.

6. Recommendation

Necessary budget should be secured every year for the adequate operation and maintenance of the final disposal site. After the reception of a bulldozer procured by the grant assistance of the Japanese Government in 2015, the cost for operation and maintenance including the use of the excavator is estimated at 133,354 thousand kip per year.

The capacity of the present disposal site will be full by 2023. UDAA is required to have acquired a land, prepared an engineering design and constructed the landfill by then.

As for the daily operation, the main issue is to keep the site operational and to keep allowing the access of waste trucks in the rainy season by applying the concrete plates. As the concrete plates, however, will be deteriorated with age, UDAA should produce new concrete plates using formwork provided by the LPPE.

3.1.2 Proper management of waste pickers and improvement of their working conditions

1. Project Purpose

The purpose of this PP is to manage the waste pickers properly and to improve their working condtions.

2. Concept

The proper management of waste picker is formulated and conducted to improve their working condtions by UDAA and SJET. The management of waste pickers is monitored by waste pickers meeting.

Table 3-33. Implementation schedule of Proper management of waste pickers and improvement of their working conditions PP

Activities	Detailed Activities	Allocation of Roles	Time Schedule				
			2012	2013	2014	2015	2020
Project Planning	Set up project management system	UDAA, SJET	▬				

	Set up concept	UDAA, SJET	
Planning of PP	Identify the waste pickers	UDAA, SJET	
	Formulation of management and improvement plan	UDAA, SJET	
Implementation of PP	Management of Waste Pickers and Improvement of their Working Conditions	UDAA, SJET	
	Waste pickers meeting	UDAA, DONRE, SJET	▲ ▲ ▲
	Evaluation of the PP	SJET	
	Suggestion for continuation by C/P	SJET	

3. Plan

a. Identify the waste pickers

The ID cards of waste pickers are issued to identify and organize the waste pickers.

b. Formulation of management and improvement plan

In order to regulate and control the activities of waste pickers, UDAA established and issued "Temporary Regulation on Management and Monitoring KM9 Disposal Site" in May 2013. Furthermore, in order to facilitate control of waste pickers, UDAA in cooperation with SJET stated the control of waste pickers in the KM9 disposal site operation plan finalized in August 2015 as follows.

- The regular discussion between the waste pickers and UDAA staff are held.
- Waste pickers are required to be registered for working at the disposal site.
- Waste pickers are required to bring the issued ID cards when they work at the disposal site.
- Waste pickers are required to put on safety jackets, gloves, masks and long boots.
- Waste pickers are required to have Preventive injection for infection disease supported by LPPE.
- Waste pickers are required not to work at the active disposal area to avoid any accident.

4. Implementation

a. Management of Waste Pickers and Improvement of their Working Conditions

In order to facilitate control of waste pickers UDAA in cooperation with SJET has conducted the following activities:

(1) ID cards were issued to organize the waste pickers

(2) The following equipment was provided to the waste pickers.

- Preventive injection for infection disease (20 persons)
- Gloves (20persons)
- Long boots (20persons)
- Safety Jacket (20 persons)

UDAA instructed the waste pickers to put on the gloves, boots and safety jackets when they

work on waste picking and warned anybody not following this.

The implementation of the KM9 disposal site operation plan contributes the improvement of working condition, such as the prevention of infectious disease, accidents caused by heavy machinery and disputes among waste pickers and so on.

b. Waste picker meeting

The waste picker meeting was held once a year since January 2013 and the above mentioned management plan was instructed to them.

5. Evaluation and output

The status of the indicators is as shown below and the project purpose is achieved.

Table 3-34. Evaluation of Proper management of waste pickers and improvement of their working conditions PP

Objectively verifiable Indicator	Means of verification	Achievement
Indicator 2.3. The operation of the final disposal site is improved		
1. A management plan of waste picker is formulated.	1. Final disposal operation plan	Achieved. A management plan of waste pickers was formulated.
2. The waste pickers working conditions is improved in accordance with the management plan.	2. Progress report	Achieved. The waste pickers' working conditions was improved in accordance with the management plan.
3. The management of waste pickers is monitored by waste pickers meeting	3. Progress report	Achieved. The management of waste pickers is monitored by the waste picker meeting.

6. Recommendation

The regular discussion is recommended to manage the waste pickers.

After the reception of a bulldozer by the grant aid of the Japanese Government in November 2015, the operation method of the final disposal will be changed. For example, the frequency of waste movement and soil coverage will increase and the waste disposal work and waste picking work can have conflicts. The waste picker management rule will need a revision and all the waste pickers understand it.

Approach 3.2: Sludge from septic tanks is treated properly to mitigate impacts to surrounding aquatic environment.

3.2.1 Development and management of the treatment facility for the sludge from septic tanks

1. Project Purpose

The purpose of this PP is to properly manage the treatment facility for the sludge from septic tanks and to mitigate impacts to the surrounding aquatic environment.

2. Concept

The proper operation and maintenance of the treatment facility for sludge from septic tanks is conducted in accordance with the formulated operation plan. its operation is regularly monitored after improvement.

Table 3-35. Implementation schedule of Development and management of the treatment facility for the sludge from septic tanks PP

Activities	Detailed Activities	Allocation of Roles	Time Schedule				
			2012	2013	2014	2015	2020
Project Planning	Set up project management system	UDAA, SJET					
	Set up concept	UDAA, SJET					
Planning of PP	Identify and study the pilot area at KM9 existing final disposal site	UDAA, SJET					
	Formulation of improvement plan of infrastructure	UDAA, SJET					
	Formulation of draft operation plan of treatment facility for the sludge from septic tanks	UDAA, SJET					
	Finalization of operation plan	UDAA, SJET					
Implementation of PP	Establishment of treatment facility for the sludge from septic tanks	SJET					
	Proper operation of treatment facility for the sludge from septic tanks	UDAA, SJET					
	Monitoring	UDAA, DONRE, SJET	▲	▲	▲	▲	
	Evaluation of the PP	SJET					
	Suggestion for continuation by C/P	SJET					

3. Plan

a. Identify and study the pilot area

The topographic survey was conducted to identify the boundary of the pilot area at KM9 existing final disposal site.

b. Formulation of improvement plan of infrastructure

A facility plan for the treatment of the sludge from septic tanks was formulated as follows;

1	Pipe Drain dia.= 300 mm	m	32
2	Drainage pit 0.6 x 0.6 x 0.7m	place	1
3	Drainage pit 0.6 x 1.2 x 0.7m	place	1
4	Leveling and Gravel pavement (10x10m)	place	1

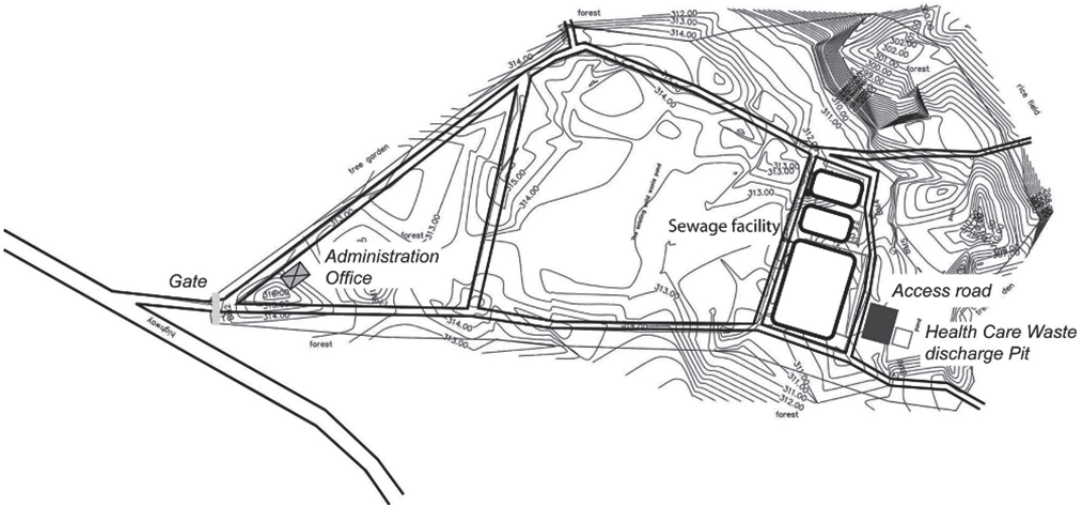


Figure 3-12. Location of the treatment facility for the sludge from septic tanks

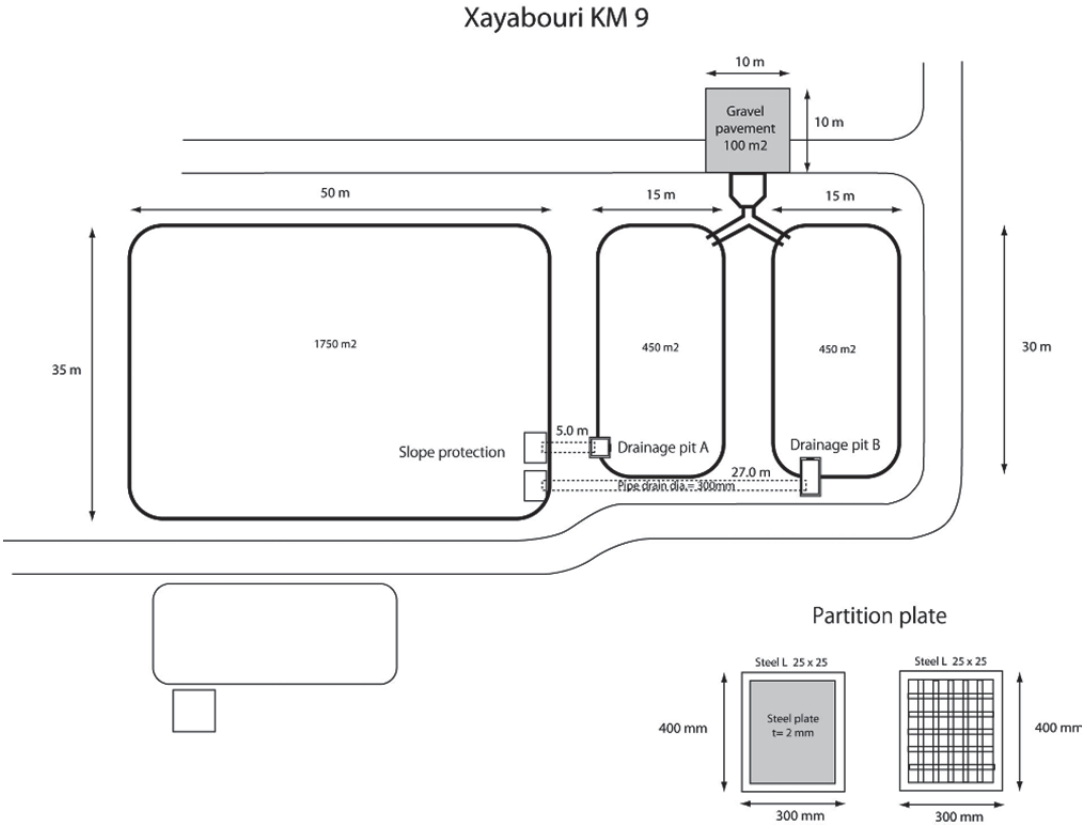


Figure 3-13. Layout of the treatment facility for the sludge from septic tanks

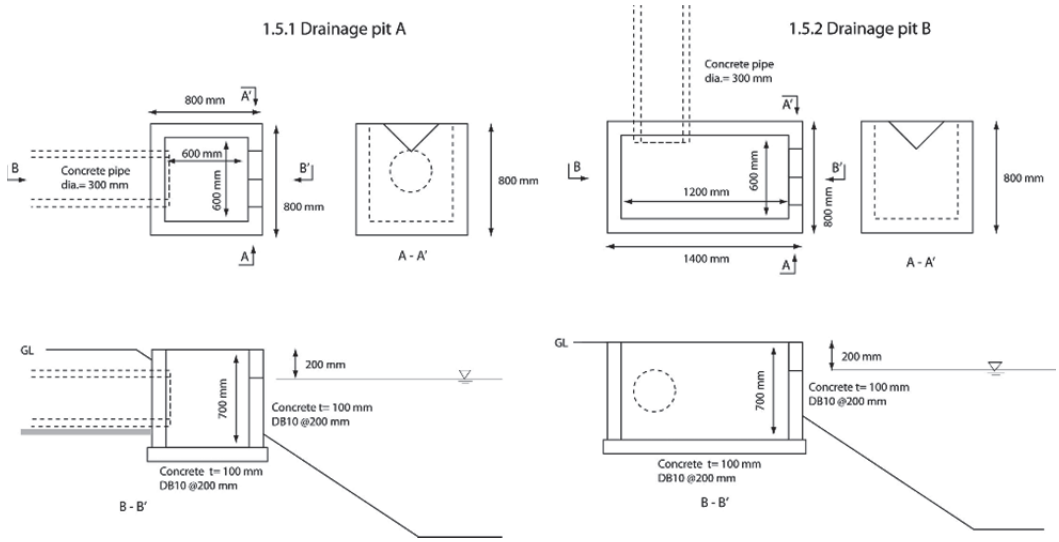


Figure 3-14. Typical section of the treatment facility for the sludge from septic tanks

c. Formulation of draft operation plan of treatment facility for the sludge from septic tanks

The constructed treatment facility for the sludge from septic tanks requires not only proper operation but also proper maintenance. The draft operation plan included following maintenance procedure.

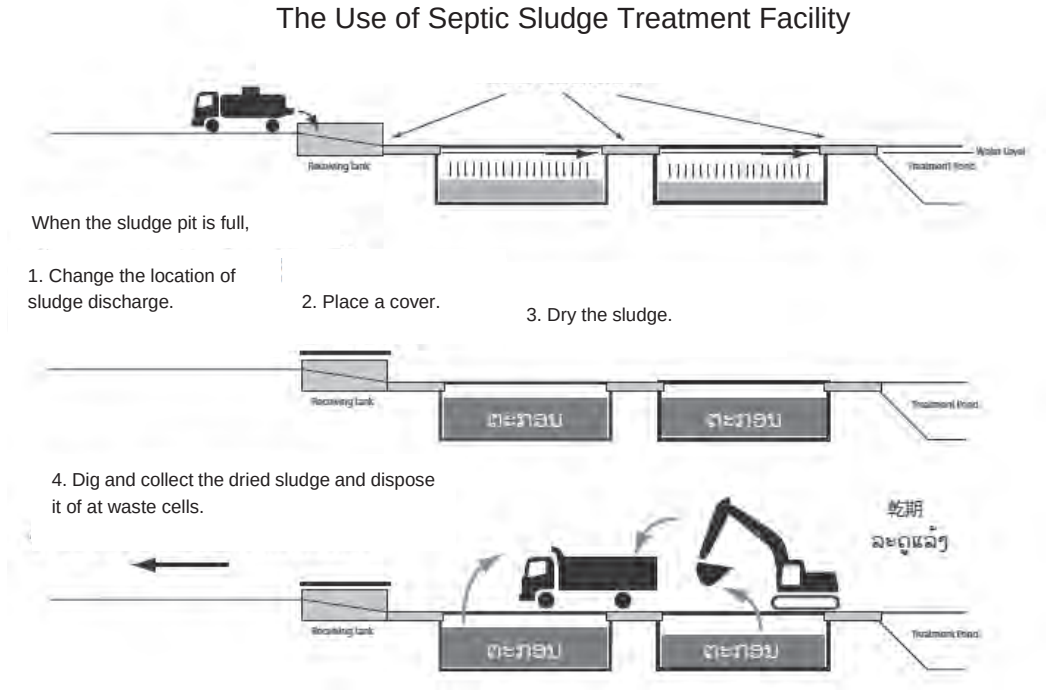


Figure 3-15. Procedure of operation and maintenance of treatment facility for the sludge from septic tanks

d. Finalization of operation plan

The finalized operation and maintenance plan of treatment facility for the sludge from septic tanks is described in Appendix 5.

4. Implementation

a. Implementation of construction of treatment facility for the sludge from septic tanks

The construction started in March 2013 and completed in June 2013. The operation of treatment facility for the sludge from septic tanks started in July 2013.

Table 3-36. Construction of treatment facility for the sludge from septic tanks

No	Item	Unit	Quantities
1	Site clearing	m2	1,000
2	Pumping out sewage water	m3	1,000
3	Removal of sewage sludge	m3	1,000
4	Pipe Drain dia.= 300 mm	m	32
5	Drainage pit 0.6 x 0.6 x 0.7m	place	1
6	Drainage pit 0.6 x 1.2 x 0.7m	place	1
7	Slope protection	place	2
8	Leveling and Gravel pavement (10x10m)	place	1
9	Repairing Receiving tank	set	1

b. Operation of treatment facility for the sludge from septic tanks

The treatment facility for the sludge from septic tanks has operated since July 2013. The incoming amount of collected sludge was recorded by staff at administration office in 2014.

- Number of collection vehicles of sludge from septic tanks: 959 vehicles
- Incoming amount of sludge from septic tanks: 2,877m^3

c. Monitoring

The treatment facility for the sludge from septic tank was monitored by the monitoring committee once a year in the monitoring committee for the proper management of final disposal site. The monitoring result of 2013 was not favorable, but those in 2014 and 2015 show that most of the monitoring participants considered that the septic tank sludge treatment facility was operating at an acceptable level or a medium level.

5. Evaluation and output

The status of the indicators is as shown below and the project purpose is achieved.

Table 3-37. Evaluation of treatment facility for the sludge from septic tanks PP

Objectively verifiable Indicator	Means of verification	Achievement
Indicator 2.3. The operation of the final disposal site is improved		
1. An operation plan of the treatment facility for the sludge from septic tanks is formulated.	Final disposal operation plan	Achieved. An operation plan of the treatment facility for the sludge from septic tanks was formulated.
2. The treatment facility for the sludge from septic tanks is operated in accordance with the operation plan.	Final disposal operation record	Achieved. The treatment facility for the sludge from septic tank was operated in accordance with the operation plan.
3. The treatment facility for the sludge from septic tanks is monitored by the	The monitoring report of	Achieved. The treatment facility for the sludge from septic tank was

final disposal site monitoring committee once a year.	the committee	monitored by the final disposal site monitoring committee once a year

6. Recommendation

So far, VUDAA removed the sludge sediment approximately once a year and the facility keeps functioning well. UDAA should continue sludge removal at the same frequency as present.

The facility developed by this PP has a sufficient capacity of sedimentation pond and treatment pond. As long as the sludge is regularly removed by UDAA, the expansion of facility is not necessary.

Strategy 4. Healthcare waste management (HCW) is improved.

Approach 4.1: HCW is collected properly.

4.1.1 HCW collection system establishment

Approach 4.2: HCW is disposed of properly.

4.2.1 HCW treatment and disposal system establishment

Due to the close linkage of these two PPs, they are described below together.

1. Project Purpose and Summary

The PP for HCW Collection System Establishment aims to establish a separate collection and transportation system for HCW generated in main hospitals in LPB and its monitoring system.

The PP for HCW Treatment and Disposal System Establishment aims to establish a treatment and disposal system for the separately collected HCW generated from main hospitals in LPB and its monitoring system.

Through these projects, infectious HCW discharged from two main hospitals in XYB is separately collected and disposed of.

2. General Concept

To establish the project concept, the PP implementation body, which was chaired by deputy director general of UDAA and consisted of members of DONRE and DOH, was organized in the beginning of year 2012. SJET in cooperation with the implementation body made the outline and schedule of overall PP as shown in the table below.

Table 3-38. Outline of the Plan for HCW Collection System Establishment PP and HCW Treatment and Disposal System Establishment PP

Activities	Detailed Activities	Allocation of Roles	Time Schedule				
			2012	2013	2014	2015	2020
Project Planning	Set up project management system	UDAA, DOH, DONRE, SJET	▬				
	Set up concept	SJET, UDAA, DOH, DONRE,	▬				

Planning of PP	Study and selection of pilot hospitals	UDAA, DOH, DONRE, SJET,					
	Preparation of collection and transportation PP plan	SJET, UDAA, DOH, DONRE					
Implementation of PP	Procurement of a HCW collection equipment	SJET					
	Construction of a HCW pit	SJET					
	Instruction of the HCW pit operation	SJET, UDAA					
	Negotiation of HCW contract	UDAA, DOH, DONRE,					
	Implementation of separated HCW collection	UDAA, DOH, DONRE, SJET					
	Implementation of HCW disposal	UDAA, DOH, DONRE, SJET					
	Monitoring and awareness raising	DOH, DONRE, UDAA, SJET					
	Evaluation of the PP	SJET, UDAA, DOH, DONRE					
	Formulation of HCWM plan	SJET, UDAA, DOH, DONRE					
	Suggestion for expansion	SJET, UDAA, DOH, DONRE					

3. Planning

a. Study and Selection of Pilot Hospitals

a.1 Study on Current HCWM

After litarature search until April 2012, an interview survey was carried out in May at XYB provincial hospital to know its waste generation, separation, collection, treatment and disposal practices. Based on the results, HCW generation in XYB district is estimated as shown in the table below.

Table 3-39. HCW Generation in XYB (2012)

Name of Medical Institution (MI)	Nos of MI	Nos of bed	Occupancy Rate (%)	Infectious Waste Amount (incl. Sharp Waste) (kg/day)	Waste Collection Service Provider
Provincial Hospital	1	120	63.4	16 (*1)	UDAA
Military Hospital	1	20		3 (*2)	UDAA
Clinics	10	-			UDAA
Total	12	140		19	

Source: XYB Province Health Department and SJET

(*1) Data obtained by weighing for a week, with the average of 0.13kg/bed/day without regard for bed occupancy rate in May 2012.

(*2) The average of 0.13kg/bed/day without regard for bed occupancy rate obtained from the Provincial hospital multiplied by the number of beds.

HCW collection practice for the Provincial hospital in May 2012 is shown in the table below.

	A	B	C	D
No	**Name of Hospitals**	**Fee for General Waste (kip/month)**	**Fee for Infectious Waste (kip/month)**	**Separate Collection**

1	XYB provincial	800,000	LS	No

LS: lump sum (fee for general waste collection covers infectious waste collection)

As Column D shows, no separate collection was provided. All the waste was collected by a container collection system. According to the UDAA, which operated the container collection system, the contract with the hospital only allowed the discharge of general waste and the hospital was supposed to treat their infectious waste by itself. In fact, the hospital had an abandoned incinerator nearby the waste container. It was hardly used due to the complaint of smell and smoke from the neighbors.

a.2 Selection of Pilot Hospitals

Based on the results of the current HCWM study the target hospitals of PP were selected as follow. Also, two project targets were set.

Target hospitals: 2 Main hospitals of XYB, namely Provincial Hospital and Military Hospital.

Indicator:

1. A healthcare waste collection, treatment and disposal plan for the target hospitals is formulated.
2. Healthcare waste from the target hospitals is collected, treated and disposed of in accordance with the aforementioned plan.

b. Preparation of Collection, Transportation, Treatment and Disposal PP Plan

SJET made a plan to procure containers dedicated for infectious HCW in order to separately collect it from the target hospitals. Although the infectious HCW in the dedicated containers are collected together with general HCW, it should separately disposed of at the disignated infectious HCW pit.

4. Implementation

a. Procurement of Equipment and Construction of Facility

a.1 Procurement of Collection Equipment

In June 2013, UDAA, DONRE and the provincial hospital had discussion and confirmed that UDAA would collect infectious HCW separately discarded by the hospital and dispose it of at the special pit newly installed in KM9 disposal site. For this activity, SJET provided two containers with 240 litter capacity for the infectious HCW transportation. Further, for the convenience of infectious HCW transportation, it was designed that the skip loader, which used to haul a $5m^3$ container with general HCW from the hospital, should have a flame to load the 240L container. With material procured by SJET, UDAA manufactured the flame at the workshop of $5m^3$ container manufacturing.

UDAA had continuous discussion with the hospital and they agreed that the fee should be at 25,000 kip/trip and collection should be three times a week. The system started on August 1 in 2013. The problems of offensive odor from putrefactive HCW such as body parts and blood made disposal of infectious HCW at the infectious HCW pit difficult. In order to solve the problem, SJET, UDAA, DONRE and the hospital met together on August 21 and agreed on the following.

- The pit at the disposal site cannot receive putrefactive HCW including body parts and bloods. The provincial hospital should deal with such kind of HCW in a conventional

manner (i.e. disposal by the hospital or burial by the patient's family).

- If such a measure faces difficulties, the construction of an incineration facility similar to that in LPB will be examined assuming the payment of the necessary fee by hospitals.

a.2 Construction of Facility for Infectious HCW Disposal Pit

In June 2013 specialized infectious HCW disposal pit was constructed. After the construction, however, due to the problem of rain water infiltration to the pit countermeasure works against the problem have been conducted twice in February 2014 and January 2015.

b. Implementation of Separate Collection and Disposal of Infectious HCW

UDAA keeps a record of the amount of separate collection and disposal of infectious HCW using a format prepared by SJET. The table below shows the record from October 2013 to July 2015.

Table 3-40. Achievement of HCW Collection and Disposal of Infectious HCW in XYB

Period	Nos of collected 240L containers	Average loading ratio of the container (%)	Amount of collection and disposal (kg)	Daily average collection and disposal (kg/day)
October – December 2013	40	56.0	801	8.72
January – June 2014	80	51.3	1,476	8.15
July – December 2014	80	46.3	1,332	7.24
January – June 2015	77	47.1	1,305	7.21
July 2015	14	42.9	216	6.97
Total	**291**	**49.0**	**5,130**	**7.67**

(Note) The unit weight of HCW was assumed at 0.15 kg/ltr. The amount of collection and disposal = 0.15 kg/ltr x 240 ltr x loading ratio / 100. Loading ratio was set by the visual judgment.

This table shows the following.

- The average monthly number of 240L containers collected is 13.2. This means approximately 3 times collection per week, as one container is collected by one collection time.
- Daily average amount for disposal is 7.67 kg/day. This is about half of infectious HCW amount, which is 16 kg/day estimated by using 0.13 kg/day/bed as a result of weighing survey during a week carried out in May 2012. The reason will be that putrefactive waste is not accepted in the pit.
- Since separate collection and disposal amount is increasing comparing with the beginning, separate collection of infectious HCW has been established.

c. Education, Monitoring and Awareness Raising Activities

HCWM PP in XYB district targets only Provincial hospital and Military hospital, and the former generates bulk of the amount. Consequently the following education, monitoring and awareness raising activities have been conducted by the lead of the Provincial Hospital.

Table 3-41. Major Education, Monitoring and Awareness Raising Activities to Improve HCWM in XYB

Date	Activities
August 1, 2013	UDAA and the provincial hospital agreed to start separate collection and disposal three times a week at 25,000kip/trip. Separate collection and disposal started on August 1, 2013.

August 13, 2013	The HCW pit cannot accept putrefactive HCW such as body parts and blood. The provincial hospital agreed to treat such HCW in a conventional manner (treated by the hospital or burial by families).
Mid-April in 2014	A training video was made in mid-April by using the video shooting of the seminar on March 14, 2014. Since then, the SJET has provided the video to the target hospitals in XYB to promote separate discharge of infectious HCW.
January to May 2015	The Infection Control Committees (ICC) held seminar and workshop three times on separation and discharge of infectious HCW at the hospitals inviting staffs of hospitals in HYB Province.

d. Formulation of HCWM Plan

A HCWM Plan (draft) was formulated and reviewed several times through the discussion with the C/P before finalization. The finalized HCW flows are shown in the figures below.

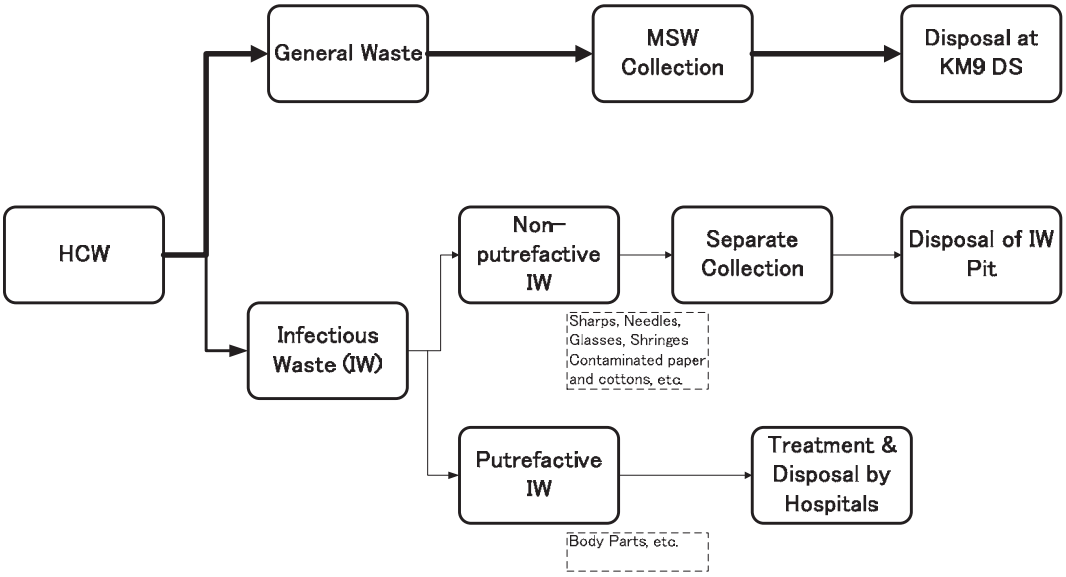


Figure 3-16. HCWM Flow in 2015

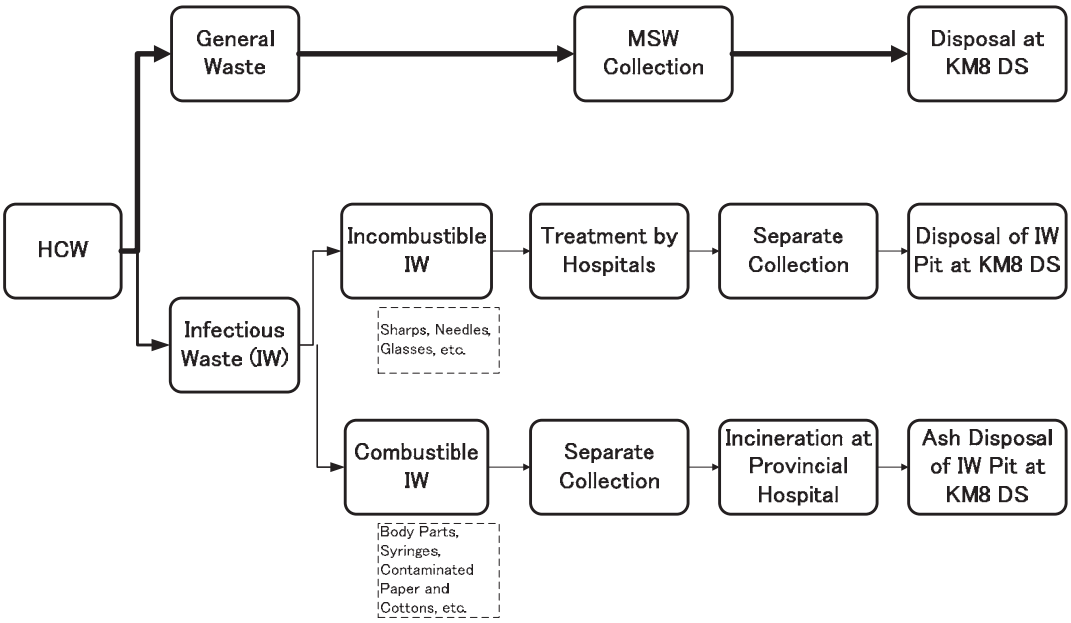


Figure 3-17. HCWM Flow in 2020

The details of the Plan are shown in Appendix 6, Supplement 3.

5. Evaluation and Achievements

Achievement of the PP indicators is as follows:

- HCWM Plan (draft) was formulated. Based on the results of the discussions with C/Ps, the plan was reviewed and finalized. The indicator (target 1), therefore, has been achieved.
- As for separate collection, treatment and disposal of infectious HCW, the target is achieved only partly. Separate collection and disposal has not yet been conducted for the infectious HCW from the Military Hospital. In terms of the amount of separate collection and disposal of infectious HCW 85% of it is achieved.

Table 3-42. Evaluation of HCWM Improvement PP

Objectively Verifiable Indicators	Means of Verification	Achievement Status
Indicator 2.4. Healthcare waste management is improved.		
1. A healthcare waste collection, treatment and disposal plan for the target hospitals is formulated.	1. The healthcare waste collection, treatment and disposal plan	Achieved. HCWM Plan was formulated, reviewed and finalized.
2. Healthcare waste from the target hospitals is collected, treated and disposed of in accordance with the aforementioned plan.	2. The record of healthcare waste collection, treatment and disposal.	Partly achieved. Separate collection and disposal is not conducted for the infectious HCW from the Military Hospital. In terms of the amount of separate collection and disposal of infectious HCW 85% of it is achieved.

Besides, the following outputs were produced through the implementation of the PP:

- A discussion structure among UDAA, DONRE and Provincial hospital, which is the largest generator of infectious HCW, was created to improve HCWM in XYB.
- This discussion structure became a foundation to establish a system to examine the introduction of incinerator for infectious HCW in XYB district.
- The Infection Control Committees (ICC) of the Provincial hospital is taking an initiative to improve HCWM in XYB district.

6. Suggestion for the Post-Project Activities

Although the service does not cover all the target hospitals, the base for a system of separate collection, incineration and final disposal was established due to the system establishment of the system for the largest generator of the waste. The target set by the HCWM Plan for the year 2020 is to separately collect, incinerate and dispose of all the infectious waste in XYB district. UDAA in cooperation with DOH and DONRE is recommended to take the following improvement measures by continuing and expanding the PP:

1. UDAA should make a contract with Military hospital on the separate collection and disposal service of infectious HCW and put it into force as soon as possible.
2. A reliable list of medical institutions in XYB should be prepared and the HCWM plan should be reviewed and modified when necessary using the list. .

3. Based on the review of the HCWM plan, UDAA should formulate and implement a construction plan of an incinerator which has enough capacity to treat all IWs in XYB district.
4. UDAA should operate and maintain the HCW pit referring to the manual shown in Appendix 7.
5. In order to introduce the incinerator UDAA shall learn the experiences of VTE Capital and LPB, and establish necessary legal tools. Then it shall ask fair fee to users.
6. UDAA shall also examine to construct the next infectious HCW disposal pit.

Strategy 5. Institutional system to support the above improvements be established.

Approach 5.1: The responsibilities that the relevant stakeholders should bear to achieve a goal of solid waste management are clarified.

5.1.1 Consensus building among stakeholders

1. Project Purpose and Summary

To improve SWM in XYB District a lot of pilot projects (PPs) have been conducted based on the strategies of the A/P, i.e. Promotion of 3Rs, Improvement of Collection System, Improvement of Final Disposal System and Improvement of Healthcare Waste Management. The purpose of this PP is to codify the responsibilities of each stakeholder regarding PPs for SWM improvement conducted in XYB and build consensus among them.

The PP has clarified the responsibilities of each stakeholder necessary for the implementation of PPs and built consensus among them through mutual discussions. When consensus was made, the PP tried to codify the contents of the consensus as much as possible. The products of codification varied from legal documents to leaflets distributed among the stakeholders according to the nature of the PPs.

2. General Concept

To establish the project concept the PPs implementation body, which is chaired by deputy director general of DONRE and consists of members of UDAA and DOH, was organized in the beginning of year 2012. SJET in cooperation with the implementation body made the outline and schedule of overall PP as shown in the table below.

As for the PPs for Promotion of 3Rs, Improvement of Collection System, Improvement of Final Disposal System and HCWM Improvement, DONRE, UDAA and DOH formulated the PP execution bodies in consideration of their roles and duties.

Table 3-43. Outline of the Plan for Consensus Building among Stakeholders PP

Activities	Detailed Activities	Allocation of Roles	Time Schedule				
			2012	2013	2014	2015	2020
Project Planning	Set up project management system	DONRE, UDAA, DOH, SJET					
	Set up concept	SJET, UDAA, DONRE, DOH					
Planning of PP	Study on the needs of consensus building for PPs	SJET, UDAA, DONRE, DOH					
	Preparation of draft consensus building plan	SJET, UDAA, DONRE, DOH					
Implementation of PP	Implementation of PPs	UDAA, DONRE, DOH, SJET					
	Monitoring and awareness rising	DONRE, UDAA, DOH, SJET					
	Evaluation of the PP	SJET, UDAA, DONRE, DOH					
	Suggestion for expansion	SJET, UDAA, DOH, DONRE					

3. Planning

The purpose of this PP is to codify the responsibilities of each stakeholder regarding PPs for SWM improvement conducted in XYB District and build consensus among them. The activities and incidatorof the project is shown below.

Target Area: XYB District

Activities: The clarification of roles and responsibilities of the stakeholders of the PPs for SWM improvement conducted based on the 4 strategies of the A/P, i.e. Promotion of 3Rs, Improvement of Collection System, Improvement of Final Disposal System and Improvement of Healthcare Waste Management.

Indicator: Regulation on the responsibilities of stakeholders for improved SWM is prepared and/or drafted.

4. Implementation

a. Situation before the PP

Situation before the PP is shown in the reports of each PP in this Appendix.

b. Implementation

The PPs for SWM improvement have been conducted in order to implement 4 strategies of the A/P, i.e. Promotion of 3Rs, Improvement of Collection System, Improvement of Final Disposal System and Improvement of Healthcare Waste Management. The roles and responsibilities of the stakeholders of the PPs are codified as shown in the table below. The officially issued regulations are shown in underlined and bold letters.

Table 3-44. Roles and Responsibilities of Stakeholders of SWM Improvement PPs in LPB

Pilot Project	Stakeholder	Roles and Responsibilities	Method of Codification
Strategy 1: 3Rs Promotion			
1.1.1. Reduction of kitchen waste and garden waste at households (On-site Composting)	DONRE, UDAA	Planning, Public education, awareness raising and instruction, Monitoring, Dissemination	• On-site composting leaflet • Worm composting dissemination video
	Village	Public education, awareness raising and instruction	
	Resident	Implementation	
	MONRE	Dissemination and Expansion	
1.1.2.a. Recyclable waste separation project at household	DONRE, UDAA	Planning, Public education, awareness raising and instruction, Monitoring, Dissemination	• Primary collection leaflet
	Village	Public education, awareness raising and instruction	
	Resident	Implementation	
	MONRE	Dissemination and Expansion	
1.1.2. b. School recycling project	DONRE, UDAA	Planning, Monitoring, Dissemination	• School recycling leaflet • School recycling dissemination video
	School, Teacher	Planning, Education, awareness raising and instruction to students, Management of recyclable materials	
	Student	Implementation	
	MONRE	Dissemination and Expansion	
1.1.3. Avoidance of the use of excess packages, Eco-basket project	DONRE, UDAA	Planning, Public education, awareness raising and instruction, Monitoring, Dissemination	• Eco-basket leaflet
	Village	Public education, awareness raising and instruction	
	Resident, Stalls of the market	Implementation	
	MONRE	Dissemination and Expansion	
Strategy 2: Collection System Improvement			
2.1.1&2 Improvement of exiting collection and discharge system, Primary collection system project	UDAA, DONRE	Planning, Preparation of awareness raising tools, Monitoring, Dissemination	• Primary collection education leaflet
	Village	Public education, awareness raising and instruction	
	Resident	Implementation	
	MONRE	Dissemination and Expansion	
2.2.2 Waste collection service expansion by using $5m^3$ containers	UDAA,	Planning, construction of $5m^3$ containers, Contract negotiation with large discharger, Dissemination	• Contract agreement of collection service
	Large discharger	Contract negotiation with UDAA, Education and instruction in the discharger	

	MONRE	Dissemination and Expansion	
Strategy 3: Final Disposal System Improvement			
3.1.1. Proper management of existing final disposal site	UDAA	Establishment of the rule and tipping fee, Education, awareness raising and instruction to user	• **302/UDAA OFF 22/01/2013: Rules of KM8 disposal site**
	KM9 disposal site	Enforcement and instruction of the rule	
	User of KM9 disposal site	Compliance of rules	
	MONRE	Dissemination and Expansion	
3.1.2. Proper management of waste pickers and improvement of their working conditions	UDAA	Establishment of the rule, Education, awareness raising and instruction to Waste Picker	
	KM9 disposal site	Enforcement and instruction of the rule, Improvement of working condition of Waste Picker	
	Waste Picker	Compliance of rules	
	MONRE	Dissemination and Expansion	
Strategy 4: HCWM Improvement			
4.1.1. HCW collection system establishment	DOH, Provincial Hospital	Public education, awareness raising and instruction to MIs	• Contract agreement of separate collection service with MIs
	UDAA	Separate collection of infectious HCW	
	Medical institution (MIs)	Separate discharge of infectious HCW and payment for service	
4.2.1. HCW treatment and disposal system establishment	DOH, Provincial Hospital	Public education, awareness raising and instruction to MIs	
	UDAA	Separate disposal of infectious HCW	
	Medical institution	Separate discharge of infectious HCW and payment for service	

5. Evaluation and Achievements

Achievement of the PP indicator (Regulation on the responsibilities of stakeholders for improved SWM is prepared and/or drafted.) is as follows:

Strategy 3: Final Disposal System Improvement :

1. **121/UDAA 08/05/2013: Temporary Regulation on Management and Monitoring KM9 Disposal Site**:

- To establish rules to control the users of the KM9 disposal site and its waste pickers KM9, tipping fee and penalty of violator.

As mentioned above, the rule of UDAA on the strategy for improvement of final disposal site was established. For the other strategies of 3Rs Promotion and Improvement of Collection System, the PP activities were carried out in villages and the codification of the responsibilities did not correspond to regulation. Nevertheless, the codification of responsibilities and consensus building, which were the purpose of the PP, were completed and the codified documents could serve for the future regulations at the district or provincial level. Accordingly, the purpose of the PP was achieved.

Table 3-45. Evaluation of Consensus Building among Stakeholders PP

Objectively Verifiable Indicators	Means of Verification	Achievement Status
Indicator 2.5. The following documents are prepared.		
1. Regulation on the responsibilities of stakeholders for improved SWM is prepared and/or drafted.	1.1 UDAA's regulation on waste discharge, collection and final disposal. 1.2 Draft amendment of LPB District's regulation on SWM or additional implementation rules.	Achieved. UDAA rule on final disposal site improvement was established in the PPs and other documents could serve for the future regulations. ,

In addition to the above-mentioned targets, the following outputs have been achieved through the implementation of the PP:

- The roles and responsibilities of stakeholders on improvement of SWM became clear through the implementation of various PPs.
- Through the implementation of various PPs coordination system among MONRE, MOH and MPWT of central government and Province, District and Village of local government, and Residents have been established.
- The coordination system among relevant organizations was established to enforce the regulations on the improvement of HCWM.

6. Suggestion for the Post-Project Activities

Although the implementation of various PPs clarified roles and responsibilities of stakeholders for the improvement of SWM, the number of regulations formulated was limited. In order to promote further legislation, relevant organizations are recommended to conduct the following measures:

- "Basic Laws on SWM" should be established as soon as possible by the lead of MONRE.
- Following the "Basic Laws on SWM", XYB Province in cooperation with XYB District should establish "Regulation on SWM in XYB" according to the situation of XYB District.

- If "Basic Laws on SWM" of national level delays, XYB Province may need to establish "Regulation on SWM in XYB" with the cooperation of MONRE.
- For the establishment of "Regulation on SWM in XYB" XYB Province and District should utilize the experiences of the PPs.

Approach 5.2: Financial system necessary for proper SWM is improved.

5.2.1 Financial System Improvement

1. Objectives and Project Summary

To improve SWM in XYB District a lot of pilot projects (PPs) have been conducted based on the strategies of the A/P, i.e. Promotion of 3Rs, Improvement of Collection System, Improvement of Final Disposal System and Improvement of Healthcare Waste Management. The purpose of this PP is to make proposals for financial system improvement necessary for SWM improvement through the implementation of the above-mentioned PPs.

The proposals for financial system improvement necessary for SWM improvement are divided into two:

1. Proposals necessary for the implementation of the PPs for SWM improvement; and
2. Proposals necessary for the continuation, dissemination and expansion of the PPs to be implemented by the Laotian C/Ps after the termination of LPPE.

As for the former proposals, most of them were regarding the operation and maintenance (O&M) cost shouldered by the Laotian side since the basic investment was born by the Japanese side of LPPE. In addition, most of the proposals were actually implemented because of the necessity of implementation of the PPs for SWM improvement.

As for the latter proposals, simple proposals are prepared for both O&M cost and investment.

2. General Concept

To establish the project concept the PPs implementation body, which was chaired by deputy director general of DONRE and consisted of members of UDAA and DOH, was organized in the beginning of year 2012. SJET in cooperation with the implementation body made the outline and schedule of overall PP as shown in the table below.

As for the PPs for Promotion of 3Rs, Improvement of Collection System, Improvement of Final Disposal System and HCWM Improvement, DONRE, UDAA and DOH formulated the PP execution bodies in consideration of their roles and duties.

Table 3-46. Outline of the Plan for Financial System Improvement PP

Activities	Detailed Activities	Allocation of Roles	Time Schedule				
			2012	2013	2014	2015	2020
Project Planning	Set up project management system	DONRE, UDAA, DOH, SJET					
	Set up concept	SJET, UDAA, DONRE DOH					
Planning of PP	Study on the needs of financial system improvement for PPs	SJET, UDAA, DONRE, DOH					

	Preparation of draft financial system improvement plan	SJET, UDAA, DONRE, DOH					
Implementation of PP	Implementation of PPs	UDAA, DONRE, DOH, SJET					
	Monitoring and awareness raising	DONRE, UDAA, DOH, SJET					
	Evaluation of the PP	SJET, UDAA, DONRE, DOH					
	Suggestion for expansion	SJET, UDAA, DOH, DONRE					

3. Planning

The purpose of this PP is to make proposal for financial system improvement necessary for SWM improvement through the implementation of the PPs conducted in XYB District. The activities and targets of the project are shown below.

Target Area: XYB District

Activities: To prepare financial system improvement proposals necessary for SWM improvement through the implementation of the PPs based on the 4 strategies of the A/P.

Targets: Proposal for financial system improvement necessary for SWM improvement is prepared.

4. Implementation

a. Situation before the PP

Situation before the PP is shown in the reports of each PP in this Appendix.

b. Implementation

The PPs for SWM improvement were carried out in order to implement 4 strategies of the A/P, i.e. Promotion of 3Rs, Improvement of Collection System, Improvement of Final Disposal System and Improvement of Healthcare Waste Management. The proposals for the financial system improvement are divided into "Proposals necessary for the implementation of the PPs for SWM improvement" that were planned and implemented for the implementation of the PPs, and "Proposals necessary for the continuation, dissemination and expansion of the PPs to be implemented by the Laotian C/Ps after termination of LPPE" as shown in the table below.

Table 3-47: Results of Financial Burdens for PP Implementation in XYB District and Proposal of Financial Burdens for Continuation, Dissemination and Expansion of PPs

Projects	Implementation of PP		Continuation, Dissemination and Expansion of PP	
	Items of Financial Burden	Organization Bore Burden	Items of Financial Burden	Proposed Organization to Bear Burden
Strategy 1: 3Rs Promotion				
1.1.1. Reduction of kitchen waste and garden waste at households (On-site Composting)	Study and planning	SJET	Study and planning	DONRE、UDAA
	Procurement of equipment	SJET	Procurement of equipment	Resident
	Implementation	Resident	Implementation	Resident
	Awareness raising, education and monitoring	SJET、DONRE、UDAA、Ban、MONRE	Awareness raising, education and monitoring	DONRE、Ban、UDAA
1.1.2.a. Recyclable waste separation project at household	Study and planning	SJET	Study and planning	DONRE、UDAA
	Procurement of container for separation	Resident	Procurement of container for separation	Resident
	Implementation	Resident	Implementation	Resident
	Awareness raising, education and monitoring	SJET、DONRE、UDAA、Ban、MONRE	Awareness raising, education and monitoring	DONRE、Ban、UDAA
1.1.2. b. School recycling project	Study and planning	SJET、DONRE、UDAA、School	Study and planning	DONRE、School、UDAA
	Construction of store facility	SJET	Construction of store facility	Acquisition of subsidies and support from donors and CSR by MONRE/DONRE
	Implementation	School、Students	Implementation	School、Students
	Awareness raising, education and monitoring	SJET、DONRE、UDAA、School、MONRE	Awareness raising, education and monitoring	DONRE、UDAA、School
1.1.3. Avoidance of the use of excess packages, Eco-basket project	Study and planning	SJET	Study and planning	DONRE、UDAA
	Procurement of Eco-basket	SJET	Procurement of Eco-basket	Resident、Acquisition of subsidies and support from donors and CSR by MONRE/DONRE
	Implementation	Resident、Stalls of market	Implementation	Resident
	Awareness raising, education and monitoring	SJET、DONRE、UDAA、Ban、MONRE	Awareness raising, education and monitoring	DONRE、Ban、UDAA
Strategy 2: Collection System Improvement				
2.1.1&2 Improvement of exiting collection and discharge	Study and planning	SJET	Study and planning	UDAA、Ban
	Procurement of container for	SJET	Procurement of container for	Part of collection fee collected

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system, Primary collection system project	primary collection		primary collection	from resident by UDAA and Collection company
	Implementation	Resident	Implementation	Resident
	Awareness raising, education and monitoring	SJET、UDAA、DONRE、村、MONRE	Awareness raising, education and monitoring	UDAA、DONRE、Ban、Collection company
2.2.2 Waste collection service expansion by using $5m^3$ containers	Study and planning	SJET	Study and planning	UDAA
	Construction of $5m^3$ containers	SJET、UDAA	Construction of $5m^3$ containers	Part of collection fee collected from users by UDAA
	Implementation	Users of $5m^3$ containers	Implementation	Collection fee from large waste generator
	Awareness raising, education and monitoring	SJET、UDAA、DONRE、MONRE	Awareness raising, education and monitoring	UDAA
Strategy 3: Final Disposal System Improvement				
3.1.1 Proper management of existing final disposal site	Study and planning	SJET	Study and planning	UDAA
	Procurement of equipment and Construction of facility	SJET	Procurement of equipment and Construction of facility	Part of tipping fee collected from users by UDAA、Donor and subsidies from Province
	Implementation	UDAA	Implementation	Tipping fee from UDAA and users other than UDAA
	Awareness raising, education and monitoring	UDAA、DONRE、MONRE	Awareness raising, education and monitoring	UDAA、DONRE
3.1.2. Proper management of waste pickers and improvement of their working conditions	Study and planning	SJET	Study and planning	UDAA
	Procurement of equipment	SJET	Procurement of equipment and Construction of facility	UDAA、Waste Picker
	Implementation	SJET、UDAA	Implementation	UDAA、Waste Picker
	Awareness raising, education and monitoring	SJET、UDAA、DONRE、MONRE	Awareness raising, education and monitoring	UDAA、DONRE
3.2.1. Development and management of the treatment facility for the sludge from septic tanks	Study and planning	SJET	Study and planning	UDAA
	Construction of facility	SJET	Maintenance of facility	UDAA
	Implementation	Users of facility、UDAA	Implementation	Treatment fee from users of facility、UDAA
	Awareness raising, education and monitoring	UDAA、DONRE、MONRE	Awareness raising, education and monitoring	UDAA、DONRE
Strategy 4: HCWM Improvement				

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4.1.1. HCW collection system establishment	Study and planning	SJET	Study and planning	UDAA、DOH
	Procurement of equipment	SJET	Procurement of equipment	Part of separate collection fee collected from users by UDAA
	Implementation	Separate collection fee from medical institutions	Implementation	Separate collection fee from medical institutions
	Awareness raising, education and monitoring	SJET、DOH、UDAA、DONRE、MONRE	Awareness raising, education and monitoring	DOH、UDAA
4.2.1. HCW treatment and disposal system establishment	Study and planning	SJET	Study and planning	UDAA、DOH
	Construction of HCW pit	SJET	Construction of HCW pit	Part of infectious HCW collection fee collected from users
	Implementation	Infectious HCW collection fee from medical institutions	Implementation	Infectious HCW collection fee from medical institutions
	Awareness raising, education and monitoring	SJET、DOH、MOH、UDAA、DONRE、MONRE	Awareness raising, education and monitoring	DOH、UDAA

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5. Evaluation and Achievements

a. Proposals necessary for the implementation of the PPs for SWM improvement

As for the proposals necessary for the implementation of the PPs for SWM improvement, the following documents were prepared and officially issued:

Strategy 2: Collection System Improvement:

1. **No 1059/XYB.Pro.Gov 02/08/2013: Provision on Revenue and Fund to be used by Urban Development and Administration Authority (UDAA) of Xayaboury District**:
   - Waste collection fee of XYB District is revised according to the current situation.

Strategy 3: Final Disposal System Improvement :

2. **121/UDAA 08/05/2013: Temporary Regulation on Management and Monitoring KM9 Disposal Site**:
   - Tipping fee of KM9 disposal site is established.

Strategy 4: HCWM Improvement :

3. **No 299 /XYB.PH 13/08/2013: Munute of Meetng on HCWM at Provincial Hospital**:
   - The fee for the separate collection and disposal of infectious HCW discharged from the provincial hospital is set and agreed as 25,000 kip per a container.

As mentioned above, 3 proposals considered as "legal documents" were established for three strategies. For the 3Rs Promotion, the implementation of PPs did not need financial proposals for the implementation of the PPs.

b. Proposals necessary for the continuation, dissemination and expansion of the PPs to be implemented by the Laotian C/Ps after termination of LPPE

The financial proposals for the continueation, dissemination and expansion of the PPs were prepared as shown in the Table 3-47.

As a conclusion the PP targets (Objectively Verifiable Indicators: Proposal for financial system improvement necessary for SWM improvement is prepared.) is achieved as described above.

Table 3-48. Evaluation of Financial System Improvement PP

Objectively Verifiable Indicators	Means of Verification	Achievement Status
Indicator 2.5. The following documents are prepared.		
1. Proposal for financial system improvement necessary for SWM improvement is prepared.	1. Proposal for financial system improvement necessary for SWM improvement.	Achieved. 3 proposals were established as legal documents in the PPs and other documents could serve for the future regulations. ,

In addition to the above-mentioned targets, the following outputs have been achieved through the implementation of the PP:

- Through the implementation of various PPs, the needs of a financial system improvement plan with fair financial burden among stakeholders became clear.
- In order to prepare and implement the financial system improvement plan, the coordination system have been established among MONRE, MOH and MPWT of central government, local governments at the Province, District and Village levels and residents through the implementation of various PPs.

6. Suggestion for the Post-Project Activities

Although the implementation of various PPs clarified the needs of a financial system improvement plan and fair financial burden of each stakeholder for the improvement of SWM, the number of legal documents formulated was limited. In order to promote further legal documentation of the financial proposals, relevant organizations are recommended to conduct the following measures:

- The financial capacity on SWM improvement of the local governments is very limited. It is, therefore, recommended to examine O&M cost for SWM improvement based on the beneficiaries-bear principle.
- As for the investment, it is also recommended to apply the beneficiaries-bear principle in general. It is, however, very difficult to manage the large investment cost for the equipment procurement and facility construction with only fees from beneficiaries. It is, therefore, recommended to ask budget from the Central and Provincial governments and financial cooperation of donors and enterprises that promote CSR (cooperate social responsibility).
- As for the preparation of financial proposals it is recommended to utilize the experiences of various PPs as much as possible. Especially for the financial system improvement plan for the continueation of the PPs, and dissemination and expansion of them, it is recommended to utilize Table 3-47: Results of Financial Burdens for PP Implementation in XYB District and Proposal of Financial Burdens for Continuation, Dissemination and Expansion of PPs.

Appendix 4

OPERATION PLAN FOR KM 9 DIPOSAL SITE IN XYB

LPP-Environment

In cooperation with JICA Experts Team

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1. Operation of Landfill Site

1.1 Required Landfill Volume

1.1.1 MSW Flow in 2011

Based on the municipal solid waste management (MSWM) study conducted by LPPE in 2011, MSW flow in XYB in 2011 has been prepared as shown in the figure below.

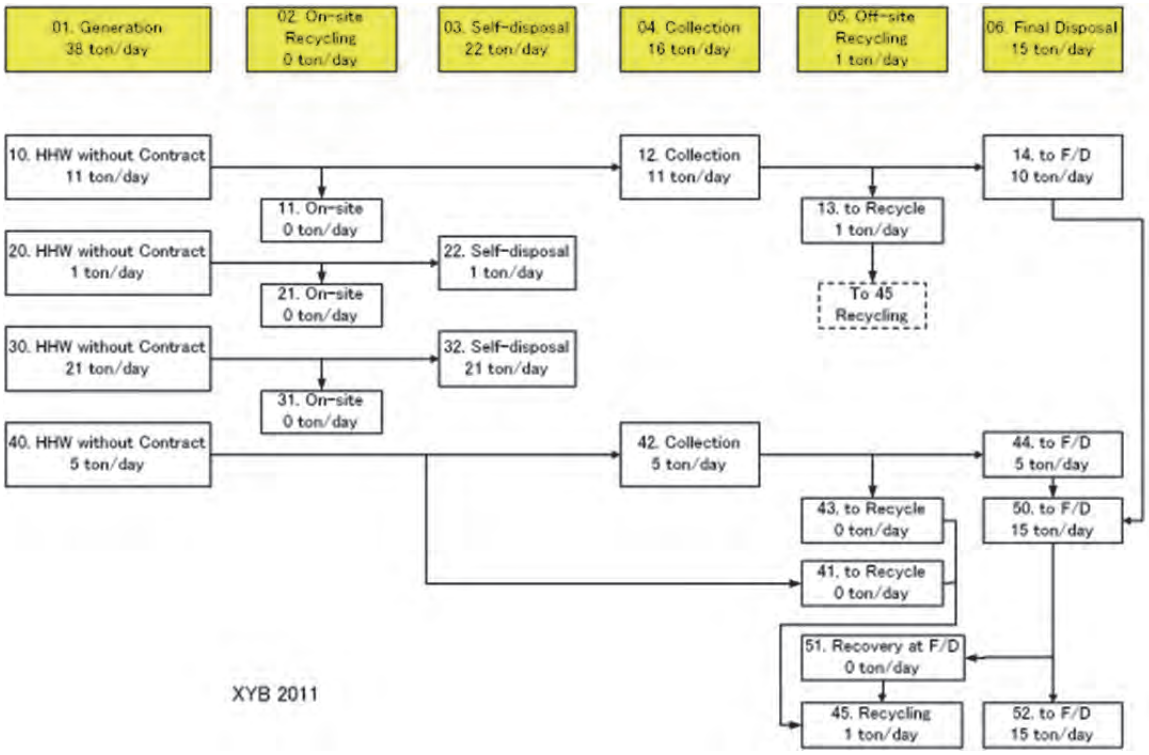


Figure 1: MSW Flow in 2011

1.1.2 Estimation of MSW Disposal Amount

Based on the above-mentioned MSW flow in 2011 the following basic data and assumptions are established for estimation of disposal amount:

d.1. Population: 67,317 in 2010, Population growth rate 1.66 % from Census in 2005 and data of Provincial governor office in 2012

d.2. Population in 20xx (Pxx): $67{,}317 \times (1 + 0.0166)^{(20xx-2010)}$

d.3. GRDP Growth Rate: 7.5 % from "The Project for Urban Development Master Plan Study in Vientiane Capital"

d.4. Household waste generation rate in 2011: 477 g/person/day from LPPE waste amount and composition survey in 2011

d.5. Household waste generation rate in 20xx (HWGRxx):

$HWGRxx = 477 \times (0.55 \times (1 + 0.075)^{(20xx - 2011)})$

Note: 0.55 is the coefficient obtained from statistic data in Japan

d.6. Household waste generation amount in 20xx (HWGAxx):

HWGAxx = HWGRxx x Pxx

d.7. MSW generation in 20xx: Estimated by considering MSW flow in 2011 and d.2, d.5 and d.6.

d.8. MSW collection coverage rate in 2020: 68% in 2020 according to the Japanese grant aid project.

Based on the above date and assumptions the disposal amount of KM9 disposal site (KM9DS) is estimated as shown in the table below.

Table 1: MSW Disposal in KM9DS by 2020

Items	Unit	2016	2017	2018	2019	2020
Population	person	74,306	75,539	76,793	78,068	79,364
Household waste generation rate	g/person/ day	583	607	632	658	685
Household waste generation amount	ton/day	43	46	49	51	54
MSW generation	ton/day	49	53	56	59	62
MSW collection coverage rate	%	61	64	64	68	68
MSW collection amount	ton/day	30	34	36	40	42
MSW disposal amount	ton/day	30	34	36	40	42

1.1.3 Required Landfill Volume

Required landfill volume is calculated by the formula below:

YRLVxx = ((YFDxx/UWWL) * (1 + CSR))

- YRLVxx: Yearly Required Landfill Volume in 20xx (m3/year)
- DDAxx: Daily Disposal Amount in 20xx (ton/day)
- YDAxx: Yearly Disposal Amount in 20xx (ton/year)
- UWWL: Unit Weight of MSW at the Landfill (ton/m3)
- CSR: Cover Soil Rate to Landfilled Waste
- ARLV: Accumulated Required Landfill Volume (m3)

Considering the current waste composition and future landfill operation the following assumptions is set for the required landfill volume calculation:

- DDAxx: Up to the year 2020 the figure of "MSW disposal amount" in the Table 1 applied. After 2021 it will increase 5% every year.
- UWWL: 1.0 ton/m^3
- CSR: 3% of landfill MSW volume. Although it is not enough for sanitary landfill operation (more than 10%), minimum soil cover will be conducted.

Table 2: Required Landfill Volume until 2030

Year	DDAxx (ton/day)	YDAxx (ton/year)	YRLVxx (m3/year)	ARLV (m3)
2016	30.0	10,950	11,279	11,279
2017	34.0	12,410	12,782	24,061
2018	36.0	13,140	13,534	37,595
2019	40.0	14,600	15,038	52,633
2020	42.0	15,330	15,790	68,423
2021	44.1	16,097	16,579	85,002
2022	46.3	16,901	17,408	102,411
2023	48.6	17,746	18,279	120,689
2024	51.1	18,634	19,193	139,882
2025	53.6	19,565	20,152	160,035
2026	56.3	20,544	21,160	181,194
2027	59.1	21,571	22,218	203,412
2028	62.1	22,649	23,329	226,741
2029	65.2	23,782	24,495	251,237
2030	68.4	24,971	25,720	276,957

1.2 Landfill Plan

1.2.1 Possible Landfill Operation Area

1.2.1.1 Possible Landfill Operation Area Operation Plan

Possible landfill area of KM9DS is divided into the three areas as shown in the figure below.

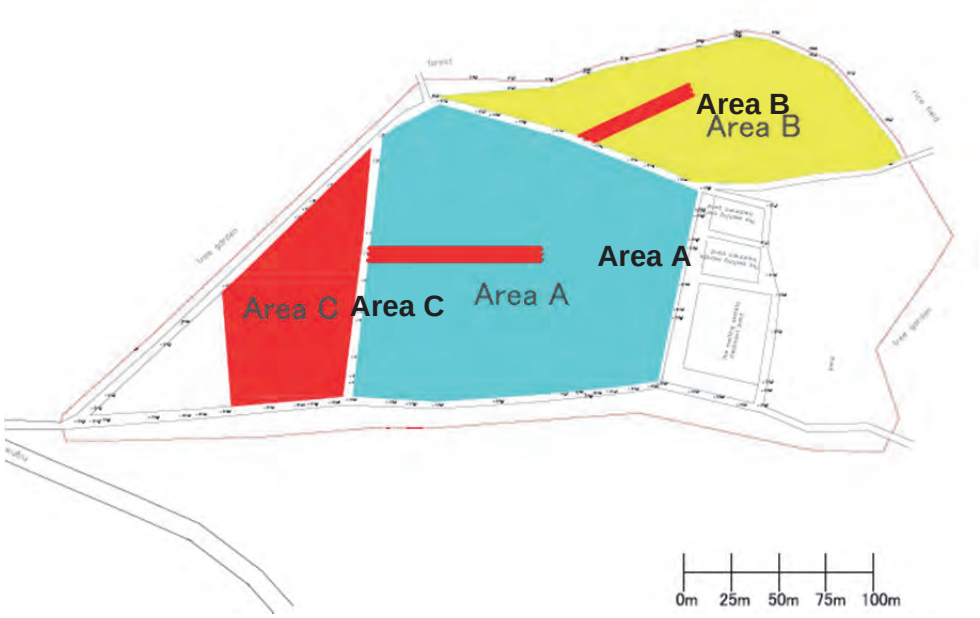


Figure 2: Possible Landfill Area of KM9DS

Landfill operation plan is made Area A, B and C respectively as shown in the Figure below.

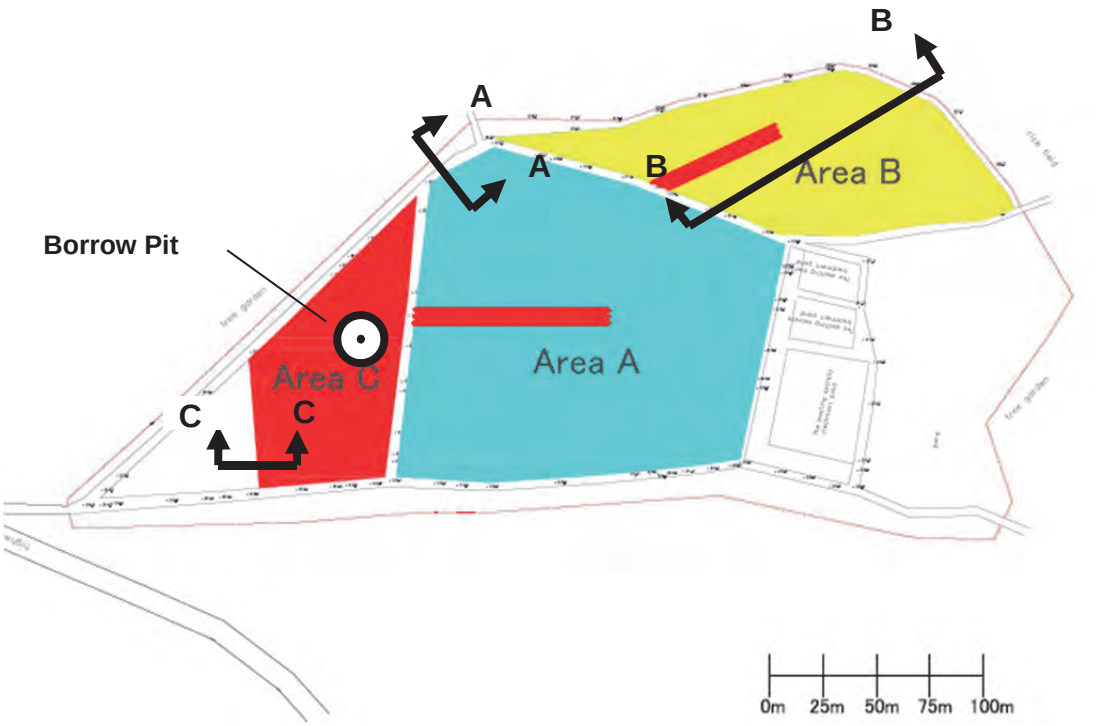
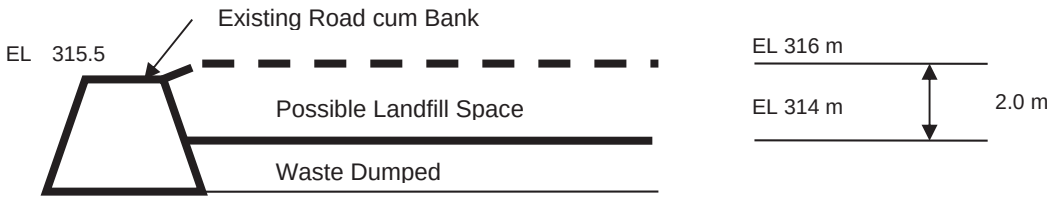


Figure 3: Landfill Area Operation Plan

1.2.1.2 Area A

Since Area A has been used as landfill, there is waste dumped as shown the Figure below. It is supposed that average dumped waste height is EL 314m and landfill operation will be continued until landfilled elevation become EL 316m. The highest elevation of the existing road cum surrounding bank is 315.5 m as shown in the Figure below.

Cross-section A-A

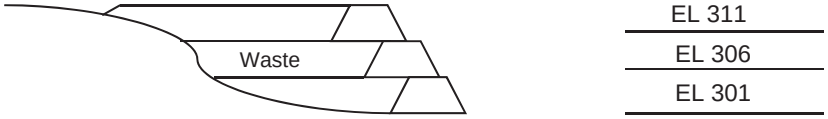


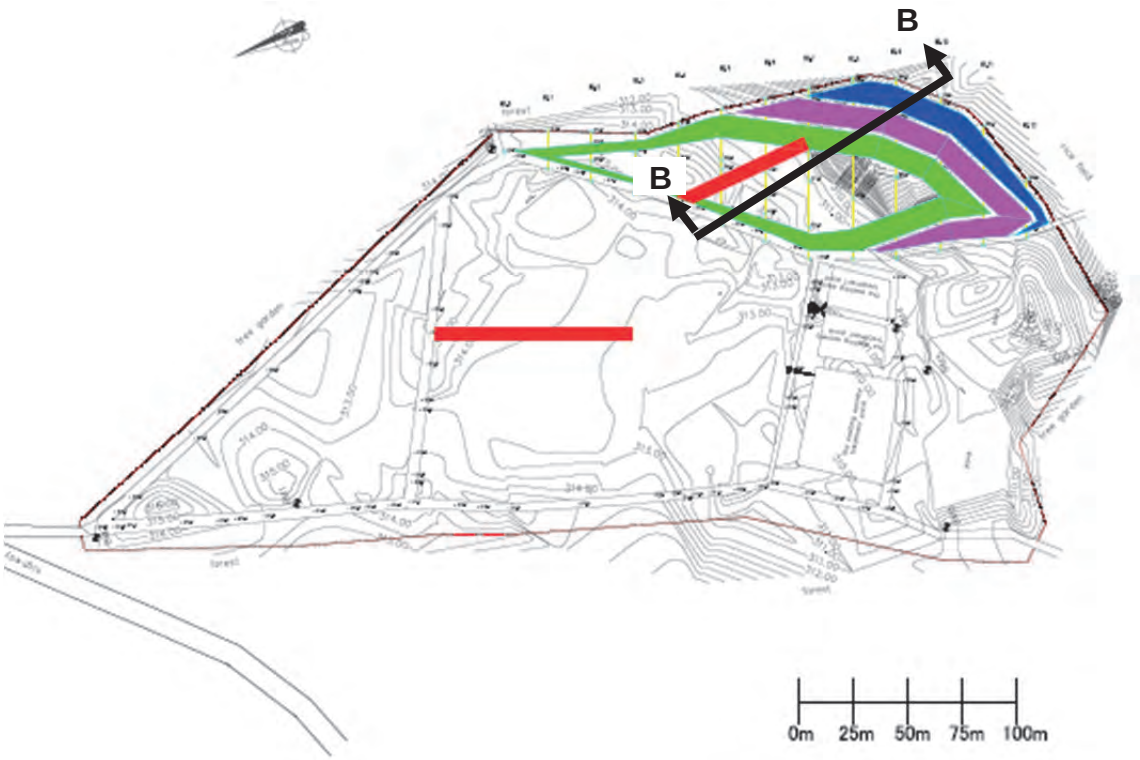
1.2.1.3 Area B

As shown the figure Area B will be landfilled by the three steps as shown in the Figure below. The first step landfill operation is conducted until the dumped waste height comes EL 306m. The dumped waste height becomes EL 311m by the second step

landfill operation. The final and completed landfill height will be EL 316m by the third step.

Cross-section B-B

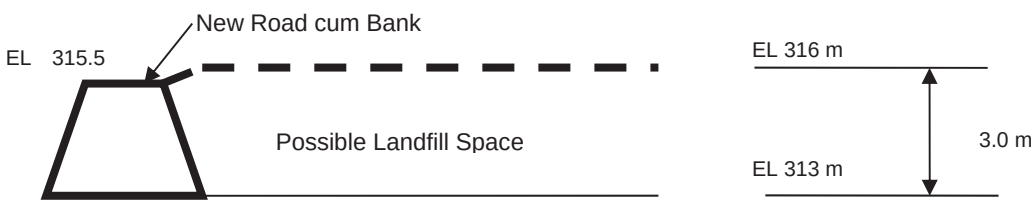




1.2.1.4 Area C

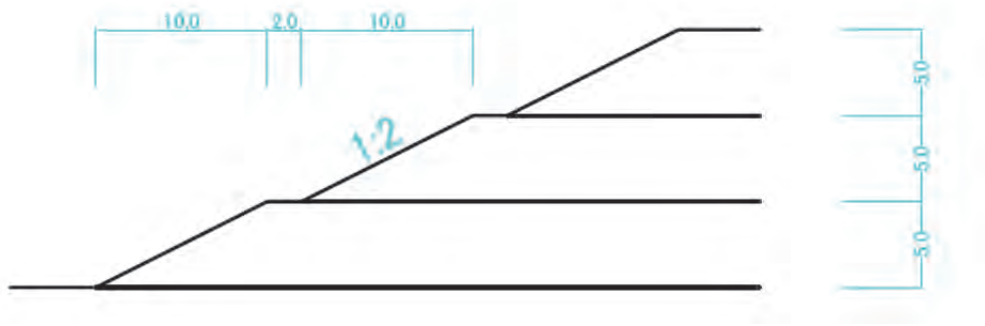
As for the Area C it is not used for landfill operation. Part of Area C new road cum surrounding bank will be constructed. The average height of Area C is supposed as EL 313m.

Cross-section C-C



1.2.1.5 Slope Structure and Grade

As shown in the Figure below the grade of landfilled waste slope shall be gentler than 1 (Height) to 2 (Length) in order for the excavator to compact the landfilled waste and cover soil on the slope. As indicated in the Figure maximum height of the slope shall be 5m. If the height is 5m the length shall be more than 10m and 2m of step shall be made before the commencement of next slope in order to avoid slope slide.



1.2.1.6 Enclosing Bank

In order to dispose waste of at designated place enclosing bank shall be constructed at the edge of the landfill. It is preferred to construct the bank by excavated soil. Considering very limited landfill budget, however, the bank could be constructed by using dumped waste. As indicated in the Figure below 1 to 2 m height of small bank (as shown in the dot line) will be constructed by using dumped waste. After filled up inside the bank and height of the landfilled area becomes about 5m, about 5m slope will be shaped as instructed in the above and cover soil on the slope.

1.2.1.7 Borrow Pit of Soil

As indicated in the Figure 3 proposed borrow pit of soil for covering slope and construction of access road will be Area C. It is advantage that in accordance with the excavation of soil the landfill capacity of Area C will increase.

1.2.2 Order of Landfill Area Operation

Proposed order of landfill area operation is as follows:

Phase 1. Landfill Area A up to EL 316m

Phase 2. Landfill Area B up to EL 316m

Phase 3. Landfill Area C up to EL 316m

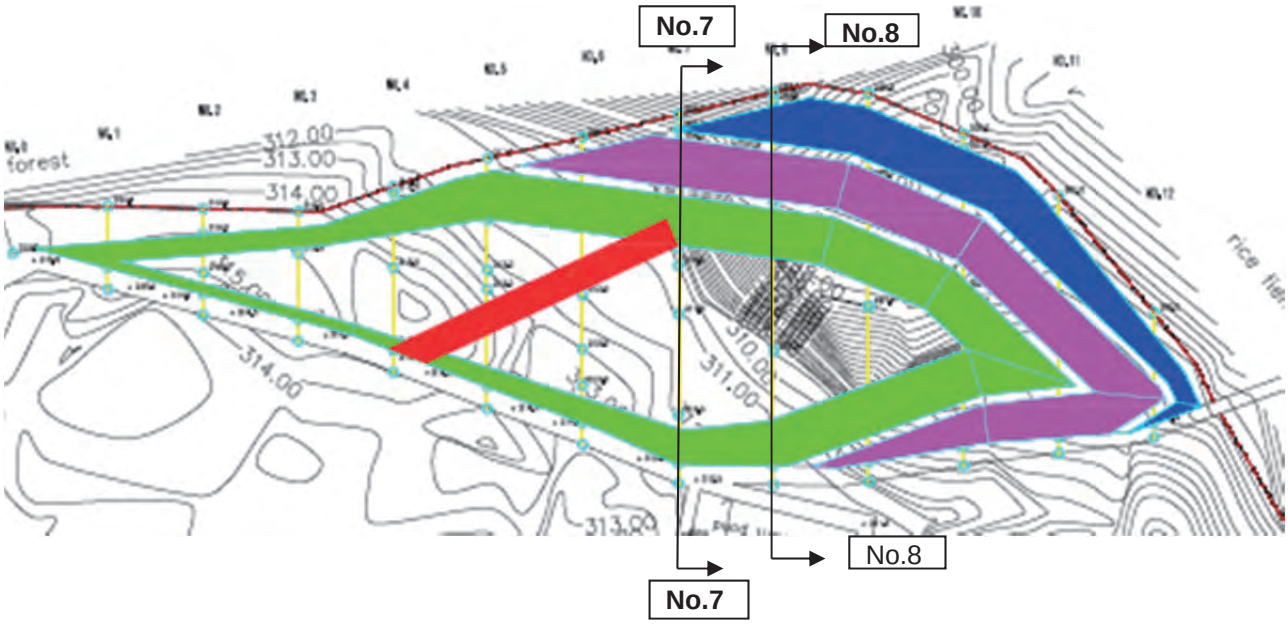
1.2.3 Duration of Landfill Area Operation

1.2.3.1 Possible Landfill Volume Calculation

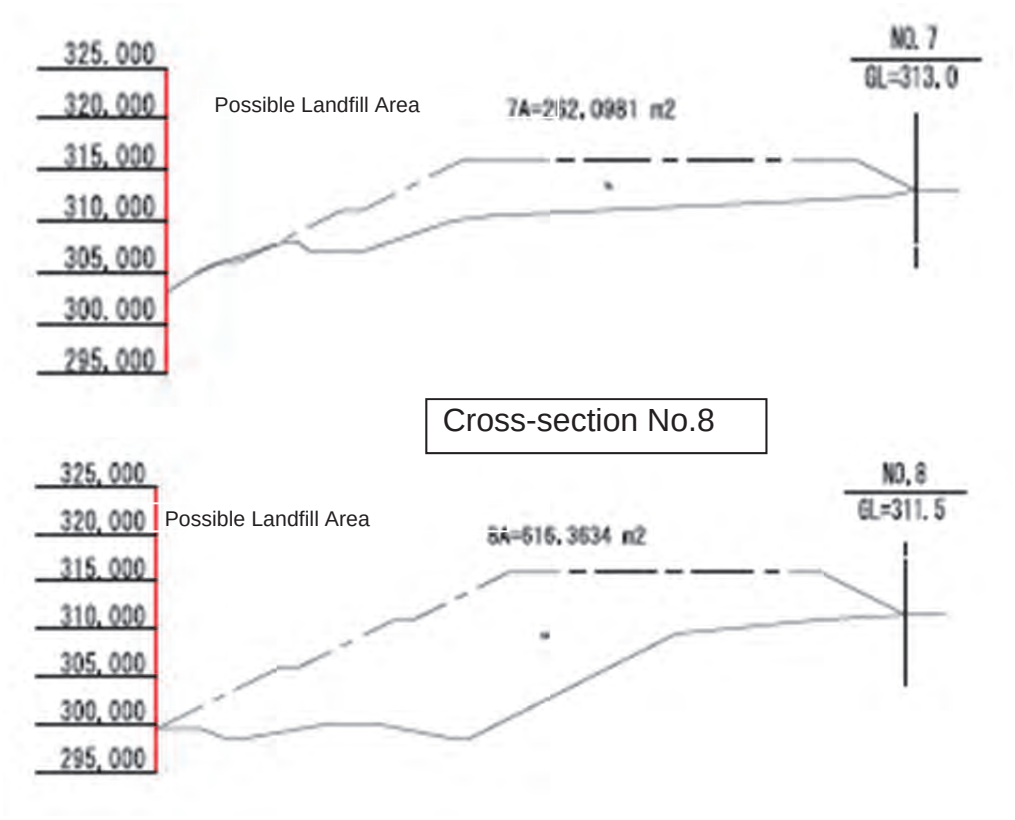
Possible landfill volume of Area A and C is calculated as following formula:

Possible Landfill Volume = Landfill Area x Average Landfill Height

As for the Area B is calculated as shown in the Figure 3: Landfill Area Operation Plan, landfill area operation plan of Area B is made by the CAD (computer aided design). Based on the CAD plan cross-section plans are prepared and possible landfill **area** of each cross-section (LACSx) is calculated by CAD system. The possible landfill **volume** of Area B is calculated by multiplying average area with width as shown in the table below.



Cross-section No.7



Cross-section No.8

Table 3: Possible Landfill Volume of Area B

Section No.	Width Between Section (m)	Landfill Area (m^2)	Average Landfill Area (m^2)	Landfill Volume (m^3)
No.0+5	0	0	0	0
No.1	15	2	1	17
No.2	20	10	6	121
No.3	20	19	14	286
No.4	20	34	27	533
No.5	20	110	72	1,443
No.6	20	175	142	2,849
No.7	20	262	219	4,371
No.8	20	616	439	8,785
No.9	20	750	683	13,661
No.10	20	481	615	12,308
No.11	20	196	339	6,774
No.12	20	32	114	2,289
No12+10	10	0	16	158
Total				53,595

Possible landfill volume of Area A, B and C is calculated as shown in the Table below. As shown in the table possible landfill volume of Phase 1, 2 and 3 operation will be 107,500 m^3.

Table 4: Possible Landfill Volume by Phase 1 and 2 Operation

Area	Area (m2)	Height (m)	Volume (m3)
Phase 1 (A)	22,308	2.0	44,616
Phase 2 (B)	-	-	53,595
Phase 3 (C)	3,094	3.0	9,281
			107,492

1.2.3.2 Duration of Landfill Area Operation

Based on the possible landfill volume of Phase 1, 2 & 3 operation, and the required landfill volume shown in the Table 2, the duration of landfill operation of each phase is estimated as follows:

Phase 1. Landfill Area A up to EL 316m

Possible Landfill Volume of Area A: about 44,600m^3

Possible Duration of Area A Operation: **Until the beginning of 2019.** Because the required landfill volume up to the end of 2018 is 37,595 m^3 according to the Table 2.

Phase 2. Landfill Area B up to EL 316m

Possible Landfill Volume of Area B: about 53,600m^3

Possible Duration of Area B&C Operation: **Until the end of 2022.** Because the required landfill volume up to the end of 2022 is 102,411 m^3 according to the Table 2 and total possible landfill volume of Area A + Area B is about 98,200 m^3.

Phase 3. Landfill Area C up to EL 316m

Possible Landfill Volume of Area C: about 9,300m^3

Possible Duration of Area C Operation: **Until the middle of 2023.** Because the required landfill volume up to the end of 2023 is 120,689 m^3 according to the Table 2 and total possible landfill volume of Area A + B + C is about 107,500 m^3.

1.3 Infrastructure Development Plan

In order to use the two possible landfill area (Area A&B) the new access road shall be constructed as shown in the Figure below.

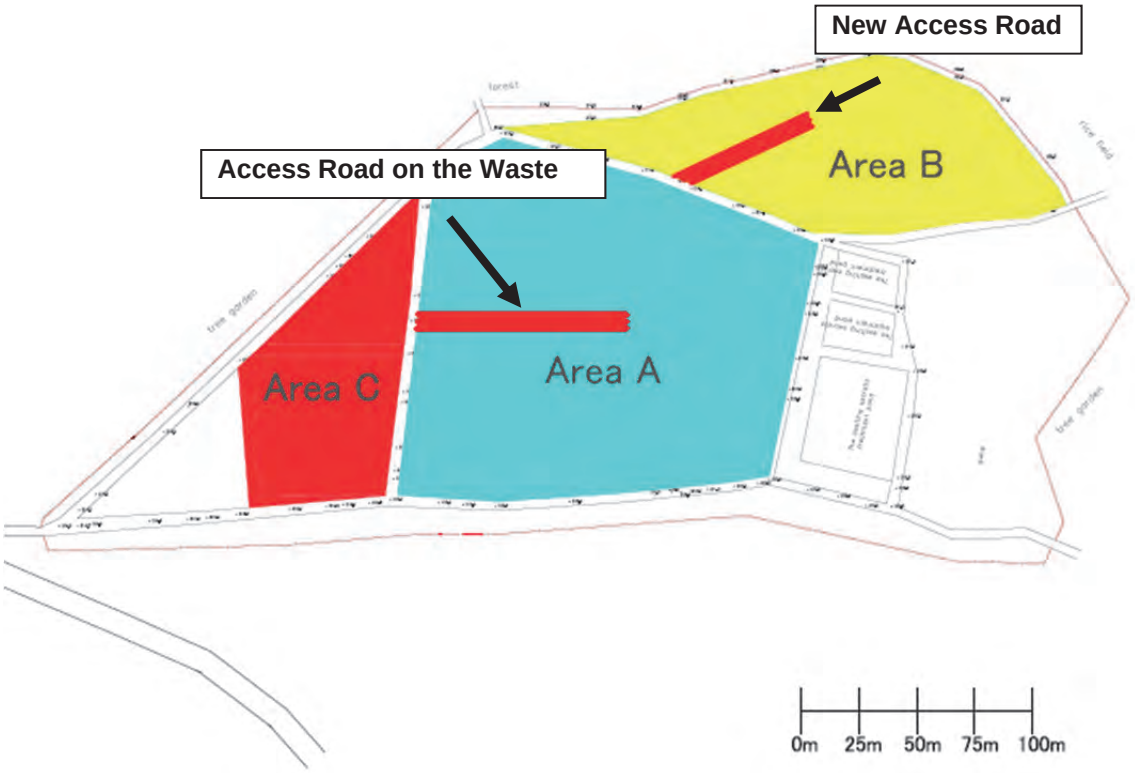


Figure 4: Infrastructure Development Plan

Volume of the works as follows;

- Access road on the waste dumped at the Area A: 100m
- New access road in the Area B: 60m

1.4 Operation Cost Estimation

Monthly operation cost of the landfill is calculated based on the Table below.

Table 5: Monthly Landfill Operation Cost

Items	Quantity	Monthly Cost (1,000 kip)	Remarks
1. Landfill Equipment			
1.1 Excavator (Bucket 0.6 m^3))	1		(18litr/hour x ??hour x 30day) x 7,200kip
1.2 Backhoe Loader	1		(?? litr/month by UDAA) x 7,200kip
1.3 Dump trunk for covering soil (10ton)	1		(?? litr/month by UDAA) x 7,200kip
2. Staff for operation of landfillsite			
2.1 Manager	1		
2.2 Excavator operator	1		
2.3 Backhoe Loader operator	1		
2.4 Dump truck driver for covering soil	1		
2.5 Foreman	1		
Total			

1.5 Other Important Issues for Proper Landfill Operation

For proper landfill operation the following issues shall be cleared:

- Clear instruction and control of dumping area to the landfill user, i.e. incoming vehicle. If an incoming vehicle does not follow the instruction, the vehicle shall be penalized.
- Provide the incoming vehicle smooth access to the dumping area. Therefore conduct frequent maintenance of access road. For the access road from paved road to the dumping area, concrete plate will be installed.
- Establish fare tipping fee system. Then revise tipping fee in order to conduct sanitary operation as much as possible, i.e. frequent cover soil, etc.
- Clear instruction and control of waste pickers not to work at the place where landfill equipment working.

2. Management of waste pickers

2.1 Identify the waste pickers

The ID cards of waste pickers are issued to identify and organize the waste pickers.

2.2 Rules and measures for the control of waste pickers in the KM 9 Disposal Site

In order to regulate and control the activities of waste pickers, UDAA established and issued "Temporary Regulation on Management and Monitoring KM9 Disposal Site" in May 2013. Furthermore, in order to facilitate control of waste pickers, UDAA in cooperation with SJET states the control of waste pickers in the KM9 disposal site as follows.

- Waste pickers are required to be registered for working at the disposal site.
- Waste pickers are required to bring the issued ID cards when they work at the disposal site.
- Waste pickers are required to put on safety jackets, gloves, masks and long boots.
- Waste pickers are required to have Preventive injection for infection disease
- Waste pickers are required not to work at the active disposal area to avoid any accident.

UDAA instructs the waste pickers to put on the gloves, boots and safety jackets when they work on waste picking and warned anybody.

2.3 Waste picker meeting

The regular waste picker meeting shall be held to manage the waste pickers.

2.4 Other Important Issues for Proper Waste Picker Management

After the reception of a bulldozer by the grant aid of the Japanese Government in November 2015, the operation method of the final disposal will be changed. For example, the frequency of waste movement and soil coverage will increase and the waste disposal work and waste picking work can have conflicts. The waste picker management rule will need a revision and all the waste pickers should understand it.

3. Monitoring

The on-site monitoring shall be carried out approximately once a year. It is recommended that the member of monitoring be from governmental agencies at the national, capital and district levels, social organizations (Labor Union, Women's Union and Youth Union).

The member of monitoring are given a lecture about the facility and operation of the disposal site, observed the facility operation and answered prepared questionnaires.

The questionnaire had a structure and questions shown below. The questions of Category A and B are asked every time of the monitoring. The result of monitoring shall be submitted to DONRE and UDAA and feedback to develop the operation of landfill site.

Check List for Monitoring Committee for the Landfill Site	Date: Time:

Category A: Environmental effect (Before and after construction)

No	Items	Acceptable	Medium	Terrible	Score	Notes
A1.	Fire & Smoke	0	1	2		
A2.	Offensive odour	0	1	2		
A3	Withering of trees caused by discharged waste	0	1	2		
A4	Waste scattering	0	1	2		
A5.	Animals (dogs, monkeys, birds etc.)	0	1	2		
A6	Vermin (Flies, etc.)	0	1	2		
A7.	View	0	1	2		
A8.	Working condition of waste pickers	0	-	2		
	Total of Category A					

Category B: Function of Facilities (After construction)

No	Items	Functioning	Medium	Not functioning	Score	Notes
B1.	Covering soil at new discharge area	0	1	2		
B3	Access road	0	1	2		
B4.	Treatment facility of sludge from septic tanks					
	Sedimentation pond	0	1	2		
	Treatment pond	0	1	2		
	Total of Category B					

Comment:

Name & Signature

Appendix 5.

OPERATION AND MAINTENANCE MANUAL FOR THE SEPTIC TANK SLUDGE TREATMENT POND AT XYB KM 9

(2015)

LPP-Environment-Component

In cooperation with JICA Experts Team

This is the Operation and Maintenance Manual for the septic tank sludge treatment pond established at KM9 final disposal site in Xayabouri District.

1. Outline of the septic tank sludge treatment ponds

The objective of the septic tank sludge treatment ponds is to remove the suspended solid (SS) of septic tank sludge collected in the Xayabouri District. The septic tank sludge treatment ponds contribute to reduce the suspended solid (SS) load in the oxidation pond. The septic tank sludge treatment ponds consist of a receiving tank and two parallel sedimentation pits and following oxidation pond. The layout of receiving tank, sedimentation pits and treatment ponds is shown in the following figure.

- The functions of the receiving tank is to screen the large particle matter of discharged septic tank sludge and to avoid the turbulence at the sedimentation pit due to high velocity of influent from receiving tank.
- The function of the 1st and the 2nd sedimentation pits is to removes the suspended solid (SS) of septic tank sludge.
- The effluent of the both sedimentation pits is flowing to the existing oxidation pond to remove BOD_5.
- The effluent of the treatment ponds flows to the drain along the site.

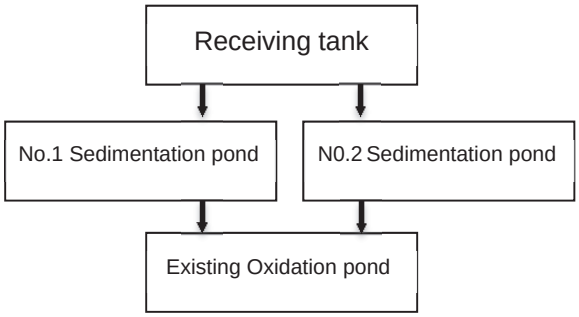


Fig: The layout of receiving tank, sedimentation pits and oxidation pond

2. Specification the septic tank sludge treatment ponds

(1) Designed treatment capacity: $18m^3$/day x 2 lines
(2) Volume capacity of tank and pit
- receiving tank : Flexible volume
- the 1st sedimentation pit : $450m^3$ x 1 lines
- the 2nd sedimentation pit : $450m^3$ x 1 lines
- treatment pond : $1,750m^3$ x 1line

(3) Retention time
- the 1st sedimentation pit : 25days （=$450m^3$ / $18m^3$/day）
- the 2nd sedimentation pit : 25days （=$450m^3$ / $18m^3$/day）
- treatment pond : 97days (=$1,750m^3$/$18m^3$=97days)

3. Operation principles of the septic tank sludge treatment ponds

There are following four principals of operation of the septic tank sludge treatment ponds.

(1) Target of treatment is the septic tank sludge
(2) Usually one line of the sedimentation pit is operated.
(3) In case that the amount of discharged septic tank sludge is quite large and one line is not enough, two lines of the sedimentation pits are operated.

(4) Sedimentation settled out and scum floating in the receiving tank and the sedimentation ponds is regularly removed to avoid blocking of drains and decreasing of retention time.

4. Work procedure of the collection vehicle of septic tank sludge and administration office at KM9 final disposal site

(1) The collection vehicle of septic tank sludge shall be designated at the administration office at KM9 final disposal site beforehand.
(2) The driver of collection vehicle of septic tank sludge shall report the amount and collection area of septic tank sludge to the administration office at KM9 final disposal site before approaching the septic tank sludge treatment ponds.
(3) The administration office shall record the reported information and instruct the location of the septic tank sludge treatment ponds where septic tank sludge should be discharged.
(4) The driver of collection vehicle of septic tank sludge shall properly discharge sludge to the receiving tank instructed by administration office.
(5) The driver of collection vehicle of septic tank sludge shall clean the surrounding of receiving tank after discharging the sludge.

5. Maintenance of the septic tank sludge treatment ponds
(1) Receiving tank, sedimentation pits and drains shall regularly be inspected and the clog shall be cleared, such as scum in the drains.
(2) The sedimentation settled out in the receiving tank and sedimentation pit shall be removed more than two times in a year; beginning and end of dry season.
(3) In case that the receiving tank and sedimentation do not function well due to the too much sedimentation, the sedimentation shall be removed more frequently.
(4) The area between two lines can be used as the access road for the operation of heavy machinery and dump truck.

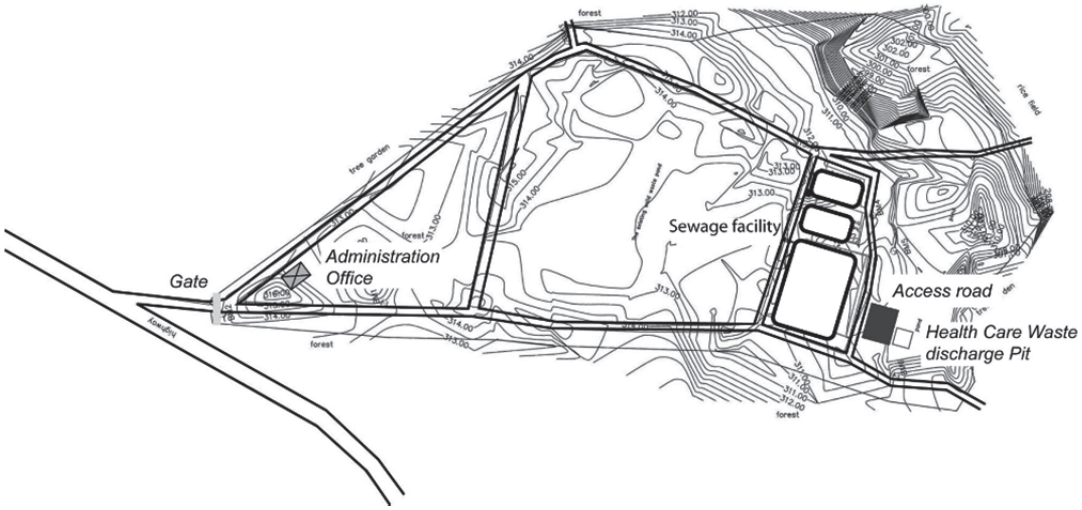
6. Methodology of removing sedimentation
(1) The sedimentation in the receiving tank shall be removed by manual.
(2) The wastewater in the sedimentation pit shall be sucked by collection vehicle of septic tank sludge before removing the sedimentation and scum in the pit. The volume of wastewater sucked is estimated 240 m^3 and 40 loading of 6m^3 collection vehicle of septic tank sludge are required.
(3) The sedimentation settled out in the sedimentation pit shall be removed by the excavator and load it to the dump truck. The volume of removed sedimentation is estimated approximately 240m^3 from one line.
(4) The removed sedimentation shall be discharged at the designated place in the final disposal site.
(5) Maintenance of oxidation pond is not implemented for a while.

Photo: Removal of sedimentation by excavator
（VTE KM32）

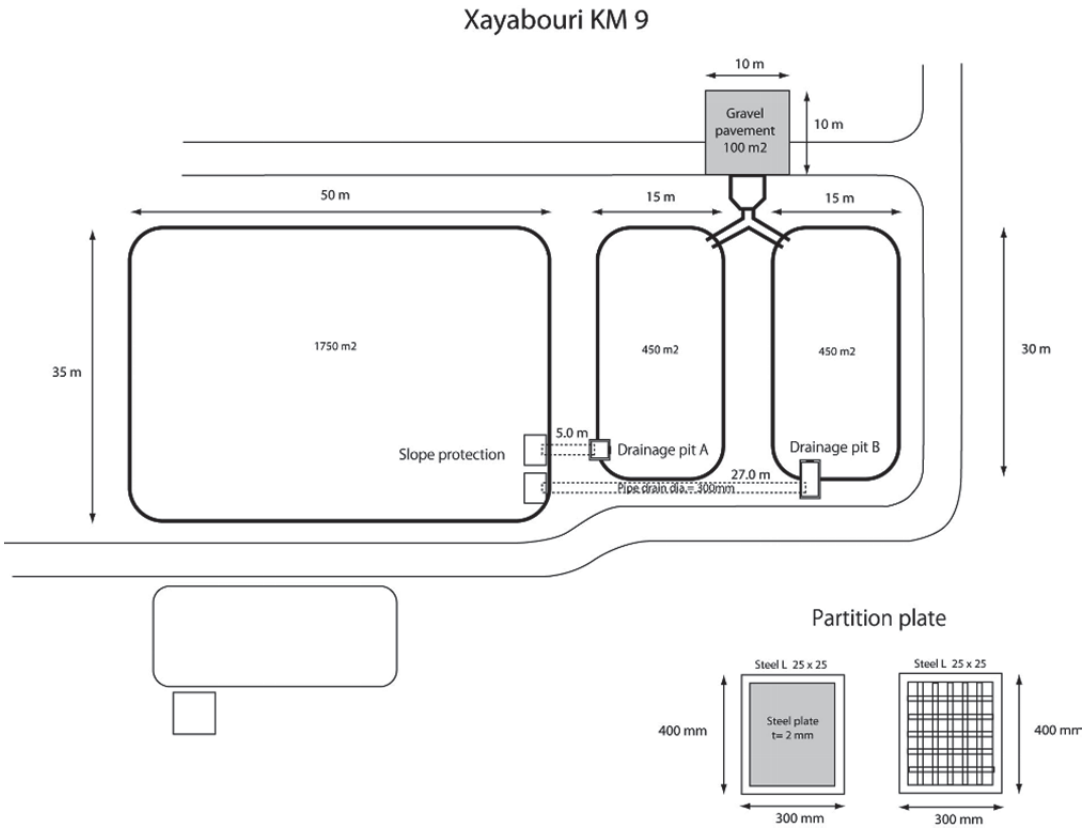
Photo: Removal of sedimentation by excavator
（VTE KM32）

7. Annex

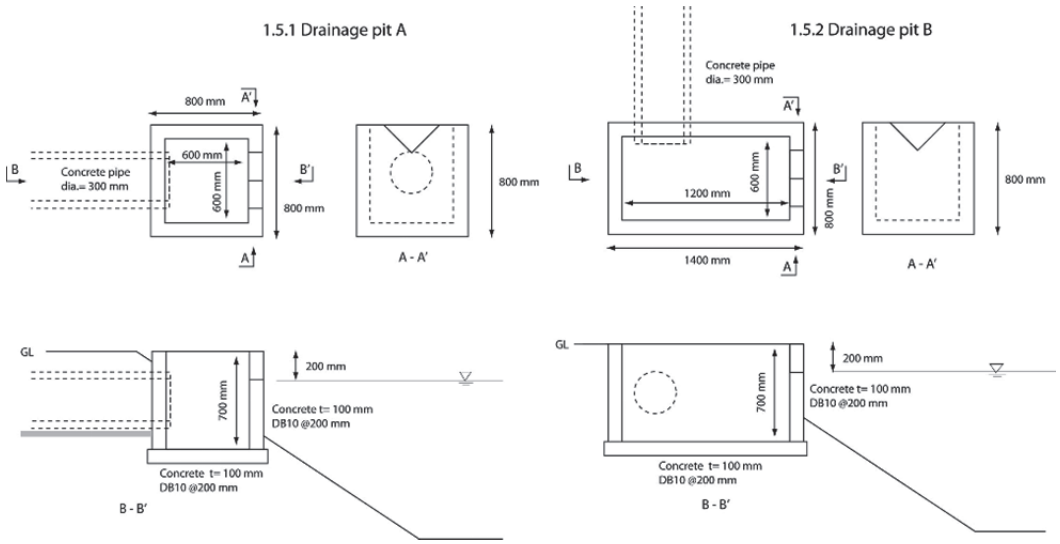
(1) The location of septic sludge treatment pond



(2) Plan of septic sludge treatment pond



(3) Cross Section of pit



Appendix 6. Plan for Healthcare Waste Management (HCWM)

1 HCWM in May 2012

1.1 HCWM in XYB

1.1.1 HCWM in the XYB Provincial Hospital

In May 2012, an interview survey was carried out at XYB provincial hospital. This is the major source of infectious waste in XYB.

As observed at hospitals in VTE and LPB, this hospital also refers to the MOH's Decree No.1706 and separats waste into infectious waste, sharps and general wastes. General waste is put into black bags, and infectious (and sharps) waste is also put into black bags, due to the scarcity of yellow bags, with yellow tags. Even though such separation practice, all the bags finally go to the single 5m3 container for collection.

1.1.2 Collection Service for the XYB Provincial Hospital

The waste collection provided to the XYB Provincila Hospital in May 2012 is summarized below.

	A	B	C	D
No	**Name of Hospitals**	**Fee for General Waste (kip/month)**	**Fee for Infectious Waste (kip/month)**	**Separate Collection**
1	XYB provincial	800,000	LS	No

LS: lumpsum (fee for general waste collection covers infectious waste collection)

As Column D shows, no separate collection is provided. As mentioned earlier, all the waste is collected by a container collection system. According to the UDAA, which operates the container collection system, the contract with the hospital only allows the discharge of general waste and the hospital is supposed to treat their infectious waste by itself. In fact, the hospital has an abandoned incinerator nearby the waste container. It is hardly used due to the complaint of smell and smoke from the neighbors.

1.2 Medical Institutions (MIs) in XYB

According to the information from the XYB Province Health Department, the following medical institutions (MIs) are located in XYB district.

Table 1: Medical Institutions (MIs) in XYB

Name of Medical Institution (MI)	Nos of MI	Nos of bed	Occupancy Rate (%)	Infectious Waste Amount (incl. Sharp Waste) (kg/day)	Waste Collection Service Provider
Provincial Hospital	1	120	63.4	16 (*1)	UDAA
Military Hospital	1	20		3 (*2)	UDAA
Clinics	10	-			UDAA
Total	12	140		19	

Source: XYB Province Health Department

(*1) Data obtained by weighing for a week, with the average of 0.13kg/bed/day without regard for bed occupancy rate in May 2012.

(*2) 0.13kg/bed/day multiplied by the number of beds.

Figure 1: Location of the Two Main Hospitals in XYB District

2 HCWM Plan in XYB District

2.1 Goal of the HCWM in XYB District

In order to improve HCWM, SJET and the C/P (UDAA and DONRE) established the target year as 2020 and the following goals.

Table 2: Goal of the HCWM in XYB District in the Year 2020

Name of Medical Institution (MI)	Nos of MI	Nos of bed	Waste Collected by	Treatment & Disposal Method
Provincial Hospital	1	120	UDAA	Separate collection, Separate disposal by 2015
Military Hospital	1	20	UDAA	Separate collection, Separate disposal by 2015
Clinics	10	-	UDAA	Separate collection, Separate disposal by 2020
Total	2	140		

2.2 HCWM Plan in XYB District

Since there is no HCW incinerator in XYB in 2015, HCWM plan divided into the following two phases:

- Phase 1 (2015): HCWM Plan without a HCW Incinerator
- Phase 2 (2020): HCWM Plan with a HCW Incinerator

2.2.1 Phase 1 (2015): HCWM Plan without a HCW Incinerator

a. Basic Conditions

Phase 1 HCWM plan in XYB district is formulated based on the following conditions:

- HCW is divided into **i. General waste** (non-infectious waste) and **ii. Infectious waste**.
- Infectious waste is divided into **ii-1. Putrefactive infectious waste** (body parts, etc.) and ii-2. **Non-putrefactive infectious waste**.
- Since general waste (non-infectious waste) is collected, treated and disposed of by the municipal collection service, HCWM plan focuses on the infectious waste.

b. Basic HCWM Flow in 2015

Basic HCWM Flow in 2015 is made based on the following assumptions:

1. All the HCW generated in XYB should be separated into i. **General waste** and ii. **Infectious waste**.
2. General waste shall be collected by municipal solid waste (MSW) collection service and disposed of at KM9 DS together with MSW.
3. Infectious waste shall be separated into ii-1. **Putrefactive infectious waste** (body parts, etc.) and ii-2. **Non-putrefactive infectious waste**.
4. The non-putrefactive infectious waste shall be separately collected and disposed of at the infectious waste (IW) pit at KM9 DS.
5. Since the IW pit at KM9 DS should not receive putrefactive infectious waste, putrefactive infectious waste should be managed by each hospital.

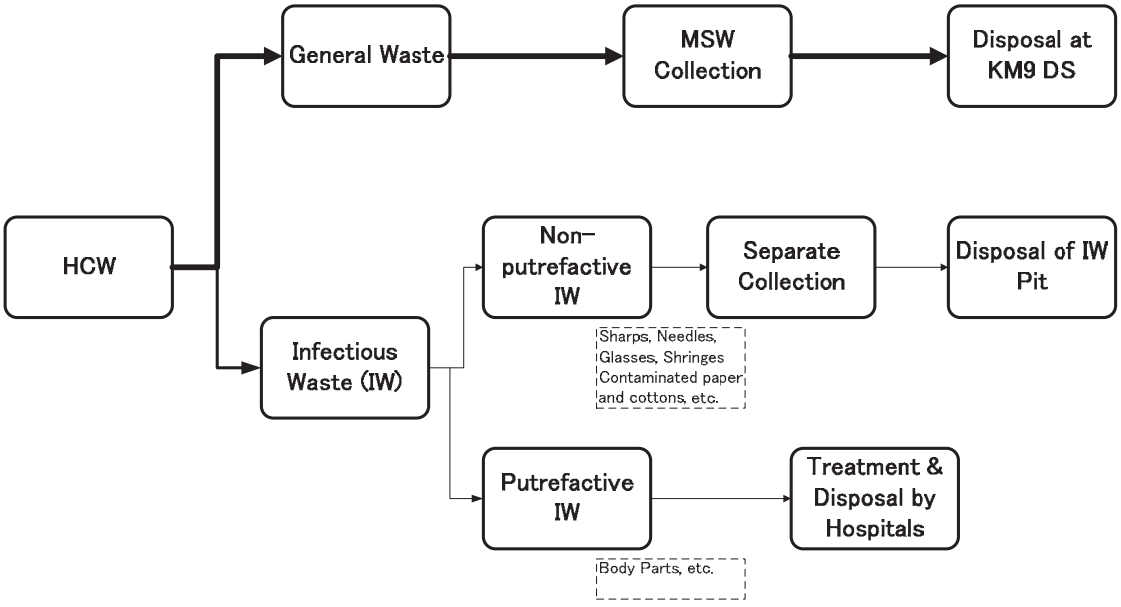


Figure 2: Basic HCWM Flow in 2015

c. Discharge, Collection and Transportation

In order to achieve the goal and realize the HCWM flow in 2015, improvement of discharge, collection and transportation system will be implemented as described below.

1. By 2015, the large HCW generators should be obligated to separate their HCW and to discard infectious waste separately using special containers.
2. The special containers containing infectious waste will be loaded onto the collection truck with other general waste and infectious waste is separately disposed of at the isolated pit.
3. Separate collection of infectious waste will be commenced from the largest generator, i.e. the Provincial Hospital.
4. Necessary legal documents should be prepared by the commencement of separate collection service.
5. Financial management system shall be established in order to support the separate collection service.

d. Treatment and Final Disposal

In order to achieve the goal and realize the HCWM flow in 2015, improvement of treatment and disposal system will be implemented as described below.

1. By March 2013 an HCW isolated pit is constructed at the KM 9 disposal site (KM9 DS).
2. By December 2015 the infectious waste separately collected from the two main generators, i.e. Provincial and Military hospitals, should be disposed of at the isolated waste pit of KM9 DS
3. Necessary legal documents should be prepared by the commencement of infectious waste disposal of at the isolated pit.
4. Financial management system shall be established in order to support the infectious waste disposal of at the isolated pit.

2.2.2 Phase 2 (2020): HCWM Plan with a HCW Incinerator

a. Basic Conditions

Phase 2 HCWM plan in XYB district is formulated based on the following conditions:

- HCW is divided into **i. General waste** (non-infectious waste) and **ii. Infectious waste**.

- Infectious waste is divided into **ii-1. Combustible infectious waste** (subjected waste for incineration) and **ii-2. Incombustible infectious waste** (needles, sharps, etc.).

- Since general waste (non-infectious waste) is collected, treated and disposed of by the municipal collection service, HCWM plan focuses on the infectious waste.

b. Basic HCWM Flow in 2020

Basic HCWM Flow in 2020 is made based on the following assumptions:

1. All the HCW generated in XYB should be separated into i. **General waste** and ii. **Infectious waste**.
2. General waste shall be collected by municipal solid waste (MSW) collection service

and disposed of at KM9 DS together with MSW.

3. Infectious waste shall be separated into ii-1. **Combustible infectious waste** (Contaminated cottons, etc.) and ii-2. **Incombustible infectious waste**.
4. The **incombustible infectious waste** shall be treated by the generation source if treatment facility like an autoclave is available, and separately collected and disposed of at the infectious waste (IW) pit at KM9 DS.
5. The **combustible infectious waste** shall be separately collected and transported to the incinerator at the KM9 disposal site. Then it shall be incinerated and ash from incineration shall be disposed of at the IW pit at KM9 DS.

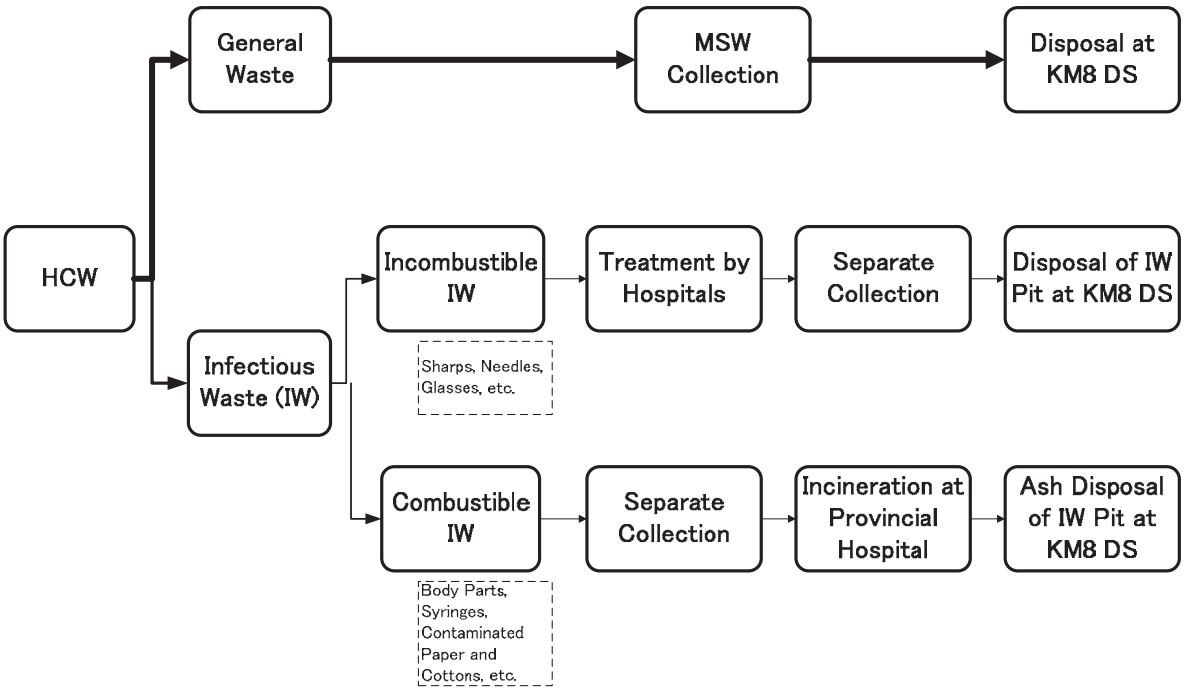


Figure 3: Basic HCWM Flow in 2020

c. Estimation of the Infectious Waste Generation

Future infectious waste generation is estimated by setting the following conditions:

- Infectious waste generation amount in 2012 is based on the survey results as shown in the Table 1.
- The infectious waste generation amount from 10 clinics in the Table 1 is assumed 20% of total generation amount from all hospitals in the table, i.e. 2kg/day.
- Then total infectious waste generation amount in 2012 in XYB District is 21 kg/day.
- The infectious waste generation amount is assumed to increase in accordance with the population growth, **2.2%**[1]. Consequently infectious waste generation amounts in 2015 and 2020 is calculated as 22 and 25 kg/day respectively.

[1] National population growth rate in 2009 is **2.2%** according to the "Statistical Year Book 2009, Ministry of Planning and Investment, Lao PDR".

- According to the incineration record of the Provincial Hospital in LPB the rate of combustible and incombustible infectious waste is assumed as 1:3.

Based on the above-mentioned assumption, infectious waste generation amount is estimated as shown in the table below

Table 3: Estimation of Infectious Waste Generation Amount

Unit: kg/day

HCW	2012	2015	2020
ii-1. Combustible Infectious Waste	5.3	5.5	6.3
ii-2. Incombustible Infectious Waste	15.7	16.5	18.7
ii. Infectious Waste	**21**	**22**	**25**

d. Discharge, Collection and Transportation

In order to achieve the goal and realize the HCWM flow in 2020, improvement of discharge, collection and transportation system will be implemented as described below.

1. By 2015, the path forwards 2020 must be clear. Therefore, the large HCW generators should be obligated to separate their HCW and to discard infectious waste separately using designated bags and/or container.
2. Separate collection of infectious waste will be commenced from the large generator, i.e. the Provincial Hospitals.
3. A collection vehicle for infectious waste collection shall be procured before the commencement of separate collection of infectious waste.
4. Necessary legal documents should be prepared by the commencement of separate collection service.
5. Financial management system shall be established in order to support the separate collection service.

2.2.3 Treatment and Final Disposal

In order to achieve the goal improvement of treatment and disposal system will be implemented as described below.

1. In 2019 an incinerator shall be constructed at the KM9 disposal site and conduct test operation.
2. By the beginning of 2020 the incinerator shall be commenced full operation for the combustible infectious waste generated in the Provincial Hospital.
3. After the procurement of the infectious waste collection vehicle, the incinerator shall receive the combustible infectious waste from other medical institutions (MIs) than the Provincial Hospital.
4. By 2020, all infectious waste generated in XYB district should be separately collected, treated and disposed as described above.
5. Necessary legal documents should be prepared by the commencement of infectious waste disposal of the incinerator.
6. Financial management system shall be established in order to support the infectious waste disposal of at the isolated pit.

Based on the above-mentioned assumption, infectious waste management in 2012, 2015 and 2020 is described as shown in the table below.

Table 4: Targets of Infectious Waste Management

Unit: kg/day

HCW	2012	2015	2020
A. Infectious Waste Generation	21 (16)	22 (17.1)	25
B. Combustible Infectious Waste Generation*1	5.3	5.5 (4.3)	6.3
C. Incombustible Infectious Waste Generation*2	15.8	16.5 (12.8)	18.7
D. Separate Collection	0	15.2	25
E. Incineration	0	0	6.3
F. Disposal at the Isolated Pit of KM9 DS	0	15.2	20.0*3

Note: Figure in parenthesis in infectious waste generation in the Provincial Hospital.
*1 = A/4
*2 = A x 3/4
*3 = 18.7 + (6.3 x 0.2)

3 Implementation of HCWM Plan

3.1 Implementation of HCWM Plan

3.1.1 Before the Implementation of HCWM Plan

Separate collection and disposal of IW has not been conducted in XYB District. The HCWM study in the Provincial hospital conducted in May 2012 found out as follows:

- The Provincial hospital discharged all the waste into the waste container, which was transferred to the final disposal site.
- Consequently infectious HCW was disposed of at the KM9 disposal site together with general HCW and other municipal waste.

3.1.2 Implementation of HCWM Plan

a. Separate collection, treatment and disposal of infectious HCW

As for separate collection and disposal of infectious HCW, the target of HCWM pilot project (PP) is not achieved because separate collection and disposal is not conducted for the infectious HCW from the Military Hospital.

b. Separate collection and disposal

As for the separate collection and disposal, the disposal amount recorded at the KM9DS by UDAA from May 2012 to July 2015 is shown in the table below.

Table 5: Separate Collection and Disposal Amount of Infectious HCW in XYB

Duration	Nos of 240L Containers	Average Loading Ratio (%)	Total Collection & Disposal Amount (kg)	Average Daily Collection & Disposal Amount (kg/day)
October to December 2013	40	55.6	801	8.71
January to June 2014	80	51.3	1,476	8.15
July to December 2014	80	46.3	1,332	7.24
January to June 2015	77	47.1	1,305	7.21
July 2015	14	42.9	216	6.97
Total	**291**	**49.0**	**5,130**	**7.67**

(Note)
*1: Collection and disposal amount is estimated by the formula of Unit Weight of Infectious HCW (0.15 kg/ltr) x 240 ltr x Average Loading Ratio /100.
*2: Loading ratio is measured by visual observation.
*3: Unit weight is made by estimation.

The table above indicate the following aspects:

- The average number of 240L container collection per month is 13.2. Then freaquency of collection is about three times per week.

- Average daily disposal amount is 7.67 kg/day. It is about half of 16kg/day that was estimated by using generation rate of 0.13kg/day/bed measured by the weighing suvey conducted about one week in May 2012. The reason of it may be because of separate management of putrefactive infectious HCW by the Provincial hospital.

- The amount of separate collection and disposal has been reducing comparing with if of the commencement in late 2013. It may be because of strict separate discharge by the Provincial hospital.

3.2 Recommendation of Improvement Measures

Since separate collection and disposal is not conducted for the infectious HCW from the Military Hospital as described above, the target of HCWM PP is not achieved. UDAA, however, has been conducting separate collection and disposal of the infectious HCW from the Provincial Hospital from August 2013 by making contract with the hospital. In order to achieve the target in 2020 of the HCWM plan, all infectious HCW in XYB district will be separately collected, treated and disposed, UDAA in cooperation with DOH is recommended to take the following improvement measures by continuing and expanding the PP:

1. UDAA shall make contract with Military hospital on the separate collection and disposal service of infectious HCW and conduct it as soon as possible.
2. Review and modify the HCWM plan by making reliable list of MIs in XYB district and using data of the list.
3. Based on the review of the HCWM plan, UDAA shall formulate and implement a construction plan of an incinerator which has enough capacity to treat all IWs in XYB district.
4. In order to introduce the incinerator UDAA shall learn the experiences of VTE Capital and LPB, and establish necessary legal tools. Then it shall ask fair fee to users.
5. UDAA shall also examine to construct next infectious HCW disposal pit.

Appendix 7.

OPERATION AND MAINTENANCE MANUAL FOR THE HEALTH CARE WASTE PIT AT XAYABOURI KM 9 (2015)

LPP-Environment-Component

In cooperation with JICA Experts Team

This is the operation and maintenance manual for the health-care waste (HCW) pit constructed at KM9 disposal site in Xayaburi

1. Outline of health-care waste pit
   The objective of the health-care waste pit is to properly dispose the health-care waste generated by the hospitals in Xayaburi District. The target health-care waste (HCW) to be disposed is non-putrefactive infectious waste properly separated and collected by the Urban Development Administration Authority (UDAA) in Xayaburi. Putrefactive waste such as body parts shall be treated and disposed at each hospital in Xayaburi.

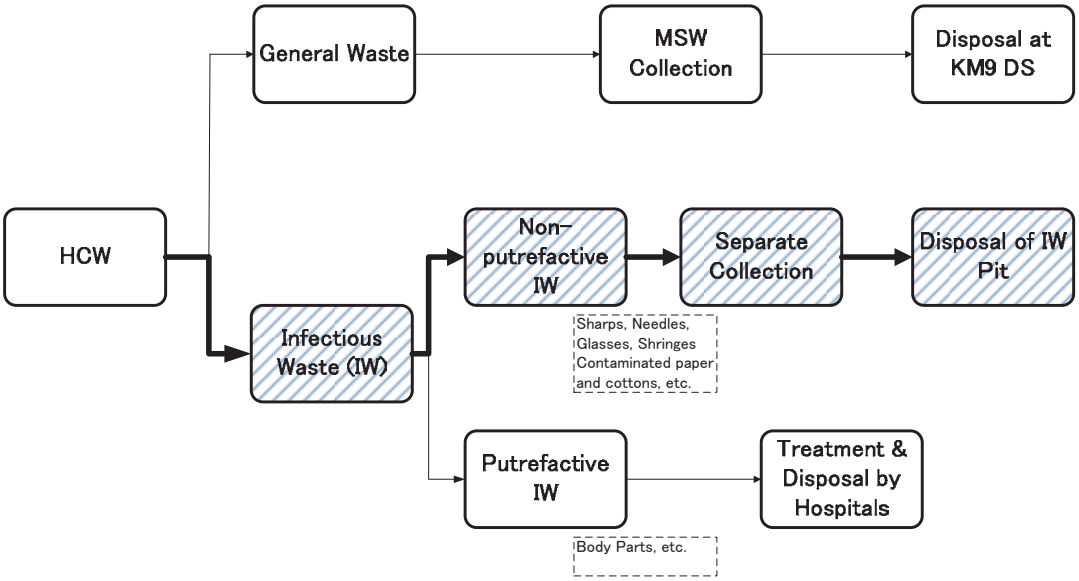


Figure 1: Waste Stream of non-putrefactive waste from HCW

2. Specification of the HCW pit
   (1) Structure: Excavated pit consists of reinforced concrete floor and brick wall with mortar finishing, while the building on the excavated pit consists of zinc material roof and galvanized sheet wall. HCW is discharged at the two doors on the wall. (refer to the drawings)
   (2) Volume of HCW pit: $50m^3$
   (3) Effective volume of HCW pit:$37.5m^3$
   (4) Dimension of HCW pit: W-5m x L-5m x D- 2m (Effective depth 1.5m)

3. Operation principles
- Target HCW is non-putrefactive health care waste.
- HCW pit is paved with mixed sand and gravel of 60 cm thickness on the floor to mitigate the underground water through the pit wall.
- When the HCW is filled with up to effective volume, new HCW pit shall be constructed by using the used roof material, walls, columns and beams.
- After the HCW pit is filled with the HCW, it shall be covered by soil and water proof material to close the HCW pit.

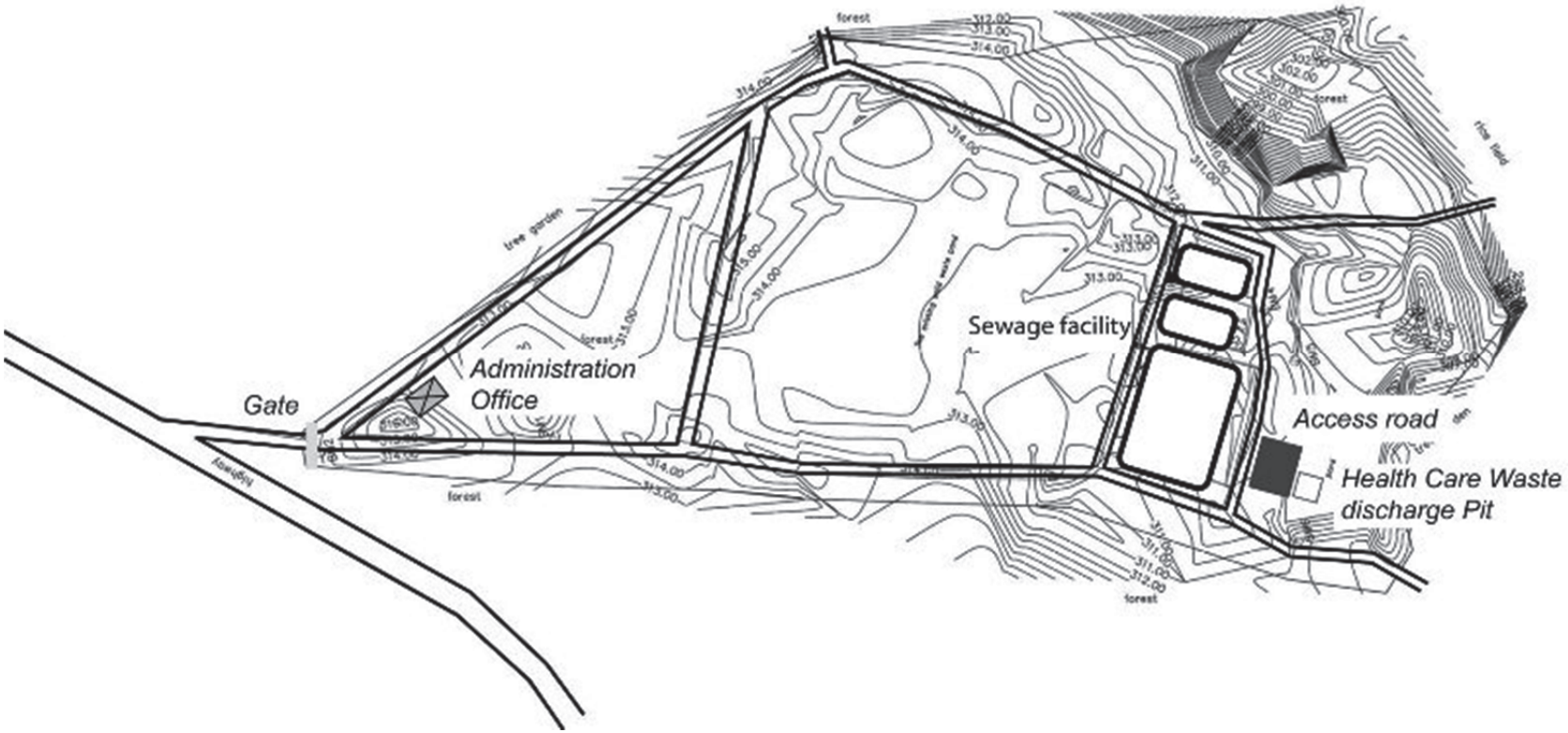
4. Operation manual
   (1) HCW is collected and transported to the HCW pit at KM9 by the designated HCW collection vehicle.

(2) The designated HCW collection vehicle shall report the amount of the HCW and the name of hospitals discharging the HCW to the administration office of disposal site.
(3) The administration office shall record the data reported by the designated HCW collection vehicle then give the door lock key of the HCW pit to the driver of it.
(4) The driver of the designated HCW collection vehicle shall unlock and open the door of the HCW pit. The HCW is carefully disposed to the pit by the driver wearing gloves and masks.
(5) The door is properly locked and the key of door is given back to the administration office by the driver. The driver shall inform to the administration office that the HCW is disposed according to proper procedure.

5. Maintenance of the HCW pit
(1) The door lock, roof and walls shall be regularly checked to avoid malfunction and damage.
(2) The discharged HCW in the pit is covered by 20 kg of hydrated lime once a year for disinfection.
(3) Effective depth of discharging HCW pit is 100 mm below the top of brick wall.
(4) Final covering shall be dealt with by concrete or high-density polyethylene (HDPE) sheet with covering soil.

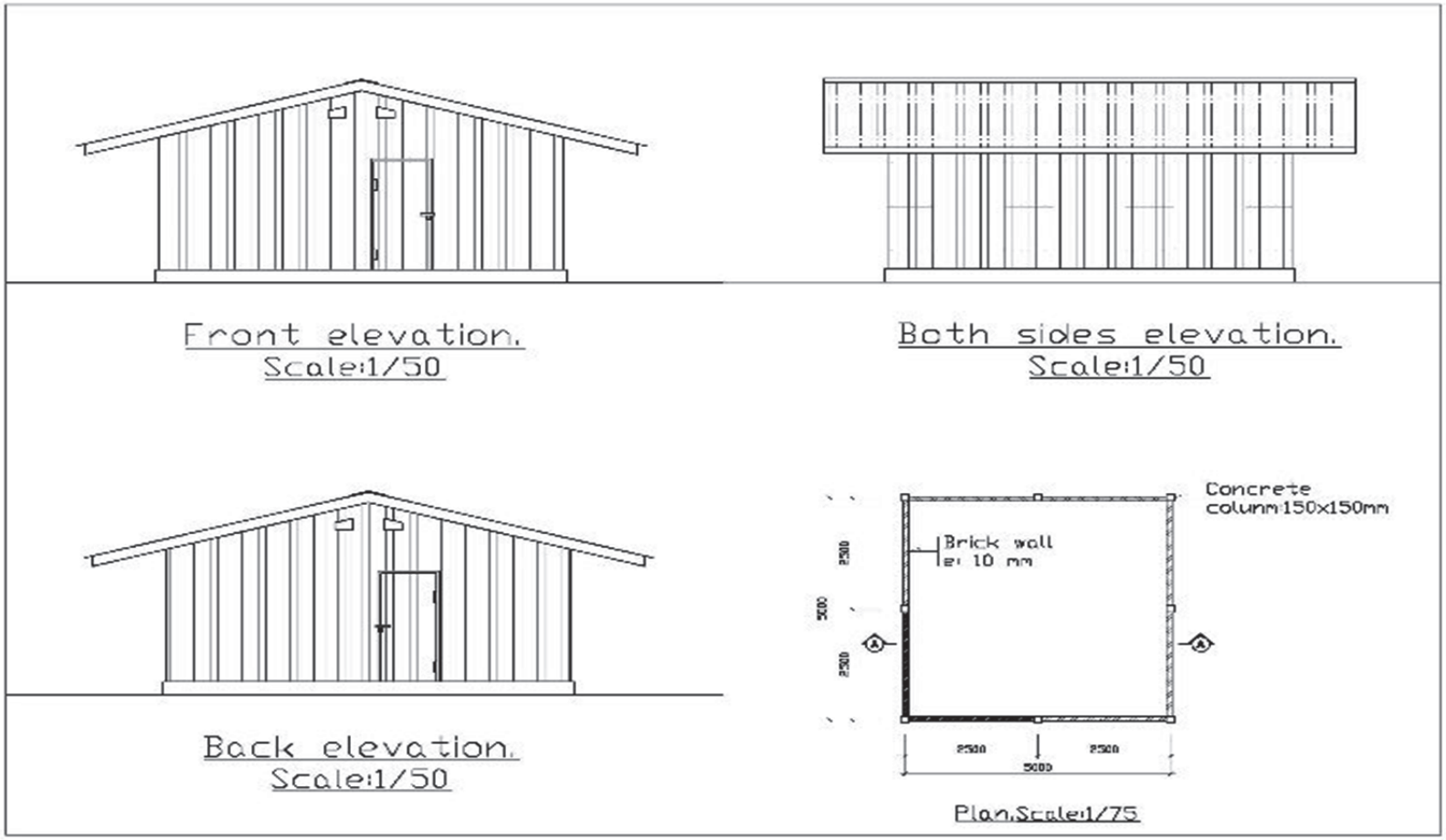
6. References

(1) Location of HCW pit

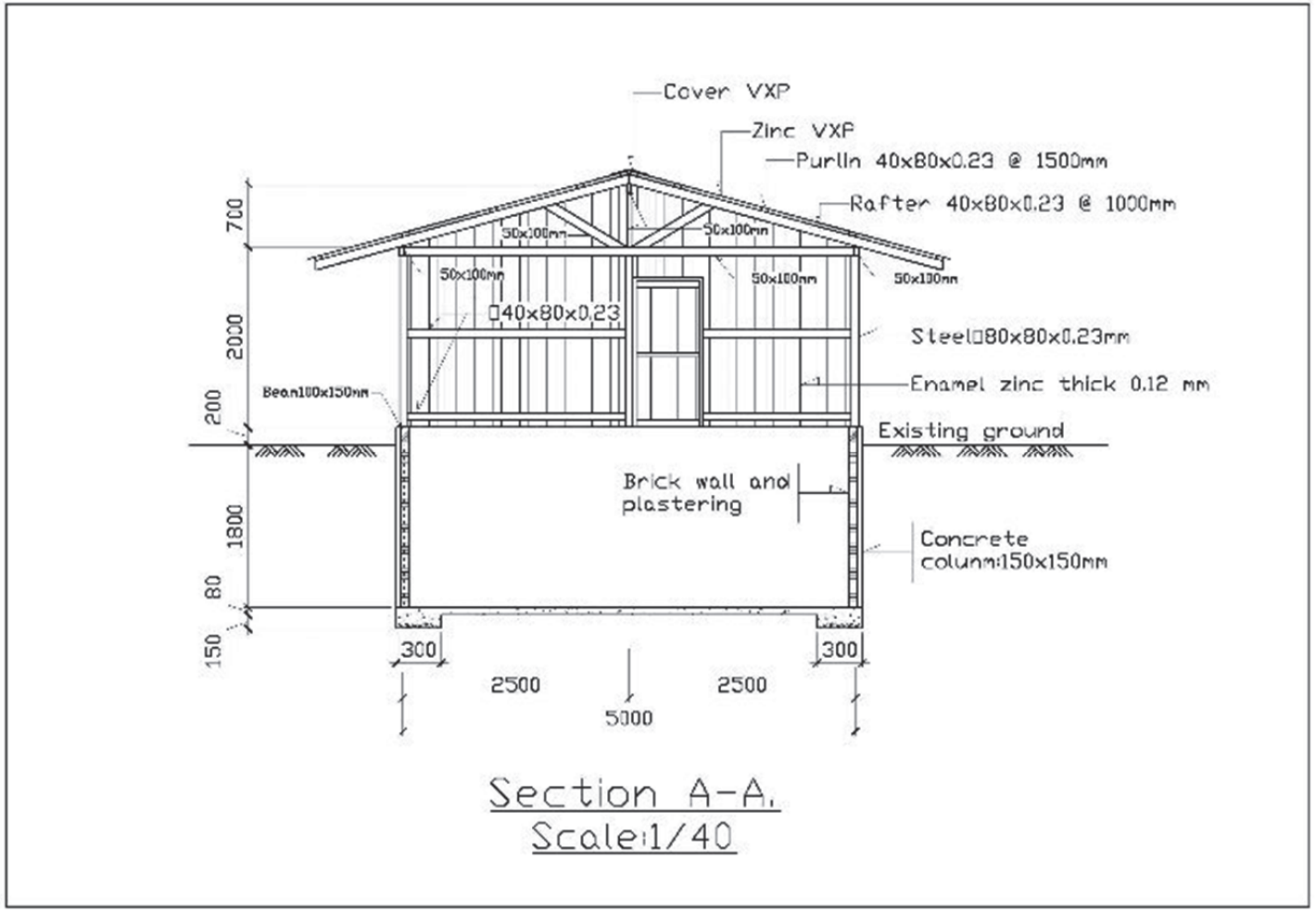


(2) Building structure

a. Elevation plan



b. Cross section of HCW pit



c. Reinforce bar plan