Wastewater and Solid Waste Management in Provincial Centers

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SURVEY REPORT ON HOUSEHOLD WASTEWATER CONNECTIONS AND SEPTIC TANKS

in

BAC NINH, CAN THO, SOC TRANG AND TRA VINH

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Ministry of Construction – Hanoi

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1. Executive Summary

1.1 Background

Within the framework of the ongoing planning and construction activities of the KfW financed wastewater Project in 6 Vietnamese provincial towns of Bac Ninh, Hai Duong, Vinh in the North and Can Tho, Soc Trang and Tra Vinh in the South, substantial investments are underway to collect and treat wastewater from domestic and non-domestic sources.

The designs of the wastewater facilities assume a household wastewater connection rate to the existing drainage system is between 85 to 90%. However, local wastewater operators raised their concern that the actual connection rate is much lower than what was assumed for the preparation of the detailed engineering design. Therefore, surveys on the situation of household wastewater connection within the KfW financed project areas were implemented to provide related stakeholders a more realistic view on the existing condition of household connections.

The survey was performed in Bac Ninh, Can Tho, Soc Trang and Tra Vinh during March 2007 - March 2008. In agreement with the director of the wastewater operator, no survey was implemented in Hai Duong. A separate survey on the conditions of the tertiary system will be implemented in Vinh in October 2008.

1.2 Objectives of the Survey

The main objectives of the survey are to:

- Identify household ratio connected to public drains within the KfW financed project area;
- Identify household ratio connecting to the future sewer system within the KfW financed project area;
- Identify current status of domestic “on-site” wastewater treatment in form of “septic tanks”;
- Disseminate survey results to stakeholders.

1.3 General Findings

1. Generally, over 90% of households in the KfW financed project area are connected to piped water supply.
2. About 90 to 95% of households have septic tanks. However, the ratio of households emptying tanks is between 29 to 61% and those using septic tank additives are 46 to 61%.
3. The ratio of households currently connected to public sewers is: 85% in Bac Ninh; 54% in Can Tho, 64% in Soc Trang and 55% in Tra Vinh.
4. During field inspections at all four towns it was found that the tertiary sewers were built long time ago, without proper design and that they are poorly maintained. Provincial companies are in charge of managing regulating lakes, pumping stations, as well as primary and secondary sewer systems. The management of the tertiary sewer systems is done by local authorities (wards, living quarters, etc). They raise budgets needed for cleaning and maintaining the tertiary sewers, from residents. However, these budgets are limited and far from enough for a proper maintenance, operation and improvement of the existing tertiary sewer systems.
5. The ratio of households connected to public sewers in Can Tho is increasing remarkably because of the on-going implementation of a World Bank financed Urban Upgrading Project.

Hence, investments in the tertiary system in the towns of Bac Ninh, Soc Trang and Tra Vinh are lacking and urgently needed.

6. The ratio of households that will eventually be discharging into the future KfW financed system is about 73% in Bac Ninh; 52% in Can Tho; 64% in Soc Trang and 55% in Tra Vinh. Hence, in only one city, Bac Ninh, a noteworthy difference was found between the ratio of 'households connected to the tertiary system' and 'households connected to the future KfW system'. This relates to the fact that residents around the Thanh Moat Lake will not be discharging to the future KfW financed system.
7. Households connected to sewers that never experience blocked sewers share: 87% in Bac Ninh, 74% in Can Tho, 82% in Soc Trang, and 72% in Tra Vinh.

The summarized survey results for Bac Ninh, Can Tho, Soc Trang and Tra Vinh, dated March 2008, are given in the table below:

Table 1: Summary of Overall Survey Results

No.	Indicators	Bac Ninh (%)	Can Tho (%)	Soc Trang (%)	Tra Vinh (%)
1	Household ratio connected to piped water	97	100	99	94
2	Household ratio having septic tanks	92	95	92	90
3	Household ratio emptying their septic tanks	34	29	62	45
4	Household ratio using septic tank additives	61	46	58	61
5	Household ratio connected to public sewers	85	54	64	55
6	Household ratio never witnessing blockings	87	74	82	72
7	Household ratio connecting to KfW financed system	73	52	64	55

Note:

- Results given at rows 1 - 6 are based on door-to-door interviews.
- Results at rows 3, 4 are only for surveyed household who have septic tank.
- Results at row 6 are only for surveyed household who connect with public sewer.
- Results at row 7 are based on site observations of existing household wastewater connections and related tertiary system. However, because of the complexity of the system and limited resources available for the survey, figures of row 7 are indicative only.

2. Background

Within the framework of the ongoing planning and construction activities of the KfW sponsored wastewater project in six Vietnamese provincial cities, including Bac Ninh, Hai Duong, Vinh in the North and Can Tho, Soc Trang and Tra Vinh in the South, substantial investments are underway to collect and treat wastewater from domestic and non-domestic sources.

The designs of the wastewater facilities assume a household wastewater connection rate to the existing sewerage system between 85 to 90%.

However, local wastewater operators raised concerns that the actual connection rate is much lower than what was assumed for

the preparation of the detailed engineering design. Moreover, there is a technical concern for certain sections of the new sewer system. In case of planned "replacements" of an existing sewer, it is the contractor's obligation to reconnect the households and/or tertiary system to the new sewer. However, if the new sewer is not a "replacement" but simply a new pipe in the street, the contractors are not made responsible for connecting the concerned households and/or tertiary system to the new sewers.

Therefore, surveys on the situation of household wastewater connection within the KfW financed project areas were implemented to provide related stakeholders a more realistic view on the existing condition of household connections. These surveys were implemented, in close cooperation with the related wastewater operators in Bac Ninh, Can Tho, Soc Trang and Tra Vinh between March 2007 and March 2008 (in agreement with the director of the wastewater operator surveys were not conducted in Hai Duong, assuming that the rate of household wastewater connection in the KfW financed project area is more than 90%. Separate surveys are scheduled for Vinh in October 2008).

3. Objectives of the Surveys

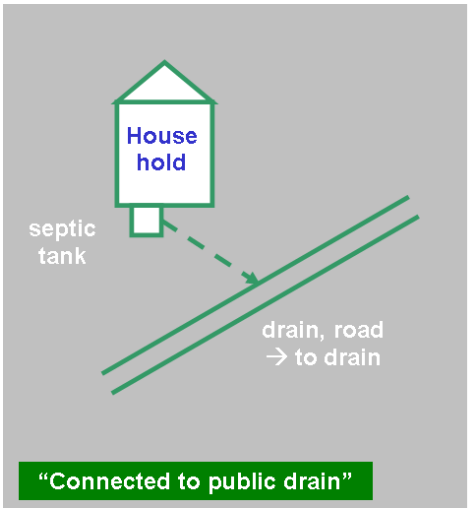
The main objectives of the surveys are:

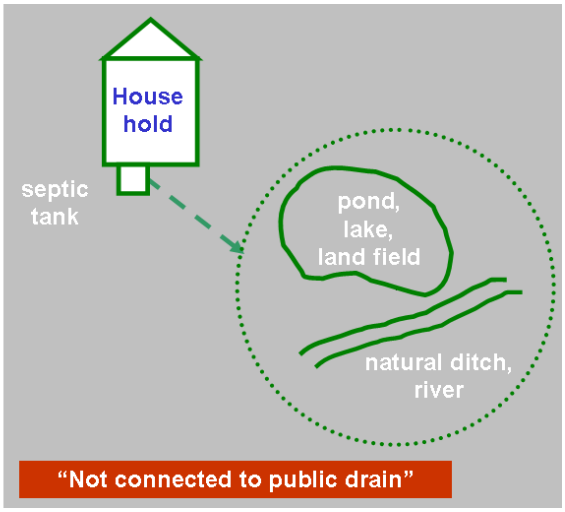
- Identify household ratio connected to public drains;
- Identify household ratio connecting to the future KfW financed system;
- Identify current status of domestic "on-site" wastewater treatment in form of "septic tanks".
- Disseminate survey results to stakeholders.

Definition of technical terms:

- "Connected to public drain" means household wastewater is discharged directly to public drain or indirectly, entering the road and then to the sewer.
- "Not connected to public drain" means household wastewater is discharged either to a , pond, lake, garden, land, natural ditch or stream, that are not connected to the KfW system.

Illustrations of the above technical terms are given at sketches below:

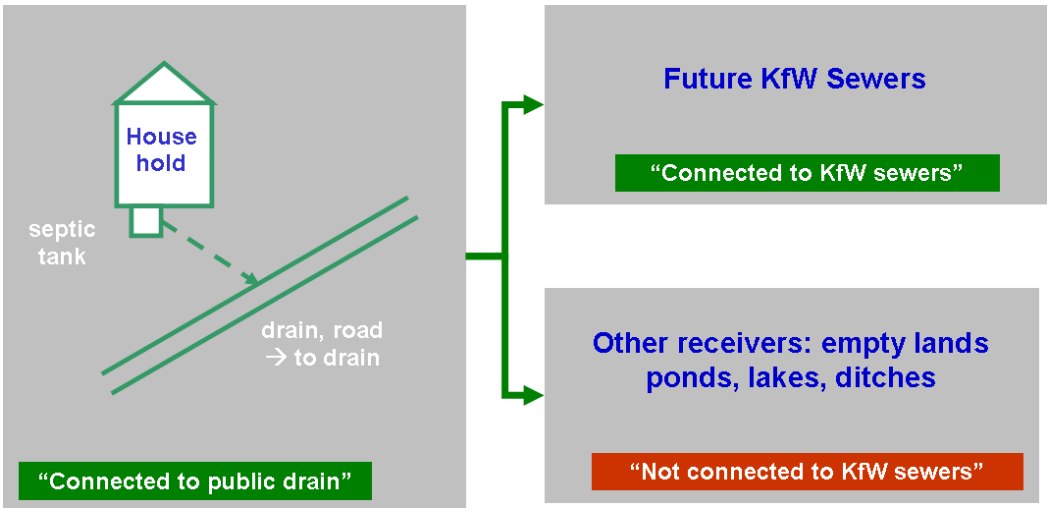




- "Connected to KfW component" means household wastewater is discharged to public drain and these drains will then be connected to the future KfW component.

- "Not connected to component under the KfW financed Project " means household wastewater (i) is not directly discharged to public drain or (ii) is directly discharged to public drain but these drains will then not be connected to future KfW component (these drains are now connected to pond, lake, land field or natural ditch or river, etc).

Illustrations of the above technical terms are given at sketches below:



4. Methodology

4.1 Survey Approach

A two-step survey approach was applied for the surveys, including:

- **First step**: Door-to-door interviews were conducted by surveyors to identify the household ratio (i) connected to piped water; (ii) having septic tanks; emptying septic tanks and using septic tank additives, (iii) connected to public drains.
- **Second step**: Field observations with detailed sketch drawings of the route of wastewater discharge from surveyed houses to the receiving water bodies were conducted by the surveyors (see Annex 1B). This served the identification of: (i) direction of wastewater flow from households to the public drains and (ii) from the public drains to the KfW components or to other sources. Results from this second step support the identification of the household ratio connecting to future KfW components.

Note: The survey in the four cities did not include a thorough assessment on the conditions of the tertiary sewer system; hence, any comments in this report with regard to the quantity and quality of the tertiary system are indicative only.

4.2 Design of the Questionnaires

Based on the survey's objectives, a questionnaire was designed for door-to-door interviews, including two parts: (a) multiple-choice questions and (b) a sketch of the site situation which helps to obtain information on:

- the household's connection to piped water
- the availability, operation and maintenance of septic tanks

- discharging points from households to public drains.

The director of each wastewater company appointed a group of technical staff to conduct the surveys. After surveyor training through the WWM project's consultant, the questionnaire was field-tested, modified and finally applied (see Annex 1 for details).

4.3 Selection of Survey Areas

The KfW financed project area of each town includes 6-10 wards. However, surveys were conducted at a limited number of wards which were selected as 'typical and representative' of the remaining wards with regard to: location, topography, population density, and existing conditions of sewers. Thus, wards with common characteristics were classified and grouped and one representative ward of each group was selected and surveyed as outlined in table below.

Table 2: List of Wards Selected for the Survey

Towns	Wards selected for the survey	Other wards of similar characteristics within group
Bac Ninh	Group 1: Ve An	non
	Group 2: Dap Cau	Thi Cau
	Group 3: Vu Ninh	Kinh Bac, Vo Cuong, Dai Phuc
	Group 4: Tien An	Suoi Hoa, Ninh Xa
Can Tho	Group 1: An Cu	An Hoi
	Group 2: An Nghiep	Thoi Binh
	Group 3: An Lac	Tan An
	Group 4: An Hoa	Cai Khe, Xuan Khanh, An Phu
Soc Trang	Group 1: Ward 1	non
	Group 2: Ward 2	non
	Group 3: Ward 3	Ward 8
	Group 4: Ward 6	non
	Group 5: Ward 9	Ward 4
Tra Vinh	Group 1: Ward 1	Ward 4
	Group 2: Ward 2	Ward 3
	Group 3: Ward 7	Ward 6

4.4 Sample Size and Sample Selection

The total number of households in the KfW financed Project areas within the four cities ranges from 4,900 to 22,400. Normally, with the aim of 95% confidence level, an acceptable error margin of 5% and an assumed (conservative) response distribution of 50%, the recommended sample size for each city was at least 550 households.

However, to ensure the accuracy of the survey results the WWM consultant team and the surveyor teams of the related companies agreed to survey approximately 20% of the total number of households living in selected wards. The exact sample size for each town is given in table 3 on the next page.

Table 3: Number of Household and Sample Size

Towns	Average size of household (persons)	Number of households within KfW financed project area (*)	Sample size	Percentage (%)
Bac Ninh	4.1	9,852	828	8
Can Tho	4.5	22,425	2,191	6
Soc Trang	4.5	4,981	900	20
Tra Vinh	4.1	5,118	588	11

(*) Figures are provided by surveyor teams of Bac Ninh, Can Tho, Soc Trang and Tra Vinh in 2007.

4.5 Coaching and Pilot Survey

At each company 4 to 6 technical staff, which have a good knowledge on wastewater and experience about the local sewer system were appointed as surveyors. Prior to the implementation of surveys the selected staff had been coached by the WWM survey consultant.


Coaching at Can Tho

A two day coaching was given to surveyors at each town between March and April 2007. The coaching provided surveyors sufficient knowledge about the survey's approach, skills for face-to-face interviews, site observation, data recording and processing.

Pilot interviews and test sketch drawings at sites were conducted to ensure that all surveyors could understand and perform the survey thoroughly. Some photos at the right hand side illustrate coaching process at Can Tho and Soc Trang.

4.6 Data Input and Data Analysis

Data obtained from household interviews and sketch drawings were processed by the surveyors with the support of the WWM consultant. Analysis and evaluation of survey data was undertaken by the surveyors and checked by WWM advisors to ensure high quality and probability of survey results.

4.7 Quality Control

To ensure a high survey quality, field checks are important and were carried out by the WWM consultant. Furthermore, a 10% of all interview sheets were randomly selected and checked. In case that the error rate was higher than 5%, surveyors were asked to re-conduct the respective interviews. Results from field checks showed that the error rate was below 3.8% for all towns.

5. Summary on Current Status of Wastewater Discharge in Bac Ninh, Can Tho, Soc Trang and Tra Vinh

5.1 Bac Ninh

The KfW financed project area comprises of four distinct areas – the moat area, the eastern and western areas of the City, south of the railway and the eastern extension area.

The existing combined gravity drainage system comprises of box culverts and circular sewers, which discharge to various locations including the moat, open channels, small ponds and the Thi Cau Lake. Many of the recently constructed main sewers and some of the older sewers in the eastern and western areas have been constructed without the existence of an overall master-plan. Some sewers have been laid with negative gradients and some of the older sewers are in poor condition.

Sewerage from the above mentioned areas discharges uncontrolled into open channels, open areas and small ponds, with some of the channels connecting to the Kim Doi Canal, which is used for drainage as well as for irrigation purposes. At the northern limit of the canal a pumping station is discharging excess water to the Cau River. Occasional flooding was experienced in recent years within the above described two areas.

Drainage from the eastern extension area (which is at a higher elevation than other parts of the KfW financed project area) currently discharges uncontrolled to open channels, small ponds and Thi Cau Lake, which is connected to the Kim Doi Canal.

In the Moat area, the existing sewers discharge sewage to the moat, small ponds, channels and open areas. Much of the discharge is being uncontrolled. In this area, flow of water is possible in both directions, allowing water from the moat to drain to a small pond and to open channels. The moat area and surrounding areas drain to a irrigation pumping station north of Bac Ninh.

The KfW financed project area includes 10 wards of Ve An, Dap Cau, Thi Cau, Tien An, Suoi Hoa, Vu Ninh, Vo Cuong, Dai Phuc, Ninh Xa and Kinh Bac. Table 4 presents a summary on demographic data and existing status of wastewater discharge at these 10 areas.

Table 4: Number of household and Size of Wards Within KfW Financed Project – Bac Ninh

Ward Names	Number of HHs (persons) by 2007	KfW financed project area (ha)	Population Density (HH/ha)	Topography and other features	Existing status of wastewater discharge
Group I					
Ve An (VA)	1,082	58	19	Located at center of BN City, around Thanh Moat. It is a very densely populated area.	Coverage of sewer system is high, discharges mainly to sewers, then to Thanh Moat.
Group II					
Dap Cau (DC)	1,270	76	17	Located at North East of the city and close to Cau River. Topography of DC ward is a mixture of hills and flat areas.	Sewer system is old, HH wastewater is discharged mainly to public sewers and partly to ponds or open land.
Thi Cau (TC)	1,583	149	11	Similar to DC	Similar to DC
Group III					
Vu Ninh (VN)	200	347	1	Located in the east of BN. Flat farming land. It is the most poorly developed area of BN City.	Sewer system is very poor both in quantity and quality. HH wastewater is discharged mainly to sewers, land fields, lakes or ponds.
Kinh Bac (KB)	738	174	4	Similar to VN	Similar to VN
Vo Cuong (VC)	728	283	3	Similar to VN	Similar to VN
Dai Phuc (DP)	142	402	0.4	Similar to VN	Similar to VN
Group IV					
Tien An (TA)	1,502	33	46	Near the center and most developed areas of BN. The area is densely populated	Coverage of sewer system is high. HH wastewater discharges mainly to public sewers and partly to roads.
Suoi Hoa (SH)	1,681	106	16	Similar to TA	Similar to TA
Ninh Xa (NX)	926	57	16	Similar to TA	Similar to TA
Total (I+II+III+IV)	**9,852**	**1,685**			

Source: Data in above table were provided by the Project Department of the Bac Ninh Water Supply and Sewerage Company and the Department of Natural Resources and Environment of Bac Ninh City

5.2 Can Tho

The city of Can Tho, the economic hub of the Mekong Delta, suffers from a number of environmental problems caused by inadequate wastewater disposal; especially severe in densely populated central areas that are located 'behind' main roads.

The existing sewer system discharges combined wastewater and storm water to local rivers, creeks and ditches. Some parts of the drainage systems are influenced by the sea tides. Thus, at high tide, wastewater and storm water get stagnant in the drainage systems and flooding occurs in low–lying areas during periods of intensive rain events. Many small canals and ditches are grossly polluted by disposal of household sewage and solid wastes.

Most of the existing sewers were built during the period between 1950 and 1975. Since then, a lot of these sewers become partly degraded. Some sewers, which have been built after 1975 are considered insufficient to carry the increasing storm water run-off. Existing small diameter sewers result in inadequate capacity to accommodate the drainage in the catchments areas because of poor maintenance and/or inferior material quality and workman ship.

The KfW financed project area is located at the center of Can Tho City, comprising 10 wards of Cai Khe, An Hoa, Thoi Binh, An Nghiep, An Cu, An Hoi, Tan An, An Lac, An Phu and Xuan Khanh. Summary on demographic data of these 10 areas is given in table 5.

Table 5: Summary on Population and Size of Wards in KfW financed project area - Can Tho

Ward Name	Area (ha)		Existing Population in 2003 (Person)	
	Total	Within KfW financed Project Area	Total	Within KfW financed project area
Group 1				
An Cu	61.02	61.02	20,581	20,581
An Hoi	33.5	33.5	9,742	9,742
Group 2				
An Nghiep	35.1	35.1	9,680	9,680
Thoi Binh	53.0	53.0	16,107	16,107
Group 3				
An Lac	46.6	46.6	14,318	14,318
Tan An	55.3	55.3	8,982	8,982
Group 4				
An Hoa	178.0	178.0	23,353	23,353
Cai Khe	666.780	178.96	23,925	7,177
Xuan Khanh	208.9	208.9	24,951	24,951
An Phu	49.3	49.3	12,937	12,937
Total		**899.68**		**147,828**

(Source: Final Design Report Can Tho Wastewater Disposal System (CES) – November 2004)

Can Tho - Vietnam Urban Upgrading Project (VUUP)

The VUUP Project of the World Bank is now under implementation in Ninh Kieu District of Can Tho City. The project aims to alleviate poverty in urban areas by improving the living and environmental conditions of the urban poor. The VUUP Project is being implemented in 10 wards of An Cu, An Hoi (first phase), An Hoa, An Phu, Xuan Khanh, Cai Khe, Thoi Binh, Hung Loi, An Lac and An Nghiep (second phase). For details see Annex 3.

Total cost of the VUUP Project – Can Tho City is estimated at US$ 39 million, comprising six components, as follows:

1. Tertiary Infrastructure Upgrading and Service Improvements;
2. Complementary Primary and Secondary Infrastructure;
3. Resettlement Housing;
4. Land and Housing Management;

5. Housing Improvement Loan Program;
6. Capacity Building.

The design of the VUUP Project was done in close cooperation with the KfW investment component; hence covering the KfW financed project area. Implementations started at An Cu and An Hoi as a pilot phase, which improved the immediate sanitation conditions remarkably within these wards (details are presented in chapter 6.2 of this report). Thus, continuous implementations during the second VUUP phase will help to improve existing sanitary conditions of the remaining wards.

5.3 Soc Trang

The city of Soc Trang, located in the south-western part of the Mekong Delta, suffers from a number of environmental problems caused by inadequate wastewater disposal, especially in the densely populated central areas, which are partly lying lower than main roads and drainage channels. Documented level of waterborne diseases and environmental nuisance are rather high.

The KfW financed project area covers the wards number 1, 2, 3, 4, 6, 8 and 9. All wards are located at the center of the City. Currently, most domestic wastewater is discharged to ditches or sewers and from there to the Maspero River and Co Bac canal. Natural ditches are prevailing at wards no: 2, 3, 6 and 8. The availability of tertiary public sewers is relatively high in the wards number 1, 4 and 9.

Generally, existing tertiary public sewers were built in Soc Trang long time ago without the existence of a suitable general master-plan and are now in poor operational conditions. Households, through unit leaders, contribute funds for cleaning the tertiary sewer system.

A summary on demographic data of the nine wards is given in table below:

Table 6: Summary on Population and Size of Wards in KfW financed project area – Soc Trang

Ward Name	2003 KfW financed Project Population (persons)	2003 KfW financed project area (ha)
Ward 1	9,061	29.29
Ward 2	16,269	114.24
Ward 3	19,359	82.84
Ward 4	12,197	54.04
Ward 6	13,289	50.40
Ward 8	10,538	38.37
Ward 9	6,994	23.90
Total	**100,378**	**424**

(Source: Final Design Report Soc Trang Wastewater Disposal System – November 2004 by CES Consulting Engineers Salzgitter GmbH and National Corporation of General Construction Consultants).

5.4 Tra Vinh

Tra Vinh, located in the southern part of the Mekong Delta, suffers, similarly to Can Tho and Soc Trang, from a number of environmental problems caused by inadequate wastewater disposal. Whereas the central part of the city is elevated and therefore experiencing few flood problems, the outskirts of the city are affected by floods and stagnant sewerage, contributing to waterborne diseases and environmental nuisance.

The sewer system of Tra Vinh Town is very poor in both quality and quantity. Main and secondary sewer systems were built long ago without general concept, some with negative gradients. In many

cases, the invert level of these sewers are higher than the level of tertiary sewers, causing stagnant domestic wastewater in the residential areas.

Household wastewater is discharged mainly to ditches or PVC pipes which will then be discharged to ponds or open spaces. Only a small number of households, which are located close to main roads, discharge their wastewater into public sewers and from there to the Long Binh River. A summary on demographic data of the wards that are part of the KfW financed project area is given in the following table.

Table 7: Number of household and current status of household wastewater discharge in KfW financed project area – Tra Vinh

Ward names	KfW financed Project Household in 2007	Existing condition of household wastewater discharge
Group 1		
Ward 1	1,020	Household wastewater is discharged mainly to PVC pipe. Length of PVC pipe is from 20 – 60m. Wastewater is then discharged to ponds or land fields. A large number of households discharge wastewater to land field where it infiltrates into the soil.
Ward 4	1,296	
Group 2		
Ward 2	482	These wards are in the center of the town. Public sewer at these wards is better than groups 1 and 3.
Ward 3	810	
Group 3		
Ward 7	1,510	Household wastewater is discharged mainly to ditches or sewers, then to ponds. The sewer system is very poor. It was built long time ago by households. Most wastewater is absorbed by soil.
Ward 6	2,331	

6. Findings of Surveys for Each City

6.1 Bac Ninh

General Findings for the entire KfW financed project area at Bac Ninh:

1. Approximately 97% of households are connected to piped water.
2. Approximately 92% of households have septic tanks, of which around 34% of the households empty tanks and 61% uses additives.
3. The ratio of households currently connected to public sewers is approximately 85%; 8% of households discharge to public roads. The connection ratio from existing public sewers to the future KfW system is approximately 73% because a number of tertiary sewers are not connected to KfW system but connected directly to ponds or open land. This is the case in Ve An and Vu Ninh Wards.
4. Result from visual inspection and door to door interviews showed that the tertiary sewer system in Bac Ninh is in poor condition, especially in the wards of Vu Ninh, Kinh Bắc, Võ Cường và Đại Phúc.
5. The ratio of households now connected to public sewers is not equal in all wards. The ratio is higher in ward Ve An, Dap Cau, Thi Cau, Tien An, Suoi Hoa and Ninh Xa and lower at 'new' administrative wards of Vu Ninh, Kinh Bac, Vo Cuong and Dai Phuc.

6. The ratio of households which are discharging wastewater to ditches, lakes or ponds is about 6%, which is mostly the case in the new wards of Vu Ninh, Kinh Bac, Vo Cuong and Dai Phuc.
7. The rate of surveyed households that do not experience blocked sewers is about 87%.

Summary of survey results at KfW financed project area - Bac Ninh is given in table below:

Table 8: Survey Results of Bac Ninh

Items	Group 1 (%)	Group 2 (%)	Group 3 (%)	Group 4 (%)	Average (%)
1. Surveyed wards	Ve An	Dap Cau	Vu Ninh	Tien An	
2. Wards within group		Thi Cau	Kinh Bac Vo Cuong Dai Phuc	Suoi Hoa Ninh Xa	
3. HH connected to piped water	95	98	100	95	97
4. HH having septic tank	95	92	83	95	92
5. HH empty septic tank	43	38	6	39	34
6. HH use septic tank additives	84	77	32	56	61
7. HH sometime witness drain blocked	7	1	0	7	5
8. HH discharge w/w to public drain	88	97	66	85	85
9. HH discharge w/w to road → public sewer	7	0	12	13	9
10. HH discharge w/w to ditch, natural channel, lake, pond	5	3	22	2	6
11. HH connected to KFW sewers	61	87	0	98	73

Note:
- Results at rows 5, 6 are only for surveyed households who have septic tank.
- Results at rows 7 are only for surveyed households who connect with public sewer.

Specific Findings for Surveyed Groups in Bac Ninh:

Group 1: Ve An

General information:

- Location: It is located at the centre of the City and surrounds Thanh Moat where the coverage ratio of the sewer system is generally high, but most of the wastewater is discharged to sewers, then to the Thanh Moat.
- Total population: 1,082 household, equivalent to 11% of the total KfW financed project area.
- Total area: 58 ha, equivalent to 3% of the total KfW financed project area.
- Main features of wastewater discharge: household wastewater is discharged mainly to public sewers, then to Thanh Moat.

Thanh Moat

Findings at Ve An Ward:

- Approximately 95% of households are now connected to piped water.

- 95% of households have a septic tank, of which about 43% of households empty their tank and 84% use additives.
- Approximately 88% of households are now connected to public drain; 5% to ditches, lakes or ponds and 7% to roads then to sewer.
- Probably, around 61% of households will be connected to the future KfW sewers. Public drains within the area between Thanh Moat and Thien Duc street are connected directly to Thanh Moat through a number of outlets and no measures have been designed to deal with that situation. This is also noted in the Final Design Report for the KfW system, dated November 2008 (Item 4: Design of overall drainage and flood protection system – Sub item 4.6 Works outside the scope of this KfW financed Project). Photos at the right handside partly illustrate wastewater discharge situation at Ve An Ward.


Canal deliver w/w to open land

- Approximate ratio of households that did not witness blocked drains is 88%.

Group 2: Dap Cau and Thi Cau

General information:

- Location: North West of the City and close to Cau River.
- Topography: hilly and flat areas.
- Total population: 2,853 household, equivalent to 29% of the total KfW financed project area.
- Total area: 225 ha, equivalent to 13% of the total KfW financed project area.
- Households discharge wastewater mainly to tertiary drains that were mostly built by ward authority and households long time ago. The rate of households connecting to tertiary system is fairly high.

Findings at Dap Cau Ward:

- Approximately 98% of households are now connected to piped water.
- About 92% of households have a septic tank, of which around 38% empty their tank and 77% use additives.
- Approximately 97% of households are now connected to public sewers and about 3% of households discharge their wastewater to open land. Photos at the right hand side illustrate the current status of tertiary sewers within the area.
- Around 87% of households never witnessed blocked drains.
- The ratio of households which will get connected to the future KfW sewers is approximately 87%. From visual inspection and discussion with local residents it


Part of tertiary sewer

was found out that quality of public sewers in the area is unsatisfactory; built long time ago without proper upgrading and rehabilitation.

Group 3: Vu Ninh, Kinh Bac, Vo Cuong and Dai Phuc

General information:

- Location: North West of the City.
- Topography: flat area, mainly farm land.
- Total population: 1,808 households, equivalent to 18.4% of the total KfW financed project area. Inhabitants living in these areas are mainly farmers and laborers.
- Total area: 1,206 ha, equivalent to 71% of the total KfW financed project area.
- Domestic wastewater is discharged to (i) tertiary drains that were mostly constructed by communities and that are in bad conditions; (ii) to ponds and open land. The rate of households connecting to the tertiary system is rather low. Main or secondary sewers have not yet been installed in this area.

Findings at Vu Ninh Ward:

- The rate of households connecting to piped water is almost 100%.
- Around 83% of households have septic tanks, of which only about 6% empty their septic tank and 32% use additives. These rates are rather low in comparison to wards in group 1, 2 and 4.
- Approximately 66% of households are now connected directly to tertiary drains, 22% to ditches, lakes and/or ponds and 12% to open land. Findings from field observations and discussion with local residents show that almost all tertiary systems in this area are in rather poor shape. Large amounts of wastewater are infiltrated to the soil before reaching ponds or open land.
- Under the KfW financed Project main sewers will be constructed along Dau Ma Street but no combined sewer is designed for connecting to the existing tertiary sewers. The photo at the right hand side illustrates the condition of ditches at Vu Ninh Ward.
- Measures including public information, education, motivation and investment for construction of new sewers and upgrading of existing sewers are needed to improve the sanitation condition in these areas.

Ditch at Dau Ma street

Group 4: Tien An, Suoi Hoa and Ninh Xa

General information:

- Location: Located at the center and most developed area of the City.
- Topography: flat area
- Total population: 4,109 households, equivalent to 41.7% of the total KfW financed project area.
- Total area: 196 ha, equivalent to 12% of the total KfW financed project area.

- Household wastewater is discharged mainly to tertiary drains that were mostly constructed by ward authority and households. The rate of households connecting to public sewers is fairly high.

Findings at Tien An Ward:

- Around 95% of households within this group are connected to piped water
- Approximately 95% of households have a septic tank, of which only 39% empty their tank and 56% use additives. A number of public toilets are still in use there.
- Approximately 99% household will be connected to the KfW future sewers.
- Approximately 92% of household never witness drain blockage.
- Approximately 85% of households discharge their wastewater directly into public drain; 13% to the public road and 2% to ponds or open land. The ratio of households discharging to roads is high in comparison to Ve An, Dap Cau and Thi Cau. Photos at the right hand side illustrate septic tank additives used by households for tank treatment and household wastewater discharge to road before entering into public sewer.


Septic tank additives


W/w discharge to road

Photo 1: Moat – Ve An Ward

Photo 2: Part of tertiary drain - Ve An Ward

Photo 3: Channel discharge wastewater to land field – Ve An Ward

Photo 4: Household wastewater discharged to Ngo Gia Tu Street – Tien An Ward

Photo 5: Part of natural ditch – Tien An Ward

Photo 6: Public toilet – Tien An Ward

Photo 7: Natural ditch along Dau Ma Street – Vu Ninh Ward

Photo 8: Pond to which household wastewater is discharged - Vu Ninh Ward

Photo 9: Part of tertiary drain - Vu Ninh Ward

Photo 10: Open drain – Dap Cau Ward

Photo 11: Public drain – Dap Cau Ward

6.2 Can Tho

General Findings for the Entire KfW financed project area:

1. The ratio of households which are connected to piped water is about 100%.
2. Approximately 95% household has septic tank, of which, only about 29% empty their tank and 46% use additives.
3. Approximately 54% of households are now connected to public sewers and 46% of households discharge their wastewater to natural ditches.
4. The ratio of households which are now connected to public sewers is high within the wards of An Cu and An Hoi as a result of the VUUP Project – Phase 1 funded by World Bank. Tertiary sewers at these wards were newly installed and up-graded, as a result 80% of households are now connected to public sewers. Prior to the VUUP Project the connection ratio at An Cu and An Hoi was around 41% only.
5. The existing connection ratio of households in the wards of An Nghiep, Thoi Binh, An Lac, Tan An, An Hoa, Cai Khe, Xuan Khanh and An Phu is quite low with around 41 to 66%. However, since the VUUP Project will expand to these wards in the near future the connection ratio will increase to the level of An Cu and An Hoi. The synergies created between the two investment projects promise comprehensive improvements of living conditions in the concerned areas.
6. However, the physical up-grading of neighborhood infrastructure in these wards must be supported by intensive information and education programs to assure best possible benefits for the local residents. Closer cooperation between the WWM Project and the VUUP Project is recommended to enhance the effectiveness, sustainability of these programs.
7. Based on present conditions, around 52% of households in the areas will be connected to the future KfW infrastructures because some natural ditches will not be connected to the future KfW sewers.
8. 22% of households cited that their sewer was blocked at times, never blocked 74%, 6% said that the sewers are regularly blocked.

Summary of survey results at KfW financed project area – Can Tho is given at table below:

Table 9: Survey Results of Can Tho

Items	Group 1 (%)	Group 2 (%)	Group 3 (%)	Group 4 (%)	Average (%)
1. Surveyed wards	An Cu	An Nghiep	An Lac	An Hoa	
2. Wards within group	An Hoi	Thoi Binh	Tan An	Cai Khe X. Khanh An Phu	
3. HH connected to piped water	100	100	100	-	100
4. HH having septic tank	99	89	96	-	95
5. HH empty septic tank	28	32	29	-	29
6. HH use septic tank additives	48	42	48	-	46
7. HH sometime witness drain blocked	19	22	26	-	22
8. HH regular witness drain block	3	3	8	-	6
9. HH connection to public sewer	82	44	65	41	54
10. HH discharge w/w to ditch, natural channel, lake, pond	18	56	35	59	46
11. HH connected to KFW sewer	82	36	62	41	52

Note:

- For group 4, including wards of An Hoa, Cai Khe, Xuan Khanh and An Phu, survey only focused on connection rate to public drains. Therefore data given under column “Total” reflect only survey results of wards within group 1, 2, 3 only.
- Results at rows 5, 6 are only for household who have septic tank.
- Results at rows 7, 8 are only for household who connect with public sewer.

Specific Findings for Surveyed Groups in Can Tho:

Group 1: An Cu and An Hoi

General information:

- Location: centre of the City and arround the Xang Thoi Lake.
- Total population: 4640 household, equivalent to 21% of total KfW financed project area.
- Total area: 94.52 ha, equivalent to 11% of total KfW financed project area.
- Main features of wastewater discharge: Thanks to the ongoing VUUP program, almost all lanes have been upgraded; sewers were built along lanes. Household wastewater is discharged mainly to public sewer then to main combined sewer, which is now under construction surrounding Xang Thoi Lake.

Findings at An Cu Ward:

- 100% of households are connected to piped water.
- 99% of households have a septic tank, of which approximately 28% of households empty their septic tank and 48% household is using septic tank additives.
- The ratio of households connected to public sewers is up to 82%. Still, approximately 18% of households discharge their wastewater to natural ditches even though connection boxes are made available by the VUUP for each house. Photos at the right hand side illustrate the conditions of public sewers and natural ditches at An Cu.
- Up to 19% of households who are connected to public sewers cite that their sewer was blocked sometime and 3% said that it is blocked regularly.
- Approximately 82% households will be connected to KfW financed project.

WW discharge to natural ditch

Group 2: An Nghiep and Thoi Binh

General information:

- Location: In the center of Ninh Kieu District of Can Tho City.
- Total population: 4,288 households, equivalent to 19% of total KfW financed project area.
- Total area: 88 ha, equivalent to 10% of total KfW financed project area.
- Main features of wastewater discharge: Wastewater is discharged mainly to natural ditches.

Natural ditch at An Nghiep Ward

Findings at An Nghiep Ward:

- Nearly 100% of households are connected to piped water.
- Nearly 89% of households have a septic tank, of which approximately 32% empty their tank and 42% use additives.
- Approximately 44% of households are connected to public drains and 56% of households discharge wastewater to natural ditches. Photos above illustrate the current status of household wastewater discharge in that area.
- As scheduled, the VUUP Project will also cover these two wards with a total length of 4,140 m of sewers to be constructed and upgraded. VUUP also implements a communication and education

program to improve knowledge, awareness and behavior of local residents. Therefore, it is recommended that WWM and VUUP cooperate in the provision of more effective information and education programs.

- 22% of surveyed households said that sewers are blocked from time to time and 8% responded that it is blocked regularly.
- Around 36% households will be connected to KfW sewers.

Group 3: An Lac and Tan An

General information:

- Location: In the center of Ninh Kieu District of Can Tho City.
- Total population: 3,855 household, equivalent to 17% of total KfW financed project area.
- Total area: 102 ha, equivalent to 11% of total KfW financed project area.
- Wastewater is discharged mainly to ditches before entering the main river. The ratio of households connected to the sewer system is less than An Cu and An Hoi but better than An Nghiep, Thoi Binh, An Hoa, Cai Khe, Xuan Khanh and An Phu.

Findings at An Lac Ward:

- 100% of households are connected to piped water.
- Approximately 96% of households have a septic tank, of which 29% of households empty their tank and 48% use additives.
- Approximately 65% of household are connected to public drains. About 35% of households are discharging wastewater to natural ditches. Photos at the right hand side illustrate current household wastewater connection to ditches at An Lac Ward.
- Approximately 62% of households will be connected to future KfW facilities.
- Approximately 66% of surveyed households uttered that the sewer is never blocked, 26% mentioned that sewers are blocked occasionally and 8% said that sewers are blocked regularly.
- In the upcoming years VUUP Project will be implemented at An Lac and Tan An and it is assumed that the household ratio connected to public sewers will increase to 80%, similar to the wards of An Cu and An Hoi.

Group 4: An Hoa, Cai Khe, Xuan Khanh and An Phu

General information:

- Location: the Ward is located at the Ninh Kieu District of Can Tho City.
- Total population: 9,642 household, equivalent to 43% of total KfW financed project area.
- Total area: 615.16 ha, equivalent to 68% of total KfW financed project area.
- Wastewater is discharged mainly to natural ditches that discharge into the river. The ratio of households connected to the sewer system is about 44%, similar to An Nghiep and Thoi Binh.

Findings at An Hoa Ward:

- Approximately 41% of households connected to public drains will be connected to future KfW sewers.
- Around 59% of households are discharging wastewater to ditches. The photo at the right hand side illustrates the current status of household wastewater discharge at An Hoa Ward.
- Because the VUUP Project will be implemented at An Hoa Cai Khe, Xuan Khanh and An Phu, household ratio connected to public sewer will be increased in the future.

Photo 1: Natural ditch – An Cu Ward

Photo 2: Natural ditch – An Cu Ward

Photo 3: New public drain installed by World Bank Bank Project – An Cu Ward

Photo 4: Natural ditch to which household wastewater is dicscharged – An Nghiep Ward

Photo 6: Natural ditch to which household wastewater is dicscharged – An Nghiep Ward

Photo 5: Natural ditch to which household wastewater is dicscharged – An Nghiep Ward

Photo 7: Natural ditch to which household wastewater is dicscharged – An Lac Ward

Photo 8: Natural ditch to which household wastewater is dicscharged – An Lac Ward

Photo 9: Natural ditch to which household wastewater is dicscharged – An Lac Ward

Photo 10: Natural ditch to which household wastewater is dicscharged – An Hoa Ward

Photo 11: Natural ditch to which household wastewater is dicscharged – An Hoa Ward

Photo 12: House which discharge wastewater to natural ditch – An Hoa Ward

6.3 Soc Trang

General Findings for the Entire KfW financed project area:

1. Household ratio connected to piped water is up to 99%.
2. Approximately 92% of households having a septic tank, of which approximately 62% households empty their tank and 58% use additives.
3. Household wastewater is discharged mainly to sewers, natural ditches then to the Maspero River or Co Bac Canal (West and East). Approximately 64% of households are connected to public sewers. This ratio is not the same in every ward within the KfW financed project area. The ratio is around 85% at ward 1, 4 and 9 while it is bellow 50% at wards 3, 6 and 8.
4. 82% of households within the survey area cited that sewers are never blocked and about 16% of households said that they are blocked from time to time.
5. In general, public sewers are insufficient both in quality and quantity, affecting sanitation conditions within the City. Programs on public education and information to local residents are also needed to improve their awareness and behavior in environment and sanitation.

Table 10: Survey Results of Soc Trang

Items	Group 1 (%)	Group 2 (%)	Group 3 (%)	Group 4 (%)	Group 5 (%)	Average (%)
1. Surveyed Wards	Ward 1	Ward 2	Ward 3	Ward 4	Ward 6	
2. Wards within group			Ward 8	Ward 9		
3. HH connected to piped water	99	98	100	99	99	99
4. HH having septic tank	97	73	100	90	93	92
5. HH empty septic tank	51	49	60	82	64	62
6. HH use septic tank additives	44	73	73	76	8	58
7. HH sometime witness drain block	9	2	55	7	28	16
8. HH connect to public sewer	86	59	35	85	55	64
9. HH discharge to ditch, natural channel, lake, pond	11	40	63	15	31	34
10. HH never witness drain block	86	97	45	93	71	82
11. HH connected to KFW sewers	86	59	35	85	55	64

Note:

- Results at rows 4, 5 are only for household who have septic tank.
- Results at row 7 are only for household who connect with public sewer.

Specific Findings for Surveyed Groups in Soc Trang:

Group 1: Ward 1

General information:

- Location: The ward is located in the centre of the City.

- Total population: 1,421 household, equivalent to 29% of the total KfW financed project area.
- Total area: 29.3 ha, equivalent to 7% of the total KfW financed project area.
- Household wastewater is discharged mainly to public sewers.

Findings at Ward 1:

- Up to 99% of households are connected to piped water.
- Approximately 97% of households have a septic tank, of which 51% empty their tank and 44% use additives.
- About 86% of the households are connected to public sewers. Over 14% household discharge wastewater to ditches or open land.
- Around 86% of households will be connected to the future KfW sewers.
- About 9% of households claim that the tertiary sewer is blocked occasionally and nearly 3% state that blockages occur regularly or very often.

Group 2: Ward 2

General information:

- Location: Ward 2 is located at the centre of the Soc Trang City.
- Total population: 1,047 household, equivalent to 21% of the total KfW financed project area.
- Total area: 114.24 ha, equivalent to 27% of the total KfW financed project area.
- Household wastewater is discharged to sewers or natural ditches. However, the general sanitary conditions appear rather poor.

Findings at Ward 2:

- Approximately 98% of households are connected to piped water.
- About 73% of households having a septic tank, of these, 49% empty their septic tank, 73% use septic tank additives.

- Approximately 59% of households are connected to public drains. The remaining 41% of households are discharging wastewater to natural ditches, which are blocked frequently and cause nuisance to local residences. Photos on the right hand side illustrate a typical situation of household wastewater discharge to natural ditches.
- Around 59% of households will be connected to the future KfW system.
- 97% of surveyed households connected to public sewers said that the system is never blocked.

Group 3: Ward 3 and Ward 8

General information:

- Location: The wards are located at the center of the City.
- Total population: 728 household, equivalent to 15% of the total KfW financed project area.
- Total area: 121.2 ha, equivalent to 29% of the total KfW financed project area.
- Household wastewater is discharged to ditches and sewers. Sanitation and environmental conditions are rather poor in the area.

Findings at Ward 3:

- The ratio of households having a septic tank is high, approximately 100%, of which 60% empty their tank and 73% use additives.
- The ratio of households connected to the sewer is 35%; thus, it is the lowest in comparison to the other wards.
- Approximately 65% of households are discharging wastewater directly to natural ditches. Photos on the right-hand side illustrate the current status of household wastewater discharge at Ward 3.
- The ratio of households that will be connected to the future KfW component is around 35%.
- 45% households said that they never experienced blocked sewers, while approximately 55% households said that sewers are sometimes blocked.

Group 4: Ward 4 and 9

General information:

- Location: The ward is located at the centre of the City.
- Total population: 889 household, equivalent to 18% of the total KfW financed project area.
- Total area: 77.9 ha, equivalent to 18% of the total KfW financed project area.
- Main features of wastewater discharge: household discharge wastewater to sewers and ditches.

Findings at Ward 9:

- Almost all households within wards 4 and 9 are now connected to piped water.
- Around 90% of households have a septic tank, of which approximately 82% empty their tank and 76% are using septic tank additives.
- Approximately 85% of households are connected to public sewer and 15% of households are discharging their wastewater to natural ditches.
- The expected ratio of households that will connect to the future KfW system is around 85%.
- Around 28% of households said that the sewers are blocked sometimes.

Group 5: Ward 6

General information:

- Location: The ward is located at the centre of the City.
- Total population: 896 household, equivalent to 18% of the total KfW financed project area.
- Total area: 50.4 ha, equivalent to 12% of the total KfW financed project area.
- Household wastewater is discharged to ditches and sewers. Sanitary conditions are rather poor in the area.

Findings at Ward 6:

- About 99% of households are connected to piped water.
- Approximately 93% of households have septic tanks, of which approximately 64% empty their tank and only 8% use additives.
- About 55% of households are connected to public sewers and 45% households are discharging wastewater to natural ditches, open land and ponds. Environmental conditions in this area are rather poor. Public education and construction of sewer systems in this area are much needed to improve the living conditions of the residents. Photos at the right hand side illustrate household wastewater discharge to natural ditches.
- Around 55% of households will be connected to the future KfW sewers.
- Only 28% households said that sewers are blocked sometimes.

Tertiary sewer

Photo 1: Natural ditch – Ward 1

Photo 2: Public drain – Ward 1

Photo 3: Natural ditch to which household wastewater is discharged – Ward 2

Photo 4: Public drain – Ward 2

Photo 5: Natural ditch to which household wastewater is discharged – Ward 3

Photo 6: Natural ditch to which household wastewater is discharged – Ward 3

Photo 7: Natural ditch to which household wastewater is discharged – Ward 6

Photo 8: Public drain – Ward 6

Photo 9: Natura ditch – Ward 9

Photo 10: Public drain – Ward 9

6.4 Tra Vinh

General Findings for the Entire KfW financed project area:

1. Up to 94% of households are connected to piped water.
2. Approximately 90% of households have a septic tank. However, operation and maintenance of septic tanks is not sufficient. Among those having septic tanks, approximately 45% of households empty their tank and 61% are using septic tank additives.
3. Household ratio connecting to public sewer and to the future KfW system is approximately 55%.
4. 19% of the households experienced blocked sewers at times and 5% said that sewers are blocked regularly.
5. Since the public sewer at Tra Vinh are not sufficient both in quality and quantity affecting living and sanitation conditions, measures on construction of new and up-gradation of existing sewers is necessary. Programs on public education and information to local residents are also needed to improve their awareness and behavior.

Table 11: Survey Results of Tra Vinh

Items	Group 1 (%)	Group 2 (%)	Group 3 (%)	Average (%)
1. Surveyed ward	Ward 1	Ward 2	Ward 7	
2. Wards within group	Ward 4	Ward 3	Ward 6	
3. Household connected to piped water	92	97	94	94
4. Household having septic tank	89	92	92	90
5. Household empty septic tank	41	67	33	45
6. Household use septic tank additives	66	57	57	61
7. Household sometime witness drain block	12	16	59	19
8. Household discharge to public drain	60	85	23	55
9. Household discharge to land field	40	15	77	45
10. Household connected to KFW component	60	85	23	55

Note:
- Results at rows 5, 6 are only for household who have septic tank.
- Results at row 7 are only for household who connect with public sewer.

Specific Findings for Surveyed Groups in Tra Vinh:

Group 1: Ward 1 and Ward 4

General information:

- Location: The ward is located at the centre of the Town.
- Total population: 2,316 household, equivalent to 45% of total KfW financed project area.

- Household wastewater is discharged to PVC pipe then to ponds or open land for infiltration.

Findings and Ward 1:

- Approximately 92% of households are connected to piped water.
- 89% of households have a septic tank, of which 41% empty their septic tank and 66% use septic tank additives.
- The ratio of households connected to sewers is approximately 60%, of which there is a number of households discharging wastewater in two ways: to PVC pipes (for greywater) and directly to the soil (for wastewater from septic tanks).
- The ratio of households connected to the future KfW system is around 60%.
- Around 40% households discharging wastewater directly to ditches, ponds and open land.
- Surveyed households that experience blocked sewers at times is 12% and regularly blockages is 6%.


Ground level is low inside ward


Lane where PVC pipe is laid

Group 2: Ward 2 and Ward 3

General information:

- Location: The ward is located at the center of the Town.
- Total population: 1,292 households, equivalent to 25% of total KfW financed project area.
- Household wastewater is discharged to sewers or PVC pipe then to secondary or primary sewers before discharging to Long Binh River. The ratio of households discharging wastewater directly to open land is relatively high.

Findings at Ward 2:

- Household ratio connected to piped water is fairly high of 97%.
- Household ratio having a septic tank is up to 92%, of which 67% empty their septic tank and 57% use septic tank additives.
- Household ratio connected to public sewers is approximately 85%. This ratio is high in comparison with wards from Group 1 and 3.
- The household ratio discharging wastewater to open land is 15%.
- Among those connected to public sewers 16% of households said that sewers are blocked from time to time.

Group 3: Ward 6 and Ward 7

General information:

- Location: The wards are located at the centre of the Town.
- Total population: 3,841 household, equivalent to 75% of the total KfW financed project area.
- Mainly households discharging wastewater to ditches or open land for infiltration. The level of land inside wards 6 and 7 is lower than level of main or secondary sewers surrounding the wards; therefore most of the domestic wastewater cannot be drained to the main or secondary sewers.

Pond to which HH w/w is discharged

Tertiary sewer at Ward 7

Findings at Ward 7:

- 94% of households are connected to piped water.
- Approximately 92% of households have septic tanks, of which 33% empty their tank and 57% are using additives.
- Household ratio connecting to public sewers is rather low with approximately 23%. 77% of households in this area are discharging their wastewater to natural ditches, ponds or low laying land.
- Approximately 23% of households will be connected to the future KfW sewers. Photos at the right hand side illustrate pond to where household wastewater is discharged and part of sewer within Ward 7.

Photo 1: Lane where PVC plpe is laid for discharging household wastewater – Ward 1

Photo 2: Public drain – Ward 1

Photo 3: Public drain – Ward 2

Photo 4: Public drain – Ward 2

Photo 5: Public drain – Ward 7

Photo 6: Naural pond to which household wastewater is discharged – Ward 7

Photo 7: Ground level is low inside the area causing household wastewater can not discharge to main public drain but to natural pond – Ward 7

Annex 1: Questionnaire

A. Survey on Household Connections and Septic Tanks

Date:……..

Name of Interviewee: .....
Address (street and no) .....Ward……City
Tel.: .....

The town is presently preparing the implementing a project for the Construction and Rehabilitation of a Wastewater Collection and Treatment System in our City. For this reason, it is necessary to obtain data and information about the present status of your domestic wastewater treatment facility (septic tank) and wastewater discharge point.

Kindly take 10 minutes of your time to answer the following questions and allow our surveyor to have a quick visual inspection.

1. Do you connected to the treated water pipe ?
   Yes ☐ 1 Not yet ☐ 2

2. Do you have septic tank?
   Yes ☐ 1 No ☐ 2

3. Do you empty your septic tanks ?
   Yes ☐ 1 No ☐ 2 Do not know ☐ 3

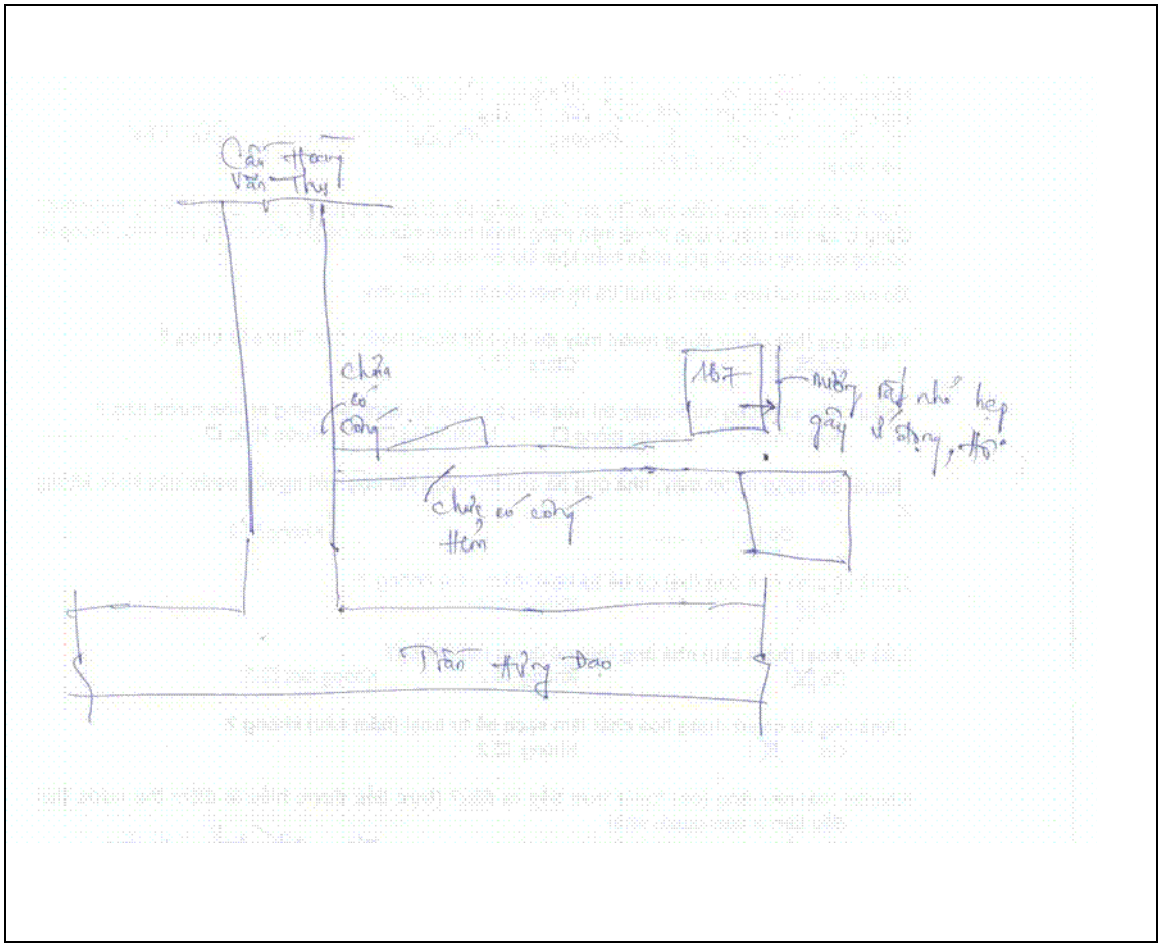
4. Do you use “septic tank additives” such as micro phot, or others?
   Yes ☐ 1 Never ☐ 2 Do not know ☐ 3

5. To where do you discharge <u>directly</u> your wastewater ? (Directly means the first discharge point of wastewater outside the property)
   - Constructed public drainage system ☐ 1
   - Public road ☐ 2
   - River, open channel, pond or lake (natural) ☐ 3
   - Infiltrate into the soil ☐ 4
   - Other (mentioned specific….) ☐ 5

6. How often dose sewerage outside your house blocked
   - Never ☐ 1
   - Sometime ☐ 2
   - Regular ☐ 3
   - Very often ☐ 4
   - Do not know ☐ 5

Thanks for your cooperation.

B. Simple drawing of household wastewater connection



Note: Drawing should be simple, indicating household drain to the public drain, etc

Supervisor **Interviewer**

Annex 2: List of Surveyors

Bac Ninh

1. Nguyen Ngoc Bon – Head of Sewer & Drainage Team
2. Dao Thanh Bien – Vice Head of Sewer & Drainage Team
3. Ha Huy Dong – Technical staff of Sewer & Drainage Team
4. Nguyen Vu Hiep – Staff Sewer & Drainage Team
5. Dương Thị Huong - Staff Sewer & Drainage Team
6. Vu Binh Hai - Staff Sewer & Drainage Team
7. Phạm Thị Hai - Staff Sewer & Drainage Team
8. Cao Phan Truong - Staff Sewer & Drainage Team
9. Cap Van Tuan - Staff Sewer & Drainage Team
10. Nguyen Dình Quang - Staff Sewer & Drainage Team
11. Dao Thị Thai - Staff Sewer & Drainage Team

Cần Thơ

1. Nguyen Xuan Phuong - Technical staff - Sewer and Drainage Division
2. Trinh Cong Doan – Staff – Technical Department
3. Tran Nguyen Son Vinh - Technical staff - Sewer and Drainage Division
4. Le Thanh Dien - Technical staff - Sewer and Drainage Division
5. Bui Vu Ngọc - Staff – Technical Department
6. Nguyen Thị Hong Ngu - Technical staff - Sewer and Drainage Division
7. Lam Quang Phat - Staff – Technical Department
8. Le Vu Phong - Technical staff - Sewer and Drainage Division
9. Ho Quoc Nam - Staff – Technical Department
10. Nguyen Nhut Hoan - Staff – Technical Department
11. La Quoc Tuan - Staff – Technical Department

Sóc Trăng

1. Thai Binh Khuols - Staff - Department of Planning - Technical
2. Nguyen Hoang Lan - Staff - Department of Planning - Technical
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4. Dau Duc Hien – Vice Head of Department of Planning - Technical
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Annex 3: List of Lanes Upgraded by CT Urban Upgrading Project (2008-2010)

Ward	Area	Upgrading Lanes		Current (m)		Widen (m)	Total Lanes
		No.	Name of Lanes	Width	Length		
An Hoa Ward	1	1	Lane No. 147 August Revolution Road	2	380	2.5	14
		5	Lane No. 2 Pham Ngu Lao Str.	1.2	280	2.5	
	2	4	Lane No. 188 Nguyen Van Cu Str.	8 – 10	280	6	
		6	Lane No. 49 August Revolution Road	2	96	4	
		7	Lane No. 38 Tran Viet Chau Str.	3	135	4 – 6	
	1&2	8	Lane No. 54 Tran Viet Chau Str. And branch Lane No. 54	3	1000	6	
		9	Lane No. 147 Nguyen Van Cu Str.	7 – 8	280	4 – 6	
	3	10	Lane No. 80 Pham Ngu Lao Str.	2 – 0	200	4	
		11	Lane No. 98 Pham Ngu Lao Str.	2 – 1	216	4	
		12	Lane No. 108 Pham Ngu Lao Str.	2 – 2	146	4	
		13	Lane No. 98 Pham Ngu Lao Str.	2 – 3	308	4	
		14	Lane No. 124 Pham Ngu Lao Str. And branch to Primary school	2 – 3	400	4	
An Phu Ward	2	1	Lane No. 123 Tran Hung Dao Str.	2	200	2.5	16
		2	Lane No. 42 April 30 Road	2	105	2	
		3	Lane No. 16 April 30 Road	2	205	2	
		4	Lane No. 105 Ly Tu Trong Str.	3	78	3.5	
		5	Branch of Lane Thoi Trang of Ly Tu Trong Str.	4	70	5	
	3	6	Lane No. 108/41 April 30 Road	1.5	220	2	
		7	Lane No. 108/75 April 30 Road	1.5	95	3	
		8	Lane No. 142 Mau Than Road	2.5	130	4	
		9	Lane No. 1 Nguyen Viet Hong Str.	1.5	400	4	
		10	Lane No. 2 Nguyen Viet Hong Str.	2	300	4	
		11	Lane No. 3 Nguyen Viet Hong Str.	2	88	3	
	4	12	Lane No. 108 April 30 Road	2	112	4	
		13	Lane No. 74 to Lane No. 108 April 30 Road	1.5	66	6	
		14	Lane No. 108/49 April 30 Road	1.5	264	4	
		15	Lane No. 108/53 April 30 Road	1.5	90	3	
		16	Lane No. 160 April 30 Road	1.5	90	3	

Xuan Khanh Ward	1	1	Lane No. 184 Nguyen Thi Minh Khai Str.	1.2	100	4	28
		2	Lane No. 194 Nguyen Thi Minh Khai Str.	1	75	4	
		3	Lane No. 204 Nguyen Thi Minh Khai Str.	1.5	120	4	
		4	Lane No. 212 Nguyen Thi Minh Khai Str.	1.5	120	4	
		5	Lane No. 33 Quang Trung Str.	1.2	70	4	
		6	Lane No. 9 Quang Trung Str.	1.2	75	4	
		7	Lane No. 49 Quang Trung Str.	1.2	25	4	
		8	Branch of Lane No. 9 to Lane No. 71 Quang Trung Str. (outer)	2	125	4	
		9	Branch of Lane No. 9 to Lane No. 71 Quang Trung Str. (inner)	1.5	122	4	
	2	10	Lane No. 139 April 30 Road	2	130	4	
		11	Lane No. 124 April 30 Road	2	270	3	
		12	Lane No. 99 April 30 Road	2	70	3	
		13	Lane No. 97 Quang Trung Str.	1.5	110	4	
		14	Lane No. 83 Quang Trung Str.	1.5	180	4	
	1&2	15	Lane No. 71 Quang Trung Str.	1.5	240	4	
	3	16	Lane next to No. 138 Tam Vu Str.	1.3	61	3 – 4	
		17	Lane next to No. 10/10 Mau Than Road	1.5	25	3 – 4	
		18	Lane No. 15 Mau Than Road	2	95	3 – 4	
		19	Lane next to No. 8A Tam Vu Str.	1.5	60	3 – 4	
	5	20	Lane No. 1 Mau Than Road	1.5	410	4	
		21	Lane No. 2 Mau Than Road	1.5	300	4	
		22	Lane No. 3 Mau Than Road	2	300	4	
		23	Lane No. 4 Mau Than Road	1.5	180	4	
		24	Lane No. 5 Mau Than Road	1.5	200	4	
	5&6	25	Lane No. 6 Mau Than Road	1.5	765	4	
		26	Lane No. 122 Mau Than Road				
		27	Lane No. 124 February 3 Road		300	4	
		28	Lane No. Area 6 Tam Vu Str., Area 4	1.2	30	4	
Cai Khe Ward	5	1	Lane No. 160/49 Doan Thi Diem Str.	2.5	307	3	9
		2	Lane No. 156/52 Doan Thi Diem Str.	2	342	3	
	6	3	Lane No. 108 August Revolution Road	1.5	405	3	
		4	Lane No. 68 August Revolution Road	1.5	870	4	
		5	Lane No. 44 August Revolution Road	1.5	685	4	
	7	6	Lane No. 65 Tran Phu Str.	1.5	104	4	
		7	Lane No. 21 Tran Phu Str.	1.5	98	3	
		8	Lane No. 4 August Revolution Road	1.5	172	4	
		9	Lane No. 54 August Revolution Road	2	78	3	

Thoi Binh Ward	1	1	Lane No. 61 Hung Vuong Str.	2	216	3 – 4	7
	2	2	Lane No. 6 Bui Thi Xuan Str. to Lane No. 1 Nguyen Trai Str.	2	886	3 – 4	
	5	3	Lane No. 90/2 Hung Vuong Str.	2	340	3 – 4	
		4	Lane No. 90/20 Hung Vuong Str.				
		5	Lane No. 90/32 Hung Vuong Str. qua Lane No. 118 Hung Vuong Str.				
	6	6	Branch of Lane No. 4 to Lane No. 14 Ba Huyen Thanh Quan Str. and Lane No. 35 Pham Ngu Lao Str.	1.5	273	3 – 4	
		7	Lane No. 77B Pham Ngu Lao Str.	2	330	3 – 4	
Hung Loi Ward	1	1	Lane No. 246 Tam Vu Str.	2	255	3 – 4	18
		2	Lane No. 250 Tam Vu Str.	2.5	245	3 – 4	
		3	Lane No. 232 Tam Vu Str.	1.5	70	3 – 4	
	2	4	Lane No. 91 April 30 Road qua Lane No. 60 Tam Vu Str.	2	415	4	
	3	5	Lane No. 190 April 30 Road	2	170	4	
		6	Branches of Lane No. 190 April 30 Road	2	274	4	
	2&3	7	Lane No. 69 Tam Vu Str. (T-junction HTX)	4.5	525	6 – 8	
		8	Lane No. 10 Tam Vu Str.	1.8	334	4	
		9	Lane No. Area 22 Tam Vu Str.	2	225	3 – 4	
		10	Lane No. Area 21 Tam Vu Str.	1.8	57	3 – 4	
		11	Lane No. 1 February 3 Road	2	300	4	
		12	Lane No. 12 February 3 Road	1.1	190	6 – 8	
	6	13	Lane No. 12 to Nga Bac Bridge & Lane 102	2	1425	4	
		14	Lane No. 58 February 3 Road	2	200	4	
		15	Lane No. 36 February 3 Road	1.5	86	4	
		16	Lane No. 38 February 3 Road	1.5	152	4	
		17	Lane No. Area 57 February 3 Road	1.5	130	4	
		18	Nhánh Lane No. 12 February 3 Road	1.5	50	4	
An Lac Ward	1	1	Lane No. Cao Ba Quat Str.	1.5	100	6	11
	2	2	Lane No. 124 Chau Van Liem Str. to Lane No. 50 Dong Khoi Str.	1.5	420	4	
	3	3	Lane No. 158 Phan Dình Pheng	2.1	260	4	
		4	Lane No. 5 Cao Ba Quat Str.	1.4	250	4	
		5	Lane No. 80 Dien Bien Phu Str.	1	300	4	
	4	6	Lane No. 32 Nguyen Thi Minh Khai Str.	1.5	494	4	
	5	7	Lane No. 88 Nguyen Thi Minh Khai Str.	1.5	190	4	
		8	Lane No. 112 Nguyen Thi Minh Khai Str.	1.5	516	4	
		9	Lane No. 128 Nguyen Thi Minh Khai Str.	2	66	4	
	6	10	Lane No. 50 Quang Trung Str.	2	85	4	
		11	Lane No. 132 Nguyen Thi Minh Khai Str.	1.7	90	4	

An Nghiep Ward	1	1	Lane No. 37 Huynh Thuc Khang Str.	2	200	4	8
		2	Lane No. 45 and branch of Lane No. 145 Huynh Thuc Khang Str.	2	190	4	
	1&2	3	Lane No. 53 and branch of Lane No. 53 Huynh Thuc Khang Str.	2	200	4	
		4	Lane No. 89 Huynh Thuc Khang Str.	4	260	4	
		5	Lane No. 149 Huynh Thuc Khang Str.	2	100	4	
		6	Lane No. 98 Tran Hung Dao Str.	2	230	4	
		7	Lane No. 70 Tran Hung Dao Str. and branches of Lane No. 70		205	3 – 4	
		8	Lane No. 138 Tran Hung Dao Str. and branch of Lane No. 138	3	710	4	

Note: Can Thoi Urban Upgrading Project funded by World Bank were implementted at 02 wards of An Cu and An Hoi before 2008.