Toward Community-based Wastewater Management Experience from Urban River Side Settlement in Yogyakarta City Indonesia

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Abstract: *Increasing populations in urban areas including river edge area of the Yogyakarta has environmentally impacted the city river. The most densely populated areas are pushing the use of the land. The land is limited so that each household has only a small piece of land or less, equal to about 60 m^2 per house. With these conditions having a home toilet is very uncommon in order to solve this issue, the community has built a communal toilet at the edge of the riverside. This is causing the black water of the public toilet to be directly discharged into the river which therefore is impacting the pollution of the water. The main pollutant of this black water is a bacteria known as Coli (Ecoli) containing above safe health level.*

Black water and grey water of community waste water are major problems in Jogyakarta. In solving these problems, it is necessary to develop some simple technologies apply these to the black water and grey water areas. Tripikon-S (Three=3, Pi = pipe; kon=concentric; S=septic) is a modest technology both individually and communally based technology that would increase the quality of black water before discharging it into the river through an aeration system. Communal wastewater system is just one alternative for solving some of the problem associated with grey water pollution. After settlement of Tripikon-S and communal wastewater treatment, the water pollutant

The project has been implemented in the Prawirodirjan sub-district, of the Gondomanan District in Jogyakarta City, Indonesia. It has shown a quite positive impact on decreasing water pollution mainly the bacteria Coli by around 60%. In a social aspect, the community has become more environmentally aware and has increased their participation in the project and is working towards the improvement of their wastewater network by themselves.

Keywords: City River, land use, communal toilet, black water, health, participation

1 INTRODUCTION

The main problem of water resources in Jogyakarta city is the quantity and quality of water. The quality of water is mainly polluted by domestic waste. Water monitoring done by the City Government in 2005 stated that 82% of 145 surface wells in the inner Jogyakarta city area had been

polluted by coli (>50MPN/100 ml). Factors affecting water pollution are population density, sandy soil, and poor sanitation systems.

Wastewater services only pertain to 40% of population, the rest is managed by the community themselves. Those who settle around the riverside mostly use the river as a wastewater site. They create the problem of having both black water and grey water being discharged directly into river. In order to solve this problem, a simple and cheap technology would be advantageous to incorporate into the water system.

a. To increase community awareness of river pollution;
b. To develop environmentally uncostly individual toilets and communal waste water treatment.
c. To increase community organization capacity in communal sanitation building and maintenance.
d. To decrease river pollution along Code River in Inner City of Jogyakarta.

Neighbourhood 18, Sub-District Prawirodirjan, District Gondomanan, Jogjakarta city was selected as a project area. This selection was based on some of the following criteria: environmental problem, areas close to and around the riverbank in Yogyakarta especially the Code River had become an alternative settlement for lower-level society members. These areas are categorized by the district government as squatter areas, which is characterized as densely populated, un-organized, dirty, and lacking of a city infrastructure. It also refers to the area as sensitive to social and environmental problem areas.

Location of the test are in administrative unit of C It is on the eastern side of the Code River at about 1.5 – 2 meters from river's limit. It's population is around 800 persons or 160 households.

The ownership level of individual water closet (WC) facility is 40% or only 64 households. While 60% or 86 households do not have their own facilities. Lack of domestic waste processing facilities and sanitation facilities contribute to the behavior of the inhabitants to throw it directly into the river without processing it. This habit has threatened the quality of the environment (especially water quality) along the river. Socially and culturally, most inhabitants are non native. Lacking of infrastructure facilities arouse bad habits amongst inhabitants as already mention above. These inhabitants are throwing household waste and human feces into the river. Economically, inhabitants are categorized as lower-income community members consisting of almost 60% working in the informal sector involved in occupations such as rig saw, carpenters, and 15% work in formal sector. The rest are unemployed.

In the last three years, more and more people in this area have joined the forum of the community riverbank the river, which is a forum of the community's at the riverbank in Yogyakarta (Code, Winongo and Gajahwong river). Its mission is to organize the settlement riverbank in protecting and promoting river conservation.

1.1 Communal-based wastewaster management

The term system and management in this paper mean some part relating each other and begining planning activity, implementation, and evaluation. A system that will be set up as a part of processing black water and part of processing grey water and relating each other in wastewater processing system at the communal-based level. Technology for processing black water is appropriate in populous areas. This is imperative with the limited land that is available for an individual septic tank. Tripikon-S is technology created by Prof. Harjoso of Engineering Faculty, Gadjahmada University. Also, mini sewage treatment is designed for limited land and located at the bottom of the communal road.

1.2 Introducing new technogy

As a system, the main activity of the project is to set up a communal organization to handle the waste water. Capacity building activities are the main activity in order to empower community members in solving wastewaster problem (Figure 1 and 2).

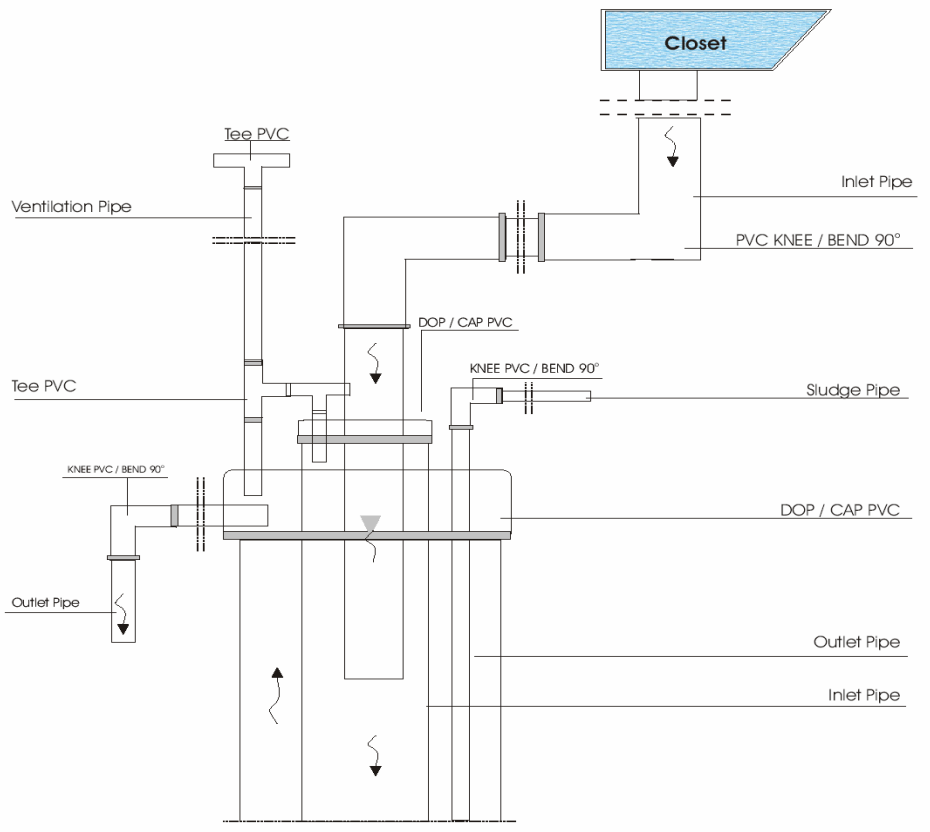

Figure 1. Construction of tripikon single type (Vertikal mode)

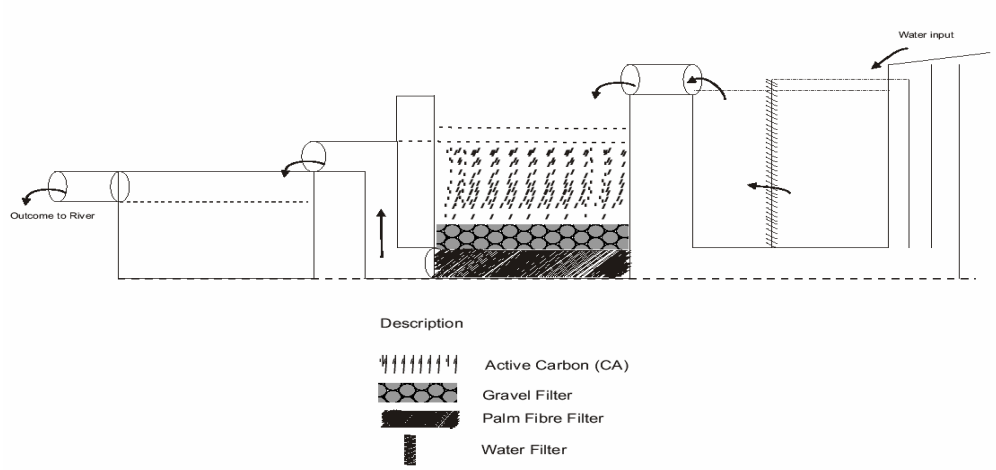

Figure 2. Instalation of sewage treatment plant

Working system of tripikon-S:

a. Black water and feces come directly in through the inlet pipe from closet;
b. In 2 x 24 hours (two days), feces will be broken into small parts in the pipe and some of them will become waste water;
c. Exhaust gas in the inner pipe pass through sludge hole with water;
d. Whenever the sludge has been filled in the outer pipe, it directly drains into exhaust pipe;
e. Air in outlet pipe will be sent out from ventilation pipe.

Due to the high volume of black water from the public toilet, the plastic pipe for three pipe was been changed with cement pipe diameter around 1 meter and 50 centimeters. Construction of the system

2 CONTRIBUTION OF THE PROJECT IN DECREASING RIVER POLLUTION

Contribution of waste water treatment built both for grey water and black water in decreasing river pollution could be checked through laboratory tests. In order to prove the suitability of used technology for wastewater, laboratory test activity would be conducted three times. First test is conducted for drinking water in communal well in order to know the type of pollutant. The second and last tests are conducted for black water and grey water before treatment and after the treatment process.

First test was conducted before project implementation in order to know the level of river and water resource pollution.

Tabel 1. Laboratory test for drinking water in individual well

No	Parameter	Unit	Maximum level	Well (drinking water)				
				1 /RT 61	2 /RT 60	3/ RT 59	4/ RT 58	5/RT59
1.	pH	-	6.5-9	7	7	7	7	7
2.	Turbidity	NTU	25	0.798	0.928	1.143	1.021	1.281
3.	Color	PtCo	50	2,7	10	15	10	10
4.	Smell	-	-	TB	-	-	-	-
5.	Chloride	mg/L Cl	600	27,8	42.33	39.51	35.68	35.27
6.	Fluoride	mg/L F	1.5	0,098	0.081	0.471	0.261	0.211
7.	Nitrate	mg/L	10	1,485	2.282	1.482	2.92	4.028
8.	Nitrite	NO3-N	1.0	0,004	0.036	0.025	0.016	0.001
9.	Permanganate	mg/L	0.5	12,2	0.001	0.001	0.001	0.001
10.	Oil	No2-N	-	1		-	-	-
11.	Fe	mg/L	1	0	0.076	0.086	0.261	0.116
12.	Sulfate	KmnO	400	37.97	46.27	40.74	49.87	36.2
13.	Organic	mg/L	10	5.64	5.95	8.13	7.82	5.64
14.	material	mg/l Fe	-	5.98	7.08	6.28	4.78	5.4
15.	BOD5	mg/l	-	11.280	13.89	11.46	10.78	12.42
16.	COD	mg/l	40	78	166	55	390	38
	Coli bacteria							

Source: Health Laboratory Agency, Health Agency Jogyakarta Province

Based on the first test show it is shown that drinking water of individual wells in almost all of sub-Neighbourhood 18 are polluted by coli and also comes from grey water from both individual toilets and a poor drainage system. In order to solve this problem, the project developed sewage treatment plants in two sub-neighbourhoods and seven Tripikon-S in public and individual toilets.

After development of Tripikon–S in public toilets, laboratory test were conducted for wastewater as follows (Table 2).

Table 2. Laboratory test result of Tripikon-S in public toilets

No	Sample From	Result		Government Regulation Standard PP Ab Bts 82 Tahun 2001	
		MPN/100 ml **Coli**	MPN/100 ml **Feaces Colly**	MPN/100 ml **Colly**	MPN/100 ml **Feaces Colly**
1	Toilet 1	27	48	1000	5000
2	Toilet 2	29	19	1000	5000
3	Toilet 3	17	13	1000	5000

Source: Health Laboratory Agency, Health Agency Jogyakarta Province

Laboratory test for grey water in Sewage Treatment 1 was conducted from the 28th September 2006 until the 9th October 2006. These tests show the level of BOD5, total suspended solid and PH as shown bellow in Table 3.

Table 3. Laboratory test of sewage treatment

No	Parameter	Unit	ST in Neighbourhood 59		ST in Neighbourhood 60		Health level
			Inlet	Outlet	Inlet	Outlet	
1	BOD_5	Mg/l	156	100	420	100	100
2	TSS	Mg/l	160	100	480	98	100
3	PH		7	6	7	6	6

Source: Health Laboratory Agency, Health Agency Jogyakarta Province
Test date: 28September 2006 to 9 October 2006

BOD_5 and Total suspended Solid levels in each Treatment 1 and Treatment 2 decreased by 50% and around 300%. PH level decreased from 7 before treatment to 6 after treatment.

In order to know the impact of waste water treatment on water in nearby drinking wells, the laboratory test was conducted, especially for coli and BOD5 and COD. The test result as follows.

Table 4. Laboratory test in drinking water

No	Parameter	Unit	Well (drinking water) Wastewater treatment developed nearby				
			1 /RT 61	2 /RT 60	3/ RT 61	4/ RT 60	Maximum level
			Before treatment		After treatment		
1.	PH	-	7	7	7	7	6.5-9
2.	Turbidity	NTU	0.798	0.928	0.50	0.68	25
3.	Color	PtCo	2,7	10	5	6	50
4.	Smell	-	TB	-	-	-	-
5.	Chloride	mg/L Cl	27,8	42.33	22.7	35.68	600
6.	Fluoride	mg/L F	0,098	0.081	0.03	0.02	1.5
7.	Nitrate	mg/L	1,485	2.282	0.89	1.56	10
8.	Nitrite	NO3-N	0,004	0.036	0.002	0.002	1.0
9.	Permanganate	mg/L	12,2	0.001	0.001	0.001	0.5
10.	Oil	No2-N	1		-	-	-
11.	Fe	mg/L	0	0.076	0	0.261	1
12.	Sulfate	KMnO	37.97	46.27	20.87	20.67	400
13.	Organic	mg/L	5.64	5.95	2.36	2.87	10
14.	material	mg/l Fe	5.98	7.08	-	-	-
15.	BOD5	mg/l	11.280	13.89	-	-	-
16.	COD	mg/l	78	166	25	20	40
	Coli bacteria						

Source: Health Laboratory Agency, Health Agency Jogyakarta Province

Based on the laboratory tests shown BOD5, COD, and Coli released, decreased according to the health standard.

3 MANAGERIAL ASPECT

The first step in managing wastewater at a grass root level is the creation of a communal organization involved with specific training. This organization developed themselves Tripikon-S and Sewage Treatment at their sub-neighbourhood with assistance from a Project Team. They developed Tripikon-S according to site conditions and worked in collaborative ways with different or same type organization. Environmental problem are basically an inter-organizational and network management problem that need a collaborative arrangement. Collaborative arrangements are a unique institutional forum, consisting of different processes different from the spontaneous coordination or the conscious management of a hierarchy (Agranoff and McGuire, 2003). Other organizations concerning the Code River are Communal Organization for River Conservation (Masyarakat Peduli Kali Blunyah) Code. Some activities launched in recent years were public campaign for river cleaning, a river tourism promotion, and a yearly fishing rod competition in Code River.

4 EFFECTIVENESS OF COMMUNITY-BASED WASTEWATER MANAGEMENT

Community organization at grass root level owing capital that is vital to the organization's activity and helps solve their problem. Main capital of community organizations is social capital that maintains its sustainability. Social capital consists of norms, trust, and networks. The Institutional dimension of institution is for the purpose of carrying out the function of governance and is perhaps the most important determinant of environmental quality. Some criteria of institutional benchmarks include (Lohani in Stubbs and Clarke, 1996):

- Geographic coverage: do governing institutions have authority over the entire urbanizing area?
- Sectoral coverage and internal integration: are institution fragmented along the sectoral line? Are there multiple institutions working in parallel, and if so, do sufficient interagency coordinating bodies exist to carry out integrated project development effectively?
- Autonomy: Are urban management institutions sufficiently removed from central government to undertake activities that clearly benefit the urbanizing area? Autonomous functions are both administrative and financial.
- Articulation: are institutions sufficiently developed in term of interaction with their constituencies and the problems they are poised to solve in order to provide realistic responses to those problems?
- Functional definition: this refers specifically to the distinction between project implementing and regulatory functions, whether these functions are recognized in the mandates of specific institutions and whether the dichotomous roles are recognized and accepted as matters of civic policy and as aa approved means toward a more liveable environment.

Table 5. Community-based wastewater organization (CWO)

No.	Indicator	Community-based organization
1	Geographic coverage	Neighbourhood level
2	Sectoral coverage and internal integration	Not fragmented
3	Vertical integration	Don't have vertical line with formal authority
4	Autonomy	Full discretion and weak financially
5	Articulation Functional definition	Free
6	Functional definition	Clear

Based on above criteria, potentiality of CWO is very important to solve river and water pollution. CWO could cover a small area that is settled and provide wastewater management. Some activities relating to environmental management they currently manage are as follows

Table 6. Current environmental management of CWO in project area

Wastewater	Solid waste
Managing public toilet	Collection
Developing local drainage	Transfer solid to transfer point
Maintenance drainage	Recycling
Collecting user charge	Collecting user charge

Institutional mechanisms that need to be addressed are how the institutional relations amongst the District Office, Sub-district, Environmental Protection Agency of the City government and Provincial Government and how do they manage in planning, implementation, and evaluation.

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Urban Wastewater and Sanitation Situation in Vientiane, Lao PDR

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Abstract: *Rural to urban migration, tourism and industrial sector growth have significantly contributed to increased waste production, both liquid and solid. Wastewater treatment needs more attention in urban environment. In Vientiane, water and sanitation management in the urban area is experiencing stagnant pollution. Unsanitary conditions and threat of seasonal pollution in selected spots is likely to occur and increase with the growing urban population. The sanitation system entails an on–site disposal of human waste without introduction of full water-borne sewerage with treatment facility and safe disposal arrangement. The majority of households rely on water flush latrines and are connected to a pit or chamber for containment of excreta. However, due to the low permeability of the soil and the high groundwater table around Vientiane, many soak-a-ways fail to operate effectively resulting in discharge of sewage from tanks into drainage channels or low lying areas. This results in polluted effluent overflows, environmental degradation and health hazards.*

Keywords: Urban wastewater discharge, sanitation, environmental policy

1 INTRODUCTION

Urbanization is one of the most important demographic trends of the twenty-first century, and growth has been particularly rapid in low-income countries. The majority of urban growth is associated with rapid expansion and development of small urban centers. Much growth is unplanned and informal, with community members and informal sector developer taking advantage of the fact that regulatory capacity of government authorities is weak, particularly in those areas that are outside official municipal boundaries. Peri-urban areas are characterized by mixture of land uses associated with a range of urban and peri-urban livelihoods. Settlements are generally inhabited by communities of different economic status relating to land prices, which are affected by locations in relation to the city, and which are considerably, higher than in rural areas. Many industries locate on the edge of the city because land is relatively cheap and not subject to stringent development controls. At present, the wastes they produce rarely receive adequate treatment. Due to the ongoing development, peri-urban areas are generally in a state of rapid transition that may result in serious social and environmental tensions.

At the moment, Vientiane has a population of 692,900 people with a density of 176 people per km^2 (ADB, 2000). The population density is increasing at a rate of 4.7% per year (ADB, 2001). The urban area is divided into 112 villages with a total area of approximately 30 km^2 (ADB, 2001b). The core urban population has been estimated to be 180,410 people. The urban area of Vientiane is located between the Mekong River and a hinterland of swamps and ponds. The wastewater from individual households in Vientiane is discharged into open drains along the roads and into the natural wetlands in and around the city (Cecilia, 2003). Vientiane capital city (as the largest city) contains almost 1,500 km^2 of permanent and seasonal water bodies, floodplains, swamps and marshes. The wetland areas supply a wide range of economically valuable goods and services, including fishery products, farming and natural resource collection activities, and flood attenuation, maintenance of water quality and supplies, and treatment of domestic, agricultural and industrial wastes (DANIDA, 1998).

Overtime, Urban Vientiane land has been going through tremendous transformations due to sprawls in agricultural cultivation, industrial developments and urbanization. The changes in land use affect the ecosystem in terms of land cover, land quality and capability, weather and climate, and the extent of land that can be sustained. The development projects include:

Rehabilitation of Sihom Area, UNCDF/UNDP, 1991-1997: The Vientiane Master Plan identified priority areas afflicted from environmental problems related to poor drainage, household sanitation, and access to services such as waste management. The priorities of the project were to improve the living conditions of the population of Sihom area through rehabilitation and upgrading, improve the sanitation and storm water drainage, and strengthen the institutional capacity.

Wastewater Management of Thatluang Marsh, EU, 1993: Thatuang wastewater management project was designed to improve wastewater treatment and drainage out of the central Vientiane area. The project built a system of stabilization ponds at Thatuang Marsh designed to serve an estimated population of 44,590 for 2005 with a per capita BOD[5] discharge of 45g/capita/day assuming 50% of the pollutant load would reach the treatment plant.

Vientiane Integrated Urban Development Project, ADB, 1996-2000: The overall objective of the Vientiane Integrated Urban Development Project was to improve access to basic services and infrastructure, thus providing benefits of urban environmental health to the population of Vientiane. The project supported the formation of Vientiane Urban Development and Management Committee (VUDMC) to institutionalize urban planning and strengthen the development of the control system.

Improvement of Urban Environment in Vientiane, Danida, 2001-2004: The project aimed to continue support to the municipal planning with the development of linkages between green and brown environmental issues and increased village involvement in environmental planning, implementation and monitoring.

[5] Biochemical Oxygen Demand

2 STATUS OF WASTEWATER AND SANITATION IN VIENTIANE

Through the years, the government has set up four water analysis laboratories in different regions throughout the country. These laboratories cooperate by exchanging information and dividing responsibilities over the water analysis processes in an efficient manner. For example, the management and control of water in the Mekong River and its tributaries are the responsibility of the water analysis laboratory of the Irrigation Department. The quality of water drinking is analyzed and laboratory of the Ministry of Health is responsible for it; water released from industries is handled by the laboratory of Ministry of Industry and Commerce. Wastewater in urban surroundings in VCC is taken care by the laboratory of Science Technology and Environment Agency.

For Thatluang wetland, its water quality is a part of the water quality-monitoring project of Mekong Secretariat, in the vicinity of VCC. Main problems found are wastewater and sewage (from the city area) which discharge into the marsh. A part of such water is diluted by irrigation water pumped from the Mekong River to the surrounding rice fields through various canal systems.

As known, urban centers are always attractive places for both educational institutions and employment opportunities, and increasing in-migration from rural to urban areas is commonly observed. Currently, Vientiane city lacks effective systems of development control, and therefore the means to control the future development and its concomitant environmental degradation are inefficient. The drainage system is shown to be inadequate. Added to that, the contaminated liquid waste with fecal matter from the latrines is being directly discharged into the drainage channels or drains with oviform from septic tank effluents. This presents health risk, which would increase with the rising urban populations with similar sanitation practices. It also leads to the contamination of underground water sources such as wells and eutrophication of water bodies leading to a pressure on urban water resources. Increased risks of water borne and other vector borne epidemics have been perceived. For example, stormwater drainage is found to be a serious issue in Vientiane city in the year 2000. The present system suffers from inadequate design and lack of maintenance. Most drains are clogged with garbage, reflecting the absence of an organized system for solid waste disposal in the city.

2.1 Wastewater discharge

In Vientiane city, there are three main drainage channel systems including Hong Xeng, Hong Ke and Hong Khoua Khao. Hong Xeng mainly drains water from Sikhottabong district and some part of Chanthaboury district, through Nong Duang marsh and Pasak stream. Hong Ke drain is the main channel, which is connected to Hong Thong and Nong Chanh swamp, draining water from Chanthaboury and Sisattanak district through the Morning market. Hong Khoua Khao is a drainage system for draining water from Nong Chanh to Mekong River and finally to Thatluang wetland through Hong Ke drainage channel (Figure 1).

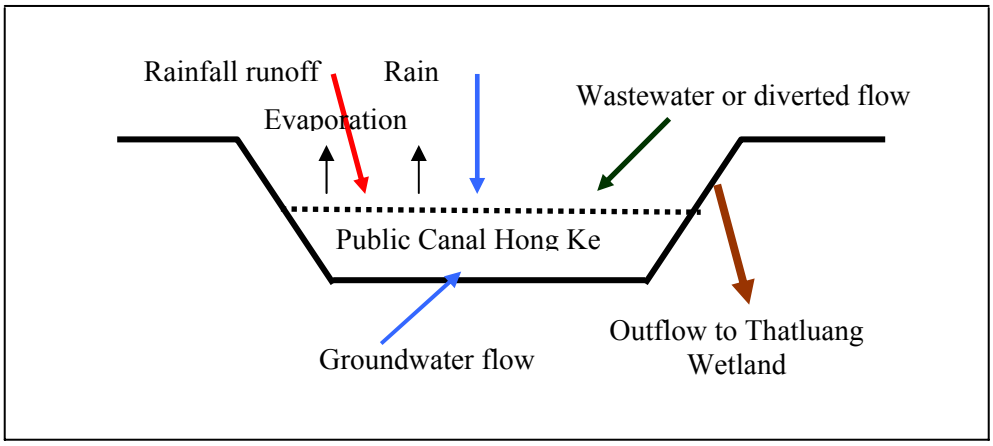

Figure 1. Water balance in the present situation

In Vientiane city, storm water drainage consists of roadside drains leading ultimately to natural streams or rivers. Drains are generally not adequately interconnected and do not form a network. Drains are lined in the center area, and covered in front of commercial establishments. Water in the drainage system is invariably contaminated with fecal matter from latrines and E. coli form septic tank effluent, presenting health risks**.** The absence of overall urban drainage plans with a functioning integrated network combined with lack of clear arrangements for maintenance causes flooding and stagnant water pools over large parts of the urban center. Sanitation system in VCC entails an on-site disposal of human waste without any introduction of full water-based sewerage with treatment facility and safe disposal arrangements (STEA, 2001). Such a system continues to have a detrimental impact on the public health by mixing sewage in the storm drainage system, polluting the natural water courses in the medium and the long term.

2.2 Sanitation and wastewater purification

Although the drainage system in Vientiane has improved somewhat as a result of the projects listed earlier, the situation of sanitation and wastewater purification is still very limited. Since the completion of the EU project, Wastewater Management of Thatluang Marsh, the stabilization ponds which were built as part of the project have been unused for wastewater treatment and are now being managed as aquaculture ponds. Similarly, the sewage waste treatment plant funded by ADB was built in a smaller size than what was originally planned. Moreover, it was not properly maintained. Due to complaints of smell by local residents, it was shut down and despite increased hauling cost, sewage is now disposed of at a secondary waste treatment plant 18 km outside of the city. However, the Danida project Improvement of the Urban Environment in Vientiane, gives hopes for a positive result of considerable improvements for urban residents in the core downtown area. The project is in the process of constructing communal septic tanks, improving the Nong Chanh Marsh in the center of the town, and will re-establish the use of the original EU built sewer line and stabilization ponds. Above all, these improvements are focused on the core downtown area and do not extend to other areas of the city or surrounding city areas.

The amount of industrial wastewater production around the city is little known as well as about the extent of industrial water pollution. According to the country's Environmental Law (Provisions on Discharge of Wastewater from Factories, Ministry of Industry and Handicrafts decree No. 180/H), industries are responsible for the treatment of all wastewater and by-products produced as a part of the industrial processes. The Science Technology Environment Agency (STEA) is responsible for the assessment and monitoring of wastewater quality. STEA is currently in the process of developing an environmental monitoring system for the country as a whole but at this point, very little information is available about the industrial wastes.

Table 1. Sanitation situation and needs in Vientiane and its surrounding areas

Drainage Areas in VCC	**Area** (ha)	**Population**	**HH**	**Drain into**	**%**	**Septic Tank Cesspool**		**Direct discharge to surface water**		**No toilet**		
						hh	%	hh	%	hh	%	hh
A	214	17,451	2,959	Hong Ke	60	1,775	32	947	7	207	2	59
B	556	35,572	5,971	Hong Ke	67	4,001	22	1,314	9	537	2	199
C	306	17,529	2,882	Hong Xeng	69	1,989	24	692	5	144	1	29
D	572	35,214	6,007	Nan Pasak	66	3,965	29	1,742	4	240	3	120
E	728	34,150	5,281	Hong Ke	63	3,327	30	1,584	4	211	3	158
F	435	15,744	2,413	Hong Ke	71	1,713	23	555	3	72	3	72
Total that Drain into Hong Ke	1,933	102,917	16,624	Hong Ke	66	10,816	26	4,400	6	1,028	2	409

Source: ADB, 2000

In relation to Sanitation and Wastewater Purification, Thatluang Marsh is currently performing wastewater treatment services for domestic wastewater that is being drained into it. As stated above, drainage areas: Urban protection area (A), Commercial area (B), Urban development area (E), and Resident area (F) drain via primary and tertiary canals to Hong Ke canal and then into Thatluang marsh (Table 1). The marsh is thus providing wastewater and sanitation services for household wastewater and sewage drainage. There are two major types of costs that are associated with artificially replacing the wastewater treatment and water purification services of Thatluang marsh:

- Construction or improvement of household sanitation facilities in areas that drain directly in the marsh.
- Extension of the waste treatment plant so that it can deal with increased waste load. According to the ADB survey in Sanitation, Drainage, and Wastewater Management,

there are 1,256 households which directly discharge their sewage into surface water and 501 households with no toilet within areas are draining their wastewater into Hong Ke and Thatluang marsh.

It should be noted that with high water table and impermeable soils throughout the Vientiane Municipality, sanitation using cesspools or elevated soak-a-ways are largely inefficient and provide inadequate services.

3 SETTINGS OF WASTEWATER AND SANITATION MANAGEMENT

The Lao Government strategies on development and maintenance of urban environment infrastructure are based on achieving sustainable and affordable environmental improvement of its main urban center (STEA, 2001). Implementation priorities relate to specific urban center needs, which would be identified along with urban hierarchy adopted by the government. The management of water supply requires the government involvement and institutional capacity as well as financial resources for its development. Drainage master plan for VCC urban area, covering all catchments, needs to be given high priorities. Such urban drainage plans with the need for creating and maintaining functioning drainage networks, including identification of final points of discharge must be emphasized.

3.1 Public-private participation

In response to the deficiencies of centralized approaches to service delivery, in recent years, there has been increasing emphasis on the potential benefits of adopting decentralized approaches to sanitation and wastewater management. These relate to the opportunities for stakeholder involvement in decision-making and planning, financial advantages, and benefits of segregation of wastewater at source and the compatibility with local demands for wastewater reuse. In general, central elements that shape the institutional setting for environmental management include: a) the key actors in the public and private sectors whose motives and mandates significantly affect the urban water and sanitation; b) management functions that can be used to address environmental issues in the city, including the instruments of intervention and mechanism for coordination; and c) existing initiatives that affect efforts to manage wastewater and sanitation problems.

3.3 Wastewater and sanitation management function

Management function consists of policy and other instruments that actors can apply to affect environmental quality and mechanisms in coordinating environment-oriented decisions. Urban governance often adopts policies to deal with wastewater and sanitation management problems. Based on that, the government will formulate a long-term national wastewater and sanitation strategy to guide any future investment in water and sanitation activity. The most prevalent tool for environmental management that affects a city is legislation with its regulations. The sophistication and effectiveness of this tool is low in Laos, since there are only few environmental standards and an incomplete set of environmental laws. Moreover, lack of enforcement is a pervasive problem.

However, the environmental impact assessment (EIA) process is being positively promoted and selectively implemented in Lao PDR.

3.4 Planning and policy development

The processes of planning and implementation can be addressed in partial aspects of environmental problem, since there are may be an ability to handle wastewater disposal within the municipality borders. However, water and sanitation disposal often calls for city-wide solution, metro-level authority to plan, coordinate, and execute a wastewater disposal program. The planning has generally not been an effective environmental tool, although monitoring varies according to the city's level of economic and human resource development. It has been observed that coordination across different levels of the government has been improving in a more centralized manner although there still exist problems in recent decentralized policies.

In terms of environmental coordination and decision-making processes, intersected coordination to manage urban environmental affairs has been lacking and has become a problem in Vientiane city, although the coordinating mechanism given below has been established for urban development in Vientiane city.

- At the central government level, there is a planning body that is in charge of synchronizing interdepartmental coordination for urban activities.
- At the city level, there is a community to coordinate sectoral program and projects from loans (i.e., ADB loans).
- For implementation of infrastructure activities, there is a program to coordinate investment and institutional strengthening (i.e., VUDAA).

4 CONCLUSION

Sanitation, including wastewater treatment is an important environmental service that is closely linked to water management. In urban areas, poor management of sanitation system generally contributes to wastewater pollution. In Vientiane city, outfall from poor functioning central sewage system contaminates water resources. Poor system coverage results in serious lagoon and stream pollution, as well as soil contamination from open defecation in slum and around the city. Moreover, urban VCC land has also been going through tremendous transformations due to sprawls in agricultural development, industrialization and urbanization. As the urban areas develop with new buildings and infrastructure, the wetlands are becoming increasingly isolated and their capacity to perform their environmental functions greatly diminishes. Urban development throughout the city has been growing in an unplanned manner often resulting in aggravating flooding and drainage problems, partly due to the limited capacity at the municipal planning level. Moreover, there has been little sustainable built-in project design resulting in discontinued use of wastewater stabilization ponds and limited use of the waste treatment plant in Thatluang wetland. Access to and affordability of adequate sanitation is always a problem for the poor, especially in the low-income households. Combination of poor management and low-level service to the poor that causes inadequate sanitation has eventually negatively affected health consequences.

ACKNOWLEDGMENT

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Model Ordinance for Environmental Sanitation Solutions in the Philippines

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Abstract: *The level of coliform bacteria in the coastal waters of Dumaguete City is 22 times more than normal. This is caused largely by the city's untreated wastewater that leads straight to the sea. The resulting water pollution will continue to worsen because of the increasing human population and activities in the city. This paper discusses both the short-term and medium-term solutions to the city's domestic wastewater. The Philippine Clean Water Act of 2004 (RA 9275) requires a city the size of Dumaguete to employ a septage management system. This means that septic tanks shall be pumped out periodically and treated in a septage management plant. Dumaguete, with the assistance of the LINAW project of USAID, is now working on the setting up of a biological wastewater treatment plant with a constructed wetland in a 3-hectare dry river bed. This project will properly treat and dispose the septage from the city's 22,000 households and 2,500 commercial establishments, including schools, hospitals, public market, City Hall, and other institutions. The ultimate aim is to free the underground water of pollutants and restore the water quality of the Dumaguete Bay to its previous status many years ago. This paper likewise discusses the newly enacted Septage Management Ordinance of Dumaguete City which supplements the provisions and specifications of existing laws related to septage management as well as complements existing laws on clean water and building and plumbing regulations. The ordinance establishes a septage management system in the city and provides for the specific requirements for permitting, siting, designing, installing, approving and operating on-site wastewater treatment systems. It explains the rules and regulations governing the collection, handling, transport, treatment and disposal of domestic sludge and septage. The ordinance makes septage management system a basic deliverable service of the city. This law may be adopted by other local governments or they could use the model as a framework to add specific requirements that might be applicable to their particular jurisdiction.*

Keywords: Water and sanitation, wastewater, septage, ordinances

1 INTRODUCTION:

According to the Philippine Local Government Code of 1991 (Republic Act 7160), Local Government Units are responsible for the provision of potable water supply and sanitation services to the public. The Philippine Clean Water Act of 2004 (RA 9275) also provides the authority and regulatory framework for protecting the waters of the Philippines. It is up to the LGUs to use this authority and determine how to implement these broad requirements.

The best way to approach this is to prepare a Model Ordinance for the regulation of on-site wastewater treatment and disposal systems. The enactment of Ordinance No. 18, Series of 2006, entitled "An Ordinance Establishing a Septage Management System in the City of Dumaguete" was in line with the Local Initiatives for Affordable Wastewater Treatment (LINAW) project carried out with the assistance of the United States Agency for International Development (USAID). Dumaguete was one of the four developing cities in the Philippines selected by the USAID for the three-year-old project, which was aimed at helping local government units implement Republic Act 8749 or the Clean Water Act. The other cities were Muntinlupa City in Metro Manila, Naga City in Camarines Sur, Iloilo City in Western Visayas.

Enacting local legislations in accordance with national policies and laws is a fundamental aspect of the wastewater management process to address deteriorating water quality and to reverse current trends. Local resolutions and ordinances are essential legal instruments to assist in improving the status of water resources and their management.

A septage management program is a good first step, readily implementable, affordable, and simple program that local government units and communities can adopt to fulfill the provision of the Philippine Clean Water Act.

2 LINAW PROJECT BACKGROUND

The Local Initiatives for Affordable Wastewater Treatment (LINAW) Project, a 2-year project started in October 2003 with funding from the U.S. Agency for International Development, was created to facilitate local responses to the urgent need for sanitation services in the Philippines. Together with the 3 other pilot cities (Naga, Muntinlupa and Iloilo), the project is assisting Dumaguete City in developing and implementing low-cost wastewater treatment systems to improve water quality management. It also assists the city in developing public awareness program on sanitation and wastewater problems.

The LINAW Project is now on Phase 2 and Dumaguete City has been included in the project along with Iloilo, Muntinlupa and Naga to bring planned pilot projects to completion. Dumaguete City has adopted some short-term and medium-term plans. Short-term projects include the improvement of septic tanks in the city and the installation of grease traps for restaurants and eateries. Medium-term projects will focus on the construction of a citywide septage management plant for domestic wastes, decentralized wastewater treatment facility for the public market complex and the business district, and community sanitation facilities.

3 BRIEF PROFILE OF DUMAGUETE CITY

Dumaguete City, located on the southeast of the Negros Island, is the capital city of the Province of Negros Oriental in Central Visayas. With an area of 3,426 hectares, it is bounded in the east by the Mindanao Sea, on the north by the municipality of Sibulan, Bacong on the south and Valencia on the west. It has thirty barangays and a population of 110,237 based on the 2000 census with a 2.14% average annual growth rate in the second half of the nineties.

Dumaguete has earned the distinction of being known as “the Center of Learning in the South,” or a "University Town". The city is also the service center of regional commerce and trade as well as the administrative center of national and provincial government offices. The city is a fascinating place of friendly, warm and hospitable people and has been known throughout the Philippines as the “City of Gentle People” as it is a quiet and peaceful town. This image is being enhanced by its vision for an ecologically-balanced city. Such vision is being pursued through projects and programs that protect, sustain, and enhance environmental quality.

Most of the people in Dumaguete have a set of issues that are equally immediate and real. Issues that most directly affect what the people hope to achieve for themselves and their families. Issues that relate to building a life free of poverty and deadly disease, with enough food and clean drinking water, in a clean and safe environment. It is simply intolerable to see the persistence of poor sanitation and limited access to clean water.

4 WASTEWATER SITUATION

Dumaguete is endowed with rich natural resources, including water, which are essential for the city’s economic development. Water resources of the city include inland freshwater (river, creeks and underground water) and marine (bay and coastal waters). City residents are largely dependent on underground water supply for its daily water consumption. In a previous study, the average water consumption of every person in Dumaguete is 30 gallons a day.

Most of the residences, businesses and institutions in Dumaguete City use septic tanks for wastewater treatment and disposal. However, most of these septic tanks are not properly designed, constructed or regularly desludged.

Water pollution is an increasingly important issue for Dumaguete City. In recent years, more and more residents of the city have come to realize the tremendous impact that water pollution have on the city’s economic development and well being. The city’s drainage system which has been in place for more than 50 years now, has converted the sea off the Rizal Boulevard into one giant septic tank. Untreated wastewater from various sources within the Poblacion area end up here. This resulted to the Class SD classification of the coastal waters of the city. Class SD waters are the lowest classes of water quality under the DENR standards.

Dumaguete wastewaters consist of washing and sewage effluents from homes, wastewater from hospitals, and industrial washings from oil depots, etc. Thus far, these liquid wastes are not subjected to treatment, primary or secondary, except sewage effluent which goes through septic tanks before being emptied to the general environment. But all of these wastewaters still contain large amount of polluting substances and microorganisms when released. 90% of the sewage generated in the city is not disposed or treated in an environmentally acceptable manner.

Nevertheless, the City is committed to the improvement, maintenance and conservation of the ecosystem and the protection of public health.

5 THE NEED FOR WASTEWATER TREATMENT: LEGAL BASIS

The city has worthwhile plans and ordinances designed to protect the water environment. On September 27, 2001, the City Council passed Resolution No. 438 , series of 2001, adopting the 5-Year Coastal Resource Management Plan of the city (2001-2005). This plan contains plans and strategies for the setting up of wastewater treatment facilities to control coastal water pollution and the degradation of the coastal ecosystem.

On November 8, 2001, the City Council approved the Comprehensive and Unified Coastal Resources Management Ordinance (Ordinance No.88, series of 2001). This ordinance prohibits all activities in the grounds or waters which result or likely to result hazards to human health. The ordinance likewise penalizes any person, entities, organizations or corporations to dispose or dump solid and liquid wastes in coastal areas *(Section 58)* for violation.

On October 14, 2004, the City Council adopted Resolution No. 367, series of 2004, declaring the dry river bed at Barangays Candauay and Camanjac as the Biological Wastewater Treatment Site. On June 2, 2005, the City Council passed City Ordinance No. 48, series of 2005, adopting the Environment Code of Dumaguete City. Chapter 8, Section 131 (f, g) mandates the construction of a city-owned, operated and managed sanitary sewer system and wastewater treatment plant. It also requires residences, business establishments, market complexes, academic institutions, housing subdivisions, hospitals and sanitary facilities to connect to the City-owned, operated and managed sewer system and wastewater treatment plant when these are already operational. User fees will be charged for the facilities.

It took the City Council 20 months to deliberate, improve and approve the City Environment Code which was drafted for 11 months by the E-Code multi-sectoral Technical Working Group chaired by the Vice-Mayor. Big and small workshops and consultations with concerned stakeholders, organizations and experts were conducted to draft the code. These local legislations are guided by the common vision for Dumaguete City developed during the formulation of the 5-Year Coastal Resource Management Plan participated in by leaders from both the public and private sectors and facilitated by the Coastal Resource Management Project, a technical assistance project of the U.S. Agency for International Development. The vision states for an “ecologically-balanced city, and as a center for quality education and dynamic trade”.

Aside from local legislations, the newly enacted Philippine Clean Water Act of 2004 (RA 9275) also mandates:

- That “each LGU shall appropriate the necessary land, including the required rights of way/road access to the land for the construction of the sewage and/or septage treatment facilities. Each LGU may raise funds to subsidize necessary expenses for the operation and maintenance of sewerage treatment or septage facility servicing their area of jurisdiction through local property taxes and enforcement of a service fee system.” (Sec. 7, par. 3)
- That within 5 years all households, commercial centers, and public buildings must be connected to a sewerage system (for HUCs).

- That non-HUCs shall employ septage management system (pumping out septic tanks and treating the septage)
- That all subdivisions and commercial establishments must have sewage treatment facilities to get ECC and permit to operate

It is good to stress that the recently enacted Environment Code of Dumaguete City provides a guiding framework for improving compliance with the Clean Water Act as well as the Building Code and Sanitation Code of the Philippines {Chapter 8, Sec. 131, (a)}

6 SEPTAGE MANAGEMENT ORDINANCE

The Septage Management Ordinance of Dumaguete City provides for the desludging of septic tanks every 3-5 years from 22,000 households, 4,500 business establishments, 3 hospitals, 7 colleges and universities, and 17 elementary and high schools. Wastewater from septic tanks will be treated in a septage treatment facility in Bgys. Camanjac and Candauay utilizing the natural system of treatment without the use of chemicals and electricity. The capital cost of the facility which is P17M will be loaned from a local bank. A user's fee will be collected from each household and a revolving fund based on a service cost recovery scheme will be established. Ultimately, through the facility the water environment is conserved and the well-being of the people is enhanced.

The ordinance provides for the specific requirements for permitting, siting, designing, installing, approving and operating on-site wastewater treatment systems. It likewise explains the rules and regulations governing the collection, handling, transport, treatment and disposal of domestic sludge and septage. The ordinance makes septage management system a basic deliverable service of the city.

Under the ordinance, building permits shall only be issued to new construction whose septic tanks have 3 compartments, located outside the building, 25 meters away from any water source, water tight, sealed and accessible for desludging. Regular desludging will make the effluent cleaner, the septage treated and the underground water supply free from any pollutant. The city is currently implementing the ordinance.

Following is the Resolution and Ordinance establishing a septage management system in Dumaguete City passed by the City Council of Dumaguete on April 6, 2006 and duly approved by the Provincial Board of the Province of Negros Oriental.

7 CONCLUSION: TACKLING THE SANITATION CHALLENGE

The tackling of the sanitation challenge involves handling the issues that have long been ignored. As a result, over 90% of all sewage generated in the Philippines is not treated. This has lead to very high levels of pollution causing 1/3rd of all illnesses, 12 deaths per day (mostly children) and high economic costs (P67 billion per year in health, fisheries and tourism losses). The situation here is much worse than in most other Asian countries. The Philippines is third to the last in Asia in providing households with sewage treatment. Dhaka, Bangladesh is ahead of us with 30% coverage

while Phnom Penh, Cambodia has 40% coverage. The Philippine government, recognizing the seriousness of the problem, enacted the Clean Water Act in 2004. The law calls for sewage treatment within 5 years. Several LGUs are taking action to implement the law, focusing on building environmentally friendly, low-cost systems. Everyone needs to work together to promote sanitation—from the family to the community, from local government units to national government agencies, and from civil society groups to the international donor community. One immediate action that can reduce the incidence of diarrhea by 35% is for all of us to wash our hands with soap before each meal and after using the toilet. It is about time we do something to protect our environmental health and that of our posterity.

Community-Based Urban Sanitation Improvement for the Urban Poor in Nam Dinh City, Vietnam

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***Abstract**: Poor urban environment and sanitation in urban poor livelihood in Nam Dinh city has been contributed by the poor condition of drainage, frequent flooding, wastewater discharges, solid waste litter and bucket latrine spills. Limited state funding and inefficient upgrading works because of traditional top down approach in implementation over the time resulted in deterioration of the conditions of the urban poor living condition. A majority of the poor are low-income government civil staffs, pensioners, workers and small merchandisers, having low awareness on hygiene/sanitation and urban environmental related health issues. A Community Participation Program (CPP) of Nam Dinh Urban Development Project (NDUDP) funded by the Swiss Agency for Development Cooperation (SDC) launched in 1997 had implemented various initiatives to improve the situation. The program covered health and urban environment activities, strengthening the capacity of city Women Union (WU), providing hygiene education in schools, WU-managed revolving credit fund for improving household sanitation with the introduction of septic tanks to replace bucket latrines and assistance for community-based micro-drains improvement. Under the goal to enable Nam Dinh communities to "sustainably stand on their own feet" as the city Chairman stated, the NDUDP's CPP aimed to help communities in Nam Dinh city to be able in self-managing their own community-based activities in general and hygiene/sanitation related health improvement in particular through the dissemination of messages on relationship between hygiene/sanitation and health and need of improvement to promote all people to contribute initiatives in hygiene behaviorial changes and solutions for living environment improvements using their own resources including finances. In the program implementation process, women took the key role in problems identification, solutions, decision-making and mobilization of resources from the community for implementation of solutions.*

Keywords: Hygiene, sanitation and health, community participation, training, cost-effective options

1 BACKGROUND

Located 90 km south of Hanoi, Nam Dinh City, the capital of a province also named Nam Dinh in the north Vietnam, has an area of 4,635 hectares with a population of 240,000 people. It is a land with cultural, physical and spiritual values for thousands of years, the native land of the Tran royal dynasty, which lasted 175 years (1225-1400) through the reigns of 14 kings, and is considered one of the most brilliant dynasties in the Vietnamese feudal history. Before 1975, Nam Dinh City

was the third biggest in North Vietnam (after Hanoi and Hai Phong) and served as an economic, political and cultural centre of Nam Dinh Province in general and as the southern area in the Red River delta in particular.

Nam Dinh, once the textile heartland of Vietnam, is recently in a deep economic crisis. Exacerbated by rapid urbanization and shortage of state budget for infrastructure improvement with community lacking awareness on hygienic urban sanitation environment and health related issues the people rely on the state investment. The residential areas of the urban poor has been facing severe pollution of the living environment with frequent flooding due to inadequate drainage system, open wastewater flow, unhygienic sanitation, etc.

In such a context, the urban development project in Nam Dinh city funded by the Swiss Agency for Development Cooperation was launched, initially for a large-scale drainage and pilot water supply service improvement, restructuring of municipal offices and their roles related to provision of public utility services, as well as setting up community participation program dealing with environmental health issues and micro-infrastructures, such as micro-drains and access footpaths, household sanitation facilities and septic tanks. These activities laid the foundations for a dynamic partnership between the municipality, civil society and the private sector. Currently, the ongoing 3rd phase of the project is seeking to capitalize on the initial results and to consolidate relations between the stakeholders.

Community participation program under Nam Dinh urban development project lasting for 6 years (1997-2003) in 2 phases of the project included a range of sub-programs covering Environmental Health and Micro Activities (EHMA), strengthening the capability of the Women Union of the city, hygiene education in schools, construction of septic tanks using revolving credit fund managed by the Women Union for improvement of the household sanitation facilities and community consultation for urban micro-infrastructure improvement. The program was successful beyond expectation and several sub-programs were gradually transferred to the municipality and have been sustainably replicated by the municipality.

After project | Work underway | Before project

Figure 1: 210m of sewer and 367m^2 of access footpaths was upgraded at a cost of $430

This paper presents the major achievements of the community-based micro-infrastructure (including micro-drains and access footpaths) improvement of sub-program, methodology to promote participation from community in Nam Dinh city and lessons learned from this model.

2 OBJECTIVE AND ACHIEVEMENTS

The overall objective of the community participation program (CPP) is to help Nam Dinh people to be able confident in managing their own community activities and ultimately to institutionalize community programs. The targets of the program is to enable people in the project-participated by communities to continue such activities piloted by the project and replicate to another areas with the support from the local government authority. In addition to that, by doing so, capability, creativeness, awareness and knowledge on environmental sanitation and method to improve living environment of the Nam Dinh people will be improved. The local government staffs involved in the program also get their capability, skills and methodology improved to receive, maintain and expand the program when the project is phased out.

The specific objectives of the CPP include raising awareness for people on the link between their living environment and health to promote people to contribute initiatives to change hygienic sanitation behaviour and empower the community to deal with their environment-related problems using their own resources including finance, manpower and expertise.

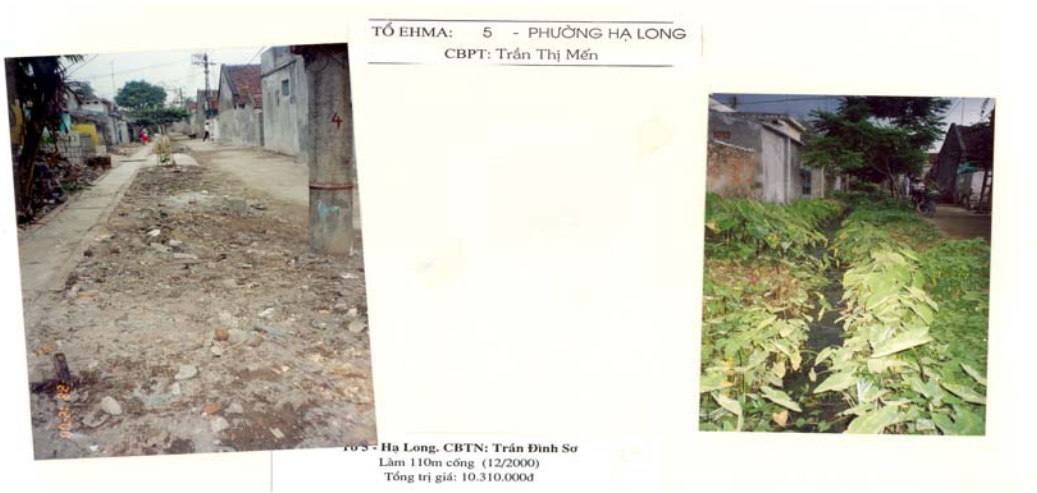


Figure 2: 110m of culvert was constructed at a cost $660

The city administratively is divided into 15 units called wards. The program was initiated in the first year of the project in 57 community groups in 5 pilot wards. As activities were successfully piloted, during the next year the program was expanded to 61 new community groups in another 4 wards and further to 65 groups in the rest of 6 wards in the third year. People in those selected community groups were all poor government civil staffs/workers, pensioners, small merchandisers and simple laborers, having very low income, but once they understood well the issues and what they

should do, they were willing and happy to participate and make contribution to solve their own problems. The program was gradually transferred to the municipality and a Community Consultation Center (CCC) was established under the municipaladministration sustainably maintaining the program after the project phased out.

With the catalytic financing mechanism of $100 for each selected community group, $50 for each related group (group having related drain/sewer), and VND500,000 (equal to about $45) for each group under the city CCC management, by the end of 2003 about $70,000 of the catalytic support and more than $550,000 of contribution from community have been implemented.

3 METHODOLOGY TO PROMOTE COMMUNITY PARTICIPATION

3.1 Proper community participation process

Community program is based on the foundation of a strong awareness raising campaign through which people get knowledge on the link between their living environment and health thus promoting community to contribute resources including idea on solution and implementing initiatives to settle their own identified problems.

Steps in community participation process to promote changes in the EHMA program is presented in the diagram below:

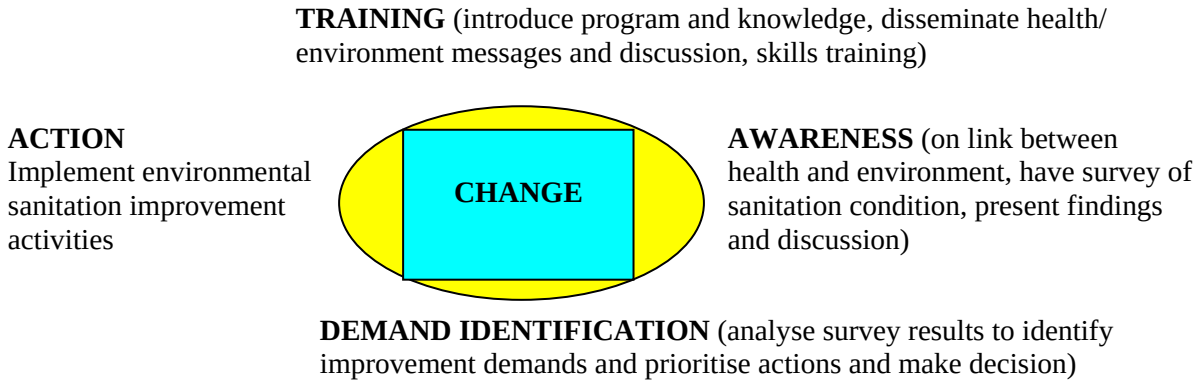


Figure 3: Steps in community participation process

Step by step, with assistance from the project consultants and motivators, the community can confidently identify their problems, propose idea and solutions, estimate resources required, select priorities appropriately to suit their resources and available capacity. Community makes decision for their activities and organizes implementation by themselves.

Process circle was defined one year with three rounds of training workshops organized for motivators, volunteers, community group heads and grassroot government leaders. The first training organized at the beginning of the circle introduced health/sanitation/environment messages, training

on method and skill of dissemination of messages to people. Message dissemination was practiced within 6 months following the training. During this period, through messages and community meetings, people gained enough knowledge/awareness on their problem and improvement need. In the next 6 months, following the second training, group survey, problem identification, activities selection and implementation will be completed. At the end of the year for completing a circle, the 3rd training on ending a cycle, doing assessment, drawing lessons learned and planning replication for the next circle for program sustainability was carried out.

Figure 4: Training on self survey, priority selection and work execution

3.2 Effective training method and contents

3.2.1 Proper and adequate training target

Training target includes people directly and indirectly participating in a program, as the community term here is understood by including all regardless of gender, position and status, provided that they have a common target, that is to improve environmental sanitation for the better health of the community.

Proper training contents: Training was conducted for various target groups on all subjects covered in the program such as health and sanitation, self survey, development and implementation of activities and maintaining programs. Program motivators were also trained at different skills such as conducting community meetings, promoting community, working with group activities and supervision forms, speech skill, presentation skill, etc.

Knowledge and skills provided at the training were tested, applied and improved during practice. Each training has a timeframe of 6 months planned for practicing and applying the knowledge and skills provided. During this time both the community and the program staffs – motivators, coordinators and volunteers – got further trained through the practice. The initial knowledge was just catalyst.

Proper training method: As the trainees are not pupils or students but common people, and as the training is for application into practice but not for a certificate, presentation must be clear, simple, easy to understand, practical, promotive and encouraging to stimulate experiences and

knowledge of the trainees thus making them ready for practice. The trainers are to provide knowledge and to help the trainees to turn this knowledge into practical action.

The Motto

Learning must go together with practicing

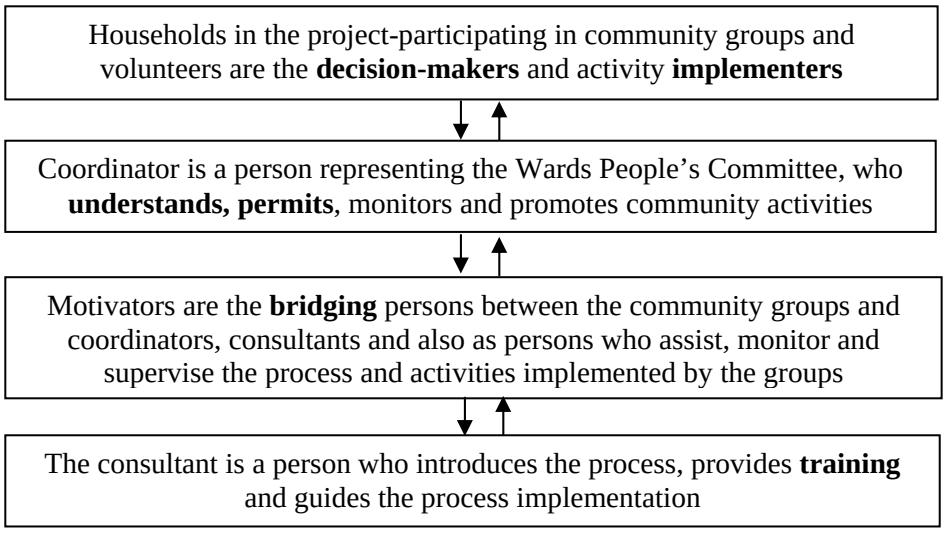
Implementation and Supervision: The most important step of self survey and action is to trust in the community's capability and initiatives. Decision making on the course of action is not by the consultant or the coordinators, and neither by the motivators or the volunteers but it must be jointly by all the households in the community group as problems, solutions, resources and standards are theirs, and they are the beneficiaries of their working results and contributions. Practically, the standards will be improved through their awareness, experience and activities. Therefore, doing improvement activities will help them achieve higher standards.

Repeating project circle: In the next project circle, complete activities of the previous circle will be repeated, i.e. health/ sanitation/environment message dissemination, self survey and improvement activities. This is repeated to strengthen a concept that one should not stop learning and should do more and more to improve one's living standard even without external financial support.

Following the community participation model in improvement of sanitation conditions, community groups continue to apply the same process to deal with other their problems such as drain desludging, solid waste collection, communal toilet improvement, etc.

4 ROLE OF THE INVOLVED PARTIES

Giveb below is the interacting relationship and role of the parties involved in the community participation process.



5 IMPORTANT FACTORS ENSURING SUCCESS OF THE PROGRAM

An appropriate and enthusiastic crew working for the program, and a suitable process for community are the two decisive factors for the success of the program.

The city leaders: As a member of the crew, the city leaders must understand community problems, sympathize with community difficulty, have perspective vision to welcome changes, support their initiatives, facilitate them with enabling of policy and legal framework and proper payment for the coordinators and motivators.

Program staffs: The consultants, both local and international, must be the resource personnel with qualified and experienced knowledge in community issues and skills in community participation program. Meanwhile the local staffs – motivators, coordinators, volunteers – must be creative and supportive, willing to learn and to help, have good nature, sympathize with the community and not fear hardships but be willing to work for the community. All members of the crew must be enthusiastic with a motto "living and working for the community".

Suitable process: As it is a community-based program and activities, the process and activities must be appropriate for the community level conditions, i.e. clarity, understandability, flexibility, low cost and lowtech and addressing the community problems that are essential.

6 IMPACTS OF THE PARCIPATORY APPROACH

6.1 Attract attention and investment from the local-city government

To receive a program transferred by the project, the city has established a Community Consultation Centre with one coordinator and 12 motivators arranged with a support fund from the city state budget. Till date, the community program is institutionalized and continued to run for the rest of community groups in all the 15 wards of the entire city.

Cost-effective program: It was summarized that a ratio of the state budget and community contribution in this program is almost 10:90, much more effective than the common government "the state and people doing together" program where this ratio is 50:50. On the other hand, it is the most cost effective program because the community selected the least cost option and supervised by themselves so that nothing was wasted. It means that this program saved the state budget and kept contribution from the community to minimum.

6.3 Contagious impact

Many groups continued this model to carry out other activities in their communities, or households to improve their own sanitation facilities. Even many unselected community groups (as they are not as poor as the selected) in the city have obtained some experiences and followed this model to organize themselves in their work.

6.4 Potentials and creativeness from communities are exploited

This program promoted communities not only in raising awareness on environmental sanitation but also promoted them to practice changes for better health. Below are the changes practiced by the community.

Changes implemented with support from the project	Constructing and upgrading drains, sewers and access footpaths, making cleaner areas near public taps, etc.
Changes implemented purely by community contribution	Cleaning drains, channels, removing accumulated solid wastes, making playground for children, planting trees, installing public lighting
Changes implemented with no cost	Cleaning public toilets, following regulation on dog keeping, no littering of waste, regular area cleaning campaign.
Changes implemented purely by the household cost	Construction of septic tanks and hygienic toilets, installing water supply connection, using covered waste bins.
Changes implemented by the households with no cost.	Change hygiene behavior such as washing hands with soap, covering food well, etc.

Promoted self-reliance of the community: Ideology of reliance on support or provision or subsidy from the government among the community is eliminated. The community is fully accountable with its own problems. This impact is generated not only among the project-participating communities but largely over the whole city and also among the individual households.

7 LESSONS LEARNTED

As analysed with the illustrated facts above, the best lesson learned from this practice is a synchronized condition enabling the success of the program, with the availability of the three factors which make it stable like a 3-legged tripod:

- Technical factor: Community-based participatory process
- Human factor: Enthusiastic program staff crew
- Legal factor: Supportive local (city) government leaders with bright and practical vision for forwarding the changes

Having a suitable process without good personnel to turn the process into practice would keep it as a theory and background knowledge. Without a supportive legal framework, it would be difficult for the program to sustain. These three factors are mutually interacting and supporting. The program would not be sustainable if any of the 3 factors is missing or weakened.

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2. Photos of the Program Activities and Training Workshops Taken by the staff Working in the program.