# **CHAPTER 5. PREFEASIBILITY STUDY**

# 5.1 Background, Study Objectives and Selection of Study Area

# 5.1.1 Background and Study Objectives

The draft of the Master Plan for Improvement of Water Environment in Vientiane City gives Community-Based Sanitation (CBS) the highest priority among the possible countermeasures for the wastewater treatment system. For the period of June to December 2010, one CBS in Thonkankham Village and one SBS (School Based Sanitation) in Khualuang Primary School have been constructed as a pilot project.

Under the above-mentioned situation, the pre-feasibility study (pre-F/S) has been made for smoothly extending the CBS coverage and achieving efficient wastewater improvement through installation of CBS/SBS. The study objectives are:

- (1) To collect information on the present sanitary and communal sewer conditions to discuss the improvement direction of sanitation as well as water environment;
- (2) To propose suitable measures to keep a good balance between sanitary improvement in a household level and improvement on water environment along the drainage canal;
- (3) To set up remedial measures against water quality deterioration of surface water along the selected drainage canal in conformity with site conditions; and
- (4) To propose a realistic approach to popularize the above drainage basin measures in the near future.

# 5.1.2 Selection of Study Area

The study area shall be selected paying attention to the followings:

- (1) Urgency: seriously deteriorated water quality in the canal;
- (2) Remediable possibility: easy installation of countermeasures;
- (3) Immediate appearance of improvement effects: small catchment or uppermost of the drainage system; and
- (4) Visibility of improvement effects: noticeable improvement to residents.

In due consideration of the above factors, the drainage basins of the Hong Pasak and Hong Thong could be selected as the most seriously deteriorated canals in the Vientiane. **Table 5.1.1** compares between two basins in the above factors, and finally Hong Pasak basin was selected as the priority area for the pre-feasibility study.

In the Hong Pasak basin, the study area of the upper part of the basin is set up as illustrated in **Fig. 5.1.1** in due consideration of possible study period, available human resources and suitable scale of implementation. As a result, sub-drainage basins 12 and 13 were selected for the pre-F/S. As tabulated in **Table 5.1.2**, the selected study area makes up 34% in area and 42% in population to the entire Hong Pasak drainage basin.

Drainage Basin Evaluation Factors	Hong Thong	Hong Pasak
Urgency	Seriously deteriorated in water quality	Seriously deteriorated in water quality
Remediable Possibility	Low due to highly congested area	Relatively high due to low congested area
Immediate Appearance of Improvement Effects	No suitable site to install improvement works due to highly congested area	Possible if improvement works start from the upstream end toward the lower reaches
Visibility of Improvement Effects	Invisible due to covering the canal with concrete	Visible due to open sewer canal in the entire stretch

Table 5.1.1	Comparison betwee	n Two Drainage	<b>Basins for Pre-</b>	Feasibility Study
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Fig. 5.1.1 Hong Pasak Drainage Basin

<b>Fable 5.1.2</b>	Sub-Catchment Area and Population in
	Hong Pasak Drainage Basin

Sub-Catchment Index	Catchment Area (km <sup>2</sup> )	Population in 2009	Remarks
12-1	0.24	1,368	Catchment Area: 34 %
12-2	0.15	1,147	Population: 42 %
12-3	0.28	2,407	
13	0.10	847	
Sub-total	0.77	5,769	Total in the area of pre-F/S
14	1.24	6,971	
15	0.23	865	
Basin Total	2.24	13,605	

# 5.2 Sanitary Condition in the Priority Area

# 5.2.1 Sampling Data

Total samples of 856 houses/buildings were collected by sub-contract work. The breakdown of the data could be summed up in the table below, in accordance with the type of sanitary facilities, namely, the toilet type. The sampling data are compiled as GIS data overlaying the Quickbird satellite imagery.

The collected samples could cover around 90% of entire houses/buildings in the target area through ocular examination. Furthermore population coverage of 85% could be estimated comparing the figures of population in **Tables 5.1.2** and **5.2.1** (= 4,878/5,769). Based on the results, the samples could cover 85 to 90% of the entire houses/buildings in the target area.

	Sanitary	Number of		
	Facilities	Number	Percentile	Residents
	Soak Pit	364	57	
Residential	Septic Tank	271	42	2 205
House	Others	6	1	5,295
	Sub-total	641	100	
	Soak Pit	88	41	
Commercial	Septic Tank	116	54	1 592
Building	Others	11	5	1,383
-	Sub-total	215	100	
	Soak Pit	452	53	
Total	Septic Tank	387	45	1 070
	Others	17	2	4,878
	Total	856	100	

 Table 5.2.1
 Sampling Data from the Upper and Middle Reaches of Hong Pasak

# 5.2.2 Installation and Maintenance of Sanitary Facility in Residential Houses and Commercial Buildings

As tabulated in **Table 5.2.1**, significant differences in sanitary conditions cannot be recognized between residential house and commercial building. Installation ratio of soak pit or septic tank is similar to around 50% each in residential houses as well as commercial buildings. One of the reasons might be that respondents have not enough knowledge about the differences between a soak pit and a septic tank in terms of principal features of those structures and treatment process of human wastes.

It was examined how major toilet types such as soak pit and septic tank were historically adopted to the housing/buildings. **Fig. 5.2.1** presents those toilet types corresponding to building age. According to governmental building guidance, the standard type of septic tank has been guided for new houses/building since 1992. Therefore, the standardized septic tanks should be installed for the new houses/buildings built in 1990's and 2000's. The results could not show such tendency.



Fig. 5.2.1 Sanitary Facilities corresponding to their Building Age

Meanwhile **Fig. 5.2.2** shows how often accumulated sludge of soak pit or septic tank has been removed. The desludging has never been conducted for 35% of soak pit and 46% of septic tank, even for old facilities. Except for such facilities, desludging has been normally conducted once a year.



Fig. 5.2.2 Frequency of Desludging of Sludge Accumulated in Soak Pit or Septic Tank

# 5.2.3 Condition of Residential Houses due to Pre-F/S

# (1) Basic Information and Water-Related Conditions of Households

Actual sample number of Pre-F/S is 641 households as shown in **Table 5.2.1** and the total resident number is 3,295. Monthly total income of family varies from 500,000 KIP to 30,000,000 KIP and the median is 5,000,000 KIP.

The target area is so urbanized that all water sources are tap water with neither wells nor rain water. Water consumption of household varies very much and the average is 1,350 l/day, which is larger than that of Tokyo. Low price of tap water may be one of the reasons of this matter. Water uses also vary and share of water uses for each household is shown in **Fig. 5.2.3**. It should be noted that the share of water use whose wastewater contains oil is considerably high; house cleanliness (more than 70%) and car/motor cycle washing (more than 40%).



Fig. 5.2.3 Share of Water Uses for Households

# (2) Human Waste and Domestic Wastewater of Households

Installation of sanitary facilities by households is shown in **Table 5.2.1**, which means that almost all the answering households have some kind of toilet and kitchen and about 90% have bathroom (shower room).

Concerning toilets, about 50% uses flush discharging and the same uses manual discharging. The frequency of desludging by households is shown in **Fig. 5.2.4**. Majority of households desludge once a year.



Frequency of Desludging of Toilet at Individual Housing

Frequency of Desludging

# Fig. 5.2.4 Frequency of Desludging by Households

Interview survey of the Pre-F/S does not show clear results about treatment of black and gray water by households. Field survey shows that domestic wastewater is discharged to Hong Pasak through PVC pipes from residential houses, hotels and restaurants in the target area.

# 5.2.4 Discharging Route of Septic Tank Effluent and Gray Water

Discharging route of septic tank effluent and gray water from the surveyed buildings were incorporated in the GIS database as graphics based on those described in the questionnaire sheets. An example (Anou Village, Chanthabouly District) is shown below.



Fig. 5.2.5 Example of Discharging Route of Septic Tank Effluent and Graywater Incorporated in GIS Database

# 5.2.5 Data of Lateral Drainage Canal

Lateral drainage canals connected to the buildings were also surveyed and are summarized as follows:

Village	Sample #	Concrete	Earth	Natural	None	% of Concrete
Anou	12	10	0	2	0	83.3%
Haisok	56	40	2	1	13	71.4%
Khoaluang	228	140	10	5	77	61.4%
Nongduang	61	44	9	0	10	72.1%
Sihom	153	115	14	0	27	75.2%
Sithan	94	72	10	0	16	76.6%
Thongtoum	30	26	6	0	1	86.7%
Vatchan	28	16	0	5	7	57.1%

 Table 5.2.2
 Lateral Drainage Canals Connected to Residential Buildings

Note: Since some buildings are connected to both earth and natural drainage canals, the total number of connected drainages does not coincide with the sample number.

Except Vathchan Village, more than 60% of the samples are connected to concrete drainage canals, which vary from 61.4% in Khoaluang Village to 86.7% in Thongtoun Village.

Dimensions of lateral drainage canals connected to residential buildings are summarized as follows:

											(Ur	nit: cm)
		Con	crete			Ea	rth			Nat	ural	
Village	Wi	dth	De	pth	Width		Depth		Wi	dth	De	pth
	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
Anou	100	10	100	10	-	-	-	-	100	100	-	-
Haisok	50	10	80	10	-	-	-	-	15	15	-	-
Khoaluang	300	5	300	5	60	10	40	10	50	1	30	10
Nongduang	80	15	100	10	20	10	50	5	-	-	-	-
Sihom	100	10	100	2	60	10	50	5	-	-	-	-
Sithan	70	10	100	10	100	10	50	10	-	-	-	-

#### **Table 5.2.3 Dimensions of Lateral Drainage Canals Connected to Residential Buildings**

#### 5.2.6 Relevant Information from "Rapid Assessment of Household Sanitation Services in Vientiane City" by Water and Sanitation Program (WSP) of the **World Bank**

#### (1) **Sampling Data**

The -Rapid Assessment of Household Sanitation Services in Vientiane City" by WSP included an interview survey of existing household sanitation facilities (hereinafter referred to as -the WSP Households Survey"), which was conducted during June and July 2010. This Survey was to focus on urban middle- and low-income areas for a total of 16 villages in the selected 4 districts by a random sampling approach. The total sampling households number was 548 (refer to Table 5.2.2).

Tal	ole 5.2.4 San Existing Ho	npling Number of tusehold Sanitation	the Interview Su Facilities Surve	urvey of 2y
Name	Urba	in Totals	Actual Sa	mple Number
	U 0X X 11	// OXX 1 11	// OX 111	// OXX 1

District Name	Urba	n Totals	Actual Sample Number		
	# of Villages	# of Households	# of Households		
Sikhottabong	36	9,869	4	140	
Chanthabuly	37	11,778	4	103	
Sisattanak	40	10,853	4	177	
Xaysetha	setha 39		4	128	
	152	47,475	16	548	

Source: Rapid Assessment of Household Sanitation Services in Vientiane City, 2010. WSP

#### (2) **Sanitary Facility Conditions**

According to the result of the WSP Households Survey, about 95% of the respondents answered that they had access to private sanitation facility. The largest ratio of the type of septage storage was -direct pit (49%)", and the second ratio is -septic tank (22%)" within the respondents who had own private sanitation facility. According to the result of basic data collection survey for the Pre-F/S, more than the ratio (about 99%) of the respondents answered that they have access to private sanitation facility. These ratios exceed the ratio (about 83%) of the respondents of the Vientiane's Household Survey in Population and Housing Census (PHC) of 2005. Thus, it could be said that possession ratio of private sanitary facilities has improved since 2005.

#### (3) **Construction Periods of Sanitary Facility and Septic Tank**

According to the result of the WSP Households Survey, most toilet discharged not to communal septic tank, but to some sort of on-site septage storages. Also, about a quarter of the septage storages constructed after 1995 were septic tanks. This is a substantially low ratio considering the fact that the governmental building guide regulated that the standard type of septic tank has been guided for new houses/building since 1992 as mentioned in **Section 5.2.2**. There are many reasons that standardized septic tanks were not be installed for the new houses/buildings in Vientiane. These results by the WSP Survey could not show such tendency as well.

# (4) Desludging of Septage Storages

Concerning desludging from the septage storages, 37% of the septage storages had filled up at some stage, according to the respondents of the WSP Households Survey. This means that 63% of the septage storages have never filled up. This fact may have been caused by preventive desludging activities, or there was a possibility that some sort of soak or seepage from the septage storages infiltrated into the surrounding soil. Based on the results of the WSP Households Survey, almost all of the storages (99%) are emptied by private service providers, and then, it might be said that most of the residential people do not understand the importance of desludging.

Although the frequencies depend on the situations, desludging of septic tanks is recommended once every two or three years in general, but roughly 50% of the septic tanks had never been emptied. This ratio is almost the same as the ratio by the result of the basic data collection survey for the Pre-F/S.

Desludging charge is set at 70,000 KIP/m<sup>3</sup> by the government. A household usually pays 210,000 KIP for one time of desludging. The median of the total monthly income of a household amounts to 5,000,000 KIP in the target area of the Pre-F/S. Thus, the desludging cost is 0.35% of the total income of a household if it usually desludges once a year.

# 5.3 Possibilities of Improvement of Water Environment

Based on the sub-contract survey and site inspection, examined are possibilities of water environment improvement through installation of small-scale wastewater treatment system such as SBS and CBS.

In the course of site survey, the team noticed that the drainage basin could be divided into two areas: (1) core area from which wastewater is directly connected to Hong Pasak canal; and (2) fringe area from which wastewater cannot be smoothly discharged into the canal due to flat topography and malfunction of the local sewer network, as illustrated in **Fig. 5.3.1**. Normally, boundaries between core area and fringe area could be identified along the trunk road.

![](_page_7_Figure_10.jpeg)

Fig. 5.3.1 Characteristics of Drainage Area

The following are surface water and drainage canal conditions by stretch and discussion on possibilities of installing wastewater treatment plants and wastewater collection network (interceptors).

# 5.3.1 Uppermost Stretch: Upstream End to Souphanouvong Road

The uppermost stretch of 250 m long is located mostly in Vatchan Village, as shown in **Fig. 5.3.2**. There are two possible countermeasures in this stretch as described below.

# (1) SBS in Pakpasak Technical College

Pakpasak Technical College occupies a wide campus in the left bank of the uppermost dtretch of the Hong Pasak. In the southeastern edge of the campus, there are two wings of dormitory. As presented in **Photos 5.3.1** to **5.3.2**, two septic tanks receiving black water from the dormitory are deteriorated and malfunctioning, and pipe system for gray water conveyance is broken in some parts. Thus the SBS (T1 in **Fig. 5.3.6**) shall be installed in the dormitory. If the existing septic tanks could be still usable, those tanks can be utilized as settling basins in the entire treatment system.

![](_page_9_Picture_2.jpeg)

Fig. 5.3.2 Uppermost Stretch of Hong Pasak (Core Area)

![](_page_9_Picture_4.jpeg)

Photo 5.3.1 Old septic tank spilling stored wastewater

Photo 5.3.2 Discharge of washing water due to broken pipe

# (2) Local Interceptor and Wastewater Treatment Plant (WTP)

At the upstream end of Hong Pasak, wastewater is discharged through two sewer pipes; one is connected to the drainage area in the opposite side of Khun Bu Lom Road, and another one is connected to the dormitory of Pakpasak Technical College. From this upstream end to Souphanouvong Road, wastewater is discharged through about 20 small pipes from the right bank along the canal as presented in **Photos 5.3.3** to **5.3.4**.

Collecting gray water from the pipes through installation of interceptor, WTP (T2 in **Fig. 5.3.6**) shall be constructed in the left bank just upstream of the Souphanouvong Road by utilizing some available space (public area) in between the canal and side road.

![](_page_10_Picture_5.jpeg)

# 5.3.2 Upper Stretch: Souphanouvong Road to Samsenthai Road

The upper stretch of 250 m long is located between Souphanouvong and Samsenthai roads as shown in **Fig. 5.3.3**. The drainage area of the right bank in this stretch is situated in Haisok Village, while the left bank is situated in Sihom Village.

# (1) Upper Half in a Stretch of 80 m Long

There are 8 drains discharging gray water into the canal in this stretch. Six drains among them are located at upstream and downstream ends, discharging gray water from both left and right sides along the roads. These effluent conditions are presented in **Photos 5.3.5** to **5.3.6**.

As for the 6 drains located at upstream and downstream ends, their invert levels are not so high for wastewater to be collected by gravity and the other 2 drains discharge small amounts of water, or water quality is not so bad because the water passes through an existing swampy area and is purified to some extent. Considering the conditions, no local interceptor and/or WTP would be required along the stretch.

![](_page_11_Picture_2.jpeg)

100 m

Fig. 5.3.3

Upper Stretch of Hong Pasak (Core Area)

![](_page_11_Picture_6.jpeg)

Photo 5.3.5 Roadside drain discharging gray water from the right bank on the Souphanouvong Road

Photo 5.3.6 Two drainage pipes along the left bank, discharging gray water

# (2) Lower Half in a Stretch of 170 m Long

Around 6 drains discharge gray water into the canal in this stretch. Three drains among them are located at upstream and downstream ends, discharging gray water from both left and right sides along the roads. Local interceptor shall collect the gray water discharged through three drains and around three pipes, and the collected water shall be conveyed to WTP (T3 in **Fig. 5.3.6**) to be installed on the lowest part of the right bank. These effluent conditions are presented in **Photos 5.3.7** to **5.3.8**.

![](_page_12_Picture_2.jpeg)

# 5.3.3 Upper Part of Middle Stretch: Samsenthai Road to Sihom Road

Upper part of middle stretch of Samsenthai Road to Sihom Road is illustrated in **Fig. 5.3.4**. The upper part is 315 m long. The drainage area in this stretch is mainly situated in Khoaluang Village, while the area in the backside of the left bank is partly situated in Sihom Village.

This stretch is one of the most congested areas in the Hong Pasak Basin. Lateral sewer network of open type was constructed through the Rehabilitation Project of Sihom Area for the period of 1991 to 1997 under UN-HABITAT. More than ten outfalls of the lateral sewer connect to the Hong Pasak canal as shown in **Photos 5.3.9** to **5.3.10**. Thus local interceptor and WTP could be installed connecting the existing lateral sewer outfalls. In parallel with interceptor and WTP construction, community sidewalk shall be constructed for citizen's comfort as a green corridor.

In consideration of the available land and locations of the lateral sewer outfalls, two WTPs (T4 and T5 in **Fig. 5.3.6**) including local interceptors are suitable.

![](_page_12_Picture_7.jpeg)

Photo 5.3.9 Road side drain conveying gray water from the residential houses

Photo 5.3.10 Sewer outfall discharging gray water from the left bank

![](_page_13_Figure_2.jpeg)

Fig. 5.3.4 Upper Part of Middle Stretch of Hong Pasak (Core Area)

# 5.3.4 Lower Part of Middle Stretch: Sihom Road to Asian Road

The lower part of the middle stretch, Sihom Road to Asian Road, is illustrated in **Fig. 5.3.5**. The upper part is 240 m long. The drainage area in this stretch is situated in Khoaluang Village. This stretch is also one of the most congested areas in the Hong Pasak basin. Lateral sewer network of open type was constructed through the Rehabilitation Project of Sihom Area for the period 1991 to 1997 under UN-HABITAT. Around seven outfalls of the lateral sewer connect to the Hong Pasak as shown in **Photos 5.3.11** to **5.3.12**. SBS at Khoualuang Primary School, which was constructed in the pilot project of this study, is located in this stretch. The garment factory under the army is located on the right bank in the uppermost of this stretch.

Based on the conditions of existing sewer network, the entrance of Khoualuang Primary School is a suitable site for a WTP (T8 in **Fig. 5.3.6**) to collect and treat wastewater through lateral sewers from the local drainage area. Another WTP (T6 in **Fig. 5.3.6**) shall be installed on the right bank (public area) of Hong Pasak to collect wastewater from the area including the garment factory.

Considering the low invert level of outfall, the third WTP (T7 in **Fig. 5.3.6**) with interceptors would be required to collect and treat wastewater discharged from an existing open canal located in the middle of this stretch.

Thus three WTPs along with local interceptors could be installed in this stretch. In parallel with WTP and interceptor construction, community sidewalk shall be constructed for resident's comfort as a green corridor.

![](_page_14_Picture_2.jpeg)

Photo 5.3.11 Biggest lateral open sewer discharging gray water from the right bank

![](_page_14_Picture_4.jpeg)

Photo 5.3.12 Sewer outfall discharging gray water from the left bank

![](_page_14_Figure_6.jpeg)

Fig. 5.3.5 Lower Part of Middle Stretch of Hong Pasak (Core Area)

# 5.3.5 Preliminary Design

# (1) Location of WTPs and Interceptors

Based on the survey results discussed in the previous subsection, Fig. 5.3.6 summarizes the locations of eight wastewater treatment plants and their interceptors.

# (2) Preliminary Design of WTP and Interceptors

The wastewater treatment system along Hong Pasak consists of three components: (1) wastewater treatment plants (WTP); (2) interceptors (including discharging pipes from WTPs); and (3) control boxes.

The WTPs employs an anaerobic treatment method which consists of 3 processes (sedimentation tank, anaerobic reactor and anaerobic filter), with design conditions and typical cross section as shown in **Table 5.3.1** and **Fig. 5.3.7**.

Item		Unit	Description	Remarks
Wastewater per capita	Pakpasak college	l/d/person	230	1)
(Daily maximum)	Others		270	2)
Design HRT	Sedimentation tank	hrs	12	
(Hydraulic retention	Anaerobic reactor	hrs	24	
time)	Anaerobic filter	hrs	12	
	Total	hrs	48	

Table 5.3.1Design Conditions of WTPs

Note: 1) 170 l/d/person / 0.75 = 230 l/d (assumed ratio of daily average/daily maximum is 1/0.75) 2) 170 l/d/person x 1.2 (including commercial wastewater) / 0.75 = 270 l/d

As for interceptors, vinyl pipes with diameter of 200 mm would be installed along the bank at shallow depth in consideration of load reduction and easiness of construction works. Control boxes are designed to change the direction of pipes, to trap garbage and sand/sludge and to inspect inside.

**Table 5.3.2** summarizes outlines of WTPs, as well as estimated construction quantities of interceptors and control boxes, and site ownership.

	Population		WTP		Interceptor	Control	Site
		Design	Total	Land	(m)	box	Ownership
		Inflow (m <sup>3</sup> /day)	length (m)	requirement (m <sup>2</sup> )		(no.)	
T1	585	135	85.6	230	100	8	School
T2	293	79	53.2	140	260	12	Government
T3	182	49	33.9	90	200	12	Government
T4	244	66	45.4	120	180	11	Government
T5	247	67	45.4	120	180	11	Government
T6	159	43	30.0	80	100	7	Government
T7	98	26	19.2	60	350	18	Government
T8	308	83	56.9	150	60	6	School
Total	2,116	548	369.6	990	1,430	85	

 Table 5.3.2
 Outline of WTPs and Interceptors and Control Boxes and Site Ownership

Table 5.3.3 shows specifications of WTP.

	Waste-	Width	Length (m)			Number			Depth
	water		Sedimen-	Anearobic	Anearobic	Sedimen-	Anearobic	Anearobic	
	(m <sup>3</sup> /d)	(m)	tation tank	reactor	filter	tation tank	reactor	filter	(m)
T1	135	2.10	2.00	0.90	1.50	9	40	12	1.80
T2	79	2.10	1.60	0.90	1.40	7	24	8	1.80
T3	49	2.10	1.40	0.90	1.40	5	15	5	1.80
T4	66	2.10	1.60	0.90	1.40	6	20	7	1.80
T5	67	2.10	1.60	0.90	1.40	6	20	7	1.80
T6	43	2.10	1.50	0.90	1.30	4	13	5	1.80
T7	26	2.10	1.30	0.90	1.30	3	8	3	1.80
T8	83	2.10	1.60	0.90	1.50	8	25	8	1.80
Others 1)	80	2.10	1.60	0.90	1.40	7	24	8	1.80
Total									

Table 5.3.3	Specifications	of WTP
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	Length (m)	Remarks			
	Sedimen-	Anearobic	Anearobic	Total	
	tation tank	reactor	filter		
T1	12.1	24.2	12.1	48.4	
T2	12.9	24.8	12.9	50.6	
Т3	13.0	25.0	13.0	51.0	
T4	13.2	24.7	13.5	51.4	
T5	13.0	24.4	13.3	50.7	
T6	12.7	24.7	13.7	51.1	
T7	13.6	25.1	13.6	52.3	
T8	14.0	24.6	13.1	51.7	
Others 1)	12.7	24.5	12.7	49.9	
Total					

Note 1) Contingency which is equivalent to construction cost of WTP with capacity of 80  $m^3/day$ 

As a reference, plan and typical section of three WTPs (T1, T5 and T8) are presented in **Fig. 5.3.9** to **5.3.11**.

![](_page_17_Figure_1.jpeg)

![](_page_17_Figure_2.jpeg)

Fig. 5.3.6 Location of WTP and Interceptor

![](_page_18_Figure_2.jpeg)

Fig. 5.3.7 Typical Cross Section of WTP (Anaerobic Treatment Plant)

# 5.3.6 Water Quality Improvement Effects

Water quality improvement effects are evaluated using the water quality model formulated in **Section 2.5**.

The evaluation is carried out under the following conditions:

WTPs cover 90% of core area and 10% of fringe area in population (a definition of the core area and fringe area is as shown in **Fig. 5.3.1**). Installation rate of septic tank is set at 100% and BOD removal rate of the WTPs is set at 70%.

**Fig. 5.3.8** presents the estimated water quality (BOD) along Hong Pasak with/without WTPs in the target year 2020. According to the figure, BOD in the area along Hong Pasak will be reduced to about 12 mg/l or less.

# 5.3.7 Cost Estimate

Total cost is estimated at about 1.28 million US dollars, as shown in **Table 5.3.4**.

Direct cost of WTP sums up cost of concrete structure, excavation, backfill and so on. Unit construction cost of 60 USD/m and 65 USD/number is applied to the installation of interceptor and control box, respectively.

![](_page_18_Figure_12.jpeg)

Fig. 5.3.8 BOD Projection for the Upper Reaches of Hong Pasak (2020)

<b>Table 5.3.4</b>	Cost Estimation of Wastewater Treatment System
	in the Pre-F/S Area

				ι	Unit: US dollar
	WTP	Interceptor	Control	Total	Remarks
		_	box		
Direct cost					
T1	177,185	6,000	520	183,705	
T2	111,715	15,600	780	128,095	
T3	72,640	12,000	780	85,420	
T4	96,430	10,800	715	107,945	
T5	96,430	10,800	715	107,945	
T6	65,040	6,000	455	71,495	
T7	43,495	21,000	1,170	65,665	
T8	119,320	3,600	390	123,310	
Others <sup>1)</sup>	111,715	0	0	111,715	
Total	893,970	85,800	5,525	985,295	
Indirect cost	30%	of direct cost		295,590	
Grand total				1,280,885	

Note <sup>1)</sup> Contingency which is equivalent to construction cost of WTP with capacity of 80 m<sup>3</sup>/day.

![](_page_20_Figure_2.jpeg)

Fig. 5.3.9 Plan and Typical Cross Section of WTP (T1)

![](_page_21_Figure_1.jpeg)

![](_page_21_Figure_2.jpeg)

Fig. 5.3.10 Plan and Typical Cross Section of WTP (T5)

![](_page_22_Figure_2.jpeg)

Fig. 5.3.11 Plan and Typical Cross Section of WTP (T8)

# **CHAPTER 6. RECOMMENDATIONS**

In the course of the Study for the period of two and half years, various points and issues to be improved were clarified. Most of these issues were incoporated into the master plan as subjects to be solved or improved. Urbanization in Vientiane has been rapidly progressed, and natural environment in the urban areas has been deteriorated in parallel. The natural environment, however, still significantly remains in Vientiane in remediable level, so that it shall be urgent issues to conserve the remaining natural environment and to restore the lost one. In finalizing this report, those points and issues are summarized to provide some help in the future improvement of water environment.

# 6.1 Early Implementation of the Structural Water Environment Improvement Plan

Rapid urbanization in Vientiane has been progressing in a faster pace than expected. As frequently described, water environment improvement shall be integrated to encompass man-made treatment facilities and the natural purification function of marshes, ponds and river courses as natural assets given to the Vientiane residents from the physical improvement viewpoint. In this regard, the first step of improvement works shall be started as early as possible to make the residents understand the importance of conserving the precious environment. This process could easily link to the enhancement of people's awareness, for environment improvement.

# 6.2 Prevention of Concrete Covering on the Drainage System

Hong Thong receives wastewater and rainwater from the most congested areas of Vientiane, similar to Hong Pasak. Hong Thong joins with Hong Khoua Khao near the Nong Chanh Marsh, and changes its name to Hong Ke. Hong Thong has been covered with concrete slabs in almost all stretches. Although the concrete covering is one of the alternatives to make people shun the offensive odor and deteriorated scenery of worsened water quality, the difficulties of improving the water environment will come out due to invisibility of existing conditions on water quality and inability of conducting improvement works and monitoring their effects. Conducting the possible improvement measures on the water environment in a step-by-step manner would rather be recommended than removing the deteriorated environment from the urban residents' vision.

# 6.3 Conservation of Marshes/Wetlands

Wastewater discharged from the urban areas flows down through drainage systems, and empties into the That Luang Marsh. The Mak Hiao River receives the surface water from the marsh, runs through the Na Khay Marsh and various pondage stretches, and finally joins the Mekong mainstream. Due to natural purification functions of wetlands and ponds along the river course and dilution with natural runoff and irrigation tail water, BOD concentration of 3 mg/l is computed at the rivermouth of the Mak Hiao even in 2020. The BOD concentration of 3 mg/l could still be regarded as good water quality.

The rapid urbanization of Vientiane, however, has been progressing in/around the That Luang Marsh so that the marsh areas and their functions shall be conserved, including the remaining marshes in the urban areas, such as Nong Chanh, Nong Bo, and Nong Tha. Unless such conservation measures are undertaken, similar urbanization process, where several wide mashes that existed in the past have been reclaimed into urban areas, would occur in the remaining marshes mentioned above.

In order to conserve these remaining marshes and wetlands, the following two conservation approaches are necessary.

(1) Prohibition of Encroachment by Developments and Sustainment of Existing Water Surface

Various types of land developments have reduced water surface of marshes and wetlands accompanying land filling. In order to prevent these activities, peripheral road encompassing the marsh/wetland area shall be constructed as a role of border piling system of pubic water body, and land use control shall be done inside of the road announcing the necessity of the conservation and the necessary control to the public. As a result, natural water purification functions could be conserved from viewpoints of the water environment improvement.

(2) Onsite Treatment of Wastewater Inflow from Surrounding Development Areas

Deterioration of water quality in the marshes/wetlands by the untreated wastewater inflow from the surrounding areas is a major factor to decrease the environmental values of marshes/wetlands. Wastewater treatment facilities targeting domestic wastewater as well as human waste shall be installed in the new development areas surrounding the marshes/wetlands as one of the environmental conservation measures in the marsh/wetland areas.

#### 6.4 Strengthening of Administrative Guidance

There are noticeable point sources in the Study area. Some small-scale enterprises discharge highly polluted wastewater, and the neighboring residents complain about the offensive odor and accumulated sludge. To solve such problems, the strengthening of administrative guidance by the responsible agency shall be necessary. The enterprises have to follow the effluent standards through the installation of appopriate devices for wastewater treatment with administrative guidance. To attain the situation of clean water quality, efforts by various stakeholders, such as citizens and governmental organizations, are indispensable. Through these well-functioning efforts, the related government offices would gain high reliability among the residents.

# 6.5 Strengthening of Maintenance Work and Monitoring Activities for Drainage Network

A major part of the drainage canals had been improved as concrete-lined channels with support mainly from ADB in the 2000's. At present, sediment has accumulated at the bottom of the channels due to sediment inflow of small particles from the surrounding areas, and various plants have grown in the channel depending on the accumulated sediment. These plants have some purification function against water quality deterioration, which are composed of acceleration of settling suspended solids and contact oxidation by biofilm attached to the plants.

The local government of Vientiane as administrator of the drainage canal system shall conduct this maintenance works in the drainage system without any donor's technical and financial support. These management works consist of 1) dredging of accumulated sediment at the bottom of the channel, if necessary; 2) proper management of plants in the channel based on the site monitoring in due consideration of their natural purification functions; and 3) clarification of encountered issues based on the periodical water quality monitoring in cooperation with WREA.

**APPENDICES** 

![](_page_28_Figure_0.jpeg)

# Appendix 1 Original Construction Schedule of CBS for Thongkhankham Village

Weekend (Sunday)

![](_page_29_Figure_0.jpeg)

Appendix 2 Original Construction Schedule of SBS for Khoualuang Primary School

r	II	8-11	1
		Category 1	Category 2
		Required to undertake Initial	Required to undertake
Types of	f Investment Project	Environmental Examination	Environmental Impact
- )		(IEE)	Assessment (EIA)
			rissessment (Enri)
	1. Developm	nent Projects: Energy Sector	
		<15 MW or $<200$ million m <sup>3</sup>	$\geq 15$ MW or $\geq 200$ million
1 1	II. Anony along and any is of		m <sup>3</sup> water capacity,
1.1	Hydropower plant project	water capacity, or having	or having reservoir area
		reservoir area of <1,500 ha	>1 500 ha
12	Nuclear power plant project		All scale
1.2	Natural gas power plant project	5 50 MW	>50 MW
1.5	Thermal newer plant project		
1.4	De classer de classer de caracteria de carac	$\leq 10$ M W	>10M W
1.5	Development of oil and gas pipeline		All scale
	project		
1.6	Oil refinement project		All scale
17	High voltage electric powerline		
1.7	construction project		
171	High voltage electric powerline	< 50 Km	> 50 Vm
1./.1	construction project $\geq 230 \text{KV}$	$\geq$ 30 Km	= 30 KIII
			In case of power line is
	High voltage electric powerline		through National
1.7.2	construction project <230KV	All scale	conservation area or
	construction project 325010		community area
172	High voltage electric newer station	< 10 ha	> 10 ba
1.7.5	The voltage electric power station	< 10 lid	
	II. Development Proj	ects: Agriculture and Forestry	Sector
2.1	Industrial tree plantation project	20-300 ha	>300 ha
2.2	Industrial plants project	20-500 ha	>500 ha
2.3	Irrigation construction project	100-2000 ha	>2000 ha
	Livestock farming project (cattle horse	100 2000 114	2000 114
2.4	etc.)	$\geq$ 500 animals	
2.5	Boultry forming project	>1000 poultrios	
2.5	Poultry failing project	$\geq 1000$ poultiles	
2.0	Pig nusbandry project	2200 animais	
2.7	Fishery or aquatic animals in pond	≥10 ha	
2.8	Fishery or aquatic animals in floating	>300 animals	
2.0	basket in the river		
2.9	Crocodile farming project	$\geq 100$ animals	
	III. Development Pr	ojects: Industrial Processing S	ector
3.1	Meet processing plant	<20Ton/day	>20Top/day
2.1	Fish measuring plant	<20Ton/day	>20Ton/day
3.2	Fish processing plant	$\leq 2010 \text{n/day}$	>2010h/day
3.3	Fruit and vegetable processing plant	All scale	4077 (1
3.4	Milk manufacturing plant	$\leq 40 \operatorname{lon/day}$	>401on/day
3.5	Flour manufacturing plant	50-100Ton/day	>100Ton/day
3.6	Animal feed factory	All scale	
3.7	Sugar refinery	≤50Ton/day	>50Ton/day
3.8	Noodle manufacturing plant	>1Ton/day	
2.0	Alcohol processing factory (whisky, wine.	-500.000.11	> 500,000 19
3.9	beer, etc.)	≤500,000 liters/year	>500,000 liters/year
	Non-alcoholic beverage processing factory		
3.10	(soda soft drink mineral water)	All scale	
2.11	Drinking water processing factory		
2.11	Tabaaaa products manufactoring factory		
3.12	Tobacco products manufacturing factory	All scale	
3 1 3	Industrial textile, cord and fiber	All scale	
5.15	manufacturing factory		
3 14	Garment and dyed textile manufacturing	All scale	
5.17	factory		
3.15	Tanning factory	All scale	
2.16	Bag, suitcase and similar products (saddle		> 1 Our 111
3.16	and bridle) manufacturing	$\leq$ 1.0 million unit/year	>1.0million unit/year
3.17	Leather shoes factory	<1.0 million pair/vear	>1 Omillion pair/year
2.11	Lowellor billoop inotory	Puill Puill Jour	1.0mmin pun/ your

# Appendix 3 Screening Criteria

3.18	Wood, rattan, straw products and wicker	All scale	
3.19	Plywood product	$\leq 100,000  \text{m}^2/\text{year}$	>100,000m <sup>2</sup> /year
3.20	Paper and pulp production	≤50Ton/day	>50Ton/day
3.21	Printing service	All scale	
3.22	Petroleum factory		All scale
3.23	Basic chemical manufacturing excluding chemical fertilizers	≤500 Ton/year	>500 Ton/year
3.24	Pesticide and agricultural chemicals		All scale
3.25	Medicine, chemical medicine and traditional medicine products	≤500 Ton/year	>500 Ton/year
3.26	Soap, detergent, hygiene and cleansing liquid products, perfume and cosmetic production	≤10 Ton/day	> 10 Ton/day
3.27	Other chemical products		All sale
3.28	Elastic rubber, rubber products	100-300 Ton/year	>300 Ton/year
3.29	Plastic products	≤500 Ton/year	> 500 Ton/year
3.30	Crystal products	All sale	
3.31	Non-metal products	All sale	
3.32	Cement, lime and plaster products	≤30 Ton/hour	> 30 Ton/hour
3.33	Iron making and Steel making	≤120 Ton/day	> 120 Ton/day
3.34	Value metal and other metal making	≤50 Ton/day	> 50 Ton/day
3.35	Steel casting	≤50 Ton/day	> 50 Ton/day
3.36	Non-steel metal casting	All sale	
3.37	Metal forming	All sale	
3.38	Generator manufacturing	All sale	
3.39	Domestic appliance manufacturing	All sale	
3.40	Stationary and computing machine manufacturing	All sale	
3.41	Electronic device and apparatus manufacturing	All sale	
3.42	Battery manufacturing	≤100 Ton/year	>100 Ton/year
3.43	Radio, Television, communication devise and their accessories manufacturing	All sale	
3.44	Medical appliance, Ophthalmic equipment and clock manufacturing	All sale	
3.45	Automobile, trailer and semi-trailer assembly plant	All sale	
3.46	Vehicle spare parts and machine	≤1,000 Ton/year	>1,000 Ton/year
3.47	Bicycle and wheelchair manufacturing	$\leq$ 10,000 unit/year	>10,000 unit/year
3.48	Home furniture manufacturing	≤10,000 unit/year	>10,000 unit/year
3.49	Storage of non-hazard waste	All sale	
3.50	Hazards waste disposal		All sale
3.51	Services of others waste disposal and management		All sale
3.52	Fish source manufacturing factory	All sale	
	IV. Development Proie	cts: Infrastructure and Service	es Sector
4.1	Reclamation of ponds, rivers, canals and drainages system that will affect the public		All scale
4.2	Service apartment, detached house construction project	>50 rooms	
4.3	Golf course construction project	9 holes	
4.4	Sports complex construction project		All scale
4.5	Oil storage construction	600-60.000 bushel	
4.6	Industrial zone development and construction		All scale
4.7	Special economic zone development and		All scale
4.8	Waste water drainage canal construction	All scale	
4.9	Urban, hospital and processing factory; Wastewater treatment plant construction		All scale
	project		

4.10	Road construction through national		All scale
4.11	preservation, and preserved wildlife area		>100 km
4.11	New road construction (national		≥100 KIII
4.12	provincial, district, rural road, and special highway)		All scale
4.13	Road improvement (National, provincial, district, rural road, and special high way)	All scale	
4.14	Reconstruction (National, provincial road)	All scale	2 500
4.15	Air port runway construction project	1,000-2,500 m	≥2,500 m
4.16	Hospital construction	≤100 beds	>100 beds
4.17	Hotel complex construction near river	<80 room	>80 room
4.10	Tourist spot and accommodation	<50 lla	~50 lia
4.19	development in national conservation area		All sale
4.20	Waste recycling plant construction project		All scale
4.21	Incinerator construction project		All scale
4 22	All kinds of waste incinerator construction		All scale
1.22	project		
4.23	A project that uses part or whole areas which have negative impacts to natural preservation area, national park, historical cultural and natural trace zone, and range view that is preserved by provincial and local authorities who belong to central		All scale
4.24	Telecommunication network construction project	All scale	
4.25	Waterway construction project (improvement of waterway navigation along Mekong River)	≤200 Ton	>200Ton
4.26	Port construction		
4.26.1	Passenger port	$\leq$ 500 Ton (exclude boat weight)	>500 Ton (exclude boat weight)
4.26.2	General cargo port	≤500 Ton (exclude boat weight)	>500 Ton (exclude boat weight)
4.26.3	Hazard substance cargo port (chemical, petrol, coal, etc.)		All scale
4.27	Embankment construction project	<50 h -	>1km
4.28	Londfill for barard wasts construction	<50 ha	>50 ha
4.29	project		All scale
4.30	project		All scale
	V. 1	Minerals/Ore Sector	<u>.</u>
5.1	Utilizing underground water for industrial, agricultural and urban development project	<4,500 m <sup>3</sup> /day	>4,500 m <sup>3</sup> /day
5.2	Gravel and sand excavation in water project	1,000-50,000 m <sup>3</sup> /year	50,000 m <sup>3</sup> /year (one site)
5.3	Rock excavation and crushing	≤50 Ton/year	>50 Ton/year
5.4	Construction material excavation (soil, gravel and sand) on the surface soil	<100,000 m <sup>3</sup> /year	≥100,000 m <sup>3</sup> /year
5.5	Mining projects (Non-chemical)		All scale
5.6	Solid mineral processing using hazard chemical project		All scale
5.7	Solid minerals processing project	≤50,000 Ton/year	>50,000 Ton/year
5.8	Underground water drilling project		>5,000m <sup>3</sup> /day
5.9	Surface water consumption		>10,000m³/day
5.10	Natural minerals drilling (surface water and underground water) for consumption		>1,000m <sup>3</sup> /day
5.11	Natural minerals drilling (surface water and underground water) for medical treatment and usage, etc.		>500m <sup>3</sup> /day
5.12	Mining projects (using chemicals)		All scale
5.13	Oil and gas drilling projects		All scale
- C			

Source: WREA

SCOPE OF WORK

AND

MINUTES OF MEETINGS

# SCOPE OF WORK FOR

# THE STUDY ON IMPROVEMENT OF WATER ENVIRONMENT IN VIENTIANE CITY, LAO PEOPLE'S DEMOCRATIC REPUBLIC

# AGREED UPON BETWEEN MINISTRY OF PUBLIC WORKS AND TRANSPORT AND JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

VIENTIANE, 3<sup>rd</sup> November, 2008

Mr. Hiroaki TAKASHIMA Chief Representative Laos Office Japan International Cooperation Agency

Mr. Sommad Pholsena Minister Ministry of Public Works and Transport (MPWT)

# I. INTRODUCTION

In response to the request from the Government of Lao People's Democratic Republic (hereinafter referred to as "the Government of Lao PDR"), the Government of Japan has decided to conduct "the Study on Improvement of Water Environment in Vientiane City, Lao People's Democratic Republic" (hereinafter referred to as "the Study") in accordance with the relevant laws and regulations in force in Japan.

Accordingly, the Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for the implementation of the technical cooperation programs of the Government of Japan, will undertake the Study in close cooperation with the relevant authorities concerned of the Government of Lao PDR.

The present document sets forth the Scope of Work with regard to the Study.

#### II. OBJECTIVE OF THE STUDY

The specific objectives of the Study are:

1. To survey and analyze the existing conditions of water environment in the Study area

2. To formulate a master plan for water environment management in Vientiane City

3. To transfer the technique on how to formulate a master plan for water environment management to Lao counterparts

#### **III. STUDY AREA**

The Study area is seven (7) districts (Sikhottabong, Chanthabury, Sissatanak, Xaisetha, Hadxaifong, Xaithany, Pakngum) especially Mak Hiao river basin in Vientiane city as shown in the attached sheet of Annex I.

#### IV. SCOPE OF THE STUDY

To achieve the above objectives, the Study will cover the following items:

#### Phase I

Baseline Survey and making draft master plan for water environment management in Vientiane City

- 1. Review of the existing data and information such as governmental environment policy, related legal system, hydrology, meteorology, geography, geology, natural and social environmental information and related existing reports
- 2. Monitoring survey for natural conditions in the Mak Hiao river basin
- 3. Survey of current situation of the storm water and wastewater management systems in the Study area
- 4. Review of the existing urban development plan, water supply project plan, wastewater treatment plan, urban drainage plan in the Study area
- 5. Formulation of the draft master plan for water environment management in Vientiane City including following items
  - (1) Water Environment Improvement Strategy for 2020
  - (2) Implementation plan based on the strategy
    - 1) Improvement plan of drainage water quality in Vientiane City
    - 2) Promotion plan of environmental education for water environment improvement

- 3) Consolidation plan of the legal framework for water environment
- (3) Implementation of Initial Environmental Examination (IEE)
- (4) Identification of priority items(s) among each plan showed in above: 5.(2). 1),2)and 3).
- (5) Recommendations
- 6. Selection of the target item(s) from priority ones showed in 5.(2).1)2)and 3) for a pilot project and a pre-Feasibility Study
- 7. Conducting (a) seminar(s) and/or (a) workshop(s)

# Phase II

Implementation of a pilot project and a pre-Feasibility Study (pre-F/S)

- 1. Implementation of an environmental education pilot project
- 2. Implementation of a pre-F/S
  - (1) To conduct field survey at the construction site (Topographic survey, Environmental survey)
  - (2) To formulate a construction plan and a procurement plan
  - (3) To formulate an operation and maintenance plan
  - (4) To estimate the project cost
  - (5) To conduct the IEE survey (See attached Annex II)
  - (6) To evaluate the project by economical, financial, technical, social and environmental aspects)
- 3. Finalization of the master plan based on the result of 1) and 2) of Phase II.
- 4. Conducting (a) seminar(s) and/or (a) workshop(s)

# V. STUDY SCHEDULE

The Study will be carried out in accordance with attached tentative schedule shown in the Annex III. The schedule is tentative and subject to be modified when both parties agree upon and any necessity that arises during the course of the Study.

# VI. REPORTS

JICA shall prepare and submit the following writing reports and a digital data to the Government of Lao PDR.

1. Inception Report:

Twenty five (25) copies in English at the commencement of the Study

2. Progress Report (1)

Twenty five (25) copies in English during Phase I

3. Interim Report:

Twenty five (25) copies in English at the end of Phase I

4. Progress Report (2)

Twenty five (25) copies in English during Phase II

5. Draft Final Report:

Twenty five (25) copies in both English and Lao at the end of Phase II

The Government of Lao PDR shall submit its comments within one (1) month after receipt of the Draft Final Report.

6. Final Report:

Fifty (50) copies in both English and Lao within one (1) month after receipt of the comments on the Draft Final Report from the Government of Lao PDR.

# VII. UNDERTAKING OF THE GOVERNMENT OF LAO PDR

- 1. To facilitate smooth conduct of the Study, the Government of Lao PDR shall take the following necessary measures ;
  - (1) To secure the safety of the Japanese study team (hereinafter referred to as "the Team"),
  - (2) To permit the members of the Team to enter, leave and sojourn in Lao People's Democratic Republic (hereinafter referred to as "Lao PDR") for the duration of their assignments therein and exempt them from foreign registration requirements and consular fees,
  - (3) To exempt the members of the Team from taxes, duties, fees and any other charges on equipment, machinery and other materials brought into and out of Lao PDR for the conduct of the Study,
  - (4) To exempt the members of the Team from income tax and charges of any kind imposed on or in connection with any emoluments or allowances paid to the members of the Team for their services in connection with the implementation of the Study,
  - (5) To provide necessary facilities to the Team for remittance as well as utilization of the funds introduced into Lao PDR from Japan in connection with the implementation of the Study,
  - (6) To secure permission for the Team to enter into private properties or restricted areas for the implementation of the Study,
  - (7) To secure permission for the Team to take all data and documents including maps and photographs related to the Study out of Lao PDR to Japan, and
  - (8) To provide medical services as needed. Its expenses will be chargeable to the members of the Team.
- 2. The Government of Lao PDR shall bear claims, if any arises, against the members of the Team resulting from, occurring in the course of, or otherwise connected with, the discharge of their duties in the implementation of the Study, except when such claims arise from gross negligence or willful misconduct on the part of the member of the Team.
- 3. Public Works and Transport Institute (hereinafter referred to as "PTI") shall act as counterpart agency to the Team and also as coordinating body in relation with other governmental and non-governmental organizations concerned for the smooth implementation of the Study.
- 4. PTI and the related organizations shall nominate a counterpart team that will work closely with the Team throughout the study period.
- 5. PTI shall, at its own expense, provide the Team with the followings, in cooperation with other organizations concerned:
  - (1) available data and information related to the Study,
  - (2) counterpart personnel,
  - (3) suitable office space with necessary equipment such as desks, chairs, telephone,
  - (4) credentials or identification cards to members of the Team,
  - (5) necessary permission by security authorities for field surveys of the Team, and
  - (6) information on as well as support in obtaining medical services.
- 6. Ministry of Public Works and Transport (MPWT) will be the executing agency for the Study. A Steering Committee will be organized under the chairmanship of MPWT consisting of all the concerned organizations, such as PTI, DHUP, the related departments of the Water Resources and Environment Administration (WREA), Department of Public Works and Transport of Vientiane city and Vientiane Urban Development Administration Authority (VUDAA). The Committee will be convened at times when there is a need to discuss and resolve critical issues related to development policies and strategy.

#### VIII. OTHERS

JICA and PTI shall consult with each other in respect of any matter that may arise from or in connection with the Study.

![](_page_40_Figure_0.jpeg)

![](_page_40_Figure_1.jpeg)

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Annex II

# Terms of Reference for the Environmental and Social Considerations Study

Environmental and Social Considerations Study (IEE Level)

- 1. Analysis of environmental baseline data
- (1) Social and economic conditions

population, economy, employment, infrastructure/public facilities (water supply, sewerage, etc.), land use, water use, landownership, public health, local conflicts, religious groups, cultural heritage/historical site, hazards(risk), accident, protection/reserve area, etc.

(2) Natural conditions

Topography, geology, soil, ground water, meteorology, hydrology (water level, tidal current, wave, etc.), ecology (fauna & flora), vegetation/forests, water bodies (river, canal, reservoir, pond, etc), erosion, landscape, natural disaster, etc.

(3) Polluted situations

Air pollution/quality, water pollution/quality, soil contamination, noise and vibration, land subsidence, offensive odor, waste materials, etc.

(4) Laws

Laws concerning Environmental Impact Assessment, compensation and resettlement and environmental issue, etc.

2. Scoping

"scoping" means deciding alternatives to be analyzed, and grasping a range of significant and likely significant impacts, and considering study methods.

- 3. Initial environmental examination and study on mitigation measures (including study on alternatives)
- 4. Consultations with stakeholders (stakeholders meetings) at the appropriate study stage.

![](_page_41_Picture_16.jpeg)

Annex III

Tentative Schedule of the Study

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Work Schedule									Ph	ase I											-	PI	nase	[]						
Reports	Z IC	2 C/R							PI	∆ R/R(	(1)					I	∆ T/R					]	ے PR/F	2 R(2)				∆ DF/R	. 1	∆ F/R

IC/R : Inception Report IT/R : Interim Report PR/R : Progress Report DF/R : Draft Final Report F/R : Final Report

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![](_page_42_Picture_4.jpeg)

# MINUTES OF MEETINGS ON

# THE STUDY ON IMPROVEMENT OF WATER ENVIRONMENT IN VIENTIANE CITY, LAO PEOPLE'S DEMOCRATIC REPUBLIC

# AGREED UPON BETWEEN MINISTRY OF PUBLIC WORKS AND TRANSPORT AND JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

VIENTIANE, 3<sup>rd</sup> November, 2008

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Mr. Hiroaki TAKASHIMA Chief Representative Laos Office Japan International Cooperation Agency

Mr. Sommad Pholsena Minister Ministry of Public Works and Transport (MPWT)

#### **1. COUNTERPART ORGANIZATION**

Department of Housing and Urban Planning (DHUP), Ministry of Communication, Transport and Construction (MCTPC) requested the proposal of the Study in August, 2007. After that MCTPC was reorganized and changed its name to Ministry of Public Works and Transport (MPWT) in 12 October, 2007. MPWT assigned PTI (the former URI: Urban Research Institute) as the counterpart agency for the Study.

PTI shall nominate a counterpart team that work closely with the Japanese Study Team throughout the Study period. And related organization such as DHUP, the related departments of the Water Resources and Environment Administration (WREA), Department of Public Works and Transport of Vientiane city and Vientiane Urban Development Administration Authority (VUDAA) shall nominate member(s) of the counterpart team mentioned above. Lao side will provide a list of counterpart team personnel before commencement of the Study.

#### 2. STUDY PERIOD

The duration of the Study will be two (2) years and six (6) months.

#### **3. COLLECTING DATA AND INFORMATION**

Both sides agreed that PTI will provide JICA Study Team with all available data and information related to the Study. PTI will also make best efforts to provide data and information of other organizations. JICA Study Team will utilize those data and information for the purpose of the Study.

Necessary information and data should be provided by Lao side before formulating a master plan for Water Environment Management in Vientiane City, such as quality and quantity of water discharge to That Luang Marsh and Mak Hiao River basin and those related to legal framework changes with respect to EIA.

Especially, "Vientiane New Town Project" will affect the contents of the Study in quality and quantity. Lao side shall provide JICA Study Team with basic design including target population, planned standard quality of effluent from residents, facilities etc as pre-condition for the Study.

#### **4. STEERING COMMITTEE**

Both sides agreed that PTI would set up a steering committee for the smooth implementation of the Study. It will consist of the representatives of relevant organizations under the chairpersonship of MPWT. Organizations as follows are assumed to join the committee at the present moment. The JICA Study Team and JICA representative will also attend the committee.

(1) Ministry of Public Works and Transport (MPWT) (Chair)

- (2) Vientiane city
- (3) PTI
- (4) WREA
- (5) Department of Housing, and Urban Planning (DHUP)
- (6) Department of Public Works and Transport (DPWT), Vientiane city
- (7) Health Department, Vientiane city
- (8) Agriculture and Forestry Department, Vientiane city
- (9) Industry and Commerce Department, Vientiane city
- (10) Environment Office, Vientiane city
- (11) Vientiane Urban Development Administration Authority (VUDAA)
- (12) Vientiane New Town Project, Vientiane City
- (13) Other related organizations

#### 5. Local sub contractor

The Japanese study team will contract local specialists to assist the Study. The Lao study director and Japanese Study Team Leader are responsible for preparing terms of the references (TOR) for recruiting the local specialists and their work plans. The finalization of contract of local sub-contractor(s) will be carried out under rules and regulations of JICA

#### 6. Equipment for the study

JICA would provide an equipment and supplies for the Study, if necessary.

The equipment will remain the property of JICA for the duration of the Study. Its ultimate ownership shall be decided by JICA in consultation with Lao side.

#### 7. Counterpart fund

Lao side shall bear the allocation of the counterpart fund for the study, in accordance with the Agreement on Technical Cooperation between the Government of Japan and the Government of Laos signed on 12 December in 2003.

#### 8. Dispatch of Japanese study team

JICA will dispatch, at its own expense, the Japanese study team to Laos. The Japanese study team will jointly work with Laos study team and pursue technology transfer to ensure the effective management of water environment in Vientiane City in the course of the Study.

#### 9. Disclosure of the reports

MPWT and JICA agreed that the final reports specified in the S/W would be disclosed to all interested parties to facilitate the dissemination of the Study.

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#### **Minutes of Meeting**

on

#### the First Steering Committee

of

# The Study on Improvement of Water Environment in Vientiane City

#### agreed upon between

#### Public Works and Transport Institute, Ministry of Public Works and

#### Transport

#### and

# Japan International Cooperation Agency

February 6, 2009 Vientiane, LAO PDR

Mr. Kanehiro MORISHITA Leader of the Study Team Japan International Cooperation Agency

Mr. Keophilavanh APHAYLATH Director General of Public Works and Transport Institute Ministry of Public Works and Transport

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Mr. Kazuya SUZÚKI Director of Environmental Management Division 1 Global Environment Department Japan International Cooperation Agency

Mr. Bounchanh SINTHAVONG Vice Mayor of Vientiane City

#### I. General

The Government of Japan, in response to the official request of the Government of Lao People's Democratic Republic (hereinafter referred to as "the Government of Lao PDR"), decided to conduct the Study on Improvement of Water Environment in Vientiane City (hereinafter referred to as "the Study") and the Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched the Preparatory Study Team to Lao PDR in March 2008.

Based on the above study results, Ministry of Public Works and Transport (hereinafter referred to as "MPWT") and JICA Laos Office signed on and exchanged agreement on the Scope of Work (hereinafter referred to as "S/W") and Minutes of Meetings (hereinafter referred to as "M/M") for the Study in November 2008.

JICA has prepared the Study according to the S/W and M/M, and dispatched the Study Team, headed by Mr. Kanehiro MORISHITA of CTI Engineering International Co., Ltd., to Lao PDR from January 20, 2009.

At the commencement of the Study, the Study Team explained the overall activities described in the Inception Report to Lao organizations concerned (hereinafter referred to as "Lao side"), and Lao side and the Study Team (hereinafter referred to as "Both sides") had a discussion on the Inception Report, which was chaired by Mr. Bounchanh SINTHAVONG, Vice Mayor of Vientiane City. Finally the Committee members agreed upon work components and work plan contained in the Inception Report. The list of attendance in the meeting is attached in Attachment.

#### **II. Discussions and Suggestions**

#### 1. Agreement upon the Study Framework

The chairman mentioned that (1) boundary of the study area, (2) study approach and methodology, (3) planning strategy and (4) study period of 30 months, which were explained by the Study Team, could be agreed upon by the Lao side.

#### 2. Comments from VUDAA

Vice president of VUDAA pointed out the followings: (1) information on drainage system as shown in 2.1.2 of the Inception Report is not fully covered over the VUDAA projects, (2) responsibility of planning should be included into present capacity of VUDAA as shown in 2.1.3 of the Inception Report, and (3) local authorities of districts and villages should be involved in the proposed pilot project. The Japanese side replied that (1) the drainage information mentioned would be collected in the course of the Phase 1 Study, (2) The planning would be included in the responsibility of VUDAA,

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and (3) the local authorities should be involved in the future activities on the pilot project.

#### 3. Comments from DOAF, Vientiane City

Since the Mak Hiao River basin is suitable for agriculture and inland fishery, water quality management is important for agricultural activities. Director of DOAF suggested that the newly surveyed data would be provided to the Study Team.

#### 4. Comments from DOH, Vientiane City

Deputy Director of DOH mentioned that the sanitary village projects had been progressed and villages of 255 were already completed so far. He also promised providing the information on the project to the Study Team and further cooperation.

#### 5. Comments from DOE, WREA

Deputy Director of DOE suggested that (1) drainage network consists of primary, secondary and tertiary canals so that such entire network should be examined in the Study, (2) DOE had much experience widely covered over the entire stakeholders, and (3) DOE strongly agreed upon the collaborative work with the Study Team and relevant agencies mentioned in the Inception Report. He also added that the comments on the report would be provided to the Study Team in a week.

#### 6. Request from JICA HQ

Mission leader of JICA HQ requested for providing the counterpart list from relevant agencies, and Deputy Director of PTI promised it in a week.

#### **III. Summary and Closing Remarks**

The chairman summarized the discussion results. Finally he gave closing remarks to expect the further progress of the study and the meeting was closed.

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#### ATTACHMENT

List of participants in the Steering Committee Meeting for Presentation of Inception Report on February 5, 2009 at the Meeting Room of Ministry of Public Works and Transport (MPWT)

#### Lao Side

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Mr. Bounchan SINTHAVONG	Vice Mayor	Vientiane Capital City
Mr. Keophilavanh APHYLATH	Director General	Public Works and Transport Institute
Mr. Thenekham Thongbon	Deputy Director	Public Works and Transport Institute
Mr. Ketkeo SIHALATH	Vice President	VUDAA
Mr. Khamthavi Thaipachan	Director	Department of Housing and Urban Planning
Mr. Khampadith KHAMMOUNHEUANG	Deputy Director	Department of Environment, (WREA)
Mr. Oudong NHENGVANNAVONG	Deputy Director	Department of Public Works and Transport
Mr. Sengthong BIRAKOUNE	Deputy Director	Department of Health
Mr. Laisanivong AMARTHITHAJA	Director	Department of Agriculture and Forestry
Ms. Viengphone VIRAVONG	Deputy Director	Department of Industry and Commerce
Mr. Boutsady SIPHILOM	Deputy Director	Water Resources and Environment Office
Mr. Saythivi NHENGVANNAVONG	Chief of Secretariat	Vientiane New City Development Project
Ms. Ketmany BANDASACK	Deputy Director	Department of Education
Ms. Maniseng DOUANGNOULACK	Project Coordinator	Public Works and Transport Institute
Mr. Vongsack MIXAY	Project Coordinator	Public Works and Transport Institute
Mr. Thatsakone CHOULAMOUNTRY	Project Coordinator	Public Works and Transport Institute

#### Japanese Side

Mr. Kazuya SUZUKI	Director	Environmental Management Division 1,
		Global Environment Department, JICA
Ms. Hiroko KAMATA	Senior Advisor	ЛСА
Mr. Yasutoshi SAGAMI	Associate Expert	Environmental Management Division 1, JICA
Mr. Sota SEKINE	Assistant Resident Representative	JICA Laos Office
Mr. Kanehiro MORISHITA	Team Leader	JICA Study Team
Mr. Yasuhiko KATO	Environmental Education	JICA Study Team
Ms. Kyoko MISHIMA	Ecological Conservation/EIA	JICA Study Team
Mr. Hiroshi SHIMOKOCHI	Sanitation/Water Quality	JICA Study Team
Mr. Makoto KODAMA	Drainage Planning	JICA Study Team
Mr. Yunshan BAI	GIS	JICA Study Team

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# **Minutes of Meeting**

on

# the Second Steering Committee

of

The Study on Improvement of Water Environment in Vientiane City agreed upon between

# Public Works and Transport Institute, Ministry of Public Works and

# Transport

#### and

# Japan International Cooperation Agency

September 9, 2009 Vientiane, LAO PDR

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Mr. Kanehiro MORISHITA Leader of the Study Team Japan International Cooperation Agency

Mr. Thenekham THONGBON Deputy Director of Public Works and Transport Institute Ministry of Public Works and Transport

#### I. General

The Government of Japan, in response to the official request of the Government of Lao People's Democratic Republic (hereinafter referred to as "the Government of Lao PDR"), decided to conduct the Study on Improvement of Water Environment in Vientiane City (hereinafter referred to as "the Study") and the Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched the Preparatory Study Team to Lao PDR in March 2008.

Based on the above study results, Ministry of Public Works and Transport (hereinafter referred to as "MPWT") and JICA Laos Office signed on and exchanged agreement on the Scope of Work (hereinafter referred to as "S/W") and Minutes of Meetings (hereinafter referred to as "M/M") for the Study in November 2008.

The Japan International Cooperation Agency (hereinafter referred to as "JICA") has prepared the Study according to the Scope of Work (hereinafter referred to as "S/W") and Minutes of Meetings (hereinafter referred to as "M/M") exchanged in November 2008, and dispatched the Study Team, headed by Mr. Kanehiro MORISHITA of CTI Engineering International Co., Ltd., to Lao People's Democratic Republic (hereinafter referred to as "Lao PDR") from January 20, 2009.

At the end of first half of phase 1 in the Study, the Study Team explained the overall results in the Progress Report 1 to Lao organizations concerned (hereinafter referred to as "Lao side"), and Lao side and the Study Team (hereinafter referred to as "Both sides") had a discussion on this Report, which was chaired by Mr. Sithong THONGKEO, Vice Minister of Ministry of Public Works and Transport. Finally the Committee members agreed upon the work results and work plan for formulation of master plan contained in the Progress Report 1. The list of attendance in the meeting is attached in Attachment.

#### **II. Discussions and Suggestions**

# 1. Comments and Questions from Department of Housing and Urban Planning, MPWT

Acting Director of DHUP mentioned (1) Water Supply Law was already issued through the Cabinet Council, and formulation of the Wastewater Management Strategy was almost completed, (2) Installation of septic tank to individual houses was important to solve the sanitation improvement, and (3) Community-based sanitation (CBS) system should be developed in Vientiane since decentralized system might be suitable to our country. In addition, capacity building for survey and designing of CBS system should be required for the DHUP staff.

The study team replied to the above questions (2) and (3). (2) Installation of septic tank shall be basically made by building owner so that administrative guidance shall be strengthened for increase of

coverage of modern toilet system. (3) Regarding CBS system, the JICA team will cooperate with LIRE (Lao Institute for Renewable Energy), which is planning to install CBS in Vientiane and has much experiences in Indonesia, and will conduct environmental education in the same community where LIRE is planning the installation.

#### 2. Questions and Comments from National University of Laos

Vice Dine of Faculty of Science, National University of Laos, asked why BOD value decreases in accordance with going downstream, and requested to share the experiences and data together between the university and the study team.

The study team answered that water quality purification occurred through SS settling by vegetation filter and increase of DO by photosynthesis of algae and natural aeration effects by shallow flow. The team agreed upon future continuous cooperation.

#### 3. Questions from WWF

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WWF representative mentioned that remaining marshes should be conserved to maintain their flood retention and water purification functions, but how secured their areas in future.

The team replied that urban planning study under JICA would start in the near future, and urban planning could be suitable tools for conservation of That Luang marsh as well as remaining marshes in the urban areas.

#### 4. Comments from Department of Health, Vientiane City

Deputy Director of DOH emphasized that propagation of mosquitoes would be one of the problems after water environmental improvement, and DOH needed to work cooperatively with the team in phase II.

The team agreed upon the comments and promised to collect the information prevention of mosquitoes' propagation.

# 5. Comments from Department of Public Works and Transport, Vientiane City

Technical staff of DPWT made the following comments; (1) Recommendation on water quality standard as a target of the master plan was agreeable, but situation on wastewater in both countries, Laos and the Philippines, might be different. (2) There was no suitable treatment system for New City Development. (3) What kind of wastewater treatment should be done in the industrial area. (4) What kind of facilities the team considered for communal sanitation system.

The team replied as follows; (1) The standard which the team mentioned was set up by water usage, e.g. for fishery, or for agriculture. Fish species and agricultural products were similar in both countries so that the standard of the Philippines could be applied to Laos. (2) There is a large wastewater treatment pond constructed by EU in the New City Development area. Thus DPWT should consider

how utilize the EU pond for wastewater treatment. (3) "The Preparatory Survey on Industrial Zone Development in Laos" under JICA was being carried out. Outcomes in the survey could be used for industrial wastewater treatment facilities.

Project manager of BORDA explained their CBS (Community Based Sanitation) and DEWATS (Decentralized Wastewater Treatment System) with experiences in Indonesia.

#### 6. Comments from Public Works and Transport Institute (PTI)

Deputy Director of PTI suggested; (1) The major issue of popular use of septic tank was how the house owners could willingly install the septic tank. Some budgetary support such as a subsidy might be necessary for this purpose. (2) Another issue was how the sites of priority projects could be secured. Land of canal was not owned by VUDAA, but drainage structures were maintained by VUDAA.

#### 7. Comments from JICA Expert, MPWT

According to the experiences in Japan, it took a considerable time to appear the effects of improvement works in water environment. The proper measures should be taken in a sustainable manner with a long-range perspective.

#### 8. Comments from VUDAA

In recent years, landscape and land use in Vientiane City had been changed drastically due to rapid urbanization. Severe flooding might be apprehensive about frequent occurrence in the outskirt of the City area. Thus additional new drainage canal system should be necessary to prevent such situation.

#### III. Summary and Closing Remarks

For and on behalf of the chairman, Deputy Director of PTI summarized the discussion results. Finally he gave closing remarks to expect the further progress of the study and the meeting was closed.

# **ATTACHMENT**

List of participants in the Steering Committee Meeting for Presentation of Progress Report 1 on September 9, 2009 at the Meeting Room of Ministry of Public Works and Transport (MPWT)

#### Lao Side

#### Ministry of Public Works and Transport

Mr. Sithong THONGKEO	Vice Minister	
Mr. Thenekham THONGBON	Deputy Director	Public Works and Transport Institute
Mr. Khamthavi THAIPACHAN	Acting Director	Department of Housing and Urban Planning
Mr. Bounphanh	Deputy Director	Department of Water Way
Ms. Vanh VIRAPANT	Staff	Department of Housing and Urban Planning
Mr. Koyen MURAOKA	JICA Expert	MPWT
Mr. Vongsack MIXAY	Project Coordinator	Public Works and Transport Institute

#### Water Resources and Environment Administration (WREA)

Mr. SengKeo TASAKET	Technical staff	Department of Environment
<u>Vientiane City</u>		
Mr. Oudong NHENGVANNAVONG	Deputy Director	Department of Public Works and Transport
Mr. Somechayvang DETOUDOM	Technical Staff	Department of Public Works and Transport
Mr. Ketkeo SIHALATH	Vice President	VUDAA
Mr. Sonetavy PHIMMASAN	Deputy Head	Housing section, VUDAA
Mr. Dr. Khamtanh BOUNPHAYVANH	Deputy Director	Department of Public Health
Mr. Amphone	Deputy Director	Department of Agriculture and Forestry
Mr. Sompath SENEPHEMMACHAK	Technical Staff	Department of Agriculture and Forestry
Ms. Viengphone VIRAVONG	Deputy Director	Department of Industry and Commerce
Mr. Sounalath SOUKCHALEAR	Staff	Department of Industry and Commerce
Ms. Boutsady SIPHILOM	Deputy head	Water Resources and Environment Office
Mr. Sommith SANDCHONGHAK	Engineer	Water Resources and Environment Office
Mr. Sengaloon VONGPHOUTHONE	Head of Admin.	Department of Education
Mr. Saythivi NHENGVANNAVONG	Chief of Secretariat	Vientiane New City Development Project
Mr. Silavanh	Staff	Department of Science and Technology

#### National University of Laos

Ms. Dr. Somechan BOUNPHANMY

Vice Dean

Faculty of Science

# <u>NGO</u>

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Ms. Pauline GERRAD	Project Manager	WWF
Ms. Noica DESTALINA	Project Manager	BORDA
Mr. Sengdeuan	Project Assistant	LIRE

# Japanese Side

Mr. Koichi TAKEI	Senior Representative	JICA Laos Office
Ms. Yoko HATTORI	Representative	JICA Laos Office
Mr. Kayasith	РО	JICA Laos Office
Mr. Kanehiro MORISHITA	Team Leader	JICA Study Team
Mr. Yasuhiko KATO	Environmental Education	JICA Study Team
Ms. Kyoko MISHIMA	Ecological Conservation/EIA	JICA Study Team
Mr. Hiroshi SHIMOKOCHI	Sanitation/Water Quality	JICA Study Team