SOCIALIST REPUBLIC OF VIETNAM
MINISTRY OF CONSTRUCTION

FINAL REPORT
ON THE DETAILED PLANNING PHASE FOR THE PROJECT FOR ENHANCING MANAGEMENT CAPACITY OF SEWAGE WORKS IN SOCIALIST REPUBLIC OF VIETNAM

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JAPAN INTERNATIONAL COOPERATION AGENCY

JAPAN TECHNO CO.,LTD.
SEWERAGE BUSINESS MANAGEMENT CENTRE
WATER AGENCY INC.
NIHON SUIKO SEKKEI CO., LTD.
YOKOHAMA WATER CO.,LTD.

GE
JR
17-053

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Abbreviation

ADB	Asian Development Bank
ATI	Administration of Technology Infrastructure
BIWASE	Binh Duong Water Supply Sewerage Environment Co., Ltd.
BOD	Biochemical Oxygen Demand
CNEE	Training Center for Water and Environment
COD	Chemical Oxygen Demand
CPC	City People's Committee
CSS (1)	Combined Sewerage System
CSS (2)	City Sanitation Strategy
CUWC	College of Urban Works Construction
DANIDA	Danish International Development Agency
DOC	Department of Construction
DONRE	Department of Natural Resources and Environment
DPI	Department of Planning and Investment
FS	Feasibility Study
GCUS	Japan Global center for Urban Sanitation
GI	General Information
GIZ	Deutshe Geselleschaft fuur Internationale Zusammenarbeit
HCMC	Ho Chi Minh City
HSDC	Hanoi Sewerage and Drainage Company
IBST	Vietnam Institute for Building Science and Technology
JCC	Joint Coordination Committee
JICA	Japan International Cooperation Agency
JS	Japan Sewage Works Agency
JSC	Joint Stock Company
JSWA	Japan Sewage Works Association
JSWAS	Japan Sewage Works Association Standard
MABUTIP	Management Board of Urban Technical Infrastructure Development Projects
MOC	Ministry of Construction
MOF	Ministry of Finance
MOIT	Ministry of Industry and Trade
MOLISA	Ministry of Labor – Invalid and Social Affairs
MONRE	Ministry of Natural Resources and Environment
MOT	Ministry of Transport
MPI	Ministry of Planning and Investment
NILIM	National Institute for Land and Infrastructure Management

O&M	Operation and Maintenance
ODA	Official Development Assistance
OJT	On-the-Job Training
PAM	Project Administration Manual
PC	People's Committee
PCM	Project Cycle Management
PI	Performance Indicator
PIU	Project Implementation Unit
PMB	Project Management Board
PMU	Project Management Unit
PPC	Provincial People's Committee
PPTA	Project Preparatory Technical Assistance
R&D	Research and Development
R/D	Record of Discussion
SOP	Standard Operating Procedure
SSS	Separated Sewerage System
T-N	Total Nitrogen
TOT	Training of Trainers
TSS	Total Suspended Solid
UCCI	Urban - Civil Works Construction Investment Management Authority of Ho Chi Minh City
VSC	Vietnam Sewerage Center
VWSA	Vietnam Water Supply and Sewerage Association
WB	World Bank
WWTP	Wastewater Treatment Plant

Chapter 1

Outline of Detailed Planning Phase

CHAPTER 1 OUTLINE OF DETAILED PLANNING PHASE

1.1 Background

After 1990's, rapid urbanization resulted by economic growth of more than 7% in average has caused severe environmental deterioration in Vietnam. Accordingly, urgent improvement of environment is required by developing of sewerage system which does not cope with urbanization. More than one quarter of urban population in Vietnam live in 4 cities (Hanoi, Ho Chi Minh, Hai Phong, Da Nang) and the environmental pollution, especially water pollution, in their resideicial places as well as perioheries are serious problems. Considering further economic development and demographic growth focusing in urban cities, as well as less advanced urban infrastructures compares to other neighbour countries, the issues on the environmental pollution are apprehended to be more severe than current state.

Vietnamese government has enhanced measures to protect environment by implementing construction of public sewerage system in recent years. Japan International Cooperation Agency (JICA, hereinafter) is also assisting Vietnam through Official Development Assistance (ODA, hereinafter) loan to sewerage sectors, which count 18 projects in total (implementation phase and completed), including Hanoi Water Environment Improvement Project (Phases 1 and 2), Hanoi City Yen Xa Sewerage Improvement Project, Ho Chi Minh City Water Environment Improvement Project (Phases 1 and 2), South Binh Duong Water Environment Improvement Project (Phases 1and 2), Hue City Water Environment Improvement Project, Hai Phong City Environment Improvement Project, Ha Long City Water Environment Improvement Project (E/S), Vinh Phuc Province Investment Environment Improvement Project, and Hanoi City Infrastructure Development Project. Sewerage works in metropolises has been proceeded and medium and small cities is expected to implement sewerage projects in near future too.

Not only human resource for proper management of sewerage system but also human resource for operation and maintenance are very limited to promote appropriate sewerage projects. Besides, management capacity for sewerage system, such as operation and maintenance (O&M, hereinafter) for sustainable operation of facilities, designing financial plan, formulateing investment plan, and administrating organization/institution for implementing these activities, are weak along with lack of engineers in municipalities for sewerage sector. Hence, implementation capacity in sewerage works should be enhanced for further development of the sewerage sector that enables elaboration of sewerage design and implementation of construction, for example. To solve these issues, The Ministry of Construction (MOC, hereinafter) sent a

request of technical assistant project namely “Project for Enhancing Management Capacity of Sewerage Works in the Socialist Republic of Vietnam (the Project, hereinafter)” to Government of Japan, which expects to establish Vietnam Sewerage Center (VSC, hereinafter) for the development of human resource in sewerage sector.

Following the request from MOC, JICA implemented a basic planning survey in October 2015. Based on the basic planning, MOC and JICA concluded Record of Discussion (R/D, hereinafter) on 16th October 2015.

1.2 Overview of the Project

(1) Project title

Project for Enhancing Management Capacity of Sewerage Works in the Socialist Republic of Vietnam

(2) Overall Goal

To enhance the planning, implementation and management capacity of the sewerage sector to meet the future needs in Vietnam

(3) Project Purpose

Establishment of planning documents for Sewerage Center is proposed and refined based on the result of the pilot projects.

(4) Expected Outputs

- Comprehensive needs of human resource development for sewerage sector is defined.
- Structure of the organization, function, tasks and business plan for the Sewerage Center are drafted.
- Basic pilot training for sewerage sector is implemented.
- Pilot activities for the Project Implementation Support function are identified.
- The pilot activities for consulting and research and development (R&D, hereinafter) for the sewerage sector in Vietnam are identified.

1.3 Objectives of the Study in Detailed Planning Phase

JICA Study Team conducts activities to identify needs of human development for sewerage sector, to draft structure, function, and business plan of the Sewerage Center, and to elaborate

detail planning (period of project, contents of activities, indicators, inputs) of the project in Full Scale phase.

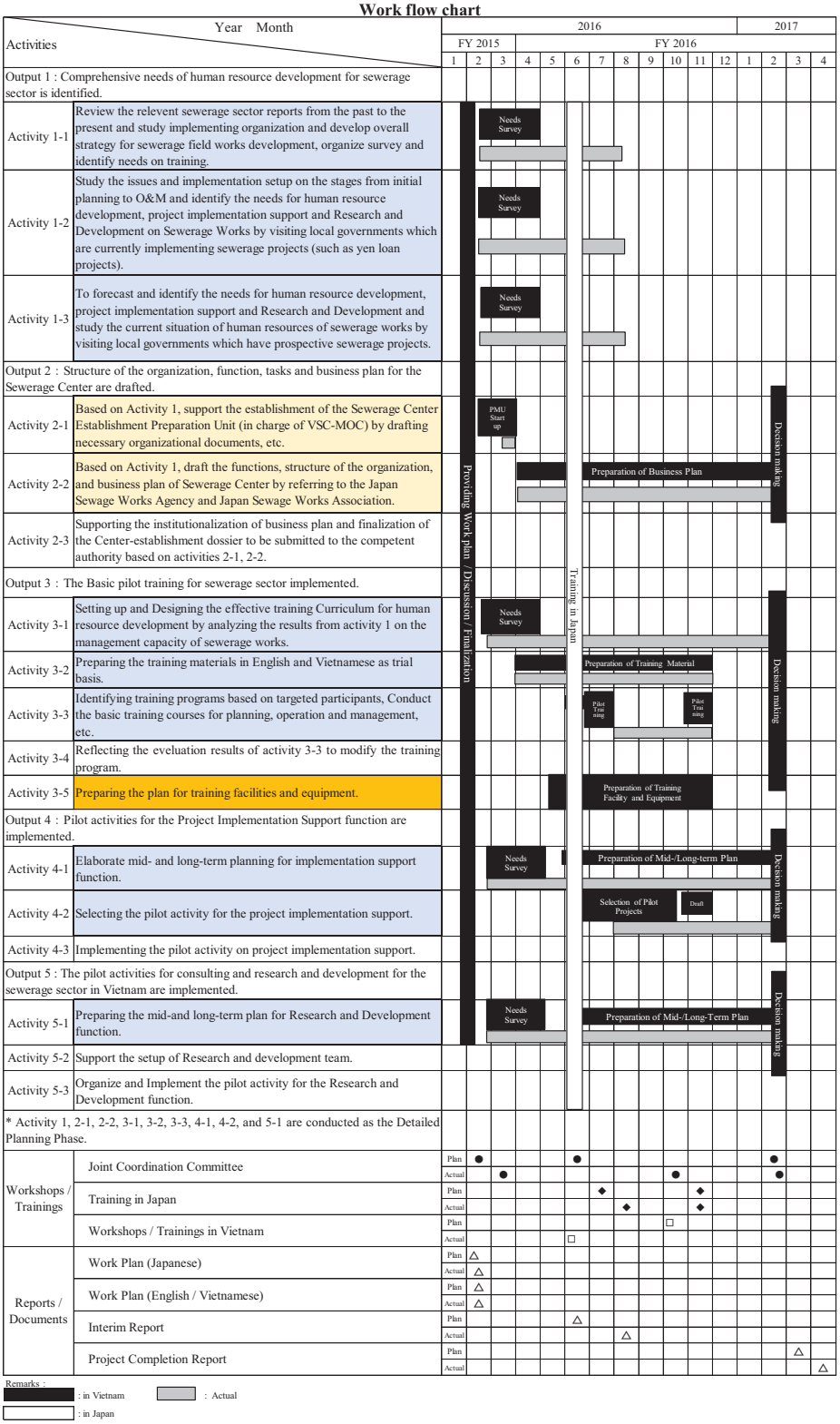
1.4 Period of Project

The Project is composed of 2 phases as indicated below. This document is a completion report for the Detailed Planning Phase.

- Detailed Planning Phase: from January 2016 to March 2017
- Implementation Phase: from April 2017 to May 2019

As indicated in following flowchart, the Detailed Planning Phase has been implemented.

Work flow chart



Source: JICA Study Team

Figure 1.4-1 Flowchart of project implementation

Chapter 2

Project Activities and Outputs of the Detailed Planning Phase

CHAPTER 2 PROJECT ACTIVITIES AND OUTPUTS OF THE DETAILED PLANNING PHASE

2.1 Output 1: Comprehensive Needs of Human Resource Development for Sewerage Sector is Identified

2.1.1 Purpose of Survey

JICA and MOC of Vietnam have agreed to establish VSC to provide assistance in enhancement of management capacity of sewerage works in Vietnam. The VSC will have 3 functions (training, project implementation support, and research & development), which are elaborated based on the model of Japan Sewage Works Agency (JS, hereinafter). However, VSC must suit to natural and social conditions of the country. Otherwise it is impossible to promote appropriate sewerage facility of water environment and sewerage.

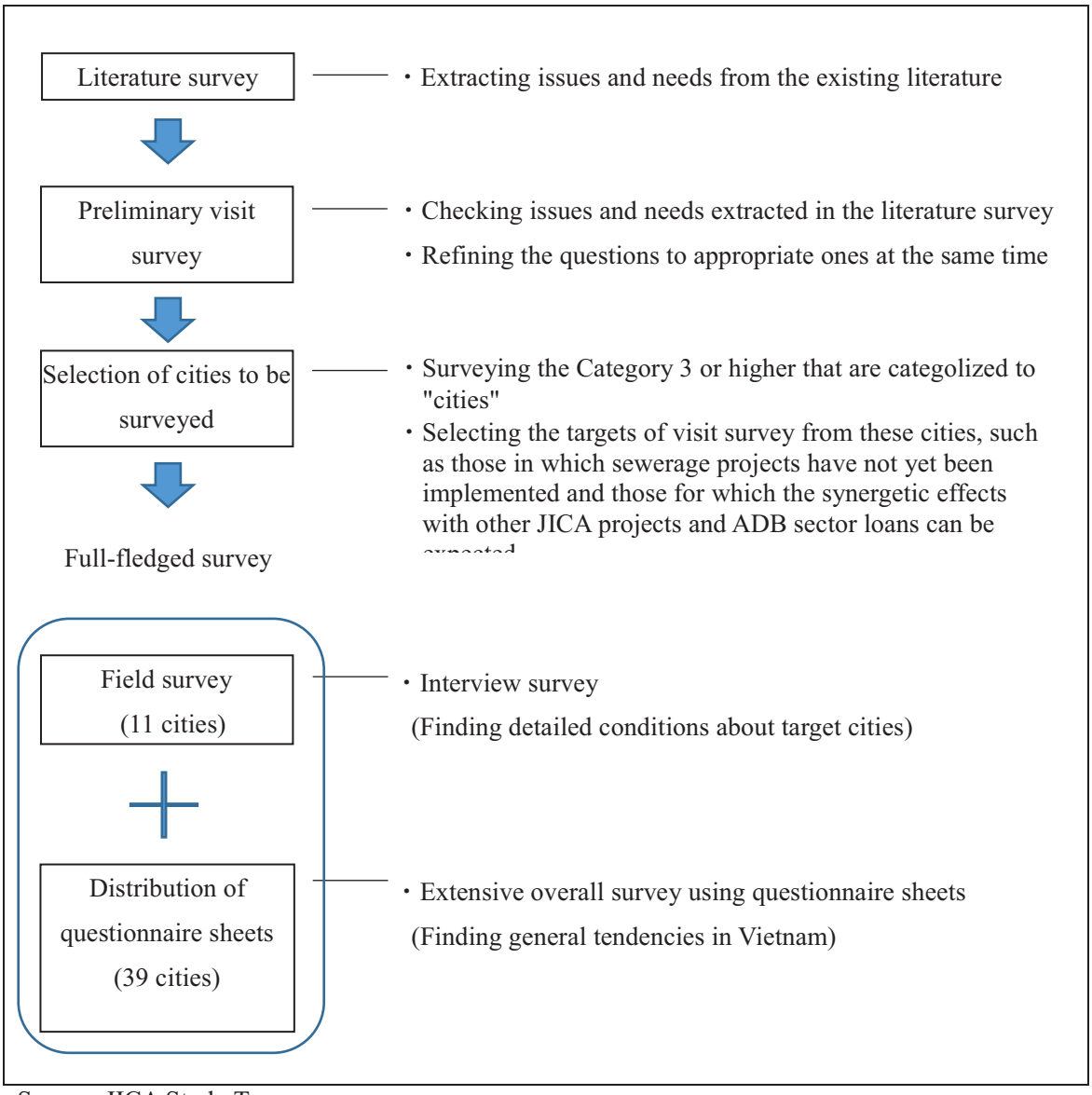
This survey consists of identifying situations and needs of sewerage sector for its development so the functions of VSC will be effectively implemented in Vietnam.

2.1.2 Survey Flow

The survey was conducted in the following order.

- Various surveys have been conducted by JICA and other organizations on the issues regarding the sewerage service in Vietnam and evaluation reports have been submitted. JICA Study Team extracted these documents to identify issues and needs. (Literature survey)
- For a better preparation of field survey, JICA Study Team implemented preliminary survey. The results were referred to refine questionnaire and increase effectiveness of field survey. JICA Study Team visited implementing agencies to conduct survey to learn their situation, problems, and needs on VSC. (Preliminary visit survey)
- Based on the questionnaire, JICA Study Team conducted interviews to the officials of Provincial People's Committee (PPC, hereinafter) and City People's Committee (CPC, hereinafter) respectively. (Field survey)
- JICA Study Team distributed questionnaires to entities as many as possible and implemented the survey through telephone and email. (Questionnaire survey)

Survey flow is indicated in the figure below.



Source: JICA Study Team

Figure 2.1-1 Needs survey flow

2.1.3 Literature and Interview Survey

(1) Purpose of Survey

Collecting information about sewerage sector in Vietnam through existing sources, and understand situations, problems, and necessity of VSC.

(2) Survey Method

Collecting and organizing related literature from 4 points of view listed below, and completing information on unclear issues through interview.

- Current water pollution, policy for wastewater management, finance, situation of facility

construction, and situation of O&M in sewerage works in Vietnam

- Situation of companies in sewerage sector
- Situation of training in sewerage sector by donors
- Activities of Japanese companies

(3) Target Literature surveyed

Target literature for survey is indicated in Appendix 8-22.

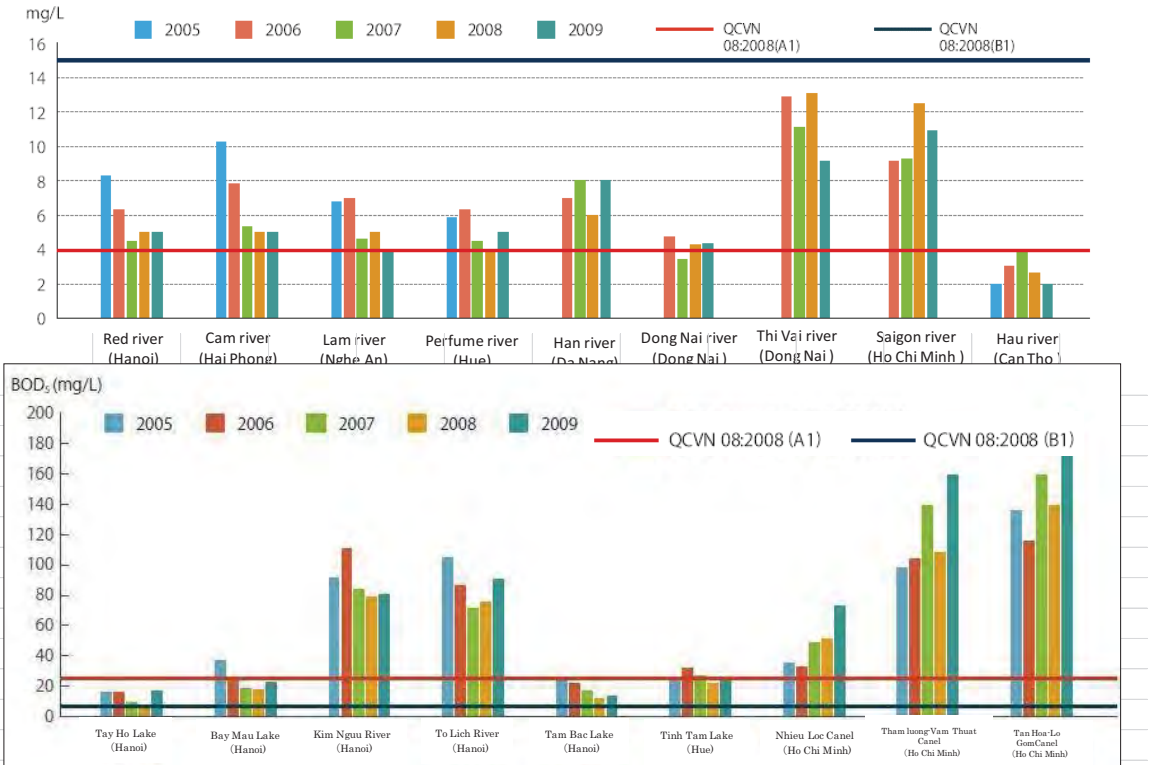
(4) Survey Results

1) Current Status of Water Environment

A report of WEPA Outlook on Water Environment Management in Asia summarizes the current situations of sewerage system and water environment in Vietnam as shown below.

River water quality is deteriorating in downstream areas, particularly in expanding city areas. The figure shows Biochemical Oxygen Demand (BOD_5, hereinafter) values monitored at several different points along major rivers flowing through city areas. A gradual improvement of water quality during last 5 years is observed, but at almost all points, the values are exceeding the national standard value of 4mg/L, of the Category A1 (appropriately treated municipal water). In cities, canals are also seriously polluted. The BOD_5 level observed in 2009 at Tham Luong-Vam Thuat Canal of Ho Chi Minh City, for instance, far exceeded the standard value, which was 8 times as high as the water environment standard for the Category B2 (water used for purposes that do not require high water quality such as waterway transport and others). The pollution is mainly caused by discharge of wastewater from industry and households without treatment or with insufficient treatment.

The figure shows water quality of surface water in city areas as well as suburban areas. In many lakes, swamps, canals, and rivers, BOD values exceed those set by the national technical standards concerning surface water (08:2008/MONRE Category B2).



Source：WEPA Outlook on Water Environment Management in Asia 2012

Figure 2.1-2 Transition of Average BOD Level in Major Rivers and City Areas (Between 2005 and 2009)

2) Vietnamese Government Policies for Sewerage Development

The Vietnamese government policies for sewerage development were revised in April 2016. Article 1 (Perspective) of the Prime Minister Decision No. 589 /QD-TTg, April 6th, 2016 defines the drainage and sewerage services as public utility services and specifies to promote them as bellows;

- contribute to environmental protection by promoting implementation
- appropriately manage them according to the regulations and criteria
- adopt environment-friendly technologies and products
- charge a price for the sewerage service

Furthermore, Article 3 (Implementing Organization) specifies that “A center for training on the water field will be established to develop human resources in the sewerage and drainage sector.”

Decision approving “Adjusted Orientations for Development of Water Drainage in Vietnamese Urban Centers and Industrial Parks up to 2025 and a Vision towards 2050”

Article 1.To approve the adjusted orientations for development of water drainage in Vietnamese urban centers and industrial parks up to 2025, and a vision towards 2050 with the following contents:

I. Viewpoints

1. Water drainage is a public-utility service; the State encourages economic sectors to involve in construction investment, management and operation of water drainage systems.

2. Sustainable water drainage development contributes to the environmental protection and is the responsibility of the whole society, including the community involvement and supervision, close coordination among local governments along related river basins as well as the cooperation with regional countries to ensure the safety and effectiveness of water drainage and mitigation of impacts caused by climate change and sea level rise.

3. Wastewater, sewerage sludge must be thoroughly collected and treated meeting required technical regulations/standards, while contributing to environmental and community health protection. Wastewater and sludge treatment must be applied advanced and energy saving technologies in appropriateness with local socio-economic development conditions.

4. Centralized and decentralized solutions shall be combined to increase the coverage rate of treated wastewater before discharge into the environment; wastewater-separating facilities shall be added for urban centers where combined water drainage systems are already provided; separate water drainage systems shall be built for industrial parks and new urban centers; decentralized method or improvement of the efficiency of on-site treatment facilities shall be applied for areas where wastewater have not been able to collect and treat by decentralized method.

5. Rainwater must be collected, treated and reused in meeting technical standards. Reuse of rainwater shall be encouraged for daily life and production needs, while saving natural water resources and minimizing the exploitation of ground water and surface water towards sustainable drainage and sewerage management.

6. To conserve, develop and use effectively ponds and lakes (natural and artificial) for rainwater regulation, partially flood mitigation, concurrently for creation of landscape and serving activities in urban centers.

7. Materials, equipment used in the sewerage sector must be produced by advanced, environment-friendly manufacture technologies in order to save natural resources and protect the environment.

8. Organizations, households, individuals who use drainage and sewerage service are responsible for payment of sewerage service as stipulated on local regulations.

The target values of service for development of sewerage have been determined as follows: A sewage collection and treatment rate of 15% to 20% in the urban central area by 2020; wastewater treatment rate of 50% in the urban central area of Grade II or higher cities and wastewater treatment rate of 20% in the urban central area of Grade V or higher cities by 2025. (Cf. Table 2.1-1)

Table 2.1-1 Policies for Sewerage Development in Vietnam: Revised Version, Prime Minister Version No. 589 (April 2016)

Target year	2020		2025		2050
Wastewater	Service coverage of the urban drainage systems	70%	Same as left	80%	100%
	Total wastewater volume collected and treated in urban centers	15-20%			100%
			Total wastewater volume collected and treated in Grade-II urban centers upward	50%	100%
			Total wastewater volume collected and treated in Grade-V urban centers upward	20%	100%
	Collected and treated wastewater generated from hospitals and industrial parks	100%			
	Collected and treated wastewater generated from craft villages	30-50%	Same as left	80%	100%
			Reuse of treated wastewater for different purposes such as plant watering, road cleaning and others	20-30%	
Rainwater drainage and urban flood control	Service coverage of the rainwater drainage systems in urban center	70%	Same as left	80%	100%
	Rainwater drainage systems of main roadways in urban centers as well as roadways in urban centers and residential areas.	100%			
	Inundation reduction in urban centers of grade II upwards	50%			
			Regular inundation not occurred in urban centers in rainy seasons	100%	
	Centrally-governed cities/provinces promulgate and implement local regulations on drainage management and sewerage service price	100%			
			Rainwater collection, treatment and reuse in urban center	10-20%	

Source: No. 589 /QD-TTg, April 06, 2016 Decision Adjusted Orientations for Development for Water Drainage in Vietnamese Urban Centers and Industrial Parks up to 2025 and a Vision towards 2050

The following methods for sewerage development have been determined: Creating and implementing a national investment plan, reviewing and revising various regulations, reviewing and adding technical standards, etc. to complete them, achieving harmony with the environment,

and reviewing and revising processes and regulations about tendering.

Concerning finance, too, the following items have been determined: Investment on sewerage facilities, utilization of private funds, securing of financial source for maintenance and management, charging of fee for sewerage, and improvement of a tendering system (socialization).

Regarding the technical development, the following items have been determined: Development of advanced and environment-friendly technologies, securing of safety of cities, use of treated water and rainwater, development of various analysis models, and securing of excellent human resources.

Decision approving "Adjusted Orientations for Development of Water Drainage in Vietnamee Urban Centers and Industrial Parks up to 2025 and a Vision towards 2050"

Article 2. Implementation solutions:

1. Mechanism and policy applicable to the water drainage and sewerage field:

- To develop and implement the National Program on wastewater treatment investment immediately focusing on large urban centers and river basins under appropriate roadmap.
- To review, revise and add regulations on construction investment, on capital sources for investment and development of water drainage systems in large urban cities, urban cities along river basins affected by natural disasters (such as floods, sea tides, etc.) which cause impacts on the environment and inhabitants' lives.
- To review, add and complete technical regulations and standards related to the field of drainage and sewerage.
- To develop and promulgate technical regulations and guidelines related to rainwater collection and reuse to meet required standards before discharge into the environment.
- To develop regulations on management of regulation lakes; to maximize and synchronize the drainage regulation function with the ecological, landscape scenery functions as well as with other functions; to identify appropriate location, scope of lakes to ensure the maximum efficiency of rainwater regulation of lakes according to specific economic /technical / environmental conditions and urban master plan.
- To review, add and promulgate regulations related to conditions, competences of organizations and individuals involving in bidding process for operation and management of sewerage systems.

2. Planning and plans for the development of water drainage systems

-To review, revise, add specialized drainage/sewerage plans, contents of drainage plans within urban master plans in response to the climate change.

- To make and manage flooding maps according to climate change scenarios as well as forecast maps of areas at risks of flooding, landslide, flash flood etc. in centrally-governed provinces/cities, costal and mountainous areas.

- To review, adjust or make plans of drainage systems investment and development in accordance with the approved planning; to determine investment demand, priority investment projects and duties according to periodic planning or plans of each locality.

3. Investment in the development of water drainage systems

- To concentrate investment capital sources for construction of centralized water drainage systems in large urban centers and river basins; to prioritize the investment in urgent projects in order to address serious environmental pollution in dense residential areas directly affected to the health and lives of inhabitants.

-To promote the implementation of investment and construction of drainage projects in PPP form in appropriateness with local socio-economic conditions.

- To encourage local governments in supporting craft villages and production /service establishments to invest in construction of the drainage systems in accordance with the State policies.

- To develop a wastewater service price roadmap appropriated with local socio-economic conditions to cover O&M costs towards full recovery of construction investment costs and completion of the water drainage systems.

-To promote the socialization of management and operation of the water drainage systems through bidding for drainage service provision.

4. Scientific researches on the development of drainage and sewerage technologies

- To prioritize resources for scientific researches and technology transfer in the field of drainage and sewerage towards to master advanced and environmental-friendly wastewater treatment technologies.

- To study the topics relating to safe and sustainable water drainage as well as to propose regulations to ensure the safety of urban drainage systems.

- To study, select treatment technologies of wastewater and sewerage sludge, appropriate to climate, topographic-geological and hydrographic conditions of localities and load ability of receiving bodies; to study and propose regulations on reuse of treated wastewater and sludge

ensuring the technical environmental standards.
- To study and apply treatment methods and technologies in order to reuse rainwater serving daily life and production, contributing to save water natural resources, to minimize the exploitation and use of ground and surface water.
- To study, apply the model of multi-functional flood defense and propose urgent measures for urban flood control in appropriateness with climate change scenarios.
- To encourage organizations and individuals to participate in scientific researches on wastewater treatment and urban flood control. To support in improving the effectiveness of scientific researches activities in order to attract capable talents for technological research, development and application of high scientific and technological achievements of the world in the field.

3) Implementation Sytem of Sewerage Projects

a) Implementation System for Sewerage Projects

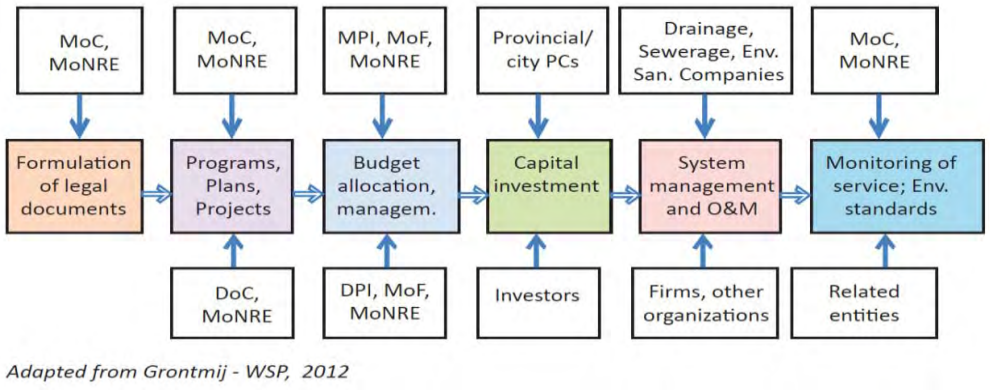
Law on Public Investment (No. 49/2014/QH13) stipulates that the local government which intends to implement sewerage system shall require the approval of central government. Processes and procedures for the authority of giving approval depends on the socio-economic development strategy and five-year socio-economic development plan, the Ministry of Planning and Investment (MPI, hereinafter) shall direct and cooperate with the Ministry of Finance (MOF, hereinafter) and relevant authorities.

Table 2.1-2 Authority to decide investment policies on public investment programs and projects

Classification criteria projects	Investment amount （Article 8-10）	Authority to decide on investment policies （Article 17）
Group-A	Total investment amount of more than VND 1,500 billion	Prime Minister
Group B	Total investment amount ranging from VND 80 billion to below VND 1,500 billion.	Heads of Ministries and Central Agencies
Group-C	Total investment amount ranging below VND 80 billion.	Heads of Ministries and Central Agencies

Source：Law on Public Investment No. 49/2014/QH13

Relations among the project owner and PPC, Department of Planning and Investment (DPI, hereinafter), MOC, MOF and Ministry of Natural Resources and Environment (MONRE, hereinafter) at each stage of project implementation are illustrated. A proposal drafted by the project owner shall consult with Department of Construction (DOC, hereinafter), then shall be applied to PPC, which further would be approved by MOC. Screening on land acquisition and environmental issues caused by sewerage system shall be performed by MONRE, which at a provincial level should be by Department of Natural Resources and Environment (DONRE, hereinafter). As for planning of investment and financing, DPI, PPC, MPI and MOF are committed to screening and approval.



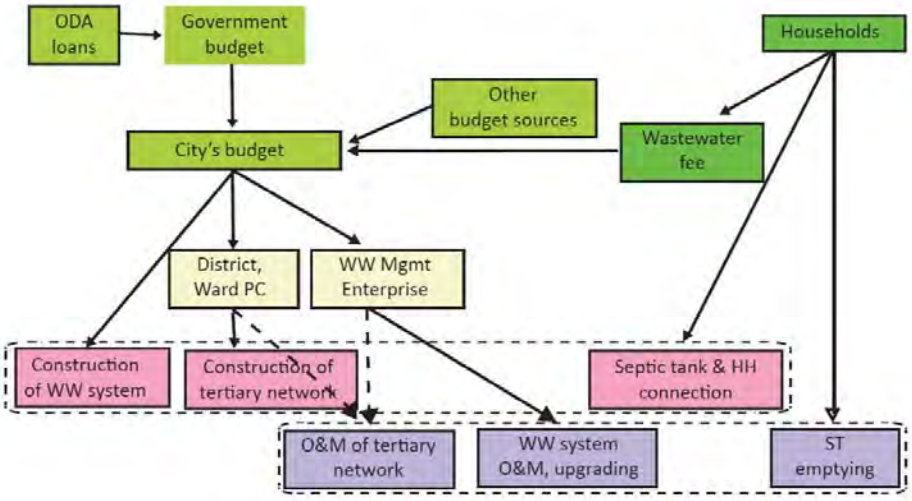
Source：Vietnam Urban Wastewater Review 2013, World Bank

Figure 2.1-3 Commitment of Sewerage Projects Process by Nation, Provinces and Cities and Companies

b) Flow of Funds

Figure 2.1-4 shows the structure and flow of funds of sewerage development project. At the construction stage, sewerage facilities are constructed by applying ODA loans and government budget. To some extent, PPC and CPC also share the burden. As for private enterprises, at times Call for Investment is publicized. Individuals bear the cost of house connection and others.

At operation stage, funds are allocated through sewerage user charges and general account of provincial government.



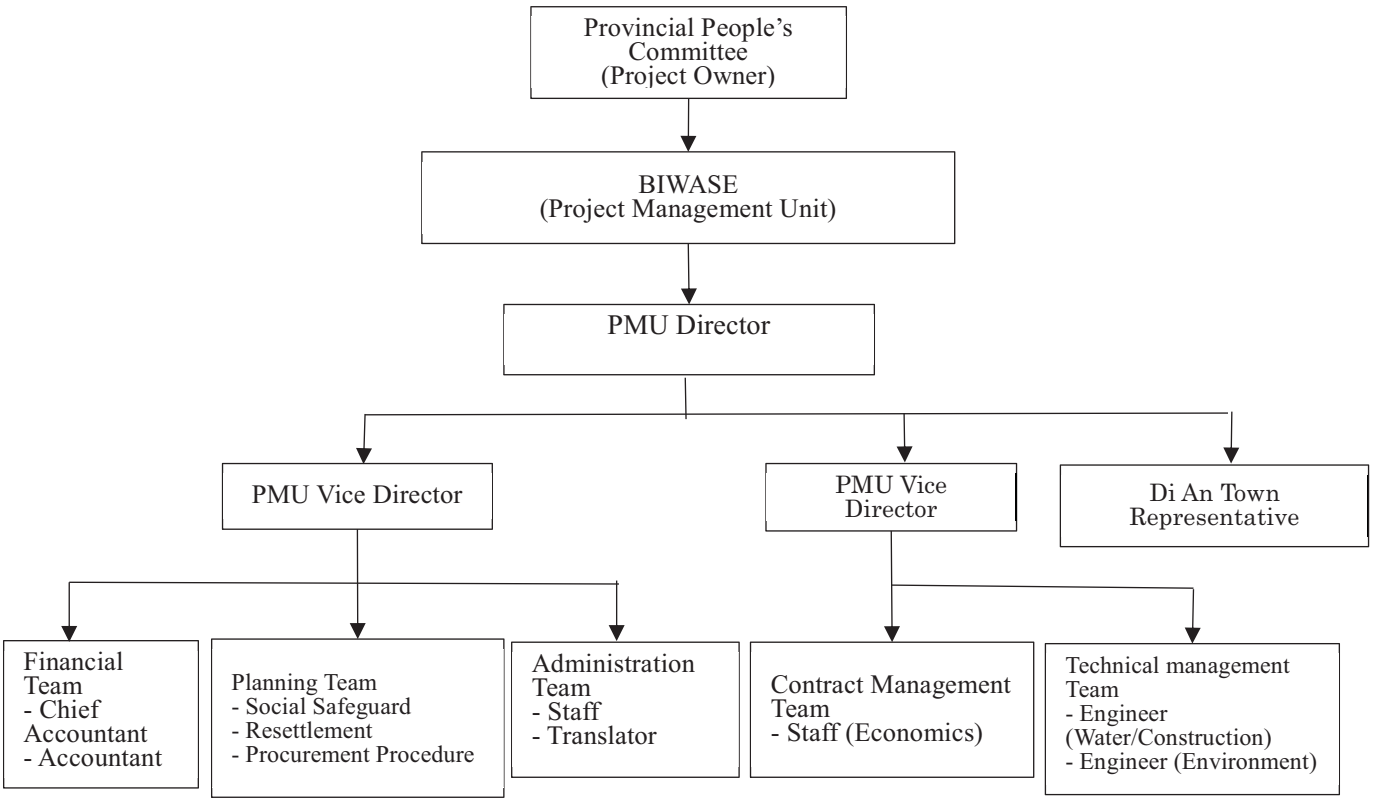
Source：Vietnam Urban Wastewater Review 2013, World Bank

Figure 2.1-4 Flow of Funds of Sewerage Projects

c) Implementation System of PMU (Project Management Unit) (example)

In Vietnam, establishment of Project Management Unit (PMU, hereinafter) or Project Management Board (PMB, hereinafter) is mandatory . Either for sewerage works, Construction Law stipulates the establishment of PMU. For the organizational structure of PMU, the figure below shows the example of PMU established in Binh Duong where World Bank (WB, hereinafter) implements projects.

PMU is established in Binh Duong Water Supply Sewerage – Environment Co., Ltd (BIWASE, hereinafter) under the supervision of PPC, and there are deputy directors/staffs respectively for finance/planning and division in charge of jurisdiction under PMU Director. Staffs of PMU are composed of engineers and experts of financial, planning, administration, contract management and technical management teams.



Source: Addendum to Proposed Operations Manual for Vietnam Urban Water Supply and Wastewater Project, World Bank April 2016

Figure 2.1-5 Example for proposition of PMU's organizational composition

d) Example of Project Formulation Activities

ADB has implemented grant aid, such as study for project formulation (pre-feasibility study) and consensus formulation (according to an interview to ADB), for the purpose of supporting development of sewer/sanitation projects in provincial cities. In small cities of Southern Vietnam including Mekong Delta Region, ADB is elaborating City Sanitation Strategy (CSS, hereinafter) on the premise of ADB's loan.

The following shows an example of the CSS in the Mekong Delta area which is ADB supported.

After CSS survey, ADB confirms the intention of the PPC/CPC and conducts Project Preparatory Technical Assistance (PPTA, hereinafter). ADB elaborates procurement documents of the project for the approval of the project (first phase). The review of the FS report of Master Plan is conducted and suggests supported programs for implementation of the project when needed.

CDIA: Cities Development Initiative for Asia
UCCR：Urban Climate Change Resilience
PPTA: Project Preparatory Technical Assistance
Source: Preparing Urban Climate Change Resilience Program for Viet Nam under ADB financing, April 2016, Asian Development Bank

Figure 2.1-6 Example of Project preparation by ADB

e) Example of Project Preparation

In a project preparation from identification of project to loan diversement, ADB verifies implementation status as follows;

- Readiness criteria for loan fact finding includes
  - ✓ approval of Project Detailed Outline (PDO) stipulated in Decree 131/2006/ND-CP or any subsequent legislation
  - ✓ endorsement of feasibility study report (FSR), stipulated in Decision 48/2008/QD-TTg by the water companies before submission to the city or provincial government for approval after loan fact finding
  - ✓ Project Administration Manual (PAM, hereinafter), including procurement plan discussed and agreed
  - ✓ cost estimate, financing and counterpart funds agreed
  - ✓ PMU structure and staffing levels agreed

- ✓ draft project implementation plan discussed and agreed
- ✓ safeguard framework and tranche frameworks or plans agreed
- ✓ financial management system and auditing arrangements discussed and agreed
- ✓ consulting services and technical assistance as discussed and agreed.

➢ Prior to loan effectiveness, the following readiness criteria need to be complied

- ✓ PAM confirmed
- ✓ counterpart funds for first year of implementation confirmed
- ✓ PMU established with key staff appointed
- ✓ project implementation plan agreed

environmental impact assessment/initial environment examination and Resettlement Plan (RP)/Resettlement Framework (RF) confirmed; if there is a need for an Indigenous People Development Framework or Plan

- ✓ procurement plan confirmed
- ✓ auditing arrangements confirmed

4) Master Plan of Sewage Sector

JICA Study Team collected data of urban Master Plan Summary from 47 cities out of 72 target cities. The overview of sewerage planning is shown below;

a) Target Year

Target year for most of sewerage planning are set to be 2020, however the year is extended to be 2030 -2050 for those which have conducted implementation review.

b) Wastewater Collection System

At present, most of the cities employ an interceptor system. The initial plans of all the cities adopted a combined or separate sewerage system. Some of the cities that have revised the plan adopt the separate system as a future goal.

Currently, in Vietnam, septic tank remains and treats human waste. Miscellaneous wastewater (gray water) flows directly into the road side trench. An interceptor sewer system is a system that collects wastewater from roadside trench before discharging into river and transfers it to a treatment plant and treats it.

The interceptor sewer system, the raw urine does not discharge human waste due to septic tank remained. In rainy weather, rainwater is collected from existing drains. Therefore, interceptor

sewer system is different from conventional sewer system which is applied in developed countries.

c) Number of Wastewater Treatment Plants

The number of wastewater treatment plants (WWTP, hereinafter) specified in Table 2.1-3, increases from 122 in 47 cities in the previous plans to 155 in the current plans (assuming that the number of them remains the same as in the previous plans unless otherwise specified). This is an increase of about 20%, which is outstanding in large cities next to Hanoi and Ho Chi Minh, such as Haiphong. This is considered to be due to the urbanization. Accordingly, sewerage service areas are also expanded.

Table 2.1-3 Outline of sewerage planning (1)

No.	City Name	Previous Planning		Current Planning		Collecting System		Number of WWTP(-)	
		Established Year	Target Year	Established Year	Target Year	Previous Planning	Current Planning	Previous Planning	Current Planning
1	Hanoi	Jul. 26, 2011	2020	May. 10, 2013	2030/2050	CSS/SSS	SSS	39	39
2	Ho Chi Minh	Jun. 19,2001 Jan. 10,2001	2020	Oct. 29, 2014	2030	CSS/SSS	CSS/SSS	12	12
3	Hai Phong	Jan. 10,2001	2020	Sep. 16,2019	2025/2050	CSS/SSS	SSS	15	31
4	Da Nang	Jun. 17, 2002	2020	Dec. 4,2013	2030/2050	CSS/SSS	SSS	N/A	N/A
5	Can Tho	Sep. 7, 2006	2025	Aug. 28,2013	2030/2050	CSS/SSS	SSS	4	7
6	Hue	Aug. 10,1999	2020	6-May-14	2030/2050	CSS/SSS	SSS	N/A	N/A
7	Vinh	Apr.21,2000	2020	6-May-14	2030/2050	CSS/SSS	SSS	N/A	7
8	Da Lat	27-May-02	2020	12-May-14	2030/2050	CSS/SSS	SSS	N/A	N/A
9	Nha Trang	Sep. 25, 2012	2025	N/A	N/A	CSS/SSS	N/A	N/A	N/A
10	Quy Nhon	Jun. 1, 2004	2020	12-May-14	2035/2050	CSS/SSS	SSS	2	N/A
11	Bun Ma Thout	Feb. 13, 2014	2025	N/A	N/A	CSS/SSS	N/A	5	5
12	Than Guyen	Nov. 2, 2005	2020	N/A	N/A	CSS/SSS	N/A	1	1
13	Nam Dinh	Mar. 12, 2001	2020	Nov. 22, 2011	2025 2030	CSS/SSS	CSS/SSS	2	3
14	Viet Tri	Nov. 2, 2005	2020	Jul. 30, 2015	2030	CSS/SSS	CSS/SSS	2	4
15	Vung Tau	Sep. 26, 2005	2020	Oct. 29, 2014	2030	CSS/SSS	CSS/SSS	3	3
16	Ha Long	Nov. 20, 2003	2020	N/A	N/A	CSS/SSS	N/A	N/A	N/A
17	Thanh Hoa	Jun. 11, 1999	2020	N/A	N/A	CSS/SSS	N/A	N/A	N/A
18	My Tho	N/A	N/A	N/A	N/A	CSS/SSS	N/A	N/A	N/A
19	Bien Hoa	Nov. 6, 2003	2020	Oct. 29, 2014	2030	CSS/SSS	CSS/SSS	N/A	N/A
20	Long Xuyen	Nov. 12, 2010	2020	N/A	N/A	CSS/SSS	N/A	N/A	N/A
21	Hai Duong	Jan. 23, 2006	2020	Jan. 25, 2013	2030	CSS/SSS	CSS/SSS	3	3
22	Phan Thiet	Feb. 12, 2009	2025	N/A	N/A	CSS/SSS	N/A	N/A	N/A
23	Ca Mau	Nov. 12, 2010	2020	N/A	N/A	CSS/SSS CSS/SSS	N/A	4	4
24	Tuy Hoa	Nov. 12, 2010	2020	N/A	N/A	CSS/SSS	N/A	N/A	N/A

No.	City Name	Previous Planning		Current Planning		Collecting System		Number of WWTP(-)	
		Established Year	Target Year	Established Year	Target Year	Previous Planning	Current Planning	Previous Planning	Current Planning
25	Uong Bi	Nov. 20, 2003	2020	N/A	N/A	CSS/SSS	N/A	N/A	N/A
26	Thai Binh	17-May-11 Jan. 10,2001	2020	N/A	N/A	CSS/SSS	N/A	N/A	N/A
27	Rach Gia	Nov. 12, 2010	2020	N/A	N/A	CSS/SSS	N/A	5	5
28	Bac Lieu	Nov. 12, 2010	2020	Sep. 22, 2011	2030	CSS/SSS	CSS/SSS	N/A	N/A
29	Ninh Binh	Oct.12, 2012	2020	3-May-13	2030/2050	CSS/SSS	CSS/SSS	4	3
30	Bac Ninh	Jan. 25, 2013	2020	N/A	2030	CSS/SSS	CSS/SSS	1	2
31	Thu Dau Mot	Oct. 29, 2014	2020	N/A	2030	CSS/SSS	CSS/SSS	1	1
32	Dong Hoi	Feb. 22, 2013	2020	N/A	N/A	CSS/SSS	N/A	1	1
33	Phu Quoc	Nov. 12, 2010	2020	N/A	N/A	CSS/SSS	N/A	N/A	N/A
34	Vinh Yen	Oct. 26, 2011	2020	Jan. 25, 2013	2030	CSS/SSS	CSS/SSS	1	5
35	Lao Cai	Aug. 24, 2009	2020	N/A	N/A	CSS/SSS	N/A	3	3
36	Ba Ria	Sep. 22, 2008	2020	N/A	N/A	CSS/SSS	N/A	1	1
37	Bac Giang	Jan. 25, 2013	2020	Dec. 6, 2013	2030 2030	CSS/SSS	N/A	3	3
38	Phan Rang	Jan. 13, 2009	2015	Nov. 29, 2014	2025	CSS/SSS	N/A	2	3
39	Thap Cham	Jan. 13, 2009	2015	Nov. 29, 2014	2025	CSS/SSS	N/A	2	3
40	Chau Doc	Sep. 12, 2010	2020	N/A	N/A	CSS/SSS	N/A	1	1
41	Cam Pha	Sep. 22, 2008	2020	Mar. 27, 2015	2030	CSS/SSS	CSS/SSS	2	2
42	Quang Nai	Nov. 10, 2010	2020	N/A	N/A	CSS/SSS	N/A	1	1
50	Dien Bien Phu	Aug. 5, 2011	2020/2030	N/A	N/A	CSS/SSS	CSS/SSS	2	2
52	Hoa Binh	Oct. 6, 2011	2020	N/A	N/A	CSS/SSS	N/A	N/A	N/A
68	Tra Vinh	Nov. 26, 2015	2020/2030	N/A	N/A	CSS/SSS	CSS/SSS	N/A	N/A
69	Tu Yen Quang	Nov. 25, 2015	2020/2030	N/A	N/A	CSS/SSS	CSS/SSS	N/A	N/A
72	Yen Bai	Sep. 13, 2006	2020/2030	N/A	N/A	CSS/SSS CSS/SSS	CSS/SSS	N/A	N/A
Total								122	155

Source: JICA Study Team

Table 2.1-4 Outline of sewerage planning (2)

No	City Name	Outline of WWTP						Document source (Decision.)	
		Previous Planning			Current Planning			Previous Planning	Current Planning
		Daily Maximum Volume	Daily Mean Volume	Hourly maximum volume	Daily Maximum Volume	Daily Mean Volume	Hourly maximum volume		
		m^3/day	m^3/day	m^3/sec	m^3/day	m^3/day	m^3/sec		
1	Hanoi	1.014.000	N/A	11,736	1.808.300	N/A	20,929	1259/QĐ - TTg	725/QĐ - TTg
2	Ho Chi Minh	1.862.000	N/A	21,550	3.076.000	N/A	35,601	752/QĐ - TTg	1942/QĐ - TTg
3	Hai Phong	N/A	N/A	N/A	36.000	N/A	0,417	04/2001/QĐ - TTg	1448/QĐ - TTg
4	Da Nang	51.000	N/A	0,590	200.000	N/A	2,314	465/2002/QĐ - TTg	2357/QĐ - TTg
5	Can Tho	12.000	6.000	0,139	30.000	N/A	0,347	207/2006/QĐ - TTg	1515/QĐ - TTg
6	Hue	6.500	N/A	0,075	30.000	N/A	0,347	166/1999/QĐ - TTg	649/QĐ - TTg
7	Vinh	25.000	N/A	0,289	N/A	N/A	N/A	49/2000/QĐ - TTg	52/QĐ - TTg
8	Da Lat	7.400	N/A	0,086	43.000	N/A	0,498	49/2000/QĐ - TTg	704/QĐ - TTg
9	Nha Trang	60.000	N/A	0,694				1396/QĐ - TTg	
10	Quy Nhon	14.000	N/A	0,162	49.000	N/A	0,567	98/2004/QĐ - TTg	495/QĐ - TTg
11	Bun Ma Thout	32.500	N/A	0,376				249/QĐ - TTg	
12	Than Guyen	28.000	N/A	0,324				278/2005/QĐ - TTg	
13	Nam Dinh	14.500	N/A	0,168	22.000	N/A	0,255	31/2001/QĐ - TTg	2084/QĐ - TTg
14	Viet Tri	10.000	N/A	0,116	36.000	N/A	0,417	277/2005/QĐ - TTg	1214/QĐ - TTg
15	Vung Tau	12.000	N/A	0,139	82.600	N/A	0,956	235/2005/QĐ - TTg	1942/QĐ - TTg
16	Ha Long	N/A	N/A	N/A				250/2003QĐ - TTg	
17	Thanh Hoa	60.000	N/A	0,694				140/1999QĐ - TTg	
18	My Tho	N/A	N/A	N/A				N/A	
19	Bien Hoa	95.000	N/A	1,099	71.000	N/A	0,822	227/2003QĐ - TTg	1942/QĐ - TTg
20	Long Xuyen	82.000	N/A	0,949				2006QĐ - TTg	
21	Hai Duong	45.500	N/A	0,526	90.000	N/A	1,042	405/2006QĐ - UBND	228/QĐ - TTg
22	Phan Thiet	24.000	N/A	0,277				434/QĐ - UBND	
23	Ca Mau	18.120	N/A	0,210				2006QĐ - TTg	
24	Tuy Hoa	N/A	N/A	N/A				2006QĐ - TTg	
25	Uong Bi	N/A	N/A	N/A				250/2003QĐ - TTg	
26	Thai Binh	N/A	N/A	N/A				733/QĐ-TTg	
27	Rach Gia	33.000	N/A	0,382				2066/QĐ-TTg	
28	Bac Lieu	N/A	N/A	N/A	N/A	N/A	N/A	2066/QĐ-TTg; no.04/2011/NQ-HĐND	2066/QĐ-TTg; 04/2011/NQ-HĐND
29	Ninh Binh	5.000	N/A	0,058	8.000	5.500	0,0926	681/QĐ-TTg; no.796/QĐ-UBND	681/QĐ-TTg, 796/QĐ-UBND
30	Bac Ninh	28.000	N/A	0,324	28.000	18.000	0,324	228/QĐ-TTg	228/QĐ-TTg
31	Thu Dau Mot	34.000	N/A	0,394	70.000	N/A	0,81	1942/QĐ-TTg	1942/QĐ-TTg
32	Dong Hoi	10.000	N/A	0,116				396/QĐ-UBND; No.952/QĐ-TTg	
33	Phu Quoc	40.000	N/A	0,463				1197/2005/QĐ-TTG; No.2066/QĐ-TTg	
34	Vinh Yen	12.000	N/A	0,014	49.000	42.000	0,567	1883/QĐ-TTg ; no.228/QĐ-TTg	1883/QĐ-TTg ; 228/QĐ-TTg
35	Lao Cai	8.000	N/A	0,0925				2617/QĐ-UBND	
36	Ba Ria	22.000	N/A	0,255				1336/QĐ-TTg	
37	Bac Giang	15.000	N/A	0,174	25.000	N/A	0,289	652/QĐ-UBND; No.228/QĐ-TTg	652/QĐ-UBND; no.228/QĐ-TTg
38	Phan Rang	26.300	N/A	0,304	40.500	N/A	0,469	10/2009/QĐ-UBND; no.1942/QĐ-TTg	10/2009/QĐ-UBND; no.1942/QĐ-TTg
39	Thap Cham	26.300	N/A	0,304	40.500	N/A	0,469	10/2009/QĐ-UBND; no.1942/QĐ-TTg	10/2009/QĐ-UBND; no.1942/QĐ-TTg
40	Chau Doc	5.000	N/A	0,058				2066/QĐ-TTg	
41	Cam Pha	72.000	N/A	0,083	72	N/A	0,083	2066/QĐ-TTg; no.1336/QĐ-TTg	2066/QĐ-TTg; no.1336/QĐ-TTg
42	Quang Nai	6.000	N/A	0,694				2052/QĐ-TTg	
50	Dien Bien Phu	12.0000	N/A	0,139	30.000	N/A	0,347	733/QĐ-UBND	733/QĐ-UBND
52	Hoa Binh	N/A	N/A	N/A				1867 /QĐ-UBND	
68	Tra Vinh	N/A	N/A	N/A	N/A	N/A	N/A	2134/QĐ-UBND	2134/QĐ-UBND
69	Tu Yen Quang	N/A	N/A	N/A	N/A	N/A	N/A	343/QĐ-UBND	343/QĐ-UBND
72	Yen Bai	N/A	N/A	N/A	N/A	N/A	N/A	372/QĐ-UBND ; No.399/QĐ-UBND	372/QĐ-UBND ; No.399/QĐ-UBND

Source: JICA Study Team

5) Situation of Operation and Implementation of WWTP

The Table 2.1-5 and 2.1-6 compiles the development of WWTPs in the Master Plan.

36 WWTPs are operating in 23 cities, and 30 plants are under construction (including planning phase) in 24 cities. WWTPs under construction will be in service in near future; therefore, issues related to sewerage O&M will be raised as common issues in cities in Vietnam.

Various treatment technologies such as conventional activated sludge process (CAS), A_2O method, sequencing batch reactors (SBR), oxidation ditch (OD), and others are applied. Many donors such as Japan, the WB, the ADB, France, Germany and others finance sewerage development projects. Accordingly, individual donors seem to recommend its preferable sewerage in Vietnam.

Table 2.1-5 Situation of development of wastewater treatment plant (1)

No.	Provice	City	Level	Situation of WWTP				
				Name	Method	Treatment System	Starting year	Capacity (m3/d)
1	Hanoi		S	Kim Lien	CSS	A2O	2005	3,700
2				Truc Bach	CSS	A2O	2005	2,500
3				North Thang	CSS	AO	2009	42,000
4				Yen So	CSS	SBR	2013	200,000
5				Ho Tay	CSS	SBR	2014	22,800
6				Bay Mau	CSS	CAS	2016	13,300
7	HCM		S	Bin Hung	CSS	CAS	2009	141,000
8				Binh Hung Hoa	CSS	Lagoon	2008	30,000
9				Canh Doi	SSS	OD	2007	10,000
10				Nam Vien	SSS	A2O	2009	15,000
11	Da Nang		CI	Son Tra	CSS	Lagoon	2006	15,900
12				Hoa Cuong	CSS		2006	36,400
13				Pho Loc	CSS		2006	36,400
14				Khanh Son	CSS		2006	11,600
15				Hoa Xuan	CSS	SBR	2015	20,000
16	Can Tho		CI	Can Tho	CSS	TF	2016	30,000
17	Quang Ninh	Ha Long	PI	Bai Chay	CSS	SBR	2007	3,500
18				Ha Khanh	CSS	SBR	2009	7,000
19	Nghe An	Vinh	P I	Vinh	CSS	CAS	2013	25,000
20		Cua Lo	PⅢ	Cua Lo	CSS	SBR	2014	3,700
21	Lam Dong	Da Lat	PI	Da Lat	SSS	TF	2006	7,400
22	Dac Lac	Buon Ma Thout	PI	Da Lat	SSS	SP	2006	8,500
23	Bin Dinh	Quy Nonh	PI	Non Binh	CSS	TF	2014	14,000
24	Khanh Hoa	Nha Trang	PI	Nha Trang	CSS	OD	2014	40,000
25	Vin Phuc	Vinh Yen	PⅡ	Vinh Yen	CSS	CAS	2015	5,000
26	Hai Duong	Hai Duong	PⅡ	Hai Duong	CSS	—	2013	13,000
27	Binh Duong	Thu Dau Mot	PⅡ	Thu Dau Mot	SSS	SBR	2013	17,650
28	Bac Ninh	Bac Ninh	PⅡ	Bac Ninh	CSS	SBR	2013	17,500
29		Tu Son	PIV	Tu Son	CSS	SBR	2015	33,000
30	Bac Giang	Bac Giang	PⅡ	Bac Giang	SSS	A2O	2010	10,000
31	An Giang	Chou Doc	PⅡ	Chou Doc	CSS	SP	2016	5,000
32	Quang Binh	Dong Hoi	PⅡ	Duc Ninh	CSS	Lagoon	2014	10,000
33	Ninh Thuan	Phan Lang - ThapCham	PⅡ	Thap Cham	CSS	Lagoon	2012	5,000
34	Ha Nam	Phu Ly	PⅢ	Phu Ly	CSS	A2O	2015	2,500
35	Soc Trang	Soc Trang	PⅢ	Soc Trang	CSS	—	2013	13,200
36	Thanh Hoa	Sam Son	PⅢ	Sam Son	CSS	—	2015	4,000
Total								875,550

*City Level: S(Special), CI(Central I), PI(Provincial I), PⅡ(ProvincialⅡ), PⅢ(ProvincialⅢ)
**Treatment System:OD(Oxidation Ditch), TF(Trickling Filter), SP(Stabilization Pond)
Source: WB Report Dec. 2013,Vietnam Urban Westewater Review, Report Oct 2013 of VWSA_Report Oct 2013 of VWSA_Resarch, Survey and Evaluate about WWTP in some City, JICA Study Team added

Table 2.1-6 Situation of WWTP in cities currently proceeding design or construction

No.	Province	City	City Level		WWTP			
				Name	Collecting System	Treatment System	Capacity (m^3/d)	Current Condition
1	Hanoi		S	Yen Xa	CSS	CAS	270,000	Under Bidding
2				Phu Do	CSS	SBR	84,000	Under Design
3	HCM		S	Nhieu Loc-Thi Nghe	CSS	SBR/CAS	480,000	
4				Tham Luong - Ben Cat	CSS	SBR	250,000	Under Construction
5				Suoi Nhum	CSS	SBR	65,000	Under Design
6				North Saigon	CSS	A2O/SBR	139,000	
7				Binh Hung (Phase 2)	CSS	CAS	328,000	Under Construction
8	Hai Phong		CI	Vinh Niem	CSS	CAS	360,000	
9	Da Nang		CI	Lien Chieu	CSS	OD	40,000	
10	Can Tho		CI	Can Tho	CSS	SBR	30,000	
11	Thua Tien Hue	Hue	PI	Hue	CSS	CAS	17,000	
12	Binh Dinh	Binh Ding	PI	Ha Thanh	CSS	TF	14,000	
13		Quy Nhon	PI	Quy Nhon 2	CSS	OD	8,000	Under Bidding
14	Thai Nguyen	Thai Nguyen	PI	Thai Nguyen	CSS	OD	10,000	Under Construction
15	Phu Tho	Viet Tri	PI	Viet Tri 1	CSS	OD	5,000	
16			PI	Viet Tri 2	CSS	OD	10,000	Under Design
17	Ba Ria Vung Tau	Ba Ria	PII	Ba Ria	CSS	OD	12,000	Under Construction
18		Vung Tau	PI	Vung Tau	CSS	OD	20,000	
19		Phu My	PIV	My Xuan	CSS	Aerobic Biological Treatment (CARROUSEL, Netherland)	21,700	
20		Tan Hoa	PV	Tan Hoa	CSS		8,000	
21		Vung Tau	PI	Vung Tau (Phase 2)	CSS		30,000	
22		Long Dien	PV	Long Dien	CSS		16,000	
23		Ga Gang	PV	Ga Gang	CSS		2,260	
24		Long Son	PV	Long Son	CSS		5,460	
25	Tien Giang	My Tho	PI	My Tho	CSS	N/A	40,000	
26	An Giang	Long Xuyen	PII	Long Xuyen	CSS	N/A	20,000	
27	Hai Duong	Hai Duong	PII	Hai Duong	CSS	SBR	13,500	
28	Lao Cai	Lao Cai	PII	Lao Cai	CSS	-	5,700	
29	Dien Bien	Dien Bien Phu	PII	Dien Bien Phu	CSS	Aeroten	10,000	
30	Tra Vinh	Tra Vinh	PII	Tra Vinh	CSS	Primaryri Sedimentation	18,000	
Total							2,008,620	

Source: Report of Oct 2013 VWSA_Report Oct 2013 of VWSA_Resarch, Survey and Evaluate about WWTP in some City, WB Report Dec. 2013_Vietnam Urban Westewater Review, MoC Report NoV.2015_Viet Nam - Finland Forum for Cooperation in Water Sector, JICA Study Team added

6) Wastewater Treatment in Major Cities

According to a report by the WB (Vietnam Urban Wastewater Review, 2013), present wastewater treatment in major cities of Vietnam is as shown in the Table 2.1-7.

Effluent quality comply mostly with effluent standards. The wastewater is comparatively diluted, and that makes it easier for WWTPs of combined sewage system whose influent now is lower than the designed capacity, to satisfy the effluent standards, regardless of applied treatment technologies. In case of two WWTPs of separate sewage system on the other hand, at Buon Ma Thuot and Da Lat respectively comply with Class B effluent standards in QCVN40: 2011/BTNMT as far as BOD, Chemical Oxygen Demand (COD, hereinafter), TSS, and Total Nitrogen (T-N, hereinafter) are concerned. However, both plants do not comply with the standards for ammonium and phosphorus.

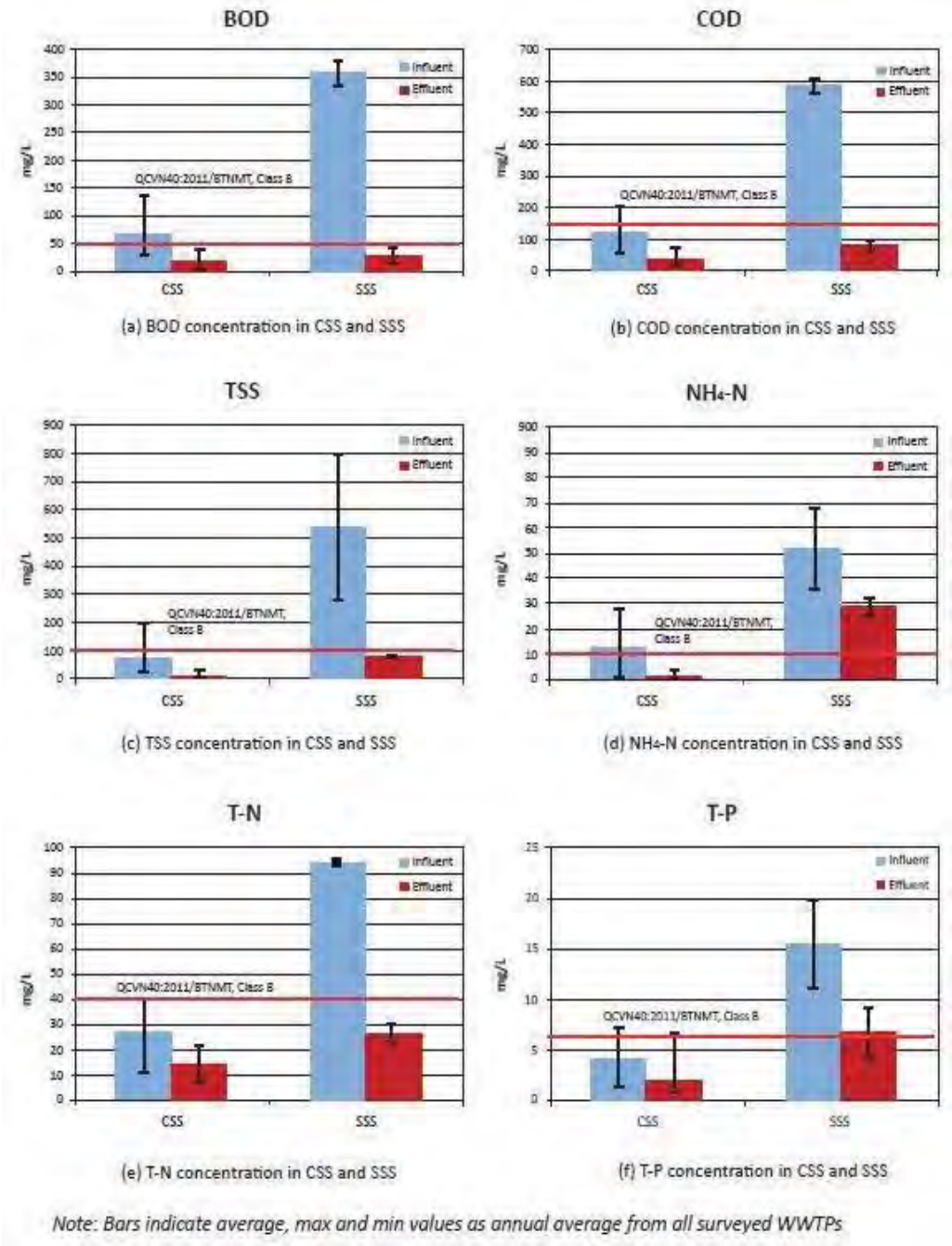
Different characteristics of combined and Separate Sewerage System (SSS, hereinafter) should be carefully examined when wastewater treatment process and technologies are selected. Separate sewer system collects through house connections, which thereby increases the volume of pollutants to much higher levels than in Combined Sewerage System (CSS, hereinafter). So far, however, there is no differentiation between combined and separate sewage system in terms of design criteria for pollutant load and treatment technology.

Table 2.1-7 Wastewater Treatment Status in Vietnam

No.	WWTPs	City	Treatment process	Sewage system	BOD (mg/L)		COD (mg/L)		TSS (mg/L)		NH_4-N (mgN/L)		T-N (mg/L)		T-P (mg/L)		Coli-form (MPN/ 100mL)	Applicable Effluent Standard
					Inf.	Eff.	Inf.	Eff.	Inf.	Eff.	Inf.	Eff.	Inf.	Eff.	Inf.	Eff.	Eff.	
1	Kim Lien	Hanoi	A2O (AS)	CSS	115	9	145	18	85	5	18	-	40	17	6.5	1.7	0	TCVN5945-2005, B
2	Truc Bach		A2O (AS)	CSS	135	8	155	15	85	5	-	-	34	16	6.5	1	0	TCVN5945-2005, B
3	Bac Thang Long		A2O (AS)	CSS	85	12	135	16	65	8	-	-	38	12	5.4	0.85	100	QCVN40-2011, A
4	Yen So		SBR (AS)	CSS	45	6	132	24	51	10	28	0.5	34	8	7.2	6.5	-	QCVN40-2011, B
5	Binh Hung	Ho Chi Minh City	Aer/Mat Ponds	CSS	42	3	135	30	103	7	-	-	11	7			175	QCVN14-2008, B
6	Binh Hung Hoa		CAS	CSS	78	10	203	50	49	18	17.9	3.3	-	-			-	QCVN14-2008, B
7	Son Tra	Da Nang	OD (AS)	CSS	37	25	67	49	38	19	-	-	18	14	1.7	1.4		QCVN40-2011, B
8	Hoa Cuong		A2O (AS)	CSS	63	31	115	60	59	23	-	-	23.6	18.6	1.9	1.5		QCVN40-2011, B
9	Phu Loc		Ana. pond	CSS	96	37	169	73	71	23	-	-	28.3	21.4	2.2	1.8		QCVN40-2011, B
10	Ngu Hanh Son		Ana. pond	CSS	31	22	60	44	27	16	-	-	15.6	12.9	1.4	1.1		QCVN40-2011, B
11	Bai Chay	Quang Ninh	Ana. pond	CSS	36	20	80	32	196	11	1.3	0.79					13	
12	Ha Khanh		Ana. pond	CSS	45	23	68	68	41	35	1.1	1					43	
13	Da Lat	Da Lat	SBR (AS)	SSS	380	14	604	65	792	82	68	25.6	95	30	19.7	9	-	QCVN24-2009, B
14	Buon MaThuat	BMT	SBR (AS)	SSS	336	45	564	98	286	76	36.4	32	93.7	23	11.2	4.3	15000	QCVN24-2009, B
15	Bac Giang	Bac Giang	Imhoff Tank/ TF	CSS	90	-	120	25	-	-	-	-	-	-	-	-	-	QCVN14-2008, B
QCVN 40:2011/BTNMT, A class						30		75		50		5		20		4	3000	
QCVN 40:2011/BTNMT, B class						50		150		100		10		40		6	5000	

Source: Vietnam Urban Wastewater Review, by Australian Aid and The World Bank, December 2013

Difference of water quality based on sewerage system is shown in the figure below. Concentration of BOD, COD, TSS, N, and P of SSS are higher than CSS. It seems necessary hereafter to consider treatment options based upon sewerage systems.



Source: Vietnam Urban Wastewater Review, by Australian Aid and The World Bank, December 2013

Figure 2.1-7 Difference of Water Quality Based Upon Sewerage Systems

7) Stakeholder Companies of Sewerage Sector

The Table 2.1-8 shows the number of member companies in Vietnam Water Supply and Sewerage Association (VWSA, hereinafter). Members are water supply and sewerage companies, municipal waste management companies, consultancy companies, material and equipment manufacturers and suppliers, universities and research institutes, and individual members, totaling 261 members. Sewerage service companies are public companies (either One Member Company or Joint Stock Company), making a total of 70 companies. Maintenance companies, consultancy companies, manufacturers and research institutes are considered to be the clients or joint researchers of VSC.

Table 2.1-8 Major Water Supply and Sewerage Companies

Category	Number of Members
Water Supply Companies	79 companies (28 sewerage companies included)
Water, Sewerage, Drainage and Urban Environment Company	42 companies
Domestic Water Supply Center	8 companies
Consultancy Company	26 companies
Center, Institute, University	8 companies
Material and Equipment Supplying Company	78 companies
Associated, Individual Member	20
Total	261

Source: VWSA

System for project implementation of water supply and sewerage companies that take charge of sewerage service are shown in the Table 2.1-9. Such companies are the whole province, and they are implementing projects in the fields of water supply and sewerage service, drainage, and waste management, while obtaining functions of both PMU and maintenance. The number of personnel also varies from 200 to 700, depending presumably upon the different scope of work in such water supply and sewerage companies.

Table 2.1-9 Examples of System for Project Implementation of Water Supply and Sewerage Companies

Name of Companies	Binh Duong Water Supply, Sewerage and Environment Company	Can Tho Water Supply and Sewerage Co., Ltd.	Ba Ria Vung Tau Sewerage and Urban Development Company	Dong Thap Water Supply and Urban Environment Company Ltd.	Lam Dong Water Supply and Sewerage Co., Ltd.	Soc Trang Urban Public Works Company	Thai Nguyen One Member Water Business Company Ltd.	Tien Giang Water Supply and Sewerage Company
Service Area	Binh Duong Province (2,696km²)	Can Tho City (1,390km²)	Ba Ria - Vung Tau Province	2 cities, 10 towns	Lam Dong Province (9,765km²)	Soc Trang Province (3,223km²)	Thai Nguyen Province (3,543km²)	Tien Giang Province (2,367km²)
Population in Area	1,482,636	1,187,089	1,005,000	1,680,979	1,186,786	1,289,441	1,124,786	1,670,216
Number of Staffs	730	560	340	485	514	242	507	320
Form of business organization	JSC	One member company	One member company	One member company	JSC	One member company	JSC	One member company
PMU	Has PMU	ND	Has PMU	Has PMU	Has PMU	Has PMU	ND	ND

Source: South East Asia Water Utility Network

8) Collaboration of VWSA and GIZ

In 2005, the Government of Germany and the Government of Vietnam signed a development program of "Wastewater and Solid Waste Management in Provincial Centers," by which advisory services to provincial as well as municipal level governments and to water companies, and assistance to legislative system at the national level are provided.

Based upon 10 years' experience, the training program for sewerage sector in 2015-2017 provides assistance for capacity development from three different standpoints below.

- Development of training modules
- Implementation of Training of Trainers (TOT, hereinafter)
- Assistance to VWSA in view of dissemination to sewerage service and drainage companies.

TOT has been periodically implemented since its first time in December 2015, followed by implementation in January, March, and June 2016 in order to enhance capacity for O&M of water supply and sewage companies in Vietnam. In case of two training courses held in June 2016, the training was planned in view of strengthening knowledge, technology, theories and presentation techniques, for 30 technical and planning staff members. A certificate of completion is handed over to training participants who complete the program, so that it should be an incentive to improve the quality and capacity of their daily work.

- Formulation of provincial level ordinances for sewerage system management
- Road-mapping of tariff system to supplement O&M cost
- Template of maintenance contract based upon performance evaluation

In April 2016, a workshop on needs of short term training for technical workers was held. As for training programs (vocational training) implemented by GIZ, needs for 12 water-related companies were examined and summarized as follows.

- The training period should be short, and include practical sessions (8 to 10 days for basic courses, and 4

to 5 days for advanced courses).

- Networking should be done with engineers of similar fields to share experiences of participants.
- The training subjects should be safety management, O&M, biological and chemical treatment process, N/P removal process, treatment and utilization of sludge.
- Upon completion of the training, participants should play a core role to disseminate knowledge in their water companies.

Also, the following were discussed in the workshop.

- Since these companies are introducing European and American equipment, they require knowledge and technology to fully utilize it.
- Workers lack knowledge on sewerage service.
- For successful maintenance, capacity of equipment and personnel should be allocated respectively for 50%. Investment to human resources would contribute to the management.
- Training should be conducted continuously, as staff members of water companies take charge of various works such as water supply and sewerage service, waste management, environmental engineering and burial service.
- The contents of the training program conducted upon commencement of service by the construction project are too general and insufficient to be of service.
- The training program should be harmonized with capacity of participants.
- Standardization and certification of qualifications obtained by training should be legalized and systematized.
- HCMVC (Ho Chi Minh Vocational College) submitted a proposal to the Directorate of Vocational Training, Ministry of Labor, Invalids and Social Affairs (MOLISA, hereinafter), defining that "Sewerage Service should be a job category in the environmental field," and brought promulgation of Ordinance on Certification in 2013 after pilot sessions started since 2008.

According to the document "Wastewater Training Catalogue", GIZ has been implementing technical supports for sewerage and drainage sector in Vietnam since 2005. For the phase 4 (latest phase), GIZ introduced 11 modules and operating 9 training courses in collaboration with VWSA to help the sector developing institutions, structure creation, and supporting financial/technical aspects. GIZ disposes 27 lecturers being able to teach 11 modules.

Through the activities depicted above such as TOT, GIZ aims at enhancing organizational capacity of VWSA as training structure. In future, GIZ will take over training function to VWSA to implement courses independently. To do so, VWSA needs to ensure its financial sustainability but this issue is still not clear.

9) Activities of DANIDA (Denmark)

Danish International Development Agency (DANIDA, hereinafter) implemented NTP3 (Vietnamese National Target Program for Rural Water Supply and Sanitation phase 3) as a sector program support project from 2011 to 2015. This project was implemented through a syndicate loan with Australia and the Netherlands. The objectives were availability of drinking water among local people in rural areas, use of hygienic toilets, promoting popularization of animal excretion facilities for livestock. As for the construction project, 90% of the project budget was assisted through a sector loan to MOF. Technical cooperation is also provided through a grant aid whose fund management is performed by the embassy, and the aim is to contribute to an improvement of human health, to improvement of city water quality, to encourage privatisation and to measures for climate change.

In the field of sewerage service, DANIDA supports sewerage projects in 5 provinces; namely, Cao Bang and Ha Giang Provinces in Northern Mountain Region, Dak Lak Province of Central Highlands, Quang Binh Province of Central Region and Hau Giang Province in Mekong Delta Region. DANIDA also supports a city water project in Thanh Hoa Province. In September 2015, the first training workshop was held on city water and sewerage projects of these six cities. The objectives were to evaluate commercialization of city water and sewerage projects, and to reinforce operation and management capacities of the management staff and workers. Training on basic knowledge, construction management, project management, and administration and public finance of sewerage service are covered in the training plan of six local authorities mentioned above. Targeting a sewerage project in Hau Giang Province, training sessions with 13 courses, 41 total days, and 71 total participants as listed in the Table 2.1-10 are being carried out from October 2015 for 16-month duration.

Table 2.1-10 DANIDA Training Plan in Hau Giang Province

No.	Name of the training course	Training period			Venue	Number of participants
		Number of days	From	Until		
1	TT – Translation of technical terms on wastewater treatment and management of contract documents	4	2015.10.12	2015.10.15	Ha Noi	1
2	B – Basic knowledge on sewerage service	3	2016.01.16	2016.01.06	Bac Ninh City WWTP	8
3	C – Construction management	5	2016.03.07	2016.03.11	Bac Ninh City WWTP	3
4	ST – Study tour and learning in Buon Ma Thuat	3	2016.03.21	2016.03.23	Buon Ma Thuat City	5
5	X2 – Coordination of institutional framework for a sustainable sewerage service management	1	2016.04.18	2016.04.18	Dong Hoi City	8
6	X3 – Design of sewerage user charges	1	2016.04.19	2016.04.19	Dong Hoi City	8

7	X1 – Business growth strategic planning	3	2016.05.16	2016.05.18	Ho Chi Minh City	6
8	D – Basic knowledge on sewerage service	3	2016.06.06	2016.06.08	Bac Ninh City WWTP	6
9	A – Management of contract documents	2	2016.07		Ho Chi Minh City	4
10	H – Basic knowledge on sewerage service	5	2016.07.18	2016.07.22	Bac Ninh City WWTP	2
11	F – Function of electrical equipment and machinery, fundamental works of O&M, measurement works, data gathering, storage and reporting	3	2016.10.10	2016.10.12	CUWC Ha Noi	16
12	G – Health and labor safety	3	2016.10.13	2016.10.16	Bac Ninh City WWTP	16
13	I – Development of Standard O&M Procedures (SOP) documents	5	2017.01.09	2017.01.13	Bac Ninh Sewerage Company	2
Total		41				79

Source: JICA Study Team

Trainings conducted by DANIDA includes construction of facilities thus differ from VSC's concept.

10) Activities of Japanese Companies

The results from interviews with Japanese consultants and engineering companies are shown below.

a) Results from Interviews with Japanese Consultants

【Issues of clients】

i) Issues related to project management

- Delay in land acquisition influences on progress of construction.
- Lack of understanding about safety management thus the risk measures are not reflected on cost estimation, specification, and construction supervision. Consequently, incidences of ground subsidence and construction damage to buildings increase.
- There are particular issues of civil engineering in urban area of Vietnam (ex. relocation of buried items of public utilities) that need to be consider for construction.

ii) Problems related to the system of procurement

- Evaluation of contractors' financial ability
- Unilaterality of interim payment and request of document for confirmation completed volume, such as documents equivalent to a Bill of Quantity contract in a Lump Sum (LS) contract. A standardized process of construction management is not shared.
- Reduction in payment amount by State Audit and Government Inspector (standard for construction

inspection is not shared).

- There are few foreign and local competent companies interested in sewer constructions (necessity of standard for cost estimation, improvement in procurement system, activities to develop sewerage sector such as case study of procurement and construction supervision)

iii) Issues related to technology

- Lack of understanding regarding safety management during construction, for example lack of knowledge on soft ground and earth retaining.
- Except some cities, provinces and cities in Vietnam experienceonly cut and fill method. There are needs for microtunneling method but it is an unexperienced field for these provincial cities.
- There is no experience of twin box culvert for sewerage sector (storm drain) in provincial cities.

【Issues of contractors】

i) Project management

- Lack of financial management ability (ethical manner) such as contractors demand increase in amount of advance payment and interim payment.

ii) Issues related to procurement

- Delay in equipment and labor because of fund shortage

iii) Issues related to technology

- Lack of understanding of design documents
- Lack of understanding regarding security during construction, for example lack of knowledge on soft ground and soil fastening method

【Issues and needs that VSC could involve its activities】

- Construction supervision: standard for construction supervision (documents on construction management (volume, quality, and volume management), indispensable standards such as for inspection, documents on construction planning (soil fastening method, quality management, process management, etc.) (Note) Standard for construction supervision, inspection standard, construction planning: involvement of Vietnamese experts is indispensable
- Design: Sewer planning, material, new technology
- O&M: Sewer management

There are possibilities for VSC to be involved in every aspect of projects, especially for supervision works. Delay of works is frequent both in projects financed by ODA and Vietnamese Government. VSC's involvement is expected to be a driving force to promote sewerage works in such situations.

b) Results from Interviews with Japanese Engineering Companies

【Issues of clients】

- Lack of understanding regarding new technologies and standard specification in Japan. Selection of equipment bases principally on price thus it is difficult to introduce equipment considering lifecycle cost as in Japan, as well as maintainability.
- There is no public organizationtion evaluating process and selection of equipment in a fairly manner.
- Social value of information on technology is not established thus technology and know-how could be stolen and it is difficult to conduct business activities.
- There are few projects to which competent technology of Japanese engineering experience can apply, as well as small scale projects.

【Issues of contractors】

- Business scale of each project is small thus there is little profits
- Business scale is small thus contractors' activities and propositions are not budgeted, leading to miss contract opportunities.
- It is difficult to secure sufficient number of projects to be able to establish and maintain local corporation. Japanese companies conduct activities in representative offices on project base.
- Japanese products are too expensive to adopt. Equipment sales through agencies cannot be a sustainable business model because of appearance of similar products.

【Issues and needs that VSC could involve its activities】

- Role as a public organization to evaluate technologies and to serve as a standardizing function for applicable technologies
- Research on process and equipment in regard of maintainability and lifecycle cost

11) Issues Pointed Out by Foreign Donor Agencies

a) Issues pointed Out by ADB

Asian Development Bank (ADB, hereinafter) reports on sewerage projects facing the issues on finance, connection to sewer and its cost, duty of local governments, entry of private companies, human resource development, technology, effluent quality and others. (Urban Sanitation Issues in Vietnam, 2015).

i) Financial Issues

Provincial governments are the owners (managers) of sewerage facilities, and they are responsible for harmonization of financing and budget planning for their sewage management program with policies of the national government, while responsibilities of O&M can be entrusted to city water supply and sewerage companies. Inability of provincial governments to bear the capital investment, however, ends up with dependence on subsidy from the central government or ODA projects. Sewerage user charges indeed are imposed, but it is not enough to cover the maintenance cost, and that further makes it impossible to cover the renewal cost.

ii) Connection Cost of Sewer

Even after construction of sewer facility, there are a lot of households being not yet connected to the facility due to the connection cost as well as benefit of sewerage being not yet recognized. Consequently, investment efficiency of projects are worsen.

The separated sewage system requires house connection (drain being inside a house). To connect households to a sewer system, additional cost is required for flush toilet instllation thus the connection does not progress. For this reason, there are unutilized facilities and negative influences appear in improvement of water quality.

Hence, it is important to establish public relations for the purpose of public awareness in regard of improvement effect of sanitation and water quality, sewerage tariff (wastewater management) as well as its facilities.

iii) Entry of Private Companies

Entry of private companies including those from overseas is referred to as a mean to compensate for financial insufficiency in sewerage service sector, but has not been successful in gathering private capital. The main reasons can be regarded as follows.

- Uncertainty of asset ownership and its conditions
- Lack of affirmation for a legal system to protect the investment
- Ambiguity of responsibilities
- Uncertainty of sewerage user charges revenue

In present days, entry of private sector should normally be realized through public applications, and the contract negotiation should either be done by competition or partial nondisclosure.

iv) Education and Training

With increase in number and advancement of sewerage service facilities, skills for business planning, financing and contract management are required, in addition to skills for O&M of newly constructed facilities. Lately, an inventory survey about training demands by water-related companies has started. Establishment of a consistent qualification system, and at the same time, a tireless effort to duly evaluate education and research are both required.

v) Technical Issues

Evaluation of present implementation status in water-related field found that concentration of inflow water quality is low because of:

① development of CSS,
② inflow of river water, underground water, and rainwater,
③ preprocessing of urination in septic tanks and excessive retention time in sewer.

Many WWTPs apply the activated sludge method whose energy consumption is big. Effluent standards should be harmonized with capacity and water usage of river.

Therefore, consideration is necessary for design standard and quality standard of effluent wastewater to comply with regional contexts.

vi) Water Quality Standard Issues

Treated wastewater discharged into the environment is controlled either by technical standards or QCVN. These standards are ambitious but lack flexibility, and are not related to the self-purification capacity of water basin to which such treated water is discharged. There are some local governments that avoid clear application of frequently modified standards. Applying tentative standards such as partial treatment and exemption of pollution load on discharge water to designated WWTPs that are in operation may work as an incentive for a local government to launch a sewerage project. Through a gradual reinforcement of water quality standards by modifying effluent standards responding to technical development, introduction of a step by step wastewater treatment with which operational technique and financing can catch up should be guided. Moreover, current water quality standards apply items that cannot be easily monitored, due to lack of institutions capable of reliable sampling and water quality analysis. Therefore, a compromise should be made regarding degree of impacts by water quality regulations in ensuring water quality.

Findings through interviews to ADB are shown below. ADB stated certain points such as

① VSC like the JS is recognized to be useful for development and operation of sewerage system projects in Vietnam
② ADB is considering a cooperation between VSC
③ Importance of adopting technologies well harmonized with natural and socioeconomic conditions in Vietnam
④ Fostering of incentives such as assistance for pre-Feasibility Study (pre-FS, hereinafter) cost to cities who are interested in implementing sewerage project
⑤ Cooperation on administration and finance for project management are emphasized
⑥ ADB is conducting comprehensive activities of sewerage works

The detail of the interviews is to be referred in Table 2.1-11.

Table 2.1-11 Results of interviews to ADB

Items	Contents
1. City water management	Focus is on an improvement of operation and management capacities. Target fields: service coverage rate, information technology, non-revenue water (NRW), systemic strategies
2. Loan Agreement for sewerage service	The circumstances of the project and supports are summarized in the attachment (documents for Coordination Meeting). It has started with Manila-Vietnam Convention in 2009, and the commitment was made approximately every 2 years. The assistance is USD100 million/city. In City-by-City program approach, ADB incorporates technical cooperation for capacity development.
3. Sewerage service financing	Sewerage service has rapidly spread since 1960's in Japan with subsidies by national and local governments. Likewise, capital investment was subsidized in EU as well. MOF is aware that full cost recovery is difficult.

4.Development policy on sewerage and sanitation service	Sewerage service covered area is 15% in the whole Vietnam, and the remaining 85% is covered by on-site treatment facilities. For 15 major cities, like JICA, ADB provide assistance for sewerage service. As for HCMC, ADB is providing a syndicate loan of 2 billion USD with JICA, targeting 5 wastewater treatment areas. Regarding mid-sized cities with population of 50 to 100 thousand, sewerage service, separate type treatment and sludge treatment (Fecal Sludge Management) are combined. A study on a 5-year pilot project since 2015 including O&M was inaugurated jointly with Hanoi Civil Engineering University, using assistance by Switzerland. As for small cities with population of 10, 000 and less, the assistance is focusing on sanitation. Sewage disposal tank, or "Joukasou" of Japan is not applicable to Vietnam due to its high quality and high cost. Local production is required. Institutional Structures such as inspection and management, operation can be considered very effective.
5. Japan Sewage Works Agency	The report writer came to know the agency three years ago through Japan Sanitation Consortium and JICA Vietnam Office, as an agency to provide assistance to sewerage system in Vietnam. It can be considered a perfect model.
6. Project finance mechanism	Ho Chi Minh City and its surrounding areas, as well as Mekong Delta Region are wealthy. For the sake of project finance, ADB is committed to financing of pre-FS. Upon obtaining agreement to formulate the project by the respective PC, ADB would provide financial assistance. Due to vulnerability of management capacity, leadership of the respective PC should be carefully watched. Out of 20 to 25 cities to which an offer is conveyed, about 10 cities would fail in the middle and about 15 cities survive as the targets in the end. Implementation of FS should be funded by the respective PC. Even for municipalities that have failed in the middle, ADB is ready to provide assistance under condition that the respective PC make a request for project formulation. Assistance to 4 cities in Mekong Delta Region: 3 cities of Ben Tre, Sa Dec, and Vi Thanh, to which assistance by ADB is already in progress, while assistance for Bac Leu is currently suspended.
7.Technical theories of sewerage system	Pre-FS is extremely important in that it is concerned with planning strategies, in addition to topography friendly sewerage facilities planning, sludge treatment of septic tanks. In modifying Decree 80, ADB offered a 40-page proposal. Use of existing drainage facilities (interceptor method): Through this method, reduction of sewer construction expenditure by 50% compared with house connection method is made possible. This would contribute to reduction of the project cost and earlier onset of the project impacts. It would be appropriate if effluent quality standards (A/B) are set according to actual circumstances, and then would be upgraded step by step. Wastewater treatment procedures would not be well balanced both in terms of technology and cost with capacity to bear the respective burdens, if A standards are fully applied to all cases. Influent quality of combined sewerage system (high infiltration and low concentration) and planned wastewater volume are 50-100L/capita/day, which is lower than normal planned value of 200L/capita/day. Financing policies about house connection are different to each other depending on donor agencies. In case of ADB, public funds cover up to public basin, and in-house drainage facilities should be covered by individuals.

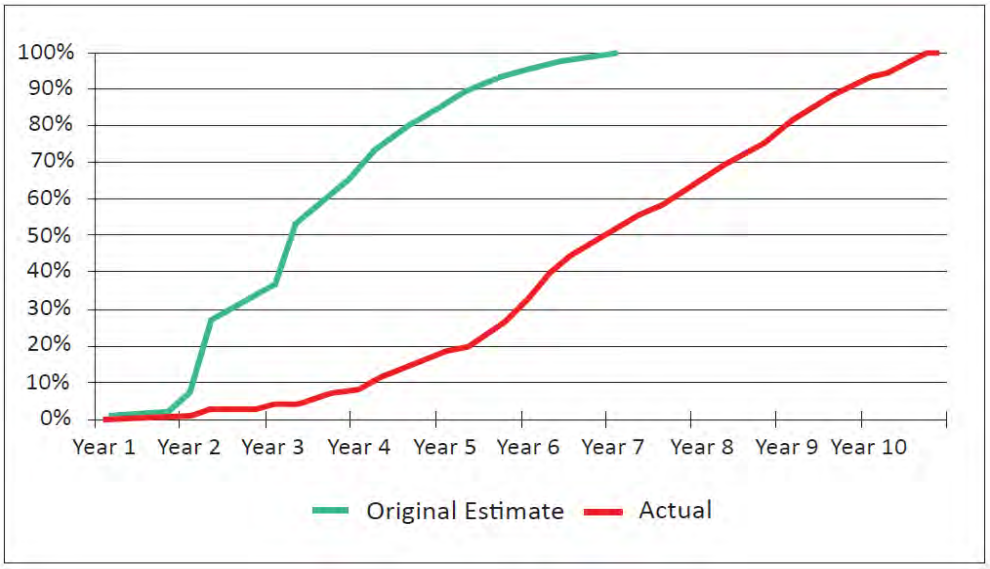
Source: JICA Study Team

b) Issues Pointed Out by WB

WB points out followings on implementing ODA projects of Vietnam and overseas countries.

- Preparation of ODA project in Vietnam takes longer period of 3 through 4 years than 2 years in average of oversea experience.

  Project implementation progress also takes longer period of 7 through 9 year than 5 years in average of oversea experience.



Most of projects are implemented with slow progress and low disbursement. The preparation period for a sanitation infrastructure development project averages 3 - 4 years (about 2 years in other countries). Implementation averages in 7 - 9 years (about5 years in other countries) (Figure C16) (Le D. H., 2011).
Source: Vietnam Urban Wastewater Review, December 2013 World Bank

Figure 2.1-8 Typical ODA Project Implementation Progress, Actual versus Plan

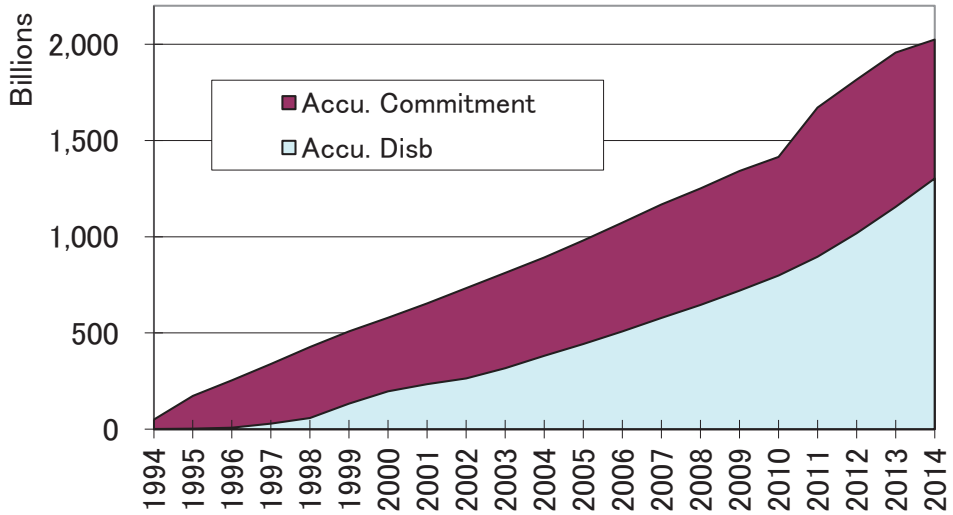
c) Issues Pointed Out by JICA

JICA points out followings on issues of sewerage sector in Vietnam:

"Veridical bottle neck in sewerage sector in Vietnam is not lack of finance but lack of implementation capacity of construction project. Financial disbursement will be stagnant unless such bottle neck is solved. Financial resource is truly utilized subject to enhanced project implementation capacity of PPC. First of all, project implementation capacity shall be enhanced, and then scaled up and diversified financial resource follow in order to disseminate sewerage service rapidly in Vietnam."

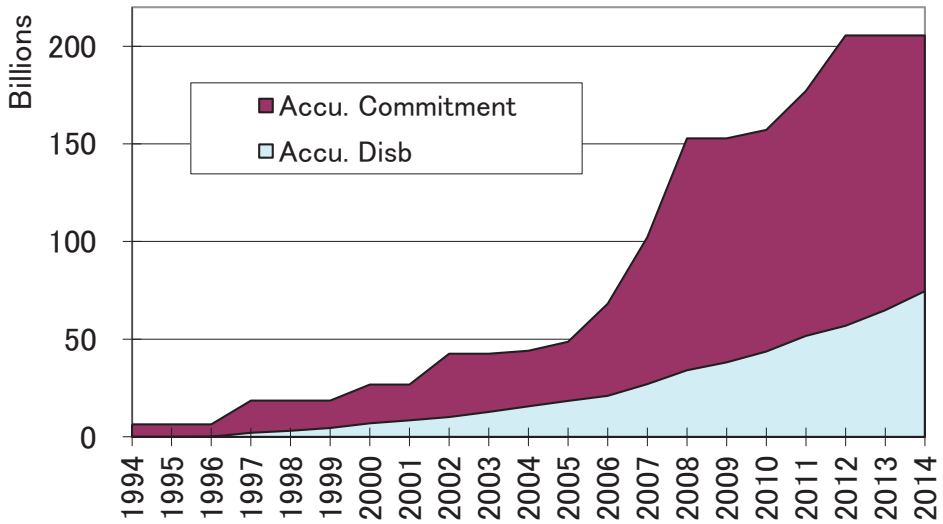
i) Issues learned from experience of JICA

Change of accumulated commitment and disbursement of ODA loan of whole sector is shown in Figure 2.1-9. That of sewerage sector is also shown Figure 2.1-10. Disbursement follows pace of commitment in whole sector (Figure 2.1-9). Disbursement of sewerage sector delays to pace of commitment, consequently fund becomes a waste (Figure 2.1-10). JICA stresses low performance of sewerage sector on the basis of experience in 20 years.



Source: JICA Vietnam Office Policy Paper "Accelerating Wastewater Treatment in Vietnam: Adaptive Application of the Japanese Experience", Jan. 2016, Katsurai Taro JICA Vietnam Office

Figure 2.1-9 Change of Accumulated Commitment and Disbursement of ODA Loan in Whole Sector

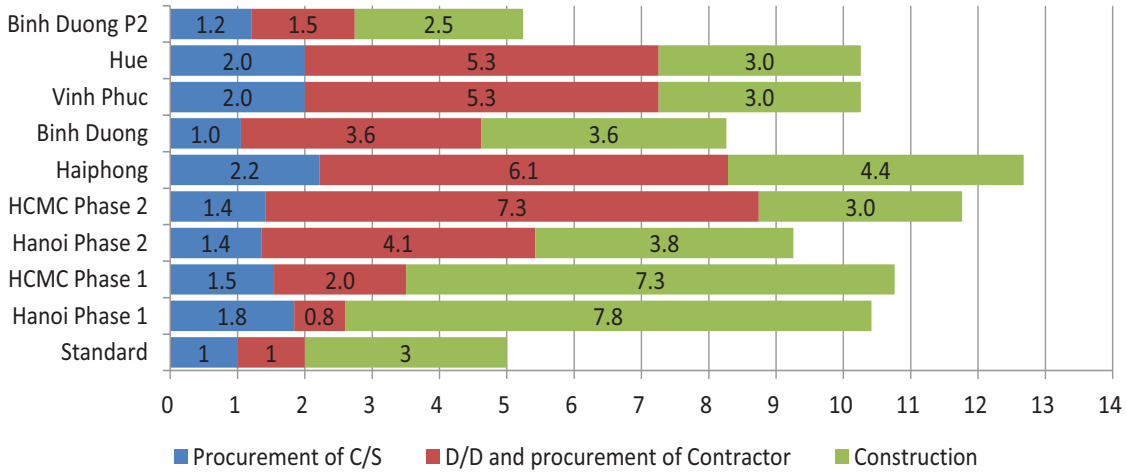


Source: JICA Vietnam Office Policy Paper "Accelerating Wastewater Treatment in Vietnam: Adaptive Application of the Japanese Experience", Jan. 2016, Katsurai Taro JICA Vietnam Office

Figure 2.1-10 Change of Accumulated Commitment and Disbursement of ODA Loan in Sewerage Sector

ii) Implementation Progress of Individual Project

Procurement procedure of consultant contract takes 1.6 year in average. Detailed design and procurement procedure of contractor take 3.7 years in average. That of excluding Binh Duong, which has superior project management capacity, takes 4.1 years in average. This means that period of L/A through construction contract takes 6 years in average.



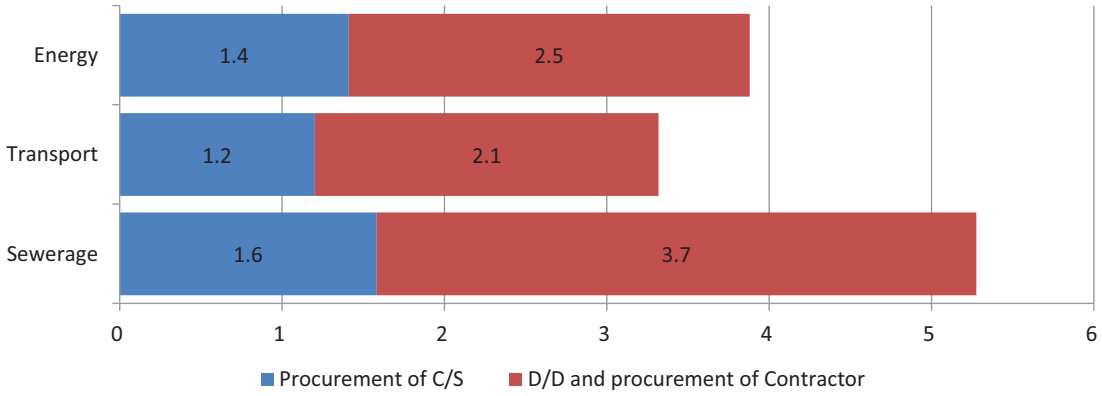
Source: JICA Vietnam Office Policy Paper "Accelerating Wastewater Treatment in Vietnam: Adaptive Application of the Japanese Experience", Jan. 2016, Katsurai Taro JICA Vietnam Office

Figure 2.1-11 Project Implementation Periods of JICA ODA Loan of Sewerage Sector

iii) Comparison with other sectors

In transportation sector, procurement procedure of consultant contract takes 1.2 year in average. Detailed design and procurement procedure of contractor take 2.1 years in average (in total, 3.3 years).

In energy sector, procurement procedure of consultant contract takes 1.4 year in average. Detailed design and procurement procedure of contractor take 2.5 years in average (in total, 3.9 years). Sewerage sector delays 1.4 through 2 years in average to transportation and energy sectors. Construction period will be delayed in long period although it is difficult to be affirmed due to limited samples.



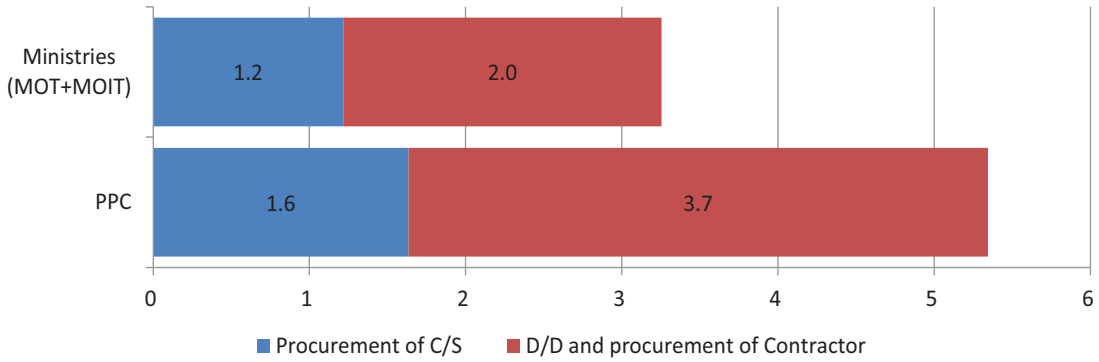
Source: JICA Vietnam Office Policy Paper "Accelerating Wastewater Treatment in Vietnam: Adaptive Application of the Japanese Experience", Jan. 2016, Katsurai Taro JICA Vietnam Office

Figure 2.1-12 Project Implementation Periods of JICA ODA Loan of Sewerage Sector vs. Energy and Transportation

iv) Comparison with implementation period according to executing agency

In project executing agencies basis of Ministry of Transport (MOT, hereinafter) and Ministry of Industry and Trade (MOIT, hereinafter) which are National agencies as well as implement themselves transportation and energy projects, procurement procedure of consultant contract takes 1.2 year in average, and detailed design

and procurement procedure of contractor take 2 years in average. Whole period is 3.2 years (Figure 2.1-13). Average periods of PPC projects take 1.2 year and 3.7 years, respectively (in total 5.3 years).



Source: JICA Vietnam Office Policy Paper "Accelerating Wastewater Treatment in Vietnam: Adaptive Application of the Japanese Experience", Jan. 2016, Katsurai Taro JICA Vietnam Office

Figure 2.1-13 Project Implementation Periods of JICA ODA Loan of Ministries vs. PPC

Project implementation of PPC subjects to take longer time for documentation of consultant selection and bidding as well as procurement procedure and successful bidder determination than that of ministries. Followings can, for instance, be exemplified in sewerage sector.

- Subdivided project package: Project executing agencies subject to subdivide project package into LCB regardless of agreed structure of project package and bidding at detailed design stage of sewerage work. Project executing agency intends that sewer construction project is appropriate to local contractors, who are small and medium enterprises, and then individual project package shall be subdivided in accordance with procurement condition. Some specified sewer construction sections, which had better to be constructed with river and drainage improvement project simultaneously or occupy specified road, are required to implement urgently, accordingly it shall be subdivided. JICA does not approve subdivision of project package due to significant increasing cost of project management. JICA spends long time for negotiation since execution agency seriously concerns on subdivided project package. JICA sometimes approves a certain amount of subdivision. These subdivision project package require additional bidding documentation and successful bidder determination, accordingly project results to delay as well as increase of consultation fees.

- Serious concerns on one-side obligation contract: Many project executing agencies concern on one-side obligation contract. Following contract conditions are exemplified for instance. (1) Right of contractor is omitted such as objection on additional contract amount in case for not provided access road to project site. (2) Owner's obligation on approval procedure of urban planning and/or spatial plan is omitted. (3) Right of contractor interest payment is omitted due to delayed payment. And others. Amendment of contract standard, which exempts obligation of owner above described, leads to failure of bidding or increase of cost. JICA does not agree such amendment at all, and it takes time to get understanding of executing agency. Such standard contract is often amended at contract negotiation phase in spite of

agreed bidding document between JICA and executing agency.

- Vicious spiral due to sequential delays: Delay causes vicious spiral of sequential delays such cost estimation must be reviewed due to keep latest.

Above mentioned are delays in procurement phase, and various delays in construction are also remarkable. Suspension of construction works due to delayed payment and/or dispute among stakeholders are remarkable. Many factors cause for such delay. Confirmation and approval take time for documents of payment. Furthermore, contract amendment requires agreement of relevant organizations and documents provided by contractor in order to amend contract condition such as extension of construction work, price escalation, and additional costs for change of amount and variation order as well as time for provisional work.

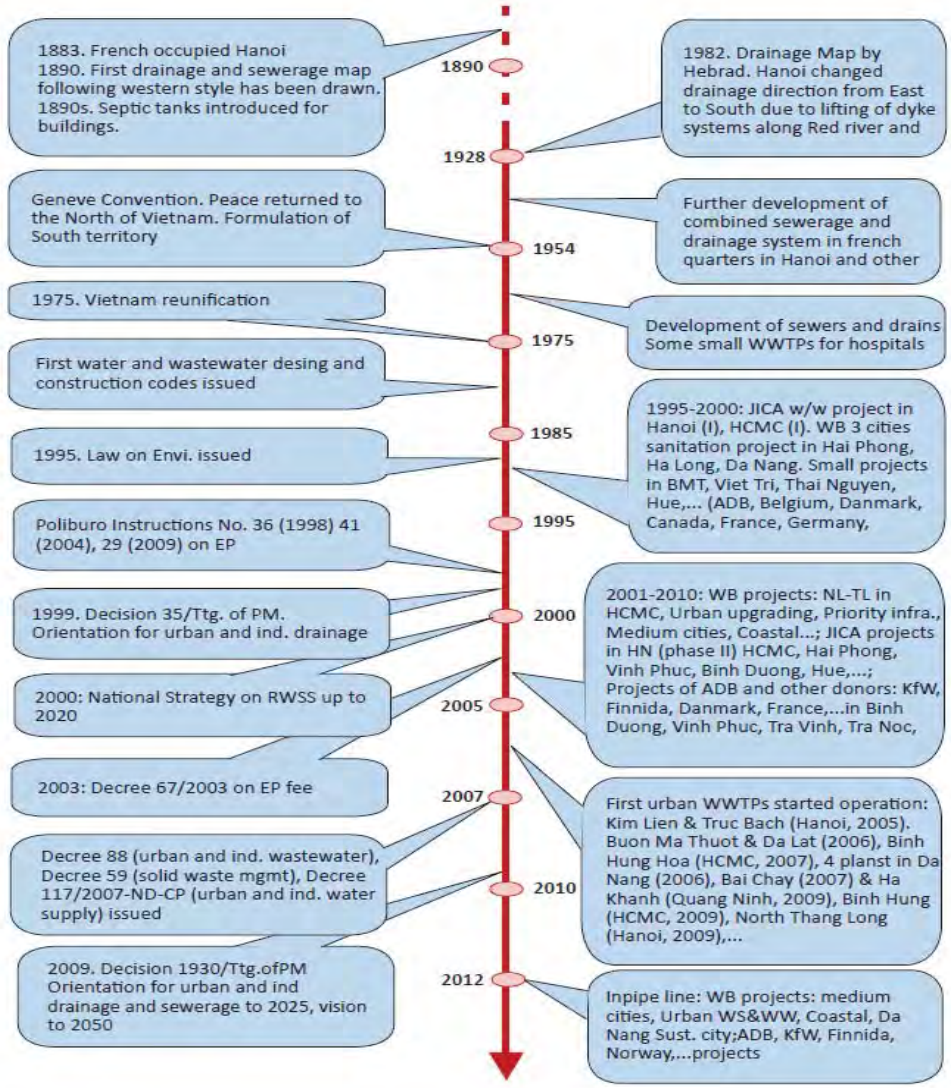
Delays of procurement and construction phases are simply due to lack of experience of large scale project and international bidding procedure. Project implementation unit (PIU, hereinafter) of MOT is assigned to another project sequentially once project completes. Accordingly. PIU of MOT can accumulate experience of implementing large scale projects. Personnel exchange among project executing agency also enhances to keep experience of project-by-project. On the other hand, PPC and CPC are lack in experience of project implementation due to scarce large scale project. Relevant organizations as well as PIU take much time for agreement and approval due to lack of experience in implementing large scale project.

Above mentioned verifies that veridical bottle neck in sewerage sector in Vietnam is not lack of finance but lack of implementation capacity of PPC/CPC. Financial disbursement will be stagnant unless such bottle neck is solved. Financial resource can be utilized subject to enhanced project implementation capacity of PPC. As a result, project implementation capacity enhancement is required first, and then keeping enough amount of and diversified financial resource follow in order to disseminate sewerage service rapidly in Vietnam.

(5) Summary of Literature and Interview survey

Below is a summary of current issues of sewerage works in Vietnam obtained through existing documents (Cf. Figure 2.1-14 to be referred together with process of sewerage sector).

The sewerage works in Vietnam started with construction of sewer (combined drainage sewer) in the French Colonial Period. A modernized sewerage system, however, would wait until JICA Master Plan Study in Ho Chi Minh City (1995). Wastewater treatment further would wait until service commencement of Kim Lien and Truc Bach WWTPs in 2005. Therefore, operation of WWTP has experienced only for about 10 years, and in most cities, they have not experienced aperation at all. Maintenance and management issues of sewerage works are regarded as new, since there has been no feedback from O&M and management to planning and designing.



Source: Vietnam Urban Wastewater Review, by Australian Aid and The World Bank, December 2013

Figure 2.1-14 Development Process of Sewerage Sector

1) Water Environment and Sewerage Administration

① As shown in the Figure 2.1-2, water pollution in big cities deteriolating and exceeding national water quality standards. To improve this situation, the installation of wastewater treatment systems is strongly requested.

② The construction of a sewerage system is spreading from large cities to central cities of provinces as well. The purification infrastructures are the new technologies for these cities, so the lack of engineers would arise.

③ It is very difficult to perceive the costs of constructions, as well as maintenance since the sewerage tariff. It is to introduce a means of revenue to balance the budget.

2) Issues Concerning Engineers

Since sewerage sector is a new technology and business, following issues are revealed to be solved in regard of engineers.

a) Sewerage Work is a New Business

Since sewerage sector is a new business in Vietnam, its know-how is not sufficiently accumulated in the country. Sector master plan for the sewerage development are elaborated in most of cities but the procedures for approval delays the implementation of works. Besides, ineffective sewerage planning and selection of equipment are causing increase in cost and making O&M difficult.

b) Insufficient of Technical Knowledge

Knowledge of planning, design and supervision of construction, and operation are insufficient as the sewerage work is new in Vietnam thus constructed facilities may not fulfil the efficiency as expected. As a result, there are cases where effluent standards is not kept in terms of BOD・COD, T-N, and T-P. It is expected that appropriate facility design is ensured according to the characteristics of inflaw water quality.

c) Lack of Engineers

Ensuring quality and number of engineers is important to enhance management capacity of sewer system. To do so, VWSA and other foreign donors conduct activities for capacity development. GIZ and DANIDA are proceeding capacity development on management and O&M but these activities do not fully answer to the needs in sewerage sector thus human resource development is still on the way.

d) Lack of Public Awareness

Regarding usage of sewerage system and improvement of water environment there is lack of understanding among residents. The management problems are present such as house connection rate of households is low and not establishing sewerage tariff system.

[Issues] Lack of engineers, insufficiency in capacity as well as knowledge and experience of engineers, unprepared standards and Standard Operation Procedure (SOP, hereinafter), importance of public awareness and public relations

3) Issues Concerning Project Implementation

In regard of project implementation, followings are revealed as problems in execution phase. In addition to the know-how of engineers, structure and implementation system, as well as implementation flow contains problems.

- Delay in planned implementation and lack of project implementation capacity
- Inappropriate treatment process and selection of equipment
- Lack of strategy for sewer sludge
- Delay of implementation because of lack of residents' and PPC's understanding

It tends to take a long time for a sewerage project in Vietnam upon completion of a master plan before it enters service. There are various reasons for it but from technical standpoints, those are cases of changes in wastewater treatment technique after detailed design, requirement to modify sewer laying routes at construction works stage, which both further are caused by insufficient evaluation at planning and designing stages, and cases of change in design and construction works technique at the construction works stage due

to insufficient geological survey. The problems lie not only in an insufficient study performed by planners and designers, but also in technical skills of the project owners, who are supposed to check the performance of the former.

It is pointed out that technical and financial capacity of Vietnam was not adequately considered in the selection of treatment procedure as well as machinery and equipment. Knowledge and expertise in the project implementation such as adoption of appropriate technology, cost estimation capacity. Moreover, knowledge and expertise in the treatment and use of sludge have not been accumulated practically, which is expected to increase as sewerage service area is expandedof the sewerage system. By establishing strategies on treatment and disposal of sewage sludge, and by drawing a roadmap in view of project implementation, unnecessary burdens like reworking can be avoided.

Regarding formulation and implementation of sewerage projects in cities which do not have sewerage system, consensus building on both wastewater treatment and improvement of water environment has not yet been obtained from respective PC and residents, although development of city infrastructure is proceeding in all those cities. In order to help small and medium sized cities to formulate sewerage service project, ADB provides assistance to conduct pre-FS, upon making confirmation of respective PC. Technical as well as financial assistance by specialized agencies is indispensable to carry out FS and to foster understandings.
[Issues] Insufficient verification and evaluation , insufficient planning, urgent nature of sewage sludge treatment project, budgetary shortage to conduct FS, lack of capacity in decision making to launch a project

4) Issues Concerning Research and Development

In addition to human resource and implementation structure, sewerage works require problem solving activities such as R&D, as well as technical evaluation.

- Statistics in sewerage and data on technology to be basis of sewerage policy
- R&D for equipment necessary in sewerage works, as well as standardization of technology
- R&D of technology being able to answer soci-economic request and implementation of policy

In Vietnam, major indicator for sewerage and drainage such as sewerage service rate in population, sewerage serice area, compilation and solution of sewerage implementation know-how have not been developed. Data collection about influent quality also is not done systematically. Due to lack of statistical database on sewerage system, which is required for decision making and facilities planning of sewerage system, overseas consultants are working with facilities planning in an empirical manner. As such, design specifications such as water quality and load, water temperature as well as reaction rate are not necessarily coinciding with those on site.

As for technical terms on sewerage system, terms in the medical and sanitation sectors have been defined. As was mentioned before, experts in sewerage sector are limited in number, and that makes it difficult to obtain understandings on sewerage technology among city infrastructure sectors. Development of a glossary list in Japanese-English-Vietnamese for water environment and sewerage sector is an urgent issue, considering

circumstances in which sewerage technology as well as knowledge and experience are highly dependent upon those from overseas.

Development of sewerage system is underway nationwide, and with that regard, corrosion resistant technology of concrete, high quality and low life cycle cost equipment, both tested by Japanese experience are timely. In the Public-Private Partnerships Program by JICA, strong interest was expressed in polymer concrete which is resistant to sulfuric acid corrosion.

Other than that, advanced technology is not introduced yet in many cases due to the short period of involvement in sewerage service. In the case of sewer construction works, for instance, currently the open cut method is the basic one in use. The open cut method indeed is less expensive, but on the other hand, it has disadvantages such as significant impact to nearby environment during construction work, and limitation in burial depth of sewer. As a result of that, there are cases in which the sewer network requires many lift pumping stations, which further brings complicated operational management. Though introduction of microtunneling method is supported from the Japanese side, it is far from being generally in use yet.

With regard to sewage sludge, the quantity is getting bigger year by year in proportion to development of sewerage system, and its treatment is an issue. Currently, sewage sludge is either composted or disposed of at landfill sites, but in near future, it would be necessary to consider introduction of drying and incineration plants, together with consideration of sludge recycling and other measures.

Other than that, there are high interests in global environment issues, and with that regard, research topics like low carbon technology, energy conservation technology, use of treated water and rain water and so on, would be considered as prioritized issues.
[Issues] Promotion of new technology introduction, standardization of equipment, glossary list, development of database and standards, low carbon technology, use of treated water and rainwater

2.1.4 Preliminary Visit Survey

(1) Purpose of Survey

In the needs survey, it is important to precisely obtain issues and needs of sewerage service in Vietnam. Specifically, methods and target of survey, and contents of questions should be discussed prior to the actual implementation of the survey on sites, taking circumstances such as management structure of sewerage works in Vietnam, and technical level of staff members in charge into consideration. Thus, in order to know circumstances of sewerage works in cities of Vietnam, a preliminary visit survey was conducted in two cities, Bac Ninh and Bac Giang.

(2) Target Cities and Persons

・March 10, 2016: Bac Giang CPC

(Mr.) Huan, Head of City Management Office, Bac Giang City Sewage Treatment Plant

(Mr.) Dat, Vice Head of Bac Giang City Drainage Management Center

・March 15, 2016 : Department of Construction (DOC), Bac Ninh Province

(Mr.) Chinh, Head of Infrastructure Management Office,

(Mr.) Quinn, Chief Engineer, DITTO

(Mr.) Hai, Vice President, Water Supply and Sewerage Company, Bac Ninh Province

(Mr.) Hiep, Vice President, Sewerage Company, Bac Ninh Province: Bac Ninh City Sewage Treatment Plant

(Mr.) Day, Director of Wastewater Treatment Division, Sewerage Company, Bac Ninh Province

・April 9, 2016: PMU, Bac Ninh Province

(Mr.) Hai, Vice President, Water Supply and Sewerage Company, Bac Ninh Province

(Mr.) Day, Director of Wastewater Treatment Division, Sewerage Company, Bac Ninh Province

・April 15, 2016 : DOC, Bac Giang Province

(Mr.) Quyen, Deputy Director General of DOC,

(Mr.) Hai, Vice Head of City and Rural Planning Office, Bac Giang City Sewage Treatment Plant

(Mr.) Trong, Plant Manager (Bac Giang City Municipal Wastewater Management Center)

(3) Survey Result

The results from preliminary visit survey in Back Ninh and Bac Giang are shown below.

Table 2.1-12 Results of Preliminary Visit Survey in Bac Ning, Bac Giang

Evaluated Items	Bac Ninh Province/City	Bac Giang Province/City
Outline of sewerage service project	Donor Agency KfW: Kreditanstalt für Wiederaufbau, Germany *70% of the Project Expenditure is covered. Remaining 30% is covered by loan provided from Bac Ninh Province. ② WWTP ・Start of service: 2013 ・Treatment method: SBR ・Processing capacity: 28,000m^3/day Transfer pumping stations ・ 6 stations Collection system ・Combined type (Interceptor type)	Donor Agency DANIDA: Danish International Development Agency WWTP ・Operation commencement of service: 2010 ・Treatment method: A2O ・Treatment capacity: 10,000m^3/day * Proposed to be expanded by ADB loan (scheduled to start service in 2017) Transfer pumping stations ・7 stations Collection system ・Newly developed city area: Separate type ・Conventional city area: Combined type (Interceptor type)
Roles of Provincial DOC	・ Management is done by the Infrastructure Office, DOC, managed jointly with transportation and roads ・DOC checks and gives advice on whether or not a project complies with the relevant laws	・① Examination of basic design ② Examination of detailed design ③ Construction works inspection (whether or not compliance to the laws is secured) shall be directly performed by MOC, for facilities specially designated by the relevant laws or by MOC, and Level 1 facilities * Sewerage service in Bac Giang City is basically administered by the city government
Structure of Provincial DOC	・There are no specialized departments in sewerage sector	・3 engineers are allocated for sewerage service and agricultural irrigation
PMU	・Water Supply and Sewerage Company has PMU, employing experts (5 sewerage engineers and 1 finance specialist, totaling 6). PMU performs duties such as supervision of consultants, payment, land acquisition and others. * Currently, PMU exists in Sewerage Company (proposed to be privatized in 2016), which was separated from Water Supply and Sewerage Company in 2015 for the sake of closing.	・PMU of the past project is now liquidated. ・As for an expansion project of the existing treatment plant, out of 3 options ① Establishment of new PMU by Provincial Government, ② Use of Project Management Board under PPC, ③ Use of Project Management Board of the City, ③ is supposed to be selected.
Stakeholder organizations	・Bac Ninh Province PC: financing	・Department of Agriculture and Rural Development (DARD): Management of 7 pumping stations ・Departments and sections on roads: city drainage ・DOT: Construction of sewer (due to attachment to road construction) ・ Urban Works Division of People's Committee (UDPC): House connection
Ordinance of sewerage service	・Already stipulated	・None
Maintenance organizations of sewerage facilities	・Maintenance contract of 2015 to 2020 was won by Sewerage Company in a public tender.	・Directly administered by PC with approximately 60 staff members, of which 40 shall be engaged in operational management of pumping stations.

	・Provincial Government covers 70% of maintenance costs for the WWTP till 2020, and the remaining 30% will be covered by sewerage user charges. ● Sewerage Company A president, 2 vice presidents, and 112 staff members, of which 70 are engaged in maintenance of WWTP and sewer.	・Rainwater sewer shall be managed by road management authority (DARD) and Sewerage and Drainage Company.
Management structure of WWTP	● Sewerage Service Public Corporation ・Performed around the clock, with 3 time shifts by 4 groups of 3 staff members ・Operational management is done by 2 members, with 1 plant manager and 1 more staff. ・Allocation of management staff for the WWTP is the plant manager (university graduate), 14 operators, 1 water quality analyst (university graduate), and treatment specialists (1 university graduate and 12 technical school graduates)	・Staff members allocated for maintenance are 21, who are mainly workers, and 2 water quality analysts are chemistry graduates of university.
Operational management of WWTP	・No particular troubles are found since the facility is new. ・Water quality data (BOD, COD, SS, T-N, T-P) is measured monthly, satisfying effluent discharge standards. ・Statutory water quality inspection is performed twice a year, and items that cannot be checked in water quality analysis laboratory are outsourced to Environment Management Center and others. ・Generation of sludge is 4m^3/day, which is disposed of by landfilling (only the transportation cost will be borne), upon reducing water contents to 40% (in a month) on drying bed.	・Automated operational control by SCADA became impossible 2 years after service commencement due to mechanical troubles, so currently operation is manually done (equipment such as DO meter and others are not operational, either). Repair is in demand but the budget is lacking. Rehabilitation Plan was submitted to PC in the very limited budget. ・Due to both budget shortage and advice by DANIDA, dose of chlorine is not done. ・Power expense including that of 7 pumping stations is VND 20 million/Month ・Power usage of the WWTP is 60,000 kwh/Month (approx. 0.2kwh/m^3)
Storage of design drawing books and documents, records of operational management	・Kept in the Administration Building	・Daily report, reports of breakdown and so on are compiled and stored. ・Storage of design drawing books and documents is done in PPC.
Issues and demands in training programs	・In-house training sessions are conducted 2 to 3 times a year mainly via On-the-Job Training, targeting design & construction works supervision agencies of the city and province, officials and staff members including private sector	・Participating in training courses by DANIDA ・Management level of maintenance is still low, and also engineers in private sector are inexperienced. Improvement of technical level is necessary. ・Requirement of training programs for workers is high, but cannot be implemented due to budget shortage. The requirement is especially high in the

	who are in charge of plant as well as sewer management (university graduate engineers and technical school graduate workers). ・Participating in training courses by GIZ and DANIDA ・Indispensability of human resources development and requirement of specialty oriented training program are the impressions.	fields of ① Operational management of pumping stations and treatment plant ② Chemical analysis such as water quality analysis etc., ③ Operation of electrical devices.
Issues and needs in implementing sewerage projects	・It took as long as 13 years for the WWTP Project since formulation of the plan in 2000 till service commencement of the WWTP in 2013. Construction of sewer and treatment plant implemented by separate projects, time consumption for land acquisition, cutting of project budget due to fluctuation in exchange rate influenced by global recession and so on would have caused it.	・Nonexistence of a WWTP in the southern part of city area ・The only master plan for the project is the one included in city planning, there is no sewerage master plan for its own sake. Because of that, coherence of planning is not secured. ・Maintenance staff members are directly administered by the PC, which brings inefficiency of maintenance. Moreover, subsidy from the government is insufficient. ・Collection of sewerage user charges is not going well. It is necessary to obtain understanding of local residents. ・Sewerage facilities are administered by many agencies in a complicated manner. It causes inefficiency; thus, organization restructuring is required. ・Maintenance of drainage is rarely done, therefore rainwater management is at stake.
Issues and needs in R&D		・The control system initially introduced to the WWTP by DANIDA broke down caused by lack of harmonization with climatic conditions in Vietnam, and it is manually controlled. A new and easy to handle technology is required for operational management.
Others	・An effort to improve awareness on sewerage service is made by inviting primary and junior high school students to a study tour of sewerage system.	

Source: JICA Study Team

(4) Conclusions of the survey

1) Issues and needs of training programs

Both 2 target cities already possess sewerage service facilities. Because of that, mainstream of sewerage service is transferred to operational management of facilities (WWTP). The 2 target cities are aware of requirement to foster engineers for operational management, and indeed send their staff members to training programs by GIZ, DANIDA and others. However, it still is not

adequate to tackle shortage of engineers, so human resource development of engineers should be an issue.
[Issues] Human resources development of engineers (especially on operational management)

2) Issues and needs in project implementation support

In DOC of both provinces, there is no departments specializing in sewerage sector, and depending on the province, there is even no expert in the field. With that regard, there is a shortage of sewerage experts. DOC performs duties on evaluation, examination and inspection of designing and construction works, and due to that, lack of technical experts is a big problem.
[Issues] Shortage of sewerage experts

3) Issues and needs in R&D

As seen in the case of WWTPs in Bac Giang City, there are problematic cases of unsuitable direct transfer of technology and equipment from overseas to Vietnam. Thus, a prior verification of newly introduced technology, or customization to conditions in Vietnam (conversion to local specifications) are required.
[Issues] Verification in introducing technology from overseas, customization (conversion to local specifications)

2.1.5 Field Survey

(1) Puruse of survey

According to the results from preliminary visit survey, field survey was conducted to grasp comprehensive situation of sewage works.

(2) Contents of Survey

Principal contents of the field survey are indicated in the Table 2.1-13.

Table 2.1-13 Contents of field survey in Bac Ninh, and Bac Giang

Item	Contents
1. Outline of sewerage works	1) Status quo of sewerage works 2) Outline of sewerage work(MP) 3) Outline of sewerage work (Detail Design) 4) Outline of sewerage work (Construction) 5) Outline of sewerage work (O&M) 6) Budget 7) PMU and DOC 8) O&M organization 9) O&M budget 10) Local regulation
2. Expectation to sewerage work from residents	1) Do residents feel the necessity of the sewerage? 2) Which purpose has higher priority for residents? Please write down the priority. 3) Do you think residents accept to pay user charge?
3. Expectation to the VSC	1) Major trouble and problem in sewerage work 2) Expectation to VSC 3) Training 4) Will you participate pilot training which will be held in July and November? 5) Technical Assistance 6) R&D 7) If there are pilot trainings this year, do you want to participate to them? 8) What do you expect to VSC other than above mentioned. Please write down.

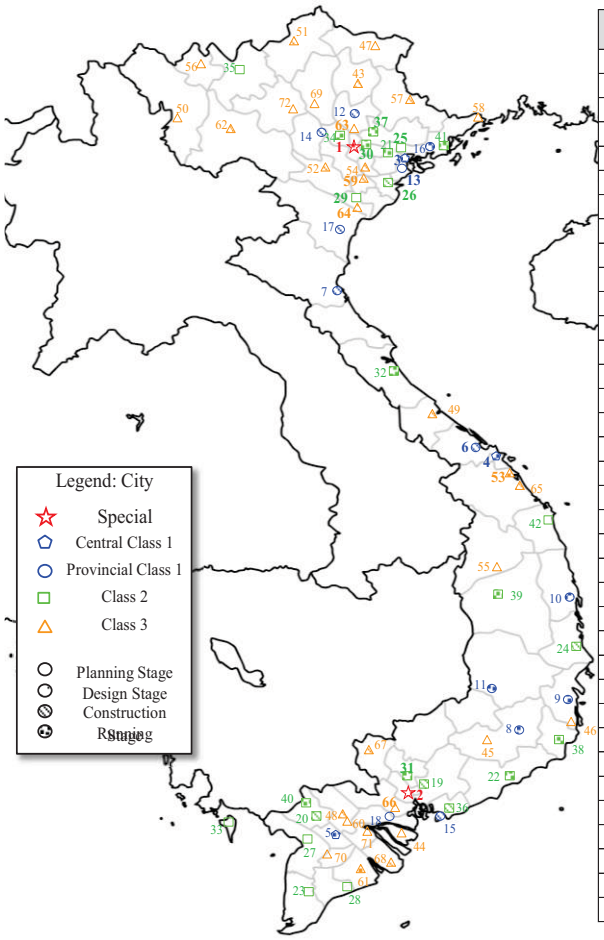
Source: JICA Study Team

(3) Selection of Target Cities for Survey

1) Implementation Status of Sewerage Works in Vietnam

In this study, the target is defined to be cities of Class 3 and upward are as many as 72 (Special: 2, Central Class 1: 3, Provincial Class 1: 13, Class 2: 24, Class 3: 30 but 14 town level cities are excluded). The figure below indicates locations and names of target cities.

Sewerage works have been implemented in all cities classified as Special, Central Class but for smaller cities the ratio of non-implementation increases. As a result, 26 cities out of 72 (higher than Class 3) have not yet implemented any project in sewerage facilities.



No.	Name of urban cities	No.	Name of urban cities
1	Hanoi	37	Ba Ria
2	Ho Chi Minh	38	Bac Giang
3	Hai Phong	39	Phan Rang-Thap Cham
4	Da Nang	40	Chau Doc
5	Can Tho	41	Cam Pha
6	Hue	42	Quang Ngai
7	Vinh	43	Tam Ky
8	Da Lat	44	Tra Vinh
9	Nha Trang	45	Bac Kan
10	Quy Nhon	46	Ben Tre
11	Buon Ma Thuot	47	Bao Loc
12	Thai Nguyen	48	Cam Ranh
13	Nam Dinh	49	Cao Bang
14	Viet Tri	50	Cao Lanh
15	Vung Tau	51	Dong Ha
16	Ha Long	52	Dien Bien Phu
17	Thanh Hoa	53	Ha Giang
18	My Tho	54	Hoa Binh
19	Bien Hoa	55	Hoi An
20	Long Xuyen	56	Hung Yen
21	Hai Duong	57	Kon Tum
22	Phan Thiet	58	Lai Chau
23	Ca Mau	59	Lang Son
24	Tuy Hoa	60	Mong Cai
25	Uong Bi	61	Phu Ly
26	Thai Binh	62	Sa Dec
27	Rach Gia	63	Soc Trang
28	Bac Lieu	64	Son La
29	Ninh Binh	65	Song Cong
30	Bac Ninh	66	Tam Diep
31	Thu Dau Mot	67	Tan An
32	Dong Hoi	68	Tay Ninh
33	Phu Quoc	69	Tuyen Quang
34	Vinh Yen	70	Vi Thanh
35	Lao Cai	71	Vinh Long
36	Pleiku	72	Yen Bai

Source: JICA Study Team

Figure 2.1-15 Map of Target Cities for Survey

Table 2.1-14 Status of Sewerage Projects in Each City

No.	Name of urban cities	Urban Categories	Population (People)	Area (km^2)	Status of WWTP			
					Plan	Under Design	Under Construction	Running
1	Hanoi	Special	7,095.800 (2014)	3,328.9				○
2	Ho Chi Minh		7,567.700 (2015)	2,095.6				○
3	Hai Phong	Central, Class I	2,103.500 (2015)	1,527.4			○	
4	Da Nang		1,007.700 (2014)	1,285.4				○
5	Can Tho		1,238.300 (2014)	1,409.0				○
6	Hue	Provincial, Class I	354,124 (2015)	71,68			○	
7	Vinh		314,351 (2014)	104,96				○
8	Da Lat		211,696 (2011)	394,64				○

No.	Name of urban cities	Urban Categories	Population (People)	Area (km^2)	Status of WWTP			
					Plan	Under Design	Under Construction	Running
9	Nha Trang		398,751 (2012)	252,6				○
10	Quy Nhon		286,400 (2014)	284				○
11	Buon Ma Thuot		331,262 (2011)	377,18				○
12	Thai Nguyen		306,842 (2015)	170,7		○		
13	Nam Dinh		352,108 (2010)	46,4	○			
14	Viet Tri		283,995 (2013)	111,75			○	○
15	Vung Tau		450,000 (2014)	141,1			○	
16	Ha Long		236,972 (2014)	271,95				○
17	Thanh Hoa		411,302 (2015)	146,77			○	
18	My Tho		244,000 (2014)	81,55			○	
19	Bien Hoa		1,104.495 (2015)	264,08	○			
20	Long Xuyen		368,376 (2013)	106,87			○	
21	Hai Duong		253,893 (2013)	71,39				○
22	Phan Thiet		220,560 (2012)	206	○			
23	Ca Mau		278,395 (2015)	250,3	○			
24	Tuy Hoa		155,637 (2012)	107		○		
25	Uong Bi		174,678 (2012)	256,3	○			
26	Thai Binh		268,167 (2013)	67,71			○	
27	Rach Gia		223,491 (2013)	104	○			
28	Bac Lieu		190,045 (2014)	175,25	○			
29	Ninh Binh	Provincial,	160,166 (2014)	48,36	○			
30	Bac Ninh	Class II	272,634 (2013)	82,60				○
31	Thu Dau Mot		271,165 (2014)	118,67				○
32	Dong Hoi		160,325 (2013)	155,71				○
33	Phu Quoc		96,940 (2014)	589,23	○			
34	Vinh Yen		152,801 (2013)	50,80				○
35	Lao Cai		150,368 (2013)	229,67			○	
36	Pleiku		214,700 (2010)	266,61	○			
37	Ba Ria		153,862 (2014)	91,46			○	
38	Bac Giang		185,000 (2014)	66,67				○
39	Phan Rang-		202,315 (2015)	78,90				○

No.	Name of urban cities	Urban Categories	Population	Area	Status of WWTP			
			(People)	(km^2)	Plan	Under Design	Under Construction	Running
	Thap Cham							
40	Chau Doc		158,787 (2014)	105,29				○
41	Cam Pha		195,800 (2012)	486,45	○			
42	Quang Ngai		260,252 (2013)	160,15	○			
43	Tam Ky		110,700 (2012)	107,6		○		
44	Tra Vinh		109,341 (2010)	68,035			○	
45	Bac Kan	Provincial, Class III	57,800 (2015)	137		○		
46	Ben Tre		231,904 (2016)	71,11	○			
47	Bao Loc		156,866 (2014)	232,2	○			
48	Cam Ranh		123,859(2012)	316	○			
49	Cao Bang		84,421 (2012)	107,6	○			
50	Cao Lanh		161,292 (2009)	107			○	
51	Dong Ha		84,157 (2011)	72,96			○	
52	Dien Bien Phu		48,020 (2009)	64,27			○	
53	Ha Giang		71.689 (2010)	135,33			○	
54	Hoa Binh		94,607 (2014)	148,20		○		
55	Hoi An		92,000 (2012)	614,688		○		
56	Hung Yen		147,275 (2013)	73,42			○	
57	Kon Tum		155,214 (2013)	43,298.15	○			
58	Lai Chau		52,557 (2013)	70,77	○			
59	Lang Son		92,200 (2014)	77,69			○	
60	Mong Cai		100,000 (2013)	516,6	○			
61	Phu Ly		136,654 (2013)	87,87				○
62	Sa Dec		152,237 (2013)	59,81	○			
63	Soc Trang		173,922 (2013)	761,522				○
64	Son La		95,730 (2011)	324,93		○		
65	Song Cong		109,409 (2015)	98,37	○			
66	Tam Diep		104,175 (2015)	104,979				○
67	Tan An		186,612 (2015)	81,94	○			
68	Tay Ninh		153,537 (2013)	140		○		
69	Tuyen Quang		110,119 (2010)	119,17	○			

No.	Name of urban cities	Urban Categories	Population (People)	Area (km^2)	Status of WWTP			
					Plan	Under Design	Under Construction	Running
70	Vi Thanh		190,200 (2014)	118	○			
71	Vinh Long		140,872 (2013)	48,01	○			
72	Yen Bai		95,361 (2013)	108,15	○			
Sub Total					26	8	17	21
Sum Total					72			

Source: JICA Study Team

2) Cities visited in the Field Survey

The 3 conditions mentioned below were used for the selection of the cities visited in the field survey. In consideration of 3 following conditions, field survey cities (candidate) were selected.

a) Collaboration of not-yet-started cities and JICA project (Condition A)

6 cities are selected for candidate, considering that they are the not-yet-started cities, and collaborate with JICA project.

Table 2.1-15 candidate cities considering with Condition A

City	Province & population	Reason
1. Nam Dinh	Nam Dinh, 350,000	Biggest city of the not-yet-started cities
2. Thai Nguyen	Thai Nguyen, 300,000	Synergy effects with JICA Project with technical cooperation for river basin management,
3. Cam Pha	Quang Ninh, 200,000	Synergy effects with technical cooperation for Ha Long sewerage, green growth,
4. Unog Bi	Quang Ninh, 170,000	Target of technical cooperation for Ha Long sewerage, synergy effects with JICA, ADB project
5. Bao Loc	Lam Dong, 150,000	Synergy effects with project with Lam Dong program
6. Song Cong	Thai Nguyen, 100,000	Target of technical cooperation for river basin management, synergy effects with JICA Project

Source: JICA Study Team

b) ADB sector loan（Condition B）

The selected cities are considering with ADB sector loan.

Table 2.1-16 candidate cities considering with Condition B

City	Province & population	Reason
1. Ben Tre	Ben Tre, 230,000	Target of ADB sector loan Sa Dec is a target of technical cooperation for river basin management
2. Vi Thanh	Hau Giang, 190,000	
3. Sa Dec	Don Thap, 150,000	

Source: JICA Study Team

Also 2 cities, Da Lat City and Bao Loc Cty in Lam Dong province,were recommended by MOC, adding these 2 cities, total10 cities are selected.

c) Advanced city (Condition C)

Cities provided sewerage service are experiencing various problems in the process of implementing. In addition to project implementation support and R&D, Ho Chi Minh City and Bing Duong City were selected of important cities concerning cooperation with the VSC. Unlike the cities corresponding to the above requirements A and B, the content of the survey was a questionnaire survey on sewerage project issues and Sewerage Center. For Hanoi City, the capital of the country, excluded it from the visiting survey city by using existing information.

d) Selection of the target cities of field survey in final

Cities that meet the above conditions, including preliminary visit survey cities, are 12 cities as described above. For Thai Nguyen City and Cam Pha City, we were not allowed to visit, so those were removed from the visiting survey city. Also, Bao Lac city of Lam Dong province, DOC did not take part in the survey stage of commercialization, and detailed information could not be obtained, it was removed from the visiting survey city as well. As a result, the visited survey target cities became 11 cities including those from the preliminary visit survey. The project implementation stage of these 11 cities is shown in the Table 2.1-17. Bac Gianh City and Da Lat City are undertaking expansion projects for sewage line and WWTPs. Ho Chi Minh City and Binh Duong Province have already carried out maintenance and project started in new zones.

Table 2.1-17 Sewerage development status of target cities

No	City	Province	Visit	Implementation			Remarks
				the not-yet-started	Under Construction	O&M	
1	Bac Ninh	Bac Ninh	DOC			✓	Preliminary survey
2	Bac Giang	Bac Giang	DOC		✓	✓	
3	Nam Dinh	Nam Dinh	DOC	✓			
4	Song Cong	Thai Nguyen	PMU	✓		✓	Existing small plant
5	Unog Bi	Quang Ninh	PPC	✓			
6	Da Lat	Lam Dong	DOC Da Lat WTP		✓	✓	
7	Ben Tre	Ben Tre	DOC	✓		✓	Existing plant
8	Vi Thanh	Hau Giang	DOC	✓			
9	Sa Dec	Don Thap	DOC DOWASEN PPC	✓			
10	Ho Chi Minh	Ho Chi Minh	UCCI SCFC		✓	✓	
11	Binh Duong	Binh Duong	BIWASE		✓	✓	

Source: JICA Study Team

(4) Results of the Field Survey

The detailed results of field survey are indicated in Appendix 8-1. The Table 2.1-18 shows the summary of visit survey in 9 cities except Ho Chi Minh City and Binh Duong Province.

Table 2.1-18 Implementation Status of Sewerage, and Issues and Needs in the Target Cities of the Survey

Province		Quang Ninh		Lam Dong		Ben Tre	Don Thap	Hau Giang	Nam Dinh	Thai Nguyen
City		Uong Bi	Cam Pha	Da Lat	Bao Loc	Ben Tre	Sa Dec	Vi Thanh	Nam Dinh	Song Cong
Provincial DOC	Department in charge of sewerage service	Urban infrastructure management		Urban planning * No dedicated department (A proposal has been made for creating a dedicated		Urban infrastructure management * No dedicated department	Urban infrastructure * No dedicated department	Urban infrastructure * No dedicated department	Urban technical infrastructure management * No dedicated department	Urban technical infrastructure management * No dedicated department
	Presence of sewerage experts	None		None		None	None	None	None (Doubled by water supply experts)	None (Doubled by water supply experts)
	Issues to be addressed	Insufficient engineers		Insufficient engineers and budget		Insufficient engineers and budget	Insufficient engineers	Insufficient engineers	Insufficient engineers and budget	Insufficient engineers and budget
Status of sewerage works	Donor	Belgium	WB	DANIDA * To be expanded by WB	Belgium	ADB	ADB	DANIDA	None	None
	Progress of the project	M/P	In service	In service	F/S	Pre-F/S	F/S	D/D	Sector M/P yet to establish	In service
Project implementing body	Sector M/P	PMU	PMU	DOC	City's people's committee	DOC	DOC	PMU		City's people's committee
	Pre F/S		PMU	DOC	City's people's committee	DOC	DOC	PMU		City's people's committee
	F/S		PMU	DOC	City's people's committee	DOC	DOC	PMU		City's people's committee
	Design		PMU	PMU		PMU	PMU	PMU		City's people's committee
	Construction		PMU	PMU		PMU	PMU	PMU		City's people's committee
	O/M		PMU	PMU		PMU	PMU	PMU		Urban infrastructure public corporation
	Role of the provincial DOC	Mainly responsible (examination and inspection)		Mainly responsible (examination and inspection)	Observer (hardly involved)	Mainly responsible	Evaluates up to the basic design and is responsible for the management of facilities, but not deeply involved.	Gives technical advice and orientation	Mainly responsible	
Creation of PMU		PMU for storm drainage and waste management handles also sewerage service		Within the public corporation (Comprised of the corporation's members)	Not created	Within the DOC (Recruited from among local authorities) * In case of large-scale projects	To be created within the public corporation (Comprised of the corporation's members)	Within the public corporation (Comprised of the corporation's members)	To be created within the public corporation	Not created
Wishes for training	Sewerage service operation	X	X	X					X	X
	Planning	X	X						X	X
	Design and cost calculation	X	X		X	X			X	X
	Construction								X	X
	Maintenance and management	X	X	X	X	X	X	X	X	X
	Remarks			Training by DANIDA provided	No participation	No participation	Training by GIZ and DANIDA is not sufficient	Training by GIZ and DANIDA is not sufficient		
Wishes for assistance to project implementation	Replacement of PMU functions								X	
	Dispatch of experts			X		X			X	
	Technical advice and evaluation	X	X	X		X			X	
Wishes for R&D	Introduction and verification of new technologies			X						
	Development of standards, etc.									
	Certification of products									
Remarks				In Da Lat city, expansion is under way In Bao Loc city, F/S is under way		Sewerage works are yet to build * Has experience in the installation of a treatment plant in an industrial zone	Construction under way in Cao Lanh city in the province	Design under way		Project is suspended

Source: JICA Study Team

1) Issues of survey target provinces and cities in sewerage works

Surveyed provinces and cities had same issue as Japan experienced, such as ensuring number of engineers and their capacity development, planning of sewer, construction technology of sewer, house connection, know-how of O&M, water quality management, and sludge treatment.

a) Issues of law and policy on sewerage sector

- Fund shortage in sewerage works
- Issues related to house connection including connection cost
- Pumping upsewerage to road from house which evaluation is low because facing toward a river and issues on house connection

b) Shortage of human resource

- Engineers graduated from environmental engineering or sewerage engineering are limited to be 1 to few persons in provinces/cities starting sewerage works.
- There are not sufficient number of engineers disposing of sewerage knowledge hence these provinces/cities have to replace human resources from water supply sector or others.
- As described above there are 72 cities implementing sewerage works but even in these cities it is difficult to secure enough engineers dealing with construction/O&M of sewerage sector.

c) Shortage of experience

- Shortage of theory on sewerage planning, experience and know-how in many municipalities result they do not know how to proceed a sewerage work.
- Binh Duong Province applied microtunneling technology for sewer construction, however there are many challenging issues because of lack of knowledge, experience and know-how.
- Lack of knowledge, experience and know-how which are necessary for construction safety and reduction of construction cost

d) Lack of various manuals

- There is no manual necessary for facility planning, design, and construction supervision. Municipalities refer to cases in developed countries, but this causes issues such as misselecting treatment method or equipment which are not necessarily appropriate to Vietnam.
- Cities providing sewerage service do not dispose of manual on house connection and guide plumber based on experience, thus there are frequent problems.
- Even in the advanced cities such as Ho Chi Minh, no manual of sewer inspection and ,aintenance not O&M constract standard raise many issues.

- Pumping from house is low and facing toward a river to higher sewerage system and problemson construction works of house connection.

e) Problems of O&M

- Lack of necessary guidance on water quality analysis such as biological test (microscopic examination), thus effective water quality analysis cannot be implemented.
- Absence of effective O&M because of lack of knowledge, experience and know-how
- Sludge treatment and disposal in big cities

2) Needs on Sewerage Works of Target Cites

a) Needs for training

Results of needs obtained from visit survey and literature review are shown in the Table 2.1-19.

Provinces and not-yet-started cities expressed their needs in overall aspects of sewerage works such as planning, design, construction supervision, O&M, and management, as they will start projects in the work.

Also, following needs were expressed by provinces and cities already implementing sewerage works.

- General knowledge on sewerage facilities design from those which are planning expansion of facilities but do not take advantage from experience of existing facilities such as treatment process and equipment.
- Skill up of engineers being able to conduct appropriate O&M
- Some cities have problems for increasing and collecting sewerage tarif thus public relations to obtain understanding from residents.
- Public relation to build up awareness in some cities in order to solve issues on tariff amendment and collection

Besides, cities in central and Southern part of the country requested organization of training courses in other cities such as Ho Chi Minh City since they have financial problems to pay for the travel expense.

Table 2.1-19 Needs for Training

Item		Description
Sewerage technology	City without sewerage	These cities do not have engineers with practical knowledge and experience in maintaining sewerage systems.
	City with sewerage	Because sewerage is a relatively new technology introduced recently in those cities, they have used it for a brief period. Therefore, there is little accumulation of knowledge and expertise.
Individual issues	Management	-
	Planning and designing	-
	Designing sewer	Technology of house connextion in lowland (Lam Dong Province)
	Cost estimation	Efficient cost estimation technology (Ho Chi Minh City and Binh Duong Province)
	Cleaning of sewer	Advanced technology of sewer cleansing (Binh Duong Province)
	Inflow of rainwater and infiltration of ground water	Rainwater inflow (Binh Duong Province)
	Wastewater treatment	Operation with low-concentration sewage (Binh Duong Province) Reduction of the utility costs (Binh Duong Province)
	Water pollution	Measures against non-point source pollution from farmland (Lam Dong Province)
	Environmental measure	Measures against offensive odor (Binh Duong Province)
	Disposal of sludge	Technology for effective use of sludge (Ho Chi Minh City)
	Maintenance	Knowledge and expertise in the maintenance in general (Lam Dong and Bac Ninh Provinces)
	Safety	Safety measures during the construction against electrocution and heatstroke (Binh Duong Province) Safety measures in the maintenance work against hazardous gases and infectious diseases (Binh Duong Province)
	Financing public relation/public hearing	Installation of of house connections and wastewater discharge (Binh Duong and Dong Thap Provinces) Problems associated with the sewerage user charges (Binh Duong Province)
Number of engineers (potential trainees)	PMU	Number of staff: 2 - 5
	O&M	Number of staff in a company operating services of and urban drainage systems: 200 - 500
Venue and training costs		Hanoi is too far. (The cities in the central and southern regions) It is difficult to secure the budget for the training. (Bac Giang Province)

Source: JICA Study Team

b) Needs for assistance in project implementation

The Table 2.1-20 shows the needs revealed in the visit survey and existing documents.

The differences in the needs found between the cities that do not have sewerage systems and the

cities that have the systems are described below.

- Cities without sewerage systems

The DOCs of these cities do not have a section specifically for sewerage. Most of these cities do not employ an expert in sewerage among their staff. While they are supposed to assess and evaluate plans for sewerage development and designs of sewerage systems, there is a concern that they may not be able to perform these duties under the above-mentioned circumstances. Therefore, they require not only technical assistance but also dispatch of engineers to undertake whole or part of the PMU function.

* This visit survey revealed that a sector master plan for the sewerage project in Nam Dinh City had not been formulated and that assistance in the implementation of the project was requested. Therefore, this city can be a candidate site of the pilot project including undertaking of the PMU functions.

- Cities with sewerage systems

The DOCs of these cities do not have a section specifically for sewerage or most of these cities do not have sewerage engineers among their staff, as sewerage system employs, they have experience in the development of sewerage systems from their planning to construction through the other infrastructure development. Many of the provinces of project implementation in this survey have assigned the PMU function to public utility companies and the staff with experience of water supply projects. Accordingly, these cities in general request technical assistance to VSC. In the cities that plan to extend the sewerage systems, the PMUs for the implementation of the initial projects are commissioned to operage sewerag systems These public companies are expected to implement the extension projects (public utility companies serve as PMUs), therefore, they tend to request only technical assistance.

Table 2.1-20 Needs for Assistance in Project Implementation

Item	Description/problems
Employment of personnel for sewerage projects	Employment of personnel with experience in sewerage projects (Bac Ninh Province, Uong Bi City, Nam Dinh Province, Dong Thap Province, Hau Giang Province, Bing Duong Province and Ving Long Province)
Planning and designing of sewerage development projects	Selection of appropriate technologies (Bac Giang Province) Review of the sewerage development plan and facility designs (Hau Giang Province)
Disposal of Sludge	Technologies for effective use of sewage sludge (Hanoi and Ho Chi Minh Cities)
Project implementation support	Support for Bac Gian City and towns, comprehensive support including PMU (Nam Ding Province)

Source: JICA Study Team

c) Needs for R&D

The interview surveys and field reconnaissance, which were conducted in the cities operating sewerage systems in the field survey, revealed that they had a need for manuals and guidelines as well as to solve technical problems. The Table 2.1-21 shows the needs revealed in the survey.

Some of the cities require the introduction of technologies appropriate for the local circumstances and customization of the introduced technologies. The number of requests for R&D was small presumably because of the lack of experience in the sewerage sector and the low level of technical capacity of the persons.

Table 2.1-21 Needs for R&D

Item	Description/problems
Sewerage technology in general	Dissemination of the information including design guidelines and the technical terms used in the sewerage sector (MOC and all the provinces and cities visited in the survey)
Water quality control/ designing of treatment facilities	Selection of appropriate treatment process (MOC) Methods to design and operation for low concentration sewage (Bing Duong Province)
Standardization of the materials and equipment of sewerage system	Standardization of manholes, manhole covers, microtunneling method etc. (MOC and Hanoi City)
Measures against corrosion by hydrogen sulfide	Measures against concrete corrosion of by hydrogen sulfide (MOC and Hanoi City)
Disposal of Sludge	Technologies for effective use of sewage sludge (Hanoi and Ho Chi Minh Cities)
Operation of sewerage systems	O&M plan, management plan of sewerage works, responses to inquiries from the people, etc. (Ho Chi Minh City and Bing Duong Province)
Environmental measures	Measures against odor (Bing Duong Province and Da Lat City)
Cost norms	Cost norms and unit prices

Source: JICA Study Team

2.1.6 Questionnaire Survey

(1) Purpose of Survey

In the field survey, the cities are limited. We selected the questions for "Needs survey" and exploited needs from more cities.

(2) Selection of the Targets

The questionnaire survey was conducted over the phone and using e-mail. 39 cities gave responses to the questionnaire. All the 39 cities are operating WWTPs. 34 of them responded that they were planning the extension of the sewerage systems.

(3) Contents of the Questionnaire Survey

- Necessity of sewerage
- Roles of sewerage
- Willingness to pay sewerage user charges
- Expectations of VSC
- Training subjects
- Intention to participate in the pilot training

(4) Results of the Questionnaire Survey

The responses were very positive by the fact that the asked questions did not commit in any interests. The aggregated results are shown in Appendix 8-3.

(5) Summary of the Results of the Questionnaire Survey

1) Necessity of sewerage

While all the cities responded that they felt sewerage necessary, none showed strong conviction on the necessity. This may be because people's understanding on the role of sewerage system might be still low. Public awareness campaign on daily basis might be an important activity to raise the residents' understanding.

Table 2.1-22 Necessity of Sewerage

Sewerage is necessary	Reply	Yes
Strongly feel	39	0
Feel	39	39
Do not feel much	39	0

Source: JICA Study Team

2) Roles of the sewerage

Many responded that the mitigation of inundation was the primary role of the sewerage (87%), followed by the improvement of sanitary condition (13%). The necessity of its role in the improvement of water environment was least prioritized in the responses of all the cities.

Table 2.1-23 Roles of the Sewerage

Priority role of sewerage	Reply	1st	2nd	3rd
Mitigation of inundation	39	34	5	0
Improvement of sanitary condition	39	5	34	0
Improvement of water quality in water body	39	0	0	39

Source: JICA Study Team

3) Willingness to pay sewerage user charges

All the cities acknowledge that the payment of sewerage user charges is necessary on the condition that the charges have to be low. However, it would be impossible to operate sewerage works unless improving this situation.

Table 2.1-24 Willingness to Pay Sewerage User Charges

Pay user charge	Reply	Yes
Yes, definitely	39	0
Yes, if the amount is small	39	39
No	39	0

Source: JICA Study Team

4) Expectations of VSC

15 of the 16 cities that responded to the question on the roles of VSC acknowledged the necessity of the training, project implementation support and R&D functions of the center in the responses to the questionnaire. The number of the respondents to the questions on VSC was 16, only about 40% of the 39 cities that responded to the questions on the understanding of the sewerage. This reduction suggests the difficulty in understanding the roles and functions of VSC in the questionnaire and telephone surveys. 1 city responded negatively to the question on the functions and training program of VSC.

Table 2.1-25 Roles of VSC

Expectation of VSC	Reply	Yes	No
Training	16	15	1
Technical assistance	16	15	1
R&D	16	15	1

Source: JICA Study Team

5) Training subjects

The respondents felt that the training on the planning of sewerage systems, designs of sewer, treatment plants, O&M, and management of sewerage systems were necessary. Because the cities that responded to this question are operating sewerage systems, they emphasize the necessity of the training on O&M.

Table 2.1-26 Training Subjects at VSC

Kind of training	Reply	Yes, strong feel	Yes, feel	Not feel much	No
Planning	16	7	8	0	1
Design (sewer)	15	6	8	0	1
Design (treatment plant)	15	5	8	1	1
O&M	16	11	4	0	1
Management	14	7	6	0	1
Others	0				

Source: JICA Study Team

6) Intention to participate in the pilot training

All but 1 of the 16 cities responded positively to the question on the intention to participate in the pilot training.

Table 2.1-27 Intention to Participate in the Pilot Training

Pilot training	Reply	Yes	No
Willing to participate	16	15	1

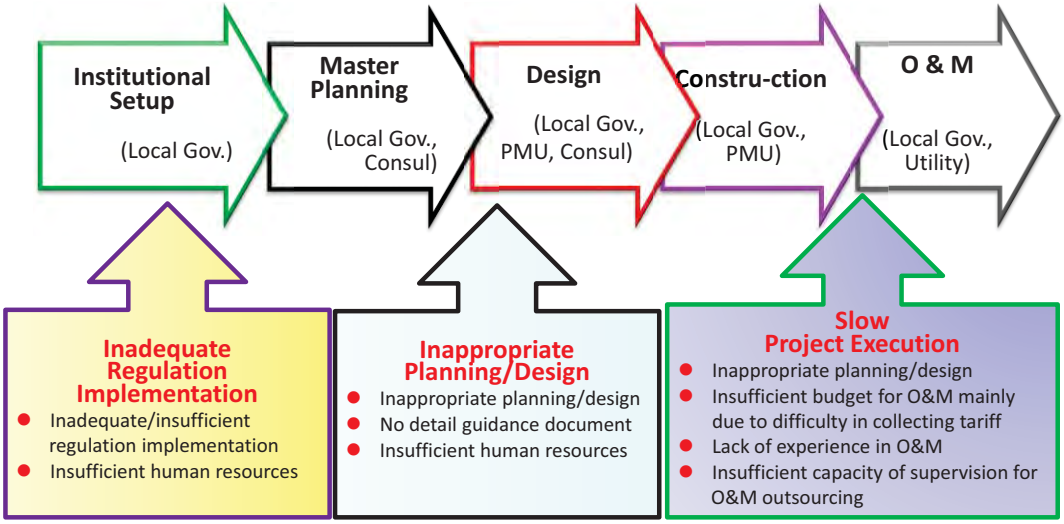
Source: JICA Study Team

2.1.7 Summary of Needs Survey

To enhance implement capacity in sewerage sector, problems and needs for VSC's 3 functions are summarized below.

(1) Needs for Overall of Sewage

In Vietnamese sewerage works, there are many issues from the planning stage to stages of Initial setup, master planning, design, construction, and O&M as follows.



Source: JICA Study Team

Figure 2.1-16 Needs for each phase of sewerage works

Table 2.1-28 shows summary of issues collected from literature survey, field survey, and interviews divided into implementation phases and technical fields of sewerage system.

Table 2.1-28 Project Implementation Procedure/Issues associated with Sewerage Technology

Procedure of implementation	Technical field		
	Planning	Piping・pump	Treatment plant
Implementation Plan	・Difficult to secure killed engineers. ・To be delayed since land expropriation affects commencement of project ・Knowledge on sewerage technology and project implementation is inadequate and it takes time to obtain approval ・As a result of the time-consuming formalities, inflation has progressed. For this reason, it is difficult to secure the necessary financial resources. In addition, sewerage planning area and project	・Knowledge about propulsion and sewer rehabilitation methods are insufficient and sewer planning is inadequate ・Numerous booster pumping stations are used and consideration for maintenance is insufficient ・Evaluation of house connection to the separated sewer system is inadequate, and the amount of collected sewage is inferior to the planned amount. ・Environmental problems such as the presence of sediments in the sewer and odor generation occur due to the evaluation of	・Estimations of water quality and pollutant load are inadequate and excessive facilities are being planned ・A change in the wastewater treatment process caused a review of the project plan. ・Inadequate consideration of stepwised development plan for treatment facilities such as not being able to respond to idle treatment facilities and their improvement ・Lack of knowledge about selection of site area and treatment processes imposes burdens on treatment costs, disinfection, and sludge treatment ・The impacts of the selection of treatment facilities and

	implementation plan were revised. ・Investigation of sludge utilization plan is not enough in major cities ・There are cases where treatment of septic tank sludge is not reflected in sewerage plan. ・Features of the interceptor type sewerage system is not shared and evaluation of CSO (combined sewer over flow) is confused.	existing facilities and the poor sewer design ・Since there is no public institution to evaluate sewerage technology, standardization of quality and specifications has not been established.	discharge points locations on water use at the discharge point have been a cause of concern ・Since there is no public institution to evaluate sewerage technology, standardization of quality and specifications has not been established
Detailed design	・Social understanding of intellectual property rights with respect to sewerage system is insufficient ・New technologies and know-how are not appropriately reflected in the project.	・Design knowledge such as the influence on surrounding ground and ground subsidence is insufficient. ・Knowledge about evaluation and accumulation of new technologies are appropriate.	・Accumulation of technologies and know-how is insufficient and adequate consideration is not reflected to equipment specifications and selection ・Adequate knowledge of maintenance costs· and maintainability is inexistent. ・Knowledge about evaluation and accumulation of new technologies is appropriate
Construction	・There is a lack of consideration for location selection as regards main sewer routes and treatment plants such as land acquisition and planning of road use for private and construction purposes.	・Lack of knowledge about retaining walls causes accidents associated with ground subsidence ・There is a shortage of knowledge of construction safety ・Collection costs such as those of sewage from low-lying ground are burdensome.	・Inappropriate knowledge of equipment selection resulting in the selection of unused equipment
Maintenance	・Facilities are becoming idle owing to the inconsistency between sewer and treatment facilities business plans ・Institutionalization of sewerage tariff is delayed ・Databases on seeweragеservice rate, sewerage served population, planning and design specifications etc. are not well developed.	・Formulation of maintenance plan and databases are not institutionalized ・Numerous booster pumping stations are used and maintenance and operation are troublesome. ・Know-how about contents of maintenance work and implementation method are required	・Decision on O&M plan and know-how about its utilization is insufficient ・Lack of knowledge about proper operation and cost reduction ・Knowledge of water quality and treatment process is insufficient, and quality of treated water in terms of BOD and· T-N etc. is unstable ・Knowledge on safety is required

Source: JICA Study Team

Regarding VSC, main results of needs survey obtained by hearing and survey table are shown in the Table 2.1-29.

Table 2.1-29 Main results of needs survey

Major survey items	Results
Strengthening of management capacity	100% of provinces and cities need it
VSC`s Functions	100% of provinces and cities pointed out that the combination of the three functions is effective.
Sewerage Technology	100% of provinces・cities considered it to be a new technology.
Human resources	100% of provinces・cities need sewer engineers / experts.
Training expenses	100% of provinces・cities in central and southern areas emphasized that it is difficult to budget for travel expenses and hope for local training.
Finance for commercialization	Concerning ADB's pre-FS (commercialization support) cities, commercialization was impossible without grant aid.
Survey targets / cities	12 provinces・cities (Hanoi, HCM, Da Lat (Lam Dong), Na Dinh, Uong Bi, Bac Ninh, Binh Duong, Bac Giang, Ben Tre, Cao Lanh (Dong Thap), Vi Thang (Hau Giang), Vinh Long

Source: JICA Study Team

Appropriate VSC institution design includes comprehensive discussion on issues raised by overseas donors and potential issues confirmed by this work, in addition to the issues and needs gained from interviews with local governments (provincial and municipal). It is important to analyze and make a judgment.

Engineers with adequate knowledge on sewerage are lacking. Besides, sewage treatment technology and facilities are not suited to social and economic conditions in Vietnam, often adopted by entrusting to consultants or engineering companies. As a result, problems such as O&M are not performed appropriately, and forces to operate uneconomical operation which cannot obtain the planned water quality through treatment, and the like occur. Also, due to lack of management skills, delays and improper enforcement have occurred. Even in the O&M stage, maintenance tools such as management plan and PI (business indicator), various manuals/scopes and SOP are inadequate. Therefore, quality of treated water does not always comply with wastewater effluent standard.

In order to solve these problems and needs, each function of VSC is proposed below.

Table 2.1-30 Problems and needs of the Project

	Current Situation	Resulting Issues	Needs
DOC	No dedicated personnel in charge of sewerage sector. Water supply and civil engineering background personnel often covers the sewerage sector.	Master planning and project planning is fully dependent on the consultants who often apply one-size-fits-all approach without taking into account local conditions.	Trainings on basics of sewerage planning, basics of sewerage engineering (mechanical, electrical, biological, etc.) Project implementation support
PMU	[Large Cities] Limited experience in doing international competitive bidding and managing contractors under FIDIC conditions. Limited knowledge on specific issues such as sludge management. [Medium and Small Cities] Non existent or limited experience in managing construction projects in general and sewerage projects in particular.	Project implementation is delayed especially during the procurement stage Erroneous selection such as unappropriated technology, equipment & material to local condition, low efficiency and high-cost for O&M, etc.	[Large Cities] Trainings on Procurement and contract management Trainings on specific technical issues such as sludge management, microtunneling method Project Implementation support [Medium and Small Cities] Some kind of comprehensive support mechanism for boosting PMU's capacity.
Operator	[Large Cities] Lack of SOP of sewer management Weak financial source [Medium and Small Cities] Limited experience in O&M of WWTP as well as large cities	Low operation rate of WWTP, low rate of house connection rate, etc. Waste of energy & cost, improper O&M planning, etc. Severe damage of equipment due to lack of periodical maintenance know-how Sometimes violating WQS of BOD, COD, NH3, P. No indicator is set thus management is insufficient	Training of wastewater treatment Providing O&M manual Obtaining efficient management know-how Enhancing public relation know-how

Source: JICA Study Team

(2) Needs for Support Project Implementation Support Function

CSS's scheme (supported by ADB) is taken as a case which resembles to the VSC's project implementation support function.

1) Description of the project

The Table 2.1-31 describes the sewerage project being implemented in southern Vietnam with assistance from ADB.

The sewerage project consists of construction of WWTPs, sewer and relay pump stations financed by ADB's loan in the context of "Urban Climate Change Resilience Program for Viet Nam". The treatment capacity of WWTPs of the sewerage project in smaller cities around Mekong Delta and HCM are within the range of 2,500 – 27,000m^3/day. The aerated lagoon system has been adopted due to minimum mechanical facilities. In addition, small-scale treatment plants of 700 – 1,500m3/day are being constructed as part of decentralized sewerage systems. The scale of the project cost is 15 – 50 million USD per city and 146 USD per person. The technologies required for this project are basic design and construction management technologies for the construction of the sewer and aerated lagoon treatment processes.

Table 2.1-31 Sewerage Project Assistance from ADB in Southern Vietnam

City	Proposed Sanitation Component	Population	Budget		ADB (M.USD)
			Project Cost (M.USD)	Project cost (USD/cap.)	
Ben Tre	Phase 1&2: 3,000m^3/day - aerated lagoon, 4 x 700 – 1200m3/day (decentralized), 59km sewers, 7 PS, Drainage upgrade	231,904	50	215.6	45
Lagi	Phase 1: 4,000m^3/day - lagoon, 3km sea wall, combined system rehabilitation, 4 PS	112,588	25	222.0	20
Vinh Long	Phase 1: 7,000m^3/day – lagoon + 2 x 1,100m3/day (decentralized), 40km sewers, 7 PS, Drainage	147,039	20	136.0	15
Sa Dec	Phase 1: 5,000m^3/day - lagoon, 82km sewers, 8 PS	152,237	20	131.4	15
Vi Thanh	Phase 1: 2,500m^3/day - lagoon, 1 x 1,000m3/day (decentralized), 65km sewers, 5 PS	190,200	15	78.9	10
Bac Lieu	Phase 1: 3,000m^3/day lagoon, 2 x 1,500m3/day (decentralized), 36km sewers, 4 PS, 3km canal dredging	190,045	20	105.2	15
Average		-	-	146.5	-
Total		-	150	-	120

Source: JICA Study Team, data collected from ADB

Aplied wastewater treatment processes in operation and construction are the advanced activated sludge treatment for the removal of nitrogen and phosphorus, activated sludge process, trickling filter process, aerated lagoon process and other processes with adopted in 5, 39, 3, 11 and 5 WWTPs respectively, in operation and under construction. The activated sludge process is used in many plants in the cities with advanced sewerage systems, i.e. large cities and tourist cities, where only limited space is available for constructing the plants.

2) Needs for PMU functions

Of the sewerage development projects, 26 cities were in the planning stage, 8 in designing stage, 17 in construction and 21 in the operational stage.

Among 7 target cities of the visit survey in the planning stage. Nam Dinh City is the only city that has not established a PMU. The other 6 cities intend to assign the PMU function for the sewerage projects to the existing PMUs established for other urban infrastructure development projects. The technically complex activated sludge process has been adopted in the WWTPs found in large cities and tourist cities with advanced sewerage systems. The rural cities tend to adopt simple technologies such as the aerated lagoon process for the easy of maintenance.

Even the cities operating sewerage systems plan to implement sewerage projects in multiple processing districts. The interview survey has revealed that new WWTPs are designed and constructed under the leadership of consultants and engineering companies because the knowledge and expertise in the selection of wastewater treatment methods and equipment and outsourcing construction works have not been accumulated sufficiently in the governments.

Ordinary local governments implement a project for constructing a wastewater treatment facility intermittently at intervals of 10 to 20 years. The needs for the projects mentioned below are expected at the O&M stage of maintenance of sewerage systems.

- Projects to treat and use sewage sludge that is expected to increase according to the development of sewerage systems
- Projects to increase processing capacity with consideration to the environment in response to the increase in water use due to the progress of urbanization and intensive land use
- Projects to improve wastewater treatment functions in response to the change of (increase in) water use in a river basin and need to recycle treated wastewater
- Project to regularly reliable wastewater treatment facilities

A local government will be able to evaluate wastewater processing methods appropriately and construct efficient and high-quality WWTPs with the support of engineers of VSC in those highly technical projects.

3) Challenges in the process to the implementation of sewerage projects

The field survey revealed that the cities visited in the survey had a challenge in building up awareness of citizens and city council members of the importance of the sewerage projects by preparing a sewerage master plan and conducting FS.

ADB, which has confirmed its intention to support the development of sewerage systems in Vietnam, supports the education to PPCs and citizens on issues in the water environment and sanitation in order to solve the problems in the formulation and implementation of sewerage projects. ADB provides a series of assistance, including grant aid for the formulation of a plan for a sewerage development project (pre-FS) and commitment to financial assistance to sewerage projects to be implemented in future, to a city intending to implement a sewerage development project.

4) Proposal on the project support function (conclusions)

There is still a possibility that VSC can support implementation of commissioned sewerage development projects in the processes from the formulation of a master plan to the approval of FS, detailed design, commissioning of construction work and execution supervision in some cities.

Specifically, PPCs hope VSC to promote project implementation, in other words, elaborate appropriate plan for earlier realization including financial source. For example, Nam Dinh city, as one of candidate cities, is hoping VSC's promotion function not only for elaboration of master plan but also for the further stage, which is construction of sewerage facility. The need is equivalent for many cities of the same scale to Nam Dinch city, especially in regard of introduction of new technologies such as micronutuennel technology and sludge treatment method.

VSC can conduct its technical assistance for the enhancement of O&M capacity since it is a field which requires know-how on O&M and management of sewerage sector. As shown in the Table 2.1-32, some cities have needs on formulation of a master plan to the approval of FS, detailed design, commissioning of construction work and execution supervision. For cities having established PMU, VSC can support DD and procurement as well as dispatch its staffs for construction supervision. For the enhancement of O&M, VSC could replace part of PMU's

function by supporting from VSC headquarter.

The Table 2.1-32 shows mid- and long-term needs collected through the needs survey, summarized in August 2016.

Table 2.1-32 Needs of the Project Support Function (Short-Term and Mid-Term Plan 2016-2020)

	PMU function (Whole)	PMU function (Part)
Target cities	Nam Dinh City	1 – 3 cities in the project area of the ADB project (Mekong Delta Region)
Main activities	Development of new sewerage systems Review of Master Plan and support to pre-FS Evaluation of FS and assistance to LA DD/assistance in procurement Execution management (construction of sewer and WWTPs) Strengthening of O&M capacity (by VSC Headquarters)	Development of new sewerage systems DD/assistance in procurement Execution management Strengthening of O&M capacity (by VSC Headquarters)
Project cost	Option-1: ++ USD/year Option-2: Project cost ×XX%	Option-1: ++ USD/year Option-2: Project cost × Y%

Source: JICA Study Team

When sewerage development progresses to the O&M stage, the number of projects for the expanding treatmen capacity and upgrading of the process, construction of sludge treatment and recycling facilities, as well as reconstruction and renewal of facilities will increase, in addition to those for the construction of new facilities. At the same time, the importance of the function to provide technical support (consultation) to issues on O&M and business management will also increase. As issues and O&M and management of the projects will decrease, with the exception of some specific projects such as those for constructing sludge incinerators, it will become difficult to place the (whole) PMU function at project sites.

Table 2.1-33 Needs of the Project Support Function (Long-Term Plan 2020 and Later)

	PMU function (Whole and Part)	Consultation
Target cities	Among 72 cities in the present circumstances Condition A: 6 cities Condition B: 3 cities (Cf. Table 2.1-15, 16)	Hanoi, Ho Chi Minh, Binh Duong, Hai Phong, Da Nang, Others
Main activities	Sewerage development projects for the improvement and renewal of the functions ・ Review of MP and support to pre-FS ・ Evaluation of FS and assistance to LA ・ DD/assistance in procurement ・ Execution management (construction of sewer and WWTPs) Strengthening of O&M capacity	Projects for the renewal and up-grading of WWTPs ・ DD/assistance in procurement ・ Guidance of execution management and confirmation of functions ・ Project for disposal and recycling of sewage sludge ・ Pre-FS ・ DD/assistance in procurement ・ Guidance of execution management and confirmation of functions
Project cost	Short- and medium-term action plans of VSC shall be reviewed and a management plan shall be formulated using the review results.	

Source: JICA Study Team

(3) Needs of training function

1) Needs of training function

Responding to the needs for training and human resource development, all responded cities got "required". Regarding the subjects of training, training content and methods of training, we propose "to feed back the know-how gained through project implementation and R&D to the training for the practitioners," proposed by the study team, are agreed with all the cities. In addition, they expected the problem solved by the practitioner such as maintenance method maintenance consignment method (specification regulation, price etc.) required for O&M work, equipment maintenance and management method to reduce O&M and, safety and labor accident prevention etc.

Understanding of training for human resource development differs for each PPC and CPC. Water company understands the necessity of training and conducts training internally. Binh Duong Province (BIWASE), etc., which has financial resources and personnel foundations for integrally operating large cities such as Ho Chi Minh City and water supply and sewer systems, has established a training department. However, there are several cities that it is difficult to request training costs and budget requests in the public corporation reporting to the PC.

Table 2.1-34 Needs of training function

Items	Details of the training needs
The need of the training	Answer, "it is necessary" in all cities
The person who is targeted for the training	Answer, "the training for a manager, the engineer" to suggest "agrees" to VSC Preference to set a training course in accord are with abilityand the carrier of the student attending a lecture.
Training contents	Practicable training for the practitioner is are necessary. It is agreeable in feeding back know-how provided by technology development, a project implement support function for the training. The practical training using true facilities in operation is effective. Only in foundations of universities study, it is inadequate for the sewerage works.
Piority subjects	
New business start city	A sewerage plan, the design of the duct line, construction management, the selection of wastewater treatment process.
City during a business operation	The evaluation of the new technology, specifications, the price of facilities, the O&M constract, work-related accident, know-how to reduce O&M
Place of the training	Only in the northern part, the cities in the middle southern Province could not participate. Even city in central, and or southern part want to make an opportunity of the attendance training in branch school, or business trip training.
Expense of the training	The budget preparation of the travel expenses is difficult.
Period of the training	The manager class hopes for several days. The nucleus engineer class thinks that 1-2 weeks are suitable.
Completion qualification of the training	The interest in training qualification system was sent.

Source: JICA Study Team

2) Recommendations on the training function

a) Sharing of responsibilities with other donors (GIZ/VWSA and DANIDA)

GIZ is implementing a project focused on the development of training modules and TOT for water companies, in cooperation with VWSA, in order to extend the training in the water supply and sewerage sectors. VWSA looks forward to the cooperation with VSC. It will be essential for VSC to create a training plan with no overlap with the existing training plans of other organizations.

Enhancing of the management capacity of managers and engineers shall be the highest priority training function of VSC and VSC shall offer training programs that continuously provide expertise required in the field of work to the trainees. From this, solutions learnt through VSC's training in order to solve the issues of sewerage works will be disseminated to municipalities in whole Vietnam.

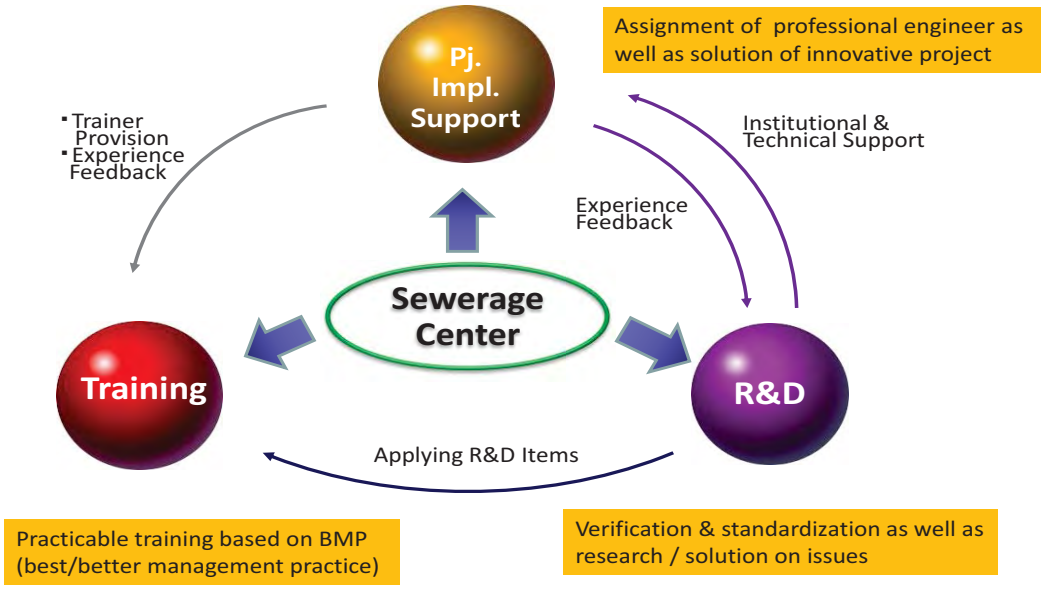
Table 2.1-35 Recommendations on the Training Function

	GIZ/VWSA, DANIDA	VSC (JICA)
Objectives of training	Enhancement of management capacity in O&M of sewerage facilities Conveying know-how required for practical business	Enhancement of implementation capacity of sewerage works Conveying know-how required for practical business
Trainees	Mainly technicians (including managers and engineers of PMU)	Managers and engineers (future managers)
Target Cities for the Training	Mainly for the water companies in the southern region Cities in northern and central Vietnam supported in ODA projects	DOCs, PMUs and water companies in the whole country
Training contents	Enactment of by laws on the management of sewerage systems Tariff charging system Maintenance contract	O&M, management, Development of sewerage systems and sewer construction Wastewater treatment and O&M
Training method	TOT, on-the-job training	On-the-job training
Training material	Modularization of existing knowledge Exchange among trainees	Using feedback manual made from solutions which are learnt through VSC's implementation support and R&D functions

Source: JICA Study Team

b) Mutual complementation with implementation support and R&D function

In implementation of sewerage project, various problems arise when O&M starts through construction stage. In order to provide sustainable sewage service, it is important to incorporate know-how and new technology brought about by technological developemntI in social conditions in addition to solving individual problems into O&M. As shown in the following figure, VSC strengthens the practical ability of engineers by feeding feedback on know-how and providing manuals obtained in project implementation support and R&D.



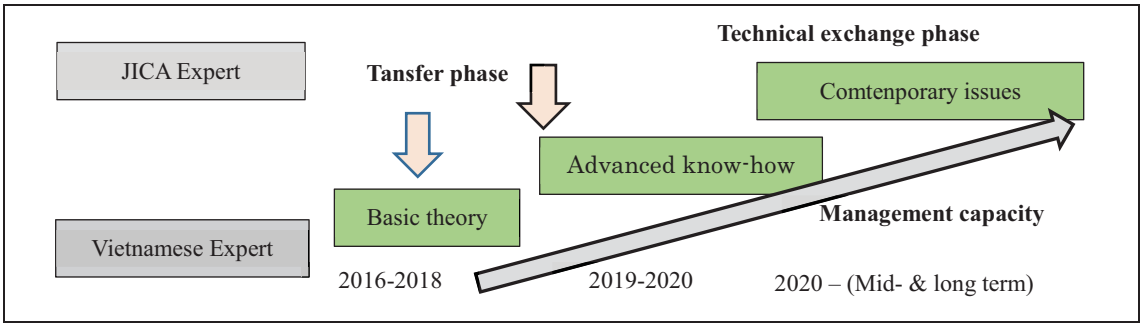
Source: JICA Study Team

Figure 2.1-17 Mutual complement mechanism of VSC's three functions

c) Step-wise reinforcement of the training function and technology transfer (TOT)

Know-how on technical and administration (management and public relation) is required for establish management foundation of sewerage woks.

Although their lecturers and staff have basic knowledge of sewerage, they do not have practical work experience in the sewerage sector. Therefore, JICA experts shall prepare textbooks of the training and give lectures to trainees to transfer expertise required in the practical work step-by-step, in the short run. Later, the training shall be developed into technical exchange in which Japanese and Vietnamese experts exchange their experience as equal partners, in the medium to long run.



Source: JICA Study Team

Figure 2.1-18 Step-by-step trainer development

d) Utilization of external human resources (out sourcing)

Practical experience is indispensable to properly manage the sewerage project. Training of the Japan Sewerage Works' Association, the inhouse lecturer is in charge of the planning and management of the training course, and reflects the needs of the trainees according to the time in the training. However, hiring numerous experts as lecturers is not appropriate due to the project volume of the training and the expertise of the training subjects. The practitioners in charge of the project are familiar with the solution to daily tasks and the format of daily work. In addition to the tasks of various sewerage projects, engineers of private enterprises also have know-how on handling equipment requiring expertise and new technologies.

By outsourcing, it is possible to respond to the highly-specialized needs that trainees need, and encourage the spread of technology and know-how even in private companies. For the training function of VSC, we propose training plan to utilize external lecturer.

e) Qualification system and financial assistance that make the training function sustainable

The combination of the 3 elements mentioned below will be effective in ensuring the sustainability of the training function of VSC. With this regard, the qualification system for sewerage engineers stipulated in the Sewerage Act and the Japan Sewage Works Agency Act of Japan can be used as reference.

- The training programs shall be based on the practical business and be attractive.
- Both VSC and donors shall implement human resource development efficiently and reduce the financial burden of human resource development by combining the training programs mentioned in this document with the training programs of assistance projects supported by foreign donors including JICA and ADB.
- The quality of designs, construction work and O&M shall be improved and maintained by stipulating the qualification requirements of engineers by a law.

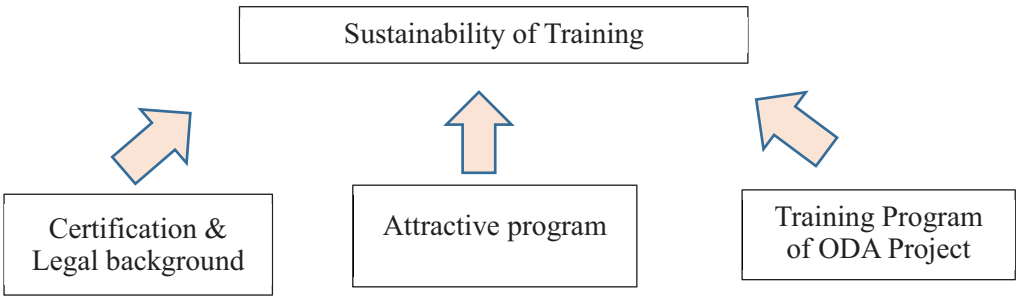
The Sewerage Act of Japan (Designer Qualifications) Article 22. If a Public Sewerage System is installed or reconstructed (excluding the cases specified by Cabinet Order), relevant Public Sewerage System Administrator must not have any person other than those qualified as specified by Cabinet Order perform design of the system (which means formulation of design drawings under its responsibility) or supervision and management of sewerage works (which means verification of construction with the design drawings under its responsibility to confirm if it is performed as specified in such design drawings). 2 A Public Sewerage System Administrator must have no person other than those qualified as

specified by Cabinet Order perform maintenance of Public Sewerage Systems concerning matters specified by Cabinet Order.

The Japan Sewage Works Agency Act of Japan
Chapter 4. Business
Article 26. In order to achieve the purpose set forth in Article 1, the Agency shall conduct the following business activities:
7. Fostering and training persons in charge of technology related to sewerage systems, and conducting technical examinations of persons who engage in the design of sewerage systems, supervision and management of sewerage facilities, or operation and maintenance of sewerage systems, pursuant to the provisions of a Cabinet Order.

The Urban Planning Act of Vietnam stipulates the qualification requirements for engineers and companies to be engaged in urban planning as "(to) possess training diplomas and certificates relevant to jobs," "(to have) university or higher degree in architecture, urban planning, urban technical infrastructure or urban economy" and five years of work experience. Decree on Construction Project Management No. 59/2015/NĐ-CP issued in accordance with the Construction Act regulates the administrative work concerning the issuance of construction licenses. The construction authorities affiliated to MOC issue Class 1 construction license.

Training for strengthening the O&M capacity is included in ODA projects supported by foreign donors as a soft component. The staff of PMUs in the Mekong Delta Region have taken the GIZ/VWSA training in ODA projects. The ODA projects supported by ADB and JICA will contribute to the solution of the financial problem of the trainees and the sustainability of the VSC's operation by incorporating the training programs of VSC in the projects.



Source: JICA Study Team

Figure 2.1-19 Governmental and Financial System that Make the Training Function Sustainable

2.2 Output 2: Structure of the Organization, Function, Tasks and Business Plan for Sewerage Sector are Identified

2.2.1 Support the Establishment of the Sewerage Center Establishment Preparation Unit (in charge of VSC-MOC) by Drafting Necessary Organizational Documents

The establishment of the Sewerage Center Establishment Preparation Unit was agreed during the First Joint Coordination Committee (JCC, hereinafter) meeting. Immediately after that, PMU was settled on April 2016. For the activities during the period of Detailed-Planning Phase, discussion and coordination have been proceeded with its members.

However, the name of the structure is not PMU but PMB, gathering officials from related divisions in MOC to establish VSC.

2.2.2 Draft the Functions, Structure of the Organization, and Business Plan of Sewerage Center by Referring to the Japan Sewage Works Agency and Japan Sewage Works Association

(1) Functions of VSC

VSC will have 3 functions, training function, project implementation support function, and research and development function.

1) Training Function

VSC will develop human resource in sewerage sector in Vietnam. Trainees will mainly from PC. VSC will contribute planning, design, construction of sewerage facilities with excellent quality.

2) Project Implementation Support Function

VSC will support sewerage projects from planning stage to construction stage. To do so, VSC will contribute to improve their quality and to enhance better management.

3) Research and Development Function

VSC collects and arranges knowledge, information and experiences required to implement sewerage projects and offers information including “Planning and Design Guideline for Sewerage Facilities” to promote sewerage system. An organic linkage of the above 3 functions is expected to encourage the efficient, effective management of sewage works in Vietnam.

(2) Training Function

1) Necessity of Training Function

It is urgently required to develop human resource in sewerage sector in Vietnam to carry out sewerage projects which are expected to be spread throughout Vietnam.
Human resource development for both public and private sectors is required in each phase of planning, design, construction, and O&M.

2) Cooperative Organization

MOC has a training institute which is named CUWC. CUWC has Training Center of Water and Environment (CNEE, hereinafter) which deals with training on water sector. CNEE/CUWC does not have sewerage training courses currently, but it is appropriate organization to provide training in sewerage sector since CNEE has several staffs having experience on sewage works.

According to the Article 6 of the Project' specification, "Concerning human resource development", VSC should cooperate with CUWC based on the result of basic planning research of VSC. CUWC's facilities such as lecture rooms will be utilized for VSC's training courses. VSC's lecturers will be CUWC's lectures mainly and lectures from Architecture University and VWSA will be utilized on necessary basis.' VSC will cooperate with these organizations.

GIZ, DANIDA and VWSA currently provide training courses on sewerage in Vietnam. It is effective and efficient to have cooperation with such organizations to carry out training courses.

3) Training Facilities

CNEE/CUWC has training facilities such as classes and dormitories already. Also, hotels are located nearby. It is appropriate to utilize CUWC as training function of VSC to minimize requirement of new facilities.

In principle, training program consists of classroom lecture and site visit to sewerage facilities. Engineering course/WWTP design will have water quality measurement practice using portable device which will be provided by JICA in 2017. Installation plan of necessary equipment for training course will be discussed in 2017-2018.

Currently, CUWC has septic tanks to treat its sewage. If wastewater treatment demonstration plant will be installed in CUWC, trainees can understand sewerage technology easily. The necessity and installation plan of demonstration plant will be examined in 2017 – 2018.

During needs survey, it was requested that training courses should be held other than Hanoi, too. So, VSC will have training courses in southern part using universities' facilities or in CUWC's Hue Branch. Detail plan will be examined in early 2017 and training courses will be held in 2017.

4) Trainees

a) Central/local Government Management

To accelerate implementation of JICA's sewerage projects and to construct facilities with appropriate quality, trainees should be mainly sewerage project members in PCs, such as DOC and PMU.

Training courses will be provided depending on the progress of municipal sewage works in each city. The target cities for VSC's training will be 72 municipalities in class 3 and above. Table 2.2-1 classifies cities based on the progress of sewage works: completed, under construction, under design, and not yet started.

Table 2.2-1 Target 72 cities and their phases of sewerage projects

Target city	Condition	Phase of project			
		Plan	Design	construction	management
Undeveloped/ Not yet started 26 cities	No sewerage planning or complete General Master Plan or Sector Master Plan	○			
Under design 8 cities	Detailed design for sewers and WWTPs are underway		○		
Under construction 17 cities	Procurement and construction for sewers and WWTPs are underway.			○	
Completed 21 cities	Sewers and WWTPs are completed and in operation. Expansion and retrofit and new service areas may be added.	△	△	△	○

Source：JICA Study Team

b) Enterprises Working in Sewerage Sector

VSC will provide a training program targeting engineers of enterprises working in sewerage sector. Table 2.2-2 classifies members of VWSA and shows possible contents of training for them. Through discussion with MOC, trainees from enterprises working in sewerage sector will attend training courses for trainees from central/local government management.

Table 2.2-2 Private companies (Members of VWSA) and possible contents of Training

Category and the number of companies	Possible contents of training
Vietnam Water and Sewerage Association: 42	Basics of Sewage Works, O&M of Sewer and WWTP
Consultant firm: 26	Basics of Sewage Works, New Technology, Planning, Design
Material and facilities company:78	Basics of Sewage Works, Sewer, Wastewater Treatment, Sludge Treatment

Source：JICA Study Team

5) Lecturers

Japanese lecturers joined pilot training in 2016 and will join practical training in 2017-2018. The development of Vietnamese lecturers is necessary to have training program only by Vietnamese lecturers. It is expected that only Vietnamese lecturers will carry out VSC's training program from 2019.

CNEE/CUWU has engineers who have experiences in sewerage; thus, they are candidates for VSC's lecturers. To educate such candidates, training based on On-the-Job Training (OJT, hereinafter) will be carried out. Training program in Japan is expected to be precious opportunity for candidates to have experience and learn sewerage technology. The cooperation of MOC, PCs, and universities is indispensable. GIZ has a TOT training program to develop lecturers with appropriate training skill.

Appendix 8-4 shows a list of the GIZ's TOT trainees. Appendix 8-5 shows the TOT trainees with their specialized field. VSC will appoint lecturers based on these lists. Also, GIZ's trainers and local consultants are possible lecturers. Appendix 8-6 shows the curriculums and name of the lecturers of the first and the second pilot training in 2016. In the pilot training, MOC staffs, CNEE/CUWC staffs, Hanoi city's staffs, GIZ's trainers and local consultants were joined as lecturers.

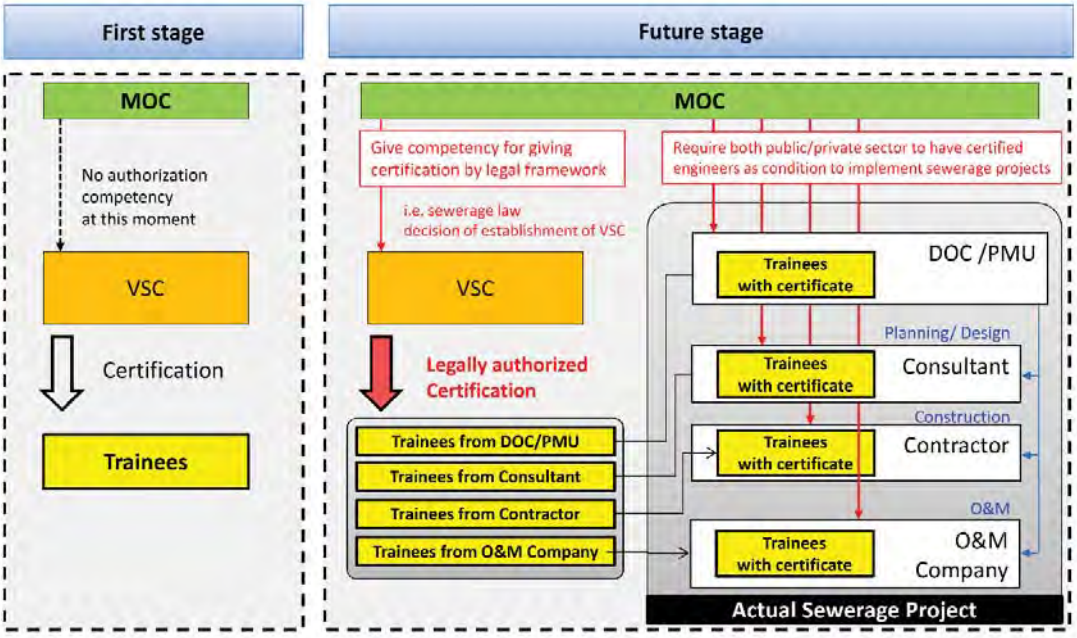
6) Qualification System

CUWC provides certificate to trainees at the end of training. VSC will provide certificate, also. If qualification system which requires VSC's certificate is established, it will be a big incentive for trainees to attend VSC's training courses. Then, human resource development in sewerage sector will proceed; thus, quality of sewage works will be assured and finally we expect to have good water environment in Vietnam. In 2017 - 2018, VSC will study and examine qualification

system. Qualification systems which will be studied are shown follows.

- Sewerage engineer qualification system resembled engineer qualification based on Construction Law
- Qualification as a requirement of contract
- Requirement of JICA project

In 2016, JICA Study Team studied qualification of engineer by Construction Law (Cf. Appendix 8-23). The Construction Law regulates qualification of engineer in each field and step of construction. The Construction Law focuses on private sector, not on public sector. To develop human resource in public sector, VSC will study to set VSC's training course for requirement of JICA's ODA. To develop human resource in private sector, sewerage engineer qualification system based on VSC's certificate, and VSC's certificate as requirement of contract (planning, design, and construction) will be incentive to attend VSC's training courses. Concerning above three qualification systems, VSC will study further to realize qualification system based on further study on Vietnam's situation and further discussion between MOC staff and Japanese experts in 2017 - 2018.



Source: JICA Study Team

Figure 2.2-1 Image of Qualification System

(3) Project Implementation Function

1) Necessity of Project Implementation Support Function

According to the needs survey which was conducted Class 3 and upper cities, JICA Study Team obtained answers saying sewerage technology is new to them and there is no appropriate engineer. Also, a PMU hired a foreign sewerage consultant to compensate the PMU's lack of engineers. From these facts, JICA Study Team confirmed that needs for VSC's project implementation support function are existing.

2) Contents of Project Implementation Support Function

Advantages of VSC's project implementation support function are shown below.

- It is expected that sewerage project will be carried out smoothly and completed facilities with excellent quality when VSC which has experts on sewage works supports PC which has shortage of experience and knowledge on sewage works.
- VSC gathers knowledge on sewerage works and will be a showcase for PCs.

The detail is to be referred in "2.4: Output 4"

(4) Research and Development Function

1) Necessity of Research and Development Function

It can be considered that by diffusing the knowledge on current situation and the expertise acquired in exploring for solutions for various issues in sewage works in Vietnam during trainings, knowledge, information and experiences on sewerage works will be shared and the overall technology level will be enhanced, which will significantly contribute to the sewage works in Vietnam.

The themes for R&D which will be mentioned in "2.5: Output 5" shall be implemented from 2017 to 2018, and based on the outcome, it will be continued from 2019 onwards. In the future, the survey commissioned by donners including JICA, MOC and private companies shall be implemented.

The detail is to be referred in "2.5: Output 5."

(5) Organization and Number of Staff

VSC will be an organization under Administration of Technical Infrastructure (ATI)/MOC at the beginning. It will be examined to be directly under MOC in the future. Minister's decision on establishment of VSC will be officially decided in 2017. At the initial stage, MOC allocates 1

full-time counterpart as well as several part-time counterparts. Salary of the full-time counterpart will be provided by MOC.

After the establishment, VSC will increase its number of full-time counterparts on its self-financing resources. Specific number of staff will be decided once the consideration on the budget plan for 2017 will be done. In this document structure and number of staff are proposed below.

- Organization and number of staff
  - ✓ Director of VSC: 1
  - ✓ Chief Accountant: 1
  - ✓ Training Division staff: 2
  - ✓ Project Implementation Support Division staffs: 2
  - ✓ Research & Development Division staffs: 2

    Total number of staff: 8

Staff in each Division should complete sewerage class in University or have at least 2 years' work experience in sewerage field.

2.2.3 Supporting the Institutionalization of Business Plan and Finalization of the Center-Establishment Dossier to be Submitted to the Competent Authority

In the detailed planning phase, the business plan (draft) was prepared, and in the implementation phase, the plan will be modified aligning with the status of the government of Vietnam as well as the status of sewerage works in Vietnam after the completion of the project. Especially, it is essential to collect the information on the policy of reducing the number of civil servants and on the organizations in the Ministry (the following two state organizations).

- Regulation & Policy (operated by the budget for the Ministry)
- Public Service (self-financed)

2.2.4 Budget Plan

VSC's budget plan will be made. Various conditions are assumed to make budget plan as shown below.

- Establishment of VSC : Because VSC wi11 establish in 2017, VSC's establishment is assumed to be the end of 2017.
- Salary: In 2017, 1 full-time counterpart and several part-time counterparts will be provided by MOC. Their salary will be paid by MOC. After establishment of VSC (from 2018), VSC will employ its staff, 8 of them as shown in Organization.

- JICA's input : In the JICA's project period, until May 2019, JICA will provide necessary expenditure to hire local consultants for project implementation support and Research & Development, and cost for web page development and maintenance. Also, JICA will provide necessary expenditure for Japanese experts and training equipment.
- MOC's input : MOC will provide necessary expenditure for counterparts salary in 2017. Also, MOC prepares VSC's office and necessary equipment.

(1) Budget Plan in 2017 (before establishment of VSC)

Budget plan in 2017 is shown in Table 2.2-3. 5 training courses will be held. The number of trainees in each course will be 30; 20 from central/local government management and 10 from enterprises working in sewerage sector. Since running cost is estimated to be 49,365,000 VND/course (see Table 2.2-3, 2.2-4, 2.2-5), training cost in 2017 will be 246,825,000 VND. Tuition fee will be 2 million VND/trainee for central/local government management and 4 million VND/trainee for enterprises working in sewerage sector. Costs for committee of Research & Development will be covered by revenue from training courses.

Table 2.2-3 Budget Plan in 2017

	Revenue	(VND)	Expenditure	(VND)	R-E (VND)
Training	Training Fee	400,000,000	Training Cost	246,825,000	153,175,000
PIS					0
R&D			R&D Committee	150,000,000	▵ 150,000,000
Total					3,175,000

Source: JICA Study Team

(2) Budget Plan in 2018 (after establishment of VSC)

Table 2.2-4 shows budget plan in 2018. 5 training courses will be held twice. The number of trainees in each course will be 30; 10 from central/local government management and 20 from enterprises working in sewerage sector. Tuition fee will be 2 million VND/trainee for central/local government management and 9 million VND/trainee for enterprises working in sewerage sector. Salary for VSC staff is assumed by VSC as shown in Table 2.2-5.

Table 2.2-4 Budget Plan in 2018

	Revenue	(VND)	Expenditure	(VND)	R-E (VND)
Training	Training	1,800,000,000	Training Cost	493,650,000	1,306,350,000
PIS					0
R&D			Committee	300,000,000	∆ 300,000,000
General			Salary	636,000,000	∆ 636,000,000
			Business trip	2,250,000	∆ 2,250,000
			Web const.	100,000,000	∆ 100,000,000
			Communication	24,000,000	∆ 24,000,000
			Others	10,000,000	∆ 10,000,000
Total					234,100,000

Source: JICA Study Team

Table 2.2-5 VSC Staff's salary

Position	VND/month	person
Director	10,000,000	1
Head of Division	7,000,000	3
Accountant	7,000,000	1
Officer	5,000,000	3

Source: JICA Study Team

(3) Budget Plan after 2019

JICA's Project will end in May 2019. Table 2.2-6 shows budget plan in 2019 and after 2019, assuming the same activity will continue. 5 training courses will be held twice. The number of trainees and tuition fee will be the same as in 2018. Concerning project implementation support, it is assumed that necessary expenditure will be covered by revenue from PC which asks VSC to support its project thus on the budget plan the R-E is 0.

Table 2.2-6 Budget Plan in and after 2019

	Revenue	(VND)	Expenditure	(VND)	R-E (VND)
Training	Training Fee	1,800,000,000	Training Cost	493,650,000	1,306,350,000
PIS					0
R&D			Committee	75,000,000	∆ 75,000,000
General			Salary	636,000,000	∆ 636,000,000
			Business trip	2,250,000	∆ 2,250,000
			Communication	24,000,000	∆ 24,000,000
			Others	10,000,000	∆ 10,000,000
Total					559,100,000

Source: JICA Study Team

2.3 Output 3: Basic Pilot Training for Sewerage Sector is Implemented

2.3.1 Designing the Training Curriculum

(1) Necessity of Training Function

Human resource development is urgently required in the sewerage sector to carry out sewerage projects throughout Vietnam. Human resources need to be developed in both of public and private sectors in each stage of planning, design, construction, and O&M.

(2) Cooperative Organization

MOC has the training institute "CUWC," to which belongs CNEE. CNEE implements the trainings which are focused on water sector. Although CNEE/CUWC has not implemented any sewerage training courses, it has the potential of providing trainings on sewerage sector, because CNEE has several staff members who have experienced the sewage works.

The Article 6 of the Project's specification states "Regarding human resources development, the result of basic planning research suggests that VSC should cooperate with CUWC, for example VSC's training venue should be provided by CUWC. VSC's lecturers should also be provided mainly by CUWC, combined with the lecturers from Architecture University and VWSA as necessary." VSC will cooperate with these organizations in accordance with this Article.

GIZ, DANIDA and VWSA are the organizations which currently provide training courses related to sewerage sector in Vietnam. Among these, GIZ and VWSA issued "Wastewater Training Catalogue," in which it is stated that since 2005, GIZ has supported the sewerage and drainage

sector in Vietnam from technical aspects. In the phase 4 which started in 2015, 11 training modules were developed by GIZ and 9 training courses were implemented by GIZ in collaboration with VWSA, assisting the development of systems, organizations, financial and technical aspects of this sector in Vietnam. GIZ has 27 available lecturers who can teach 11 training modules. It will be effective and efficient to cooperate with these organizations in implementing VSC's training courses.

(3) Training Facilities

For the venue of VSC's training, CNEE/CUWC's facilities will be utilized. For further details, refer to 2.2.2.

(4) Trainees

1) Trainees from public sector

In order to accelerate the implementation of JICA's projects and to construct the facilities with appropriate quality, trainees should be mainly from sewerage project members in PCs, such as DOC and PMU. For further details, refer to 2.2.2.

2) Trainees from private sector

VSC will provide a training program targeting the engineers from the enterprises working in sewerage sector. VSC classified the member enterprises of Vietnam Water and Sewerage Association (VWSA) and examined possible contents of the trainings for them. Although initially it was assumed that the trainings for private sector be separated from those for public sector, through the discussion with MOC, it was decided that trainees from both sectors attend the same trainings.

(5) Lecturers

With regards to the training lecturers, 2.2.2 already described the details, therefore the following is the reprint of 2.2.2. The Japanese lecturers joined 2 pilot trainings held in 2016 and will join the practical trainings which will be held during 2017-2018. The capacity development of Vietnamese lecturers will be conducted in the meantime so that the trainings will be implemented on their own; from 2019, VSC's trainings will be implemented only by Vietnamese lecturers.

For VSC's lecturers, the engineers in CNEE/CUWU with experiences in sewerage sector are considered as candidates. In order to train these candidates, training based on OJT will be conducted. In this regard, the training program in Japan is considered to be an ideal opportunity

for the candidates to learn about the sewerage technologies. In addition, cooperation with MOC, PCs, and universities is also indispensable. GIZ has a TOT training program to develop lecturers with appropriate training skill. Appendix 8-4 shows a list of GIZ's TOT trainees. Appendix 8-5 shows the TOT trainees with their specialized field. VSC will appoint lecturers based on these lists. GIZ's trainers and local consultants are also expected to be VSC's lecturers, therefore VSC will ask these organizations to send their lecturers to the trainings. Appendix 8-6 shows the curriculums and the names of lecturers of the first and the second pilot trainings in 2016. In the pilot trainings in 2016, staff members from MOC, CNEE/CUWC and Hanoi city, GIZ's trainers and local consultants joined as lecturers.

(6) Training Courses and Curriculum

1) Targets and Contents

As mentioned above, target participants of the training courses are from the Vietnamese Central Government, public sector such as provinces and municipalities, as well as from private sector such as design consultants and contractors. In the public sector, the following organizations are working on the sewerage sector: PC, DOC, PMB and in some cases O&M Companies. In addition, public sector has different classes, such as Manager Class, Engineer Class and Worker Class, thus the contents of training courses should be designed to satisfy the needs from different classes. Referring to JS's training contents, the contents needed for practical operation in sewerage works will be administration, finance, planning, design, procurement/construction, O&M, and public relation. The Table 2.3-1 is a matrix elaborated with combination of training targets and training contents. Based on this matrix, VSC's training will be designed.

Table 2.3-1 Matrix to decide curriculum

Source: JICA Study Team

2) Training Courses (initial plan)

Training courses planned at the beginning of the Project are the Manager course targeting Manager Class from PC, DOC and PMB, and the Engineer course. The initial plan is shown in the Table 2.3-2.

Manager course is planned to target Manager Class from all provinces and cities with the contents on overview of sewerage system, administration/finance of sewerage sector, planning for sewerage work, management and introduction to O&M. Engineer course was planned to be divided into sewer course and wastewater treatment plan course, and the contents consisted of planning, design, supervision of construction and O&M.

This initial plan was introduced at the interim meeting of the Project on 12 August 2016, where MOC requested that the number of courses should be increased by referring to the JS's training courses, therefore JICA Study Team modified the plan accordingly.

Table 2.3-2 Initial plan of training courses

No.	Course Name	Overview	Target	Period	Capacity (trainees)
1	Manager course	Overview of sewerage works	PC, DOC, DPI, PMU from all provinces and cities	1 week (course of 4 days)	20
2	Engineer course (sewer)	Design, sewer construction supervision	PMU from provinces and cities currently designing or constructing, and already constructed	1 week (course of 4 days)	15
3	Engineer course (wastewater treatment)	Design, construction supervision of wastewater treatment plan	PMU from provinces and cities currently designing or constructing	1 week (course of 4 days)	15

Source: JICA Study Team

3) Training Courses (second plan)

Incorporating the opinion received at the interim meeting, JICA Study Team revised the initial plan to add the following courses: beginner course, intermediate course and special subject. The second plan is shown in the Table 2.3-3.

On this second plan, at the meeting with ATI and MOC in January 2017, an opinion was received that the number of courses was too many. MOC also requested that VSC's trainings be self-financed by generating revenue from the training courses.

Table 2.3-3 Training course (second plan)

No	Course Name	Level	Overview	Target	Period
1	Manager course	Beginner	Overview of sewerage works	PC, DOC, DPI, PMU of all provinces and cities	1 week (course of 4 days)
2	Manager course	Intermediate	Management of sewerage system	PC, DOC, DPI, PMU of all provinces and cities	1 week (course of 4 days)
3	Engineer course	Introduction	Basis on sewerage work	PC, DOC, DPI of provinces and cities not yet started or planning	1 week (course of 4 days)
4	Engineer course (sewer)	Beginner	Design and construction supervision of sewer	PMU of provinces and cities designing, constructing, already served	1 week (course of 4 days)
5	Engineer course (sewer design)	Intermediate	Sewer design	PMU of provinces and cities designing, constructing	1 week (course of 4 days)
6	Engineer course (sewer construction supervision)	Intermediate	Construction supervision of sewer	PMU of Provinces and cities designing, constructing	1 week (course of 4 days)
7	Engineer course (WWTP design)	Beginner	Design and construction supervision of WWTP	PMU of Provinces and cities designing, constructing	1 week (course of 4 days)
8	Engineer course (theory on WWTM design)	Intermediate	WWTP design	PMU of Provinces and cities designing, constructing	1 week (course of 4 days)
9	Engineer course (WWTP design with exercise)	Intermediate	WWTP design with exercise	PMU of Provinces and cities designing, constructing	1 week (course of 4 days)
10	Engineer course (design sludge treatment)	Special subject	Design and O&M for sludge treatment	PMU of Provinces and cities designing, constructing, already served	1 week (course of 4 days)
11	Manager course (planning and design)	—	Planning and design of sewerage system	PC, DOC, DPI, PMU of all provinces and cities	1 week (course of 4 days)

Source: JICA Study Team

4) Training Courses for Private Sector

For VSC's revenue generation and enabling VSC to be self-financed structure, JICA Study Team planned training courses for private sector. The courses target consultants, contractors, O&M companies and include the following contents: planning, O&M and sewer's special method of construction. Outline of training courses for private sector is shown in the Table 2.3-4.

Table 2.3-4 Training courses for private sector

No	Course Name	Overview	Target	Period	Capacity (trainees)
1	Consultants	General Master Plan, explanation on Sector Master Plan	Local consultants	1 week (4 days course)	20
2	O&M companies	O&M of sewer and WWTP	Public corporation of water supply and sewerage, O&M companies		20
3	Consultants/contractors (microtunneling method)	Outline of design of microtunneling method and construction	Local consultants, contractors		20

Source: JICA Study Team

5) Training Courses (final plan)

Based on the considerations been done so far and lessons learned from 2 pilot trainings which are described later in this report, JICA Study Team proposed the curriculum of training courses that VSC will implement from 2017. These courses consist of the contents that Vietnamese regional (provinces and cities) officers in sewerage sector need to know: overview of sewerage works, design and construction supervision. When planning courses and proposing curriculums, JICA Study Team paid attention to the implementation status of sewerage works and its circumstances in Vietnam, as well as to the training courses that other donors are currently implementing.

JICA Study Team proposed 5 courses as shown in the Table 2.3-5. The training courses consist of Manager course targeting regional managers, sewerage planning course, course on design and construction, course on supervision of sewer, WWTP s and course on new technology. The length of each course is 1 week. The course on new technology will be on microtunneling method for the time being, which could be altered according to necessities. Each course targets both of public and private sectors, therefore no courses were dedicated to private sector. Besides, VSC's training courses will not mention O&M at the moment, because it is already included in VWSA and GIZ's training. Depending on the management policy of VWSA and GIZ, O&M training can be included in VSC's training after necessary discussions with VWSA and GIZ.

Table 2.3-5 Training course for public sector

No.	Course Name	Overview	Target	Period	Capacity (trainees)
1	Manager course	Overview of sewerage works	PC, DOC, DPI, PMU from all provinces and cities and private sector	1 week (course of 4 days)	30
2	Sewerage planning course	Planning and design of sewerage system	PC, DOC, DPI, PMU from all provinces and cities and private sector		30
3	Engineer course (sewer)	Design and construction supervision of sewer	Provinces and cities designing, constructing, organizing, or already served, and private sector		30
4	Engineer course (WWTP design)	Design and construction supervision	Provinces and cities designing, constructing, and private sector		30
5	New technology course (microtunneling method)	Outline of microtunneling method and its construction	PC, DOC, DPI, PMU from all provinces and cities and private sector		30

Source: JICA Study Team

Curriculum of training courses are shown in Appendix 8-7. For the elaboration of curriculum, JICA Study Team referred to JS's training courses and the matrix of Table 2.3-1. Before starting the trainings in implementation phase and at the actual trainings, VSC will conduct questionnaire survey and discussions among trainees and respective organization to collect opinions on trainings. Based on the result of questionnaire and discussions, the curriculum will be restructured as appropriate.

Basically, training texts will be elaborated by lecturers. Before starting actual courses, Vietnamese and Japanese lecturers will hold meetings to elaborate and improve the texts. After the training, VSC and lecturers will note the evaluations and comments from trainees for the improvement of textbooks.

(7) Training Execution Plan

For the elaboration of training implementation plan, JICA Study Team prepared the forecast of sewerage projects in target provinces and cities as shown in Appendix 8-2. This forecast was prepared on the basis of following assumptions.

Assumptions:

- By 2021, sewerage projects will be started in all 72 PCs.
- The period dedicated to design will be 1 to 2 years. Following that, the projects will enter the procurement, construction and O&M phase while design will also be continued.
- Approximately 5 PCs will complete the sewerage development and start the operation every year.

Table 2.3-6 The Number of PCs by sewerage development stage (forecast)

Year	Undeveloped	Under design	Under improvement	Completed	Total
2016	26	8	17	21	72
2017	20	10	20	22	72
2018	14	9	22	27	72
2019	8	8	24	32	72
2020	2	7	26	37	72
2021	0	6	24	42	72

Source: JICA Study Team

Taking into consideration the above-mentioned forecast of sewerage works shown in Table 2.3-6, annual training schedule was prepared. In 2017, trainings will start in September at the earliest, after establishment of VSC and preparation of training material. A total of 5 courses, each will be held once in 2017. The number of trainees will be 150: 30 trainees x 5 courses. In 2018, 5 courses will be held, twice for each. The number of trainees in 2018 will be 300: 30 trainees x 5 courses x twice. From 2019 onwards, training schedule will be the same as that of 2018 (refer to Table 2.3-7, 2.3-8 and 2.3-9).

Trainees from private sector will attend the above mentioned training courses with trainees from public sector.

(8) Training WBS (WBS: Work Breakdown Structure)

For the successful implementation of training courses, VSC should be able to identify the tasks to be done and to complete them, such as necessary procedures, documents, request for lecturers and recruitment of trainees. Based on the experience of 2 pilot trainings conducted in 2016, JICA Study Team listed up the tasks from the beginning to the end of a training course and elaborated WBS (Work Breakdown Structure) as shown in Table 2.3-10.

2 personnel are assumed to be in charge of the training. During 2017 and 2018, the staff A indicated in Table 2.3-12 will be mentored by JICA Study Team, while staff B will be mentored by MOC's counterpart for the smooth OJT and transmission of training know-how. The collection of training fees and payment of facility usage fees which are indicated with "CNEE" in the Table, will be conducted by CNEE/CUWC until the foundation of VSC, therefore MOC needs to ask CUWC to do these tasks. Hereafter, this WBS is expected to be improved as necessary to be utilized for the successful implementation of training courses.

Table 2.3-7 Annual Training Schedule in 2017

	Course Title	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	Manager Course												
2	Sewerage Planning Course												
3	Engineer Course (Sewer)												
4	Engineer Course (WWTP)												
5	New Technology Course (Microtunneling Method)												

Textbook making

Source: JICA Study Team

Table 2.3-8 Annual Training Schedule in 2018

	Course Title	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	Manager Course												
2	Sewerage Planning Course												
3	Engineer Course (Sewer)												
4	Engineer Course (WWTP)												
5	New Technology Course (Microtunneling Method)												

Textbook Review

Textbook Review

Source: JICA Study Team

Table 2.3-9 Annual Training Schedule from 2019

	Course Title	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	Manager Course												
2	Sewerage Planning Course												
3	Engineer Course (Sewer)												
4	Engineer Course (WWTP)												
5	New Technology Course (Microtunneling Method)												

Textbook Review

Textbook Review

Source: JICA Study Team

Table 2.3-10Training WBS (idea)

Activities	Staff A	Staff B
1. Training Course Establishment	◎	
1.1 Select names of course, fix course contents (based on questionnaire analysis)	○	
1.2 Setting Course Schedule	○	
1.3 Arrange objective trainee for each course	○	
2. Lecture Room Arrangement	◎	
2.1 Confirm available lecture rooms of CNEE/CUWC	○	○
2.2 Submit rental permission of lecture room	○	○
2.3 Confirm rental fee for lecture room	○	○
2.4 Pay rental fee for lecture room		(CNEE)
3. Lecturers Arrangement	◎	
3.1 Select lecturer	○	
3.2 Dispatch request letter to lecturer		○
3.3 Meeting with lecturer	○	
3.3.1 Purpose of training course/curriculum	○	
3.3.2 Object trainee	○	
3.3.3 Number of trainee	○	
3.3.4 Contents of lecture/level	○	
3.4 Calculate lecturer fee and transportation cost		○
3.5 Pay lecturer fee		○
4. Textbook Preparation		
4.1 Prepare request letter for textbook preparation	○	○
4.2 Meeting with lecturer about textbook contents	○	
4.3 Order textbooks printing		○
4.4 Receive and store textbooks		○
5. Study Tour Arrangement	◎	
5.1 Select related facilities for study tour	○	
5.2 Prepare request letter for study tour	○	○
5.3 Pre-meeting on the spot about study tour route etc.	○	○
5.4 Prepare facilities instructive documents	○	○
6. Training Program Notification	◎	
6.1 Notify annual training program	○	
6.1.1 Web site (Home Page)	○	○
6.1.2 Mail, E-mail, Fax	○	○
6.1.3 Individual invitation management	○	○
6.2 Request for Cooperation	◎	
6.2.1 JICA Vietnam Office	○	
6.2.2 MOC-ATI	○	
6.2.3 VWSA	○	
7. Trainee Invitation	◎	
7.1 Make up General Information (GI) of training course		○
7.2 Dispatch GI		○
7.3 Accept trainee		○
7.3.1 Make up trainee list		○
7.3.2 Prepare nameplate, etc.		○

	7.4 Logistics		○
	7.4.1 Transportation		○
	7.4.2 Accommodation		○
	7.4.3 Meal		○
	7.5 Invoice of Lecture Fee		(CNEE)
8. Training Course		◎	
	8.1 Prepare equipment for lecture		○
	8.1.1 PC & Projector, screen		○
	8.1.2 Microphone, speaker, amplifier		○
	8.1.3 Whiteboard, pointer		○
	8.2 Arrange desks & chairs		○
	8.3 Registration of trainee		○
	8.3.1 Registration		○
	8.3.2 Delivery of textbooks and Stationary		○
	8.4 Program Orientation	○	
	8.4.1 Program schedule		○
	8.4.2 Accommodation guidance		○
	8.4.3 Transportation guidance		○
	8.4.4 Meal spot guidance		○
	8.5 Lecture and Lecturer		
	8.5.1 Lecture in classroom		○
	8.5.2 Transport service for lecturer		○
	8.6 Study tour		○
	8.8.1 Transportation		○
	8.8.2 Restaurant		○
	8.7 Questionnaire after lecture		○
	8.9.1 Questionnaire delivery		○
	8.9.2 Collect, compile and analysis	○	○
	8.8 Closing Ceremony	◎	
	8.8.1 Credits approval	○	
	8.8.2 Certificate issuance		○
	8.8.3 Guests invitation	○	○
	8.8.4 Presentation of certificate	○	○
	8.9 Questionnaire after training course	○	
	8.9.1 Questionnaire delivery		○
	8.9.2 Collect, compile and analysis	○	○

Source: JICA Study Team

2.3.2 Elaboration of Training Texts in Vietnamese

Training texts used in 2 pilot trainings in 2016 were elaborated in collaboration with Japanese lecturers, MOC, CNEE/CUWC and Hanoi city. These texts contain not only universal knowledge and basic theory on sewerage sector but also individual cases and introduction of sewerage projects adapted to Vietnam's local contexts that JICA Study Team requested Vietnamese lecturers to add. The elaborated texts were translated into Vietnamese by the Project's local staff.

2.3.3 Invitation Program in Japan

(1) Objective of Invitation Program in Japan

The main objective of the Invitation Program in Japan is to hold an exchange of ideas among the JS and other related agencies by inviting counterparts from the VSC Project to Japan. It also had the objectives of contributing to the formulation of the VSC start-up plan, business plan and mid-term plan by sharing information about the organization, functions and management of the JS, roles and cooperation among sewerage-related agencies in Japan and the relationship with the local governments.

(2) Invitation period, number of trainees invited and training outline

Initially, the plan for the Invitation Program in Japan was to invite 5 staff members from implementing agencies for a period of 15 days in early October 2016. With a strong request from MOC that the Vietnamese counterparts should immediately understand the background of establishment of JS as well as actual operations, as a model for the establishment of VSC, the implementation period was brought forward by 2.5 months. In addition, invitation period was shortened to start from June 6 to June 12 in order to invite as many relevant parties as possible, as a result the number of invitees was increased to 10. Table 2.3-11 and Table 2.3-12 are the lists of trainees and training managers participated in the Invitation Program in Japan.

The main aims of the Invitation Program in Japan were:

- Deepen understanding of the JS
- Understand the R&D of sewerage sector in Japan
- Understand the production and promulgation of sewerage technical standards

The invitation Program in Japan was implemented in order to achieve these objectives. The outline of the visit is listed below.

- Implementation period: 6 June to 12 June, 2016
- Participants: A total of 10 personnel from agencies comprising PMB for this Project and officers in charge of sewerage from Hanoi City and Ho Chi Minh City
- Outline of the Invitation Program is shown below.

- ✓ Courtesy calls to Ministry of Land, Infrastructure Transport and Tourism, and to the JICA Headquarters
- ✓ Lecture on sewerage administration in Japan
- ✓ JS's roles and objectives
- ✓ JS's contracted business
- ✓ Inspection visits to JS's contracted organizations (Fukaya City in Saitama)
- ✓ JS's training center and technical development
- ✓ State of sewerage works in local government (Yokohama)
- ✓ Inspection visit to research agencies (National Institute for Land and Infrastructure Management (NILIM, hereinafter), Public Works Research Institute)
- ✓ Inspection visit to Japan Sewage Works Association (JSWA, hereinafter)
- ✓ Closing discussion
- ✓ Water environment and the role of sewerage (Inspection visit to Yamanashi Fujihokuroku Purification Center)

Table 2.3-11 List of Participants

No.	Name	Position	Affiliated Organization
1	Mrs. Mai Thi Liên Huong	Deputy General Director	Administration of Technical Infrastructure (ATI), Ministry of Construction(MOC)
2	Mr. Nguyen Ngoc Duong	Deputy Director	Drainage, Sewerage & Wastewater Management Division, ATI, MOC
3	Mr. Đo Manh Quân	Authorized staff	Drainage, Sewerage & Wastewater Management Division, ATI, MOC
4	Mrs. Phạm Thị Thanh Thúy	Accountant	Accounting Division, ATI, MOC
5	Mr. Lê Đông Thành	Deputy Director	Planning and Finance Department, Ministry of Construction (MOC)
6	Mrs. Nguyen Thi Nga	Deputy Director General	Personnel Department, Ministry of Construction (MOC)
7	Mr. Phạm Trọng Đoàn	Researcher	Institute for Construction Economy (ICE)
8	Mr. Trịnh Văn Dũng	Vice Rector	College of Urban Works Construction (CUWC)
9	Mr. Đang Ngoc Hoi	Director	PMU of Water Environment Improvement 2, Urban - Civil Works Construction Investment Management Authority of Ho Chi Minh City (UCCI)
10	Mr. Nguyen Manh Hùng	Deputy Director	Hanoi Sewerage & Drainage Project Management Board (HSDPMB)

Source: JICA Study Team

Table 2.3-12 Training manager

No.	Name	Position	Affiliated organization
1	Mrs. Do Thi Nga	Senior Assistant	JICA Study Team

Source: JICA Study Team

(3) Comments from participants

At the end of each lecture, question and answer sessions were held and noted. A questionnaire survey was also conducted among the participants. Although not all the participants filled in the questionnaire, most of them evaluated the lectures with "Very good," while no one selected "Dissatisfied" or "Very dissatisfied."

After returning to Vietnam, a discussion was held between Vietnam side and JICA on the outcomes of the Invitation Program in Japan. It was reported that the content of the Invitation Program was extremely beneficial.

2.3.4 Implementation of Pilot Trainings

(1) Pilot Trainings

In 2016, Pilot Training was conducted twice (3 courses) for government workers. The first Pilot Training was conducted for 20 PC managerial class personnel from 8 August to 12 August 2016. The second Pilot Training was conducted for 15 PC engineers across 2 courses - a sewer course and a treatment plant course – from 14 November to 18 November 2016. Appendix 8-6 shows the curriculum of the first and the second Pilot Trainings.

(2) First Pilot Training

1) Objectives of Training

While "Implement Basic Pilot Training," Outcome 3 of the Project, is scheduled to be implemented in the implementation phase, 2 sessions of preliminary Pilot Training were scheduled in this detailed planning phase for the purpose of understanding the training needs of human resources in sewerage sector. The evaluation of the preliminary Pilot Trainings was conducted by means of questionnaire surveys among trainees and their organizations with the objective of reflecting the results in the future trainings in the implementation phase. This is the first round of the preliminary Pilot Training and it had the following objectives.

- Establish Sewerage Center training function and conduct trial training
- Identify potential Vietnamese lecturers

2) Outline of Training

An outline of the first Pilot Training is shown below.

a) Implementation Period

The training was implemented from 8 August to 11 August 2016 (8 August and 11 August were for travel, therefore actual training period was from 9 August to 10 August).

b) Location

The training was held in the lecture halls on the 2nd floor of CNEE in CUWC.

c) Training Schedule

The training schedule is shown on Table 2.3-13.

Table 2.3-13 Schedule for 1st pilot training

Date	Time	Lecture	Outline of lecture	Lecturer
8 Aug. (Mon)	15:00- 17:00-	Move to CUWC Registration Welcome party	(provided by JICA study team)	(MC by CUWC)
9 Aug. (Tue)	8:30- 8:45- 9:00	Textbook delivery Opening ceremony	Opening speech by MOC and JICA	(MC by CUWC)
	9:00- 9:30	Orientation	Orientation of the program, objectives & targets, introduction of VSC	JICA Experts (Mr. Kawai)
	9:30-945	Tea Break		
	9:45 -11:30	Introduction to sewage works	Outlines of sewage works and background (Japan and Vietnam), including recommendation to Vietnam	JICA Expert (Mr. Kawai), ATI (Ms. Thao Huong)
	11:30-13:30	Lunch		
	13:30-14:30	Administrative systems for sewage works (*)	Introduction of administration/regulation system for sewage works	JICA Expert (Mr. Inoue), ATI (Dr. Mai Huong)
	14:30-14:45	Tea Break		
	14:45-15:45	Financial system for sewage works	Introduction of financial system in sewage works (water tariff/user charge)	JICA Expert (Mr. Inoue) and GIZ (Mr. Tim, & Ms. Ngoc)
	16:00-17:00	Discussion (1)	Wrap-upping for needs/scope of VSC	All lecturers
10 Aug. (Wed)	8:30-10:00	Sewage work planning (1)	Master planning of sewage works development (experience in Japan), and life cycle of sewage works	JICA Expert (Mr. Fujimoto)
	10:00-10:15	Tea Break		
	10:15-12:00	O&M of Sewerage system	Efficient O&M of sewerage system	JICA Expert (Dr. Kim) HSDC in Hanoi (Ms. Nga)
	12:00-13:30	Lunch		
	13:30-14:30	Public relation and hearing	Public relation, public hearing and citizen participants in sewage works	JICA Expert (Mr. Kohama), GIZ (Mr. Hiep)
	14:30-14:45	Tea Break		
	14:45-16:45	Discussion (2)	Summarizing training course/Lesson learned	All Lecturers
	16:45-17:15 17:15-	Closing ceremony Farewell party	Speech by MOC, JICA and CUWC. Certification presentation (provided by CUWC)	(MC by CUWC) (MC by CUWC)
11 Aug. (Thu)		Leave from CUWC		

Source: JICA Study Team

d) Trainees

After discussions with MOC and JICA Vietnam Office, Invitation Letters and General Information (GI, hereinafter) (refer to Appendix 8-15) were sent to the provinces and municipalities for their trainee recommendations, and a total of 20 trainees were selected as shown in Table 2.3-14. The trainees were from variety of organizations in 12 provinces and municipalities including CPC, DOC, DPI, PMB, Hanoi Sewerage and Drainage Company (HSDC, hereinafter), Dong Thap Water Supply, Sanitation and Urban Environment Company Limited (DOWASEN, hereinafter), Urban-Civil Works Construction Investment Management Authority of HO CHI MINH City (UCCI, hereinafter) and Sewerage Companies. These organizations cover all the roles needed for implementation of sewerage works, such as sewerage works planning, design, construction supervision and O&M.

Table 2.3-14List of trainees for 1st pilot training

No.	Name	Position	Organization	Province/ City
1	Le Van Du	Official, Water Supply and Sewerage Technical Infr. Division	DOC	Ha Noi
2	Ms. Oanh	Deputy Head of Planning and Investment Division	HSDC	Ha Noi
3	Le Thanh Giang	Vice Director	PMB	Ha Noi
4	Trịnh Minh Ngọc	Official of Urban Management Division	Uong Bi (CPC)	Quang Ninh
5	Nguyen Nhu Vinh	Deputy Head of Technical Infr. Division	DOC	Nam Dinh
6	Nguyen Huu Sang	Official	DOC	Ben Tre
7	Bui Tuan Phuong	Vice Head of Technical Ifr. Division	CPC	Ben Tre
8	Nguyen Ngoc Trang		DOC	Dong Thap
9	Nguyen Van Hau		DOWASEN	Dong Thap
10	Nguyễn Việt Dũng	Head of Infrastructure Development Division	DOC (related to Vi Thanh)	Hau Giang
11	Bui Ngoc Tan	Official	DOC	Hai Phong
12	Nguyễn Trần Minh Nguyệt	Infr. Management Division	DOC	Dong Nai
13	Bùi Kim Tiến	Official	Sewerage Center	Dong Nai
14	Nguyen Dac Phuoc	Deputy Head of Technical Infr. Division	DOC	Thua Thien Hue
15	Trinh Le Nhan	Head of Technical Division	PMB	Thua Thien Hue
16	Pham Thanh Trunng	Official	PMB	Pham Thanh Trunng
17	Tran Huu Quoc Vi	Vice director of WEIP2-PMB	UCCI	Ho Chi Minh
18	Mai Tấn sĩ		DPI	Vinh Long
19	Nguyễn Trung Kiên	Official	Sewerage Company	Thai Nguyen
20	Nguyễ Bá Tuyên	Vice Director of WWTP	Sewerage Company	Thai Nguyen

Source: JICA Study Team

e) Lecturers

The list of lecturers is as shown in Table 2.3-15. The Project requested ATI at MOC, HSDC from Hanoi and GIZ to dispatch the lecturers and also to prepare the lectures which reflect the current situation in Vietnam.

Table 2.3-15 List of lectures for 1st pilot training

Lecture	Japanese side	Vietnamese side
Introduction to sewage works	Mr. KAWAI	Ms. Thao Huong, MOC
Administrative system for sewage works	Mr. INOUE	Dr. Mai Huong, MOC
Financial system for sewage works	Mr. INOUE	Mr. Tim and Ms. Ngoc, GIZ
Sewage works development planning	Mr. FUJIMOTO	
Sewerage system control	Dr. KIM	Ms. Nga, HSDC
Public relation and hearing	Mr. KOHAMA	Mr. Hiep, GIZ

Source: JICA Study Team

3) Outline of Lectures and Discussions

During 2 days training, 6 lectures and a discussion were held. Main keywords appeared in the discussion are shown below.

(Keywords during the discussion)

septic tank, sewerage coverage ratio, sewerage tarif, beneficiary's burden, PI (Performance Index), national budget for project implementation, factory drainage, dredging sludge, O&M, implementation of pilot project, public relations, deodorizing facilities, method of O&M

Keywords regarding O&M and management frequently appeared, which need to be taken into consideration for the further improvement of training contents.

4) Post-Lecture Survey Results

In the first Pilot Training, 6 lectures were held during 2 days. In order to assess trainees' understanding, simple questionnaire survey was conducted after each lecture. The questionnaire form is attached in Appendix 8-12. The following 3 questions were asked:

- Question 1: Was the lecture easy to understand and of satisfactory quality?
- Question 2: Were you satisfied with the textbook and the training materials used in the program?
- Question 3: Were the lecture/observation adapted to the Project?

The trainees answered these questions using a 4-stage evaluation, ranging from Level 4 ("Excellent," "Satisfactory") to Level 1 ("Poor," "Unsatisfactory").

The survey result is shown in Table 2.3-16. According to the result, it can be said the first Pilot Training was highly evaluated by the participants.

Table 2.3-16 Overall results from post-lecture survey

Question 1	Was the lecture easy to understand and of satisfactory quality?					
Evaluation	4	3	2	1	Answers	Unanswered
Lecture①Introduction	10	9	0	0	19	0
Lecture②Administrative system	8	6	2	0	16	3
Lecture③Financial system	14	5	0	0	19	0
Lecture④Sewage work planning	11	5	0	0	16	3
Lecture⑤O&M of sewerage system	14	5	0	0	19	0
Lecture⑥Public relation & hearing	10	7	1	0	18	1
Question 2	Were you satisfied with the textbooks and materials used in the program?					
Evaluation	4	3	2	1	Answers	Unanswered
Lecture①Introduction	12	6	1	0	19	0
Lecture②Administrative system	8	7	1	0	16	3
Lecture③Financial system	15	3	1	0	19	0
Lecture④Sewage work planning	11	5	0	0	16	3
Lecture⑤O&M of sewerage system	13	6	0	0	19	0
Lecture⑥Public relation & hearing	11	6	1	0	18	1
Question 3	Were the lecture/observation adapted to the Project?					
Evaluation	4	3	2	1	Answers	Unanswered
Lecture①Introduction	14	5	0	0	19	0
Lecture②Administrative system	9	6	0	0	15	4
Lecture③Financial system	16	2	0	0	18	1
Lecture④Sewage work planning	14	2	0	0	16	3
Lecture⑤O&M of sewerage system	16	2	1	0	19	0
Lecture⑥Public relation & hearing	13	5	1	0	19	0

Source: JICA Study Team

5) Post-Training Survey

After the first Pilot Training, a questionnaire survey was conducted among the trainees' organizations. The questionnaire format is attached in Appendix 8-13. The questionnaire results are shown below.

Question 1: How would you rate this training overall?

Table 2.3-17 Question 1: How would you rate this training overall?

Evaluation items	Excellent	Satisfactory	Unsatisfactory	Poor	Total
Answers	7	4	—	—	11

Source: JICA Study Team

Question 2: What did you like the best about the training?

- Sewerage planning, O&M of sewerage system, Public relation (Bui Ngoc Tan, Hai Phong

DOC)

- Sewerage planning (Bui Tuan Phuong, Ben Tre)
- Overview knowledge on sewerage in Japan (Mai Tan Si, Vinh Long DPI)
- O&M (Nguyen Ba Tuyen, Thai Nguyen Sewerage Company)
- Sewerage planning (National vision of sewage system development program) (Nguyen Ngoc Trang, Dong Thap DOC)
- Sewerage planning (Nguyen Nhu Vinh, Nam Dinh DOC)
- Sewerage planning, cost definition and roadmap of sewage usage fee (Nguyen Tran Minh Nguyet, Dong Nai DOC)
- Effective O&M of sewerage system (Nguyen Trung Kien, Thai Nguyen)
- Sludge treatment and its effective use, O&M (the reason of the choice is that these issues are not effectively solved in all over Vietnam) (Nguyen Van Hau, DOWASEN)
- Sewerage planning (Japanese experience), sewerage lifecycle (Pham Thanh Trung, Hue PMU)

(Points where improvement is needed)

- The real situation in Vietnam should be included in order to make a comparison (Mai Tan Si, Vinh Long DPI).
- The Japanese-Vietnamese interpreters need to improve their interpretation skills (Nguyen Ngoc Trang, Dong Thap DOC).
- Sewage management experiences and lessons from Japan and other countries should be added to the training course. On that basis, trainees will improve their wastewater management experience (Nguyen Tran Minh Nguyet, Dong Nai DOC).
- PR: The explanation was unclear in the Japanese interpretation. More pictures should be added to the textbook and this lecture should be longer (Nguyen Van Hau, DOWASEN)

Question 3: What kind of training do you need?

- Inspections of sites in Japan where the technology introduced in the training is being used (Bui Ngoc Tan, Hai Phong DOC)
- Training for laws and policies related to the sewerage sector (Mai Tan Si, Vinh Long DPI).
- I want to learn about wastewater treatment technology in depth. It was focusing on providing a large amount of information in the training period (Nguyen Ba Tuyen, Thai Nguyen Sewerage Company).
- Management training course: Abilities and skills for managers of sewerage systems and WWTPs (Nguyen Ngoc Trang, Dong Thap DOC).
- Training related to inspections and evaluations of current sewerage systems, and training for selecting optimum wastewater treatment methods (Nguyen Ngoc Trang, Dong Thap DOC).
- Comprehensive training that includes site inspections (Nguyen Nhu Vinh, Nam Dinh DOC)

- Short-term training courses (Nguyen Tran Minh Nguyet, Dong Nai DOC)
- Efficient O&M, sewerage master plan (Nguyen Van Hau, DOWASEN)
- Sewerage system management, O&M plan (Pham Thanh Trung, Hue PMU)

Question 4: How would you rate the quality of the training textbook/materials?

Table 2.3-18 Question 4: How would you rate the quality of the training textbook/materials?

Evaluation item	Excellent	Satisfactory	Unsatisfactory	Poor	Total
Answered	7	4	–	–	11

Source: JICA Study Team

Comments

- The pictures and content were fresh; however, the effects of sewerage would be clearer if there was a comparison between Vietnam and Japan (Mai Tan Si, Vinh Long DPI).
- The teaching materials had been carefully prepared. The English interpretation was good (Nguyen Ngoc Trang, Dong Thap DOC).
- The teaching materials had been carefully prepared by VSC (Nguyen Nhu Vinh, Nam Dinh DOC).
- The documents had been carefully prepared and the content was appropriate to the course participants (Nguyen Tran Minh Nguyet, Dong Nai DOC).

Question 5: Were the meeting room and facilities adequate and comfortable?

- All was satisfactory and enough (Bui Ngoc Tan, Hai Phong DOC)
- Unsatisfied (Bui Tuan Phuong, Ben Tre)
- Satisfied (Mai Tan Si, Vinh Long DPI)
- Satisfied (Nguyen Ba Tuyen, Thai Nguyen Sewerage Company)
- Satisfied and good (Nguyen Ngoc Trang, Dong Thap DOC)
- Satisfied (Nguyen Nhu Vinh, Nam Dinh DOC)
- Satisfied (Nguyen Tran Minh Nguyet, Dong Nai DOC)
- Satisfied (Nguyen Tran Minh Nguyet, Dong Nai DOC)
- Good (Nguyen Van Hau, DOWASEN)
- Satisfied (Pham Thanh Trung, Hue PMU)
- Satisfied (Trinh Minh Ngoc, Uong Bi)

Comments

- Trainees should be divided into smaller groups to make discussion easier. (Nguyen Ngoc Trang, Dong Thap DOC)
- Microphone battery packs should be prepared in order to eliminate interruption. (Nguyen Ngoc Trang, Dong Thap DOC)
- Laser pens should be used. (Nguyen Ngoc Trang, Dong Thap DOC)
- Mistakes in the Project need to be taken care of before the training started. (Nguyen Ngoc Trang, Dong Thap DOC)

Question 6: Question for trainees who stayed overnight: How would you rate the accommodation for training?

Table 2.3-19 How would you rate the accommodation for training?

Evaluation items	Excellent	Satisfactory	Unsatisfactory	Poor	Total
Answers	3	6.5	1.5	–	11

Source: JICA Study Team

Comments

- The pick-up service was great. However, the accommodation was located in an isolated area without any public transport or other services, so it was not easy to get around. (Mai Tan Si, Vinh Long DPI)
- The trainees were satisfied with the facilities. However, there were some points that were unsatisfactory, including the poor-quality Wi-Fi, and the bad food service of the hotel (there were no noodles and hot water, and the restaurants near the hotel closed early). (Nguyen Ngoc Trang, Dong Thap DOC)
- Hotel's facilities were very poor (there was no toothbrush, toothpaste, comnb). (Nguyen Tran Minh Nguyet, Dong Nai DOC)

Question 7: Was the time allocated sufficient?

- The training period was quite short. There was not enough time in some of the lectures. (Bui Ngoc Tan, Hai Phong DOC)
- It was sufficient. (Bui Tuan Phuong, Ben Tre)
- It was good, but there should also be on-site inspections. There is a need for visual training. (Mai Tan Si, Vinh Long DPI)
- Satisfied. (Nguyen Ba Tuyen, Thai Nguyen Sewerage Company)
- 11 lectures in 2 days were sufficient, but the volume was too much for the trainees. (Nguyen Ngoc Trang, Dong Thap DOC)

I would suggest increasing the training period. (Nguyen Nhu Vinh, Nam Dinh DOC)

- 2 days were not sufficient for the course, and more time for discussion is need during the training course. (Nguyen Tran Minh Nguyet, Dong Nai DOC)
- Satisfied. (Nguyen Tran Minh Nguyet, Dong Nai DOC)
- The period was insufficient. Some of the content of the lectures were insufficient. (Nguyen Van Hau, DOWASEN)
- Basically, the lecture time was sufficient. However, the time for the matters related to special and largely new knowledge was insufficient for responding to the trainees' questions. (Pham Thanh Trung, Hue PMU)
- Satisfied. (Trinh Minh Ngoc, Uong Bi)

Question 8: What aspects of the training could be improved?

- Sewerage finance systems. (Bui Ngoc Tan, Hai Phong DOC)
- PR: The quality of the Japanese-Vietnamese interpretation needed improvement. (Nguyen Ngoc Trang, Dong Thap DOC)
- GIZ lecturer Mr. Dinh Quang Hiep: It was mainly theoretical, it was difficult, and the solutions were not analyzed. (Nguyen Ngoc Trang, Dong Thap DOC)
- Wastewater management experiences and lessons from Japan and other countries (especially in Asia) need to be added to the training course. On that basis, trainees can improve their experience of wastewater management. (Nguyen Tran Minh Nguyet, Dong Nai DOC)
- Sewerage administration systems, PR. (Nguyen Van Hau, DOWASEN)
- Introduce finance systems (sewerage tax/usage fees) for sewerage projects. The lectures were interesting, but the concepts were very difficult. The time for these lectures needs to be slightly increased. (Pham Thanh Trung, Hue PMU)

Question 9: Would you like to join the next training (second pilot training?)

Table 2.3-20 Question 9: Would you like to join the next training (2nd pilot training?)

Choice	Yes	No	Total
Answers	10	1	11

Source: JICA Study Team

Comment

- Regarding the fields of planning and investment, familiarity with policies and mechanisms is required, and the content of the training course was mainly technical, while policies and mechanisms were more general. There was no specialization for policies and mechanisms. (Mai Tan Si, Vinh Long DPI)

Question 10: What, if any, improvements would you suggest or request to VSC?

- The training course should be split into 2; one session regarding technology, and another for policies and mechanisms. (Mai Tan Si, Vinh Long DPI)
- VSC needs to include videos about Japanese sewerage systems and treatment methods (as seen in Yokohama) to increase the interest of trainees. Subtitles should be added (English and Vietnamese) so that the trainees can understand. (Nguyen Ngoc Trang, Dong Thap DOC)
- The length of the course should be extended so that lecturers and trainees have more time for discussion. The quality of accommodation needs to be improved. Wastewater management experiences from Japan and other countries should be added to the training course. On this basis, trainees can improve their wastewater management experience. (Nguyen Tran Minh Nguyet, Dong Nai DOC)
- There needs to be more lecture time for sewerage administration systems and PR. (Nguyen Van Hau, DOWASEN)
- VSC needs to form a training course with more comprehensive and definite content, and there needs to be more time for discussion between lecturers and trainees. (Pham Thanh Trung, Hue PMU)

Suggestion: (Nguyen Ngoc Trang, Dong Thap DOC)

- R&D
  - ✓ VSC advisory reports regarding Vietnamese sewerage systems and treatment methods
  - ✓ Investigations and proposals for analytical processes and investment methods regarding sewerage systems and treatment methods appropriate to Vietnam.
- Technical support systems: VSC shall support potential provinces by means of sewer connection handbooks, O&M handbooks for sewerage systems and treatment methods, and a handbook for managers working in sewerage sector.
- Training
  - ✓ In order to make travel easier, VSC shall establish the training courses in the major northern, central and southern cities of Hanoi, Da Nang and HCM.
  - ✓ The training network shall be expanded across the country step-by-step.

Other comments

- It is important for the lecturers to teach with more flexibility (lecture with trainee, trainee with lecture). (Nguyen Ba Tuyen, Thai Nguyen Sewerage Company)
- Coffee should be prepared before starting the afternoon lectures in order to stop people from sleeping. (Nguyen Ngoc Trang, Dong Thap DOC)
- The interpreters have a key role. Ms. Nga is doing an excellent job but Ms. Lanh needs to make

more effort. In addition, there should be a backup interpreter (when Ms. Nga is absent) and the quality of Japanese-Vietnamese interpretation needs to be improved. (Nguyen Ngoc Trang, Dong Thap DOC)

- The teaching materials should be handed out in advance so that trainees can make time for preparation. (Nguyen Ngoc Trang, Dong Thap DOC)
- The training course should make time for group discussion and presentations. (Nguyen Ngoc Trang, Dong Thap DOC)
- Reference materials should be indicated for further study. (Nguyen Ngoc Trang, Dong Thap DOC)
- It was a good training course. The English-Vietnamese interpreter was really good, and provided an accurate interpretation, which influenced how good the course was. The lecturers were friendly specialists. I would like to participate in the next training course too. Sewerage planning and O&M is a new field in the Mekong Delta region, particularly in Dong Thap. (Nguyen Van Hau, DOWASEN)

6) Summary of the First Pilot Training

The first pilot training was conducted from 8 August to 11 August 2016 (lectures were held for 2 days on 9 August and 10 August), in the lecture rooms of CUWC/CNEE in Hanoi. 20 trainees participated from 12 provinces and cities in Vietnam.

Lecturers were invited from the JICA Study Team and from MOC, HSDC and GIZ from Vietnam to give lectures on introductory texts, administration systems, finance systems, sewerage plans, sewerage O&M, sewerage advertising and PR.

The post-lecture survey result showed that the trainees were highly satisfied with all the lectures. In the discussions held after the lectures, a lively question and answer session was held. The main keywords appeared in the session are shown below.

(Main keywords from the discussion)

Septic tank, sewerage diffusion rate, sewer usage rates, beneficiary payments, PI (Performance Index), national budget for Project implementation, industrial wastewater, dredged sludge, O&M, Pilot Project implementation, PR, city planning, sewerage plan, technical development functions, deodorization plants, O&M methods.

(3) Second Pilot Training

1) Objectives of Pilot Training

The objective of the second Pilot Training was same as that of the first Pilot Training; to understand the training needs of human resources in sewerage sector, by conducting preliminary Pilot Trainings.
The preliminary Pilot Training also has the following objectives.

- Establishment of Sewerage Center training functions and trial training
- Identify potential Vietnamese lecturers

2) Outline of Pilot Training

An outline of the second Pilot Training session is shown below.

a) Implementation Period

The training was implemented from 14 November to 19 November 2016 (14 November 19 and November were for travel; therefore, actual training period was 4 days from 15 November to 18 November).

b) Location

The training was held in the lecture halls on the 2nd floor of CNEE in CUWC. The inspection visits were conducted in WWTPs around Hanoi and sewer construction facilities in Haiphong.

c) Training Courses

While the first Pilot Training session targeted the managerial class from the DOC, PMU, and DPI in provinces and cities, the second Pilot Training targeted the engineers from the DOC, PMU, DPI, and sewage companies in provinces and cities. The training consisted of 2 courses; “sewage planning and sewer course” for sewage planning and sewer design and construction, and “wastewater treatment course” for wastewater treatment facilities. 15 trainees were recruited for each course, making a total of 30 trainees.

d) Training Schedule

The training schedules for the “sewerage planning and sewer course” and the “wastewater treatment course” are shown in Table 2.3-21 and Table 2.3-22.

Table 2.3-21 Schedule for 2nd pilot training (Sewerage planning and sewer course)

Date	Time	Lecture	Outline of Lecture	Lecturer
14 Nov (Mon)		Move to CUWC		
	15:30-	Reception		
15 Nov (Tue)	8:30-	Textbook delivery		
	8:45-9:00	Opening ceremony	Opening speech by MOC and JICA	(MC by CUWC)
	9:00-9:30	Orientation	Explanation of outline of the training	Mr. Kawai
	9:30-9:45	Tea Break		
	9:45-12:00	Introduction to Sewage Works	Outlines of sewage works and background	MOC (Ms. Thao Huong), Mr. Kawai
	12:00-13:30	Lunch		
	13:30-14:35	Outlines of Sewage Planning	Explanation of sewage planning and storm water management	Mr. Hayashi, Hanoi PMB (Ms. Giang)
	14:35-14:55	Tea Break		
	14:55-16:00	Outlines of Sewage Planning	Explanation of sewage planning and storm water management	Mr. Hayashi, Hanoi PMB (Ms. Giang)
	16:00-17:00	Discussion	Review/Wrap-up of lesson learned	All lecturers
	17:00-	Welcome party	(Provided by JICA study team)	(MC by CUWC)
16 Nov (Wed)	9:00-10:05	Planning and design of sewer	Outline of planning and design of sewer	Mr. Hayashi
	10:05-10:25	Tea Break		
	10:25-12:00	Planning and design of sewer	Outline of planning and design of sewer	Mr. Hayashi
	12:00-13:30	Lunch		
	13:30-14:35	Construction and O&M of sewer	Outline of construction, cleaning, inspection, repairing, replacement	Mr. Thanh (VCC), Mr. Iida
	14:35-14:55	Tea Break		
	14:55-16:00	Construction and O&M of sewer	Outline of construction, cleaning, inspection, repairing, replacement	Mr. Iida
	16:00-17:00	Discussion	Review/Wrap-up of lesson learned	All lecturers
17 Nov. (Thu)	8:00	Lv. CUWC		
	9:00-11:00	Site visit of secondary concrete products plant	Site visit of concrete sewer manufacturing plant	SONG DAY Company
	11:30-12:30	Lunch		
	12:30-15:00	Move to Hai Phong		
	15:00-16:30	Site visit of sewer construction site	Site visit of sewer & WWTP construction sites	(Hai Phong PMU)
	16:30-18:30	Move from Hai Phong to CUWC		
18 Nov. (Fri)	8:00-8:45	Public relation and public hearing in sewage works	Introduction of public relation, public hearing and citizen participants in sewage works	Mr. Kohama
	8:45-9:00	Tea Break (Showing DVD related to public relation)		
	9:00-9:45	Public relation and public hearing in sewage works	Introduction of public relation, public hearing and citizen participants in sewage works	Mr. Kohama
	9:45-13:30	Attend 40 years Anniversary Ceremony of CUWC & Party with Farewell party provided by CUWC, MC by CUWC		
	13:30-14:35	Final Discussion	Discussion about overall program	All lecturers
	14:35-14:55	Tea Break		
	14:55-16:30	Final Discussion	Discussion about overall program	All lecturers
	16:30-17:00	Closing ceremony	Speech by MOC, JICA and CUWC, Certification presentation	(MC by CUWC)
19 Nov (Sat)		Leave from CUWC		

Source: JICA Study Team

Table 2.3-22 Schedule for 2nd pilot training (wastewater treatment course)

Date	Time	Lecture	Outline of Lecture	Lecturer
14 Nov (Mon)		Move to CUWC		
	15:30-	Reception,		
15 Nov (Tue)	8:30-	Textbook delivery		
	8:45-9:00	Opening ceremony	Opening speech by MOC and JICA	(MC by CUWC)
	9:00-9:30	Orientation	Explanation of Outline of the training	Mr. Kawai
	9:30-9:45	Tea Break		
	9:45-12:00	Introduction to Sewage Works	Outlines of Sewage Works and background	MOC (Ms. Thao Huong), Mr. Kawai
	12:00-13:30	Lunch		
	13:30-14:35	Outlines of Wastewater treatment	Principle of wastewater treatment and process selection method	CUWC (Ms. An), Dr. Kawaguchi
	14:35-14:55	Tea Break		
	14:55-16:00	Outlines of Wastewater treatment	Principle of wastewater treatment and process selection method	Dr. Kawaguchi
	16:00-17:00	Discussion	Review/Wrap-up of lesson learned	
	17:00-	Welcome party	(Provided by JICA study team)	(MC by CUWC)
16 Nov (Wed)	9:00-10:05	Design of mechanical equipment in WWTP	Outline for designing mechanical equipment in WWTP	CUWC (Mr. Liem), Mr. Suzuki
	10:05-10:25	Tea Break		
	10:25-11:30	Design of mechanical equipment in WWTP	Outline for designing mechanical equipment in WWTP	Mr. Suzuki
	11:30-13:00	Lunch		
	13:00-14:35	Design of Electric equipment in WWTP	Outline of roles and design for electric equipment in WWTP	Mr. Kaneko
	14:35-14:55	Tea Break		
	14:55-16:30	Outline of O&M of WWTP	Outline for O&M of WWTP	Dr. Kim, HSDC (Ms. Nga)
	16:00-17:00	Discussion	Review/Wrap-up of lesson learned	
17 Nov. (Thu)	8:30	Lv. CUWC		
	9:30-11:30	Site visit of Truc Bach WWTP	Site visit of A2O process treatment plant	HSDC/Hanoi
	11:30-12:30	Lunch		
	12:30-14:00	Move to Bac Giang		
	14:00-16:00	Site visit of Bac Giang WWTP	Site visit of A2O treatment plant	Bac Giang
	16:00-17:00	Move from Bac Giang to CUWC		
18 Nov. (Fri)	8:00-8:45	Public relation and public hearing in sewage works	Introduction of public relation, public hearing and citizen participants in sewage works	Mr. Kohama
	8:45-9:00	Tea Break (Showing DVD related to public relation)		
	9:00-9:45	Public relation and public hearing in sewage works	Introduction of public relation, public hearing and citizen participants in sewage works	Mr. Kohama
	9:45-13:30	Attend 40 years Anniversary Ceremony of CUWC & Party with Farewell party provided by CUWC, MC by CUWC		
	13:30-14:35	Final Discussion	Discussion about overall program	All lecturers
	14:35-14:55	Tea Break		
	14:55-16:30	Final Discussion	Discussion about overall program	All lecturers
	16:30-17:00	Closing ceremony	Speech by MOC, JICA and CUWC, Certification presentation	(MC by CUWC)
19 Nov. (Sat)		Leave from CUWC		

Source: JICA Study Team

e) Trainees

As for the trainees, after the discussions with MOC and the JICA Vietnam Office, Invitation Letters and GI (refer to Appendix 8-15) were sent to provinces and municipalities for their recommendations and a total of 28 trainees were selected as shown in Table 2.3-23 and Table 2.3-24 (13 in the Sewerage planning and sewer course, and 15 in the wastewater treatment course). The trainees were from 14 provinces and municipalities. Certificates were issued to participating trainees with an attendance ratio of 50% or more. 9 people completed the Sewerage planning and sewer course, and 13 completed the Wastewater treatment course, making a total of 22 graduates from the second Pilot Training.

Table 2.3-23 List of trainees for 2nd pilot training (Sewerage planning and sewer course)

No.	Name	Organization	Province/City	Certificate Received	Remark
1	Nguyen Tat Hien	Thai Nguyen Sewerage and Urban Infras Development one member Limited Company	Thai Nguyen	Yes	
2	Le Vu Tien Hung	Thu Dau Mot Wastewater Treatment Enterprise-Design Dept-BIWASE	Binh Duong	Yes	
3	Nguyen Ba Da Tuong	HCM UDC-Western Sewage brand	TP HCM	Yes	
4	Nguyen Hai Duong	DOC- Infras Management Dept	Da Nang	No	Absence more than 50%
5	Pham Hoang Huy	DOC-Architecture and Infras Dept	Dong Thap	Yes	
6	Duong Tran	DOWASEN- Urban Environment Service Enterprise	Dong Thap	Yes	
7	Trinh Hoai Phong	CPC-Urban Management Dept	Ben Tre	Yes	
8	Van Bao Lan	HEPCO- WWT Enterprise	Hue	Yes	
9	Nguyen Thanh Trung	DOC Ha Nam	Ha Nam	Yes	
10	Nguyen Van Tho	CPC Uong Bi-Urban management Dept	Quang Ninh	Yes	
11	Nguyen Van Manh	DOC Quang Nam	Quang Nam	No	Absence more than 50%
12	Vo Van Le	Institute of of Construction Planning	Da Nang	No	Absence more than 50%
13	Nguyen P.Khoi Nguyen	Institute of of Construction Planning	Da Nang	No	Absence more than 50%

Source: JICA Study Team

Table 2.3-24 List of trainees for 2nd pilot training (wastewater treatment course)

No.	Name	Organization	Province/City	Certificate Received	Remark
1	Tran Thanh Duy	Thu Dau Mot Wastewater Treatment Enterprise-BIWASE	Binh Duong	Yes	
2	Phung Ngoc Chau	HCM UCCI- Quality Technical Dept	HCMC	Yes	
3	Pham Quoc Thien	HCM UDC- Bình Hưng Waste Water Treatment Enterprise	TP HCM	Yes	
4	Vo Van Chung	DOC- Dept of Infras&Urban Development	Quang Ninh	Yes	
5	Nguyen Van Ung	DPI-Economic Dept	Vinh Long	Yes	
6	Nguyễn Lệ Quyền	Dept of Environment-Infras	Vinh Long	Yes	
7	Nguyen Duc Binh	DOC- Infras Management Dept	Da Nang	No	Absence more than 50%
8	Nguyen Thanh Hoang	Da Nang Priority Infras Investment Project- Planning and Procurement Dept	Da Nang	Yes	
9	Nguyen Nhu Vinh	Nam Dinh DOC-Ifras and Urban Development Dept	Nam Dinh	Yes	
10	Hoang Van Tien	HEPCO- Lighting Enterprise	Hue	Yes	
11	Dao Duy Cuong	PMB	Hanoi	Yes	
12	Le Thi Hai Minh	DOC Ha Nam	Ha Nam	Yes	
13	Vu Phuc Long	PMU of Hai Phong environment improvement	Hai Phong	Yes	
14	Nguyen Thanh Hai	DOC Quang Nam	Quang Nam	No	Absence more than 50%
15	Dang Thi Thu Huyen	HSDC	Hanoi	Yes	

Source: JICA Study Team

f) Training Lectures

Table 2.3-25 shows the list of lecturers. Lecturers from ATI of the MOC, PMB and HSDC of Hanoi city, CNEE of CUWC, and VCC Engineering Consultants were asked to present lectures on the same theme, and to reflect the situation in Vietnam in their lectures.

Table 2.3-25 List of lecturers for 2nd pilot training

Lecture	Japanese side	Vietnamese side
Introduction to sewage works	Mr. KAWAI	MOC (Ms. Thao Huong)
Outlines of Sewage Planning	Mr. HAYASHI	Hanoi PMB（Ms. Giang)
Planning and design of sewer	Mr. HAYASHI	
Construction and O&M of sewer	Mr. IIDA	VCC (Mr. Thanh)
Public relation and public hearing in sewage works	Mr. KOHAMA	
Outlines of Wastewater treatment	Dr. KAWAGUCHI	CUWC (Ms. An)
Design of mechanical equipment in WWTP	Mr. SUZUKI	CUWC (Mr. Liem)
Design of Electric equipment in WWTP	Mr. KANEKO	
Outline of O&M of WWTP	Dr. KIM	HSDC (Ms. Nga)
Discussion facilitator in sewer course	Mr. INOUE	
Discussion facilitator in treatment course	Mr. KAWAI	

Source: JICA Study Team

g) Preparation of Training Texts

Training text were prepared by the invited Japanese lecturers. For the lectures on the same theme as those of the lecturers on the Vietnamese side, prior discussions were held regarding the content of the lectures, and roles were allocated. The lectures whose content was coordinated were as follows.

- Outline of Sewage Planning (Sewerage planning and sewer course, afternoon of 15 November)
- Lectures were presented by Mr. Hayashi of the JICA Study Team and Ms. Giang of Hanoi PMB. They did not have an opportunity to coordinate the contents in advance, but Mr. Hayashi was asked to describe the basics of sewerage planning, and Ms. Giang was asked to introduce examples of sewerage planning in Hanoi city.
- Construction and O&M of sewers (Sewerage planning and sewer course, afternoon of 16 November)
- Mr. Iida of JICA Study Team and Mr. Thanh of VCC Consultants coordinated, and Mr. Thanh described the design standards for sewers in Vietnam, and Mr. Iida described Japanese technologies that can be introduced into Vietnam (microtunneling method, rehabilitation methods, flush gates, etc.).
- Outlines of wastewater treatment (sewage treatment course, afternoon of 15 November)
- Dr. Kawaguchi of the Study Team and Ms. An of CNEE/CUWC coordinated to divide their lecture contents, and Ms. An was responsible for the basics of treatment, Dr. Kawaguchi lectured on biological removal of nitrogen, etc.
- Design of mechanical equipment in WWTP (sewage treatment course, in the morning of 16 November)
- Mr. Suzuki of the Study Team and Mr. Liem of CNEE/CUWC coordinated to divide their lecture contents, and Mr. Liem was responsible for lecturing on pump equipment, and Mr. Suzuki lectured on other mechanical equipment.
- Outline of O&M of WWTP (sewage treatment course, in the afternoon of 16 November)

Dr. Kim of the Study Team and Ms. Nga of HSDC conducted the lecture, with Dr. Kim presenting a lecture on the basics of O&M at WWTPs, and Ms. Nga introducing examples of actual O&M in the WWTP in Hanoi city.

h) Preparation of Site Visit

At the second Pilot Training, site visits to facilities were conducted in order to deepen the understanding of the classroom lectures for the 2 courses.

For the Sewerage planning and sewer course, the construction site for 2 box culverts under construction in Hai Phong City was selected, and discussions were held in advance with Hai Phong City in which the

training and observation route was examined. For the sewage treatment course, the Truc Bach WWTP in Hanoi City and the Bac Giang WWTP in Bac Giang City were selected, discussions were held in advance with their operators regarding the objectives of the visit. Leaflets were prepared with facility information for each course, which were distributed to the trainees in order to deepen their understanding of the site visits.

3) Outline of Lectures and Discussions

Over the 4 days and the 2 courses, a total of 9 lectures, discussions, and site visits were held. The main contents of the discussions were as follows.

a) Common Lectures

- Introduction to Sewage Works

An outline of sewerage projects was presented in lectures by Ms. Thao Huong of ATI/MOC and Mr. Kawai of the JICA Study Team. Main keywords appeared in the discussion are shown below.
(Keywords from the discussion)
Roadmap for increasing sewerage usage fee, Semi Separate System, Septic Tank, Deodorizing facilities (underwater discharge sewer, combined and separated system)

- Public Relation and Public Hearing in Sewage Works

Mr. Kohama of the JICA Study Team presented a lecture regarding public relations and public hearings for sewerage projects, taking specific examples from Japan, such as Yokohama City. Due to the necessity to start on the next event, a question and answer session was carried out during the final discussion time in the afternoon.

b) Sewerage Planning and Sewer Course

- Outline of Sewage Planning

Mr. Hayashi of the Study Team described the basics of sewerage planning, and Ms. Giang introduced the example of sewerage planning in Hanoi City. Main keyword appeared in the discussion is shown below.
Method of CSO (Combined Sewer Overflow)

- Planning and design of sewer

Mr. Hayashi of JICA Study Team lectured on sewer and design.

- Construction and O&M of sewer

Mr. Thanh of VCC presented a lecture on the standards of design and construction of sewers in Vietnam, and Mr. Iida of the Study Team introduced Japanese technologies that were considered could be applied

to Vietnam (microtuneling method, rehabilitation methods, flush gates, etc.). Main keywords appeared in the discussion are shown below.

(Keywords from the discussion)

HDPE for microtunneling method, accident prevention during construction of system of microtunneling method, material of manhole, SPR flash gate, sewer cleaning, interceptor sewer system, bad smell from sewer, steps of construction

- Site visit of secondary concrete products plant

The secondary concrete products factory of Son Day Construction Materials Joint Stock Company in Bac Ninh City was visited to view the manufacturing process, etc. The process adopted is a vibration, compression, and compaction method introduced from Denmark (known as Vicon in Japan). A factory to manufacture centrifugally spun concrete sewer was under construction in a joint venture with Japan.

- Site visit of sewer construction site

Site visits were carried out to the rainwater sewer under construction and the Vinh Niem WWTP construction site in the "Hai Phong City Environmental Development Project (II) Sewer and Storm water Drainage Development Facility Development Project" being implemented in Hai Phong City under a JICA loan. The objectives of these projects are:

- Construction of sewer and WWTP (treatment area: 820 ha, planned population served: 170,000)
- Storm water drainage facility improvement and new construction (5-year probability flood: 175 mm/12 hours, sewer length: 7.1 km, storm WWTP: 12 m^3/s).

The construction sites visited from among these projects were the An Kim Hai water course improvement project under construction as a storm water drainage facility improvement project, and Vinh Niem wastewater treatment works. In the An Kim Hai water course improvement project, the existing water course is improved with 2 RC box culverts (2×3 m×3 m, L = 3 km). The Vinh Niem WWTP is a standard activated sludge treatment plant with a processing capacity of 54,000 m^3/day, but in the first phase will be 36,000 m^3/day.

In the conference room of the WWTP construction site, Nguyen Dinh Khang, Deputy Head of the Haiphong City PMU gave an outline of the sewerage projects in Hai Phong City and showed a publicity video. The main content of the presentation was as follows.

- In the An Kim Hai water course improvement project, it is difficult to acquire land, so the Project is being delayed.
- Construction of the pumping station was scheduled to commence in November 2015, but the land acquisition problem was not solved, so construction has not yet started. The land to be purchased is 200 ha, and the number of households affected is 2,000.

- The ground conditions are soft soils GL -5 to 6 m (or where shallow, 3 to 4 m), and steel sheet piling retaining walls are being used so as to not affect the nearby houses, but in some cases, they have been affected.

(Keywords from discussion)

Public relation, incineration of garbage, risk management and measures during construction, Public relation during land sale, method for selection of technology, Application of Jokaso.

c) Wastewater Treatment Course

- Outlines of Wastewater Treatment

Ms. An of CNEE/CUWC gave an overview of wastewater treatment, and Dr. Kawaguchi of the Study Team gave an overview of biological treatment. Main keywords appeared in the discussion are shown below.

(Keywords from discussion)

Ammonia removal step, septic tank, hybrid process, hybrid fixed biomass system, form of sewer (cross section)

- Design of mechanical equipment in WWTP

Mr. Liem from CNEE/CUWC explained on pump facilities and Mr. Suzuki of JICA Study Team explained on water treatment equipment as well as sludge treatment equipment. Main keywords appeared in the discussion are shown below.

(Keywords from discussion)

Pump failure monitoring, depreciation of facilities

- Design of electric equipment in WWTP

Mr. Kanko of JICA Study Team lectured about electrical equipment of WWTP. Main keywords appeared in the discussion are shown below.

(Keywords from discussion)

Sewer leakage, international standard of electrical equipment, security standard of electrical facilities

- Outline of O&M of WWTP

Ms. Nga of HSDC presented a lecture on examples of O&M of WWTPs in Hanoi City, and Dr. Kim of the Study Team presented a lecture on the important matters in O&M.

- Site visit to Truc Bach WWTP

Truc Bach WWTP in Hanoi City was visited in order to understand the actual facilities at a treatment plant. Truc Bach WWTP commenced operation in 2005, with a planned processing capacity of 3000 m^3/day

(current capacity: 2300 m^3/day), and is a circulating type anaerobic aerobic activated sludge method A_2O method (using a carrier). Main keywords appeared in the discussion are shown below.

(Keywords from discussion)

- Quantity variation of entering water, regulating reservoir, flocculant, electric bill, number of people for O&M, number of engineers, sewerage collection fee, disinfection, sewerage collection sewer, number of sewer for water discharge, inflow water quality (BOD, N…), central monitoring system

- Site visit of Bac Giang WWTP

The second site visit to a WWTP was to the treatment plant in Bac Giang City located to the northeast of Hanoi. Bac Giang WWTP commenced operation in 2010, it has a total planned capacity of 20,000 m^3/day (currently: 9,500 m^3/day), and uses the circulating biological treatment method (continuous method) A_2O method. Main keywords appeared in the discussion are shown below.

(Keywords from discussion)

Electricity consumption, share of operation monitoring, sewerage tarif collection, nitrogen, phosphorus treatment, dehydrator, house-connection (individual connection)

- Final Discussion

The final lecture time of the training course consisted of a discussion with all the lecturers answering questions from the trainees. Main keywords appeared in the discussion are shown below.

(Question) To what extent should bad odors be anticipated?

(Answer) The main cause of smells is decay of the sewage under anaerobic conditions. Typically, smells are caused by sulfides. To minimize bad odors, the sewage and sludge should be in an anaerobic environment as little as possible. Specifically, it is important that the influent sewage be under aerobic conditions as soon as possible. If it is in an anaerobic environment then the whole treatment plant will smell bad.

(Question) For the methods of treating smells by biological deodorization, how are the initial microorganisms cultivated, and is the effect of these microorganisms maintained?

(Answer) Biological deodorization uses the activities of microorganisms, and it is necessary to feed these organisms (to create conditions in which they can breed).

If activated sludge is dispersed and aerated, the microorganisms will breed. Their main food is hydrogen sulfide (sulfides). Smells cannot be seen, but as a countermeasure against smells by just seeing the track of the sludge process, the smells can be visually sensed. Therefore, visual countermeasures against smells should be taken at facilities.

In deodorization with activated carbon, when moisture adheres to the surface of activated carbon, the microorganisms can breed on it, so there is a certain amount of biological deodorization. However, it cannot be maintained if the wastewater is not properly controlled. Also, when there

is too much sulfide in the smell or when the pH is too low, the microorganism activity is reduced so the deodorization process stops. It is important to adjust the pH.

The ultimate countermeasure against bad smells is to prevent the occurrence of bad smells. For this purpose, the necessary and sufficient condition is not to allow sludge to accumulate within the treatment plant as much as possible, and to rapidly process and dispose of it.

(Question) In the separate system, rainwater wastewater and domestic sewage are separated, but in the event that sewage that includes toxic substances such as wastewater from factories, etc., were to flow into the facility, what would happen?

(Answer) In Japan, this is prohibited, and a separate facility must be provided.

The persons responsible for management of sewage should have the authorities of warning, wastewater planning, and prohibition of wastewater granted by regulations. It is necessary to prevent the inflow from factories through awareness activities and enforcement of laws and regulations, but sometimes oil, etc., flows into the treatment plant. In this case, measures should be taken before it arrives at the facility.

Oil and other volatiles (gasoline, etc.) can cause fires, so care is necessary.

Response in advance: Information collection, cameras.

Response after occurrence: Temporary storage, analysis of the stored water and if there is no problem, carry out treatment of the water.

Determination of the cause: Where did it come from?

(Question) When there is heavy rain, there is a possibility of flooding. However, what should be done about the case where when the road is flooded and residents open the manholes to discard the domestic wastewater?

(Answer) There are some areas where development of rainwater facilities is not advanced even with separate systems, and residents have connected the rainwater sewer to the sewer. The best thing is to take countermeasures against flooding of the rainwater sewer, but this requires time and expense. It is necessary to carry out awareness activities, and install temporary facilities (retarding reservoirs), and install actual facilities (install rainwater sewer).

(Question) What are the measures for bleeding air (gas) from the sewer?

(Answer) In Japan smells generally do not occur from manholes. The sewers are provided with a slope, so to a certain extent, there is a natural flow rate. On the other hand, in Vietnam, the sewer within the facilities have no slope, so matter accumulates in the sewer and as a result smells occur. These installed sewer should be cleaned. In the case of Vietnam, the cause of bad odors is almost always the deposited matter, and this is caused by reverse flow within the sewers. This can only be corrected by construction.

(Question) In Vietnam, the sewage companies including private companies are not trusted by the users.

(Answer) In Japan, projects are carried out in response to the needs for sewerage, and this has a result that

can be seen. (Flushing toilets, prevention of flooding). If there is no trust from the residents, it is necessary to seriously analyze why this is the case.

(Question) Where do the funds for public relations activities come from in Japan?

(Answer) It is paid from a special account known as the Sewage Account, in other words, from the sewerage tarifs paid by the users and from tax. It is important to ensure the organization system and resources.

(Question) At what stage does JICA become involved in sewerage planning in Vietnam?

(Answer) It is necessary that there be a request from the Vietnamese side (to be confirmed).

(Question) Bac Giang WWTP is a European type of facility, and when there is a breakdown of the terminals in the control room, replacement with other companies' products is blocked. Therefore, it is necessary to procure from the same European company. What is the situation with Japanese facilities?

(Answer) The parts can be replaced, if at the ordering stage the part used is indicated in the requirements documents.

(Question) Tell us about the method of planning WWTPs and sewers in rural areas (areas where the population is small compared with cities)?

(Answer) In Japan, sewerage planning areas are defined. The method of defining them takes into consideration the efficiency of individual processing and processing as a group. Therefore, it is not the case that all areas have a treatment plant installed, and in rural areas it may be that processing is carried out using individual septic tanks.

(Question) In Vietnam, is it possible to use the PPP format when constructing WWTPs?

(Answer) At present, only 10% of the water bills is allocated to sewage costs. Currently, the private sector does not provide resources in the form of PPP.

(Question) At present only solar drying is carried out for sludge processing. What is the ideal method of processing?

(Answer) It is necessary to investigate the ideal processing method in accordance with the conditions such as wastewater standards, fluctuations in incoming flow rates, etc., whether the processing method is for processing organic matter only, or for removal of nitrogen and phosphorus, etc., and in accordance with the scale of the treatment plant (personnel cost, O&M cost).

Countermeasures against smells are necessary for both solar drying and dewatering processes. The area of the floor for solar drying must be taken into consideration. Also, solar drying is affected by the weather, so it is necessary to take measures such as installing a roof and industrial fans.

Various substances are concentrated in sludge processing. Likewise, heavy metals are concentrated. In some cases, a high concentration of heavy metals remains. Countermeasures against this are essential.

4) Questionnaire survey after lectures

In the second Pilot Training, 2 courses were provided: "Sewerage planning and sewer course" and "Sewage treatment course." Over 4 days a total of 9 lectures were held, 2 common lectures, 3 lectures on the "Sewerage planning and sewer course," 4 lectures on the "Sewage treatment course" and facilities were visited at 4 locations. In order to measure the degree of understanding of the trainees, a simple questionnaire survey was held after each lecture. The questionnaire form is shown in Appendix 8-12. There were 3 questions:

Question 1: Was the lecture high quality and easy to understand?

Question 2: Were you satisfied with the texts and training materials provided?

Question 3: Was the lecture suitable as VSC training?

The trainees were asked to answer these questions by evaluating in 4 levels: 'excellent' or 'satisfactory' was level 4, 'somewhat satisfactory' was level 3, 'somewhat unsatisfactory' was level 2 and 'poor' or 'unsatisfactory' was level 1.

The questionnaire results were as shown in Table 2.3-26, Table 2.3-27, and Table 2.3-28. Level 4 and 3 were considered as good and satisfactory, so from the questionnaire results it can be considered that the trainees found the lectures in the second Pilot Training generally good.

Table 2.3-26 Aggregate results of questionnaires after lectures (common lectures)

Question 1	Was the lecture easy to understand and of satisfactory quality?					
Evaluation	4	3	2	1	Total answers	Unanswered
Lecture①Introduction	11	11	2	0	24	0
Lecture②Public relation & hearing	15	5	0	0	20	1
Question 2	Were you satisfied with the textbooks and materials used in the program?					
Evaluation	4	3	2	1	Total answers	Unanswered
Lecture①Introduction	12	11	1	0	24	0
Lecture②Public relation & hearing	15	5	0	0	20	1
Question 3	Were the lecture/observation adapted to the Project?					
Evaluation	4	3	2	1	Total answers	Unanswered
Lecture①Introduction	13	10	1	0	24	0
Lecture②Public relation & hearing	18	3	0	0	21	0

Source: JICA Study Team

Table 2.3-27 Aggregate results of questionnaires after lectures (Sewerage planning and sewer course)

Question 1	Was the lecture easy to understand and of satisfactory quality?					
Evaluation	4	3	2	1	Total answers	Unanswered
Lecture①Outlines of Sewage Planning	5	5	0	0	10	2
Lecture②Planning & Design of Sewer	5	6	1	0	12	0
Lecture③Construction & O&M of Sewer	6	3	0	0	9	3
Question 2	Were you satisfied with the textbooks and materials used in the program?					
Evaluation	4	3	2	1	Total answers	Unanswered
Lecture①Outlines of Sewage Planning	8	2	0	0	10	2
Lecture②Planning & Design of Sewer	5	6	1	0	12	0
Lecture③Construction & O&M of Sewer	7	2	0	0	9	3
Question 3	Were the lecture/observation adapted to the Project?					
Evaluation	4	3	2	1	Total answers	Unanswered
Lecture①Outlines of Sewage Planning	5	5	0	0	10	2
Lecture②Planning & Design of Sewer	5	6	1	0	12	0
Lecture③Construction & O&M of Sewer	8	1	0	0	9	3

Source: JICA Study Team

Table 2.3-28 Aggregate results of questionnaires after lectures (wastewater treatment course)

Question 1	Was the lecture easy to understand and of satisfactory quality?					
Evaluation	4	3	2	1	Total answers	Unanswered
Lecture①Outlines of Wastewater Treatment	3	8	3	0	13	1
Lecture②Design of Mechanical in WWTP	5	7	2	0	14	0
Lecture③Design of Electrical in WWTP	6	3	0	0	9	5
Lecture④Outlines of O&M in WWTP	8	3	0	0	11	3
Question 2	Were you satisfied with the textbooks and materials used in the program?					
Evaluation	4	3	2	1	Total answers	Unanswered
Lecture①Outlines of Wastewater Treatment	4	9	0	0	13	1
Lecture②Design of Mechanical in WWTP	6	8	0	0	14	0
Lecture③Design of Electrical in WWTP	7	2	0	0	9	5
Lecture④Outlines of O&M in WWTP	9	2	0	0	11	3
Question 3	Were the lecture/observation adapted to the Project?					
Evaluation	4	3	2	1	Total answers	Unanswered
Lecture①Outlines of Wastewater Treatment	4	10	0	0	14	0
Lecture②Design of Mechanical in WWTP	6	8	0	0	14	0
Lecture③Design of Electrical in WWTP	8	1	0	0	9	5
Lecture④Outlines of O&M in WWTP	8	3	0	0	11	3

Source: JICA Study Team

5) Questionnaire survey after the training

After completion of the training, a questionnaire survey regarding the second Pilot Training was carried out for the trainees' organizations. Refer to Appendix 8-13 for the questionnaire form and the questionnaires collected. Responses were received from 8 persons (planning and sewers: 3 persons, sewage treatment: 5 persons) from among 22 persons that completed the training (planning and sewers: 9 persons, sewage treatment: 13 persons). The results were as follows.

Question 1: What was your overall view of the training?

As can be seen from the responses shown in the following Table 2.3-29, the participants of the 2 courses were generally satisfied with the courses overall.

Table 2.3-29 How would you rate this training overall?

Evaluation items	Excellent	Satisfactory	Unsatisfactory	Poor	Total
Sewerage planning/sewer	1	2	0	0	3
Wastewater treatment	2	3	0	0	5
Total	3	5	0	0	8

Source: JICA Study Team

Question2: What did you like the best about the training?

- Sewerage planning and sewer course
  - ✓ Sewer inspection methods, flush gate models, microtunneling methods (Duong Tran, DOWASEN)
  - ✓ Sewer construction and O&M (Van Bao Lan, HEPCO, Hue)
  - ✓ Mr. Iida's lectures (Pham Hoang Huy, Dong Thap DOC)
- Sewage treatment course
  - ✓ Discussion time (Hoang Van Tien, HEPCO, Hue)
  - ✓ Wastewater treatment technologies (Nguyen Nhu Vinh, Nam Dinh DOC)
  - ✓ Mr. Kawai's lectures (Phung Ngoc Chau, UCCI, HCMC)
  - ✓ Introduction to technologies, sharing of the experience of Japanese specialists (Vo Van Chung, Quang Ninh DOC)
  - ✓ Wastewater treatment methods (Vu Phuc Long, Hai Phong PMU)

Question 3: What kind of training are you needed?

- Sewerage planning and sewer course
  - ✓ Site visits. Sharing of experience between organizations involved in operation and organizations involved in construction, and discussions (Duong Tran, DOWASEN)
  - ✓ Management by GIS (Pham Hoang Huy, Dong Thap DOC)

- Wastewater treatment course
  - ✓ Training adapted for the level of manager, operator, and technician (Hoang Van Tien, HEPCO, Hue)
  - ✓ Project Management (Nguyen Nhu Vinh, Nam Dinh DOC)
  - ✓ Training combined with the site visits (Phung Ngoc Chau, UCCI, HCMC)
  - ✓ Theory and practice (Vu Phuc Long, Hai Phong PMU)

Question 4: How would you rate the quality of the training textbook/materials?

Table 2.3-30 Question 4: How would you rate the quality of the training textbook/materials?

Evaluation item	Excellent	Satisfactory	Unsatisfactory	Poor	Total
Sewerage planning and sewer	1	2	0	0	3
Wastewater treatment	1	4	0	0	5
Total	2	6	0	0	8

Source: JICA Study Team

Comment

Textbooks with good quality paper in order to avoid humidity (Phung Ngoc Chau, UCCI, HCMC)

Question 5: Were the meeting room and facilities adequate and comfortable?

- Sewerage planning and sewer course
  - ✓ Yes (Duong Tran, DOWASEN)
  - ✓ Yes (Van Bao Lan, HEPCO, Hue)
  - ✓ Yes (Pham Hoang Huy, Dong Thap DOC)
- Wastewater treatment course
  - ✓ Sound system should be improved (Hoang Van Tien, HEPCO, Hue)
  - ✓ Yes (Nguyen Nhu Vinh, Nam Dinh DOC)
  - ✓ Satisfied (Phung Ngoc Chau, UCCI, HCMC)
  - ✓ Yes (Vo Van Chung, Quang Ninh DOC)
  - ✓ Yes (Vu Phuc Long, Hai Phong PMU)

Question 6: How would you rate the accommodation for training?

Table 2.3-31 Question 6: How would you rate the accommodation for training?

Evaluation items	Excellent	Satisfactory	Unsatisfactory	Poor	Total
Sewerage planning and sewer	0	2	1	0	3
Wastewater treatment	0	4	0	0	4
Total	0	6	1	0	7

Source: JICA Study Team

Comment

- ✓ Training and accommodation should be located in urban area of Hanoi (Nguyen Nhu Vinh, Nam Dinh DOC)

Question 7: Was the time allocated for the training sufficient?

- ➢ Sewerage planning and sewer course
  - ✓ Yes (Duong Tran, DOWASEN)
  - ✓ The locations and time for site visits need to be increased (Van Bao Lan, HEPCO, Hue)
  - ✓ The final discussion time was shortened and was not sufficient (Pham Hoang Huy, Dong Thap DOC)
- ➢ Wastewater treatment course
  - ✓ The lecture time was too short compared with the amount of information in the texts (Hoang Van Tien, HEPCO, Hue)
  - ✓ The contents were enormous so the time was insufficient (Nguyen Nhu Vinh, Nam Dinh DOC)
  - ✓ Sufficient and optimal (Phung Ngoc Chau, UCCI, HCMC)
  - ✓ Ideally the time for 1 course is 1 week. However, because of the considerable volume of the contents, the prescribed lecture time was insufficient, and generally only the introduction was completed (Vo Van Chung, Quang Ninh DOC)
  - ✓ More time is necessary (Vu Phuc Long, Hai Phong PMU)

Question 8: What aspects of the training could be improved?

- ➢ Sewerage planning and sewer course

  No answer
- ➢ Wastewater treatment course
  - ✓ It is necessary to add a general criterion to the texts to enable an evaluation of the sewage processing per 1 m^3 to satisfy the Vietnamese wastewater criterion B (Hoang Van Tien, HEPCO, Hue)
  - ✓ Lecture on a comparison of the current state in Vietnam (Nguyen Nhu Vinh, Nam Dinh DOC)
  - ✓ I would like the training documents to be sent prior to the start of training (Phung Ngoc Chau, UCCI, HCMC)

- ✓ I would like more detail on special item contents (Vo Van Chung, Quang Ninh DOC)
- ✓ Power equipment system (Vu Phuc Long, Hai Phong PMU)

Question 9: Would you like to join the next training (2nd pilot training)?

Table 2.3-32 Question 9: Would you like to join next training (2nd pilot training)?

Choice	Yes	No	Total
Sewerage planning and sewer	3	0	3
Wastewater treatment	5	0	5
Total	8	0	8

Source: JICA Study Team

Question 10: What, if any, improvements would you suggest or request to VSC?

- ➢ Sewerage planning and sewer course
  - ✓ Wastewater treatment (Duong Tran, DOWASEN)
  - ✓ All JICA courses on sewerage works (Pham Hoang Huy, Dong Thap DOC)
- ➢ Wastewater treatment course
  - ✓ Wastewater treatment (Hoang Van Tien, HEPCO, Hue)
  - ✓ Sewerage projects and management of wastewater treatment (Nguyen Nhu Vinh, Nam Dinh DOC)
  - ✓ I would like to be sent a list of the training courses scheduled for 2017 (Phung Ngoc Chau, UCCI, HCMC)
  - ✓ Introduction to waste treatment models in other countries, and models that can be applied in Vietnam (Vo Van Chung, Quang Ninh DOC)
  - ✓ Management of WWTP, O&M (Vu Phuc Long, Hai Phong PMU)

Question 11: How much could your organization pay as training fee?

- ➢ Sewerage planning and sewer course
  - ✓ We would like to bear the cost of transport and accommodation, but the course fee to be borne by the organization holding the training (Duong Tran, DOWASEN)
  - ✓ 5,000,000VND (Van Bao Lan, HEPCO, Hue)
  - ✓ 1,000,000VND (Pham Hoang Huy, Dong Thap DOC)
- ➢ Wastewater treatment course
  - ✓ No answer (Hoang Van Tien, HEPCO, Hue)
  - ✓ DOC to request JICA to sponsor local DOC (Nguyen Nhu Vinh, Nam Dinh DOC)
  - ✓ Depends on the proposal by VSC and the content of the training (Phung Ngoc Chau, UCCI, HCMC)

- ✓ No answer (Vo Van Chung, Quang Ninh DOC)
- ✓ 10,000,000VND (Package of meal and accommodation) (Vu Phuc Long, Hai Phong PMU)

Question 12: Please write down if you have any requests for improvement.

- ➢ Sewerage planning and sewer course
  - ✓ At present, the provinces in the Mekong River Delta have insufficient experience in construction, management, and operation of wastewater treatment facilities, so the demand for training has suddenly increased for managers and in particular for technical workers. I would like VSC to hold training courses in HCMC. In this way, the organizations in the southern region can participate sufficiently (Duong Tran, DOWASEN)
  - ✓ The scope of Vietnamese sewerage projects is small. For example, the Cao Lanh City sewage collection and processing system capability is only 10,000 m^3/day, and the sewer network is small (sewer diameters do not exceed 1000 mm), and the conditions are not the same as for developed countries (large sewer systems). I would like VSC to deal with inspection methods for sewer networks suitable for Vietnamese conditions, and to enhance the content of management and O&M (Duong Tran, DOWASEN)
  - ✓ The training courses should be held in other provinces also (Van Bao Lan, HEPCO, Hue)
  - ✓ The bus was late due to the driver, but VSC should have let us be at the reception on time. The trainees had to wait 3 to 4 hours at the airport before boarding the bus (Pham Hoang Huy, Dong Thap DOC)
- ➢ Wastewater treatment course
  - ✓ VSC touched on the current difficulties with projects in Vietnam, and it is necessary to look at how to solve these. When forming projects and project plans, the climate and weather of each region of Vietnam should be taken into consideration so that the WWTP functions well (Hoang Van Tien, HEPCO, Hue)
  - ✓ In the content of the lectures it is necessary to share experiences in detail. General ideas should be avoided, and the content of the lecture and the text should coincided with each other, as was always the case for the Vietnamese lecturers (Phung Ngoc Chau, UCCI, HCMC)
  - ✓ Increase the practicality and applicability in Vietnam (Vu Phuc Long, Hai Phong PMU)
- ➢ Other comments
  - ✓ In Vietnamese WWTP projects, it is necessary to have a plan after the construction project. For example, a plan for O&M cost, etc., and it is necessary to know what the facility manager should do after commencement of service (Hoang Van Tien, HEPCO, Hue)

6) Summary of the Second Pilot Training

The second Pilot Training had the same objectives as the first Pilot Training, and was held between 14

November to 19 November 2016 (the training lecture period was 4 days from 15 November to 18 November), with lectures at the lecture halls of CNEE/CUWC in Hanoi City, and site visits to sewage related facilities in Hanoi City and Hai Phong City.

2 training courses were provided, “Sewerage planning and sewer course”, and “Sewage treatment course” with a limit of 15 participants in each course or a total of 30 participants. A total of 28 trainees were accepted from 14 provinces and cities throughout Vietnam (sewerage planning and sewer course: 13, sewage treatment: 15). The number completing the courses taking attendance rate into consideration was 22. (sewerage planning and sewer course: 9, sewage treatment: 13).

Lectures that were common to the 2 courses included basics of sewage, PR and public hearings for sewerage projects. The sewerage planning and sewer course included sewerage planning, planning and design of sewers, sewer construction and O&M and site visits to 2 sewage facilities. The sewage treatment course included an overview of wastewater treatment, mechanical design for treatment plants, electrical design for treatment plants, O&M of treatment plants and site visits to 2 WWTPs.

In the questionnaire surveys held after completion of the lectures, an elevated level of satisfaction was indicated for all the lectures, but the response rate to the questionnaire was poor. An elevated level of expectation was indicated for the VSC training, and the content of the expectation was also indicated. In the questionnaire a question was also asked about the training fee, and the answers ranged from the cost should be borne by the organizers, to an amount ranging from 1 million to 10 million VND.

The main keywords from the discussions held in the lectures of the 1st and 2nd pilot trainings are summarized below.

(Main keywords from the discussions)

- Sewerage administration and finance

  Sewerage diffusion rate, beneficiary payments, sewer usage rates, the price rise roadmap, PR activities for the city residents, public information and public hearings for residents when purchasing land, waste incineration, risk management during the construction, house connections (connections to each house), number of persons to be involved in O&M
- Regarding sewer

  Dredged sludge, semi separate system, HDPE in the microtunneling method, countermeasures against the breakdowns during microtunneling, material of manhole covers, SPR, flush gates, sewer cleaning, interceptor sewers, bad odors from sewers, planning and design of sewer, maintenance and management of sewers, combined system and separate system, countermeasures against combined sewer overflows (CSO) (water discharge occurs during rainy periods), shape of sewer

(cross-section), leakage from sewers, sewerage collection sewer

- Regarding treatment facilities

  O&M, Septic Tank, deodorizing equipment, discharge sewer in the sea, methods for selecting wastewater treatment technologies, application of septic tanks, decomposition of ammonia, septic tank, hybrid process, addition of carrier, monitoring of pump breakdown, depreciation of equipment, international standards of electrical systems, safety standards used for electrical equipment, fluctuations in incoming flow, regulating pond, flocculant, PAC, electricity cost, number of engineers, collection of sewerage tarifs, disinfecting, number of effluent pumps, incoming water quality (BOD, N...), central monitoring system, electrical power consumption, allocation of operation and monitoring, removal of nitrogen and phosphorus, dewatering equipment

The above-mentioned keywords are considered to be the fields attracting high attention of the trainees, which should be noted as the important items to be incorporated in the training materials.

Regarding the training in 2017 and later, it is necessary to carry out a study based on the knowledge and texts from the 2 pilot trainings, such as course setting, training implementation methods, training fee setting, etc.

2.3.5 Preparation of Plan for Training Facilities and Equipment

(1) Training Expenses

CUWC has accumulated know how on estimating the cost of each training course and setting training fees. The fees must be appropriately set and collected in order to sustainably implement the training.

The calculation of the training expenses is as follows. The salaries of the CNEE/CUWC staff is paid by the MOC, so the staff salaries are not included in the training expenses. The unit prices from CNEE/CUWC were also used as the unit prices.

For calculation of the lecturers' fee, 2 million VND/day was used as the unit cost for external lecturers.

- Printing of text books

  The necessary costs should be calculated. A uniform of 100,000 VND per course (about 300 pages black and white) has been used (approximate cost 300 VND/page (black and white), 3,000 VND/page (color)).

- Pens and notebooks for training

  Per trainee 100,000 VND was used.

- Lecture consumables

  The necessary consumables costs for lectures should be calculated, 3,865,000 VND per training course has been used (CUWC unit cost).

- Printing certificates of completion

  A cost of 50,000 VND (CUWC unit price) has been used.
- Facility usage fees, utilities expenses

  A cost of 1 million VND per trainee (CUWC unit price) has been used.

The calculated training cost (5 days, capacity 30 persons) based on the above is as shown in Table 2.3-33. These training costs are counted as expense items in the income and expenditure plan referred to in 2.2.4. Since facility usage fee and utilities costs are the major part of training expense, effort should be made to reduce them by negotiating with the facility owners such as CNEE/CUWC and MOC, in order to reduce the training fee and to attract as many trainees as possible.

Table 2.3-33 Costs for a training course (capacity of 30 trainees)

No.	Items	Unit	Quantity	Unit price (VND)	Subtotal (VND)
1	Compensation for lectures	Day	4	2,000,000	8,000,000
2	Printing of texts	Person	30	100,000	3,000,000
3	Pens and notebooks for training	Pair	30	100,000	3,000,000
4	Lecture consumables	Set	1	3,865,000	3,865,000
5	Printing certificates of completion	Person	30	50,000	1,500,000
6	Facility usage fees, utilities expenses	Set	30	1,000,000	30,000,000
Total					49,365,000
Cost per person				1,645,500	

Source: JICA Study Team

(2) Planning for training equipment

Necessary equipment for training is principally ones for the lecture of water quality analysis as indicated in the table 2.3-34, which is found in the final training plan of Engineer Course (design of WWTP).

Table 2.3-34 List of training equipment JICA expects to provide to VSC

No.	Name	Specipication	Unit
1	Portable pH/ORP meter Manufacturer / Origin: Hanna / Rumani Model: HI2211	DO Range: 0.00 to 50.00 ppm (mg/L); 0.0 to 600.0% saturation	2
2	Portable DO meter Manufacturer / Origin: Hanna / Rumani Model: HI2400	DO Resolution: 0.01 ppm (mg/L); 0.1% saturation	2
3	Potable EC meter Manufacturer / Origin: Hanna / Rumani Model: HI8733	DO Accuracy: ±1.5% of reading ±1 digit	2
4	Transparency Meter -2 Model: ST-100 Origin: Japan	Atmospheric Pressure Range: 450 to 850 mmHg	2
5	Portable MLSS meter Manufacturer / Origin: Yokogawa / Korea Model: DWA-3000A-MLSS	Atmospheric Pressure Resolution: 1 mmHg	2
6	Potable Residual chlorine meter Manufacturer / Origin: Hanna / Rumani Model: HI 96753	Salinity Compenstaion: automatic from 0 to 70 g/L	2
7	Potable Vibrometer	With Simple diagnosis function Acceleration, acceleration peak（1kHz-10kHz） Speed, displacement（10kHz-20kHz）	2
8	Insulation Resistance Meter	5 Ranges with Hard case model	2
9	Radiation thermometer	Gun Type	2
10	Leak clamp		2
11	Tester	Digital Multimeter	2
12	Portable electroscope	For High-Low Pressure	2
13	Vernier calipers	30cm, Digital Indication Type	2
14	Others (Consumables)		1

Source: JICA Study Team

2.3.6 Comments from Local Consultant on Training Plan

After the 3rd JCC meeting, local consultant(VIWASE) provided comments on the training plan, from the view point of localization. The following comments will be taken into account in implementing the pilot trainings at the implementation phase. The comments from local consultant is shown in Appendix 8-17. It is necessary to hear the views of local consultant for implementation of the pilot project of the full-scale phase.

2.4 Output 4: Pilot Activities for the Project Implementation Function are Implemented

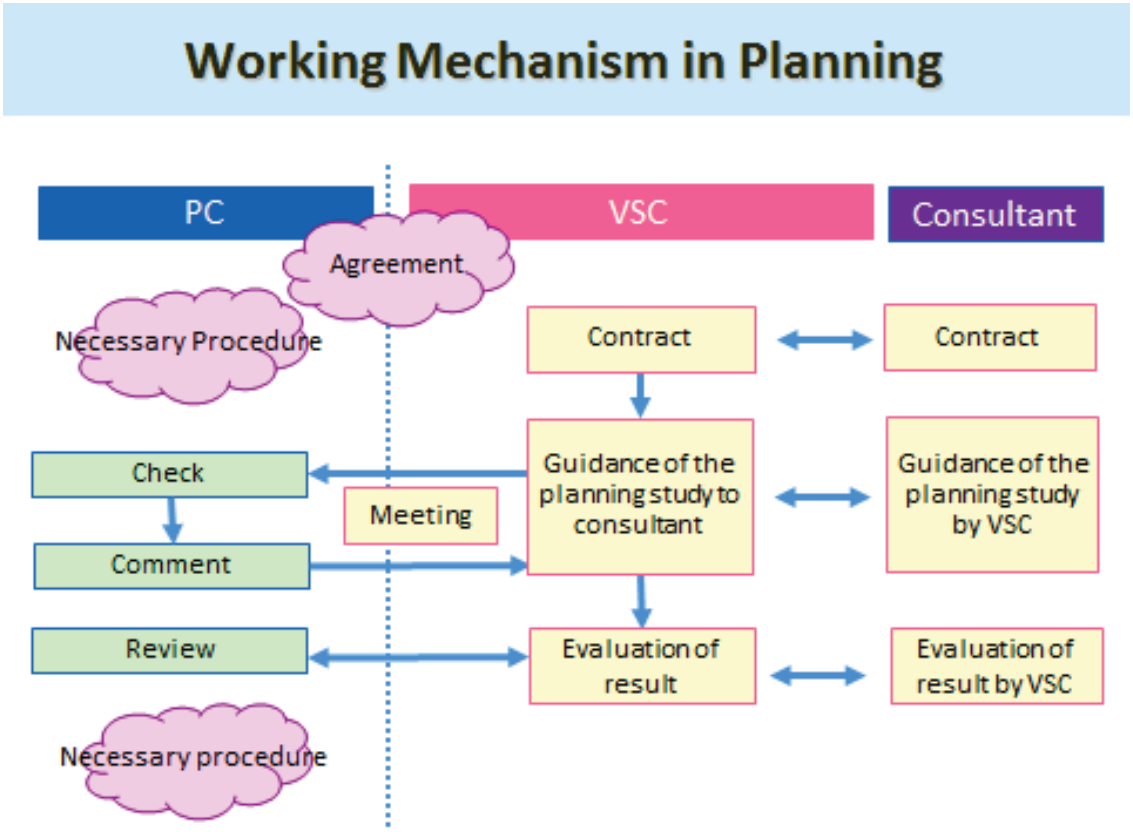
2.4.1 Elaborate Mid- and Long-Term Planning for Implementation Support function

(1) Planning Phase

In Vietnam, before a PC starts sewerage project, there are some necessary procedures; city master plan which plans major specific urban infrastructure such as sewerage, sector master plan which plans sewerage system, pre-FS which is conducted prior to feasibility study (FS, hereinafter) and FS which studies project's feasibility.

- City master plan: plan for major urban infrastructure including sewerage. VIUP (Vietnam Institute for Urban and Rural Planning) deals with city general master plan (Class 1 and upper cities) or advise (Class 2 and under cities). (Source: CIRCULAR No.01/2013/TT-BXD: GUIDING THE CALCULATION AND MANAGEMENT OF EXPENDITURE ON CONSTRUCTION PLANNING AND URBAN PLANNING).
- Sector master plan: sewerage master plan based on Decree80/2014/ND-CP (Drainage and Wastewater Treatment).
- pre-FS: it is required to prepare when construction cost exceeds 1.5 trillion VND, based on Decree81/2015/ND-CP (Construction Project Management).
- FS: it is necessary to assure the Project's feasibility. Sometimes donor organization deals with F/S.

In Vietnam, ODA loan often finances sewerage projects. When PCs would like to start sewerage projects, PCs must propose their projects to MPI. The procedures on sector master plan, project proposal and FS are shown in Appendix 8-18.



Source: JICA Study Team

Figure 2.4-1 Project implementation scheme in Vietnam

VSC's project implementation scheme on planning stage is shown in Figure 2.4-1. VSC receives planning work from PC (Provincial or City) and VSC has contract with consultant. During planning period, VSC supervises the consultant and has discussion with PC. JS has the same project implementation scheme.

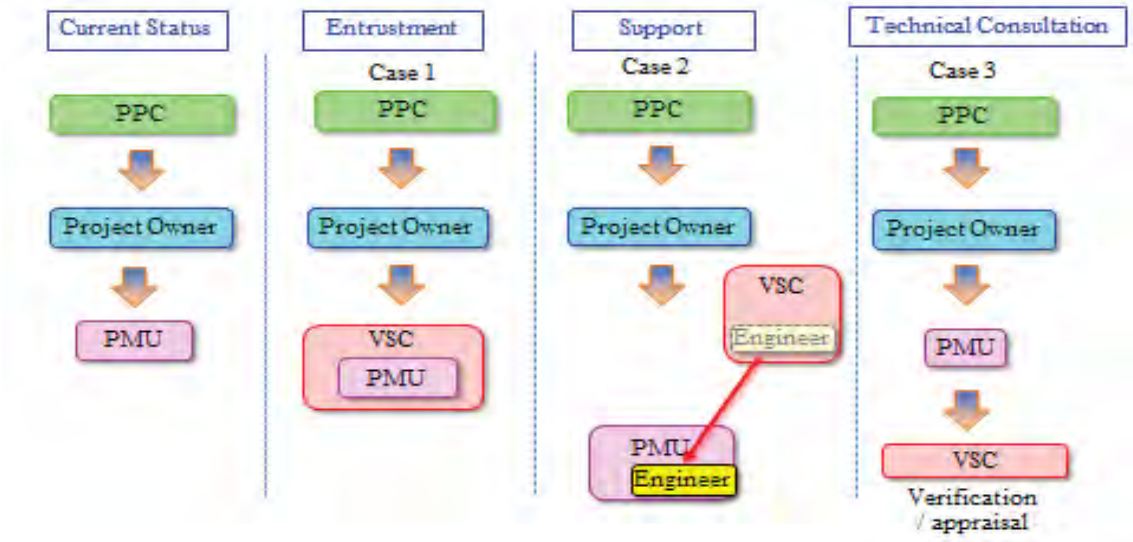
(2) Design and Construction Phase

PMU will execute the Project in the phase of design and construction. PPC assigns PMU in the organization including provincial water and wastewater companies and CPC. An image of project implementation support scheme is described in Figure 2.4-2.

Case 1 assumes VSC deals with project management instead of PMU. VSC carries out all operations of PMU by entrustment from PC.

Case 2 assumes consultation, or technical support. In Case 2, VSC dispatches engineers to PMU which needs a technical support and deals with a part of PMU's work.

In Case 3, VSC deals with technology verification instead of the central government or PPC.



Source: JICA Study Team

Figure 2.4-2 Image of Project Implementation Support scheme (design and construction phase)

Case 1: Needs survey shows that a case that each project establishes each PMU seems rare and single PMU implements multiple projects in many cases. In latter case, as sewerage project cannot split away from PMU. In needs survey, only Nam Dinh city answered that it will consider establishing PMU for only sewerage project. Case 1 will be applicable not so much cases, but possible to some cases.

Case 2: Needs survey shows that many PC answered that they need VSC's technical support for sewerage projects because sewerage is a new technology for them. One PC which sewerage project is currently underway employs a foreign sewerage expert as an in-house consultant of PMU. The PC said that ODA covered employment cost. So, case 2 is considered to satisfy actual needs.

Case 3 is a technology verification service for the government or PPC, and local consultants carry out it currently. This case is supposed to compete with local consultants and required a bidding participation. Case 3 looks not suitable for VSC.

During the discussion with MOC, 2 cases, that organization like VSC is necessary to promote project as shown below, were identified.

- In case of the Project which covers more than one province, central government should establish PMU. In this case, VSC can be the PMU.
- In case of the Project which has more than one city, some organizations are necessary to coordinate PMUs. In this case, VSC can be the coordinator.

At this moment, such project shown above does not exist; however, VSC will be necessary when such a project will be required.

(3) Mid- and Long-Term Plan

Within 72 cities in category 3 and above, 26 cities do not have sewerage plan. In mid- and long-term plan, these 26 cities will be recent target for VSC. In R&D, VSC will correct, organize and disseminate information to accelerate for cities below category 4 to start sewerage project. Also, in training, VSC will provide lectures on methods and procedures of sewerage planning. Through these activities, it is expected to increase the number of cities which start sewerage project. VSC's project implementation support will be important for these cities to start sewerage project smoothly. VSC's project implementation support scheme will be examined and established through pilot project written in 2.4.2 to implement project support in mid-and long- term.

2.4.2 Selecting Pilot Activities for the Project Implementation Support

(1) Planning Phase

Needs Survey shows that Nam Dinh City, which is Class 1 city and the one of the biggest city among the not-yet-started cities, is interested in the VSC activities. Nam Dinh City has ever developed city general master plan, but its sewerage system remains unrealized. While in the city, people discharge untreated wastewater into rivers, they take drinking water from the river in the downstream of city center. So, the city recognizes wastewater treatment is required. In order to elaborate the implementation support scheme in the planning phase, general master plan of Nam Dinh City as VSC's pilot project will be developed from 2017. The result of the field survey is indicated below.

DOC of Nam Dinh Province
① **Sewerage projects** ・ The existing drainage systems consist of the system developed in the French colonial era and the one mentioned below developed in the Urban Drainage Improvement Project supported by WB (completed in 2015). - Drainage pipeline: 53km - Canals: 13km - Reservoirs: 45ha ・ At present, wastewater is not treated (there is no WWTP) in the province or there is no plan for donor assistance in the wastewater treatment. ・ A project to construct 3 WWTPs is mentioned in the master plan for urban development. However, a detailed study has not been conducted for the Project. A master plan for the sewerage sector has not been prepared either. ・ The current issues are as follows: - The combined drainage system is used in the old city area, while the separate sanitary drainage system is used in the new city area. With the expansion of the city area, a complication has arisen from the

use of the different drainage systems in the old and new city areas.
- The water in the canals and rivers has been polluted significantly. The most problematic issue is the fact that an intake of a water supply system is located downstream of the outlet of a sewer.
- Although the DOC intends to plan a sewerage project based on the master plan, it has difficulty in doing so because it does not have experts in the sewerage planning.

② PMU and system for the implementation of sewerage projects

- The drainage systems in the city are under the jurisdiction of the CPC and maintained by Urban Construction Company, a joint-stock company (JSC) of the city.
- However, the company has no expert in sewerage.
- Urban Technical Infrastructure Management Division is responsible for the management of the sewerage systems.
- The division has five engineers, one of whom is Mr. Vinh, an engineer in the water sector specialized in the waterworks (and sewerage works).

- Neither sector-based PMU nor project-based PMU, mentioned below, has been established for the implementation sewerage projects. There used to be a project-based PMU for the implementation of the Urban Drainage Improvement Project supported by WB. However, it was dissolved in 2015.
- As the CPC controls the development of urban infrastructure in the city, it is reasonable to assume that the CPC is to establish a company to develop and maintain sewerage systems. However, the absence of experts in the sewerage sector is a major problem in the development of sewerage systems.
- It is possible for a DOC of a province to manage infrastructure development of a city with a direct instruction of MOC.
- A PMU is usually established by sector as a sector-based PMU. However, a project-based PMU is to be established for the implementation of a project funded by foreign budget, in addition to the section-based PMU.

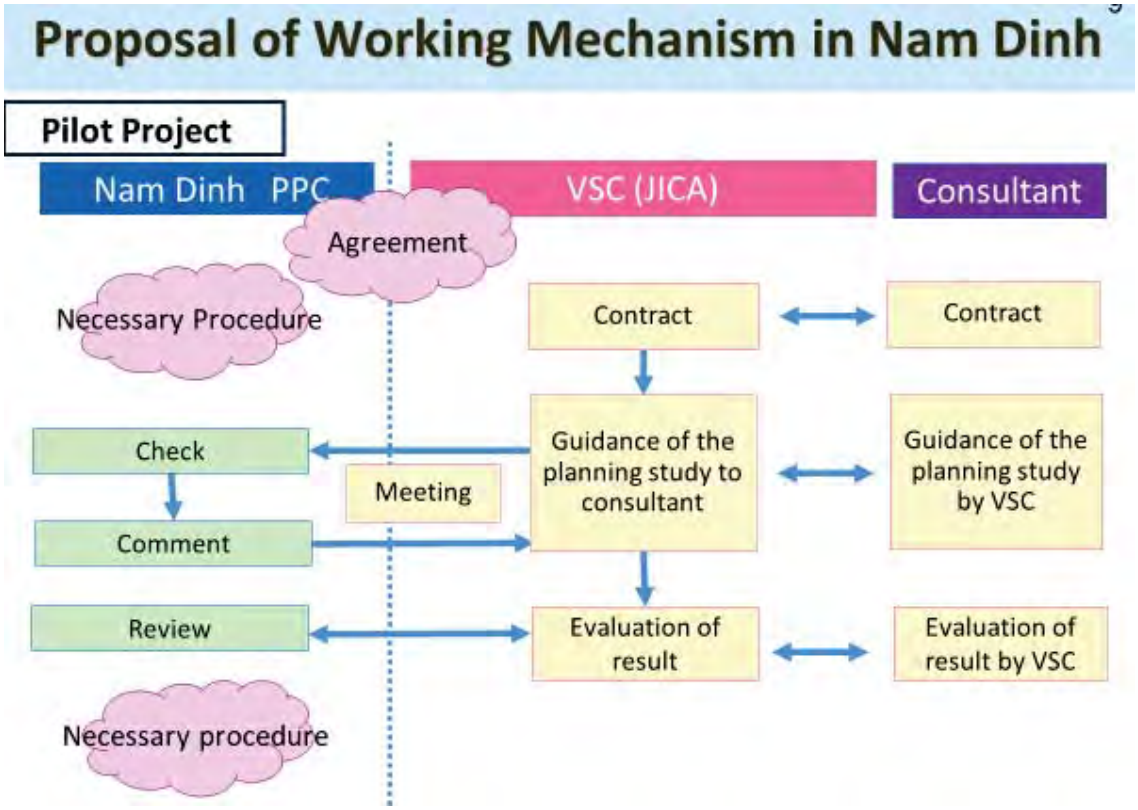
③ Training needs and human resource development

- Because of the shortage of human resource in the sewerage sector, it is necessary to develop and maintain human resource.
- It is recommended that a meeting with the director of the DOC of the province and the chairperson of the PPC be held in June to discuss the matter of requesting VSC to provide support to the PMU, including the possibility of VSC acting as PMU, again. The Survey Team has decided to revisit the province in June.

In the pilot project, VSC will make a sector master plan. Figure 2.4-3 describes the implementation scheme of the pilot project. Significance of this pilot project is to examine VSC's working mechanism on advisory support work. Through this pilot project, VSC will confirm what kind of work, procedure, approval is necessary and when. Also, this pilot project aims to develop VSC counterparts' masterplan making capacity. VSC counterparts are assumed to be several experienced staff from MOC or other organizations. In principle, PC pays necessary cost to VSC; however, JICA bears consultant fee on this pilot project. VSC counterparts supervise consultant and Japanese experts support VSC counterparts. Consultant with VSC counterparts has meetings with Nam Dinh city and makes plan based on the result of the meetings. Final report will be submitted to the city. The city will carry out necessary administrative procedure. As an example, project implementation support flowchart of JS is shown in Appendix 8-19. Through this pilot project, VSC's human resource development will be done, and suitable procedure for VSC's project

implementation support will be examined based on discussion between VSC counterparts and Japanese experts.

From 2019, VSC will implement actual projects using working mechanism examined and rearranged through pilot project.



Source: JICA Study Team

Figure 2.4-3 Nam Dinh's pilot project implementation scheme

(2) Design and Construction Phase

During needs survey, JICA study team visited 3 cities; Ben Tre, Sa Dec, and Vinh Long in Mekong Delta. The cities that currently ADB supports show interest in VSC's project implementation support. Ben Tre City, which is now under F/S, can start its design phase in 2018 at the earliest possibility. Other 2 cities expect to implement F/S in 2018. The feasibility of pilot project in Ben Tre in 2018 will be discussed in 2017.

If pilot project in Ben Tre will be performed, working mechanism will be examined through the pilot project. Based on the working method examined in the pilot project, VSC will implement actual projects from 2019.

(3) Human Resources

When carrying out sewerage project, securing sewerage experts is required. Hanoi Sewerage and Drainage Project Management Board (HSDPMB) of Hanoi City, UCCI, Urban Drainage Company (UDC, hereinafter), and Steering Committee for Flood Control (SCFC) of Ho Chi Minh City have experienced sewerage engineers. VSC will temporary send these experienced engineers, local consultants, or MOC staff to PMU as a part time basis or full time basis. Considering human resource development of VSC, some MOC staffs should be assigned to VSC to support the Project execution and to have OJT.

When executing pilot project in Nam Dinh City, JICA will employ local consultant and Japanese experts will support VSC to carry the Project. Considering the human resource development, VSC staff should be assigned to support the Project implementation as OJT. VSC counterparts are assumed to be several experienced staff from MOC or other organizations. Japanese experts will train and support VSC counterparts and facilitate the progress of the Project.

VSC plans to pool experienced sewerage engineers in the future. Considering the balance between the number of staffs and the number of projects, possibility of human resource registration system will be examined in 2017 – 2018.

2.5 Output 5: Pilot Activities for Consulting and Research & Development for the Sewerage Sector in Vietnam are Implemented

2.5.1 Necessity of R&D Function

Sewerage works in Vietnam (mainly Interceptors and WWTPs) are mostly supported by grants or ODA loans from foreign donors. As WB and JICA point out in their reports, sewerage works which have been implemented so far in Vietnam have following issues to be improved.

- Implementation of F/S, design and construction takes long time.
- The Project period from start to completion is longer than other projects in the different fields.

The probable causes are as follows:

- The review or correction of inappropriate plan or design need time;
- Insufficient design standards for planning and design cause long time for consideration; and
- Unskilled personnel of PC or PMB need time to plan and design.

Needs survey shows that many PCs which have not started sewerage projects, said that they would need VSC's technical support for sewerage project because sewerage is new technology for them. PCs which have not started sewerage projects must implement sewerage projects despite they have no experience and no skilled personnel of sewage works. When such less-experienced PCs must make decisions on sewerage projects, sewerage projects may delay or may encounter difficulties due to the causes mentioned above.
Smooth promotion of sewerage works in Vietnam requires following activities:

- Understanding the status of sewerage works in Vietnam and studying solutions for various problems based on the status;
- Based on the studied solutions;
    - ✓ Development of appropriate planning and design manuals
    - ✓ Development of appropriate O&M manual
- Developing technical capacity by sharing studied solutions such as knowledge, information and experiences; and
- Studying shared information on various issues before action.

In MOC, there are institutions which are responsible for R&D such as Vietnam Institute for Building Science and Technology (IBST, hereinafter). However, at present there is no R&D institution which is specialized in a field of sewerage works. Therefore, if R&D function is provided to VSC, a large effect can be expected as follows:

- Technical support will be provided by the development of technology and standard (Project Implementation Support)

- Development of technical capacity by sharing knowledge, information and experiences which required from study of status and solution making in sewerage works of Vietnam

2.5.2 Development of the Mid-term Plan of R&D Function

(1) Development of Sewerage Database

1) Purpose of Developing Sewerage Database

Major purpose of the sewerage database is firstly to grasp sewerage project plans, O&M status of sewerage facilities, construction cost and its source of revenue, O&M cost, and its source of revenue. Then the following effects are expected by sharing such information with the persons or organizations concerned.

- The database makes "users" understood the purpose and benefit of sewage works and the necessity that they bear the sewerage works cost to sustain sewerage services.
- The database can be useful fundamental material for central government and PCs to know precisely current situations of the country/local PCs and to make future policy and plan.
- The database can be basic materials for "R&D institutions" to promote their various researches and developments.

2) Current Situation

Sewerage Database (as a part of water and sewerage data base) was prepared and issued with WB's support in 2016. However, the database consists of Performance Indicator (PI, hereinafter) mainly collected from provincial sewerage public companies (some private companies included) which are in charge of O&M of sewerage facilities in provinces.

The existing database has the following data items.

- ✓ Name of Participating Utilities in Sewerage PIs
- ✓ Cities, Population and WW Service Coverage
- ✓ Design Parameters - WWTP: Design Capacity and Treatment Process
- ✓ Performance of WWTPs
- ✓ Electricity Consumption and Staff
- ✓ O&M Costs
- ✓ Sewerage tarifs and Revenues
- ✓ Economic and Financial Matters

For further details, refer to the Appendix 8-16.

Though this database is effective for evaluating each sewerage works by O&M company, it has following difficulties:

- The database includes data of only 14 WWTPs while 36 WWTPs are currently operated in Vietnam. And types of data are too few to grasp status of each WWTP; and
- Detailed data such as sludge disposal status are not included.

Because of these problems with the existing sewerage database, it is considered to be important to prepare a new sewerage database to accomplish the objectives above.

3) Direction of the New Database

The new sewerage database should be developed based on the following directions.

- Developing database of each WWTP
- Developing specific database (water treatment, sludge treatment, etc.) allows technical consideration:
  - ✓ Design data
  - ✓ Actual operation data
  - ✓ Financial data
- Containing data of PCs which are under construction, design, and planning
- Updating every year
- Improving the quality of the database to be at the same level as Japanese sewerage database
- Being available in English and Vietnamese

4) Method of Dissipating Information

- Disclose information in the website of ATI and VSC
- Publish database in printed form annually
- Have an annual meeting for concerned parties and receive their feedback

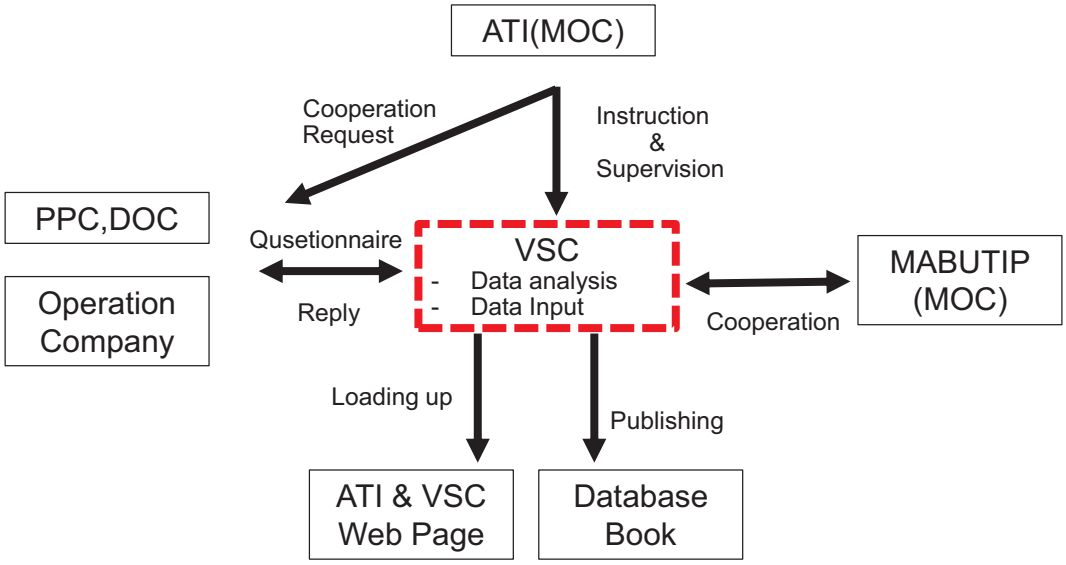
5) Work Flowchart and Work Schedule

The flowchart shown in Figure 2.5-1 assumes VSC works directly with a support of Management Board of Urban Technical Infrastructure Development Projects (MABUTIP, hereinafter) that joined the development of sewerage database of WB.

It is proposed that the database be directly prepared by VSC with support of MABUTIP which has experience in the existing sewerage database preparation by WB, and with advice of JICA experts especially for the first 2 years following schedule shown in Table 2.5-1.

Database will be prepared and provided in Microsoft ® EXCEL so that the data can be processed.

Data will be posted on web sites in PDF so that no special tool (software or hardware) is required to prepare the database and cost can be suppressed.



Source：JICA Study Team

Figure 2.5-1Work flowchart of sewerage database

Table 2.5-1 Work schedule for sewerage database development

Item	2017	2018	Remarks
1. Plan	→		Discussion with ATI
2. Database Form Making	→		Outsourcing
3. Data Collection of existing WWTPs		5 Months →	Questionnaire
4. Data Collection at Cities without WWTPs		5 Months →	Questionnaire
5. Data Analysis Database Making		5 Months →	
6. Publishing and Orientation meeting		1 Months →	Holding an Orientation meeting

＊Database will be published every year after 2019.

Source：JICA Study Team

(2) Development of Planning and Design Guideline for Sewerage Facilities

1) Purpose

As shown in the Table 2.5-2 and the Table 2.5-3, many WWTPs in Vietnam have problems of low operation rate and low influent quality (vs designed influent quality). These problems cause the following

adverse influences as well as waste of money.

- Difficulty in O&M
- Deterioration of effluent quality
- Increased O&M cost

Considering these problems, the guideline (manual) for sewerage planning and design should be prepared to conform to actual conditions of Vietnamese sewerage and the following effects can be expected:

- Prevention of excessive designs;
- Reducing designing period; and
- Prevention of adverse influence including unmanageable O&M caused by unsuited design and construction to Vietnam's condition.

Table 2.5-2 Example of WWTP Low Operation Rate
(Current inflow rate / Design capacity)

Province/City	Name of WWTP	Design Capacity (m3/d)	Current Inflow Rate (m3/d)	Operation Rate (%)	Donor
Hanoi	West Lake	22,800	15,800	69.3	-
Hanoi	North Thanlong	41,000	7,000	17.1	JICA
Nghe An	Vinh	50,000	25,000	50.0	GIZ
Binh Doung	Thu Dau Mot	17,650	8,000	45.3	JICA

Source：JICA Study Team

Table 2.5-3 Example of WWTP influent quality

Nation	Vietnam[1)]		Japan[2)]		IWA2008[3)]
Collection	CSS	SSS	CSS	SSS	
BOD_5(mg/L)	69	358	112	196	350
SS(mg/L)	73	539	96	180	400
T-N(mg/L)	27	94	25	37	60
T-P(mg/L)	4.1	15.5	2.8	4.5	15

*: Design condition: Both BOD and SS are 150～200mg/L.
Source: 1) Report No. ACS7712, Socialist Republic of Vietnam Performance of the Wastewater Sector in Urban Areas: A Review and Recommendations for Improvement -Vietnam Urban Wastewater Review-, 2013, World Bank, The average of 13 WWTPs with combined system and 2 WWTPs with separate system
2)Sewerage Database (2009), JSWA, the median of 31 WWTPs with combined system (including a part of separate system) and 603 WWTPS with separate system
3)Mogens Henze, et al. Biological Wastewater Treatment: Principles, Modeling, and Design, p35, IWA Publishing, 2008
Source：JICA Study Team

2) Current Situation

Present Vietnamese technical standard (QCVN07-2/2016/BTX) doesn't refer to sewerage planning and detail sewerage design standards such as for WWTPs. Therefore, in order not to be blamed of liability

issues, design consultants and contractors use standards of Japan or EU, in which influent flowrate is high and influent concentration is high. Using their design standards without any modification to fit Vietnam have caused some problems mentioned above 1).

3) Direction of the Planning and Design Guideline (Manual) for Sewerage Facilities

The planning and designing guideline (manual) should be developed based on the following directions.

- Enhance development of sewerage database and collect existing operation data and design specifications.
- Define the scope for 2 years and prioritize the fields. Scope of the manual to be developed during the JICA's project (2017 – 2018) is listed in the Table 2.5-4 and the rest of scope to be developed after the JICA's project is listed in the Table 2.5-6. The Table 2.5-4 is regarding the wastewater treatment, while regarding the sewer, Table 2.5-5. shows the manual contents.
- Develop the guideline (manual) that suits the actual conditions of Vietnam.
- JICA experts will instruct and supervise the development of the guideline (manual) with utilizing local consultants.
- Set up an advisory committee which mainly consists of frontline engineers. Interview with external experts and reflect their opinions on the guideline (manual).
- Set up an approval committee consisting of external experts (academics and governmental officers). Grant the approval committee an authority to approve the final guideline (manual) and give authority to the approved guideline (manual).

Table 2.5-4 Manual development during the JICA's project (2017-2018)

No.	Contents
1	Introduction
2	Planning
	Vision
	Objectives
	Need for Planning
	Basic Design Considerations
	Design Period
	Population Forecast
	Project Area
	Reuse and Disposal
	Layout and Arrangement of Sewerage
	Legislation and Regulations
	Guidelines on House Sewer Connections
	Survey and Investigation
	Detailed Project Report
	Planning of Sewerage System
	Planning of Sludge Treatment and Utilization
	Planning of Utilization of Resources and Space

	Planning for Reconstruction
	Environmental Preservation and Beautification
	Engineering Plans
	Checklist
3	Design and Construction of Wastewater treatment Facilities
	General
	Fundamental Principle of Biological Treatment
	Secondary Biological Treatment Process
	Plant Outfalls
	Essential Facilities
	Screening, Grit Removal and Flow Equalization
	Settling
	Wastewater treatment
	Disinfection Facilities
	The Issues of Nitrogen and Phosphorus
	Desirable Treated Sewage Quality and Processes
	Electrical and Instrumentation
	Corrosion Protection and Control
	Rehabilitation of Wastewater treatment Facilities
	Carbon Credit
	Recent Technologies in Wastewater treatment
	Addressing the Recent Technologies in Choice of WWTP

Source：JICA Study Team

Table 2.5-5 Manual development during the JICA's project (2017-2018) (contents related to sewers)

No.	Contents
1.	General
2.	Design Period
3.	Population Forecast
4.	Tributary Area
5.	Per Capita Sewage Flow
6.	Infiltration
7.	Sewage from Commercial Institutions
8.	Industrial Effluents to be Discouraged
9.	Storm Runoff
10.	Measurement of Flows in Existing Drains/Sewers
11.	Types of Collection System
12.	Materials of Sewers
13.	Shape and Size of Sewers
14.	Minimum Size of Circular Sewers
15.	Flow in Circular Sewers
16.	Hydraulics of Sewers Flowing under Pressure
17.	Sewer Transitions
18.	Leaping Weirs for Segregating Storm Flows
19.	Relief Sewers
20.	Basic Information

21.	Definition of Manhole
22.	Types of Brickwork Manholes
23.	RCC and Combination Manholes
24.	HDPE Manholes
25.	Drop Manholes
26.	Junction Manholes
27.	Side Entrance Manholes
28.	Scrapper (Service) Type Manhole
29.	Flushing Manholes
30.	Different Diameters of Sewers in the Same Manhole
31.	Terminal Cleanout Structure
32.	Construction of Brickwork Manholes
33.	Construction of RCC Manholes
34.	Covers and Frames
35.	Rungs
36.	Pile Supports in Loose Soils
37.	Manhole Rehabilitation
38.	Staging of Sewerage Works
39.	Sewer Construction
40.	Type of Loads
41.	Loads on Conduit due to Backfill
42.	Types of Installation or Construction Conditions
43.	Loads for Different Conditions
44.	Trench Condition
45.	Tunnel Condition
46.	Effect of Submergence
47.	Concentrated Loads
48.	Distributed Load
49.	Conduits under Railway Track
50.	Supporting Strength of Rigid Conduit
51.	Relationship between different Elements in Structural Design
52.	Cross Drainage Works
53.	Sewer Ventilators
54.	Prevention of Cross Connection
55.	Methods of Tunneling
56.	Laying of Sewers
57.	Load Carrying Mechanism of the Sewer
58.	Jointing of Sewers
59.	Precautions against Uplift
60.	The Water Jetting Issues
61.	Testing of Sewer Lines
62.	Check for Obstruction
63.	Backfilling of the Trenches
64.	Removal of Sheeting
65.	Sewer Rehabilitation
66.	Storm water Related Structures

67.	Outfall Sewers
68.	Cross Infrastructure Works
69.	Corrosion Prevention and Control
70.	Connection of House Sewer to Public Sewer
71.	Spacing of Manholes

Source：JICA Study Team

Table 2.5-6 Manual development after the JICA's project (From 2019)

No.	Contents
1	Design and Construction of Sewer
2	Design and Construction of Sewage Pumping Stations and Sewage Pumping Mains
3	Design and Construction of Sludge Treatment Facilities
4	Recycling and Reuse of Sewage
5	Decentralized Sewage and Sludge Treatment System
6	On-Site Sanitation

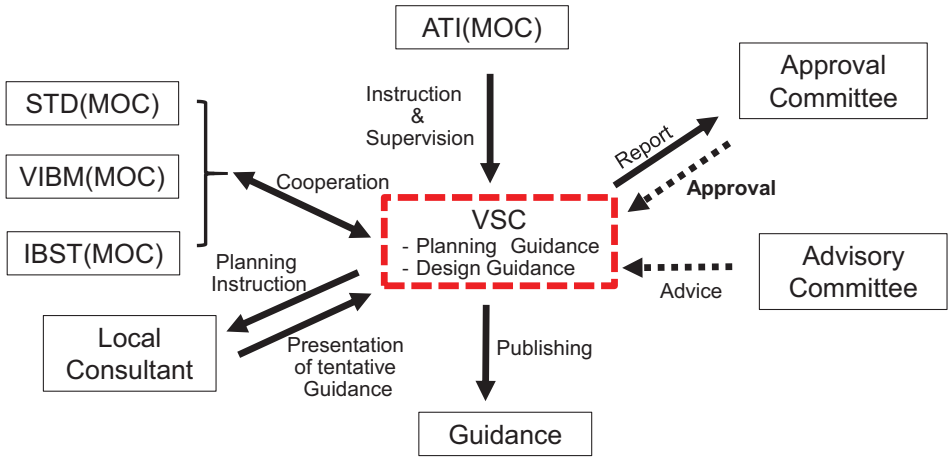
Source：JICA Study Team

4) Publishment of Manual

Sewerage planning and design manual will be published in May 2019 by organizing every part listed in the Table 2.5-4 developed during the JICA's project.

5) Work Flowchart

As shown in the Figure 2.5-2, draft of the manual will be developed mainly reflecting opinions or advices of frontline engineers which will be collected in the advisory committee. Then the guideline (manual) will be considered and approved through the approval committee consisting of academics and governmental officers. Finally, the guideline (manual) will be published as QCVN in the name of MOC.



Source：JICA Study Team

Figure 2.5-2 Flowchart of manual development for sewerage planning and design

Table 2.5-7 Time Schedule for manual development

Item	2017	2018	2019	Remarks
1. Plan	3 Months →			Discussion with ATI
2. Data Collection of existing WWTPs & Analysis		5 Months →		
3. Manual Making		12 Months →		Questionnaire
4. Holding a Advisory Committee		★ ★ ★ ★ ★ ★		Committee holding of total six times
5. Holding a Approval Committee		★ ★ ★ ★		Committee holding of total four times
6. Publishing a Guidance			3 Months →	

Source：JICA Study Team

Chapter 3

Lessons Learned

CHAPTER 3 LESSONS LEARNED

3.1 Issues, Efforts, and Lessons for the Project Operation

3.1.1 Preparation of Establishment of VSC

(1) Legislative Arrangement

JICA Study Team prepared a provision for the establishment of VSC to make the structure an official organization. To decide a location of VSC, JICA Study Team has been discussing with MOC whether the Sewerage Center should be under the responsibility of ATI or MOC. In the case where VSC will be under ATI, the necessary procedure is only within its ministry (MOC), whereas in another case VSC will be directly under MOC, approval from relevant ministries and agencies are required. Therefore, VSC will be under ATI for the initial period to realize a quick and certain procedure of the establishment.

(2) Flexible Response to Situations of Vietnamese Government

The implementation period of the Detailed Planning Phase has overlapped with organizational restructuring period of MOC. In this context, the decision on ATI's existence influenced the decision-making process for the establishment of VSC. Hence MOC could not answer any specific period of the establishment. In addition to the organizational restructure, Vietnamese Government is currently implementing a reduction of public personnel. In this context, MOC conveyed to JICA Study Team its direction that VSC should be a self-financing structure covering salaries of its own staffs during a discussion in January 2017.

According to the Project Cycle Management method, these situations above are conceived as change in external conditions that hinder the activities pursuing the Project's outputs. Therefore, JICA Study Team has modified VSC's budget plan to provide salaries of staffs by its own resources. However, the only resources for VSC will be revenue from its training course fee. To cover its own staffs' salaries, VSC must make a huge planning/budgetary effort to gather enough number of trainees and implement training courses at the lowest cost possible. Considering the preparing activities, the establishment period of VSC is expected to be January 2018. In doing so, management of bank account is necessary to receive incomes such as training fee.

3.1.2 Training

(1) Securing a Training Facility

Through discussion with CUWC, JICA Study Team could secure classrooms in CNEE/CUWC for VSC's training courses. Furthermore, CNEE/CUWC offered accommodation such as lodging facility and transport from/for Hanoi's airport for VSC's pilot trainings.

(2) Ensure Travelling Fee for Trainees from Distant Locations

For implementing pilot trainings, JICA Study Team had to consider of trainees participating from distant provinces such as South region in Vietnam because those provinces do not necessarily dispose of enough finance to pay for the travelling expenses. Therefore, JICA provided airfare for those who participated from provinces where JICA implements supporting projects and the pilot training could gather enough number of participants. The private sector in sewerage works will be invited to the VSC's training courses from Implementation Phase. Then the solution for the traveling fee of participants would be one of key issues to promote participation of trainees.

(3) Ensure the Destination for the Site Visit

It is necessary to visit actual facilities to deepen the understandings that trainees learned in classroom lecture. For the 2nd pilot training, trainees could visit construction site of sewer in Hai Phong. Henceforward, it is important to secure actual construction sites for visit in VSC's training courses.

3.1.3 Project Implementation Support

A conventional process of sewerage works in Vietnam follows as below.

1. PPCs order planning task to consultants.
2. PPCs settle PMU so that PMU order designing tasks to consultants.
3. PPCs order construction works to a contractor.

Provinces in Vietnam that implement sewerage works tend to refuse the intervention of VSC through the process above. At the beginning, JICA Study Team had discussed with MOC about the scheme of VSC's project implementation support in sewerage sector, but the discussion did not progress at all. MOC suggested a possible form of the intervention, where projects' zone includes more than 2 boundaries of provinces, as well as projects targeting sewerage works of more than 2 provinces at a time. Nevertheless, there was no such potential projects at the moment. Therefore, JICA Study Team proposed to implement a specific pilot project (sewerage planning in Nam Dinh province) to implicate MOC in the procedure.

For a pilot project of designing phase during Implementation Phase, JICA Study Team is expecting an implementation in Ben Tre. In order to realize this, there are several tasks to be done, such as to prepare the implementation schedule and to make a coordination between ADB (the Project in Ben Tre will be conducted by ADB's support).

3.1.4 Research & Development

Through 3 JCCs, Japanese side has explained the importance of R&D in sewerage sector. MOC understands the necessity of this function in VSC but could not come up with any concrete idea.

JICA Study Team is planning to conduct an elaboration of sewerage database, as well as a guideline for sewerage work planning, design of WWTP from 2017. Because the cooperation of ATI-MOC is indispensable for existing data collection, ATI's participation in the Project is a key issue to succeed in R&D function of VSC.

3.2 Problems in the Implementation System

3.2.1 Absence of the Project's Counterparts

Originally, a technical cooperation project should be conducted in a close partnership between Japanese experts and implementing agencies from the partner country on a daily basis. However, during the implementation of the Project, though it was Detailed Planning Phase, MOC did not allocate any counterpart for the Project thus the discussion took place irregularly between part-time counterparts of MOC.

3.2.2 Communication with MOC

Periodic discussions such as monthly meeting did not take place and the Project's process was shared solely during JCC meetings between Japanese side and Vietnamese side.

3.2.3 Time Required for Decision Making

Vietnamese side takes long time to make a decision thus there has been situations such as Japanese side had to confirm the appointment of JCC meeting with MOC only a week ago. Especially for the elaboration of the business plan of VSC, ATI requested self-financing system suddenly. MOC took long time to finalize each plan in cooperation.

3.3 Devices and Lessons for the Implementation System

3.3.1 Emphasize on Local Staffs' Ability

As mentioned in 3.2.1, the non-allocation of full-time counterparts had a significant impact on the progress of the Project. Hence, JICA Study Team has communicated with relative personnel through their local staffs by means of telephone and email.

During the implementation of 1st pilot training, JICA Study Team increased the number of local staffs as interpreter (Japanese/English and English/Vietnamese) to be able to work together with Vietnamese lecturers. In regard of the capacity development described in the Chapter 4, the collaboration with Vietnamese lecturers is an important activity. Through the collaboration, JICA Study Team succeeded to understand local needs from Vietnamese officials in the sewerage sector, as well as to convey Japanese experts' knowledges to these Vietnamese officials. Besides, JICA Study Team noted that there was active exchange among Vietnamese participants during the training such as Vietnamese lectures, trainees, and local assistants on the training's subject. These activities do not solely consist of inputs for shortage such as financial/human resources, equipment, facilities, but of aiming at the capacity development of local people because these local professionals are expected to complete shortages for sewerage sector in Vietnam in future. Objective of the training is to enhance the capacity of trainees in sewerage sector but at the same time, JICA Study Team noted that local staffs' knowledge and interest on the Project have been considerably increased through the training activities, which made these individual to commit in the Project more responsibly and spontaneously. The capacity of the Project Team itself has been reinforced in this manner.

3.3.2 Internal Meeting of JICA Study Team

Including lecturers of pilot trainings, Japanese experts counted their number more than 10. For preparing pilot trainings, Japanese lecturers collaborated with Vietnamese lecturers to make training texts adapted to local contexts. On the other hand, this process left little time for communication among Japanese experts. Therefore, JICA Study Team has strived to ensure the time for internal meeting even during holidays and exchanged information. Also during ordinary assignments, JICA Study Team organized regularly internal meeting to share the Project's progress and problems.

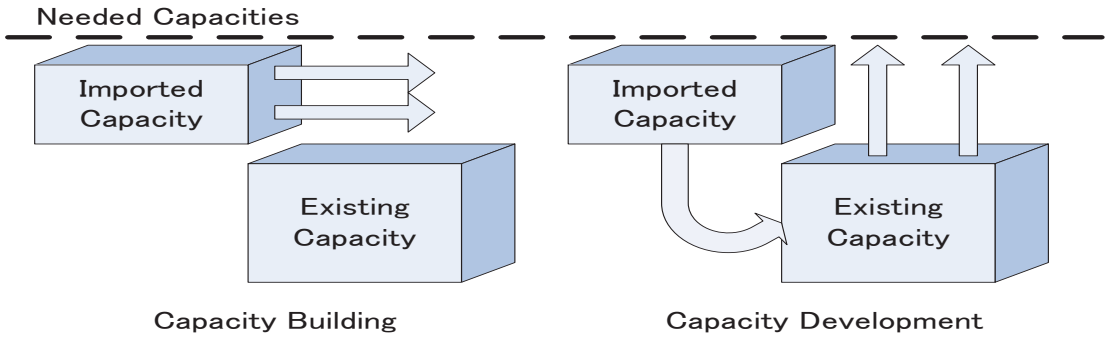
Chapter 4

Recommendation

CHAPTER 4 RECOMMENDATION

4.1 Suggestion for Vietnamese Government for Implementation Phase

The overall goal of the Project is "to enhance the planning, implementation and management capacity of the sewerage sector to meet the future needs in Vietnam" thus it is the objective that Vietnam itself commits to solving the problems in sewerage sector. Therefore, it is important to establish VSC to enhance capacity of Vietnamese professionals to cope with various issues. To do so, continuous and spontaneous efforts of Vietnam are necessary. From this point of view, the method should not focus on "how to bridge the gap" but on "how to be a catalyst" which promotes efforts that Vietnamese implement by itself such as decision-making and knowledge/idea sharing.



Source: JICA Capacity Development (CD) Resume of report 2006

Figure 4.1-1 Capacity Building and Capacity Development

During Detailed Planning Phase, there were usually situations where Japanese experts (JICA Study Team) had to fill the gap by informing ideas and plans to MOC on which MOC made comments as shown on the left side of the figure above. Nevertheless, collaboration with Vietnamese lecturers and active participation of local staffs in the Project show outputs of the Project's activities are adapted to local context.

From this point of view, certain suggestions could be made for Vietnamese Government before moving on to the Implementation Phase. These suggestions are not only for MOC but also the Vietnamese Government including relative ministries so that they understand the Project and support it from policy aspect. To do so, MOC needs to explain about VSC to the related ministries.

4.1.1 Sustainable Operation of the Project

It is necessary to assist Vietnamese Government from policy aspect in deepening its understanding on the Project and in continuing the Project activities (Vietnamese Government shall not change its

direction related to VSC).

- Secure VSC staffs (new staffs, establishment of new structure)
- Policy support to promote VSC's activities
- Policy support to spread the superiority of VSC throughout the nation

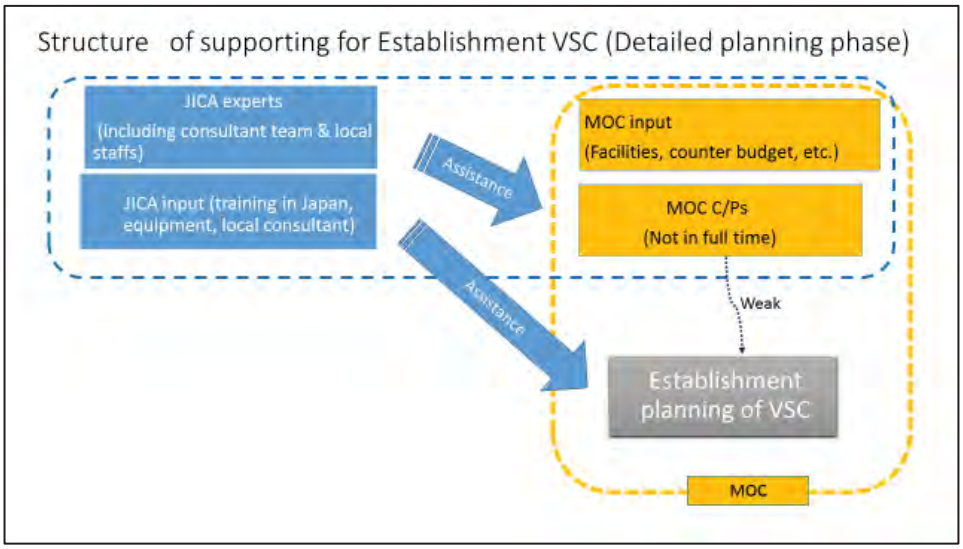
4.1.2 Policy Support for Production of the Project's Output

Outputs of the Project could not be attained when there are impediments of external conditions. Moreover, if Vietnamese Government does not implement positively the policy support, the production of the Project's outputs cannot be expected. Especially for the 2 supports listed below are to be led by Vietnamese Government and are the keys to achieve the Project's purpose.

- Arrangement of legal environment for VSC's operation (securing staffs' salaries)
- Policy support for VSC's training courses (considering certificate system)

4.2 Suggestions for the Project (Implementation Phase)

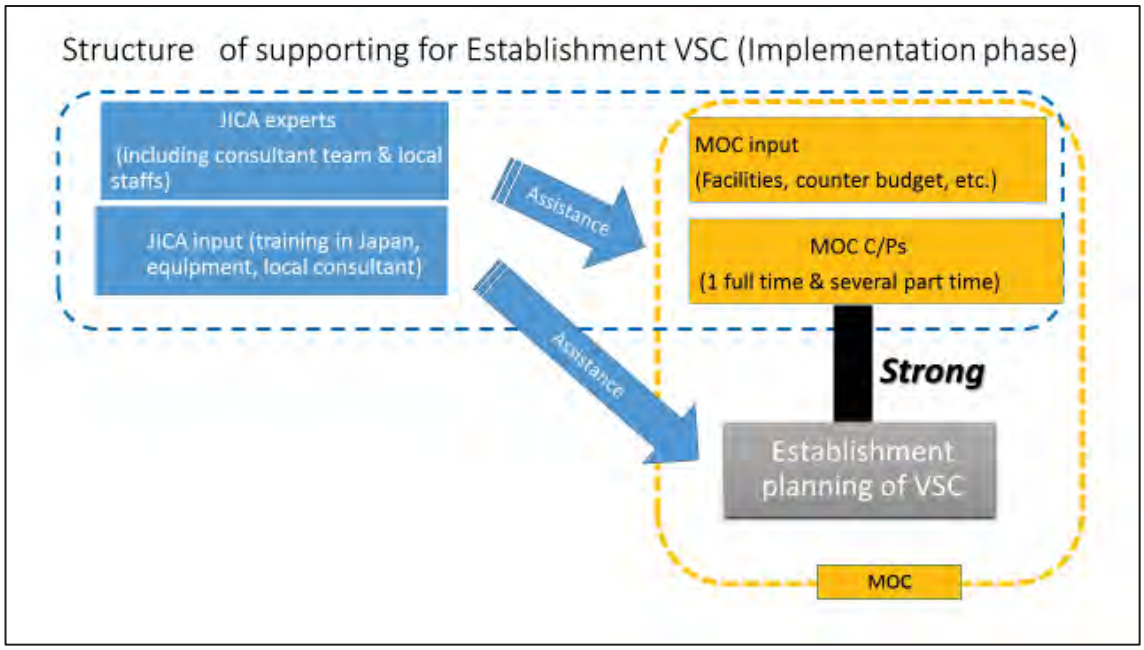
As mentioned in the chapter 3, one of important problems during the Detailed Planning Phase was the absence of the Project's full-time counterparts thus the implementation system was as the figure below. Besides, participation of part-time counterparts from MOC was neither active, nor their involvement for preparation of VSC's establishment was sufficient.



Source: JICA Study Team

Figure 4.2-1 Structure of supporting for establishment of VSC (Detailed Planning Phase)

Japanese side requested several items (the Project's full-time counterparts, establishment of VSC, financial sustainability of VSC), as well as improvement of condition for activities noted during the Detailed Planning Phase, to Vietnamese side and these items were agreed at the place of the 3rd JCC meeting. If implementation of these items is guaranteed, MOC's commitment for the establishment of VSC will be enhanced. With the improved implementation system following Japanese side's requests, the Project will progress smoothly.



Source: JICA Study Team

Figure 4.2-2 Structure of supporting for establishment of VSC (Implementation Phase)

In addition to the suggestion above, several points are recommended below for the Implementation Phase.

(1) Monitoring of the Project's Progress

- Monitoring of collaboration between Japanese experts and Counterparts
  Monitoring by Japanese experts shall be regularly implemented (settling monthly meeting)
- Monitoring of the Project's progress
  Monitoring of the Project's progress by Japanese experts shall be confirmed in monthly meeting

(2) Training and Capacity Development of VSC Staffs (candidates)

- Training and capacity development of VSC staffs
  Selection and allocation of VSC staffs are to be done by MOC with responsibility. After this, training and capacity development of these staffs will be implemented during the Project as a collaboration between Japan and Vietnam. MOC will be in charge of the arrangement for this activity.

・ Promotion of VSC's activities

Implementing the Project's activities is an obvious issue but besides this, it is necessary to promote VSC's activities to make VSC as an important structure in sewerage works of Vietnam.

(3) Superiority of VSC

・ Spread the superiority of VSC in all over Vietnam

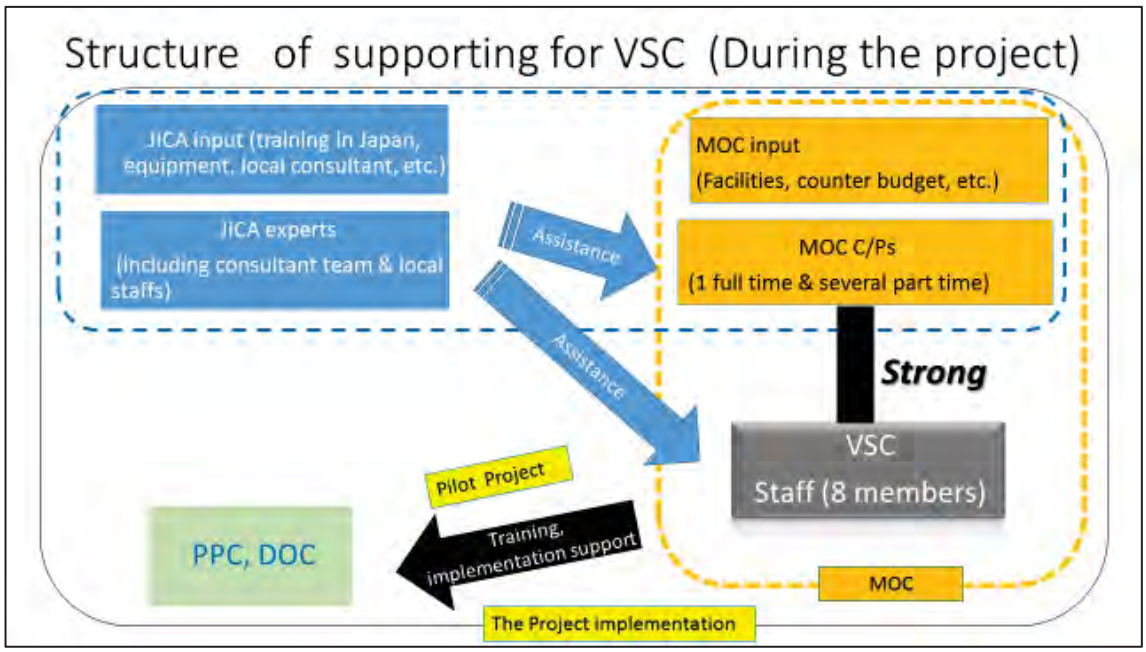
As an executing agency, MOC shall convey the superiority of VSC in all over Vietnam such as by means of issuing newsletters.

・ Discussion to arrange circumstances

Discussion between agencies with concerned jurisdiction shall be held regularly to arrange favorable circumstances to enable VSC to conduct its activities in the whole country of Vietnam.

During the implementation period, the supporting structure for establishment of VSC will be as illustrated in the figure below.

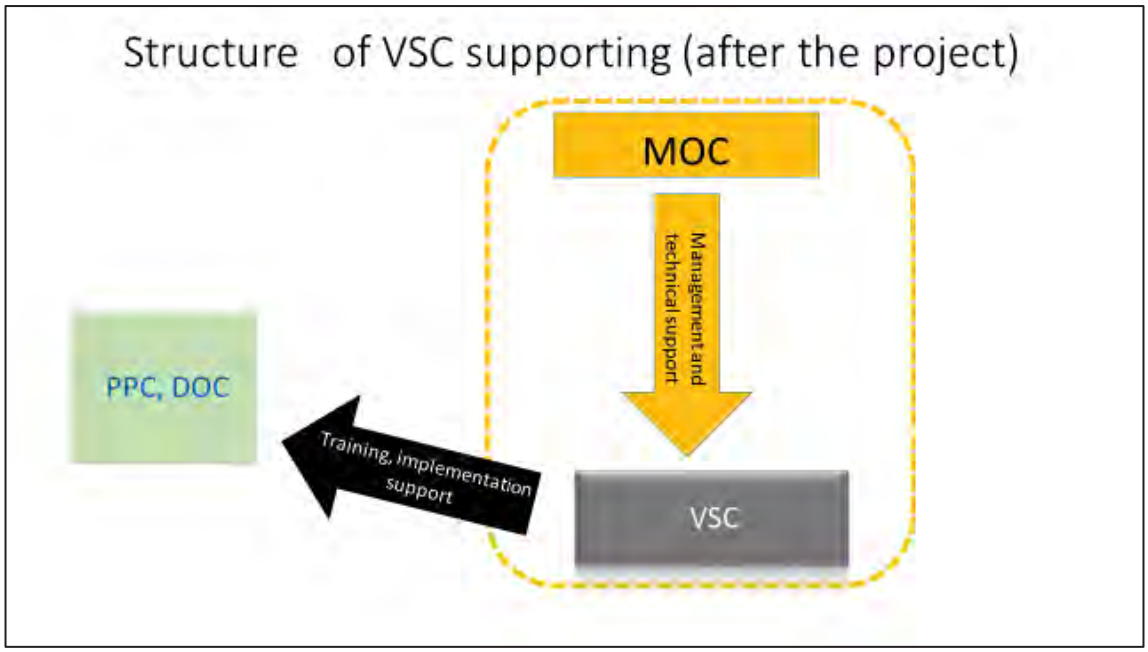
VSC will be trained and enhanced its capacity as a structure if following points will have been respected: establishment of VSC, appropriate execution of inputs by JICA and MOC, and operation of supporting structure by Japanese experts and MOC's counterparts. During the implementation period of the Project, pilot projects serves as OJT for VSC. What is important in this stage is that it will not only VSC's staffs to be trained but also VSC to acquire achievements as a structure.



Source: JICA Study Team

Figure 4.2-3 Structure of supporting for VSC (during the Project)

After the end of the Project, there will be no JICA's support and VSC, as a structure with enhanced capacity, will conduct independently its activities. If necessary, MOC will support VSC in managerial/technical aspects.



Source: JICA Study Team

Figure 4.2-4 Structure of VSC supporting (after the Project)

(4) Establishing a Qualification System

As described in the section 2.2.2 "Draft the functions, structure of the organization, and business plan of Sewerage Center by referring to the JS and JSWA", training function serves not only for human resource development but also for VSC's revenue. Therefore, it is important to secure stable number of trainees.

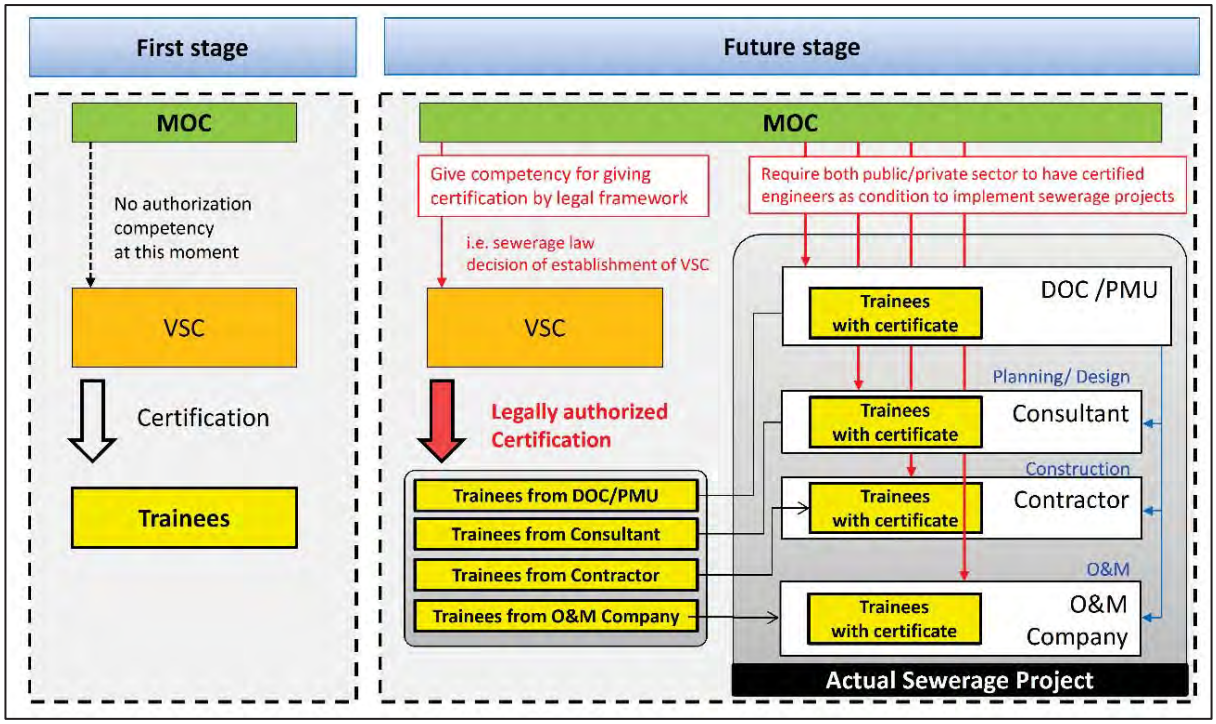
Through discussions held so far, there has not been any positive comments of MOC on the idea of establishing a qualification system, such as mentioned "Currently there is no regulation on any legal documents about capacity conditions (certificate) of public personnel in sewerage works in Vietnam" and "There is no mandatory training for companies working in sewerage sector in Vietnam." However, qualification system is indispensable for sustainable operation of VSC thus JICA Study Team strongly insists on the establishment of qualification system.

- Establishment of qualification system for sustainable operation of VSC

Develop a qualification system in regard of VSC's training courses and make them mandatory in order to use better of outputs from VSC's training courses.

- Consider attendance of VSC's training courses as a condition to participate in JICA's projects

Forms of qualification system can be supposed as figure below. The detail is to be referred in 2.3 “training function”.



Source: JICA Study Team

Figure 4.2-5 Image diagram of qualification system

(5) Direction of Research and Development

The direction of R&D function needs to be set by taking account of the coordination with future implementation support function and with training function, as well as by studying the national policy.

At the initial period of VSC, it is considered to be difficult to implement commissioned or income generating R&D. Therefore for the time being, to implement sewerage works which can receive subsidies by national governments as well as to develop the database will be the main activities of R&D function. In addition, the developed guidelines and databases will play important roles if they will be utilized in the implementation support and trainings.

In the mid- and long-term, by utilizing the basic information acquired in the short-term implementation activities, by playing a role of think-tank for national policy making and by implementing various technical operations, it is desirable that VSC becomes a supreme organization in Vietnam in terms of sewerage policy and technology. The contents of R&D which will be needed in short- and mid-term are indicated below.

1) Short-term activities(by the 5th year after the foundation, build the business foundation of sewage works)

a) Standardization of Facility Development and O&M

- Guideline for sewage planning
- Guideline for wastewater treatment facility design
- Guideline for sewer design
- Guideline for O&M of facilities
- Guideline for O&M of sewer

Through development of these guidelines for sewage works, standardize the planning, design and O&M methods.

b) Extension of databases

- Extension of facility database
- Extension of O&M database

Through these activities the direction of future sewage projects will be set.

2) Mid- and long-term (5th year and thereafter)

a) Role as a think tank to give recommendation on Vietnamese policy

Draft or propose the sewerage policies and relevant laws.

b) Technical examination such as application forms from respective local government

By implementing the technical examinations, give efficient supports to sewage works in place of MOC.

c) Technical development which is necessary for sewage works and the certification of the quality of treated

d) Update and improve the guidelines and databases as short-term issues

e) Development of certification system of new technology and appropriate technology

Appendix

Appendix
Table of Contents

Appendix 1　Business Plan (Draft)

Business Plan

for

Vietnam Sewerage Center

(Draft)

Feb. 2017

Contents

Contents of Figure and Table

1. Background

Recent rapid urbanization based on economic growth and industrialization has caused severe environmental deterioration in Vietnam. Urban infrastructure such as road, electricity and water supply has been developing, but development of sewerage system does not catch up urbanization. Currently, ODA from JICA and other donor organizations promotes sewerage projects in Vietnam. However, human resources to promote sewerage projects are not enough.

In Vietnam, based on the revised sewerage development policy (Prime Minister's Decision NO.589, April 2016), until 2025, sewerage service ratio should be 50% at city center of Class 2 cities and above, and sewerage service ratio should be 20% at city center of Class 5 cities and above, and until 2050, sewerage service ratio should be 100% at city center of Class 5 cities and above.

In Japan, sewerage projects had promoted nationwide for only 30 years from 1970s. To do so, Japan Sewage Works Agency (JS) and Japan Sewage Works Association (JSWA) is effective tool to promote sewerage projects.

JS takes contracts from municipalities and executes sewage works project including planning, design, and construction. JS's commitment has been promoting sewage works of municipalities which have a critical shortage of wastewater engineers. JS established a training center in 1972 and has been providing opportunities to develop municipal staffs involved in sewage works. JS's Training Program covers all phases of sewage works including planning, design, construction, and operation and maintenance (O&M). People who are trained in the JS's program facilitate sewage works in Japan today. JS also carries out R&D which municipalities have difficulty to do. Through collaborative research with private companies, wastewater treatment technologies suitable for municipalities have been developed.

Japan Sewage Works Association develops and publishes technical guidelines and manuals including 'Facility Planning, Design Guidelines and Manual for Sewage Works.' Municipalities follow these technical guidelines and manuals to implement their wastewater projects. Books which include all dimensions of technical knowledge and experience of experts contribute to the development of sewage works in Japan.

To enhance planning, implementation, and management capacity of sewerage sector and to promote sewerage projects nationwide in Vietnam, it is vital to establish organization which has three functions such as

① Development of overall implementation capacity building through training on sewerage

technologies,

② Supporting implementation of sewerage projects based on request from People's Committee (states, cities),

③ Preparation of technical manuals and standards on sewage works to construct and to carry out operation and maintenance of sewerage facilities suitable for Vietnam.

Based on these two examples of sewerage sector organizations in Japan, business plan of Vietnam Sewerage Center (VSC) is proposed.

2. Establishment of Vietnam Sewerage Center (VSC)

(1) Establishment of VSC

To enhance planning, implementation, and management capacity of the sewerage sector, it was agreed that VSC was going to establish under Ministry of Construction (MOC) based on JICA's support on October 16, 2016. Through this three year project (2016 – 2018), results are expected as shown below.

① Comprehensive need of human resource development for sewerage sector is established.

② To propose structure of the organization, function, tasks and business plan for the Sewerage Center

③ Implementing the Basic pilot training for sewerage sector

④ Pilot activities for the Project Implementation Support function is implemented

⑤ Implementing the pilot activities for consulting and research and development for sewerage sector in Vietnam

(2) Functions of VSC

VSC will have three functions, training function, project implementation support function and knowledge sharing function.

① Training Function

VSC will develop human resource in sewerage sector in Vietnam. Trainees will mainly from People's Committee (PC). VSC will contribute planning, design, construction of sewerage facilities with good quality.

② Project Implementation Support function

VSC will support sewerage projects from planning stage to construction stage. To do so, VSC will contribute to improve their quality and to enhance better management.

③ Research and Development Function

VSC collects and arranges knowledge, information and experiences required to implement sewerage projects and offers information including 'Planning and Design Guideline for Sewerage Facilities' to promote sewerage system.

An organic linkage of the above three functions is expected to encourage the efficient, effective management of sewage works in Vietnam.

(3) Organization

VSC will be an organization under Administration of Technical Infrastructure (ATI)/MOC at the beginning. It will be examined to be directly under MOC in the future. VSC will have cooperation with appropriate organizations based on its functions. For example, VSC will have cooperation with College of Urban Works Construction (CUWC） of MOC in the field of training. JICA will support VSC to provide Japanese experts and financial support until 2018. Until 2018, VSC will prepare to have sustainable management by itself from 2019.

3. Training Function

(1) Necessity of Training Function

It is urgently required to develop human resource in sewerage sector in Vietnam to carry out sewerage projects which are expected to be spread throughout Vietnam.

Human resource development for both public and private sectors is required in each phase of planning, design, construction, and O&M.

(2) Cooperative Organization

MOC has a training institute which is named CUWC. CUWC has CNEE (Training Center of Water and Environment) which deals with training on water sector. CNEE/CUWC does not have sewerage training courses right now, but it is appropriate organization which will provide training in sewerage sector because CNEE has several staff who has experience on sewage works.

According to the contract document of this project between JICA and JICA Study Team, “Concerning human resource development”, VSC should cooperate with CUWC based on the result of basic planning research of VSC. CUWC’s facilities such as lecture rooms will be utilized for VSC’s training courses. VSC’s lecturers will be CUWC’s lectures mainly and lectures from Architecture University and Vietnam Water Supply and Sewerage Association (VWSA) will be utilized on necessary basis.’ VSC will cooperate with these organizations.

GIZ, DANIDA and VWSA (Vietnam Water and Sewerage Association) currently provide training courses on sewerage in Vietnam. It is effective and efficient to have cooperation with such organizations to carry out training courses.

(3) Training Facilities

CUWC has training facilities such as classes and dormitories already. Also, hotels are located nearby. It is appropriate to utilize CUWC as training function of VSC to minimize requirement of new facilities.

In principle, training program consists of classroom lecture and site visit to sewerage facilities. Engineering course/STP design will have water quality measurement practice using portable device which will be provided by JICA in 2017. Installation plan of necessary equipment for training course will be discussed in 2017-2018.

Currently, CUWC has septic tanks to treat its sewage. If sewage treatment demonstration plant will be installed in CUWC, trainees can understand sewerage technology easily. The necessity and installation plan of demonstration plant will be examined in 2017 – 2018.

During needs survey, it was requested that training courses should be held other than Hanoi, too. So, VSC will have training courses in southern part using Universities facilities or in CUWC's Hue Branch. Detail plan will be examined in early 2017 and training courses will be held in 2017.

(4) Trainees

1) Central/local government management

To accelerate implementation of JICA's sewerage projects and to construct facilities with appropriate quality, trainees should be mainly sewerage project members in PCs, such as DOC and PMU.

Training courses will be provided depending on the progress of municipal sewage works in each city. The target cities for VSC's training will be 72 municipalities in class three and above. Table 3.1 classifies cities based on the progress of sewage works: completed, under construction, under design, and not yet started.

Table 3.1 Target 72 cities and their phases of sewerage projects

Target city	Condition	Phase of project			
		Plan	Design	construction	management
Undeveloped/ Not yet started 26 cities	No sewerage planning or complete General Master Plan or Sector Master Plan	○			
Under design 8 cities	Detailed design for sewers and STPs are underway		○		
Under construction 17 cities	Procurement and construction for sewers and STPs are underway.			○	
Completed 21 cities	Sewers and STPs are completed and in operation. Expansion and retrofit and new service areas may be added.	△	△	△	○

STP: Sewage Treatment Plant

Source：JICA Study Team

2) Enterprises working in sewerage sector

VSC will provide a training program targeting engineers of enterprises working in sewerage sector. Table 3.2 classifies members of Vietnam Water and Sewerage Association (VWSA) and shows possible contents of training for them. Through discussion with MOC, trainees from enterprises working in sewerage sector will attend training courses for trainees from central/local government management.

Table 3.2 Private companies (Members of VWSA) and possible contents of Training

Category and the number of companies	Possible contents of training
Vietnam Water and Sewerage Association:42	Basics of Sewage Works, O&M of Sewer and WWTP
Consultant firm: 26	Basics of Sewage Works, New Technology, Planning, Design
Material and facilities company:78	Basics of Sewage Works, Sewer, Sewerage Treatment, Sludge Treatment

Source：JICA Study Team

(5) Lecturers

Japanese lecturers joined pilot training in 2016 and will join practical training in 2017-2018. The development of Vietnam lecturers is necessary to have training program only by Vietnamese lecturers. It is expected that only Vietnamese lecturers will carry out VSC's training program from 2019.

CNEE/CUWU has engineers who have experiences in sewerage; thus, they are candidates for VSC's lecturers. To educate such candidates, training based on OJT will be carried out. Training program in Japan is expected to be precious opportunity for candidates to have experience and learn sewerage technology. The cooperation of MOC, PCs, and universities is indispensable. GIZ has a TOT training program to develop lecturers with appropriate training skill.

Appendix 2-1 shows a list of the GIZ's TOT trainees. Appendix 2-2 shows the TOT trainees with their specialized field. VSC will appoint lecturers based on these lists. Also, GIZ's trainers and local consultants are possible lecturers. Appendix 3 shows the curriculums and name of the lecturers of the first and the second pilot training in 2016. In the pilot training, MOC staffs, CNEE/CUWC staffs, Hanoi city's staffs, GIZ's trainers and local consultants were joined as lecturers.

(6) Training Courses and Curriculum

1) Pilot Training in 2016

In 2016, two pilot trainings were carried out for public sector. The first program was held in August

8-11 with 20 participants of PC's staff of manager class. The second program targeted PC's engineers and consisted of two courses for sewer and wastewater treatment plant (WWTP) with 15 trainees for each course. The second program was held in November 14 - 18. Appendix 3 describes their curriculum and lecturers.

2) Training Courses from 2017

Concerning training courses from 2017, VSC will set up training courses in the field of overview of sewage works, planning, design, and construction management that PC's staffs in charge of sewage works should know.

The courses and curriculum will be considered based on the current situation and environment of sewage works in Vietnam. Also, the demarcation and coordination with other donor organizations is considered.

Based on the discussion between MOC and JICA study team, 5 courses are proposed as shown in Table 3.3. No.1 is for managers, No.2 is planning, No.3 is sewer design and construction management for engineers, No.4 is sewage treatment plant design and construction management for engineers and No.5 is new technology. Duration of each training course will be one week. Because VWSA and GIZ are carrying out training courses on O/M of sewerage facilities, VSC will not have training courses on O/M at this moment.

Table 3.3 Training Courses

No	Course Title	Theme	Target	Period	Capacity
1	Manager Course	General Information of Sewage Works	PC, DOC, DPI, PMU of all provinces/cities & private sector	One week (actually four days)	30
2	Sewerage Planning Course	Sewerage Works Planning	PC, DOC, DPI, PMU of all provinces/cities & private sector	One week (actually four days)	30
3	Engineer Course (Sewer)	Sewer Design/ Construction Management	PMU of under design, under construction and completed provinces/cities & private sector	One week (actually four days)	30
4	Engineer Course (STP)	STP Design/ Construction Management	PMU of under design or under construction provinces/cities & private sector	One week (actually four days)	30
5	New Technology Course (Pipe Jacking Method)	Sewer Pipe Jacking Method	PC, DOC, DPI, PMU of all provinces/cities & private sector	One week (actually four days)	30

PC: People's Committee, DOC: Department of Construction, DPI: Department of Planning and Investment, PMU: Project Management Unit

Source：JICA Study Team

The curriculum is shown in Appendix 4. Curriculum was made based on training course of JS and the matrix shown in Table 3.4.

After training, VSC will provide questionnaire to trainees. Based on the answers from trainees,

curriculum should be revised.

Lectures will make training material such as textbooks basically. Japanese and Vietnamese lectures who deal with the same subject will have discussion before training course and revise training material. After training course, lecturers also revise their training material based on trainee's feedback.

Table 3.4 Matrix for Curriculum Determination

Source：JICA Study Team

(7) Training Execution Plan

1) Training coursed for public sector

Concerning the target 72 PCs which are shown in Appendix 1, situation of sewerage projects in each year is estimated. Then, the number of PCs on each situation is calculated and shown in Table 3.5.

Assumption:

① All 72 PCs will start sewerage projects by 2021.

② Design only period is for one or two years. Then, the projects will proceed procurement, construction, and O/M while design is carried out.

③ Approximately five PCs will start sewerage service every year.

Table 3.5 The Number of PCs in each sewerage situation

Year	Undeveloped	Under design	Under improvement	Completed	Total
2016	26	8	17	21	72
2017	20	10	20	22	72
2018	14	9	22	27	72
2019	8	8	24	32	72
2020	2	7	26	37	72
2021	0	6	24	42	72

Source：JICA Study Team

Based on Table 3.5, annual training schedule is made as shown in Tables 3.6 to 3.8. Table 3.6 shows training schedule in 2017. In 2017, establishment of VSC and training material formation need time; thus, training is assumed to start in September and 5 courses will be held. The number of trainees will be 150: 30 trainees x 5 courses.

In 2018, 5 courses will be held in 2 times. The number of trainees in each year will be 300: 30 trainees x 5 courses x 2 times. From 2019, training schedule will be the same as that of 2018.

Through discussion with MOC, trainees from enterprises working in sewerage sector will attend training courses for trainees from central/local government management.

Table 3.6 Annual Training Schedule in 2017

	Course Title	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	Manager Course									▬			
2	Sewerage Planning Course									▬			
3	Engineer Course (Sewer)							Textbook making			▬		
4	Engineer Course (STP)										▬		
5	New Technology Course (Pipe Jacking Method)											▬	

Source : JICA Study Team

Table 3.7 Annual Training Schedule in 2018

	Course Title	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	Manager Course			▬						▬			
2	Sewerage Planning Course	Textbook Review		▬			Textbook Review			▬			
3	Engineer Course (Sewer)				▬						▬		
4	Engineer Course (STP)				▬						▬		
5	New Technology Course (Pipe Jacking Method)				▬							▬	

Source : JICA Study Team

Table 3.8 Annual Training Schedule from 2019

	Course Title	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	Manager Course			▬						▬			
2	Sewerage Planning Course	Textbook Review		▬			Textbook Review			▬			
3	Engineer Course (Sewer)				▬						▬		
4	Engineer Course (STP)				▬						▬		
5	New Technology Course (Pipe Jacking Method)				▬							▬	

Source : JICA Study Team

(8) Training Costs

CUWC estimates necessary training cost and set training fee based on the estimation. CUWC has such knowledge already. VSC should set and collect appropriate training fee to have sustainable human resources development.

Calculation of training costs is as follows. The costs exclude salary for CNEE/CUWC staff paid by MOU. Unit price given by CNEE/CUWC is used. Teaching remuneration is 2,000,000 VND a day based on the unit price of a visiting lecturer.

1) Textbook printing

As a necessary cost, 100,000 VND per trainee is budgeted for textbook printing, assuming monochrome 300 pages. It is an approximate value assuming monochrome and color copies are 300 VND and 3,000 VND per page, respectively.

2) Pens, notebooks, and bags for trainees

100,000 VND per trainee is used for supplies.

3) Stationery

3,865,000 VND per course (unit price by CNEE/CUWC) is used for stationery.

4) Certificate Printing

50,000 VND per trainee is used for certificate printing.

5) Facility equipment

1,000,000 VND per trainee （unit price of CUWC） is used for facility equipment.

Based on the above calculation, the total cost of a training course is shown in Table 3.9.

Table 3.9 Cost of Training (30 trainees)/course

No	Content	Unit	Quantity	Unit Price（VND）	Amount（VND）
1	Teaching remuneration	Day	4	2,000,000	8,000,000
2	Textbook Printing	Person	30	100,000	3,000,000
3	Pen, notebook, bag for trainee	Set	30	100,000	3,000,000
4	Stationery	Package	1	3,865,000	3,865,000
5	Certificate	Each	30	50,000	1,500,000
6	Facility Equipment	Person	30	1,000,000	30,000,000
	Sum				49,365,000

Source：JICA Study Team

49,365,000 VND/ 30 = 1,645,500 VND per trainee

(9) Qualification System

CUWC provides certificate to trainees at the end of training. VSC will provide certificate, also. If qualification system which requires VSC's certificate is established, it will big incentive for trainees to attend VSC's training courses. Then, human resource development in sewerage sector will proceed; thus, quality of sewage works will be assured and finally we expect to have good water environment in Vietnam. In 2017 - 2018, VSC will study and examine qualification system. Qualification systems which will be studied are shown follows.

- Sewerage engineer qualification system resembled engineer qualification based on Construction Law
- Qualification as a requirement of contract
- Requirement of JICA project

In 2016, JICA Study Team studied qualification of engineer by Construction Law. The Construction Law regulates qualification of engineer in each field and step of construction. The Construction Law focuses on private sector, not on public sector. To develop human resource in public sector, VSC will study to set VSC's training course for requirement of JICA's ODA. To develop human resource in private sector, sewerage engineer qualification system based on VSC's certificate, and VSC's certificate as requirement of contract (planning, design, and construction) will be incentive to attend VSC's training courses. Concerning above three qualification systems, VSC will study further to realize qualification system based on further study on Vietnam's situation and further discussion between MOC staff and Japanese experts in 2017 - 2018.

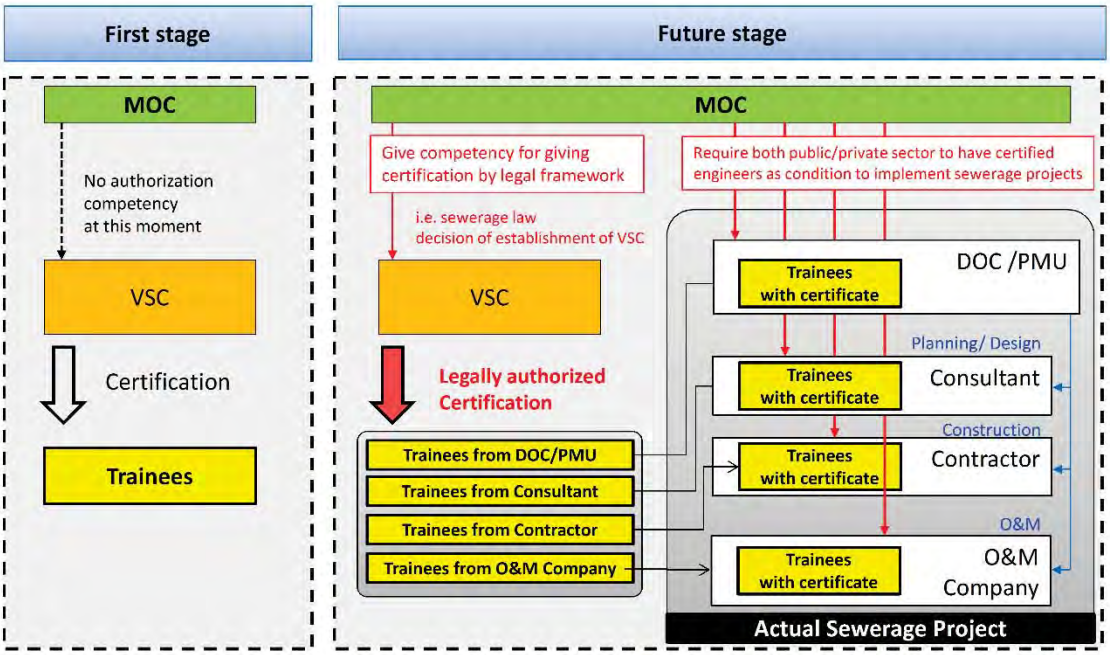


Figure 3.1 Image of Qualification System

Source：JICA Study Team

4. Project Implementation Support Function

(1) Necessity of Project Implementation Support Function

According to the needs survey which was conducted Class 3 and upper cities, we got answers which said sewerage technology is new to them and there are no appropriate engineers. Also, a PMU hired a foreign sewerage consultant to compensate the PMU's lack of engineers. From these facts, we confirmed that project implementation support function's needs that VSC supports each sewerage project are existed.

(2) Contents of Project Implementation Support Function

Advantages which VSC has project implementation support function are shown below.

・It is expected that sewerage project will be carried out smoothly and completed facilities with good quality when VSC which has experts on sewage works supports PC which has shortage of experience and knowledge on sewage works.

・VSC gathers knowledge on sewage works and will be a showcase for PCs.

VSC's project implementation support methods are proposed below.

1) Planning phase

When starting sewage works in Vietnam, the following four steps exist: "City general master plan"

for main urban infrastructures," sector master plan" for sewerage facilities, "pre-feasibility study" and "feasibility study".

Needs Survey shows that Nam Dinh City, which is Class 1 city and the one of the biggest city among the not-yet-started cities, is interested in the VSC activities. Nam Dinh City has ever developed city general master plan, but its sewerage system remains unrealized. While in the city, people discharge untreated wastewater into rivers, they take drinking water from the river in the downstream of city center. So, the city recognizes sewage treatment is required.

To consider the project implementation support scheme in the phase of planning, VSC will start development of sewerage project planning for Nam Dinh City in 2017 as a pilot project. In the pilot project, VSC will make a sector master plan. Figure 4.1 describes the implementation scheme of the pilot project. Significance of this pilot project is to examine VSC's working mechanism on advisory support work. Through this pilot project, VSC will confirm what kind of work, procedure, approval is necessary and when. Also, this pilot project aims to develop VSC counterparts' masterplan making ability. VSC counterparts are assumed to be several experienced staff from MOC or other organizations. In principle, PC pays necessary cost to VSC; however, JICA bears consultant fee on this pilot project. VSC counterparts supervise consultant and Japanese experts support VSC counterparts. Consultant with VSC counterparts has meetings with Nam Dinh city and makes plan based on the result of the meetings. Final report will be submitted to the city. The city will carry out necessary administrative procedure. As an example, project implementation support flowchart of JS is shown in Appendix 7. Through this pilot project, VSC's human resource development will be done, and suitable procedure for VSC's project implementation support will be examined based on discussion between VSC counterparts and Japanese experts.

From 2019, VSC will implement actual projects using working mechanism examined and rearranged through Nam Din's pilot project.

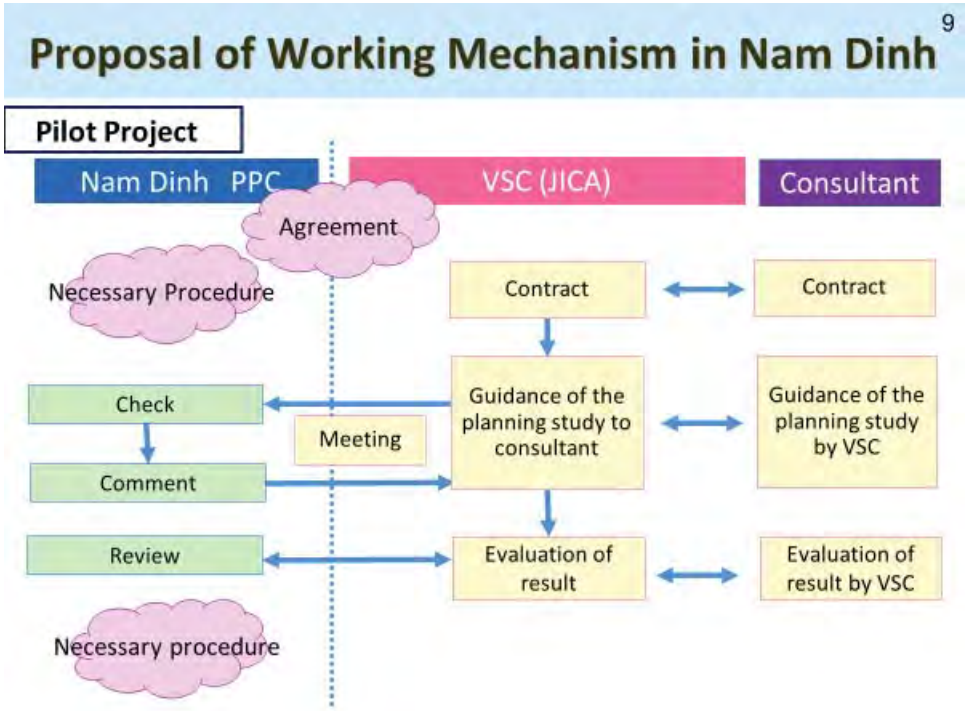


Figure 4.1 Nam Dinh's pilot project implementation scheme

Source：JICA Study Team

2) Design and construction phase

Project Management Unit (PMU) will execute the project in the phase of design and construction. Provincial Peoples Committee (PPC) assigns PMU in the organization including provincial water and wastewater companies and city people's committee (CPC). Image of project implementation support scheme is described in Figure 4.2.

Case 1 assumes VSC deals with project management instead of PMU. VSC carries out all operations of PMU by entrustment from PC.

Case 2 assumes consultation, or technical support. In Case 2, VSC dispatches engineers to PMU which needs a technical support and deals with a part of PMU's work. In Case 3, VSC deals with technology verification instead of the central government or PPC.

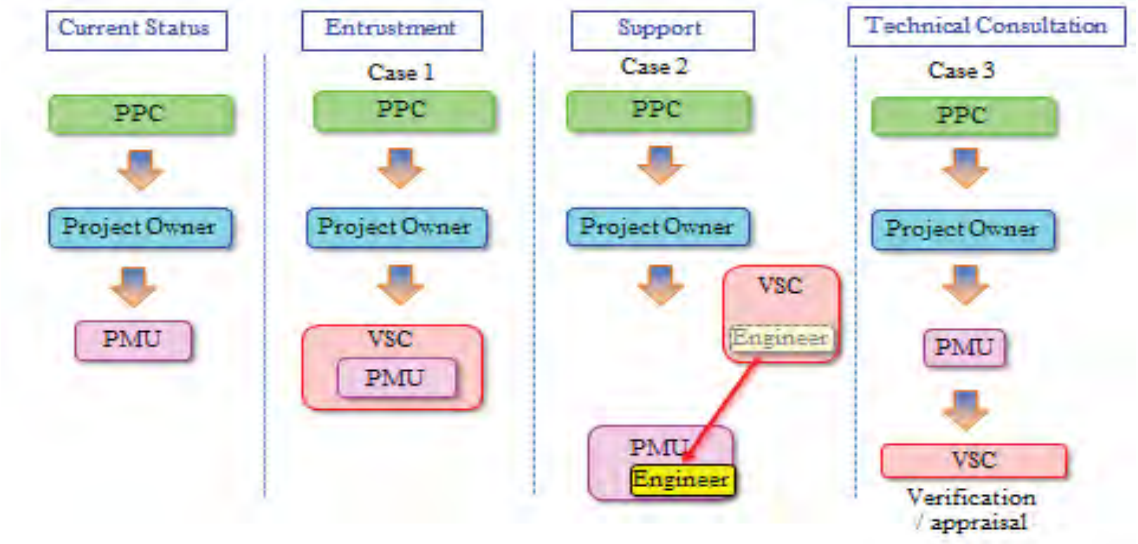


Figure 4.2 Image of Project Implementation Support scheme
(design and construction phase)

Source：JICA Study Team

Case 1: Needs survey shows that a case that each project establishes each PMU seems rare and single PMU implements multiple projects in many cases. In latter case, as sewerage project cannot split away from PMU. In needs survey, only Nam Dinh city answered that it will consider to establish PMU for only sewerage project. Case 1 will be applicable not so much cases, but possible to some cases.

Case 2: Needs survey shows that many PC answered that they need VSC's technical support for sewerage projects because sewerage is a new technology for them. One PC which sewerage project is currently underway employs a foreign sewerage expert as an in-house consultant of PMU. The PC said that ODA covered employment cost. So, case 2 is considered to satisfy actual needs.

Case 3 is a technology verification service for the government or PPC, and local consultants carry out it currently. This case is supposed to compete with local consultants and required a bidding participation. Case 3 looks not suitable for VSC.

During needs survey, JICA study team visited three cities; Ben Tre, Sa Dec, and Vinh Long in Mekong Delta. The cities that currently ADB supports show interest in VSC's project implementation support. Ben Tre City, which is now under F/S, can start its design phase in 2018 at the earliest possibility. Other two cities expect to implement F/S in 2018. The feasibility of pilot project in Ben Tre in 2018 will be discussed in 2017.

If pilot project in Ben Tre will be performed, working mechanism will be examined through the pilot project. Based on the working method examined in the pilot project, VSC will implement actual projects from 2019.

(3) Human Resources

When carrying out sewerage project, securing sewerage experts is required. Hanoi Sewerage and Drainage Project Management Board (HSDPMB) of Hanoi City, Urban Civil Works Construction Investment Management Authority (UCCI), Urban Drainage Company（UDC）, and Steering Committee for Flood Control (SCFC) of Ho Chi Minh City have experienced sewerage engineers. VSC will temporary send these experienced engineers, local consultants, or MOC staff to PMU as a part time basis or full time basis. Considering human resource development of VSC, some MOC staffs should be assigned to VSC to support the project execution and to have OJT (On the Job Training).

When executing pilot project in Nam Dinh City, JICA will employ local consultant and Japanese experts will support VSC to carry the project. Considering the human resource development, VSC staff should be assigned to support the project implementation as OJT. VSC counterparts are assumed to be several experienced staff from MOC or other organizations. Japanese experts will train and support VSC counterparts and facilitate the progress of the project.

VSC plans to pool experienced sewerage engineers in the future. Considering the balance between the number of staffs and the number of projects, possibility of human resource registration system will be examined in 2017 – 2018.

(4) Cost/Revenue

The cost/revenue of the project implementation support will be examined based on the result of the pilot project of Nam Dinh City. Basically PMU which asks VSC’s support will pay necessary cost to VSC.

Among 72 cities in class 3 and above, 21 cities have completed their projects, 17 cities are under construction, 8 cities are under design, and rest 26 cities have not yet started their sewage works. Currently, the 26 cities are assumed to be the target of the project implementation support.

5. Research and Development Function

(1) Necessity of Research and Development Function

In Vietnam, ODA has mainly supported sewage works. As World Bank (WB) or JICA points out in its report, sewage works in Vietnam have following issues to be improved.

・Implementation of F/S, design and construction takes long time.

・The project period from start to completion is longer than other projects in the different fields.

The possible causes are as follows.

・The review or correction of unappropriated plan or design need time.

・Insufficient design standards for planning and design cause long time for consideration

・Unskilled personnel of PC or PMB need time to plan and design.

・Existing many processes before starting (or formulating) projects need long time to understand correctly.

Needs survey shows that many PCs, which do not start sewerage projects, said, that they need VSC's technical support for sewerage project because sewerage is new technology for them. PCs, which do not start sewerage projects, must implement sewerage projects despite they have no experience and no skilled personnel of sewage works. When such less-experienced PCs must make decision on sewerage projects, sewerage projects may delay or may encounter difficulties due to the causes mentioned above.

Smooth promotion of sewage works in Vietnam requires following activities:

・Understand the current status of sewage works and problems in sewage works in Vietnam

・Study solutions for various problems based on the current status

・Develop technical capacity by sharing studied solution (knowledge, information and experiences).

・Study information on various issues before action

In MOC, there are institutions which are responsible for R&D such as IBST (Vietnam Institute for Building Science and Technology). But there is no R&D institution which is specialized in a field of sewerage now. Therefore, if R&D is provided to VSC, a large effect can be expected such as supply of training materials and support of project implementation.

Knowledge will be gained through study on current situation in sewage works in Vietnam and through study on their problem solutions. Such knowledge as technical information and experiences can be spread and shared through trainings, that raise Vietnam's technical level in the field of sewage works and contribute to all Vietnam's sewerage projects.

Theme of research and development shown below will be carried out from 2017 to 2018, and be carried out continuously from 2019. Also, VSC will carry out research entrusted by donor organizations, MOC and private companies in the future.

(2) Theme of Research and Development

1) Development of sewerage database

① Purpose

Major purpose of the sewerage database is firstly to grasp sewerage project plans, O&M status of sewerage facilities, construction cost and its source of revenue, O&M cost, and its source of revenue. Then the following effects are expected by sharing such information with the persons or organizations concerned.

- The database makes "users" understood the purpose and benefit of sewage works and the necessity that they bear the sewerage works cost to sustain sewerage services.
- The database can be useful fundamental material for central government and PCs to know precise current situations of the country/local PCs and to make future policy and plan.
- The database can be basic materials for "R&D institutions" to promote their various researches and developments.

② Current situation

Sewerage Database (as a part of water and sewerage data base) was prepared and issued with WB's support in 2016. But the database consists of PI (Performance Indicator) mainly collected from provincial sewerage public companies (some private companies included) which are in charge of O&M of sewerage facilities in provinces.

Though this database is effective for evaluating each sewerage works by O&M company, it has following difficulties:

- The database includes data of only 14 WWTPs while 36 WWTPs are currently operated in Vietnam. And types of data are too few to grasp status of each WWTP.
- Detail data such as sludge disposal status are not included.

Because of these problems of the existing sewerage database, it is regarded important to prepare a new sewerage database to accomplish the objectives above.

③ Direction of the new DB

The new sewerage database should be developed based on the following directions.

- Developing DB of each WWTP
- Developing specific DB (water treatment, sludge treatment, etc.) allows technical consideration:
  - ✓ Design data
  - ✓ Actual operation data
    - ✓ Financial data
- Containing data of PCs which are under construction, design, and planning.
- Updating every year
- Improving it as Japanese sewerage database
- Being available in English and Vietnamese.

④ Method of dissipating information

- Disclose information in the website of ATI and VSC
- Publish DB in printed form annually
- Have an annual meeting for concerned parties and receive their feedback

⑤ Work flowchart (Proposed)

The following flowchart assumes VSC works directly with a support of MABUTIP that joined the development of sewerage DB of WB.

As shown in Figure 5.1, it is proposed that the database will be directly prepared by VSC with support of MABUTIP which has experience in the existing sewerage database preparation by WB, and with advice of JICA experts especially for the first two years.

Database is prepared and provided in Microsoft ® EXCEL so that the data can be processed.
Data is posted on web sites in PDF so that no special tool (software or hardware) is required to prepare the database and cost can be suppressed.

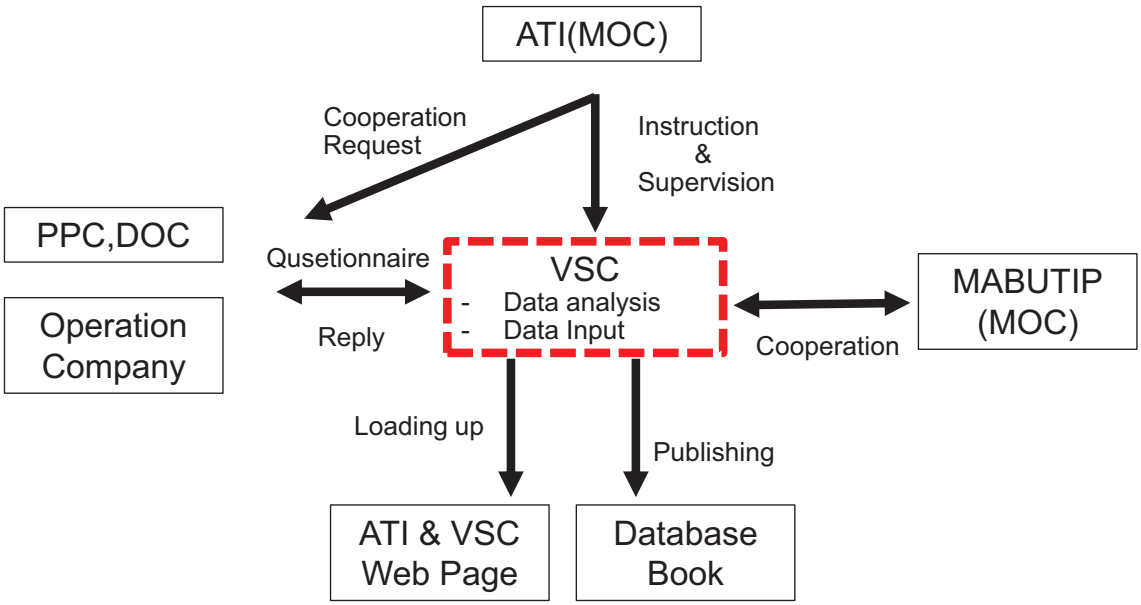


Figure 5.1 Work flowchart of sewerage database

Source : JICA Study Team

⑥ Work schedule (Proposed)

Table 5.1 Work schedule for sewerage database development

Item	2017	2018	Remarks
1. Plan	→		Discussion with ATI
2. Database Form Making	→		Outsourcing
3. Data Collection of existing WWTPs		5 Months →	Questionnaire
4. Data Collection at Cities without WWTPs		5 Months →	Questionnaire
5. Data Analysis Database Making		5 Months →	
6. Publishing and Orientation meeting		1 Months →	Holding an Orientation meeting

＊Database will be published every year after 2019.

Source : JICA Study Team

2) Development of Planning and Design Guideline for Sewerage Facilities

① Purpose

As shown in Table5.2 and Table5.3, many WWTPs in Vietnam have problems of low operation rate and low influent quality (vs designed influent quality). These problems cause the following adverse

influences as well as waste of money.

- Difficulty in operation and maintenance
- Deterioration of effluent quality
- Increased operation and maintenance cost

Considering these problems, the guideline (manual) for sewerage planning and design should be prepared to conform actual conditions of Vietnamese sewerage and the following effects can be expected:

- Prevention of excessive designs
- Reducing designing period
- Prevention of adverse influence including unmanageable O&M caused by unsuited design and construction to Vietnam's condition

Table 5.2 Example of WWTP Low Operation Rate
(Current inflow rate / Design capacity)

Province/City	Name of WWTP	Design Capavity (m3/d)	Current Inflow rate (m3/d)	Operation rate (%)	Doner
Hanoi	West Lake	22,800	15,800	69.3	-
Hanoi	North Thanlong	41,000	7,000	17.1	JICA
Nghe An	Vinh	50,000	25,000	50.0	GIZ
Binh Doung	Thu Dau Mot	17,650	8,000	45.3	JICA

Source : JICA Study Team

Table 5.3 Example of WWTP influent quality

Nation	Vietnam [1]		Japan [2]		IWA 2008 [3]
Collection System	CSS	SSS	CSS	SSS	
BOD_5(mg/L)	69	358	112	196	350
SS(mg/L)	73	539	96	180	400
T-N(mg/L)	27	94	25	37	60
T-P(mg/L)	4.1	15.5	2.8	4.5	15

Source : JICA Study Team

*: Design condition: Both BOD and SS are 150～200mg/L.

1)Report No. ACS7712, Socialist Republic of Vietnam Performance of the Wastewater Sector in Urban Areas: A Review and Recommendations for Improvement -Vietnam Urban Wastewater Review-, 2013, World Bank, The average of 13 WWTPs with combined system and 2 WWTPs with separate system

2)Sewerage Database (2009), JSWA, the median of 31 WWTPs with combined system (including a part of separate system) and 603 WWTPS with separate system

3)Mogens Henze, et al. Biological Wastewater Treatment: Principles, Modeling, and Design, p35, IWA Publishing, 2008

② Current situation

Present Vietnamese technical standard QCVN07-2/2016/BTX is attached in Appendix 8. This standard doesn't refer to sewerage planning and detail sewerage design standards such as for WWTPs. Therefore, design consultants and contractors use standards of Japan or EU in which influent flowrate is high and influent concentration is high. Using their design standards without any modification to fit Vietnam have caused some problems mentioned in ①.

③ Direction of planning and design guideline (manual) for sewerage facilities

The planning and designing guideline (manual) should be developed based on the following directions.

- Enhance development of sewerage DB and collect existing operation data and design specifications.
- Define the scope for two years and prioritize an objective. Scope of the guideline (manual) to be developed during the JICA's project (April 2017 – May 2019) is listed in Table 5.4 and the rest developed after the JICA's project is listed in Table 5.5.

Table 5.4 Guideline(Manual) development during the JICA's project

No.	Contents
1	Introduction
2	Planning
	Vision
	Objectives
	Need for Planning
	Basic Design Considerations
	Design Period
	Population Forecast
	Project Area
	Reuse and Disposal

	Layout and Arrangement of Sewerage
	Legislation and Regulations
	Guidelines on House Sewer Connections
	Survey and Investigation
	Detailed Project Report
	Planning of Sewerage System
	Planning of Sludge Treatment and Utilization
	Planning of Utilization of Resources and Space
	Planning for Reconstruction
	Environmental Preservation and Beautification
	Engineering Plans
	Checklist
3	Design and Construction of Sewage Treatment Facilities
	General
	Fundamental Principle of Biological Treatment
	Secondary Biological Treatment Process
	Plant Outfalls
	Essential Facilities
	Screening, Grit Removal, and Flow Equalization
	Settling
	Sewage Treatment
	Disinfection Facilities
	The Issues of Nitrogen and Phosphorus
	Desirable Treated Sewage Quality and Processes
	Electrical and Instrumentation
	Corrosion Protection and Control
	Rehabilitation of Sewage Treatment Facilities
	Carbon Credit
	Recent Technologies in Sewage Treatment
	Addressing the Recent Technologies in Choice of WWTP

Source：JICA Study Team

Table 5.5 Guideline(Manual) development after the JICA's project

No.	Contents
1	Introduction
2	Design and Construction of Sewer
3	Design and Construction of Sewage Pumping Stations and Sewage Pumping Mains
4	Design and Construction of Sludge Treatment Facilities
5	Recycling and Reuse of Sewage
6	Decentralized Sewage and Sludge Treatment System
7	On-Site Sanitation

Source：JICA Study Team

- Develop guideline (manual) that suit the actual condition of Vietnam.
- JICA experts will instruct and supervise the development of guideline (manual) with utilizing local consultants.
- Set up an advisory committee which mainly consists of frontline engineers. Interview with external experts and reflect their opinions on guideline (manual).
- Set up an approval committee consisting of external experts (academics and governmental officers). Grant the approval committee an authority to approve the final guideline (manual) and give authority to the approved guideline (manual).

④ Publish guideline (manual)

Sewerage planning and design guideline (manual) will be published in May 2019 by organizing every part listed in Table 5.4 developed during the JICA's project.

⑤ Work flowchart (proposed)

As shown in Figure5.2, draft of the guideline (manual) will be developed mainly reflecting opinions or advices of frontline engineers which will be collected in the advisory committee. Then the guideline (manual) will be considered and approved through the approval committee consisting of academics and governmental officers. Finally, the guideline (manual) will be published as QCVN in the name of MOC.

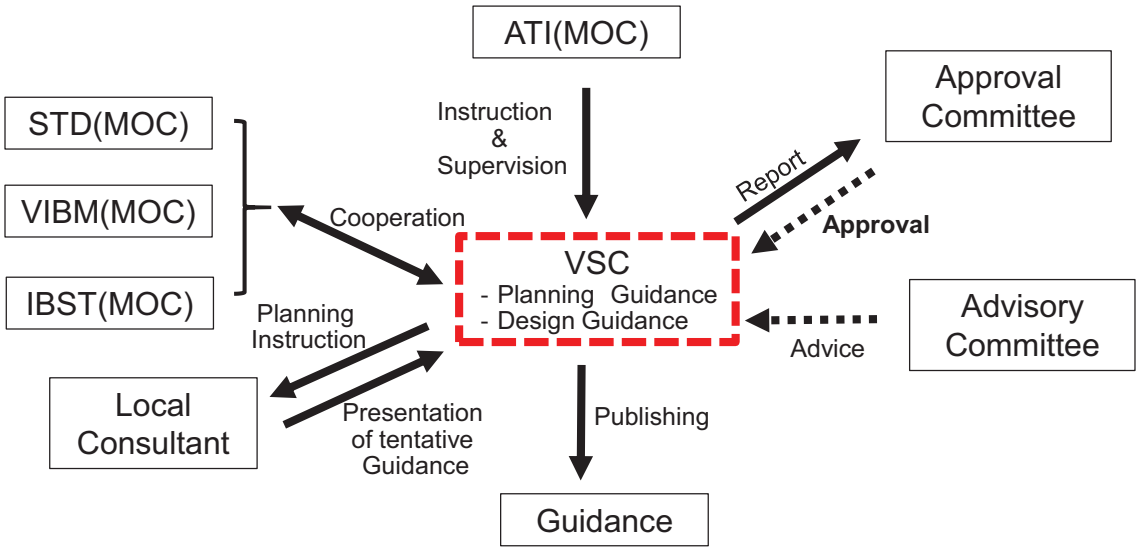


Figure 5.2 Flowchart of guideline(manual) development for sewerage planning and design

Source : JICA Study Team

⑥ Work schedule (proposed)

The guideline (manual) is proposed to be developed according to the schedule showed in Table5.6.

Table 5.6 Time Schedule for guideline (manual) development

Item	2017	2018	2019	Remarks
1. Plan	3 Months			Discussion with ATI
2. Data Collection of existing WWTPs & Analysis	5 Months			
3. Manual Making		12 Months		Questionnaire
4. Holding a Advisory Committee				Committee holding of total six times
5. Holding a Approval Committee				Committee holding of total four times
6. Publishing a Guidance			3 Months	

Source：JICA Study Team

3) Collecting, organizing, and disseminating information

① Purpose

Information on sewerage-related projects in Vietnam will be collected and organized. Useful Information for facility planning, design, construction, and O&M will be disseminated to realize suitable sewage works formulation, realization, and management.

The contents of collected, organized, and sent information are as follows:

- Study reports of donor organizations
- Government policy including MOC
- PC's policy information
- Procedures to formulate sewerage project

② Method of collecting information

- Building a cooperative relationship with WB, ADB, GIZ, DANIDA, etc. (having opportunities of information exchange, regularly)
- Collecting information about grass-roots projects and JICA's ODA projects (information provision from JICA)
- Information from MOC

③ Method of disseminating information

- Upload on website of ATI and VSC

6. Organization

VSC will be an organization under Administration of Technical Infrastructure (ATI)/MOC at the beginning. It will be examined to be directly under MOC in the future. Minister's decision on establishment of VSC will be officially decided in 2017. After establishment of VSC, VSC will hire its own staff. The number of VSC's staff will be decided based on though examination of budget plan in 2017. In this Business Plan VSC's organization is proposed as shown below.

Director: 1

Chief Accountant: 1

Training Division: 2

Project Implementation Support Division: 2

Research & Development Division: 2

Total number of staff: 8

Staff in each Division should complete sewerage class in University or have at least 2 years work experience in sewerage field.

7. Budget Plan

VSC's budget plan will be made. Various conditions are assumed to make budget plan as shown below.

- Establishment of VSC : Because VSC wi11 establish in 2017, VSC's establishment is assumed to be the end of 2017.
- Salary: In 2017, one full-time counterpart and several part-time counterparts will be provided by MOC. Their salary will be paid by MOC. After establishment of VSC (from 2018), VSC will employ its staff, 8 of them as shown in Organization.
- JICA's input : In the JICA's project period, until May 2019, JICA will provide necessary expenditure to hire local consultants for project implementation support and Research & Development, and cost for web page development and maintenance. Also, JICA will provide necessary expenditure for Japanese experts and training equipment.
- MOC's input : MOC will provide necessary expenditure for counterparts salary in 2017. Also, MOC prepares VSC's office and necessary equipment.

(1) Budget plan in 2017（before establishment of VSC）

Budget plan in 2017 is shown in Table 7.1. Five training courses will be held as written in 3.(7). The number of trainees in each course will be 30; 20 from central/local government management

1nd 10 from enterprises working in sewerage sector. Tuition fee will be 2 million VND/trainee for central/local government management and 4 million VND/trainee for enterprises working in sewerage sector. Training cost for each course will be 49,365,000 VND as shown in 3.(8).

Table 7.1 Budget Plan in 2017

	Revenue	(VND)	Expenditure	(VND)	R-E (VND)
Training	Training Fee	400,000,000	Training Cost	246,825,000	153,175,000
PIS					0
R&D			Committee	150,000,000	△ 150,000,000
Total					3,175,000

Source: JICA Study Team

(2) Budget plan in 2018（after establishment of VSC）

Table 7.2 shows budget plan in 2018. Five training courses will be held twice as written in 3. (7). The number of trainees in each course will be 30; 10 from central/local government management and 20 from enterprises working in sewerage sector. Tuition fee will be 2 million VND/trainee for central/local government management and 8 million VND/trainee for enterprises working in sewerage sector. VSC will pay general expenditure including staff's salary. Salary for VSC staff is assumed as shown in Table 7.3.

Table 7.2 Budget Plan in 2018

	Revenue	(VND)	Expenditure	(VND)	R-E (VND)
Training	Training Fee	1,800,000,000	Training Cost	493,650,000	1,306,350,000
PIS					0
R&D			Committee	300,000,000	△ 300,000,000
General			Salary	636,000,000	△ 636,000,000
			Business trip	2,250,000	△ 2,250,000
			Web const.	100,000,000	△ 100,000,000
			Communication	24,000,000	△ 24,000,000
			Others	10,000,000	△ 10,000,000
Total					234,100,000

Source: JICA Study Team

Table 7.3 VSC staff's salary (assumption)

	VND/month	person
Director	10,000,000	1
Head of Division	7,000,000	3
Accountant	7,000,000	1
Officer	5,000,000	3

Source: JICA Study Team

(3) Budget plan in 2019 and after 2019

JICA's Project will end in May 2019. Table 7.4 shows budget plan in 2019 and after 2019, assuming the same activity will continue. Five training courses will be held twice as written in 3. (7). The number of trainees and tuition fee will be the same as in 2018. Concerning project implementation support, it is assumed that necessary expenditure will be covered by revenue from PC which asks VSC to support its project.

Table 7.4 Budget Plan in 2019 and after 2019

	Revenue	(VND)	Expenditure	(VND)	R-E (VND)
Training	Training Fee	1,800,000,000	Training Cost	493,650,000	1,306,350,000
PIS					0
R&D			Committee	75,000,000	∆ 75,000,000
General			Salary	636,000,000	∆ 636,000,000
			Business trip	2,250,000	∆ 2,250,000
			Communication	24,000,000	∆ 24,000,000
			Others	10,000,000	∆ 10,000,000
Total					559,100,000

Source: JICA Study Team

Appendix 1 Sewerage Service Improvement of Cities

No.	Name of urban cities	Urban Categories	Population	Area	Status of WWTP			
			(People)	(km2)	Plan	Under Design	Under Construction	Running
1	Hanoi	Special	7.095.800 (2014)	3.328,9				○
2	Ho Chi Minh		7.567.700 (2015)	2.095,6				○
3	Hai Phong	Central, Class I	2.103.500 (2015)	1.527,4			○	
4	Da Nang		1.007.700 (2014)	1.285,4				○
5	Can Tho		1.238.300 (2014)	1.409,0				○
6	Hue	Provincial, Class I	354.124 (2015)	71,68			○	
7	Vinh		314.351 (2014)	104,96				○
8	Da Lat		211.696 (2011)	394,64				○
9	Nha Trang		398.751 (2012)	252,6				○
10	Quy Nhon		286.400 (2014)	284				○
11	Buon Ma Thuot		331.262 (2011)	377,18				○
12	Thai Nguyen		306.842 (2015)	170,7		○		
13	Nam Dinh		352.108 (2010)	46,4	○(G)			
14	Viet Tri		283.995 (2013)	111.75			○	
15	Vung Tau		450.000 (2014)	141.1			○	
16	Ha Long		236.972 (2014)	271,95				○
17	Thanh Hoa		411.302 (2015)	146,77			○	
18	My Tho		244.000 (2014)	81,55			○	
19	Bien Hoa		1.104.495 (2015)	264,08	○(F/S)			
20	Long Xuyen	Class II	368.376 (2013)	106,87			○	
21	Hai Duong		253.893 (2013)	71,39				○
22	Phan Thiet		220.560 (2012)	206	○(F/S)			
23	Ca Mau		278.395 (2015)	250,3	○			
24	Tuy Hoa		155.637 (2012)	107		○		
25	Uong Bi		174.678 (2012)	256,3	○			
26	Thai Binh		268.167 (2013)	67,71			○	
27	Rach Gia		223.491 (2013)	104	○			
28	Bac Lieu		190.045 (2014)	175,25	○(F/S)			
29	Ninh Binh		160.166 (2014)	48,36	○			
30	Bac Ninh		272.634 (2013)	82,60				○
31	Thu Dau Mot		271.165 (2014)	118,67				○
32	Dong Hoi		160.325 (2013)	155,71				○
33	Phu Quoc		96.940 (2014)	589,23	○			
34	Vinh Yen		152.801 (2013)	50,80				○
35	Lao Cai		150.368 (2013)	229,67			○	
36	Pleiku		214.700 (2010)	266,61	○			
37	Ba Ria		153.862 (2014)	91,46			○	
38	Bac Giang		185.000 (2014)	66,67				○
39	Phan Rang-Thap Cham		202.315 (2015)	78,90				○
40	Chau Doc		158.787 (2014)	105,29				○
41	Cam Pha		195.800 (2012)	486,45	○(F/S)			
42	Quang Ngai		260.252 (2013)	160,15	○			
43	Tam Ky		110.700 (2012)	107,6		○		
44	Tra Vinh		109.341 (2010)	68,035			○	
45	Bac Kan	Class III	57.800 (2015)	137		○		
46	Ben Tre		231.904 (2016)	71,11	○			
47	Bao Loc		156.866 (2014)	232,2	○			
48	Cam Ranh		123.859(2012)	316	○			
49	Cao Bang		84.421 (2012)	107,6	○			
50	Cao Lanh		161.292 (2009)	107			○	
51	Dong Ha		84,157 (2011)	72,96			○	
52	Dien Bien Phu		48,020 (2009)	64,27			○	
53	Ha Giang		71.689 (2010)	135,33			○	
54	Hoa Binh		94.607 (2014)	148,20		○		
55	Hoi An		92.000 (2012)	614,688		○		
56	Hung Yen		147.275 (2013)	73,42			○	
57	Kon Tum		155.214 (2013)	43.298,15	○			
58	Lai Chau		52.557 (2013)	70,77	○			
59	Lang Son		92.200 (2014)	77,69			○	
60	Mong Cai		100.000 (2013)	516,6	○			
61	Phu Ly		136.654 (2013)	87,87				○
62	Sa Dec		152.237 (2013)	59,81	○			
63	Soc Trang		173.922 (2013)	761,522				○
64	Son La		95.730 (2011)	324,93		○		
65	Song Cong		109.409 (2015)	98,37	○			
66	Tam Diep		104.175 (2015)	104,979				○
67	Tan An		186.612 (2015)	81,94	○			
68	Tay Ninh		153.537 (2013)	140		○		
69	Tuyen Quang		110.119 (2010)	119,17	○			
70	Vi Thanh		190.200 (2014)	118	○			
71	Vinh Long		140.872 (2013)	48,01	○			
72	Yen Bai		95.361 (2013)	108,15	○			
Sub Total					**26**	**8**	**17**	21
Sum Total					**72**			

Appendix 2-1 List of TOT Graduates/Participants in GIZ

Name of selected participants	ĐT	email	people come from
Nguyen Văn Nam - Architechtura University of Hanoi	Confidential information (telephone numbers and email addresses of the participants)		Hanoi
Nguyễn Văn Thái -Bắc Ninh WSSCo			Bac Ninh
Nguyễn Đình Hải - Construction colledge(trường trong Hà Đô ng)			Hanoi
Lê Thị Minh Nga- Construction colledge (trường trong Hà Đông)			Hanoi
Diệp Nguyên Thịnh - Wastewater and Drainadge Company of HCM city			TP HCM
Nguyễn Quang Khải -Wastewater and Drainadge Company of HCM city			TP HCM
Phạm văn Ga Lăng - Can Tho WWCo			Can Tho
Trần Nguyến Thị Kim Thoa -Can Tho WWCo			Can tho
Đào Duy Khơi - Westen Construction University			Vinh Long
Nguyễn Minh Đức - Irrigation Uni			Hanoi
Nguyễn Việt Hương - Hà Nội waste water and drainage comp			Hanoi
Nguyễn Hồng Phong - Hà Nội waste water and drainage comp			Hanoi
Lê Nhân - BIWASE Bình Dương WWCo			Binh Duong
Phạm Thành Đạt- Director of Training Centre, Colledge of Urban Works Construction			Hanoi
Đinh Quang Hiệp - Deputy Director of Training Centre, Colledge of Urban Works Construction			Bac Ninh
Nguyễn Thế Hùng - Construction University - central region branch			Phú Yên
Phan Lê Minh Hoàng - Urban Enrivonmental company of Thua Thien Hue province			Hue
Nguyễn Thị Kim Oanh, wastewater and drainage company of Hai Phong			Hai Phong
Nguyen Van Phong, wastewater and drainage company of Hai Phong			Hai Phong
Nguyen Ba Tuyen, wastewaterand drainage company of Thai Nguyen			Thai Nguyen
Nguyễn Phúc Hải -deputy director general of Vung Tau water supply and wastewater company			Vung tau
Trần Trung Sinh deputy director general of Vung Tau water supply and wastewater company			Vung tau
Trần Thị Việt Nga -ĐHXD			Hanoi
Phạm Tuấn Hùng - ĐHXD			Hanoi
Nguyễn Việt Anh -ĐH XD			Hanoi
Nguyễn Hồng Sâm			Hanoi

Appendix 2-2 Fields of TOT Graduates of GIZ

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
	1	2	3	4	5	6	7	9	13	14	15	19	22	23	24	26	
	Pham Van Ga Lang	Tran Nguyen Kim Thoa	Diep Nguyen Thinh	Nguyen Quang Khai	Nguyen Dinh Hai	Le Thi Minh Nga	Dao Duy Khoi	Dinh Quang Hiep	Nguyen Van Nam	Nguyen Minh Duc	Phan Le Minh Hoang	Nguyen Van Thai	Nguyen Viet Anh	Nguyen Thi Hong Sam	Tran Quoc Vinh	Tran Thi Luu	
Outline of sewage works		○	○		○	○	○	○	○	○	○	○	○		○		
Administration			○														
Ordiance/ regulation in local municipality							○	○				○			○		
Public relation and public hearing							○	○				○					
Management			○														
Asset management		○				○	○	○				○			○	○	
Urban drainage management	○				○	○	○	○			○	○	○		○		
Finance																	
User charge system						○	○							○	○	○	
Sewerage and drainage planning	○		○							○		○	○				
Sewer design			○														
Desing of sewer cross section	○				○		○		○		○		○				
Design of microtunneling (pipe jacking method)					○		○										
Wastewater treatment plant design			○														
Basic for biological treatment process				○			○		○	○			○		○		
Design of mechanical equipment													○				
Design of electrical equipment																	
Procurement and construction supervision			○		○		○										
Operation and maintenance			○														
Sewer inspection, cleaning, repair and rehabilitation	○				○		○		○		○	○	○		○		
Pumping facility							○		○			○	○		○		
Wastewater treatment facility				○			○		○	○		○	○		○		
Water quality analysis							○		○	○		○	○				
Sludge treatment, disposal and reuse		○		○			○	○	○	○		○	○		○		

Appendix 3 Curriculum and Lecturer of Pilot Training

Table 3.1 First pilot training (Manager Course)

Date	Time	Lecture	Outline of lecture	Lecturer
8 Aug. (Mon)	15:00- 17:00-	Move to CUWC Registration Welcome party	(provided by JICA study team)	(MC by CUWC)
9 Aug. (Tue)	8:30- 8:45-9:00	Textbook delivery Opening ceremony	Opening speech by MOC and JICA	(MC by CUWC)
	9:00-9:30	Orientation	Orientation of the program, objectives & targets, introduction of VSC	JICA Experts (Mr. Kawai)
	9:30-9:45	Tea Break		
	9:45-11:30	Introduction to sewage works	Outlines of sewage works and background (Japan and Vietnam), including recommendation to Vietnam	JICA Expert (Mr. Kawai), ATI (Ms. Thao Huong)
	11:30-13:30	Lunch		
	13:30-14:30	Administrative systems for sewage works (*)	Introduction of administration/regulation system for sewage works	JICA Expert (Mr. Inoue), ATI (Dr. Mai Huong)
	14:30-14:45	Tea Break		
	14:45-15:45	Financial system for sewage works	Introduction of financial system in sewage works (water tariff/user charge)	JICA Expert (Mr. Inoue) and GIZ (Mr. Tim, & Ms. Ngoc)
	16:00-17:00	Discussion (1)	Wrap-upping for needs/scope of VSC	All lecturers
10 Aug. (Wed)	8:30-10:00	Sewage work planning (1)	Master planning of sewage works development (experience in Japan), and life cycle of sewage works	JICA Expert (Mr. Fujimoto)
	10:00-10:15	Tea Break		
	10:15-12:00	O&M of Sewerage system	Efficient O&M of sewerage system	JICA Expert (Dr. Kim) HSDC in Hanoi (Ms. Nga)
	12:00-13:30	Lunch		
	13:30-14:30	Public relation and hearing	Public relation, public hearing and citizen participants in sewage works	JICA Expert (Mr. Kohama), GIZ (Mr. Hiep)
	14:30-14:45	Tea Break		
	14:45-16:45	Discussion (2)	Summarizing training course/Lesson learned	All Lecturers
	16:45- 17:15 17:15-	Closing ceremony Farewell party	Speech by MOC, JICA and CUWC. Certification presentation (provided by CUWC)	(MC by CUWC) (MC by CUWC)
11 Aug. (Thu)		Leave from CUWC		

Table 3.2 Lecturers of the First Pilot Training

Lectures	Japanese side	Vietnamese side
Introduction to sewage works	Mr. KAWAI	Ms. Thao Huong, MOC
Administrative system for sewage works	Mr. INOUE	Dr. Mai Huong, MOC
Financial system for sewage works	Mr. INOUE	Mr. Tim and Ms. Ngoc, GIZ
Sewage works development planning	Mr. FUJIMOTO	
Sewerage system control	Dr. KIM	Ms. Nga, HSDC
Public relation and hearing	Mr. KOHAMA	Mr. Hiep, GIZ

Table 3.3 Second Pilot Training (Sewerage Planning & Sewer Course)

Date	Time	Lecture	Outline of Lecture	Lecturers
14 Nov (Mon)		Move to CUWC		
	15:30-	Reception,		
15 Nov (Tue)	8:30-	Textbook delivery		
	8:45-9:00	Opening ceremony	Opening speech by MOC and JICA	(MC by CUWC)
	9:00-9:30	Orientation	Explanation of outline of the training	Mr. Kawai
	9:30-9:45	Tea Break		
	9:45-12:00	Introduction to Sewage Works	Outlines of sewage works and background	MOC (Ms. Thao Huong), Mr. Kawai
	12:00-13:30	Lunch		
	13:30-14:35	Outlines of Sewage Planning	Explanation of sewage planning and stormwater management	Mr. Hayashi, Hanoi PMB (Ms. Giang)
	14:35-14:55	Tea Break		
	14:55-16:00	Outlines of Sewage Planning	Explanation of sewage planning and stormwater management	Mr. Hayashi, Hanoi PMB (Ms. Giang)
	16:00-17:00	Discussion	Review/Wrap-up of lesson learned	All lecturers
	17:00-	Welcome party	(Provided by JICA study team)	(MC by CUWC)
16 Nov (Wed)	9:00-10:05	Planning and design of sewer	Outline of planning and design of sewer	Mr. Hayashi
	10:05-10:25	Tea Break		
	10:25-12:00	Planning and design of sewer	Outline of planning and design of sewer	Mr. Hayashi
	12:00-13:30	Lunch		
	13:30-14:35	Construction and O&M of sewer	Outline of construction, cleaning, inspection, repairing, replacement	Mr. Thanh (VCC), Mr. Iida
	14:35-14:55	Tea Break		
	14:55-16:00	Construction and O&M of sewer	Outline of construction, cleaning, inspection, repairing, replacement	Mr. Iida
	16:00-17:00	Discussion	Review/Wrap-up of lesson learned	All lecturers
17 Nov. (Thu)	8:00	Lv. CUWC		
	9:00-11:00	Site visit of secondary concrete products plant	Site visit of concrete pipe plant	SONG DAY Company
	11:30-12:30	Lunch		
	12:30-15:00	Move to Hai Phong		
	15:00-16:30	Site visit of sewer construction site	Site visit of sewer & wastewater treatment plant construction sites	(Hai Phong PMU)
	16:30-18:30	Move from Hai Phong to CUWC		
18 Nov. (Fri)	8:00-8:45	Public relation and public hearing in sewage works	Introduction of public relation, public hearing and citizen participants in sewage works	Mr. Kohama
	8:45-9:00	Tea Break (Showing DVD related to public relation)		

	9:00-9:45	Public relation and public hearing in sewage works	Introduction of public relation, public hearing and citizen participants in sewage works	Mr. Kohama
	9:45-13:30	Attend 40 years Anniversary Ceremony of CUWC & Party with Farewell party provided by CUWC, MC by CUWC		
	13:30-14:35	Final Discussion	Discussion about overall program	All lecturers
	14:35-14:55	Tea Break		
	14:55-16:30	Final Discussion	Discussion about overall program	All lecturers
	16:30-17:00	Closing ceremony	Speech by MOC, JICA and CUWC, Certification presentation	(MC by CUWC)
19 Nov (Sat)		Leave from CUWC		

Table 3.4 Second Pilot Training (Wastewater Treatment Course)

Date	Time	Lecture	Outline of Lecture	Lecturer
14 Nov (Mon)		Move to CUWC		
	15:30-	Reception,		
15 Nov (Tue)	8:30-	Textbook delivery		
	8:45-9:00	Opening ceremony	Opening speech by MOC and JICA	(MC by CUWC)
	9:00-9:30	Orientation	Explanation of Outline of the training	Mr. Kawai
	9:30-9:45	Tea Break		
	9:45-12:00	Introduction to Sewage Works	Outlines of Sewage Works and background	MOC (Ms. Thao Huong), Mr. Kawai
	12:00-13:30	Lunch		
	13:30-14:35	Outlines of Wastewater treatment	Principle of wastewater treatment and process selection method	CUWC (Ms. An), Dr. Kawaguchi
	14:35-14:55	Tea Break		
	14:55-16:00	Outlines of Wastewater treatment	Principle of wastewater treatment and process selection method	Dr. Kawaguchi
	16:00-17:00	Discussion	Review/Wrap-up of lesson learned	
	17:00-	Welcome party	(Provided by JICA study team)	(MC by CUWC)
16 Nov (Wed)	9:00-10:05	Design of mechanical equipment in wastewater treatment plant	Outline for designing mechanical equipment in wastewater treatment plant	CUWC (Mr. Liem), Mr. Suzuki
	10:05-10:25	Tea Break		
	10:25-11:30	Design of mechanical equipment in wastewater treatment plant	Outline for designing mechanical equipment in wastewater treatment plant	Mr. Suzuki
	11:30-13:00	Lunch		
	13:00-14:35	Design of Electric equipment in wastewater treatment plant	Outline of roles and design for electric equipment in wastewater treatment plant	Mr. Kaneko
	14:35-14:55	Tea Break		
	14:55-16:30	Outline of O&M of wastewater treatment plant	Outline for O&M of wastewater treatment plant	Dr. Kim, HSDC (Ms. Nga)
	16:00-17:00	Discussion	Review/Wrap-up of lesson learned	
17 Nov. (Thu)	8:30	Lv. CUWC		
	9:30-11:30	Site visit of Truc Bach wastewater treatment plant	Site visit of A2O process treatment plant	HSDC
	11:30-12:30	Lunch		
	12:30-14:00	Move to Bac Giang		
	14:00-16:00	Site visit of Bac Giang wastewater treatment plant	Site visit of AO treatment plant	Bac Giang

	16:00-17:00	Move from Bac Giang to CUWC		
18 Nov. (Fri)	8:00-8:45	Public relation and public hearing in sewage works	Introduction of public relation, public hearing and citizen participants in sewage works	Mr. Kohama
	8:45-9:00	Tea Break (Showing DVD related to public relation)		
	9:00-9:45	Public relation and public hearing in sewage works	Introduction of public relation, public hearing and citizen participants in sewage works	Mr. Kohama
	9:45-13:30	Attend 40 years Anniversary Ceremony of CUWC & Party with Farewell party provided by CUWC, MC by CUWC		
	13:30-14:35	Final Discussion	Discussion about overall program	All lecturers
	14:35-14:55	Tea Break		
	14:55-16:30	Final Discussion	Discussion about overall program	All lecturers
	16:30-17:00	Closing ceremony	Speech by MOC, JICA and CUWC, Certification presentation	(MC by CUWC)
19 Nov. (Sat)		Leave from CUWC		

Table 3.5 Lecturers of the Second Pilot Training

Lectures	Japanese side	Vietnamese side
Introduction to sewage works	Mr. KAWAI	MOC (Ms. Thao Huong)
Outlines of Sewage Planning	Mr. HAYASHI	Hanoi PMB (Ms. Giang)
Planning and design of sewer	Mr. HAYASHI	
Construction and O&M of sewer	Mr. IIDA	VCC (Mr. Thanh)
Public relation and public hearing in sewage works	Mr. KOHAMA	
Outlines of Wastewater treatment	Dr. KAWAGUCHI	CUWC (Ms. An)
Design of mechanical equipment in wastewater treatment plant	Mr. SUZUKI	CUWC (Mr. Liem)
Design of Electric equipment in wastewater treatment plant	Mr. KANEKO	
Outline of O&M of wastewater treatment plant	Dr. KIM	HSDC (Ms. Nga)
Discussion facilitator in sewer course	Mr. INOUE	
Discussion facilitator in treatment course	Mr. KAWAI	

Appendix 4 Training Course

No.1 Manager Course

Target： Manager class staff of PC, DOC, DPI, PMU in all provinces/cities and private sector

Goal: Understand the sewage works basics

Day	Day of the week		Lecture title	Details	Lecturer
1	Mon	A.M.	Move to CUWC		
		P.M.	Registration, Opening Ceremony, Orientation		
2	Tue	A.M.	Sewage Works Basics	General Information of sewage works	ATI/MOC
		P.M.	Sewage Works Administration (Regulations, etc.)	Sewage works regulations and administrative organizations in Vietnam, Know-how on promotion of sewage works	ATI/MOC
3	Wed	A.M.	Sewage Works Master Plan	General Information of Sector Master Plan	ATI/MOC
		P.M.	Sewage Works Management (user charge)	Sewerage user charge and sewage works management	GIZ
4	Thu	A.M.	Sewage Works O&M	Importance of O&M	HSDC/Hanoi
		P.M.	Visit Sewerage facilities(STP, Pumping station)	Visit actual Sewerage facilities	
5	Fri	A.M.	Public Relations, Public Hearings	Explanation to citizens about needs and importance of sewage works to the community	GIZ
		P.M.	Final Discussion, Closing ceremony		

No.2 Sewerage Planning Course

Target： Manager class staff and engineers of PC, DOC, DPI, PMU in all provinces/cities and private sector

Goal:
- Obtain the basic knowledge on sewage works planning
- Become to make an appraisal and monitoring on sewage works planning

Day	Day of the week		Lecture Title	Details	Lecturer
1	Mon	A.M.	Move to CUWC		
		P.M.	Registration, Opening ceremony, Orientation		
2	Tue	A.M.	Overview of General Master Plan	Regulations relating to Urban Structure Planning	VIUP/MOC
		P.M.	Outline of Sector Master Plan	Procedure of Sewage Works Planning	ATI/MOC
3	Wed	A.M.	Sewage Works Administration	Outline of Decree 80 and sewage works administration	ATI/MOC
		P.M.	Planning of sewer and pumping station	Planning method of sewer and pumping station	VCC
4	Thu	A.M.	Outline of STP	Function of STP, Outline of treatment methods	CNEE/CUWC
		P.M.	Visit wastewater facilities(STP, Pumping station)	Visit actual wastewater facilities	
5	Fri	A.M.	Sewage Works Management (user charge)	Sewerage user charge and sewage works management	GIZ
		P.M.	Final Discussion, Closing Ceremony		

No.3 Engineer Course (Sewer)

Target： Engineers of PMU in provinces/cities that are under design, under construction or completed, and private sector

Goal： • Obtain a basic knowledge of sewer design
• Become to make an appraisal and monitoring on planning, design and construction of sewer

Day	Day of the week		Lecture Title	Details	Lecturer
1	Mon	A.M.	Move to CUWC		
		P.M.	Registration, Opening ceremony, Orientation		
2	Tue	A.M.	Sewage Works Basics	General information of sewage works, regulations and legal procedure	ATI/MOC
		P.M.	Planning of sewer and pumping station	Planning method of sewer and pumping station	VCC
3	Wed	A.M.	Sewer Design	Sewer design method	VCC
		P.M.	Sewer Construction	Sewer construction method, supervision and inspection	VCC
4	Thu	A.M.	Visit Sewer Construction Site	Visit sewer construction site	
		P.M.	Selection of Soil retaining Works	General Information of soil retaining works required for open-cut method	VCC
5	Fri	A.M.	O&M of Sewer Facilities	Outline of O&M of sewer facilities	HSDC/Hanoi
		P.M.	Final Discussion, Closing Ceremony		

No.4 Engineer Course (Sewage Treatment Plant Design

Target: Engineers of PMU in provinces/cities that are under design or under construction, and private sector

Goal： • Obtain the basic knowledge on STP design
• Become to make an appraisal and monitoring on planning and design of sewage treatment plant

Day	Day of the week		Lecture Title	Details	Lecturer
1	Mon	A.M.	Move to CUWC		
		P.M.	Registration, Opening ceremony, Orientation		
2	Tue	A.M.	Sewage Treatment Overview	Principle of wastewater treatment and basic design	CNEE/CUWC
		P.M.	Sludge Treatment Overview	Principle of sludge treatment and basic design	CNEE/CUWC
4	Wed	A.M.	Visit STP	Visit actual STP	
		P.M.	Point to Consider for STP Design	Overview of point to consider for STP design	VCC
5	Thu	A.M.	Practical Water Quality Management	Explanation of the importance of water quality management	HSDC/Hanoi
		P.M.	Water Quality Measurement Practice	Practice of water quality measurement with portable device	HSDC/Hanoi
6	Fri	A.M.	O&M of STP	General information of O&M of STP	HSDC/Hanoi
		P.M.	Final Discussion, Closing Ceremony		

No.5 New Technology Course (Pipe Jacking Method)

Target： Manager class staff and engineers of PC, DOC, DPI, PMU in all provinces/cities and private sector

Goal:
- Obtain the basic knowledge on sewer pipe jacking methods (SUISHIN)
- Become to make an appraisal and monitoring on planning/design of sewer pipe jacking methods

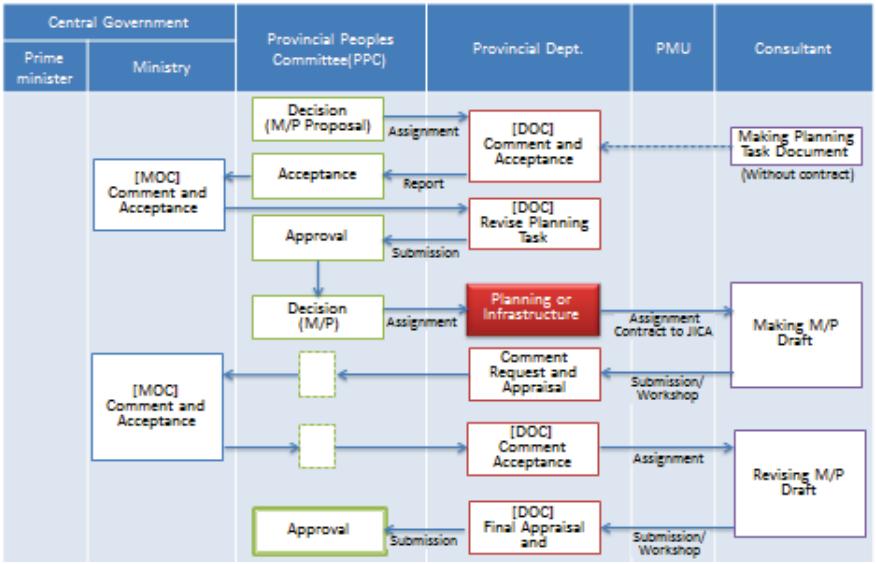
Day	Day of the week		Lecture Title	Details	Lecturer
1	Mon	A.M.	Move to CUWC		
		P.M.	Registration, Opening ceremony, Orientation		
2	Tue	A.M.	Sewage Works Administration	Outline of Decree 80 and sewage works administration	ATI/MOC
		P.M.	Overview of wastewater collection systems	Outline of wastewater collection system and prefabricated manhole	Japanese expert
3	Wed	A.M.	Outline of pipe jacking methods and selection of suitable methods	Describe feature of pipe jacking methods, important point of selection methods	Japanese expert
		P.M.	Design and construction of soil improvement method	Describe chemical grout and important point for implementation	Japanese expert
4	Thu	A.M.	Design of pipe jacking methods	Field investigation for design, selection of pipe type and jacking methods	Japanese expert
		P.M.	Visit Sewerage facilities	Visit actual Sewerage facilities	
5	Fri	A.M.	Design practice of pipe jacking methods	Primitive design practice of pipe jacking methods	Japanese expert
		P.M.	Final Discussion, Closing Ceremony		

*This training course will be conducted at Ho Chi Minh City in 2017, and at Hanoi City from 2018.

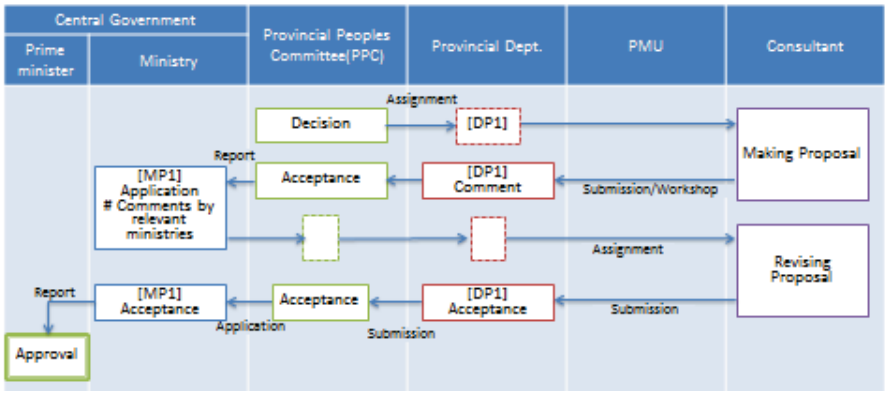
Appendix 5 Flowchart of Loan Application to Donor Organization

Procedure Flowchart of Planning and Others

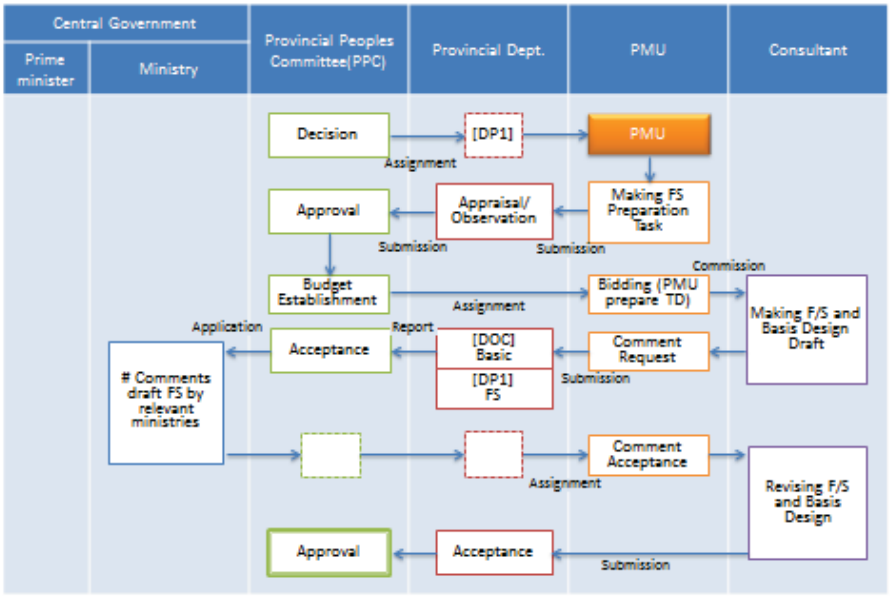
1. Sector Master Plan



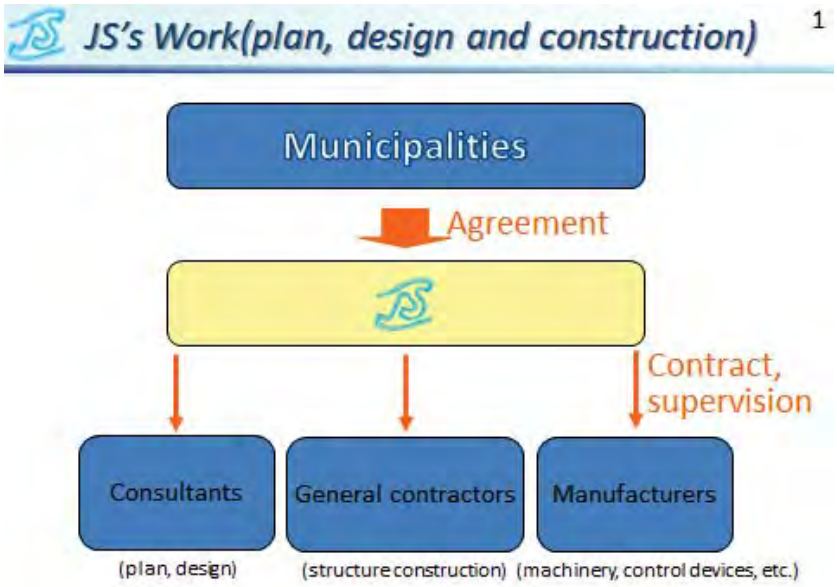
2. Project Proposal

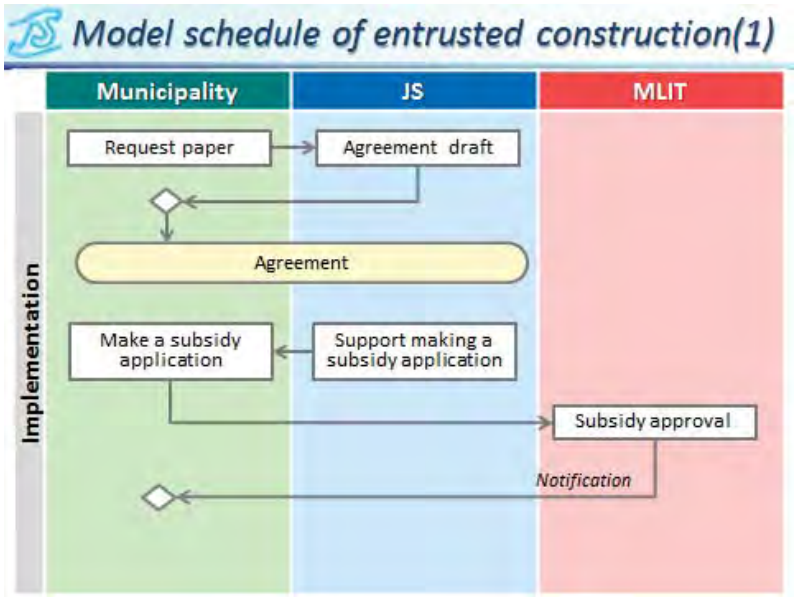


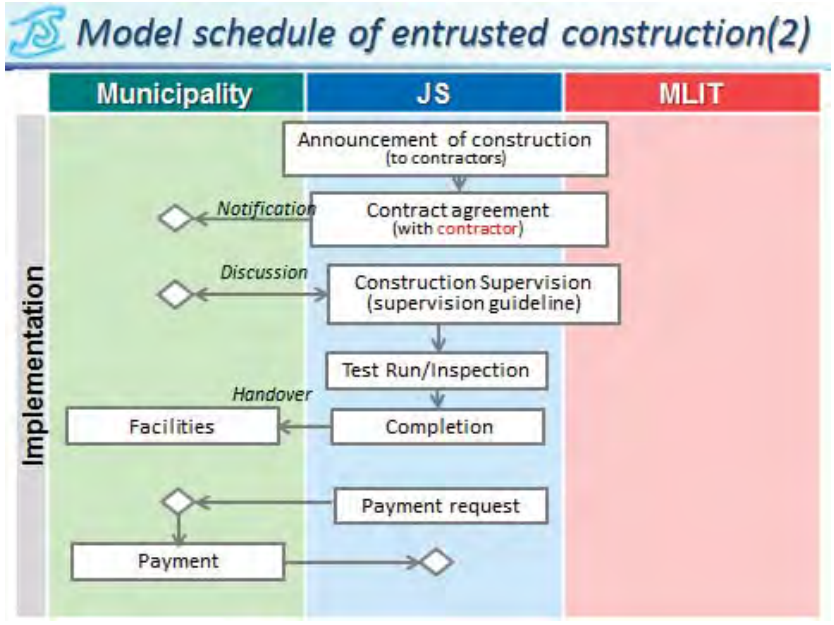
3. Feasibility Study (categorization B)



Appendix 6 Project Implementation Flowchart of JS







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CỘNG HÒA XÃ HỘI CHỦ NGHĨA VIỆT NAM

QCVN 07-2:2016/BXD

QUY CHUẨN KỸ THUẬT QUỐC GIA

CÁC CÔNG TRÌNH HẠ TẦNG KỸ THUẬT
CÔNG TRÌNH THOÁT NƯỚC

National Technical Regulation

Technical Infrastructure Works

Sewerage

HÀ NỘI - 2016

TABLE OF CONTENTS

PREFACE

QCVN 07-2:2016/BXD "Technical Infrastructure Works – Sewerage" was compied by the Vietnam Association of Civil Engineering submitted by the Department of Science, Technology, and Environment for approval, assessed by the Ministry of Science and Technology and promulgated by the Ministry of Construction under the Circular No01/2016/TT-BXD dated 01 February 2016.

National Technical Regulation QCVN 07-2:2016/BXD replaces contents of the Chapter 3 in the National Technocal Regulation QCVN 07:2010 "Urban Technical Infrastructure Engineerings" promulgated under the Circular No.02/2010/TT-BXD dated 05 February 2010 of the Minister of Construction.

NATIONAL TECHNICAL REGULATION
TECHNICAL INFRASTRUCTURE WORKS
SEWERAGE WORKS

1. GENERAL PROVISIONS

1.1 Scope of Adjustment

This Regulation stipulates compulsory technical requirements for compliance in new development, renovation, upgrade, management and operation of stormwater, wastewater sewerage works.

1.2 Subjects of Application

This Regulation is applicable for organizations and individuals that are involved in construction investment, operation and management activities of stormwater, wastewater drainage and wastewater treatment works.

1.3 Level of works

Level of works is identified based on scope , purpose, the importance, utilization time limit (lifecycle), used materials and technical construction requirements of works. Level of works or components of sewerage works must be identified in the construcion investment projects and in compliance with the QCVN 03:2012/BXD.

1.4 References

The following references cited are necessary in this Regulation. When references are edited, added of replaced, then the latest version shall be applied.

Regulations on in-house and site water supply and drainage system, the Ministry of Construction.

QCXDVN 01:2008/BXD Vietnam Building Regulation on construction planning.

QCVN 03:2012/BXD National Technical Regulation on principles of clarification, decentralization of civil, industrial engineering works and urban technical infrastrusture works.

QCVN 01:2008/BTNMT National Technical Regulation on industrial wastewater in natural rubber processing.

QCVN 11:2008/BTNMT National Technical Regulation on industrial wastewater in aquatic processing.

QCVN 12:2008/BTNMT National Technical Regulation on industrial wastewaterin papers and wood-pulp production.

QCVN 13:2008/BTNMT National Technical Regulation on industrial wastewaterin textile

QCVN 14:2008/BTNMT National Technical Regulation on domestic wastewater.

QCVN 40:2011/BTNMT National Technical Regulation on industrial wastewater..

QCVN 05:2013/BTNMT National Technical Regulation on the quality of the surounding air environment.

QCVN 50:2013/BTNMT- National Technical Regulation onwaste threshold harmful for sludge from water treatment process.

QCVN 52:2013/BTNMT- National Technical Regulation on industrial wastewater in steel manufacture.

QCVN 25:2009/BTNMTNational Technical Regulation on wastewater of solid waste landfills.

QCVN 28:2010/BTNMT National Technical Regulation on hospital wastewater.

QCVN 29:2010/BTNMT National Technical Regulations on wastewater of petrol stations and warehouses.

1.5 Definitions of terms

In this Regulations, the following terms are defined as below:

1.5.1 Drainage and sewerage systemis a complex of equipments, technical works, wastewater collection networks from generating places to treatment facilities and then discharge to receiving bodies.

1.5.2 Drainage network is a system of pipelines, sewers or drainage cannals and facilities for wastewater, stormwater collection and drainage for a specific area.

1.5.3 Receiving bodyis frequent or periodical water flows such as streams, rivers, springs, canals, ponds, lakes, lagoons, sea and underground aquifers.

1.5.4 Domestice wastewater is wastewater generated from human activities such as cooking, bathing, washing, personal hygiene.

*1.5.5 Industrial wastewater*is wastewater generated from industrial production activities, craft villages or other production activities.

1.5.6 Agreed clean water iswater that is complied with the required quality while meeting provisions of the enrvironmental Regulations or Standards and is not required to treat before discharge into water receiving bodies. Cooling water in the heat exchange system, for instance, is just getting hotter but still within specified temperature and not contaminated by impurities.

*1.5.7 Wastewater treatment in aerobic condition*is a decomposing process of organic pollutants in wastewater by microorganisms in the presence of oxygen from the air.

1.5.8 Wastewater treament in anaerobic condition is a decompositn process of pollutants in wastewater by microorganisms in the absence of oxygen from the air

1.5.9 Drainage by gravity is called *drainage by self-propelled flow*. In another word, the gravitional drainage is a wastewater transportation from a pumping stantion to a placr for treatment or for discharge.

1.5.10 *Industrial zone/industrial cluster centralized wastewater treatment plant* is responsible for treatment of wastewater from all units/ householes in industrial cluster/zone. It covers influent and treatment facilities from units/households in industrial cluster/zone meeting technical and environmental requirements before dischage into water receiving bodies.

1.5.11 *Urban centralized wastewater treatment plant* is responsible for treatment of wastewater from a basin, several basins or all wastewater of an urban area meeting technical and environmental requirements before dischage into water receiving bodies.

1.5.12 *Partial wastewater treatment plant of each unit orenterprise* is own wastewater treatment of that unit or enterprise.

1.5.13 *Wastewater treatment by mechanical method* is a wastewater treatment using mechanical and physical method.

1.5.14 *Wastewater treatment by biological/biochemical method* is a wastewater treatment technology based on the ability of microorganisms in decomposing of dirty or polluted substances.

1.5.15 *Wastewater treatment by chemical method* is a chemical wastewater treatment technology. Dirty substances will react with chemicals and form an easily-sedimented precipitate or non-toxic soluble substance.

2. TECHNICAL PROVISIONS

2.1 General requirements

2.1.1 The actual drainage and sewerage system must be compatible with the drainage and sewerage planning developed on the approved contruction plan, urban planning or planning specialized in urban drainage and sewerage and sustainable in condition of climate change.

2.1.2 Materials and structures of pipes, sewers, joints and facilities on drainage and sewerage network must ensure the durability, stability under the affects of loadability, natural conditions and corrosive impacts of the surrounding environment during the entire using period (lifecycle) of works.

2.1.3 The frequency (or cycle) of natural conditions repeatedly affected to drainage and sewerage works must be appropriate with the selected technical standards, with using time limits while taking into account the impacts of climate changes.

NOTES:see 2.2.7.

2.2 Drainage networks

2.2.1 The minimum diameter of a stormwater pipe/sewer, combined sewer is 300mminside establishment, and 400 mm for outside. The minimum diameter of wastewater pipe, sewer inside residential buildings is 150mm, and 200mm for outside.

2.2.2 Water speed

- The water speed of automatic drainage network must not be smaller than that pecified in Table 1.
- The maximumspeed of wastewater in metal pipes must not be exceeded 8m/s, while in non-metal pipes must not be exceeded 4 m/s.
- Speed of wastewater in siphon pipes must not be less than 1m/s.
- Minimum water speed in compressed sludge pipe (fresh sediments, decomposed sediments, activated sludge, etc.) must be followed the Table 2.
- Maximum speedin stormwater drainage network or combined network in metal pipes must not be exceeded 10m/s, in non-metal pipes must not be exceeded 7 m/s.
- Maximum speed in stormwater dykes and conventional-clean production wastewater dykes that are allowed to discharge into receiving bodies must be complied with the Table 3

Table 1. Minimum speed in wastewater/stormwater drainage pipes, sewers and dykes

Diameterof sewer (mm) Or dyke with equivalent hydraulic radius and thickness	**Water speed (m/s)**
150 – 200	0,7
300 – 400	0,8
400 – 500	0,9
600 – 800	1,0
900 – 1 200	1,15
1 300 – 1 500	1,2
>1 500	1,3
NOTES: 1. For production wastewater that characteristics are similar to domestic wastewater, then the minimum water speed must be followed the domestic wastewater one 2. For partial pipes and sewers at the top of network not maintaining the specified minimum speed or calculated thickness less than 0,2 D (D –pipe diameter), cleaning wells must be built or pressure spray measures must be applies. 3. The minimum speed in sedimented or biologically treated stormwater, wastewater sewers is allowed to equal to 0,4 m/s.	

2.2.3 Minimum slope

- Minimum slope of sewer is 1/D (D –sewer's diameter, mm).
- Minimum slope of stormwater drainage trench at street side must not less than 0,003.

2.2.4 Thickness of wastewater pipes

- For sewer with D = 200 - 300 mm: not exceed 0,6D
- For sewer withD = 350 - 450 mm: not exceed 0,7D
- For sewer with D = 500 - 900 mm: not exceed 0,75D
- For sewer with D > 900 mm : not exceed0,8D.
- For ditches with the height (H) from 0,9m and horizontal cross-section in any shape, thickness: not exceed 0.8H

Table2. Minimum water speed in sludge pipes

Sludge humidity %	Water speed in pressure sludge pipes (m/s) depend on diameter of sludge pipes D (mm)	
	D = 150 - 200	D = 250 – 400
92	1,4	1,5
93	1,3	1,4
94	1,2	1,3
95	1,1	1,2
96	1,0	1,1
97	0,9	1,0
98	0,8	0,9

Table 3. The allowed highest water speed

Soil type or reinforced ditch	The highest water speed (m/s)corresponds to the depth of water flow H=0,4-1,0m
Reinforced concrete	4,0
Limestone, sandstone	4,0
Mortar paving stone	3,5
Fine sand, medium sand, clay	0,4
Raw sand, thin sandy clay	0,8
Sandy clay	1,0
Clay	1,2
Grass at the bottom of the ditch	1,0
Grass at the sides of the ditch	1,6

2.2.5 The depth to lay the smallest pipe (to the top of the pipe)

- At the area with no vihicles passing by: 0,3m.
- At the area with vihicles passing by: 0,5m for all types of pipe diameter (from the height of road surface). In special cases when the depth is less than 0.5m, then the solutions for pipe protection must be taken.

2.2.6 At the connection point created by branch pipelines and main pipelines, inspection manholes must be installed. (See details on the 2.2.8)

2.2.7 Rainwater inlet

- Rainwater inlet must be arranged on streets, squares to collect all rainwater. The frequency of calculated rainfall is specified in Vietnam Construcion Regulation 01:2008/BXD
- When the street's width is smaller than 30m or when vertical slope is bigger than 0.03m, then the distance between rainwater inlets must not be bigger than 30m.
- The length of connecting conduit linking from inlets to inspection manholesis not longer than 40m. The minimum diameter of connecting pipe must be identified by the collected area of calculated rainfall, but not less than 300mm.
- At the bottom of rainwater inlet there must be a sediment collection chamber $\geq$ 0.3m in depth and waste filter at inlet gate.
- For combined drainage system in residential area, rainwater inlet must be constructed with an ordor prevention chamber.
- For rainwater drainage network, when the difference of pipe's bottom is equal or smaller than 0.5m, the pipe's diameter is smaller than 1500mm and water speed is under 4m/s, then pipe is allowed to connect by inspection manhole. When the difference is a bigger, there must be a drop manhole.

2.2.8 Inspection manhole

1) In drainage and sewerage system, inspection manhole must be placed at:

- Conduitjoints of sewers.
- Sewers' diversion, change of slope or change of diameter
- The distance between inspection manholes on horizontally-placed sewers isidentified as shown on Table 4.

- In inspection manholes that connect to sewers with diameter from 700mm and above, support floors are allowed on one side of a gutter. The distance between the floor and opposite side is not less than 100mm. In inspection manhole that connect to sewers with diameter from 2000mm and above, support floors can be allowed on console girders; whereas the size of the openingparts of gutter shall not be smaller than 2000 x 2000mm

2) Plain size of manholes is defined as below:

- Sewer with diameter smaller than 800 mm, inside dimension of a manhole D = 1 000 mm or 1 000 x 1 000 mm.
- Pipes with D bigger than 800 mm, inside dimensions of a manholeare 1200mm long and D+500mmm wide.
- The mouth of manhole has minimum size diameter of 700x700 mm or minimum inside diameter of 700mm.

Table 4. The distance between inspection manholes

Diameter of D pipe (mm)	The distance between inspection manholes(m)
150 – 300	20-30
400 - 600	40
700 – 1000	60
> 1000	100

NOTES: For pipes with diameters D400-600 mm, if the thickness is less than 0,5D and the velocity is calculated equal to the minimum velocity, then the distances between wells shall be 30m.

3) The minimum diameter of a round manhole is 1 000mm.

4) The height from the bottom of the manhole to the support of manhole neck is not less than 1,8m.

5) There should be a staircase in manhole for maintenance activity.

6) In completed building areas, manhole cover is as high as ground level. In planting area, manhole cover is 50mm higher than ground level in minimum, and in area of no construction activity, the distance is 200mm.

7) Manhole sideand bottom shall be waterproof.

8) The cover of inspection manhole and drop manhole shall be made by materials and structure ensuring load capacity corresponds to standard road or sidewalks.

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2.2.9 Drop manhole and others

Drop manhole, rainwater inlet, cleaning manhole, wastewater outlet, rainwater outlet, rainwater overflowed well shall be complied with technical requirements of selected technical standards.

2.2.10 Diuke

Diuke shall be arranged where pipelines go through river or road (if necessary). In front and behind those pipelines, inspection manhole shall be placed andlocking devices are requiredin some special cases.

2.2.11 Wastewater/rainwater discharge gates, rainwater overflowed well

Structure of treated wastewater gate or rainwater gate discharged into river, lakes must ensure the mixture of treated wastewater or rainwater with river/lake water in the most effective way. Building ground of discharge gate must take into account the impacts of vehicle transportation, geographic and hydrological conditions of rivers/lakes

2.2.12 Ventilation for drainage networks

Ventilation system shall be arranged for wastewater network.

2.2.13 Pumping station, domestic and production wastewater tanks

- According to the trust level, wastewater pumping stations and gas supply stations are classified into 3 types as shown on the Table 5

Table 5. Trust level of pump stations and air supply stations

Classification by trust level	Features of pump stations and gas supply stations
Type I	Pauseor reduction of volume are not allowed
Type II	Pause of wastewater pumping less than 6 hours is allowed
Type III	Pause of wastewater pumping less than 1 day is allowed

- Block valve must be placed on pipelines carrying wastewater to pumping stations.

- The number of pushing drains in Type-1 pumping stations must not be less than 2 and must ensure that whenever a drain is paused, the remaining drain must ensure 100% capacity of calculated volume. Thus, the use of back up pumps must be taken into account.
- For pump stations of type II and type III, only one pushing drain is allowed. Each pump must have a seperate intake/drain.
- In sediment pump station, cleaning measures of intake and pushing drains must be carried out.
- In wastewater collecting tank, waste filters must be arranged. Measures of sediment prevention must be carried out
- Structure of wastewater collecting tank must ensure that soil can not be absorbed by wastewater.
- Measures for ventilation and forthe safety of personnel who operate tanks and pump stations have to carried out and
- It must have a pulley system to lift pump vertically and horizontally for maintenance and troubleshooting.

2.2.14 Gas Supply Station

- In building of gas sypply station, it is allowed to arrange air filtration devices, pumps for technical water pumping and aeroten-chamber drying up, activated sludge pumps, centralized control devices, distribution devices, transformer, living rooms and auxiliary equipment.

2.3 Wastewater treatment works

2.3.1 Wastewater treated at WWTP must meet the requirements provided on such regulations as QCVN 14:2008/BTNMT (MONRE), QCVN 40:2011/BTNMT, QCVN 28:2010/BTNMT, QCVN 50:2013/BTNMT, in appropriateness with each wastewater type and receiving body

NOTES: For WWTP of each plant/industrial zone, treated wastewater must meet the requirements provided on related regulations such as: QCVN 01:2008/BTNMT; QCVN 11:2008/BTNMT; QCVN 12:2008/BTNMT; QCVN 13:2008/BTNMT; QCVN 25:2009/BTNMT; QCVN 29:2010/BTNMT; QCVN 36:2010/BTNMT; QCVN 52:2013/BTNMT.

2.3.2 The management of sludge collected from the sewerage system must be complied with provisions regulated on the QCVN 50:2013/BTNMT.

2.3.3 WWTP must have equipments to collect and deodorize or must have solutions to prevent odor and exhaust gas distributed to surrounding environment as sptipulated on the QCVN 05:2013/BTNMT

2.3.4 Facilites in WWTP

1) Waste filters must be installed in every WWTP with any capacity
2) Sedimentation tank must be built in WWTP with a capacity of $\geq 100m^3$/day and night.
3) Grease collector must be set up when grease concentration of more than 100mg/l.
4) Hydraulic retention time in air flow tank and concentration must not less than 6 hours.
5) Preliminary ventilation and biological coagulation tanks must be set up to increase the sedimentation efficiency and to ensure the concentration of suspended solids of wastewater flowing into biological treatment facilities below150mg/l.
6) Hydraulic cyclone: When the hydraulic magnitude of the particle is from 5 mm/s or more, it can be use simple cyclone; when the hydraulic magnitude of the particle is from 2 mm/s or higher, it can be use diaphragm and cylinder cyclones or multi-layer cyclone.
7) Floatation equipment or tank: floatation time must be less than 20 minutes.
8) Biological Ponds: the depth of an anaerobic biological pond must not be under 3m; the depth of an arbitrary biological pond (aerobic and anoxic) must not be under 2m; the depth of an aerobic biological pond with natural ventilation must not be under 1m while the one with forced ventilation must not be over 4m.
9) Wastewate treatment facilities on wet land: Irrigation field, absorbent ground is allowed to be located in areas that meet hydro-geological conditions and local hygene requirements.
10) Biological filter is a facility of attached growing mechanism used for seconday biological treatment and functions as a main process of technology diagram.

- Bioliogical filters (trickling or high rate trickling) are utilized to clean by complete or uncompleted methods
- Trickling biological filter can be utilized for complete biological treatment for plants with capacity lower than 1000m3 per day and night

- High rate biological filter can be utilized for plants with capacity up to 50.000m3 per day and night
- Biological filter can be utilized to clean wastewater from production process. It will be the main oxidized unit in the 1-level cleaning procedure or level-1 or level-2 oxidized unit in the 2-level cleaning procedure (complete or uncompleted)

11) Aeroten

- Aeroten tank must be built and operated based on such factors as components, nature and wastewater volume (Biochemical oxygen demand (BOD)20 and air efficient use)
- Concentration of poisonous substances must be lower than standard limits to ensure the normal activation of microorganisms, which are main factors to disintegrate dirty substances in wastewater.

12) Sludge compressing tank must be built in wastewater treatment plants with aeroten tank

13) Ventiltion tank for complete oxidation (or long-term ventilation aeroten tank), circulating oxidation must be considered as one of measures for level-1, level-2 or complete wastewater treatment before discharge into receiving bodies or recycle fo for reuse. Raw impurities must be removed from wastewater to ensure meeting requirements before flowing into these facilities.

14) Methane tank

- Methane tank must be considered as a measure to disintegrate sediment of domestic and production wastewater for plants with capacity from and more than 7000m3 per day and night. Different organic substances grinded from barscreens and organic wastes from factories or enterprises can be put into the methane tank.
- Fire and explosion prevention measures must be taken for methane tank.

15) Facilities and equipments for sludge drying or dewatering

- Sludge yard must be located on natural or artificial ground. Water from sludge must be collected by a pipe system and can not be absorbed into land.
- Mechanical drying equipments can be applied when drying a big volume of sludge and easy to address natural impacts (continual rainfall, high air huminity) or limited land.

NOTES: To overcome affects of rain, it can be applied drying yard with roof based on the comparision of economic-technical criteria.

16) Sand/gravel filtration ground, filtration trench and flooded filtration ground with trees

- Sand/gravel filtration gound and filtration trench are applied for on-site or scattered wastewater treatment facilities in residential areas. Treated wastewater will be discharged into land through a holed sewer system installed in filtration gorund. The thickness of unsaturated soil (from the bottom of filtration ground to the highest underground water level) is identified by type of soil as follows: (a) >1,5m for sandy, mud, mixed sandy; (b) >0,6 m for fine grained soil and clay soil.
- The construction and operation of sand/gravel filtration ground and filtration trench must be complied with related regulations.

17) Other treatment facilities and equipments must be complied with current Regulations

2.4 Maintenance and repair

Sewerage facilities and components of facilities mus be periodically maintained or replaced to ensure desinged funtions for entire utilizing duration.

3. MANAGEMENT PROVISION

3.1 Construction investment projects, profiles of designs of newly-built, renovation, upgrade, management and operation of stormwater/wastewater facilities under the scope of adjustment of this QCVN07-2:2016/BXD must include demonstration of the compliance with this regulation.

3.2 Verification and assessement of construction investment projects, designs of construction works shall be carried out in accordance with the current regulations, including the content of compliance with provisions of QCVN 07-2:2016/BXD for works under the scope of application of this Regulation.

4. IMPLEMENTATION ARRANGEMENT

4.1 The Ministry of Construction shall be responsible for disseminating and guiding the implementation of the QCVN 07-2:2016/BXD for relevant subjects.

4.2 State management agencies related to construction and technical infrastructure actitivies in localities shall be responsible for monitoring the compliance with the

provisions of the QCVN 07-2:2016/BXDin construction investment activities, management, and operation works in responsible areas as regulated by law.

4.3 During the implementation of this Regulation, inquires and comments, if any, should be sent to the Department of Science, Technology and Environment (Ministry of Construction) for guiding and handling.

Appendix 8 JCC and PMB Members

MINISTRY OF CONSTRUCTION

ADMINISTRATION OF TECHNICAL INFRASTRUCTURE

SOCIALIST REPUBLIC OF VIET NAM
Independence - Freedom - Happiness

No. 34/QD-HTKT

Hanoi, April 04th, 2016

DECISION

Translation

On appointment of members to participate in the Technical Assistance Project for "Enhancing Management Capacity of Sewerage Works in the Socialist Republic of Vietnam" granted by Japanese Governments

DIRECTOR GENERAL OF THE ADMINISTRATION OF TECHNICAL INFRASTRUCTURE

Pursuant to the Decision 997/QD-BXD dated 09 October 2013 of the Ministry of Construction stipulating functions, duties, authorities, and organization structure of the Administration of Technical Infrastructure;

Pursuant to the Decision 220/QD-BXD dated 11 March 2016 of the Minister of Construction approving the Document of TA Project for "Enhancing management capacity of Sewerage Works in the Socialist Republic of Vietnam" granted by Japanese Government;

At the proposal of the Head of Drainage and Wastewater Treatment Management Division,

DECIDES:

Article 1 Appoint the following members to participate in the Joint Coordinating Committee (JCC) of the TA Project "Enhancing the management capacity of Sewerage Works in the Socialist Republic of Vietnam" chaired by Vice Minister Phan Thi My Linh in order to implement the Project as stated on the approved Project Document.

1. Mr. Nguyen Hong Tien - Director General - Administration of Technical Infrastructure
2. Mrs. Nguyen Thi Bich Hue - Deputy Director General - International Cooperation Department
3. Mr. Le Dong Thanh - Deputy Director General - Planning and Finance Department
4. Mrs. Nguyen Thi Nga - Deputy Director General – Organization and Personnel Department
5. Mr. Bui Hong Hue - Dean – College of Urban Works Construction (CUWC)
6. Ms. Tran Thi Thao Huong - Rank of Deputy Director General – Head of Drainage and Wastewater Treatment Management Division, Administration of Technical Infrastructure

Article 2 Appoint the following members to participate in the Project Management Board (PMB) of the TA Project "Enhancing the management capacity of Sewerage Works in the Socialist Republic of Vietnam" in order to implement the Project as stated on the approved Project Document.

1. Mr. Nguyen Hong Tien - Director General - Administration of Technical Infrastructure – Head of PMB
2. Ms. Tran Thi Thao Huong - Rank of Deputy Director General – Head of Drainage and Wastewater Treatment Management Division, Administration of Technical Infrastructure – Deputy Head of PMB
3. Mr. Nguyen Ngoc Duong - Deputy Head of Drainage and Wastewater Treatment Management Division, Administration of Technical Infrastructure

4. Mr. Nguyen Vu Bao Minh - Official – International Cooperation Department
5. Ms. Nguyen Hong Nhung - Deputy Head of General Affairs, Planning and Finance Department
6. Mr. Nguyen Van Tien - Head of Training Division – Organization and Personnel Department
7. Ms. Nguyen Thi Hoai Thu - Head of General Affairs, Ministry's Office
8. Mrs. Nguyen Thu Dung - Chief Accountant, Administration of Technical Infrastructure
9. Mrs. Vu Thi Hoai An - Lecturer, College of Urban Works Construction (CUWC)
10. Mrs. Pham Thi Thanh Thuy - Accountant, Administration of Technical Infrastructure
11. Mr. Do Manh Quan - Official, Drainage and Wastewater Treatment Management Division, Administration of Technical Infrastructure
12. Mr. Ngo Van Yen - Official, Drainage and Wastewater Treatment Management Division, Administration of Technical Infrastructure
13. Mr. Pham Ngoc Chinh - Official, Drainage and Wastewater Treatment Management Division, Administration of Technical Infrastructure
14. Mrs. Pham Thi Huong - Official, Drainage and Wastewater Treatment Management Division, Administration of Technical Infrastructure

Article 3 This Decision takes effect from the march 15th, 2016. The officials named in the Article 1 and Article 2 are responsible for implementation this Decision./.

To:
1- As stated on the Article 3
2- Archives

DIRECTOR GENERAL
(Signed and sealed)

Nguyen Hong Tien

Appendix 9 Equipment to be provided for Training by JICA

No.	Name	Specipication	Unit
1	Portable pH/ORP meter Manufacturer / Origin: Hanna / Rumani Model: HI2211	DO Range: 0.00 to 50.00 ppm (mg/L); 0.0 to 600.0% saturation	2
2	Portable DO meter Manufacturer / Origin: Hanna / Rumani Model: HI2400	DO Resolution: 0.01 ppm (mg/L); 0.1% saturation	2
3	Potable EC meter Manufacturer / Origin: Hanna / Rumani Model: HI8733	DO Accuracy: ±1.5% of reading ±1 digit	2
4	Transparency Meter -2 Model: ST-100 Origin: Japan	Atmospheric Pressure Range: 450 to 850 mmHg	2
5	Portable MLSS meter Manufacturer / Origin: Yokogawa / Korea Model: DWA-3000A-MLSS	Atmospheric Pressure Resolution: 1 mmHg	2
6	Potable Residual chlorine meter Manufacturer / Origin: Hanna / Rumani Model: HI 96753	Salinity Compenstaion: automatic from 0 to 70 g/L	2
7	Potable Vibrometer	With Simple diagnosis function Acceleration, acceleration peak（1kHz-10kHz） Speed, displacement（10kHz-20kHz）	2
8	Insulation Resistance Meter	5 Ranges with Hard case model	2
9	Radiation thermometer	Gun Type	2
10	Leak clamp		2
11	Tester	Digital Multimeter	2
12	Portable electroscope	For High-Low Pressure	2
13	Vernier calipers	30cm, Digital Indication Type	2
14	Others (Consumables)		1

Appendix 2 Revised Project Design Matrix

Project Design Matrix

Project Title: Project for Enhancing Management Capacity of Sewage Works in the Socialist Republic of Vietnam (*) tentative items
Implementing Agency: Ministry of Construction, Vietnam
Target Group: Ministry of Construction, College of Urban Civil Works, Vietnam Water Supply and Sewerage Association, Provincial People's Committees and Private Companies **Version 1**
Period of Project: (*) Three Years from April, 2017 to May, 2019 **Dated 28th Feb. 2017**
Project Site: Ha Noi Area

Narrative Summary	(*) Objectively Verifiable Indicators	(*) Means of Verification	Important Assumption
Overall Goal			
To enhance the planning, implementation and management capacity of the sewerage sector to meet the future needs in Vietnam.	The number of city implementing sewerage works, the number of STP increase.	Reports from MOC and PPCs.	
Project Purpose			
Establishment planning documents for Sewerage Center is proposed and refined based on the result of the pilot projects.	Rules and duties of Sewerage Works center are drafted with the provision of the function of training, licensing, project implementation support and research & development.	Draft rules and duties of Sewerage Works Center Monitoring and management records Hearing from staff members.	The policies relating to sewerage sector management are not changed drastically even after the revision of the Sewerage Orientation.
Outputs			
1. Comprehensive needs of human resource development for sewerage sector is identified.	Needs survey of human resource development is implemented.	Needs survey reports.	The institutional setups for the Project implementation are not changed drastically.
2. Structure of the organization, function, tasks and business plan for the Sewerage Center are drafted.	Organization and Business plan for Sewerage Works are drafted.	Organization and Business plan for Sewerage Works.	
3. The Basic pilot training for sewerage sector implemented .	A training program is drafted.	Basic training program/report.	
4. Pilot activities for the Project Implementation Support function are implemented.	Project implementation support function of Sewerage Works is drafted.	Plan/report TOR for Project implementation support function of Sewerage Works.	
5. The pilot activities for consulting and research and development for the sewerage sector in Vietnam are implemented.	Research and Development function of Sewerage Works is drafted.	Plan/report TOR for Research and Development function of Sewerage Works.	

(*) Activities	(*) Inputs		Pre-Conditions
	The Japanese Side	The Vietnamese Side	
1-1 Review the relevent sewerage sector reports from the past to the present and study implementing organization and develop overall strategy for sewerage field works development, organize survey and identify needs on training. 1-2 Study the issues and implementation setup on the stages from initial planning to O&M and identify the needs for human resource development, project implementation support and Research and Development on Sewerage Works by visiting local governments which are currently implementing sewerage projects (such as yen loan projects). 1-3 To forecast and identify the needs for human resource development, project implementation support and Research and Development and study the current situation of human resources of sewerage works by visiting local governments which have prospective sewerage projects.	1. Experts <u>Long-term Expert</u> - Chief advisor - Project coordinator/training and organization planning Consultants - Basic survey - Organization / Business plan -Training (Training curriculum development, course material development, etc.) -Project implementation (Project identification, contract procedure, project management) -Research & development (Project identification, contract procedure, project management) <u>Short term Expert (trainer)</u> -Planning -Design -O&M of sewerage facilities -Asset management -Financial management 2. Training Training in Japan - Japan Sewage Works agency - Japan Sewage Works Association 3. Machinery and Equipment - Procurement of training facilities and equipment as defined in consideration of activity 3-5 Only procurement of training facilities 4. Local Cost - Expenses necessary for personnel of secretary and translator - Expenses necessary for contract of local consultant (basic survey) - Expenses necessary for accommodation of JICA experts' activities - Expenses necessary for hiring local staff - Expenses necessary for purchasing equipment served for pilot activities of the Center.	1. Counterpart staff - Sufficient number of Counterpart staff - One (1) Director of Vietnam Sewerage Center - One (1) Accountant - Two (2) Officer in charge of training - Two (2) Officer for implementing support - Two (2) Officer for research and development - Management staff for the organization / business model - Management staff for the training curriculum / trainer 2. Facilities (MOC, CUWC) - Two project offices with necessary furniture, air-conditioners, internet facility, etc. 3. Counter budget - Salaries and allowances for the Vietnamese counterpart staffs - Costs for O&M of equipment provided by the Japanese side 4. On site training for STP O&M - adjustment and agreement of cooperation about on site training of STP 5. Requesting support to municipalities for realizing implementation support and research & development functions 6. Introduction of certification system which gives person a permit to work in sewerage works.	The inputs from the Vietnamese side are secured. - Ensure the attribution of counterpart after the establishment of Vietnam Sewerage Center - Ensure the budget from Vietnamese side - Cooperation of Vietnamese side for assuring participants in training courses - Elaborating the issues above on R/D ⬇ <Issues and countermeasures>
2-1 Based on Activity 1, support the establishment of the Sewerage Center Establishment Preparation Unit (in charge of VSC-MOC) by drafting necessary organizational documents, etc. 2-2 Based on Activity 1, draft the functions, structure of the organization, and business plan of Sewerage Center by referring to the Japan Sewage Works Agency and Japan Sewage Works Association. 2-3 Supporting the institutionalization of business plan and finalization of the Center-establishment dossier to be submitted to the competent authority based on activities 2-1, 2-2.			
3-1 Setting up and Designing the effective training Curriculum for human resource development by analyzing the results from activity 1 on the management capacity of sewerage works. 3-2 Preparing the training materials in English and Vietnamese as trial basis. 3-3 Identifying training programs based on targeted participants, Conduct the basic training courses for planning, operation and management, etc. 3-4 Reflecting the eveluation results of activity 3-3 to modify the training program. 3-5 Preparing the plan for training facilities and equipment.			
4-1 Elaborate mid- and long-term planning for implementation support function. 4-2 Selecting the pilot activity for the project implementation support. 4-3 Implementing the pilot activity on project implementation support.			
5-1 Preparing the mid-and long-term plan for Research and Development function. 5-2 Support the setup of Research and development team. 5-3 Organize and Implement the pilot activity for the Research and Development function. * Activity 1, 2-1, 2-2, 3-1, 3-2, 3-3, 4-1, 4-2, and 5-1 are conducted as the Detailed Planning Phase.			

Appendix 3 Revised Plan of Operation

Tentative Plan of Operation

Version 1
Dated 28th Feb. 2017

Project Title: Project for Enhancing Management Capacity of Sewage Works

Inputs	Year	1st Year (Jan 2016-Mar 2017) I II III IV	2nd Year (Apr 2017-Mar 2018) I II III IV	3rd Year (Apr 2018-May 2019) I II III IV	Remarks	Monitoring: Issue	Monitoring: Solution
Expert							
Consultants - Basic survey - Organization / Business plan	Plan						
	Actual						
Chief advisor	Plan						
	Actual						
Sub Chief Advisor/ Buisiness Plan Development	Plan						
	Actual						
Sewage Traning Planning / Project Cordinator	Plan						
	Actual						
Supporting Consultants (Training, Implementation Support, Research and Development, Business plan)	Plan						
	Actual						
Equipment							
Training facilities and equipment in consideration of activity 3-5	Plan						
	Actual						
	Plan						
	Actual						
Training in Japan							
	Plan						
	Actual						
In-country/Third country Training							
	Plan						
	Actual						

Activities / Sub-Activities	Year	1st Year (Jan 2016-Mar 2017) I II III IV	2nd Year (Apr 2017-Mar 2018) I II III IV	3rd Year (Apr 2018-May 2019) I II III IV	Responsible Organization: Japan	Responsible Organization: GOV	Achievements	Issue & Countermeasures
Output 1: Comprehensive needs of Human resource development for sewerage works is identified.								
1-1 Review the relevant sewerage sector reports from the past to the present and study implementing organization and develop overall strategy for sewerage field works development. Organize survey and identify needs on training.	Plan							
	Actual							
1-2 Study the issues and implementation setup on the stages from initial planning to O&M and identify the needs for human resource development, project implementation support and Research and Development on Sewerage Works by visiting local governments which are currently implementing sewerage projects (such as yen loan projects.	Plan							
	Actual							
1-3 To forecast and identify the needs for human resource development, project implementation support and Research and Development and study the current situation of human resources of sewerage works by visiting local governments which have prospective sewerage projects.	Plan							
	Actual							
Output 2:Organization structure and Business plan for Sewerage Works Center are drafted.								
2-1 Based on Activity 1, support the establishment of the Sewerage Center Establishment Preparation Unit (or PMU) (consisting of MOC, related College/University, VWSA) by drafting necessary organizational documents, etc.	Plan							
	Actual							
2-2 Based on Activity 1, draft the functions, structure of the organization, and business plan of Sewerage Center by referring to the Japan Sewage Works Agency and Japan Sewage Works Association.	Plan							
	Actual							
2-3 Supporting the institutionalization of business plan and finalization of the Center-establishment dossier to be submitted to the competent authority based on activities 2-1,2-2.	Plan							
	Actual							
Output 3: Basic pilot training for sewerage works is implemented.								
3-1 Setting up and Designing the effective training Curriculum for human resource development by analyzing the results from activity 1 on the management capacity of sewerage works.	Plan							
	Actual							
3-2 Preparing the training materials in English and Vietnamese as trial basis.	Plan							
	Actual							
3-3 Identifying training programs based on targeted participants, Conduct the basic training courses for planning, operation and management, etc..	Plan							
	Actual							
3-4 Reflecting the evaluation results of activity3-3 to modify the training program.	Plan							
	Actual							
3-5 Preparing the plan for training facilities and equipment.	Plan							
	Actual							
Output 4: The project implementation support function of Project implementation for Sewerage Works is identified.								
4-1 Elaborate mid- and long-term planning for implementation support function.	Plan							
	Actual							
4-2 Selecting the pilot activity for the project implementation support.	Plan							
	Actual							
4-3 Implementing the pilot activity on project implementation support.	Plan							
	Actual							
Output 5: Research and Development function of Sewerage Works Center is identified.								
5-1 Preparing the mid- and long-term plan for Research and Development based on needs, current issues and implementation setup (such as the development of standards, specification, technologies, guidelines, etc)	Plan							
	Actual							
5-2 Support the setup of Research and Development team.	Plan							
	Actual							
5-3 Organize and Implement the pilot activity for the Research and Development function.	Plan							
	Actual							
Duration / Phasing	Plan							
	Actual							

Monitoring Plan	Year	1st Year (Jan 2016-Mar 2017) I II III IV	2nd Year (Apr 2017-Mar 2018) I II III IV	3rd Year (Apr 2018-May 2019) I II III IV	Remarks	Issue	Solution
Monitoring							
Joint Coordinating Committee	Plan						
	Actual						
Set-up the Detailed Plan of Operation	Plan						
	Actual						
Submission of Monitoring Sheet	Plan						
	Actual						
Monitoring Mission from Japan	Plan						
	Actual						
Joint Monitoring	Plan						
	Actual						
Post Monitoring	Plan						
	Actual						
Reports/Documents							
Detailed Planning Survey Report	Plan						
	Actual						
Project Completion Report	Plan						
	Actual						
Public Relations							
	Plan						
	Actual						
	Plan						
	Actual						

Appendix 4　Amendment of the Record of Discussion

MINUTES OF MEETING

BETWEEN

JAPAN INTERNATIONAL COOPERATION AGENCY

AND

AUTHORITIES CONCERNED OF

THE GOVERNMENT OF THE SOCIALIST REPUBLIC OF VIETNAM

FOR

AMENDMENT OF THE RECORD OF DISCUSSIONS

ON

THE PROJECT FOR ENHANCING MANAGEMENT CAPACITY OF SEWAGE WORKS

The Japan International Cooperation Agency (hereinafter referred to as "JICA") and Ministry of Construction (hereinafter referred to as "MOC") hereby agreed that the Record of Discussions on the the Project for Enhancing Management Capacity of Sewage Works. (hereinafter referred to as "the Project") signed on 16th of October 2015 shall be amended as follows;

Hanoi, 28th February 2017

Mr. Shigiya Satoshi
Deputy Director General
Environment Management Group
Global Environment Department
Japan International Cooperation Agency

Dr. Nguyen Hong Tien
Director General of Administration of Technical Infrastructure
Ministry of Construction
The Government of Socialist Republic of Vietnam

1. Duration of the Project

Appendix 1: Project Description, II Outline of the Project,

Before	Points to be amended from Original R/D
8. Duration: 3 years from Jan, 2016 to Dec, 2018	**8. Duration:** 3 years and 4 months from Feb. 2016 to May 2019 Implementation Phase: from April 2017 to May 2019.
The reason for amendment: Because of the importance of this project, the content of the projects needs to be deliberated and the Detailed Planning Phase of the Project is extended for two months until Mar. 2017 from the original plan. Therefore, the business plan formulation takes much time than expected and the start of Implementation Phase was forced to be postponed accordingly.	

2. Implementation structure of JICA experts for the Project

JICA explained implementation structure of JICA experts during the Implementation Phase as followings. As for Chief Advisor, considering VSC's importance in policy of Vietnam, JICA proposed the Sewerage Policy Advisor (Mr.Takatoshi WAKO), who is currently working for MOC and familiar with Vietnamese backgrounds, would be most suitable person for the post. MOC agreed that the Sewerage Policy Advisor would work as Chief Advisor for the Project with additional assignment.

-Long-term Expert
Chief advisor (additional assignment with Sewerage Policy Advisor)
Sub-Chief Advisor /Business Plan Development (full time)
Sewage Training Planning / Project Coordinator (full time)
-Short-term Expert
Consultant team members (Training, Implementation Support and R&D)

In addition to this amendment, the both sides confirmed to revise "Objectively Verifiable Indicators" and "Means of Verification" as discussed in the 3rd Joint Coordination Committee meeting. The revised PDM is attached in Annex 1.

This amendment will become effective as of 28th Feb.2017.

ANNEXES

Annex-1 PDM Version 1.0
Annex-2 PO Version 1.0
Annex-3 Copy of Original RD

Project Design Matrix

Project Title: Project for Enhancing Management Capacity of Sewage Works in the Socialist Republic of Vietnam (*) tentative items
Implementing Agency: Ministry of Construction, Vietnam
Target Group: Ministry of Construction, College of Urban Civil Works, Vietnam Water Supply and Sewerage Association, Provincial People's Committees and Private Companies **Version 1**
Period of Project: (*) Three Years from April, 2017 to May, 2019 **Dated 28th Feb. 2017**
Project Site: Ha Noi Area

Narrative Summary	(*) Objectively Verifiable Indicators	(*) Means of Verification	Important Assumption
Overall Goal			
To enhance the planning, implementation and management capacity of the sewerage sector to meet the future needs in Vietnam.	The number of city implementing sewerage works, the number of STP increase.	Reports from MOC and PPCs.	
Project Purpose			
Establishment planning documents for Sewerage Center is proposed and refined based on the result of the pilot projects.	Rules and duties of Sewerage Works center are drafted with the provision of the function of training, licensing, project implementation support and research & development.	Draft rules and duties of Sewerage Works Center Monitoring and management records Hearing from staff members.	The policies relating to sewerage sector management are not changed drastically even after the revision of the Sewerage Orientation.
Outputs			
1. Comprehensive needs of human resource development for sewerage sector is identified.	Needs survey of human resource development is implemented.	Needs survey reports.	The institutional setups for the Project implementation are not changed drastically.
2. Structure of the organization, function, tasks and business plan for the Sewerage Center are drafted.	Organization and Business plan for Sewerage Works are drafted.	Organization and Business plan for Sewerage Works.	
3. The Basic pilot training for sewerage sector implemented .	A training program is drafted.	Basic training program/report.	
4. Pilot activities for the Project Implementation Support function are implemented.	Project implementation support function of Sewerage Works is drafted.	Plan/report TOR for Project implementation support function of Sewerage Works.	
5. The pilot activities for consulting and research and development for the sewerage sector in Vietnam are implemented.	Research and Development function of Sewerage Works is drafted.	Plan/report TOR for Research and Development function of Sewerage Works.	

(*) Activities	(*) Inputs		Pre-Conditions
	The Japanese Side	The Vietnamese Side	
1-1 Review the relevent sewerage sector reports from the past to the present and study implementing organization and develop overall strategy for sewerage field works development, organize survey and identify needs on training. 1-2 Study the issues and implementation setup on the stages from initial planning to O&M and identify the needs for human resource development, project implementation support and Research and Development on Sewerage Works by visiting local governments which are currently implementing sewerage projects (such as yen loan projects). 1-3 To forecast and identify the needs for human resource development, project implementation support and Research and Development and study the current situation of human resources of sewerage works by visiting local governments which have prospective sewerage projects.	1. Experts <u>Long-term Expert</u> - Chief advisor - Project coordinator/training and organization planning Consultants - Basic survey - Organization / Business plan -Training (Training curriculum development, course material development, etc.) -Project implementation (Project identification, contract procedure, project management) -Research & development (Project identification, contract procedure, project management) <u>Short term Expert (trainer)</u> -Planning -Design -O&M of sewerage facilities -Asset management -Financial management 2. Training Training in Japan - Japan Sewage Works agency - Japan Sewage Works Association 3. Machinery and Equipment - Procurement of training facilities and equipment as defined in consideration of activity 3-5 Only procurement of training facilities 4. Local Cost - Expenses necessary for personnel of secretary and translator - Expenses necessary for contract of local consultant (basic survey) - Expenses necessary for accommodation of JICA experts' activities - Expenses necessary for hiring local staff - Expenses necessary for purchasing equipment served for pilot activities of the Center.	1. Counterpart staff - Sufficient number of Counterpart staff - One (1) Director of Vietnam Sewerage Center - One (1) Accountant - Two (2) Officer in charge of training - Two (2) Officer for implementing support - Two (2) Officer for research and development - Management staff for the organization / business model - Management staff for the training curriculum / trainer 2. Facilities (MOC, CUWC) - Two project offices with necessary furniture, air-conditioners, internet facility, etc. 3. Counter budget - Salaries and allowances for the Vietnamese counterpart staffs - Costs for O&M of equipment provided by the Japanese side 4. On site training for STP O&M - adjustment and agreement of cooperation about on site training of STP 5. Requesting support to municipalities for realizing implementation support and research & development functions 6. Introduction of certification system which gives person a permit to work in sewerage works.	The inputs from the Vietnamese side are secured. - Ensure the attribution of counterpart after the establishment of Vietnam Sewerage Center - Ensure the budget from Vietnamese side - Cooperation of Vietnamese side for assuring participants in training courses - Elaborating the issues above on R/D  <Issues and countermeasures>
2-1 Based on Activity 1, support the establishment of the Sewerage Center Establishment Preparation Unit (in charge of VSC-MOC) by drafting necessary organizational documents, etc. 2-2 Based on Activity 1, draft the functions, structure of the organization, and business plan of Sewerage Center by referring to the Japan Sewage Works Agency and Japan Sewage Works Association. 2-3 Supporting the institutionalization of business plan and finalization of the Center-establishment dossier to be submitted to the competent authority based on activities 2-1, 2-2.			
3-1 Setting up and Designing the effective training Curriculum for human resource development by analyzing the results from activity 1 on the management capacity of sewerage works. 3-2 Preparing the training materials in English and Vietnamese as trial basis. 3-3 Identifying training programs based on targeted participants, Conduct the basic training courses for planning, operation and management, etc. 3-4 Reflecting the eveluation results of activity 3-3 to modify the training program. 3-5 Preparing the plan for training facilities and equipment.			
4-1 Elaborate mid- and long-term planning for implementation support function. 4-2 Selecting the pilot activity for the project implementation support. 4-3 Implementing the pilot activity on project implementation support.			
5-1 Preparing the mid-and long-term plan for Research and Development function. 5-2 Support the setup of Research and development team. 5-3 Organize and Implement the pilot activity for the Research and Development function. * Activity 1, 2-1, 2-2, 3-1, 3-2, 3-3, 4-1, 4-2, and 5-1 are conducted as the Detailed Planning Phase.			

Tentative Plan of Operation

Version 1
Dated 28th Feb. 2017

Project Title: Project for Enhancing Management Capacity of Sewage Works

Inputs	Year	1st Year (Jan 2016-Mar 2017) I II III IV	2nd Year (Apr 2017-Mar 2018) I II III IV	3rd Year (Apr 2018-May 2019) I II III IV	Remarks	Monitoring: Issue	Monitoring: Solution
Expert							
Consultants - Basic survey - Organization / Business plan	Plan	■ ■ ■ ■					
	Actual	■ ■ ■ ■					
Chief advisor	Plan		■ ■ ■ ■	■ ■ ■ ■			
	Actual		■ ■ ■ ■	■ ■ ■ ■			
Sub Chief Advisor/ Buisiness Plan Development	Plan		■ ■ ■ ■	■ ■ ■ ■			
	Actual		■ ■ ■ ■	■ ■ ■ ■			
Sewage Traning Planning / Project Cordinator	Plan		■ ■ ■ ■	■ ■ ■ ■			
	Actual		■ ■ ■ ■	■ ■ ■ ■			
Supporting Consultants (Training, Implementation Support, Research and Development, Business plan)	Plan		■ ■ ■ ■	■ ■ ■ ■			
	Actual						
Equipment							
Training facilities and equipment in consideration of activity 3-5	Plan		■	■			
	Actual						
	Plan						
	Actual						
Training in Japan							
	Plan		■	■			
	Actual						
In-country/Third country Training							
	Plan		■				
	Actual						

Activities / Sub-Activities	Year	1st Year (Jan 2016-Mar 2017) I II III IV	2nd Year (Apr 2017-Mar 2018) I II III IV	3rd Year (Apr 2018-May 2019) I II III IV	Responsible Organization: Japan	Responsible Organization: GOV	Achievements	Issue & Countermeasures
Output 1: Comprehensive needs of Human resource development for sewerage works is identified.								
1-1 Review the relevant sewerage sector reports from the past to the present and study implementing organization and develop overall strategy for sewerage field works development. Organize survey and identify needs on training.	Plan	■ ■ ■ ■						
	Actual	■ ■ ■ ■						
1-2 Study the issues and implementation setup on the stages from initial planning to O&M and identify the needs for human resource development, project implementation support and Research and Development on Sewerage Works by visiting local governments which are currently implementing sewerage projects (such as yen loan projects.	Plan	■ ■ ■ ■						
	Actual	■ ■ ■ ■						
1-3 To forecast and identify the needs for human resource development, project implementation support and Research and Development and study the current situation of human resources of sewerage works by visiting local governments which have prospective sewerage projects.	Plan	■ ■ ■ ■						
	Actual	■ ■ ■ ■						
Output 2:Organization structure and Business plan for Sewerage Works Center are drafted.								
2-1 Based on Activity 1, support the establishment of the Sewerage Center Establishment Preparation Unit (or PMU) (consisting of MOC, related College/University, VWSA) by drafting necessary organizational documents, etc.	Plan	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■				
	Actual	■ ■ ■ ■						
2-2 Based on Activity 1, draft the functions, structure of the organization, and business plan of Sewerage Center by referring to the Japan Sewage Works Agency and Japan Sewage Works Association.	Plan	■ ■ ■ ■	■					
	Actual	■ ■ ■ ■						
2-3 Supporting the institutionalization of business plan and finalization of the Center-establishment dossier to be submitted to the competent authority based on activities 2-1,2-2.	Plan		■ ■ ■ ■	■ ■ ■ ■				
	Actual							
Output 3: Basic pilot training for sewerage works is implemented.								
3-1 Setting up and Designing the effective training Curriculum for human resource development by analyzing the results from activity 1 on the management capacity of sewerage works.	Plan	■ ■ ■ ■	■	■				
	Actual	■ ■ ■ ■						
3-2 Preparing the training materials in English and Vietnamese as trial basis.	Plan	■ ■ ■ ■	■	■				
	Actual	■ ■ ■ ■						
3-3 Identifying training programs based on targeted participants, Conduct the basic training courses for planning, operation and management, etc..	Plan	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■				
	Actual	■ ■ ■ ■						
3-4 Reflecting the evaluation results of activity3-3 to modify the training program.	Plan		■ ■ ■ ■					
	Actual							
3-5 Preparing the plan for training facilities and equipment.	Plan		■ ■ ■ ■					
	Actual							
Output 4: The project implementation support function of Project implementation for Sewerage Works is identified.								
4-1 Elaborate mid- and long-term planning for implementation support function.	Plan	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■				
	Actual	■ ■ ■ ■						
4-2 Selecting the pilot activity for the project implementation support.	Plan	■ ■ ■ ■						
	Actual	■ ■ ■ ■						
4-3 Implementing the pilot activity on project implementation support.	Plan		■ ■ ■ ■	■ ■ ■ ■				
	Actual							
Output 5: Research and Development function of Sewerage Works Center is identified.								
5-1 Preparing the mid- and long-term plan for Research and Development based on needs, current issues and implementation setup (such as the development of standards, specification, technologies, guidelines, etc)	Plan	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■				
	Actual	■ ■ ■ ■						
5-2 Support the setup of Research and Development team.	Plan		■ ■ ■ ■					
	Actual							
5-3 Organize and Implement the pilot activity for the Research and Development function.	Plan		■ ■ ■ ■	■ ■ ■ ■				
	Actual							
Duration / Phasing	Plan							
	Actual							

Monitoring Plan	Year	1st Year (Jan 2016-Mar 2017) I II III IV	2nd Year (Apr 2017-Mar 2018) I II III IV	3rd Year (Apr 2018-May 2019) I II III IV	Remarks	Issue	Solution
Monitoring							
Joint Coordinating Committee	Plan	■ ■ ■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■			
	Actual	■ ■ ■ ■ ■ ■					
Set-up the Detailed Plan of Operation	Plan	■	■				
	Actual						
Submission of Monitoring Sheet	Plan	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■			
	Actual						
Monitoring Mission from Japan	Plan	■ ■	■ ■	■ ■			
	Actual						
Joint Monitoring	Plan	■ ■	■ ■	■ ■			
	Actual						
Post Monitoring	Plan						
	Actual						
Reports/Documents							
Detailed Planning Survey Report	Plan	■					
	Actual						
Project Completion Report	Plan			■			
	Actual						
Public Relations							
	Plan						
	Actual						
	Plan						
	Actual						

RECORD OF DISCUSSIONS

ON

THE PROJECT FOR ENHANCING MANAGEMENT CAPACITY OF SEWAGE WORKS

IN

THE SOCIALIST REPUBLIC OF VIETNAM

AGREED UPON BETWEEN

THE AUTHORITIES CONCERNED OF THE GOVERNMENT OF THE SOCIALIST REPUBLIC OF VIETNAM

AND

JAPAN INTERNATIONAL COOPERATION AGENCY

Hanoi, October 16th, 2015

Mr. Kenichi Yamamoto Deputy Chief Representative, JICA Vietnam Office Japan International Cooperation Agency	Dr. Nguyen Hong Tien Director General of Administration of Technical Infrastructure Ministry of Construction

In response to the official request of the Government of the Socialist Republic of Vietnam (hereinafter referred to as "GOV") to the Government of Japan, the Japan International Cooperation Agency (hereinafter referred to as "JICA") held a series of discussions with the Ministry of Construction (hereinafter referred to as "MOC") and relevant organizations to develop a detailed plan of the Project for Enhancing Management Capacity of Sewage Works (hereinafter referred to as "the Project").

Both parties agreed the details of the Project and the main points discussed as described in the Appendix 1 and the Appendix 2 respectively.

Both parties also agreed that Administration of Technical Infrastructure (ATI) under MOC, the main counterpart to JICA, will be responsible for the implementation of the Project in cooperation with JICA, coordinate with other relevant organizations and ensure that the self-reliant operation of the Project is sustained during and after the implementation period in order to contribute toward social and economic development of Vietnam.

The Project will be implemented within the framework of the Agreement on Technical Cooperation signed on October 20 1998 (hereinafter referred to as "the Agreement") between the Government of Japan (hereinafter referred to as "GOJ") and GOV.

The effectiveness of the Record of Discussions is subject to the approval of JICA.

Appendix 1: Project Description
Appendix 2: Main Points Discussed
Appendix 3: Outline of the Sewerage Center

Appendix 1

PROJECT DESCRIPTION

I. BACKGROUND

The water environment of urban cities in Vietnam has been deteriorating severely because the development of sewerage facilities has not matched the pace of rapid industrialization and urbanization. Currently, it is estimated that only 10% of urban wastewater is treated. Given this circumstance, international development partners have been providing considerable amount of financial assistances for the development of sewerage facilities. Moreover, they are considering to scale up their assistances.

However, it is evident that the number of capable engineers and managers are currently considerably limited. Given that sewerage projects span a wide range of technical skills such as mechanical, electrical, civil, environmental, biological, etc., there is no short term solution for increasing the number of capable engineers and managers. This situation prohibits the scaling up of financial assistances.

Against this background, MOC intends to establish the Sewerage Center (tentative name) that provides trainings and services for project implementation, research and development, consultation and technology transfer on sewerage and wastewater treatment. GOV has requested the GOJ to support this initiative.

II. OUTLINE OF THE PROJECT

Tentative outline of the Project is described below. The tentative Project Design Matrix (PDM) and the tentative Plan of Operation (PO) are attached as Annex 1 and Annex 2, respectively. The PDM and PO shall be finalized in the Detailed Planning Phase.

As a prerequisite for conducting the Implementation Phase, the Vietnamese counterpart agencies are responsible for starting necessary administrative procedures within the government for the establishment of the Sewerage Center based on the outcome of the Detailed Planning Phase.

1. Title of the Project

Project for Enhancing Management Capacity of Sewage Works in Vietnam

2. Expected Goals which will be attained after implementing the Proposed Plan

(1) Overall Goal

To enhance the planning, implementation and management capacity of the sewerage sector to meet the future needs in Vietnam.

(2) Project Purpose

Establishment planning documents for Sewerage Center is proposed and refined based on the result of the pilot projects.

3. Outputs

1. Comprehensive needs of human resource development for sewerage sector is identified.

2. To propose structure of the organization, function, tasks and business plan for the Sewerage Center.

3. Implementing the Basic pilot training for sewerage sector.

4. Pilot activities for the Project Implementation Support function is implemented.

5. Implementing the pilot activities for consulting and research and development for the sewerage sector in Vietnam.

4. Tentative Activities

1-1 Review the relevant sewerage sector reports from the past to the present and study implementing organization and develop overall strategy for sewerage field development. Organize survey and identify needs on training.

1-2 Study the issues and implementation setup on the stages from initial planning to O&M and identify the needs for human resource development, project implementation support and Research and Development on Sewerage Works by visiting local governments which are currently implementing sewerage projects (yen loan projects and others).

1-3 To forecast and identify the needs for human resource development, project implementation support and Research and Development and study the current situation of human resources of sewerage works by visiting local governments which have prospective sewerage projects (prospective yen loan projects and others).

2-1 Based on Activity 1, support the establishment of the Sewerage Center Establishment Preparation Unit (as the PMU) (consisting of MOC, related College/University, Vietnam Water Supply and Sewerage Association (VWSA)) by drafting necessary organizational documents, etc.

2-2 Based on Activity 1, draft the functions, structure of the organization, and business plan of Sewerage Center by referring to the Japan Sewage Works Agency and Japan Sewage Works Association.
2-3 Supporting the institutionalization of business plan and finalization of the Center-establishment dossier to be submitted to the competent authority based on activities 2-1,2-2.

3-1 Setting up and Designing the effective training Curriculum for human resource development by analyzing the results from activity 1 on the management capacity of sewerage works.
3-2 Preparing the training materials in English and Vietnamese as trial basis.
3-3 Identifying training programs based on targeted participants, Conduct the basic training courses for planning, operation and management, etc..
3-4 Reflecting the evaluation results of activity 3-3 to modify the training program.
3-5 Preparing the plan for training facilities and equipment.

4-1 Preparing the project implementation support plan (for example, providing PMU function to local governments).
4-2 Selecting the pilot activity for the project implementation support.
4-3 Implementing the pilot activity on project implementation support.

5-1 Preparing the mid- and long-term plan for Research and Development based on needs, current issues and implementation setup (such as the development of standards, specification, technologies, guidelines, etc)
5-2 Support the setup of Research and Development team.
5-3 Select and Implement the pilot activity for the Research and Development function.

* Activities 1, 2-1, 2-2, 3-1, 3-2, 3-3, 4-1, 4-2, and 5-1 will be conducted as the Detailed Planning Phase.

5. Input

The total budget of the Project will be decided during the Detailed Planning Phase. Nevertheless, the inputs by both sides are as follows:

(1) Input by JICA

(a) Dispatch of Experts

Consultants

- Basic survey
- Organization / Business plan
- Training curriculum development, course material development, etc.

Long term Expert

- Chief advisor
- Project coordinator / training and organization planning

Short term Expert (trainer)
- Planning
- O&M of sewerage facilities
- Asset management
- Financial management

(b) Training
Training in Japan
- Japan Sewage Works Agency
- Japan Sewage Works Association

(c) Machinery and Equipment
- Procurement of training facilities and equipment as defined in consideration of activity 3-5

(d) Local Cost
- Expenses necessary for personnel of secretary and translator
- Expenses necessary for contract of local consultant (basic survey)
- Expenses necessary for accommodation of JICA experts' activities
- Expenses necessary for hiring local staff
- Expenses necessary for purchasing equipment served for pilot activities of the Center

(2) Input by GOV

GOV will take necessary measures to provide at its own expense:

(a) Services of MOC's counterpart personnel and administrative personnel as referred to in II-6;
(b) Suitable office space with necessary equipment;
(c) Information as well as support in obtaining medical service;
(d) Available data (including maps and photographs) and information related to the Project;
(e) Expenses necessary for transportation within Vietnam of the equipment referred to in II-6 (1) as well as for the installation, operation and maintenance thereof; and
(f) Necessary facilities to the JICA experts for the remittance as well as utilization of the funds introduced into Vietnam from Japan in connection with the implementation of the Project

6. Implementation Structure

The implementation structure shall be finalized by the end of the Detailed Planning phase. Tentative description is provided below.

The roles and assignments of relevant organizations are as follows:

(1) Responsible and Implementing Agency

MOC shall be the responsible agency of the Project. Administration of Technical Infrastructure (ATI) shall be the main implementing agency of the Project, responsible for coordinating other related agencies and stakeholders.

(2) Administration of Technical Infrastructure (ATI)

(a) Project Director/Director of Project Management Unit (PMU)

ATI Director General will be responsible for overall administration and implementation of the Project.

(b) Members of PMU

Sufficient number of staff of ATI, other departments of MOC and College of Urban Civil Works will be assigned as members of PMU.

(3) College of Urban Civil Works (CUCW)

Sufficient number of staff of CUCW will be assigned as members of PMU and as trainers of the training courses.

(4) JICA Experts

The JICA experts will give necessary technical guidance, advice and recommendations to involved departments, districts and MOC on any matters pertaining to the implementation of the Project.

(5) Joint Coordinating Committee

Joint Coordinating Committee (hereinafter referred to as "JCC") will be established in order to facilitate inter-organizational coordination. JCC will be held at least once a year and whenever deemed necessary. JCC will approve the annual work plan, review overall progress, conduct evaluation of the Project, and exchange opinions on major issues that arise during the implementation of the Project. Tentative members of JCC at the Detailed Planning Phase is shown in the Annex 4. Chairman and members of JCC for the Implementation Phase will be considered during the Detailed Planning Phase.

(6) Working Groups

Cross-stakeholder Working Groups will be established for identified sectors/issues in order to facilitate the Project's implementation

7. Project Site(s) and Beneficiaries
Project Site: Hanoi City
Beneficiaries: Staff of officials and engineers who are working in the sewerage sector in Vietnam

8. Duration
The Project duration is 3 years (tentatively starting from January 2016 to 2018 subject to approval of the Project by the Vietnamese Government by December 2015).
Detailed Planning phase: approximately (12) months from the arrival of the first expert.
Implementing phase: approximately (2) years (to be finalized based on the results of the Detailed Planning)

9. Reports
GOV and JICA Experts will jointly prepare the following reports in English.
(1) Monitoring Sheet on Semiannual basis until the project completion.
(2) Project Completion Report at the time of project completion.

11. Environmental and Social Considerations
GOV will abide by 'JICA Guidelines for Environmental and Social Considerations' in order to ensure that appropriate considerations will be made for the environmental and social impacts of the Project.

III. UNDERTAKINGS OF GOV

1.GOV and MOC will take necessary measures to:

(1) ensure that the technologies and knowledge acquired by the Vietnam nationals as a result of Japanese technical cooperation contributes to the economic and social development of Vietnam, and that the knowledge and experience acquired by the personnel of Vietnam from technical training as well as the equipment provided by JICA will be utilized effectively in the implementation of the Project; and

(2) grant privileges, exemptions and benefits to the JICA experts referred to in II-5 above and their families, which are no less favorable than those granted to experts and members of the missions and their families of third countries or international organizations performing similar missions in Vietnam.

IV. MONITORING AND EVALUATION

JICA and MOC will jointly and regularly monitor the progress of the Project through the Monitoring Sheets based on the Project Design Matrix (PDM) and Plan of Operation (PO). The Monitoring Sheets will be reviewed every six (6) months.
Also, Project Completion Report will be drawn up one (1) month before the termination of the Project.

JICA will conduct the following evaluations and surveys to verify sustainability and impact of the Project and draw lessons. MOC are required to provide necessary support for them.

1. Ex-post evaluation three (3) years after the project completion, in principle
2. Follow-up surveys on necessity basis

V. PROMOTION OF PUBLIC SUPPORT

For the purpose of promoting support for the Project, MOC will take appropriate measures to make the Project widely known to the people of Vietnam.

VI. MISCONDUCT

If JICA receives information related to suspected corrupt or fraudulent practices in the implementation of the Project, MOC and relevant organizations will provide JICA with such information as JICA may reasonably request, including information related to any concerned official of the government and/or public organizations of the Vietnam.
MOC and relevant organizations will not, unfairly or unfavorably treat the person and/or company which provided the information related to suspected corrupt or fraudulent practices in the implementation of the Project.

VII. MUTUAL CONSULTATION

JICA and GOV will consult each other whenever any major issues arise in the course of Project implementation.

VIII. AMENDMENTS

The Record of Discussions may be amended by the minutes of meetings between JICA and MOC. However, PO may be amended in the Monitoring Sheets.
The minutes of meetings will be signed by authorized persons of each side who may be different from the signers of the record of discussions.

Annex 1 Logical Framework (Project Design Matrix : PDM)
Annex 2 Tentative Plan of Operation

Annex 3 List of Proposed Members of the Joint Coordinating Committee (Steering Committee)

Project Design Matrix

ANNEX 1

Version 0
Dated 7th October

Project Title: Project for Enhancing Management Capacity of Sewage Works

(*)tentative items

Implementing Agency: Ministry of Construction, Vietnam

Target Group: Ministry of Construction, College of Urban Civil Works, Vietnam Water Supply and Sewerage Association, Provincial People's Committees and Private Companies

Period of Project: (*)3years from Jan, 2016 to Dec, 2018

Project Site: Ha Noi Area

Narrative Summary	(*)Objectively Verifiable Indicators	(*)Means of Verification	Important Assumption	Achievement	Remarks
Overall Goal To enhance the planning, implementation and management capacity of the sewerage sector to meet the future needs in Vietnam.	The number of city implementing sewerage works, the number of STP, the length of laying sewerage pipes and spread rates of sewerage system are periodically reported.	Periodical reports			
Project Purpose Establishment planning documents for Sewerage Center is proposed and refined based on the result of the pilot projects.	Rules and duties of Sewerage Woks center are drafted with the provision of the function of training, licensing, project implementation support and research & development.	Draft rules and duties of Sewerage Works Center Monitoring and management records Hearing from staff members	The policies relating to sewerage sector management are not changed drastically even after the revision of the Sewerage Orientation.		
Outputs 1. Comprehensive needs of human resource development for sewerage sector is identified. 2. To propose structure of the organization, function, tasks and business plan for the Sewerage Center. 3. Implementing the Basic pilot training for sewerage sector. 4. Pilot activities for the Project Implementation Support function is implemented. 5. Implementing the pilot activities for consulting and research and development for the sewerage sector in Vietnam.	Comprehensive Human resource development plan for sewerage works is determined. Organization and Business plan for Sewerage Works are drafted. A basic training program is drafted. Project implementation support function of Sewerage Works is drafted. Research and Development function of Sewerage Works is drafted.	Human resource development plan of SWC Organization and Business plan for Sewerage Works Basic training program Draft TOR for Project implementation support function of Sewerage Works Draft TOR for Research and Development function of Sewerage Works	The institutional setups for the Project implementation are not changed drastically.		

(*) Activities	(*) Inputs		Pre-Conditions
	The Japanese Side	The Vietnamese Side	
1-1 Review the relevant sewerage sector reports from the past to the present and study implementing organization and develop overall strategy for sewerage field works development. Organize survey and identify needs on training. 1-2 Study the issues and implementation setup on the stages from initial planning to O&M and identify the needs for human resource development, project implementation support and Research and Development on Sewerage Works by visiting local governments which are currently implementing sewerage projects (such as yen loan projects). 1-3 To forecast and identify the needs for human resource development, project implementation support and Research and Development and study the current situation of human resources of sewerage works by visiting local governments which have prospective sewerage projects. 2-1 Based on Activity 1, support the establishment of the Sewerage Center Establishment Preparation Unit (or PMU) (consisting of MOC, related College/University, VWSA) by drafting necessary organizational documents, etc. 2-2 Based on Activity 1, draft the functions, structure of the organization, and business plan of Sewerage Center by referring to the Japan Sewage Works Agency and Japan Sewage Works Association.	1. Experts Consultants - Basic survey - Organization / Business plan Long term Expert - Chief advisor - Project coordinator / training and organization planning Short term Expert (trainer) - Planning - O&M of sewerage facilities - Asset management - Financial management 2. Training Training in Japan - Japan Sewage Works agency - Japan Sewage Works Association 3. Machinery and Equipment - Procurement of training facilities and equipment as defined in consideration of	1. Counterpart staff - Sufficient number of Counterpart staff - Management staff for the organization / business model - Management staff for the training curriculum / trainer 2. Facilities (MOC, CUNG) - Two project offices with necessary furniture, airconditioners, internet facility, etc. 3. Counter budget - Salaries and allowances for the Vietnamese counterpart staffs - Costs for O&M of equipment provided by the Japanese side 4. On site training for STP O&M - adjustment and agreement of cooperation about on site training of STP	The inputs from the Vietnamese side are secured.

2-3 Supporting the institutionalization of business plan and finalization of the Center-establishment dossier to be submitted to the competent authority based on activities 2-1, 2-2. 3-1 Setting up and Designing the effective training Curriculum for human resource development by analyzing the results from activity 1 on the management capacity of sewerage works. 3-2 Preparing the training materials in English and Vietnamese as trial basis. 3-3 Identifying training programs based on targeted participants. Conduct the basic training courses for planning, operation and management, etc.. 3-4 Reflecting the evaluation results of activity3-3 to modify the training program. 3-5 Preparing the plan for training facilities and equipment. 4-1 Preparing the project implementation support plan (providing PMU function to local governments). 4-2 Selecting the pilot activity for the project implementation support. 4-3 Implementing the pilot activity on project implementation support. 5-1 Preparing the mid- and long-term plan for Research and Development based on needs, current issues and implementation setup (such as the development of standards, specification, technologies, guidelines, etc) 5-2 Support the setup of Research and Development team. 5-3 Select and Implement the pilot activity for the Research and Development function. * Activities 1, 2-1, 2-2, 3-1, 3-2, 3-3, 4-1, 4-2, and 5-1 will be conducted as the Detailed Planning Phase.	activity 3-5 4. Local Cost - Expenses necessary for personnel of secretary and translator - Expenses necessary for contract of local consultant (basic survey) - Expenses necessary for accommodation of JICA experts' activities - Expenses necessary for hiring local staff - Expenses necessary for purchasing equipment served for pilot activities of the Center.		<Issues and countermeasures>

ANNEX 2

Tentative Plan of Operation

Version 0
Dated 7th,Oct.,2015

Project Title: Project for Enhancing Management Capacity of Sewage Works

Inputs	Year	1st Year				2nd Year				3rd Year				Remarks	Monitoring: Issue	Monitoring: Solution
		I	II	III	IV	I	II	III	IV	I	II	III	IV			
Expert																
Consultants - Basic survey - Organization / Business plan	Plan	■	■	■	■											
	Actual															
Chief advisor	Plan					■	■	■	■	■	■	■	■			
	Actual															
Project coordinator / training and organization planning	Plan					■	■	■	■	■	■	■	■			
	Actual															
Short term Expert (trainer) - Planning - O&M of sewerage facilities- Asset management - Financial management	Plan					■	■	■	■	■	■	■	■			
	Actual															
Equipment																
Training facilities and equipment in consideration of activity 3-5	Plan								■		■					
	Actual															
	Plan															
	Actual															
Training in Japan																
	Plan					■				■						
	Actual															
In-country/Third country Training																
	Plan					■			■				■			
	Actual															

Activities / Sub-Activities	Year	1st Year				2nd Year				3rd Year				Responsible Organization: Japan	Responsible Organization: GOV	Achievements	Issue & Countermeasures
		I	II	III	IV	I	II	III	IV	I	II	III	IV				
Output 1: Comprehensive needs of Human resource development for sewerage works is identified.																	
1-1 Review the relevant sewerage sector reports from the past to the present and study implementing organization and develop overall strategy for sewerage field works development. Organize survey and identify needs on training.	Plan	■	■														
	Actual																
1-2 Study the issues and implementation setup on the stages from initial planning to O&M and identify the needs for human resource development, project implementation support and Research and Development on Sewerage Works by visiting local governments which are currently implementing sewerage projects (such as yen loan projects.	Plan		■	■													
	Actual																
1-3 To forecast and identify the needs for human resource development, project implementation support and Research and Development and study the current situation of human resources of sewerage works by visiting local governments which have prospective sewerage projects.	Plan		■	■													
	Actual																
Output 2:Organization structure and Business plan for Sewerage Works Center are drafted.																	
2-1 Based on Activity 1, support the establishment of the Sewerage Center Establishment Preparation Unit (or PMU) (consisting of MOC, related College/University, VWSA) by drafting necessary organizational documents, etc.	Plan			■													
	Actual																
2-2 Based on Activity 1, draft the functions, structure of the organization, and business plan of Sewerage Center by refering to the Japan Sewage Works Agency and Japan Sewage Works Association.	Plan			■	■												
	Actual																
2-3 Supporting the institutionalization of business plan and finalization of the Center-establishment dossier to be submitted to the competent authority based on activities 2-1,2-2.	Plan					■	■	■	■								
	Actual																
Output 3: Basic pilot training for sewerage works is implemented.																	
3-1 Setting up and Designing the effective training Curriculum for human resource development by analyzing the results from activity 1 on the management capacity of sewerage works.	Plan			■	■												
	Actual																
3-2 Preparing the training materials in English and Vietnamese as trial basis.	Plan			■		■											
	Actual																
3-3 Identifying training programs based on targeted participants, Conduct the basic training courses for planning, operation and management, etc..	Plan				■		■	■			■	■					
	Actual																
3-4 Reflecting the evaluation results of activity3-3 to modify the training program.	Plan								■	■							
	Actual																
3-5 Preparing the plan for training facilities and equipment.	Plan						■	■									
	Actual																
Output 4: The project implementation support function of Project implementation for Sewerage Works is identified.																	
4-1 Preparing the project implementation support plan (providing PMU function to local governments).	Plan			■													
	Actual																
4-2 Selecting the pilot activity for the project implementation support.	Plan				■												
	Actual																
4-3 Implementing the pilot activity on project implementation support.	Plan					■	■	■	■	■	■	■	■				
	Actual																
Output 5: Research and Development function of Sewerage Works Center is identified.																	
5-1 Preparing the mid- and long-term plan for Research and Development based on needs, current issues and implementation setup (such as the development of standards, specification, technologies, guidelines, etc)	Plan				■												
	Actual																
5-2 Support the setup of Research and Development team.	Plan				■												
	Actual																
5-3 Select and implement the pilot activity for the Research and Development function.	Plan					■	■	■	■	■	■	■	■				
	Actual																
Duration / Phasing	Plan																
	Actual																

Monitoring Plan	Year	1st Year				2nd Year				3rd Year				Remarks	Issue	Solution
		I	II	III	IV	I	II	III	IV	I	II	III	IV			
Monitoring																
Joint Coordinating Committee	Plan	■	■	■	■	■				■			■			
	Actual															
Set-up the Detailed Plan of Operation	Plan					■										
	Actual															
Submission of Monitoring Sheet	Plan		■		■		■		■		■		■			
	Actual															
Monitoring Mission from Japan	Plan			■					■				■			
	Actual															
Joint Monitoring	Plan						■				■					
	Actual															
Post Monitoring	Plan															
	Actual															
Reports/Documents																
Detailed Planning Survey Report	Plan			■												
	Actual															
Project Completion Report	Plan												■			
	Actual															
Public Relations																
	Plan															
	Actual															
	Plan															
	Actual															

Annex 3: List of Proposed Members of the Joint Coordinating Committee (Steering Committee) for the Detailed Planning Phase

(1) Co- Chairman: Director General of MOC (ATI) and JICA HQ/JICA Vietnam Office

(2) Members

JICA Expert at MOC
Other staff of ATI
Vietnam Water Supply and Sewerage Association
College of Urban Civil Works
Representatives from Local Government

Appendix 2

MAIN POINTS DISCUSSED

Both sides agreed on the necessity of the establishment of the Sewerage Center which is in line with national strategies such as the "Orientation for Development of Water Drainage in Vietnamese Urban Centers and Industrial Parks up to 2025 and Vision Towards 2050" and its forthcoming revision.

MOC confirmed its intention to establish the Sewerage Center based on the assessment and planning documents that will be prepared during the Detailed Planning Phase of this Project and based on the Vietnamese Government including MOC's regulation relevant to the new agency to be formed. The required administrative procedure for the establishment of the Center will be the issuance of MOC Decision or relevant legislative arrangements.

Both sides agreed that during the Detailed Planning Phase, concrete cooperation mechanism with training programs provided by VWSA and other institutions assisted by various donors will be elaborated.

Both sides agreed that the PMU will be established based on the activities during the Detailed Planning Phase. Both sides agreed that until the PMU is established, ATI will assign appropriate counterpart personnel to work with the Project Team. Both sides also agreed that the chairman and members of JCC for the Implementation Phase will be considered during the Detailed Planning Phase.

Both sides agreed that the involvement of Provincial People's Committees and Sewerage Utilities is critical to the success of the Project. Therefore, MOC will make their best effort to involve them by frequently consulting with the decision makers, inviting them to consultation workshops, etc.

Both sides agreed that the official name of the Center (tentatively the "Sewerage Center") will be decided during the Detailed Planning Phase taking into consideration the functions of the Center.

Both sides agreed that thorough discussion on organization structure, objectives and key functions of the Center will be conducted for the development of detail plan for establishment of the Center.

Both sides agreed that CUCW will assign prospective trainers and provide suitable lecture rooms. Necessary equipment for the lectures will be considered

in Activity 3-5 based on the actual condition of CUCW.

Both sides agreed that MOC and CUCW will provide suitable office space with necessary furniture. MOC and CUCW will secure the necessary counterpart fund.

JICA explained that after the establishment of Sewerage Center with legal grounds, JICA will consider providing another technical cooperation for its strengthening.

END

Appendix 3

TENTATIVE OUTLINE OF THE SEWERAGE CENTER

I. NAME

Sewerage Center

II. LOCATION

Headquarter: Hanoi City near MOC

Training Facility: Inside College of Urban Civil Works

III. ORGANIZATION STRUCTURE

(A) Management

1 Director

1 Deputy Director

(B) Departments

1. Training Facility: 1 Head and X staff
2. Department of Project Implementation Support (1 Head and X staff)
3. Department of Research and Development (1 Head and X staff)

IV. TRAINING AND LICENSING FUNCTION

(A) Trainees

(B) Programs

(C) Duration

(D) Implementation Structure

IV. PROJECT IMPLEMENTATION SUPPORT FUNCTION

IV. RESEARCH AND DEVELOPMENT FUNCTION

MINUTES OF DISCUSSION
BETWEEN
JAPAN INTERNATIONAL COOPERATION AGENCY
AND
AUTHORITIES CONCERNED OF THE GOVERNMENT OF THE SOCIALIST REPUBLIC OF VIETNAM
ON
THE PROJECT FOR ENHANCING MANAGEMENT CAPACITY OF SEWAGE WORKS

Japan International Cooperation Agency (hereinafter referred to as "JICA") and the authorities concerned of Vietnamese authority had series of discussion regarding the Project for Enhancing Management Capacity of Sewage Works.

As a result of discussion, both sides agreed on the matters referred to in the document attached hereto.

Hanoi, 28th February 2017

Mr. Shigiya Satoshi
Deputy Director General
Environment Management Group
Global Environment Department
Japan International Cooperation Agency

Dr. Nguyen Hong Tien
Director General of Administration of Technical Infrastructure
Ministry of Construction
The Government of the Socialist Republic of Vietnam

DISCUSSIONS

1. More proactive participation from Vietnamese side

JICA emphasized that issues on Financial Planning of VSC is key concerns of the Project and proposed to establish Joint Working Group (hereinafter referred to as "JWG") for each function (plus "Financial Planning") of the VSC from April. JICA side requested that Vietnamese side assign the C/P staff capable enough to lead the JWG activities. JICA expects especially full-time staff (staff A) will be continuously engaged to the Project activities throughout the project period as well as the operation of VSC after the Project.

JICA provides one (1) Chief Advisor, one (1) Sub-Chief Advisor, and one (1) Long-Term Expert. MOC understood and agreed to appoint one (1) Full-time Counterpart and two (2) Part-time Counterparts. MOC attributes one (1) Chief-Counterpart and two (2) Sub-Chief Counterparts. The JWG will lead and facilitate each activity of the Project. The JWG will also review the progress, revise the VSC business plan when necessary, and report to the Project Director when any issue arises during the Implementation Phase. Attributed contents of work for each personnel are as follows.

Joint Working Group (JWG)	Japan	Vietnam	Major Task, Deadline
Overall (including financial planning)	Chief Advisor	**Chief C/P** : Staff A (Full-time staff of ATI)	JWG is set up by April 2017
Training	Long-term Expert (Training)	**Chief C/P** : Staff A (Full-time Staff of ATI)	Preparation for conducting Pilot Training is completed by September 2017
Project Implementation Support	Sub-Chief Advisor	**Sub-Chief C/P**: Staff B (Part-time Staff of ATI)	Preparation for First Pilot Implementation Support Project is completed by July 2017
R&D	Chief Advisor or Sub-Chief Advisor	**Sub-Chief C/P** : Staff C (Part-time Staff of ATI)	Preparation for First R&D Projects is completed by September 2017

2. Establishment of the VSC

MOC explained that MOC is currently under the process of organizational restructure according to the new regulation of the Government. MOC will consider the decision on the establishment of the VSC at the appropriate time. JICA and MOC confirmed the process is undertaken to establish the VSC at the early stage of the Implementation Phase of the Project within 2017.

JICA requested MOC to complete the organizational structure of the VSC which includes VSC Director and Vice Director. JICA emphasized that MOC should be responsible to allocate sufficient number of staff by the time of the establishment.

3. Financial sustainability of the VSC

MOC explained that the VSC should be financially sustainable from its establishment. In this regard, JICA explained that based on the experience of Japan Sewage Works Agency, long-term financial and institutional support from the government is essential, at least during the initial stage, to enhance and achieve financial sustainability. JICA therefore requested that some measures have to be taken to enhance financial sustainability of the VSC, for which concrete ideas have to be pursued from now.

JICA and MOC agreed to establish, by the end of this project, mechanism which gives private sectors incentives to participate VSC's training programs to enhance the capacity in sewerage sector.

4. Requests from MOC

MOC made the following requests for JICA support during the Implementation phase;

i. To support budget for local training course (transportation, meals, and accommodation, etc.) for trainees from implemented or will be implemented in Japan ODA projects.
ii. To continue support for enhancing capacity training in Japan.
iii. To provide necessary equipment serving for training purpose.
iv. To support budget for carrying out R&D which is proposed by VSC

JICA answered that costs for item ii above can be covered by the Project. With respect to the item iii and iv, JICA will support the activities which are proposed in the Business Plan.

JICA expresses its concern that provision of costs for item i will undermine the financial sustainability of the VSC. However, considering the current condition of the Vietnamese side, JICA will consider financial support for this item along with the development of the incentive mechanism to encourage private sector's participation as referred to in the section 3 above.

5. Schedule

JICA and MOC agreed to the following milestone schedule.

Item	Period
Secure office space for the Project	Beginning of April 2017 throughout the project period (until May 2019)
Assignment of MOC's C/Ps	Beginning of April 2017
Dispatch of JICA Long-term Experts	End of April and May 2017
Review and elaborate the Business Plan	End of June 2017
4th JCC Meeting	July 2017
3rd Pilot Training	September 2017
Establishment of the VSC	By the end of December 2017
Secure office space for the VSC	By the end of December 2017

ANNEXES

Annex-1 Copy of JICA's letter dated 14th Feb.2017

END

Appendix 4-2

Annex - 1

Japan International Cooperation Agency

Date: 14th Feb. 2017

H. E. Phan Thi My Linh
Vice Minister,
Ministry of Construction (MOC)

Re: Request for MOC's necessary arrangements for Project on the establishment of Vietnam Sewerage Center (VSC)

On behalf of Japan International Cooperation Agency (JICA), I would like to express my deepest appreciation for your strong support and understanding for the Project for Enhancing Management Capacity of Sewage Works in your ministry.

With regards to the Project on the establishment of the Vietnam Sewerage Center (VSC), it comes now at the final stage of the Detailed Planning Phase and we are aiming to start the Implementation of the Project from April 2017 for another two years, as agreed in the R/D dated October 16th, 2015.

Since several critical issues to ensure the sustainability of VSC have been found through the survey during the Detailed Planning Phase, and to implement effectively the Phase 2 (i.e. Implementation Phase) of the Project, JICA would like to propose the MOC Vice Minister to take a kind interest in the following points.

First of all, I would like to ask MOC more proactive and subjective participation and ownership to the project in order to maximize performance of new Japanese long-term experts, who are expected to be assigned in the beginning of April,

Besides, I would like to ask your arrangement on the following three points below, which should also be resolved at the early stage of the Implementation Phase of the Project.

1. The approval of the Decision on Establishment of the VSC.
2. Taking measures below to generate revenue for VSC's financially sustainable operation, for example;
   -Allocation of MOC budget to VSC to implement R&D
   -Develop a mechanism to generate revenue from private sector (e.g., making it a condition for private companies to receive VSC training courses to participate sewage works)
3. Complete the organizational structure of the VSC including appointment of VSC Director and key personnel positions.

Your kind deliberation within MOC is highly appreciated and I would like to ask you to kindly inform us of the results in writing by 24th Feb. 2017.

Furthermore, JICA will dispatch the mission from JICA HQs in the end of Feb., 2017, to

further discuss these issues, and agree on the scope of Implementation Phase of the Project.

I look forward to hearing from you at your earliest convenience.

Thank you very much for your kind cooperation.

Sincerely yours,

Satoshi Shigiya
Deputy Director General
Environmental Management Group,
Global Environmental Department
Japan International Cooperation Agency

CC: Mr.Kenichi Yamamoro
Deputy Chief Representative,
JICA Vietnam Office

Appendix 5　Work Flow Chart

Work flow chart

Activities	Year Month	2016												2017			
		FY 2015			FY 2016												
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
Output 1 : Comprehensive needs of human resource development for sewerage sector is identified.																	
Activity 1-1	Review the relevent sewerage sector reports from the past to the present and study implementing organization and develop overall strategy for sewerage field works development, organize survey and identify needs on training.		Needs Survey														
Activity 1-2	Study the issues and implementation setup on the stages from initial planning to O&M and identify the needs for human resource development, project implementation support and Research and Development on Sewerage Works by visiting local governments which are currently implementing sewerage projects (such as yen loan projects).		Needs Survey														
Activity 1-3	To forecast and identify the needs for human resource development, project implementation support and Research and Development and study the current situation of human resources of sewerage works by visiting local governments which have prospective sewerage projects.		Needs Survey														
Output 2 : Structure of the organization, function, tasks and business plan for the Sewerage Center are drafted.																	
Activity 2-1	Based on Activity 1, support the establishment of the Sewerage Center Establishment Preparation Unit (in charge of VSC-MOC) by drafting necessary organizational documents, etc.		PMU Start up												Decision making		
Activity 2-2	Based on Activity 1, draft the functions, structure of the organization, and business plan of Sewerage Center by referring to the Japan Sewage Works Agency and Japan Sewage Works Association.						Preparation of Business Plan										
Activity 2-3	Supporting the institutionalization of business plan and finalization of the Center-establishment dossier to be submitted to the competent authority based on activities 2-1, 2-2.																
Output 3 : The Basic pilot training for sewerage sector implemented.																	
Activity 3-1	Setting up and Designing the effective training Curriculum for human resource development by analyzing the results from activity 1 on the management capacity of sewerage works.		Needs Survey												Decision making		
Activity 3-2	Preparing the training materials in English and Vietnamese as trial basis.						Preparation of Training Material										
Activity 3-3	Identifying training programs based on targeted participants, Conduct the basic training courses for planning, operation and management, etc.							Pilot Training				Pilot Training					
Activity 3-4	Reflecting the eveluation results of activity 3-3 to modify the training program.																
Activity 3-5	Preparing the plan for training facilities and equipment.						Preparation of Training Facility and Equipment										
Output 4 : Pilot activities for the Project Implementation Support function are implemented.																	
Activity 4-1	Elaborate mid- and long-term planning for implementation support function.		Needs Survey				Preparation of Mid-/Long-term Plan								Decision making		
Activity 4-2	Selecting the pilot activity for the project implementation support.						Selection of Pilot Projects					Draft					
Activity 4-3	Implementing the pilot activity on project implementation support.																
Output 5 : The pilot activities for consulting and research and development for the sewerage sector in Vietnam are implemented.																	
Activity 5-1	Preparing the mid-and long-term plan for Research and Development function.		Needs Survey				Preparation of Mid-/Long-Term Plan								Decision making		
Activity 5-2	Support the setup of Research and development team.																
Activity 5-3	Organize and Implement the pilot activity for the Research and Development function.																
* Activity 1, 2-1, 2-2, 3-1, 3-2, 3-3, 4-1, 4-2, and 5-1 are conducted as the Detailed Planning Phase.																	
Workshops / Trainings	Joint Coordination Committee	Plan	●				●								●		
		Actual		●							●				●		
	Training in Japan	Plan						◆				◆					
		Actual							◆			◆					
	Workshops / Trainings in Vietnam	Plan									□						
		Actual					□										
Reports / Documents	Work Plan (Japanese)	Plan	△														
		Actual	△														
	Work Plan (English / Vietnamese)	Plan	△														
		Actual	△														
	Interim Report	Plan					△										
		Actual							△								
	Project Completion Report	Plan														△	
		Actual															△

Providing Work plan / Discussion / Finalization

Training in Japan

Remarks :
: in Vietnam
: Actual
: in Japan

Appendix 6 Expert Dispatch Schedule

Expert Dispatch Schedule

The Project for Enhancing Management Capacity of Sewage Works in Vietnam （Detail Planning Phase）

1. Vietnam

Name	Assignment	Organisation	Grade	2016 Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2017 Jan	Feb	Mar	Total Days	Man/Month Total
INOUE Yakuro	Chief Advisor/Sewerage Business Plan 1/Project Coordination (Project Planning, Legal System, Qualification System, Organization, Finance)	Japan Techno Co., Ltd.	2	21 27 (7)	4 16 (13)	10 17 (8)	11 21 (11)	14 21 (8)	25 26 (2)	10 30 (21)								70	2.33
KANAI Shigeo (note: Chief Advisor from 4 August onwards)	Chief Advisor/Sewerage Business Plan 1/Project Coordination (Project Planning, Legal System, Qualification System, Organization, Finance)	Japan Techno Co., Ltd.	2				2 11		10 23	6 16 (11)	21 29 (9)	19 29 (11)	9 19 (11)		14 21 (8)	16 4 (17)		67	2.23
ISHIZUKA Okuto	Deputy Chief Advisor Sewerage Business Plan 2 (Needs Survey, Business Plan)	Nihon Suiko Sekkei Co.,Ltd.	3	25 16 (21)		30 18 28 (11)	12 30 (19)	20 25 (6)										57	1.90
KAWAI Takehiko	Training Plan on Sewerage 1 (Programme, Implementation Structure, Trainers Training)	Sewerage Business Management Centre	3		6 16 (11)	10 23 (14)	15 21 (7)		10 20 (11)	3 13 (11)	11 17 (7)	9 27 29 (13) (3)	7 19 (13)		10 18 (9)	23 4 (10)		109	3.63
KAWAGUCHI Yukio	Training Plan on Sewerage 2 (Facility Design, Water Quality, Equipment for Facility and Educational Material on Water Treatment, Survey)	Sewerage Business Management Centre	3	21 27 (7)		10 23 (14)	17 21 (5)	19 29 (11)		7 13 (7)		9 21 (13)	8 19 (12)					69	2.30
FUJIMOTO Hiroyuki	System of Japan Sewage Works Agency / Implementation Structure for Sewerage	Sewerage Business Management Centre (from Japan Sewage Works Agency)	3				15 26 (12)	19 29 (11)	10 20 (11)	3 16 (14)	4 14 22 29 (11) (8)	11 21 (11)	24 29 (6)		10 18 (9)	23 4 (10)		103	3.43
OKANE Fumika / MORI Naoki / MIYAUCHI Ryotaro	Project Management, Public Relations, Trainings/Workshops	Japan Techno Co., Ltd.	4	21 16 (25)			16 30 (15)		10 15 (6)	31 16 (17)	4 27 (24)	12 29 (18)	12 29 (18)	19 23 (5)	10 20 (11)	16 4 (17)		156	5.20
HAYASHI Kiyohiko	Trainer of Sewerage Training, TOT (Planning of Sewerage, Sewer Design, Quantity Survey, Construction Control)	Sewerage Business Management Centre (from Nihon Suido Consultants Co.,Ltd.)	4										13 19 (7)					7	0.23
SUZUKI Kazumi	Trainer of Sewerage Training / TOT (Machinery and Equipment, Sludge Treatment)	Sewerage Business Management Centre (from Metawater Co., Ltd.)	4							7 13 (7)		9 21 (13)	8 19 (12)					32	1.07
KANEKO Hitoshi	Trainer of Sewerage Training / TOT (Electric Equipment, Operation)	Sewerage Business Management Centre	4							7 13 (7)			11 19 (9)					16	0.53
KIM Hyeonyeoul	Trainer of Sewerage Training / TOT (Management, Procurement, Operation and Maintenance)	Wate Agency Inc.	4	21 16 (25)		9 15 26 (7)				4 13 (10)	21 29 (9)	12 2 (22)	8 19 (12)		10 20 (11)	16 2 (15)		111	3.70
IIDA Kazuki	Trainer of Sewerage Training / TOT (Management of Sewer and Drainage)	Sewerage Business Management Centre (from Nippon Koei Co., Ltd.)	4							7 13 (7)		11 21 (11)	10 19 (10)					28	0.93
KOHAMA Kazuyoshi	Trainer of Sewerage Training / TOT (Legal and Institutional System of Local Government Operation, Public Relations)	Yokohama Water Co.,Ltd.	4	21 27 (7)		10 22 (13)	12 21 (10)			7 13 (7)		9 21 (13)	11 19 (9)					59	1.97
INOUE Yakuro	Needs Survey / Trainer of Sewerage Training / TOT (Administrative and Financial Systems)	Japan Techno Co., Ltd.	4							6 13 (8)			9 19 (11)					19	0.63
GONDAIRA Tomohiro	Implementation Structure for Sewerage 2	Japan Techno Co., Ltd.	6								4 16 25 20 (26)		7 22 (16)		11 20 (10)	16 4		52	1.73
																	Vietnam total	955	31.81

Vietnam　Company's Own expenses　Continue to stay in Vietnam for another assignment

2. Japan

Name	Assignment	Organisation	Grade	2016 Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2017 Jan	Feb	Mar	Total Days	Man/Month Total
INOUE Yakuro	Chief Advisor/Sewerage Business Plan 1/Project Coordination (Project Planning, Legal System, Qualification System, Organization, Finance)	Japan Techno Co., Ltd.	2	15 19 (5)				8 10 (3)										8	0.40
KANAI Shigeo (note: Chief Advisor from 4 August onwards)	Chief Advisor/Sewerage Business Plan 1/Project Coordination (Project Planning, Legal System, Qualification System, Organization, Finance)	Japan Techno Co., Ltd.	2									12 14 (3)		12 15 (4)	5 6 (2)	6 10 (5)	9, 10, 13-15 (5)	19	0.95
ISHIZUKA Okuto	Deputy Chief Advisor Sewerage Business Plan 2 (Needs Survey, Business Plan)	Nihon Suiko Sekkei Co.,Ltd.	3	15 19 (5)				8 10 (3)										8	0.40
KAWAI Takehiko	Training Plan on Sewerage 1 (Programme, Implementation Structure, Trainers Training)	Sewerage Business Management Centre	3	15 19 (5)			26 (4)	3 (3)			20,23,27 (3)	4,6,1 25 26 (3) (2)		19 22 (4)	4 6 20 (3) (1)	8,17,20 (3)	9 16 (6)	37	1.85
KAWAGUCHI Yukio	Training Plan on Sewerage 2 (Facility Design, Water Quality, Equipment for Facility and Educational Material on Water Treatment, Survey)	Sewerage Business Management Centre	3	15 19 (5)				1 3 (3)				3 7 (5)		5 7 (3)	6 13 (5)			21	1.05
FUJIMOTO Hiroyuki	System of Japan Sewage Works Agency / Implementation Structure for Sewerage	Sewerage Business Management Centre (from Japan Sewage Works Agency)	3	12 17 (2)			27 30 (2)	2 3 (2)			1 15,20 (1) (2)	5,7 31 (2) (1)		12 20 (7)	4 6 23 (3) (1)	7 10 (4)	9, 10, 14 (3)	30	1.50
OKANE Fumika / MORI Naoki / MIYAUCHI Ryotaro	Project Management, Public Relations, Trainings/Workshops	Japan Techno Co., Ltd.	4	15 19 (5)			27 (3)	3 (3)				3 7 (5)		12 16 (5)	5 6 (2)		8 10 (3)	26	1.30
HAYASHI Kiyohiko	Trainer of Sewerage Training, TOT (Planning of Sewerage, Sewer Design, Quantity Survey, Construction Control)	Sewerage Business Management Centre (from Nihon Suido Consultants Co.,Ltd.)	4									14 31 (12)	1 11 (8)	21 22 (2)				22	1.10
SUZUKI Kazumi	Trainer of Sewerage Training / TOT (Machinery and Equipment, Sludge Treatment)	Sewerage Business Management Centre (from Metawater Co., Ltd.)	4									3 7 (5)	24 28 (5)	5 9 (5)				15	0.75
KANEKO Hitoshi	Trainer of Sewerage Training / TOT (Electric Equipment, Operation)	Sewerage Business Management Centre	4									12 25 (10)		5 9 (5)				15	0.75
KIM Hyeonyeoul	Trainer of Sewerage Training / TOT (Management, Procurement, Operation and Maintenance)	Wate Agency Inc.	4	8-10, 12. 15 (5)					1 (1)			3 7 (5)		5 7 (3)		8 10 (3)		17	0.85
IIDA Kazuki	Trainer of Sewerage Training / TOT (Management of Sewer and Drainage)	Sewerage Business Management Centre (from Nippon Koei Co., Ltd.)	4									3 7 24 28 (5) (5)		5 12 (6)				16	0.80
KOHAMA Kazuyoshi	Trainer of Sewerage Training / TOT (Legal and Institutional System of Local Government Operation, Public Relations)	Yokohama Water Co.,Ltd.	4	15 19 (5)					1 (1)			3 7 24 28 (5) (5)		5 9 (5)				21	1.05
ONO Shizuka	Training in Japan (Coordination, Preparation of Training Materials)	Sewerage Business Management Centre	4			15 28 (10)	12 31 (14)	6 27 (16)										40	2.00
																	Japan total	295	14.75
																	Total	46.56	

Submission of Reports	△ Work plan	△ Progress Report	△ Project Completion Report

Appendix 7 Minutes of JCC Meetings

MINUTES OF MEETINGS
BETWEEN
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
AND
CONCERNED
ON
FIRST JOINT COORDINATION COMMITTEE MEETING
FOR
JAPANESE TECHNICAL COOPERATION PROJECT

THE PROJECT FOR ENHANCING MANAGEMENT CAPACITY OF SEWERAGE WORKS
IN
THE SOCIALIST REPUBLIC OF VIETNAM

Hanoi, 14th March 2016

井上矢一郎

Mr. Yakuro Inoue
Chief Advisor
JICA Study Team

Dr. Nguyen Hong Tien
Director General
Administration of Technical Infrastructure,
Ministry of Construction

MINUTES OF THE MEETING

Subject: 1st JCC meeting in order to finalize plan for VSC establishment and necessary steps for implementation phase

I. Time: 8:30 – 10:00, 14th March 2016

II. Location: Meeting room No.252 - MOC

III. Participants:

MOC:

Participants:

Vietnamese side:

MOC :

1. Dr. Nguyen Hong TIEN, Director General of ATI, MOC
2. Dr. Mai Lien HUONG – Deputy, Deputy Director of ATI, MOC
3. Mr. Nguyen Ngoc DUONG Deputy head of Water supply and sewerage Division
4. Mr. Do Minh QUAN – Officials of Water supply and sewerage Division
5. Mr. Do Xuan YEN - Officials of Water supply and sewerage Division
6. Mr. Pham Ngoc CHINH - Officials of Water supply and sewerage Division
7. Ms. Pham Thi HUONG - Officials of Water supply and sewerage Division
8. Mr. Nguyen Van TIEN – Representative of Personnel Department
9. Ms. Bui Thu HANG – Officials of ATI – MOC
10. Mr. Pham Thanh HAI – Officials of ATI – MOC
11. Ms. Pham Thi Thanh HUYEN – Journalist – Construction Newspaper
12. Mr. Nguyen Anh KHOA – Representative of ICE
13. Mr . Tran Ba VIET – Deputy head of IBST
14. Mr. Tran Minh TUAN – Vice Director of Informatic Centre, MOC
15. Ms. Trinh Thi BICH – Vice office manager of Administration Dept., MOC
16. Mr. Nguyen Van Hai – Official of Administration Dept., MOC
17. Mr. Pham Trung KIEN - Officials of Finance and Planning Dept., MOC
18. Ms. Nguyen Minh ANH – Officials of ICD
19. Ms. Nguyen Thi Bich HUE – Deputy Head of ICD

VWSA:

1. Dr. Ung Quoc DZUNG – Vice Chairman of VWSA
2. CUWC : Mr. Bui Hong Hue – Rector of CUWC

Japanese side:

JICA Head Quarter:

1. Mr. IIJIMA Daisuke – Advisor of Global Environment Department
2. Mr. MORI Tamaki – Special Advisor of Global Environment Department

JICA Policy Advisor

1. Mr. WAKO Takatoshi – JICA Sewerage Policy Advisor in ATI-MOC

JICA Vietnam Office:

2. Mr. YAMAMOTO Kenichi – Deputy Chief Representative
3. Mr. KATSURAI Taro – Project Formulate Advisor

Ministry of Land, Infrastructure, Transport and Tourism

1. Mr. TAMOTO Norihide – Deputy Director of Sewerage Planning Division, Water and Disaster Management Bureau

JICA Study Team

1. Mr.INOUE Yakuro – Team Leader
2. Mr. KAWAI Takehiko – Team Member
3. Dr. KIM Hyeonyeul – Team Member
4. Mr. ISHIZUKA Okuto – Team Member
5. Mr. OKANE Fumika – Team Member
6. Ms. Do Thi Nga – Team Senior Assistant
7. Ms. Le Thi Lanh – Assistant

Dr. Tien:

- Who will manage the VSC? The VSC will be an independent structure for long-term. At the initial stage of its establishment, where will the VSC located?

- The activities in 2016 will be focused on pilot trainings (twice in Vietnam and Once in Japan). The implementations are expected to be between July and November. For the curriculum, Japanese side and Vietnamese side will discuss and elaborate and use it in pilot trainings.

- PUM will be established during March. Members will be composed of Planning and Finance Department, ICD, Personnel Department, CUWC, ATI, VWSA and other related structures, same as the JCC.

- In addition to the members participating in this 1st JCC meeting, counterparts of the Project will be composed of VWSA, GIZ, and related structures. The detailed discussion on this issue will be held during the period of the Project.

- The establishment of mechanism and policy in the sewerage work through research and development is also important.

- The organization of JCC does not need to be held for three times a year but should be reduced from second year of the Project.

Mr. Yamamoto:

- The location of VSC will be under the ATI-MOC until the establishment of the VSC. From the second year, the ATI and CUWC will be principal counterparts of the Project, however, decision regarding this Project will be made by the MOC. Japanese side requests rapid allocation of counterparts.

Dr. Tien:

- The Project's documents is already approved in the Vietnamese Government side, however, there is not detail on the budget from Japan thus Vietnamese side cannot prepare counter budget yet. The coordination of the both side is necessary.

Mr. Yamamoto:

- Salaries of counterparts will be paid by MOC and other expenditures will be covered by JICA. For the decision of budget after 2007, we expect discussion to be held this year. An official letter

on JICA's budget will be sent to MOC. For other issues, discussion and decisions will be made through process of the Project.

Dr. Tien:

- PMU will be settled on March. Counterparts will be allocated on April.

Mr. Hue:

- Pilot training should not solely focus on theory but also practical aspects thus CUWC expects provision of training materials from Japanese side. CUWC will provide facility, utility, lecturers, and accommodation.

Mr. Yamamoto:

- One of roles for central ministry is to obtain budget and power. MOC should appeal effective use of Vietnamese Government's budget through the VSC.
- From the second year, the VSC should implement training courses for private companies to earn resources for its management.

Dr. Tien:

- Both side could agree upon the issues suggested by the Project Team. Vietnamese side will cooperate with Japanese side to realize smooth implementation of the Project.

MINUTES OF MEETINGS
BETWEEN
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
AND
CONCERNED
ON
SECOND JOINT COORDINATION COMMITTEE MEETING
FOR
JAPANESE TECHNICAL COOPERATION PROJECT

THE PROJECT FOR ENHANCING MANAGEMENT CAPACITY OF SEWERAGE WORKS
IN
THE SOCIALIST REPUBLIC OF VIETNAM

Hanoi, 28 October 2016

JICA Study Team Leader Project Chief Advisor	Deputy Director General Administration of Technical Infrastructure, Ministry of Construction

MINUTES OF THE MEETING

Subject: 2nd JCC meeting in order to scrutinize activities from October to December 2016 and plan for 2017

I. Time: 10:00 – 12:00, 28th October 2016

II. Location: Meeting room No.252 - MOC

III. Participants:

MOC:

1. Ms. Phan Thi My Linh - Deputy Minister of Construction
2. Dr. Mai Thi Lien Huong - Deputy Head of ATI - MOC
3. Ms. Tran Thi Thao Huong - Head of Sewerage Division - ATI-MOC
4. Mr. Nguyen Van Tien - Head of Training Faculty - Personnel Department - MOC
5. Mr. Nguyen Ngoc Duong- Deputy Head of Sewerage Division - ATI - MOC
6. Mr. Do Manh Quan- Officer, Sewerage Division, ATI-MOC
7. Mr. Ngo Van Yen-Officer, Sewerage Division, ATI-MOC
8. Ms. Nguyen Thi Nga - Deputy Head of Personnel Department - MOC
9. Mr. Bui Hong Hue/ Rector of CUWC
10. Ms. Vu Thi Hoai An, CUWC,
11. Ms. Nguyen Thi Bich Hue, Deputy Head of International Cooperation Department - MOC
12. Mr. Nguyen Vu Bao Minh-Officer, ATI
13. Mr. Nguyen Ngoc Duc-Officer, ATI
14. Mr. Pham Ngoc Chinh, Officer, ATI
15. Ms. Le Thanh Thuy - Officer of Planning and Finance Department – MOC

JICA Head Quarter:

1. Mr. SHIBATA Kazunao – Director of Global Environment Department
2. Mr. MORI Tamaki – Special Advisor of JICA Global Environment Department
3. Mr. KITAGAWA Mitsuo – Advisor of Global Environment Department

JICA Vietnam Office:

1. Mr. ANZO Hiroshi – Senior Project Formulation Advisor
2. Mr. WAKO Takatoshi – JICA Expert in ATI-MOC
3. Ms. Nguyen Thi Dao – Assistant to JICA

Embassy of Japan:

1. Mr. FUKUSHIMA Yosuke – Second Secretary

JICA Study Team

1. Mr. KANAI Shigeo – Team Leader
2. Mr. KAWAI Takehiko – Team Member
3. Mr. FUJIMOTO Hiroyuki – Team Member
4. Dr. KIM Hyeonyeul – Team Member
5. Mr. MIYAUCHI Ryotaro – Team Member
6. Mr. GONDARA Tomohiro – Team Member
7. Ms. Do Thi Nga – Team Senior Assistant
8. Ms. Le Thi Lanh – Assistant
9. Ms. Nguyen Bich Hong – Assistant

Introduction: The 2nd Joint Coordination Committee (hereinafter referred to as "JCC") meeting of the Japanese Technical Cooperation Project, Project for Enhancing Management Capacity of Sewage Works in the Socialist Republic of Vietnam (hereinafter referred to as "the Project"), was held on 28th October, at Meeting Room in Ministry of Construction with attendance of JCC members and other stakeholders. Following the explanation of JICA Study Team on the business plan of the Vietnam Sewerage Center (VSC), issues below were discussed in the meeting, and as for absent members of JCC, the Project team visited them later and obtained the same agreement upon explanation of the same.

Remarks from Japanese side (JICA Headquarter):

1. Japanese side would like Ministry of Construction (MOC) to provide counterparts and secure necessary budget of the Project
2. The presented business plan needs to improve, especially for the project implementation support function and research and development function in 4 (four) points:
   - ① Finance:
     There is not sufficient information on the cost. The Project should refer to the case of CNEE/CUWC that is operating sound management.
   - ② Project implementation support function:
     More clarification is needed for the organization of VSC. The VSC staffs in charge of the function need to be experts. In this regard, we need to consider of the way how to find and hire them.
   - ③ Research and development function:
     We are still not certain whether or not the 3 (three) presented topics reflects the actual needs in Vietnam. The cooperating organizations should be defined more in detail.
   - ④ Cost sharing: clarify costs sharing to be bore between Japanese and Vietnamese sides.

Remarks from Vietnamese side:

1. Vietnamese side agree upon the three functions of VSC and its establishment for 2017. We'd like to request grant of equipment for training.
2. The contents and the method of the 1st pilot training was good and the discussion was done actively. Participants could get advices at the place and it was very beneficial to Vietnamese trainees.
3. For long term, a sustainable management is necessary
   - ① For lecturers, theoretical and practical knowledge is required. In this aspect, JICA's training in Japan is necessary.
   - ② Contents and curriculum should meet the needs of trainees. The issues of training fee

and participation from private sector should also be considered.

4. For long term, VSC should be under responsibility of MOC. The location would be in ATI during the JICA's support period.
5. Vietnamese side has recognized and agreed upon the number of VSC stuffs.
6. For long term, VSC should begin to organize not only trainings in CNEE/CUWC but also workshops in cooperation with universities and training institutions.
7. Vietnamese side admits the viability of the 3 (three) functions of VSC.
8. VSC is not a same structure to Japan Sewage Work Agency (JS), hence VSC cannot operate the same functions as JS.
9. In terms of the subjects of research and development function of VSC, sulfate corrosion is a problematic issue in Vietnam too. Vietnamese side is interested in this subject.
10. Standardization and inspection is appropriate for VSC. Private companies and municipalities would pay inspection costs.
11. In order to realize sustainability of training activities for long term, VSC should implement a countrywide needs survey and settle further discussions during the 2 (two) years of JICA's support period.

(Remarks below are from Deputy Minister of Construction)

1. There are too many issues to be done during the 2 (two) years of JICA's support. This period is short to accomplish these tasks.
2. In order to attribute all lectures from Vietnamese professionals, VSC needs to implement TOT trainings during the 2 (two) years of the Project.
3. The questionnaire will be distributed to trainees after the next (2^{nd}) pilot training to ask about the collection of training fees.
4. Vietnamese side agrees on the all commentaries of Japanese side (JICA Headquarter).

MINUTES OF MEETINGS
BETWEEN
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
AND
CONCERNED
ON
THIRD JOINT COORDINATION COMMITTEE MEETING
FOR
JAPANESE TECHNICAL COOPERATION PROJECT

THE PROJECT FOR ENHANCING MANAGEMENT CAPACITY OF SEWERAGE WORKS
IN
THE SOCIALIST REPUBLIC OF VIETNAM

Hanoi, 28 February 2017

Mr. Shigeo Kanai
Chief Advisor
JICA Study Team

Dr. Nguyen Hong Tien
Director General
Administration of Technical Infrastructure,
Ministry of Construction

MINUTES OF THE MEETING

Subject: 3rd JCC meeting in order to finalize plan for VSC establishment and necessary steps for implementation phase

I. Time: 9:30 – 11:30, 28th February 2017

II. Location: Meeting room No.252 - MOC

III. Participants:

MOC:

1. Dr. Nguyen Hong Tien – Director General of ATI – MOC
2. Dr. Mai Thi Lien Huong – Deputy General Director of ATI - MOC
3. Ms. Tran Thi Thao Huong - Head of Sewerage Division – ATI-MOC
4. Mr. Nguyen Ngoc Duong- Deputy Head of Sewerage Division – ATI - MOC
5. Mr. Do Manh Quan- Officer, Sewerage Division, ATI-MOC
6. Mr. Ngo Van Yen-Officer, Sewerage Division, ATI-MOC
7. Ms. Nguyen Thi Nga – Deputy Head of Personnel Department - MOC
8. Mr. Bui Hong Hue/ Rector of CUWC
9. Ms. Vu Thi Hoai An, Vice director of CNEE, CUWC,
10. Ms. Nguyen Thi Bich Hue, Deputy Head of International Cooperation Department - MOC
11. Ms. Pham Thi Huong – Officer of ATI
12. Mr. Pham Ngoc Chinh, Officer, ATI
13. 1 representative of Finance and Planning Department

JICA Head Quarter:

1. Mr. SHIGIYA Satoshi– Director of Global Environment Department,
2. Mr. IIJIMA Daisuke – Advisor of Global Environment Department
3. Mr. MORI Tamaki – Special Advisor of Global Environment Department
4. Mr. KITAGAWA Mitsuo – Advisor of Global Environment Department

JICA Policy Advisor

1. Mr. WAKO Takatoshi – JICA Sewerage Policy Advisor in ATI-MOC
2. Ms. Nguyen Thi Dao – Assistant to JICA Expert in ATI - MOC

JICA Vietnam Office:

1. Mr. ANZO Hiroshi – Senior Project Formulation Advisor
2. Mr. Nguye Vu Tiep – Program Officer

JICA Study Team

1. Mr. KANAI Shigeo – Team Leader
2. Mr. KAWAI Takehiko – Team Member
3. Mr. FUJIMOTO Hiroyuki – Team Member
4. Dr. KIM Hyeonyeul – Team Member
5. Mr. MIYAUCHI Ryotaro – Team Member
6. Mr. GONDAIRA Tomohiro – Team Member
7. Ms. Do Thi Nga – Team Senior Assistant
8. Ms. Le Thi Lanh – Assistant

Opening remark and Introduction:

Wishing close cooperation between the both sides for the success of this project

Remarks from Japanese side (JICA Headquarter):

1. After having meeting with Vice Minister of MOC, JICA conveyed major concerns regarding the Project
   - ① Allocation of counterpart personnel for this project from MOC: that is who can work for VSC.
   - ② The VSC needs support from MOC especially at the initial stage of its establishment such as salary of VSC staff and mechanism for private sector to participate in VSC training courses.
   - ③ In the budget plan, income from training participants and cost coverage should be ensured.

Business Plan was explained by JICA Study Team.

Discussion about the Business Plan

1. Remarks from CUWC
   - ① Rector of CUWC requested to JICA provision of necessary equipment for training purpose and its schedule. In CUWC, it is desirable to install small model of pipe jacking method.
     - ➔ JICA Study Team indicated to refer Appendix 9 "Equipment to be provided for Training by JICA" of the Business Plan for the clarification.
   - ② Sustainability of the Project: training contents should be focus on practical aspect should be clarified.
   - ③ VSC should focus on training for engineers because from CUWC's experience, the VSC would not be able to collect much tuition fee from training for management level. Necessity to provide qualification was mentioned.
   - ④ Organizational structures: Besides one full-time staff, two part-time staffs from ATI, CUWC will provide one another part-time staff for VSC.

2. Remarks from Personnel Department
   - ① For the process of VSC establishment preparation: representative of Personnel Department-MOC explained that after the revision of Decree No.62/2013/ND-CP regulating on the functions, tasks, rights and organizational structure of MOC is

completed, the new mechanism of MOC is consolidated. Personnel Department will commit to complete the procedures related to the establishment of VSC until the end of the year 2017.

② ATI shall appoint one person to be in charge of formulating project who is familiar with elaboration of documents for the establishment of VSC. The document should clearly mention the functions and tasks of VSC project and clearly describe the VSC will be under the management of ATI in the initial stage then submit to MOC for approval.

3. Remarks from International Cooperation Department (ICD)

① Regarding research and development function, ICD suggested to refer to GIZ case for publishing sewerage manual /guideline because they have much experience in carrying out sewerage projects in Vietnam.

② In the future, sewerage database should be located on MOC website for more people to get access with the useful information.

③ As for training: JICA should formulate outstanding training program and differentiate from other donors in order to attract trainees and to collect fees. The reason is that many projects and many donor organizations are now executing training programs at central government and local municipalities' level.

④ Sustainability of the VSC: following French project for CUWC (which is CNEE) over the past time, VSC should pay attention to this successful management.

4. Remarks from ATI-MOC

① Director General of ATI-MOC mentioned that construction of pipe jacking method is planned in Ho Chi Minh City. Also, there might be occasion to visit the site at the implementation phase of Yen Xa project in Hanoi since the project expects to use pipe jacking method.

② Regarding counterpart working place: Full-time C/P can seat wherever. However, the C/P needs closely cooperate with ATI as well as relevant authorities in order to prepare necessary procedures for VSC's establishment. Doing these procedures needs careful supervision of ATI's director. Therefore, Head of Sewerage Division of ATI-MOC suggested working place for fulltime staff seating in ATI.

③ Vietnamese side agrees to provide office which have enough space for JICA experts and fulltime staffs.

5. In conclusion, both sides agreed upon the followings:
   ① Tuition fees calculation needs further discussion.
   ② Arrange office to have enough space for JICA experts and a full-time C/P of the project for daily activities and discussion.
   ③ Financial plan shall be gradually materialized and try to elaborate mechanism in order to secure financial aspect for VSC from now on.

6. Signing ceremony
   With the agreement from both sides on the contents of discussion, General Director of ATI-MOC and Director of Global Environment Department of JICA Headquarter signed the Minutes of Meeting and Minutes of Discussion.
   As attached, the Minutes of Meeting and the Minutes of Discussion on the Annex-1 and 2 of this document.

Annex-1 The Minutes of Meeting
Annex-2 The Minutes of Discussion

Appendix 8 Other Activities

Appendix 8-1 Details of Field Survey Results in 11 Cities

DOC of Bac Ninh Province

① Sewerage systems

- The operation of a sewerage treatment plant in To Son began recently. The plant has a processing capacity of 2,000m^3/day.
- A sewerage treatment plant in Bac Ninh City has a processing capacity of 28,000m^3/day.
- The C-Tech of SBR is used for wastewater treatment in both plants.
- Bac Ninh Water Supply and Sewerage Company used to be responsible for the maintenance of the sewerage systems. This company was reorganized and independent Sewerage Company was established on 1st January 2015. The privatization of the Sewerage Company (public sales of its stock) is scheduled for 2016.
- The provincial government has provided 50% and 100% of the budget of the Water Supply and Sewerage Companies, respectively.
- The maintenance contract for the period between 2015 and 2020 was awarded in a public tender.
- Seventy percent of the maintenance expenses of the Sewerage Company are to be paid with a subsidy from the provincial government and rest is to be paid with the user fee revenue until 2020.

② Organizational structure of the Sewerage Company (as explained by Mr. Hyo)

- The company has 112 employees, including a president and two vice-presidents.
- It consists of the Accounting, Planning and Technology, and General Affairs Departments.
- Seventy employees are engaged in the maintenance of the treatment plants and sewer pipes.
- The source of the revenue is the payment from the People's Committee. The company has loans from Bac Ninh Province and the German Development Bank (KfW).

③ PMU and system for the implementation of sewerage projects

- SFC-Vietnam implemented the sewerage project after being awarded the contract in an international tender conducted by the Ministry of Planning and Investment in accordance with the relevant laws of Vietnam and Germany.
- A PMU established within Bac Ninh Water Supply and Sewerage Company supervised the designing and execution of the project.
- The PMU is under the direct supervision of the Province People's Committee (PPC).
- The PMU consists of six members, five sewerage engineers and one accountant.
- The DOC of Bac Ninh Province is responsible for waterworks, sewerage and transport infrastructure. It provides advice to those who implement water supply and sewerage projects when it approves their projects. The daily duties of the DOC include supervision of consultants, disbursement of budget and acquisition of land.

④ Training needs and human resource development

- Human resource development is essential.
- The beneficiaries of the training shall be staff responsible for the maintenance of wastewater treatment plants and sewer pipes, including those of private companies, of the organizations supervising the designing and work execution in the municipal and provincial government. It is recommended that training be provided to them in accordance with their needs.
- The DOC consists of engineers graduated from universities (such as Hanoi University) and workers graduated from colleges (there are two colleges in the province). They are given two to three in-house training courses per year. OJT is used as the main training method in these courses for human resource development

・ Some of the staff have participated in training courses in Austria and Denmark.

⑤ Example of project implementation

・ The project to construct Bac Ninh Sewerage Treatment Plant was implemented as follows:
2000: Commencement of the planning
2004: Commencement of the designing
2007: Conclusion of a loan agreement
2010: Commencement of the construction of the plant
2013: Commencement of the operation of the plant

・ The project period was long because the sewer pipes and treatment plant were not constructed simultaneously, it took a long time to survey and procure the construction sites and the foreign exchange rate had changed drastically in the global financial crisis (the exchange rate that used to be 1 USD to 20,000 VND fell to 1 USD to 30,000 VND in 2008).

⑥ Maintenance of Bac Ninh Sewerage Treatment Plant

Processing capacity: 28,000m^3/day
Processing method: Cyclic activated sludge process technology (C-Tech)
Design documents: They were found on the second floor in the Administration Building
Maintenance system: The plant is maintained 24 hours a day by four groups of three maintenance staff each working in three shifts a day.

⑦ Observation

[Overall needs]

・ Practical training on sewerage treatment is required.

DOC of Bac Giang Province

An interview survey was conducted on what kind of training and project support the DOC of Bac Giang Province required, for the establishment of the Sewerage Center that is planned to provide training and project support.

① Outlines of the cities in the province

Cities in Bac Giang Province
Level II city: one, Bac Giang City
Level IV cities: two, Chu and Thang Townships
Level V cities: 14 municipalities

② PMU and system for the implementation of sewerage projects

・ Sewerage projects are managed by municipal governments, in principle. The DOC of the province is responsible for 1) the assessment of basic designs, 2) the assessment of detailed designs and 3) inspection of constructed facilities (whether they have been constructed in accordance with laws). MOC directly assesses and inspects special facilities designated by laws and level 1 structures. While the role of the DOC in the previous sewerage project (implemented between 2004 and 2010) was only to make comment on the project, it has different roles in sewerage projects at present.
・ The DOC of the province has three engineers in sewerage/agricultural irrigation.
・ The extension of the Bac Giang Sewerage Treatment Plant is being planned with assistance from ADB. The matters concerning the establishment of a PMU shall be decided in the discussion between the PPC of Bac Giang Province and ADB. A PMU can be established in different ways, *i.e.* by 1) establishing it as a new organization in the provincial government, 2) using the Project Management Board (PMB) under the PPC as the PMU or 3) using the PMB of the municipal government as the PMU. 3) shall be used in this project. The

government of Bac Giang City does not have DOC.

- The DOC of the province is not involved in the ordering of the construction work. In principle, Bac Giang Province is not directly involved in the projects of municipalities. It only provides technical instructions to them.
- The DOF of the province is responsible for the collection of sewerage user fees. DOC advises DOF on the matter. The municipalities other than Bac Giang City have no need to establish a bylaw on sewerage because they do not have sewerage systems.
- Each municipal government prepares a plan to construct a sewerage system and the DOC of the province assesses the plan. Once the system has been constructed, each municipality will maintain it and the DOC of the province is only involved in legal processes.

③ Training needs and human resource development

- The DOC of Bac Giang Province requests that staff responsible for the maintenance of the sewerage system of the Drainage Company of Bac Giang City be included in the participants of the training at the Sewerage Center.
- There seems to be no major problem in the development of sewerage systems by the DOC, although little information is available on the sewerage projects implemented in the past.
- Several staff of the Urban Drainage Management Center of Bac Giang City are expected to participate in the PMB for the ADB-assisted treatment plant extension project.
- Some staff of the DOC participated in the training of JICA conducted at HSDC in 2010. The DOC would like to send its staff to the training courses to be held at the Sewerage Center, if possible. The trained staff of the DOC look forward to an opportunity to be a lecturer in training courses and a project support engineer. They would like to know what qualifications they have to have to be the lecturer or project support engineer.
- DOC would like to be informed of the specific qualifications required for the participation in the training when its outline has been decided.

④ Examples of project implementation

- The priority is given to the development of water supply facilities and pipelines. Although the development of waterworks is a duty of the DOC, private companies also participate in it. The sewerage is not profitable as a business and assistance to it is limited. The province used to own the Water Supply and Wastewater Company. At present, the company, which has already been privatized, only manages the waterworks.
- The number of industrial parks is on the increase. The DOC is not responsible for the wastewater from the parks. The six industrial parks (three in use, two under construction and one in the planning stage) are under the jurisdiction of the Industrial Park Management Board.
- While the residents request development of sewerage systems, the government does not have revenue source for it. The DOC earnestly requests JICA's assistance in the development of sewerage systems in the two level IV townships and the southern part of Bac Giang City.
- The DOC has agreed to provide the survey team with the master plans for the urban development of Bac Giang City and the two townships in response to the team's request.

⑤ Maintenance of the sewerage treatment plant

- BOD of the influent is approx. 100 mg/L. SS is not measured. The water quality is analyzed twice a week.
- The DO meter has been broken down. The amount of aeration is manually controlled based on the DO measurements taken with a portable DO meter. The SCADA system installed at the plant was damaged by lightning (*ca.* 2012). However, the system has not been repaired since then.
- While 10,000m^3/day of wastewater flows in the plant, the dehydrator has not been used.

When the amount of sludge in the reaction tank exceeds a set volume, it will be removed from the tank and sprayed on empty space in the premises of the plant. While the exact volume of the removed sludge is not known, it is removed approx. once per month.

⑥ Observation

[Overall needs]

- Practical training on sewerage treatment is required.

Urban Infrastructure Management Division of Uong Bi City

① Sewerage projects

2008: Master Plan of Urban Infrastructure Development
Drainage, Sewerage, Solid Waste Management, Cemetery

April 2016: FS Urban Infrastructure Development
Drainage, Sewerage, Solid Waste Management, Cemetery

This FS was conducted by a Japanese consultant as part of an urban facility development project.

Project Budget

Total:	36 million USD
ODA (estimate)	12 million USD
(Call for Investment)	24 million USD

② PMU and system for the implementation of sewerage works

MP & FS stage: 2 staff (Head & his staff), City Urban Infrastructure Management Division
Jobs: Planning, programming/project implementation of urban infrastructure
(Educational background of Head: Hanoi Architectural University)
Training experience: Urban infrastructure technology course (Sewerage is partially included)
Expert of sewerage works is not employed.

DED & Construction stage: Intended to be integrated in the PMU of the Urban Infrastructure Project

O&M stage: To be decided (outsourcing of the maintenance of wastewater treatment facilities and disposal of solid waste to private contractors) Budget 68 billion VND

③ Example of project implementation

1st: Inundation, 2nd: Sanitation, 3rd: Water pollution control
Rainwater runoff rate and pollution load are on the increase because of the rapid urbanization.

Awareness of the people: Although awareness creation activities through the media are implemented, people's interest in water pollution is low.

④ Training needs and human resource development

The standards of MOC are followed. Original guidelines have not been developed.
The training needs are met with personal efforts and inquiries to consultants.
The division has expectations of VSC.
The division intends to use the consultation and research and development services of VSC when a problem arises.
It is difficult to secure budget to meet training needs and develop human resources.

It is possible to secure budget to pay trip allowances, but not training fees.

⑤ Maintenance of sewerage (sewerage user fees)

Sewerage user fees (environmental conservation tax) are charged at 10% of the water fees. It is considered possible to raise the fees because of the good economic performance.

⑥ Observation

[Overall needs]

- To secure and train sewerage engineers is urgently required.

Song Cong City (Thai Nguyen Province)

① Sewerage projects

Sewerage is mentioned in the Urban Infrastructure Master Plan.

A sewerage treatment plant was constructed with assistance from MONRE. The plant is being operated also with the assistance from MONRE.

Processing capacity: 5,000m^3/day (actual inflow: 750m^3/day)

Sewage collection systems: existing city area – interceptor system, new city area – separate sanitary system

Sewerage treatment process: Anaerobic tank – settling/adjustment tank – soil treatment (silt, sand and gravel) – finishing tank

The city installs sewerage systems up to connection pits. The progress of the installation of house connections has been slow.

Sewer pipeline installation: The installation has been suspended because of the lack of financing.

Septic tanks of houses: Septic tanks in the premises of individual houses shall be left intact after the house connections have been installed. URENCO (Urban Environment Company) cleans sludge out of septic tanks. The removed sludge is transported to a park and used as a soil amendment after being dehydrated and composted.

A Swedish investor conducted a survey on the investment in the sewerage system in the city. However, nothing has been heard from the investor since then.

② PMU and system for the implementation of sewerage projects

The department responsible for the urban infrastructure in the CPC constructs sewer pipelines as part of urban infrastructure that includes roads, drainage systems and street lamps. It performs the combined-type PMU function for all urban infrastructures.

Number of staff: 11, including three technical staff specialized in civil engineering and one staff each specialized in sewerage, environmental, transport and electrical engineering

Urban Infrastructure Company owned by the CPC cleans sewer pipes.

Budget (for maintenance and repair of urban infrastructure): 30 billion VND

Number of staff responsible for the maintenance of sewerage treatment facility: one (security, cleaning, switching on/off of lamps, etc.)

Water Supply and Urban Infrastructure Company under the jurisdiction of PPC maintains the waterworks. It performs the PMU function for the Thai Nguyen Sewerage Project.

③ Training needs/expectation of VSC

The city has expectations of VSC. It also hopes for financial assistance from JICA.

Because simple technologies are used for the installation of sewer pipes and the sewage treatment, introductory training on overall knowledge of sewerage for general civil engineers will meet the training needs of the city.

[Thai Nguyen Sewerage Project]

① Outline of the project

The construction contract for the project was concluded in December 2015 with financial assistance from Belgium.
Implementation system (PMU): Thai Nguyen Sewerage and Urban Infrastructure Development Company Ltd. shall implement the project.
Project cost: 19.6 million USD (of which ODA accounts for 11.2 million USD)
Project contents: Repair of sewer pipelines, installation of interceptor sewer pipes, construction of relay pump stations and a sewerage treatment plant
Sewerage treatment plant: Processing capacity – 28,000m^3/day, oxidation ditch process (14,000m^3/day x 2 lines)
Project purpose: Prevention of pollution of river water and groundwater and flooding, achievement of sewerage coverage of 85% by 2020.

DOC of Nam Dinh Province

① Sewerage projects

- The existing drainage systems consist of the system developed in the French colonial era and the one mentioned below developed in the Urban Drainage Improvement Project supported by WB (completed in 2015).
  - Drainage pipeline: 53km
  - Canals: 13km
  - Reservoirs: 45ha
- At present, wastewater is not treated (there is no sewerage treatment plant) in the province or there is no plan for donor assistance in the sewerage treatment.
- A project to construct three sewerage treatment plants is mentioned in the master plan for urban development. However, a detailed study has not been conducted for the project. A master plan for the sewerage sector has not been prepared either.
- The current issues are as follows:
  - The combined drainage system is used in the old city area, while the separate sanitary drainage system is used in the new city area. With the expansion of the city area, a complication has arisen from the use of the different drainage systems in the old and new city areas.
  - The water in the canals and rivers has been polluted significantly. The most problematic issue is the fact that an intake of a water supply system is located downstream of the outlet of a sewer.
  - Although the DOC intends to plan a sewerage project based on the master plan, it has difficulty in doing so because it does not have experts in the sewerage planning.

② PMU and system for the implementation of sewerage projects

- The drainage systems in the city are under the jurisdiction of the CPC and maintained by Urban Construction Company, a joint-stock company (JSC) of the city.
- However, the company has no expert in sewerage.
- Urban Technical Infrastructure Management Division is responsible for the management of the sewerage systems.
- The division has five engineers, one of whom is Mr. Vinh, an engineer in the water sector specialized in the waterworks (and sewerage works).

- Neither sector-based PMU nor project-based PMU, mentioned below, has been established for the implementation sewerage projects. There used to be a project-based PMU for the implementation of the Urban Drainage Improvement Project supported by WB. However, it was dissolved in 2015.
- As the CPC controls the development of urban infrastructure in the city, it is reasonable to assume that the CPC is to establish a company to develop and maintain sewerage systems.

However, the absence of experts in the sewerage sector is a major problem in the development of sewerage systems.

- It is possible for a DOC of a province to manage infrastructure development of a city with a direct instruction of MOC.
- A PMU is usually established by sector as a sector-based PMU. However, a project-based PMU is to be established for the implementation of a project funded by foreign budget, in addition to the section-based PMU.

③ Training needs and human resource development

- Because of the shortage of human resource in the sewerage sector, it is necessary to develop and maintain human resource.
- It is recommended that a meeting with the director of the DOC of the province and the chairperson of the PPC be held in June to discuss the matter of requesting VSC to provide support to the PMU, including the possibility of VSC acting as PMU, again. The Survey Team has decided to revisit the province in June.

④ Observation

[Overall needs]

- To secure and train sewerage engineers is urgently required.

DOC of Ben Tre Province

① Outline of Ben Tre City

- The city has an area of 7,400 ha and consists of 10 wards.
- It has a population of 140,000 – 150,000 people.

② Sewerage systems

- There are small-scale treatment plants in a 160 ha-industrial zone.
- There is a drainage system only in the city center.
- Separate sanitary drainage systems are being constructed in the new city area. However, there is no treatment plant in the area.

③ PMU and system for the implementation of sewerage projects

- Ben Tre City manages the existing drainage system. The assignment of the responsibility to maintain the drainage systems in the new city area has not been clearly defined. Although the DOC of the province is supposed to be responsible for the maintenance of all the infrastructures in the province, in principle, it does not have sufficient capacity to fulfill this responsibility.
- The responsibility to maintain the drainage pipelines was automatically transferred to Water Supply and Sewerage Company (WSSC), when their construction was completed. The company is duly maintaining the pipelines.
- ADB conducted a pre-F/S for a sewerage project. The study estimated the total project cost at 22 to 23 million USD on the assumption that a treatment plant with a capacity of 6,000m^3/day and a separate sanitary sewer system are to be constructed in the project. Both the DOC of the province and Ben Tre City are involved in the study.
- Although the DOC intends to develop sewerage systems in Ba Tri and Vinh Thanh Districts, it does not have budget to do so. Therefore, the DOC is looking for a donor to finance this project.
- There are two treatment plants with capacities of 2,500m^3/day and 2,000m^3/day in Gia Long Industrial Zone. There is a plan to increase the capacity of the former to 5,000m^3/day. One of the plants is managed by WSSC.
- The DOC has ample experience in infrastructure development projects. The DOC establishes

a PMU within the department and takes lead in the implementation of large-scale projects for the purpose of reducing the cost. However, the PMU thus established in the DOC is not an official one. This policy of establishing a PMU in the DOC is specific to Ben Tre Province.

- Meanwhile, WSSC takes lead in the implementation of small-scale infrastructure development projects.
- The Urban Infrastructure Management Division (UIMD) in the Architecture Management Division is responsible for the sewerage sector in the DOC. UIMD has only two staff members responsible for the sewerage systems (one with a degree of master of science and the other majored in civil engineering).
- The DOC of the province and the city usually cooperate in the implementation of infrastructure projects. PPC is the owner of the ADB-assisted project.
- A stage in which a PMU is established is different among projects depending on the requirement of the projects concerned. A PMU for the implementation of the sewerage projects has not been established. Since PPC has assigned CPC to be the focal point of the sewerage project, CPC is expected to play a major role in the discussion on its establishment. A preparation team has been established with 10 staff members of relevant departments assigned to the team on a part-time basis. The team is collecting data from the relevant departments and reviewing reports including the FS report.
- The division in the DOC of the province responsible for the sewerage project used to have three staff. However, it now only has two staff because one of them has resigned. This situation is problematic as the FS is about to begin.
- As the PMU established for the implementation of the Improve Project supported by ADB was able to manage the project, it is considered possible to establish a PMU with sufficient capacity for this project.
- Preparation is being made for the establishment of a PMU for a WB-assisted project by July. This PMU is expected to have approx. 20 members. Workers of local authorities are expected to be employed as members of the PMU on a permanent basis.
- As the operating budget of the DOC is limited, the PPC and ADB provide financial assistance to the preparation of the sector M/P and pre-F/S, respectively.
- It has 230 employees including more than 20 civil engineers. The rest of the employees are laborers. WSSC is managing both waterworks and sewerage (drainage) systems. However, it does not assign engineers or laborers exclusively to the maintenance of the waterworks or sewerage (drainage) systems.

- Because donor's intention has strong influence on the composition of a PMU, it is considered straightforward to accept a request of ADB on dispatch of personnel.

④ Example of project implementation

- The development of sewerage systems in the city center and industrial zone is given priority in the master plan up to 2030. Since environmental pollution and climate changes have already made the lack of sewerage systems a serious problem, the development of the sewerage systems is urgently required.
- Wastewater treatment and the improvement of the quality of the water discharged from the industrial area are priority issues, because the people's demand for them is high. However, the lack of budget is an obstacle in addressing these issues.

⑤ Training needs and human resource development

- Although the DOC has a capacity to implement ordinary projects, it does not have a sufficient capacity to implement sewerage projects.
- Since sewerage is a new technology to the DOC, they do not have competent engineers.
- The DOC is aware of the importance of training because they have limited human resource.

- Internal discussion on the participation in the actual training is required at the DOC because it has various internal problems including those on budget. Although it expresses keen interest in dispatching its staff to the training at VSC, it will be difficult for the DOC to do so without assistance in travel allowances.
- The DOC requests an invitation letter and provision of a document explaining the training details for the discussion on the participation in the training.
- The DOC is aware of the necessity to request VSC to dispatch consultant specialized in sewerage projects or to outsource such a consultant for the project implementation.

⑥ Observation
[Overall needs]
- To secure and train sewerage engineers is urgently required.

DOC of Dong Thap Province and DOWASEN

The DOC of Dong Thap Province is only responsible for the management of sewerage projects.
- Person in charge of sewerage in the DOC: Mr. Trang (28 years of age) who had studied in Germany gave positive response in the survey.

Practical management work in sewerage projects is commissioned to DOWASEN (Dong Thap Water Supply, Sanitation and Water Environment Company) because it has a PMU function.

[Results of the interview at Dong Thap DOC]
① Sewerage projects
- The DOC is making vigorous efforts to improve the sewerage systems.
- Because the shortage of human resource is a particularly serious problem, the establishment of VSC with training service will be appreciated.
- Two sewerage projects are in progress in two cities (Cao Lanh and Sa Dec Cities) in the province.

Project	Component	Donor	Project cost	Expenditure of the province
Cao Lanh	Pipelines, sewerage treatment plant, pump stations	Norway	490 B VND	72 B VND
Sa Dec	ditto	ADB	50 M USD	16 - 20 M USD

- Cao Lanh Project: already in the execution stage, to be completed in 2017 (processing method changed from OD to SBR)
- Sa Dec Project: FS completed, a proposal submitted to and being assessed by MPI, scheduled to commence in a period between 2017 and 2020

- The processing method was changed because a study of the treatment plants in another province (Binh Duong Province) had revealed the advantages of SBR over OD, including the small site required for the construction. The change was proposed by the contractor.
- Phu Dien is constructing facilities in Cao Lanh Project.

② PMU and system for the implementation of sewerage projects
- Three staff members of the DOC, a vice director of the DOC and two engineers, are responsible for infrastructure including not only waterworks and sewerage systems but also electric power systems.

They have difficulty in performing their duties because the central government issues numerous new decisions and degrees concerning their duties.

- A PMU is established within DOWASEN, which is under the jurisdiction of PPC. The PMU manages the entire process from the planning to the maintenance and the role of the DOC is limited to providing advisory services including assessment in the stages from the formulation of a master plan to the basic design. The DOC does not assign its staff to the PMU.
- The PMU established in DOWASEN is able to manage the projects in the municipalities near Cao Lanh (such as Sa Dec).
- The notice on the pilot training in this project shall be sent to PPC, because PPC is to make decision on the participation in the training.
- The PPC of Sa Dec City has the report of the pre-F/S conducted by ADB. The provincial DOC does not have accurate information on the study because it did not participate in the meeting between ADB and the PPC of the city on a regular basis.

[Results of the interview at DOWASEN]
Mr. Hau explained the outline of the Cao Lanh Project. (He also provided the PPT presentation that explained the project.)

- Mr. Hau (38 years of age) may become a key person in the project because he has ample experience in the sewerage sector including the working experience in the private sector.

① Outline of the sewerage project

- The PPC supervises the project. DOWASEN, VISEN, WASE and GMBH participate in the project.
- Financing: ODA, 140 million euro (with contribution of 24 million euro from the government of Vietnam)
- Project period: 2010 - 2017, implemented in two phases
  I. Construction of urban drainage systems and a sewerage treatment plant (10,000m^3/day), installation of sewer pipes (in the city area)
  II. Construction of urban drainage systems, extension of the sewerage treatment plant (to 20,000m^3/day), installation of sewer pipes (in the other areas)
- The separate sanitary drainage system is used in the construction of drainage systems, in principle. However, the use of the sewer pipes and septic tanks installed in the premises of houses is to be continued.
- The sewerage coverage area is to be divided in six zones and a pump station is to be constructed in each zone. These pumps are to be used for conveying collected sewerage through a 3.8km-long channel to the sewerage treatment plant.
- A workshop was organized for the residents near the treatment plant.

② Issues in the development of the sewerage systems

- Although Decree 80 requires that drain pipes of houses are to be connected to sewerage systems, there are cases in which the stipulation of the decree is not followed. Therefore, the budget of this ODA program includes 2 million VND/house for creating 4,000 connection points.
- The drainage systems are designed as the separate sanitary drainage system, in principle. If wastewater and rainwater are not drained separately in premises of a house, a connecting pit shall be installed in the premises to adopt the overflow system. Even in such a case, no work shall be conducted on the drainage system of a house.

③ PMU and system for the implementation of sewerage projects

- The PMU for the Cao Lanh Sewerage Project has 13 members, all of whom are full-time

employees of DOWASEN.
- The PMU for the Sa Dec Project is expected to be installed in DOWASEN, although PPC is to make decision on where the PMU shall be established.
- DOWASEN has a total of 800 employees including 200 engineers. (The organizational chart of DOWASEN was obtained.) It consists of the Waterworks and Sewerage, Solid Waste, Finance, Management and Construction Sections, etc. It has five subsidiaries, which employ five managers, 120 engineers (with bachelor's degree), 73 (college-educated) workers, 300 (vocational-school-trained) workers and other laborers.
- DOWASEN is responsible also for the maintenance of the sewerage systems. The persons in charge of the maintenance are involved in the project at the construction stage and use the knowledge and expertise acquired in this stage for the maintenance of the constructed systems.
- DOWASEN has a contract with foreign sewerage consultants to fill the lack of engineers.
- It will be difficult for the staff of DOWASEN to participate in the pilot training, if it is to be held in Hanoi. DOWASEN requests that the training be held at HCM.
- Cities in the Mekong Delta developing sewerage systems share the same needs.

④ Needs for training and human resource development
- DOWASEN welcomes the establishment of VSC because it does not have sufficient staff specialized in sewerage technologies. The benefit of the establishment depends on what qualification is required for an engineer to participate in the training.
- However, the issues of which organization is to pay the cost of the training at VSC and whether the cost shall be included in the loan have to be addressed.
- DOWASEN has interest in the pilot training and requests information on its schedule and curriculum.
- DOWASEN requests that practical training taking in site visits be included in the training. It feels that listening to lectures on theories is not sufficient to develop capacities of the trainees and that establishing a network of trainees is also important.

⑤ Observation
[Overall needs]
- Basic knowledge on sewerage such as sewerage treatment process and pipeline design is insufficient.
- To secure and train sewerage engineers is urgently required.
- Practical knowledge on sewerage treatment is required.

Sa Dec City, Dong Thap Province

① State of the sewerage project
- The pre-F/S for the ADB-assisted project has been completed. The approval of MPI is awaited.

② System for the implementation of sewerage project
- PPC is to decide where to establish the PMU.

③ Training needs and human resource development
- The city has to make decision on many issues including the selection of an appropriate treatment process and the selection of an appropriate system to collect sewerage. The city has expectations of the research and development activities of VSC.
- The city has expectations of the training at VSC because it does not have sufficient sewerage engineers.

④ Maintenance
- The city is implementing a sewerage project in a craft village. There are various issues including those in site clearance and facility maintenance in the project.
- It is expected to take a long time to implement sewerage projects because of the time required for site clearance.

⑤ Observation
[Overall needs]
- Basic knowledge on sewerage such as sewerage treatment process and pipeline design is insufficient.
- To secure and train sewerage engineers is urgently required.

DPI of Ving Long Province

① Outline of sewerage projects
- The pre-F/S for the ADB-assisted project has been completed. Application for the approval for the implementation of the project was submitted to MPI in April (or May?) this year in accordance with Decree 16. The senior officials of the PPC are expected to make a petition to MPI in July.
- The WB-assisted Urban Upgrade Project and the ADB-assisted project are expected to cost 35 – 50 million USD and 45 million USD, respectively. The ratios of subleasing are expected to be 30% and 100% for ADF and OCR, respectively.

② PMU and system for the implementation of sewerage projects
- Application for the establishment of a PMU for the implementation of the WB-assisted project, the ADB-assisted project and an AusAID-assisted project (in the health sector) has been submitted to the PPC. Although the DPI is to take lead in the PMU, members of the PMU are to be selected from the staff of the DOC and DOWASEN and to be outsourced for the implementation of the sewerage projects.
- Because donor's intention has strong influence on the composition of a PMU, it is considered straightforward to accept a request of ADB on dispatch of personnel.

③ Training needs and human resource development
- Since sewerage is a new technology to the province, it does not have engineers. It appreciates the effort on VSC and considers it ideal. However, it is doubtful whether the province employs a person qualified to participate in the training at VSC.
- The assistance of VSC will be highly appreciated because the province shall implement sewerage projects for the first time.

④ Observation
[Overall needs]
- To secure and train sewerage engineers is urgently required.

DOC of Hau Giang Province (Vi Thanh City)

① Outline of Vi Thanh City
- Area: 118km^2
- Population: 72,000 people (Population of Hau Giang Province: 758,000 people)
- Large-scale and organized development and improvement of the city area is in progress. The city is aiming at being upgraded from a Class 3 to Class 2 city.
- The improvement of the sanitary environment in rural areas is urgent required because only 18% of households have toilets.
- The necessity to construct drainage channels is believed to be low because there are many

rivers and canals.

② Outline of the sewerage project

- Budget: 15 million euro (Local Fund 2 million euro)
- Project period: 2013-2020 (A contract for the construction work has not been concluded. The DOC intends to implement the project ahead of schedule.)
- Donor: Danish Government (DANIDA)
- Population in the coverage area: approx. 48,900 people (a projection of the population in the city center in 2024)
- Processing method: separate sanitary sewer system
- Processing capacity: 7,000m^3/day in the original plan, 3,500m^3/day in the construction plan, the review to reduce the capacity to 3,000m^3/day in progress
- Users are expected to pay for the house connection. A subsidy for the connection cost will be provided to the poor.

- A project (Vi Thanh Commune) supported by ADB/JICA (Japan Fund) is in progress. The project is still in the survey stage and a concrete plan for its implementation has not been developed.
- HAWASUCO (Hau Giang Water Supply and Urban Works Company) manages the public services including water supply, sewerage (including urban wastewater disposal) and solid waste disposal. The PPC has appointed HAWASUCO as the owner (PMU) of water supply and sewerage projects. HAWASUCO is expected to operate and maintain water supply and sewerage systems. It employs 600 staff. (It consists of three departments, one for the O&M of water supply systems, another for the O&M of sewerage systems, solid waste disposal, lighting equipment, green areas and tourism facilities and the third for the O&M of public transport systems, in which 220 - 230, 250 and 20 – 30 staff, respectively, work.)

③ PMU and system for the implementation of sewerage projects

- Although the DOC does not implement sewerage projects, it plays important roles in those projects, *i.e.* monitoring and consultation with the PPC. The department for the management of urban infrastructure has four staff, none of whom is a sewerage engineer.
- The PMU submits a request for budget to the DPI and the DPI submits it to the PPC. Then, the PPC submits it to the central government and MPI approves it. The PMU submits a proposal on construction and technical matters to the DOC and the DOC submits it to the PPC after reviewing it. Then, the PPC submits an application for approval to the central government and MOC approves it.
- The matters concerning site clearance are to be decided by DONRE. If a matter beyond the authority or capacity of DONRE arises, DONRE sends the matter to the PPC, the PPC sends it to the central government and MONRE makes decision on it.

- The five members of the PMU shall be secured by internal transfer of personnel in HAWASUCO.
- The PPC shall formulate a regional plan for the development of sewerage and urban drainage facilities because the development of such facilities is required urgently.
- DANIDA will provide assistance to the construction and software component of the project.
- The unit prices of construction works have risen since the FS was conducted in 2011. Because additional local investment to the project cannot be expected, review of the coverage area and the processing capacity and method (the use of an OD system was originally assumed) of the sewerage treatment plant is in progress.
- The sewerage user fee revenue is too small to pay the O&M cost. Therefore, the PPC is to subsidize the cost for five years. The DOC intends to increase the fees gradually.

④ Training needs and human resource development

- Human resource development is considered important. Staff of the DOC have participated in five training courses with assistance from DANIDA.
- There is no training opportunity to learn the technologies used in sewerage treatment plants. Higher priority is given to the maintenance of the plant. There is a strong need for safety training (for the prevention of accidents including methane gas explosion).
- GIZ and DANIDA only provide short-term training courses. There are high expectations of JICA's training.
- HAWASUCO employs no sewerage engineers. The company shall employ three graduates of Hanoi Irrigation University. It shall train 13 sewerage engineers (have 13 of its employees trained at university) in three years.

⑤ Observation

[Overall needs]

- To secure and train sewerage engineers is urgently required.

DOC of Lam Dong Province and Da Lat Sewerage Treatment Plant

① Outline of Lam Dong Province

- There are 12 cities in the province. A sewerage system has been developed only in the central city of the province, Da Lat City (population of 250,000 people).
- A F/S for the sewerage development project (with a processing capacity of 10,000m^3/day) is being conducted in the nearby Bao Loc City (population of 150,000 people) with assistance from Belgium.
- The DOC of the province is responsible for the water supply and sewerage systems, while the DARD is responsible for irrigation facilities.
- Sewerage systems shall be developed step by step in category II, III and VI cities with priority given to large-scale city areas.

② Outline of sewerage projects

- The province has no sewerage plan (sector-specific plan). Instead, sewerage development is mentioned in the urban master plan.
- An organization responsible for sewerage development is to be established in near future. However, it is difficult to implement sewerage development projects because of the financial difficulty.
- The questionnaire will be submitted later.

③ Outline of the sewerage system in Da Lat City

- Sewerage systems of the separate sanitary sewer system have been developed in the city. There is no problem in draining rainwater on the ground surface because the city is located in a rough mountainous area.
- A sewerage treatment plant (7,200m^3/day) was constructed for the treatment of wastewater in the city.
- Wastewater generated by 12,400 people, or 30% of the population, is processed in the plant.
- DANIDA supported phase 1. WB is supporting phase 2.
- Sewerage systems have been developed in four districts among the 12 districts in the city.
- The difficulty in collecting sewerage from areas near valleys is a problem in the sewerage system to be solved.
- A water supply and sewerage company owned by the DOC has been operating and maintaining the systems without serious problems.
- A total of 111 staff including 35 with bachelor's degree or above and 13 college graduates are

maintaining the plant and sewer pipes.
- The company does not have sufficient capacity to manage the sewerage systems.
- Two staff in charge of the biological processing, two in charge of the chemical processing, ten in charge of maintenance of pipes and one in charge of maintenance of machinery are in need of training.

④ PMU and system for the implementation of sewerage projects
- A PMU for a project was established by PPC after a foreign donor conducted a FS for the project and the PPC studied the results of the study.
- The PPC of the city, the donor and the DPI hold meetings to discuss a strategy for the formulation of the sewerage project. Although the DOC participates in the meetings occasionally, the information on the project being discussed in the meetings is not shared with the DOC. Therefore, the DOC does not assess the sewerage development project. It is not known who conducts technical assessment of the project.

⑤ Training needs and human resource development
- The training to be provided by VSC is important and seems interesting. The detailed information of the training including the information of the pilot training is requested.
- Because sewerage development projects are implemented in different environments, the necessity to implement training on general subjects is low. The training on facility maintenance and specific themes (such as water pollution originating from farmland) is recommended.
- The DOC was suspicious of this visit because it mistook the purpose of the visit for something like sales promotion of Chinese and Korean companies at first. However, the suspicions disappeared when the purpose of the visit was explained. The DOC thinks that every province will appreciate the training.

⑥ Maintenance of the sewerage treatment plant (operational condition of Da Lat Sewerage Treatment Plant)

Separate sanitary sewer system, processing method: trickling filtration system
Processing capacity: 7,400m^3/day against the ordinary inflow of 5,500 - 6,000m^3/day
Processing flow: Settling tank – Imhoff tank – trickling filter – disinfection – discharge (into a river)
A rainwater reservoir was constructed.
Construction of an additional processing line is in progress (with assistance from WB)
Water quality

	Influent	Effluent
BOD mg/l	450 (270)	15 – 20 (10 or below)
SS mg/l	300 – 400 (400)	around 100 (100 or below)

Figures in the parentheses are the design values.

- Sludge is processed with the drying bed method. (Sludge accumulated in sewer pipes and septic tanks transported by vacuum trucks was processed with the sludge generated in the plant.)
- The dried sludge is sold as fertilizer at a price of 4,000 VND/kg.
- Operational problem: Sewerage cannot be treated when the amount of inflow is large.
- Number of maintenance personnel: 111 (for the maintenance of the sewerage treatment plant and sewer pipelines included)
- A two to three-week-long training course was provided by the foreign donor (Denmark) when the operation of the plant began. Competitions of the workers at the plant (on the processing method and maintenance work) have been organized as in-house training.

- Although the treatment facilities are covered with plastic sheets as a measure to prevent spread of odor, the effectiveness of the measure is limited.

⑦ Observation

[Overall needs]

- It is necessary to implement the practical training and to select the research and development themes which contribute to solving the specific issues in the area.
- There are some issues to be solved concerning the development of pipelines such as difficulty in collecting sewerage from lowland and the problem of infiltration and inflow.

UCCI of Ho Chi Minh City

① PMU and system for the implementation of sewerage projects

- UCCI employs 80 engineers, who are specialized in project management. UCCI has no sewerage engineer.
- Because WB does not allow outsourcing of the implementation of a project supported by it, UCCI directly supervises implementation of WB-assisted projects.

② Training needs and human resource development

- VSC is an interesting approach and a timely endeavor because the training of workers in the sewerage sector is required everywhere in the country.
- Because many large-scale projects are implemented simultaneously in HCM, there are projects in which roles of participating organizations have not been clearly demarcated.
- The key point in the operation of sewerage systems is the maintenance of developed systems.
- UCCI is not a large organization. Its role is to control water quality by implementing sewerage development projects.
- On-the-job training is used for the human resource development in the sewerage sector. UCCI does not have training programs.
- SCFC was established ten years ago as an organization that had the PMU, sewerage management and training functions.
- Although SCFC is an expert organization, it is not capable of managing sewerage systems.
- UCCI will provide maximum support to VSC. UCCI intends to have its staff participate in the training at VSC. UCCI is willing to accept the request for the dispatch of its staff to VSC as lecturers.

③ Maintenance of the sewerage systems (effective use of sewage sludge)

In response to the detailed explanation of the study on the effective use in Hanoi by the JICA experts:

- UCCI recognizes the disposal of sludge as an important issue.
- The implementation of a similar study in HCM, in addition to Hanoi, is requested.

④ Observation

[Overall needs]

- The number of sewerage engineers is insufficient.
- To share information and to diffuse technology in collaboration with VSC is required.

SCFC of Ho Chi Minh City

① Sewerage projects (Sewerage master plan, state of the development of sewerage systems)

- Sewerage Master Plan (2001), revised Sewerage Master Plan (2010), Flood Control Master Plan (2008)
- To achieve the targets for the development of sewerage systems (55 – 65% of sewage treated by 2020 and 90% or more by 2025)

・ A flood control project of constructing a 150km-long embankment is being implemented as the highest tidal level is expected to rise by 1.32 m by 2020 because of the global warming.
・ There will be shortage of fund to implement sewerage projects against the amount of fund required by 2025 of 50 billion USD, even if the assistance from JICA (5 million USD), WB (4.5 million USD each for sewerage treatment in the period between 2016 and 2020 and flood control), assistance from ADB and the local cost are included.
・ A PPP (of a BOT model) based on the example of the GAMDA Project is considered essential.

② Training needs and human resource development
・ VSC is an interesting approach and a timely endeavor, because the training of workers in the sewerage sector is required everywhere in the country.
・ The scope of VSC may create a possibility of cooperation with HCM. VSC is considered to become an important organization if the local conditions on the matters mentioned below are taken into consideration.
- Technical standards developed with the climate, topography and culture (mindset) of southern Vietnam taken into consideration are useful.
- JICA's assistance to VSC will be for three years. However, the assistance from Japan will be essential after the assistance to VSC has been terminated.
- VSWA/GIZ does not prioritize training. Its main purposes are information sharing and community development. JICA's training for managers and engineers meets the needs of HCM.
- Because the southern region is physically far from Hanoi, the travel expenses (for transportation and daily allowances) required for the participation in training at VSC will be a burden to potential participants. Such measures as establishing a branch office in the southern region and creating a program for training outside the center shall be considered for the benefit of the southern region.
- As private companies are developing, establishment of a system to certify and authorize private companies is considered important.

③ Maintenance of sewerage systems
・ Disposal of three types of sludge (soil dredged from canals, sludge accumulated in septic tanks and sludge generated in the processing of sewerage) is a problem concerning sewerage sludge.
⇒ (The view of the study team) Measures for the disposal of sludge have to be developed with the difference in the states of sludge (organic or biologically-disintegrated sludge) and legal classification of solid waste (household or industrial solid waste) taken into consideration. It is practical to process sewerage sludge and sludge accumulated in septic tanks, which is expected increase with the development sewerage systems, separate from the dredged soil.

④ Observation
[Overall needs]
・ It is necessary to collect the know-how regarding the various management methods of sewerage projects.
・ It is important to implement the training for managers.
・ To develop the sewerage technologies which are appropriate to environmental and socio-economic condition in the area is required.
・ To develop the technology and business techniques for the efficient use of sewerage sludge is an urgent issue.

BIWASE of Bing Duong Province

① Outline of sewerage project and needs for VSC
・ At present, two sewerage treatment plants have been in operation since Thu Dau Mot

Sewerage Plant began its operation in 2013. In addition, a project to construct two plants is in progress and another project for the construction of a plant is in the planning stage. Because 400 to 500 staff will be required for the operation of all these plants, human resource development is a critical issue. BIWASE has a training department. The staff in the departments for the water supply, sewerage and solid waste disposal are being trained systematically by the training department.

② PMU and system for the implementation of sewerage projects

- Three staff are participating in the TOT course of GIZ. They will train other staff when they return from the training.
- Bing Duong Province is located between two large rivers, the Saigon and the Dong Nei, upstream of Ho Chi Minh City. Recent industrialization and urbanization have aggravated the deterioration of the environment in the province. Therefore, water quality control has become an important issue. The separate sanitary sewer system is used for the sewerage systems in the province. The province is expected to need ten sewerage treatment plants in future. Human resource development in the budgetary planning, formulation of a master plan and preparation of documents is required for the construction and operation/maintenance of these plants.
- The functions of VSC are understood. The assistance of JICA and MOC to VSC is appreciated.
- Sewage sludge is recycled as reclamation material and soil amendment (fertilizer) after being transported to a solid waste disposal site.
  (Because the solid waste disposal is one of the duties of BIWASE, a line of command, and a coordination mechanism have been established for the recycling.)

[Problems in the implementation of sewerage projects]

- BIWASE has the problems mentioned below in the sewerage sector because of the lack of experience. Therefore, JICA's assistance in the sector will be appreciated.

③ Training needs and human resource development

- BIWASE has difficulty in improving the management capacity. BIWASE has not been able to reflect consideration of costs and maintainability in plans, designs and execution of projects for the construction of sewerage treatment plants because it does not have sufficient knowledge and expertise.
- It will be necessary to reduce the O&M cost of electrical and mechanical equipment and maintain the equipment in stable condition.
- Education on the prevention of accidents (those caused by lack of oxygen) in the maintenance work is required.
- The utility costs (the costs of electricity and chemicals) are to be reduced.
- Odor control as an environmental protection measure is a concern of the people.

④ Maintenance of sewerage systems

- The cost of installing sewer pipes between plumbing of houses and connection pits of public sewerage systems is high because of the long distances between the pits and the plumbing. The progress of constructing the house connections has been slow because of this high cost. Thu Dau Mot Sewerage Treatment Plant has a processing capacity of 17,600m^3/day, while the volume of inflow in the plant is 50% of this capacity.
- The people throw rubbish in sewers. Because the diameter of sewer pipes in the separate sanitary sewer system is small, the rubbish blocks the pipes. The government has not been able to control this behavior of the people. It is considered necessary to implement awareness creation activities for them on this problem.

- The residents in the coverage area of the sewerage systems drain rainwater into sewer pipes. BIWASE has to take measures against such erroneous connection and infiltration of rainwater in the sewerage systems.
- BIWASE does not have sufficient expertise in the prevention of the blockage (the activities for the people mentioned above), cleaning and maintenance of sewer pipes.
- Because the BOD concentration of the influent is low, the performance of the sewerage treatment plants cannot be fully utilized.
- The sewerage user fee (environment protection fee) is set at l0% of the water fee. The people are not so willing to pay the sewerage user fee.

⑤ Laws and regulations/cost norms

- It is difficult to estimate costs of constructing facilities because cost norms have not been established.
- There is conflict between the standards of water quality of effluent of MONRE, DONRE and MOC. The relationship between cost and water quality of effluent shall be streamlined.
- Guidelines for the installation of drainage facilities have already been formulated.

[R&D Center of BIWASE]

- Inspection teams of 36 provinces visited the center. The center accepted seven staff members of Da Nang City.

⑥ Observation

[Overall needs]

- Towards the expansion of sewerage works, it is necessary to develop human resources on a large scale.
- Since the awareness among the people of the sewerage service is low, implementation of awareness creation activities is required.

[Needs related to the implementation of sewerage projects]

- Know-how on designs, execution of projects and O&M is not fully reflected in writing the business plan.

[Needs related to design and supervision of construction work]

- Knowledge on specification of the facilities and cost estimation is insufficient.

[Needs related to O&M and management]

- Basic knowledge on sewerage and is insufficient. Cost-cutting efforts are needed while maintaining the required function.
- The knowledge on safety is required.

Appendix 8-2 Sewerage Development Status by City

No.	Name of urban cities	Urban Categories	Population	Area	Status of WWTP			
			(People)	(km2)	Plan	Under Design	Under Construction	Running
1	Hanoi	Special	7.095.800 (2014)	3.328,9				○
2	Ho Chi Minh		7.567.700 (2015)	2.095,6				○
3	Hai Phong	Central, Class I	2.103.500 (2015)	1.527,4			○	
4	Da Nang		1.007.700 (2014)	1.285,4				○
5	Can Tho		1.238.300 (2014)	1.409,0				○
6	Hue	Provincial, Class I	354.124 (2015)	71,68			○	
7	Vinh		314.351 (2014)	104,96				○
8	Da Lat		211.696 (2011)	394,64				○
9	Nha Trang		398.751 (2012)	252,6				○
10	Quy Nhon		286.400 (2014)	284				○
11	Buon Ma Thuot		331.262 (2011)	377,18				○
12	Thai Nguyen		306.842 (2015)	170,7		○		
13	Nam Dinh		352.108 (2010)	46,4	○(G)			
14	Viet Tri		283.995 (2013)	111.75			○	
15	Vung Tau		450.000 (2014)	141.1			○	
16	Ha Long		236.972 (2014)	271,95				○
17	Thanh Hoa		411.302 (2015)	146,77			○	
18	My Tho		244.000 (2014)	81,55			○	
19	Bien Hoa		1.104.495 (2015)	264,08	○(F/S)			
20	Long Xuyen	Class II	368.376 (2013)	106,87			○	
21	Hai Duong		253.893 (2013)	71,39				○
22	Phan Thiet		220.560 (2012)	206	○(F/S)			
23	Ca Mau		278.395 (2015)	250,3	○			
24	Tuy Hoa		155.637 (2012)	107		○		
25	Uong Bi		174.678 (2012)	256,3	○			
26	Thai Binh		268.167 (2013)	67,71			○	
27	Rach Gia		223.491 (2013)	104	○			
28	Bac Lieu		190.045 (2014)	175,25	○(F/S)			
29	Ninh Binh		160.166 (2014)	48,36	○			
30	Bac Ninh		272.634 (2013)	82,60				○
31	Thu Dau Mot		271.165 (2014)	118,67				○
32	Dong Hoi		160.325 (2013)	155,71				○
33	Phu Quoc		96.940 (2014)	589,23	○			
34	Vinh Yen		152.801 (2013)	50,80				○
35	Lao Cai		150.368 (2013)	229,67			○	
36	Pleiku		214.700 (2010)	266,61	○			
37	Ba Ria		153.862 (2014)	91,46			○	
38	Bac Giang		185.000 (2014)	66,67				○
39	Phan Rang-Thap Cham		202.315 (2015)	78,90				○
40	Chau Doc		158.787 (2014)	105,29				○
41	Cam Pha		195.800 (2012)	486,45	○(F/S)			
42	Quang Ngai		260.252 (2013)	160,15	○			
43	Tam Ky		110.700 (2012)	107,6		○		
44	Tra Vinh		109.341 (2010)	68,035			○	
45	Bac Kan	Class III	57.800 (2015)	137		○		
46	Ben Tre		231.904 (2016)	71,11	○			
47	Bao Loc		156.866 (2014)	232,2	○			
48	Cam Ranh		123.859(2012)	316	○			
49	Cao Bang		84.421 (2012)	107,6	○			
50	Cao Lanh		161.292 (2009)	107			○	
51	Dong Ha		84,157 (2011)	72,96			○	
52	Dien Bien Phu		48,020 (2009)	64,27			○	
53	Ha Giang		71.689 (2010)	135,33			○	
54	Hoa Binh		94.607 (2014)	148,20		○		
55	Hoi An		92.000 (2012)	614,688		○		
56	Hung Yen		147.275 (2013)	73,42			○	
57	Kon Tum		155.214 (2013)	43.298,15	○			
58	Lai Chau		52.557 (2013)	70,77	○			
59	Lang Son		92.200 (2014)	77,69			○	
60	Mong Cai		100.000 (2013)	516,6	○			
61	Phu Ly		136.654 (2013)	87,87				○
62	Sa Dec		152.237 (2013)	59,81	○			
63	Soc Trang		173.922 (2013)	761,522				○
64	Son La		95.730 (2011)	324,93		○		
65	Song Cong		109.409 (2015)	98,37	○			
66	Tam Diep		104.175 (2015)	104,979				○
67	Tan An		186.612 (2015)	81,94	○			
68	Tay Ninh		153.537 (2013)	140		○		
69	Tuyen Quang		110.119 (2010)	119,17	○			
70	Vi Thanh		190.200 (2014)	118	○			
71	Vinh Long		140.872 (2013)	48,01	○			
72	Yen Bai		95.361 (2013)	108,15	○			
Sub Total					**26**	**8**	**17**	21
Sum Total					**72**			

Appendix 8-3 Results of the Questionnaire Needs Survey (1)

		1	2	3	4	5	6	7	8	9	10
		Province & City									
	Name of Province/City	Hai Phong	Da Nang	Can Tho	Hue	Vinh	Nha Trang	Quy Nhon (Binh Dinh)	Buon Ma Thuat	Viet Tri	Vung Tau
I	Outline of sewerage works										
1)	Status quo of sewerage works										
	No work										
	Planning	Yes	Yes	Yes	Yes	Yes				Yes	
	Designing										
	Construction										
	O&M	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
II	Expectation to sewerage work from residents										
1)	Does residents feel the necessity of the sewerage?										
	Strongly feel										
	Feel	X	X	X	X	X	X	X	X	X	X
	Do not feel much										
2)	Which purpose has higher priority for residents? Please write down the priority.										
	Mitigation of inundation	1	2	1	2	1	2	1	1	1	1
	Improvement of sanitary condition	2	1	2	1	2	1	2	2	2	2
	Improvement of water quality in water b	3	3	3	3	3	3	3	3	3	3
3)	Do you accept to pay user charge?										
	Yes, definitely										
	Yes, if the amount is small	X	X	X	X	X	X	X	X	X	X
	No										
III	Expectation to the Viet Nam Sewerage Center										
1)	Major trouble and problem in sewerage work.										
	Please show us trouble and problem you encountered in implementing sewerage work.										
2)	Expectation to Viet Nam Sewerage Center	Yes	Yes	Yes	Yes	N/A	N/A	Yes	N/A	N/A	Yes
	Training	Yes	Yes	Yes	Yes	N/A	N/A	Yes	N/A	N/A	Yes
	Technical assistance	Yes	Yes	Yes	Yes	N/A	N/A	Yes	N/A	N/A	Yes
	Research and development										
3)	Training										
	What kind of training do you expect to the Viet Nam Sewerage Center? Please write down the priority										
	Planning	Yes, feel	Yes, strong feel	Yes, strong feel	Yes, feel	N/A	N/A	Yes, feel	N/A	N/A	Yes, strong feel
	Design (sewer)	Yes, feel	Yes, strong feel	Yes, strong feel	Yes, feel	N/A	N/A	Yes, feel	N/A	N/A	Yes, strong feel
	Design (treatment plant)	Yes, feel	Yes, do not feel much	Yes, strong feel	Yes, feel	N/A	N/A	Yes, feel	N/A	N/A	Yes, strong feel
	O&M	Yes, strong feel	Yes, feel	Yes, strong feel	Yes, feel	N/A	N/A	Yes, strong feel	N/A	N/A	Yes, feel
	Management	N/A	Yes, strong feel	Yes, strong feel	Yes, feel	N/A	N/A	Yes, strong feel	N/A	N/A	Yes, feel
	Others										
4)	Technical Assistance										
	What kind of assistance do you expect from Viet Nam Sewerage Center? Please write down.										
5)	Research and development										
	What kind of R&D do you think Viet Nam Sewerage Center should conduct? Please write down with reason.										
6)	If there is a pilot training this year, do you want participate to it?										
	Yes	Yes	Yes	Yes	Yes	N/A	N/A	Yes	N/A	N/A	Yes
	No										
7)	What do you expect to Viet Nam Sewerage Center other than above mentioned. Please write down.										

Source: JICA Mission

Appendix 8-3 Results of the Questionnaire Needs Survey (2)

		11	12	13	14	15	16	17	18	19	20
	Name of Province/City	Ha Long	Thanh Hoa	Bien Hoa	My Tho (Tien Giang)	Long Xuyen (An Giang)	Hai Duong	Phan Thiet (Binh Thuan)	Ca Mau	Tuy Hoa (Phu Yen)	Thai Binh
I	Outline of sewerage works										
1)	Status quo of sewerage works										
	No work										
	Planning	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Designing										
	Construction					Yes					
	O&M	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
II	EXpectation to sewerage work from residents										
1)	Does residents feel the necessity of the sewerage?										
	Strongly feel										
	Feel	X	X	X	X	X	X	X	X	X	X
	Do not feel much										
2)	Which purpose has higher priority for residents? Please write down the priority.										
	Mitigation of inundation	2	2	1	1	1	1	1	1	1	1
	Improvement of sanitary condition	1	1	2	2	2	2	2	2	2	2
	Improvement of water quality in water b	3	3	3	3	3	3	3	3	3	3
3)	Do you accept to pay user charge?										
	Yes, definitely										
	Yes, if the amount is small	X	X	X	X	X	X	X	X	X	X
	No										
III	Expectation to the Viet Nam Sewerage Center										
1)	Major trouble and problem in sewerage work.										
	Please show us trouble and problem you encountered in implementing sewerage work.										
2)	Expectation to Viet Nam Sewerage Center	N/A	Yes	N/A	N/A	N/A	Yes	Yes	N/A	Yes	N/A
	Training	N/A	Yes	N/A	N/A	N/A	Yes	Yes	N/A	Yes	N/A
	Technical assistance	N/A	Yes	N/A	N/A	N/A	Yes	Yes	N/A	Yes	N/A
	Research and development										
3)	Training										
	What kind of training do you expect to the Viet Nam Sewerage Center? Please write down the priority										
	Planning	N/A	Yes, strong feel	N/A	N/A	N/A	Yes, strong feel	Yes, feel	N/A	Yes, feel	N/A
	Design (sewer)	N/A	N/A	N/A	N/A	N/A	Yes, strong feel	Yes, feel	N/A	Yes, feel	N/A
	Design (treatment plant)	N/A	N/A	N/A	N/A	N/A	Yes, strong feel	Yes, feel	N/A	Yes, feel	N/A
	O&M	N/A	Yes, strong feel	N/A	N/A	N/A	Yes, strong feel	Yes, strong feel	N/A	Yes, strong feel	N/A
	Management	N/A	N/A	N/A	N/A	N/A	Yes, strong feel	Yes, feel	N/A	Yes, strong feel	N/A
	Others										
4)	Technical Assistance										
	What kind of assistance do you expect from Viet Nam Sewerage Center? Please write down.										
5)	Research and development										
	What kind of R&D do you think Viet Nam Sewerage Center should conduct? Please write down with reason.										
6)	If there is a pilot training this year, do you want participate to it?										
	Yes	N/A	Yes	N/A	N/A	N/A	Yes	Yes	N/A	Yes	N/A
	No										
7)	What do you expect to Viet Nam Sewerage Center other than above mentioned. Please write down.										

Source: JICA Mission

Appendix 8-3 Results of the Questionnaire Needs Survey (3)

		21	22	23	24	25	26	27	28	29	30
	Name of Province/City	Rach Gia (Kien Giang)	Bac Lieu	Ninh Binh	Thu Dau Mot	Dong Hoi (Quang Binh)	Phu Quoc (Kien Giang)	Vinh Yen (Vinh Phuc)	Lao Cai	Ba Ria	Phan Rang
I	Outline of sewerage works										
1)	Status quo of sewerage works										
	No work										
	Planning	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Designing										
	Construction										
	O&M	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
II	Expectation to sewerage work from residents										
1)	Does residents feel the necessity of the sewerage?										
	Strongly feel										
	Feel	X	X	X	X	X	X	X	X	X	X
	Do not feel much										
2)	Which purpose has higher priority for residents? Please write down the priority.										
	Mitigation of inundation	1	1	1	1	1	1	1	1	1	1
	Improvement of sanitary condition	2	2	2	2	2	2	2	2	2	2
	Improvement of water quality in water b	3	3	3	3	3	3	3	3	3	3
3)	Do you accept to pay user charge?										
	Yes, definitely										
	Yes, if the amount is small	X	X	X	X	X	X	X	X	X	X
	No										
III	Expectation to the Viet Nam Sewerage Center										
1)	Major trouble and problem in sewerage work.										
	Please show us trouble and problem you encountered in implementing sewerage work.										
2)	Expectation to Viet Nam Sewerage Center	Yes	N/A	N/A	N/A	N/A	Yes	Yes	N/A	Yes	N/A
	Training	Yes	N/A	N/A	N/A	N/A	Yes	Yes	N/A	Yes	N/A
	Technical assistance	Yes	N/A	N/A	N/A	N/A	Yes	Yes	N/A	Yes	N/A
	Research and development										
3)	Training										
	What kind of training do you expect to the Viet Nam Sewerage Center? Please write down the priority										
	Planning	Yes, feel	N/A	N/A	N/A	N/A	Yes, feel	Yes, feel	N/A	Yes, strong feel	N/A
	Design (sewer)	Yes, feel	N/A	N/A	N/A	N/A	Yes, feel	Yes, feel	N/A	Yes, strong feel	N/A
	Design (treatment plant)	Yes, feel	N/A	N/A	N/A	N/A	Yes, feel	Yes, feel	N/A	Yes, strong feel	N/A
	O&M	Yes, strong feel	N/A	N/A	N/A	N/A	Yes, strong feel	Yes, strong feel	N/A	Yes, strong feel	N/A
	Management	Yes, feel	N/A	N/A	N/A	N/A	Yes, feel	Yes, feel	N/A	Yes, strong feel	N/A
	Others										
4)	Technical Assistance										
	What kind of assistance do you expect from Viet Nam Sewerage Center? Please write down.										
5)	Research and development										
	What kind of R&D do you think Viet Nam Sewerage Center should conduct? Please write down with reason.										
6)	If there is a pilot training this year, do you want participate to it?										
	Yes	Yes	N/A	N/A	N/A	N/A	Yes	Yes	N/A	Yes	N/A
	No										
7)	What do you expect to Viet Nam Sewerage Center other than above mentioned. Please write down.										

Source: JICA Mission

Appendix 8-3 Results of the Questionnaire Needs Survey (4)

		31	32	33	34	35	36	37	38	39
	Name of Province/City	Thap Cham (Ninh Thuan)	Chau Doc (An Giang)	Cam Pha (Quang Ninh)	Quang Ngai	Dien Bien Phu	Hoa Binh	Tra Vinh	Tuyen Quang	Yen Bai
I	Outline of sewerage works									
1)	Status quo of sewerage works									
	No work									
	Planning	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Designing									
	Construction									
	O&M	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
II	EXpectation to sewerage work from residents									
1)	Does residents feel the necessity of the sewerage?									
	Strongly feel									
	Feel	X	X	X	X	X	X	X	X	X
	Do not feel much									
2)	Which purpose has higher priority for residents? Please write down the priority.									
	Mitigation of inundation	1	1	1	1	1	1	1	1	1
	Improvement of sanitary condition	2	2	2	2	2	2	2	2	2
	Improvement of water quality in water b	3	3	3	3	3	3	3	3	3
3)	Do you accept to pay user charge?									
	Yes, definitely									
	Yes, if the amount is small	X	X	X	X	X	X	X	X	X
	No									
III	Expectation to the Viet Nam Sewerage Center									
1)	Major trouble and problem in sewerage work.									
	Please show us trouble and problem you encountered in implementing sewerage work.									
2)	Expectation to Viet Nam Sewerage Center	N/A	N/A	N/A	no	N/A	N/A	Yes	N/A	N/A
	Training	N/A	N/A	N/A	no	N/A	N/A	Yes	N/A	N/A
	Technical assistance	N/A	N/A	N/A	no	N/A	N/A	Yes	N/A	N/A
	Research and development									
3)	Training									
	What kind of training do you expect to the Viet Nam Sewerage Center? Please write down the priority									
	Planning	N/A	N/A	N/A	no	N/A	N/A	Yes, strong feel	N/A	N/A
	Design (sewer)	N/A	N/A	N/A	no	N/A	N/A	Yes, strong feel	N/A	N/A
	Design (treatment plant)	N/A	N/A	N/A	no	N/A	N/A	Yes, strong feel	N/A	N/A
	O&M	N/A	N/A	N/A	no	N/A	N/A	Yes, strong feel	N/A	N/A
	Management	N/A	N/A	N/A	no	N/A	N/A	Yes, strong feel	N/A	N/A
	Others									
4)	Technical Assistance									
	What kind of assistance do you expect from Viet Nam Sewerage Center? Please write down.									
5)	Research and development									
	What kind of R&D do you think Viet Nam Sewerage Center should conduct? Please write down with reason.									
6)	If there is a pilot training this year, do you want participate to it?									
	Yes	N/A	N/A	N/A	no	N/A	N/A	Yes	N/A	N/A
	No									
7)	What do you expect to Viet Nam Sewerage Center other than above mentioned. Please write down.									

Source: JICA Mission

Appendix 8-4 List of Course Participants of TOT Training by GIZ

Name of selected participants	ĐT	email	people come from
Nguyen Văn Nam - Architechtura University of Hanoi	Confidential information (telephone numbers and email addresses of the participants)		Hanoi
Nguyễn Văn Thái -Bắc Ninh WSSCo			Bac Ninh
Nguyễn Đình Hải - Construction colledge(trường trong Hà Đông)			Hanoi
Lê Thị Minh Nga- Construction colledge (trường trong Hà Đông)			Hanoi
Diệp Nguyên Thịnh - Wastewater and Drainadge Company of HCM city			TP HCM
Nguyễn Quang Khải -Wastewater and Drainadge Company of HCM city			TP HCM
Phạm văn Ga Lăng - Can Tho WWCo			Can Tho
Trần Nguyến Thị Kim Thoa -Can Tho WWCo			Can tho
Đào Duy Khơi - Westen Construction University			Vinh Long
Nguyễn Minh Đức - Irrigation Uni			Hanoi
Nguyễn Việt Hương - Hà Nội waste water and drainage comp			Hanoi
Nguyễn Hồng Phong - Hà Nội waste water and drainage comp			Hanoi
Lê Nhân - BIWASE Bình Dương WWCo			Binh Duong
Phạm Thành Đạt- Director of Training Centre, Colledge of Urban Works Construction			Hanoi
Đinh Quang Hiệp - Deputy Director of Training Centre, Colledge of Urban Works Construction			Bac Ninh
Nguyễn Thế Hùng - Construction University - central region branch			Phú Yên
Phan Lê Minh Hoàng - Urban Enrivonmental company of Thua Thien Hue province			Hue
Nguyễn Thị Kim Oanh, wastewater and drainage company of Hai Phong			Hai Phong
Nguyen Van Phong, wastewater and drainage company of Hai Phong			Hai Phong
Nguyen Ba Tuyen, wastewaterand drainage company of Thai Nguyen			Thai Nguyen
Nguyễn Phúc Hải -deputy director general of Vung Tau water supply and wastewater company			Vung tau
Trần Trung Sinh deputy director general of Vung Tau water supply and wastewater company			Vung tau
Trần Thị Việt Nga -ĐHXD			Hanoi
Phạm Tuấn Hùng - ĐHXD			Hanoi
Nguyễn Việt Anh -ĐH XD			Hanoi
Nguyễn Hồng Sâm			Hanoi

Appendix 8-5 Major Field of Course Participants of TOT Training by GIZ

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
	1	2	3	4	5	6	7	9	13	14	15	19	22	23	24	26	
	Pham Van Ga Lang	Tran Nguyen Kim Thoa	Diep Nguyen Thinh	Nguyen Quang Khai	Nguyen Dinh Hai	Le Thi Minh Nga	Dao Duy Khoi	Dinh Quang Hiep	Nguyen Van Nam	Nguyen Minh Duc	Phan Le Minh Hoang	Nguyen Van Thai	Nguyen Viet Anh	Nguyen Thi Hong Sam	Tran Quoc Vinh	Tran Thi Luu	
Outline of sewage works		○	○		○	○	○	○	○	○	○	○	○		○		
Administration			○														
Ordiance/ regulation in local municipality							○	○				○			○		
Public relation and public hearing							○	○				○					
Management			○														
Asset management		○				○	○	○				○			○	○	
Urban drainage management	○				○	○	○	○			○	○	○		○		
Finance																	
User charge system						○	○							○	○	○	
Sewerage and drainage planning	○		○							○		○	○				
Sewer design			○														
Desing of sewer cross section	○				○		○		○		○		○				
Design of microtunneling (pipe jacking method)					○		○										
Wastewater treatment plant design			○														
Basic for biological treatment process				○			○		○	○			○		○		
Design of mechanical equipment													○				
Design of electrical equipment																	
Procurement and construction supervision			○		○		○										
Operation and maintenance			○														
Sewer inspection, cleaning, repair and rehabilitation	○				○		○		○		○	○	○		○		
Pumping facility							○		○			○	○		○		
Wastewater treatment facility				○			○		○	○		○	○		○		
Water quality analysis							○		○	○		○	○				
Sludge treatment, disposal and reuse		○		○			○	○	○	○		○	○		○		

Appendix 8-6 Curriculum and Lecturers for Pilot Training

The First Pilot Training (Manager Course)

Curriculum for the First Pilot Training

Date	Time	Lecture	Outline of lecture	Lecturer
8 Aug. (Mon)	15:00- 17:00-	Move to CUWC Registration Welcome party	(provided by JICA study team)	(MC by CUWC)
9 Aug. (Tue)	8:30- 8:45 - 9:00	Textbook delivery Opening ceremony	Opening speech by MOC and JICA	(MC by CUWC)
	9:00 - 9:30	Orientation	Orientation of the program, objectives & targets, introduction of VSC	JICA Expert (Mr. Kawai)
	9:30 - 9:45	Tea Break		
	9:45 - 11:30	Introduction to sewage works	Outlines of sewage works and background (Japan and Vietnam), including recommendation to Vietnam	JICA Expert (Mr. Kawai), ATI (Ms. Thao Huong)
	11:30-13:30	Lunch		
	13:30-14:30	Administrative systems for sewage works (*)	Introduction of administration / regulation system for sewage works	JICA Expert (Mr. Inoue), ATI (Dr. Mai Huong)
	14:30-14:45	Tea Break		
	14:45-15:45	Financial system for sewage works	Introduction of financial system in sewage works (water tariff/user charge)	JICA Expert (Mr. Inoue) and GIZ (Mr. Tim, & Ms. Ngoc)
	16:00-17:00	Discussion (1)	Wrap-upping for needs/scope of VSC	All lecturers
10 Aug. (Wed)	8:30-10:00	Sewage work planning (1)	Master planning of sewage works development (experience in Japan), and life cycle of sewage works	JICA Expert (Mr. Fujimoto)
	10:00-10:15	Tea Break		
	10:15-12:00	O&M of Sewerage system	Efficient O&M of sewerage system	JICA Expert (Dr. Kim), HSDC in Hanoi (Ms. Nga)
	12:00-13:30	Lunch		
	13:30-14:30	Public relation and hearing	Public relation, public hearing and citizen participants in sewage works	JICA Expert (Mr. Kohama), GIZ (Mr. Hiep)
	14:30-14:45	Tea Break		
	14:45-16:45	Discussion (2)	Summarizing training course/Lesson learned	All Lecturers
	16:45-17:15 17:15-	Closing ceremony Farewell party	Speech by MOC, JICA and CUWC. Certification presentation (provided by CUWC)	(MC by CUWC) (MC by CUWC)
11 Aug. (Thu)		Leave from CUWC		

List of Lecturers of the First Pilot Training

Lecture	Japanese side	Vietnamese side
Introduction to sewage works	Mr. KAWAI	Ms. Thao Huong, MOC
Administrative system for sewage works	Mr. INOUE	Dr. Mai Huong, MOC
Financial system for sewage works	Mr. INOUE	Mr. Tim and Ms. Ngoc, GIZ
Sewage works development planning	Mr. FUJIMOTO	
Sewerage system control	Dr. KIM	Ms. Nga, HSDC
Public relation and hearing	Mr. KOHAMA	Mr. Hiep, GIZ

Curriculum for the Second Pilot Training (Sewage Planning and Pipeline Course)

Date	Time	Lecture	Outline of Lecture	Lecturer
14 Nov (Mon)		Move to CUWC		
	15:30-	Reception		
15 Nov (Tue)	8:30-	Textbook delivery		
	8:45-9:00	Opening ceremony	Opening speech by MOC and JICA	(MC by CUWC)
	9:00-9:30	Orientation	Explanation of outline of the training	Mr. Kawai
	9:30-9:45	Tea Break		
	9:45-12:00	Introduction to Sewage Works	Outlines of sewage works and background	MOC (Ms. Thao Huong), Mr. Kawai
	12:00-13:30	Lunch		
	13:30-14:35	Outlines of Sewage Planning	Explanation of sewage planning and stormwater management	Mr. Hayashi, Hanoi PMB (Ms. Giang)
	14:35-14:55	Tea Break		
	14:55-16:00	Outlines of Sewage Planning	Explanation of sewage planning and stormwater management	Mr. Hayashi, Hanoi PMB (Ms. Giang)
	16:00-17:00	Discussion	Review/Wrap-up of lesson learned	All lecturers
	17:00-	Welcome party	(Provided by JICA study team)	(MC by CUWC)
16 Nov (Wed)	9:00-10:05	Planning and design of sewer	Outline of planning and design of sewer	Mr. Hayashi
	10:05-10:25	Tea Break		
	10:25-12:00	Planning and design of sewer	Outline of planning and design of sewer	Mr. Hayashi
	12:00-13:30	Lunch		
	13:30-14:35	Construction and O&M of sewer	Outline of construction, cleaning, inspection, repairing, replacement	Mr. Thanh (VCC), Mr. Iida
	14:35-14:55	Tea Break		
	14:55-16:00	Construction and O&M of sewer	Outline of construction, cleaning, inspection, repairing, replacement	Mr. Iida
	16:00-17:00	Discussion	Review/Wrap-up of lesson learned	All lecturers

17 Nov. (Thu)	8:00	Lv. CUWC		
	9:00-11:00	Site visit of secondary concrete products plant	Site visit of concrete pipe plant	SONG DAY Company
	11:30-12:30	Lunch		
	12:30-15:00	Move to Hai Phong		
	15:00-16:30	Site visit of sewer construction site	Site visit of sewer & wastewater treatment plant construction sites	(Hai Phong PMU)
	16:30-18:30	Move from Hai Phong to CUWC		
18 Nov. (Fri)	8:00-8:45	Public relation and public hearing in sewage works	Introduction of public relation, public hearing and citizen participants in sewage works	Mr. Kohama
	8:45-9:00	Tea Break (Showing DVD related to public relation)		
	9:00-9:45	Public relation and public hearing in sewage works	Introduction of public relation, public hearing and citizen participants in sewage works	Mr. Kohama
	9:45-13:30	Attend 40 years Anniversary Ceremony of CUWC & Party with Farewell party provided by CUWC, MC by CUWC		
	13:30-14:35	Final Discussion	Discussion about overall program	All lecturers
	14:35-14:55	Tea Break		
	14:55-16:30	Final Discussion	Discussion about overall program	All lecturers
	16:30-17:00	Closing ceremony	Speech by MOC, JICA and CUWC, Certification presentation	(MC by CUWC)
19 Nov (Sat)		Leave from CUWC		

Curriculum for the Second Pilot Training (Wastewater Treatment Course)

Date	Time	Lecture	Outline of Lecture	Lecturer
14 Nov (Mon)		Move to CUWC		
	15:30-	Reception		
15 Nov (Tue)	8:30-	Textbook delivery		
	8:45-9:00	Opening ceremony	Opening speech by MOC and JICA	(MC by CUWC)
	9:00-9:30	Orientation	Explanation of Outline of the training	Mr. Kawai
	9:30-9:45	Tea Break		
	9:45-12:00	Introduction to Sewage Works	Outlines of Sewage Works and background	MOC (Ms. Thao Huong), Mr. Kawai
	12:00-13:30	Lunch		
	13:30-14:35	Outlines of Wastewater treatment	Principle of wastewater treatment and process selection method	CUWC (Ms. An), Dr. Kawaguchi
	14:35-14:55	Tea Break		
	14:55-16:00	Outlines of Wastewater treatment	Principle of wastewater treatment and process selection method	Dr. Kawaguchi
	16:00-17:00	Discussion	Review/Wrap-up of lesson learned	
	17:00-	Welcome party	(Provided by JICA study team)	(MC by CUWC)

16 Nov (Wed)	9:00-10:05	Design of mechanical equipment in wastewater treatment plant	Outline for designing mechanical equipment in wastewater treatment plant	CUWC (Mr. Liem), Mr. Suzuki
	10:05-10:25	Tea Break		
	10:25-11:30	Design of mechanical equipment in wastewater treatment plant	Outline for designing mechanical equipment in wastewater treatment plant	Mr. Suzuki
	11:30-13:00	Lunch		
	13:00-14:35	Design of Electric equipment in wastewater treatment plant	Outline of roles and design for electric equipment in wastewater treatment plant	Mr. Kaneko
	14:35-14:55	Tea Break		
	14:55-16:30	Outline of O&M of wastewater treatment plant	Outline for O&M of wastewater treatment plant	Dr. Kim, HSDC (Ms. Nga)
	16:00-17:00	Discussion	Review/Wrap-up of lesson learned	
17 Nov. (Thu)	8:30	Lv. CUWC		
	9:30-11:30	Site visit of Truc Bach wastewater treatment plant	Site visit of A2O process treatment plant	HSDC
	11:30-12:30	Lunch		
	12:30-14:00	Move to Bac Giang		
	14:00-16:00	Site visit of Bac Giang wastewater treatment plant	Site visit of AO treatment plant	Bac Giang
	16:00-17:00	Move from Bac Giang to CUWC		
18 Nov. (Fri)	8:00-8:45	Public relation and public hearing in sewage works	Introduction of public relation, public hearing and citizen participants in sewage works	Mr. Kohama
	8:45-9:00	Tea Break (Showing DVD related to public relation)		
	9:00-9:45	Public relation and public hearing in sewage works	Introduction of public relation, public hearing and citizen participants in sewage works	Mr. Kohama
	9:45-13:30	Attend 40 years Anniversary Ceremony of CUWC & Party with Farewell party provided by CUWC, MC by CUWC		
	13:30-14:35	Final Discussion	Discussion about overall program	All lecturers
	14:35-14:55	Tea Break		
	14:55-16:30	Final Discussion	Discussion about overall program	All lecturers
	16:30-17:00	Closing ceremony	Speech by MOC, JICA and CUWC, Certification presentation	(MC by CUWC)
19 Nov. (Sat)		Leave from CUWC		

List of Lecturers of the Second Pilot Training

Lecture	Japanese side	Vietnamese side
Introduction to sewage works	Mr. KAWAI	MOC (Ms.Thao Huong)
Outlines of Sewage Planning	Mr. HAYASHI	Hanoi PMB（Ms. Giang)
Planning and design of sewer	Mr. HAYASHI	
Construction and O&M of sewer	Mr. IIDA	VCC (Mr. Thanh)
Public relation and public hearing in sewage works	Mr. KOHAMA	
Outlines of Wastewater treatment	Dr. KAWAGUCHI	CUWC (Ms. An)
Design of mechanical equipment in wastewater treatment plant	Mr. SUZUKI	CUWC (Mr.Liem)
Design of Electric equipment in wastewater treatment plant	Mr. KANEKO	
Outline of O&M of wastewater treatment plant	Dr. KIM	HSDC (Ms. Nga)
Discussion facilitator in sewer course	Mr. INOUE	
Discussion facilitator in treatment course	Mr. KAWAI	

Appendix 8-7 Training Course

No.1 Manager Course

Target： Manager class staff of PC, DOC, DPI, PMU in all provinces/cities and private sector

Goal: Understand the sewage works basics

Day	Day of the week		Lecture title	Details	Lecturer
1	Mo n	A.M.	Move to CUWC		
		P.M.	Registration, Opening Ceremony, Orientation		
2	Tue	A.M.	Sewage Works Basics	General Information of sewage works	ATI/MOC
		P.M.	Sewage Works Administration (Regulations, etc.)	Sewage works regulations and administrative organizations in Vietnam, Know-how on promotion of sewage works	ATI/MOC
3	Wed	A.M.	Sewage Works Master Plan	General Information of Sector Master Plan	ATI/MOC
		P.M.	Sewage Works Management (user charge)	Sewerage user charge and sewage works management	GIZ
4	Thu	A.M.	Sewage Works O&M	Importance of O&M	HSDC/Hanoi
		P.M.	Visit Sewerage facilities(STP, Pumping station)	Visit actual Sewerage facilities	
5	Fri	A.M.	Public Relations, Public Hearings	Explanation to citizens about needs and importance of sewage works to the community	GIZ
		P.M.	Final Discussion, Closing ceremony		

No.2 Sewerage Planning Course

Target： Manager class staff and engineers of PC, DOC, DPI, PMU in all provinces/cities and private sector

Goal:
- Obtain the basic knowledge on sewage works planning
- Become to make an appraisal and monitoring on sewage works planning

Day	Day of the week		Lecture Title	Details	Lecturer
1	Mon	A.M.	Move to CUWC		
		P.M.	Registration, Opening ceremony, Orientation		
2	Tue	A.M.	Overview of General Master Plan	Regulations relating to Urban Structure Planning	VIUP/MOC

		P.M.	Outline of Sector Master Plan	Procedure of Sewage Works Planning	ATI/MOC
3	Wed	A.M.	Sewage Works Administration	Outline of Decree 80 and sewage works administration	ATI/MOC
		P.M.	Planning of sewer and pumping station	Planning method of sewer and pumping station	VCC
4	Thu	A.M.	Outline of STP	Function of STP, Outline of treatment methods	CNEE/CUWC
		P.M.	Visit wastewater facilities(STP, Pumping station)	Visit actual wastewater facilities	
5	Fri	A.M.	Sewage Works Management (user charge)	Sewerage user charge and sewage works management	GIZ
		P.M.	Final Discussion, Closing Ceremony		

No.3 Engineer Course (Sewer)

Target： Engineers of PMU in provinces/cities that are under design, under construction or completed, and private sector

Goal：
- Obtain a basic knowledge of sewer design
- Become to make an appraisal and monitoring on planning, design and construction of sewer

Day	Day of the week		Lecture Title	Details	Lecturer
1	Mon	A.M.	Move to CUWC		
		P.M.	Registration, Opening ceremony, Orientation		
2	Tue	A.M.	Sewage Works Basics	General information of sewage works, regulations and legal procedure	ATI/MOC
		P.M.	Planning of sewer and pumping station	Planning method of sewer and pumping station	VCC
3	Wed	A.M.	Sewer Design	Sewer design method	VCC
		P.M.	Sewer Construction	Sewer construction method, supervision and inspection	VCC
4	Thu	A.M.	Visit Sewer Construction Site	Visit sewer construction site	
		P.M.	Selection of Soil retaining Works	General Information of soil retaining works required for open-cut method	VCC
5	Fri	A.M.	O&M of Sewer Facilities	Outline of O&M of sewer facilities	HSDC/Hanoi
		P.M.	Final Discussion, Closing Ceremony		

No.4 Engineer Course (Sewage Treatment Plant Design

Target: Engineers of PMU in provinces/cities that are under design or under construction, and private sector

Goal： • Obtain the basic knowledge on STP design
• Become to make an appraisal and monitoring on planning and design of sewage treatment plant

Day	Day of the week		Lecture Title	Details	Lecturer
1	Mon	A.M.	Move to CUWC		
		P.M.	Registration, Opening ceremony, Orientation		
2	Tue	A.M.	Sewage Treatment Overview	Principle of wastewater treatment and basic design	CNEE/CUWC
		P.M.	Sludge Treatment Overview	Principle of sludge treatment and basic design	CNEE/CUWC
4	Wed	A.M.	Visit STP	Visit actual STP	
		P.M.	Point to Consider for STP Design	Overview of point to consider for STP design	VCC
5	Thu	A.M.	Practical Water Quality Management	Explanation of the importance of water quality management	HSDC/Hanoi
		P.M.	Water Quality Measurement Practice	Practice of water quality measurement with portable device	HSDC/Hanoi
10	Fri	A.M.	O&M of STP	General information of O&M of STP	HSDC/Hanoi
		P.M.	Final Discussion, Closing Ceremony		

No.5 New Technology Course (Pipe Jacking Method)

Target： Manager class staff and engineers of PC, DOC, DPI, PMU in all provinces/cities and private sector

Goal: • Obtain the basic knowledge on sewer pipe jacking methods (SUISHIN)
• Become to make an appraisal and monitoring on planning/design of sewer pipe jacking methods

Day	Day of the week		Lecture Title	Details	Lecturer
1	Mon	A.M.	Move to CUWC		
		P.M.	Registration, Opening ceremony, Orientation		
2	Tue	A.M.	Sewage Works Administration	Outline of Decree 80 and sewage works administration	ATI/MOC
		P.M.	Overview of	Outline of wastewater	Japanese

			wastewater collection systems	collection system and prefabricated manhole	expert
3	Wed	A.M.	Outline of pipe jacking methods and selection of suitable methods	Describe feature of pipe jacking methods, important point of selection methods	Japanese expert
		P.M.	Design and construction of soil improvement method	Describe chemical grout and important point for implementation	Japanese expert
4	Thu	A.M.	Design of pipe jacking methods	Field investigation for design, selection of pipe type and jacking methods	Japanese expert
		P.M.	Visit Sewerage facilities	Visit actual Sewerage facilities	
5	Fri	A.M.	Design practice of pipe jacking methods	Primitive design practice of pipe jacking methods	Japanese expert
		P.M.	Final Discussion, Closing Ceremony		

*This training course will be conducted at Ho Chi Minh City in 2017, and at Hanoi City from 2018.

Appendix 8-8 Outline of CUWC

GENERAL INTRODUCTION OF URBAN WORKS CONSTRUCTION COLLEGE

I. FACILITIES AND DEVELOPMENT PROCESS

1.1. The material facilities

The College locates in Yen Thuong, Gia Lam, Hanoi with the total area of 5.1 ha. With spacious campus, the College offers complete and beautiful view. The branch of college in Hue city with the area of more than 4ha has been put into operation and is being upgraded.

A combination of buildings serving for completed training courses at all levels from workers, middle level technicians to engineers at college level includes lecture halls, libraries, workshops, a water treatment plant, a wastewater treatment plant, a miniature city water supply network, water meter assembling and testing workshop , pipeline installation yards, park systems, lakes, trees, lightings, a modern automation and compressor lab etc.

The college offers advanced curriculum and qualified teachers trained domestic and abroad.

In particular, Water & Environment Training Centre, Foreign Languages and Informatics Center, Consulting and Labor Exporting Centre and Vietnam-German Construction Training Centre hold a key role in training, technology development and International cooperation.

1.2. Development process

College of Urban Works Construction under the Ministry of Construction was established in 2004 on the basis of Construction Vocational Teacher Training School.

Achievements and Awards:

- 01 first class Labor Medal;
- 01 second class Labor Medal;
- 01 third class Labor Medal;
- 01 emulation flag from the Government;
- 02 certificates of merit from the Government;
- 01 emulation flag from the Ministry of Construction;
- 01 emulation flag for pure and strong Party in five consecutive years (2000-2004) from Hanoi Party Committee;
- 13 consecutive years of being recognized by Gia Lam Party Committee as the pure and strong Party;
- 01 emulation flag from the General Confederation of Labor, Vietnam; many merits from ministries, localities and mass organizations for collective and individual achievements.

II. TRAINING STRUCTURE

2.1. Courses at college level and pre-intermediate level, includes

- Construction technology (civil and industrial construction majors) at;
- Construction Technology Teaching at College level;
- Water supply and drainage at college level and pre-intermediate level;
- Electrical Engineering Technology (urban electricity major) at college and pre-intermediate level;
- Applied Information Technology (Administration data processing of urban construction major) at College level;
- Construction Management (Construction Economics major) at college level;
- Engineering Geodesy (Engineering Geodesy major) at college level.

2.2. Vocational training courses at vocational and college level

- Water supply drainage;
- Civil Electrical;
- Industry Electric;
- Welding;
- Construction skills (bricklaying, carpentry, steel rod welding ...);
- Urban verdure management;
- Urban management;
- Waste treatment.

2.3. Advanced training courses

- Re-training and improving skills and techniques for staffs, teachers and workers;
- Short-term training courses on professional skills for technicians and workers from water supply and drainage companies, domestic and abroad urban environment firms.

2.4. Oriented training and education

- Orientation training courses, foreign languages courses for workers who want to work in foreign countries (South Korea, the Middle East, Malaysia, ...);
- Training team for Asean skills competition.

Source: CUWC Website
http://www.cuwc.edu.vn/EnTintuc.aspx?page=en_thongbaochitiet&idtintuc=365&madonvi=26&manoidung=2601

Appendix 8-9 Outline of CNEE

I.CNEE PROGRAMS

Course Name	Target:	Content:
Operation of water treatment station	- Basic understanding about water supply system, safety water supply plan, water loss prevention, customer service, water tariff, labor safety of O&M - Knowing well the water treatment technology which is under operation - Knowing how to operate, maintain equipment of the system and form a safety water supply plan.	I. Overview of water supply system II. Water loss and solution III. O&M of water treatment work IV. O&M of pumping station V. Power of PS VI. Chemical for water treatment
Water loss prevention	- Basic understanding about water supply system, safety water supply plan, water loss prevention - Planning water loss prevention - Survey of leaking - Using leaking detection equipment well	I. Overview of water supply system II. Revenue Enhancement III. Overview of safety water supply IV. Water loss and prevention V. Water loss prevention
Pipe installation	Basic understanding about water supply system, safety water supply plan, water loss prevention, customer service, water tariff, labor safety of pipe construction and installation - Can describe water supply network which under operation - Can install all kind of pipes - Installation of water measurer for households - Can read the specification of the water measurer and knowing water measurer testing procedure.	I. Overview of water supply system II. Water loss and solution III. Water supply pipe installation IV. Appurtenances processing V. Water measurer
Customer service	- Basic understanding about water supply system,Knowing well the water treatment technology which is under operation - Supplementing basic knowledge of position and importance role of customer - Understanding why have to improve customer service - Having expertise and needed skills to communicate with customer as well as professional behaviour with customer - Accurately reading all kind of water measurer aiming at water loss decrease.	I. Overview of water supply system II. Waster loss and solution III. Customer communication skills IV. Communication and behaviour with customer in collection/recording work V. Receiving and dealing with customer's information VI. Evaluation of customer's satisfaction VII. Recording parameter of water measurer VIII. Collection of water fee and checking of debt IX. Water measurer

Course Name	Target:	Content:
Inspection	- providing basic knowledge about water supply, water measurer, water loss management. - Providing basic knowledge on communication skill - Providing document, decree to trainee and based on that trainee can find and analyze violation and knowing how to deal with.	
Water quality management	- Proficiently using sampling equipment - Can form a plan of sampling according to the regulation - Proficiently using chemical dosage for water treatment - Can define 15 indicators A and other such as: Amoni, TDS, EC.... - Proficiently operating jarrtest, spectrograph, pipet washer, water distiller.. - Can prepare chemical following the process of respective indicator analysis. - Recording, managing analyzed test result correctly.	I. Overview of water supply system II. Overview of water and fresh water supply standard III. Flocculate IV. Instruction of liquid preparation V. Parameter of water quality assessment and analyzing method VI. Practicing VII. Sampling, preserving, supervising water quality
Equipment O&M	- Enhancing experience exchange between water supply companies - O&M of equipment following the process - Can install control and protection circuits of pump	I. Overview of water supply system II. Equipment O&M on the network III. O&M of pump and pumping station IV. O&M of electric equipment V. Installation

II. LECTURERS

No	Lecture Name	Speciality	Position	Years of experience
I	**Main lecturers**			
1	Pham Thanh Dat	Master of water supply and sewage and environment	Acting director	14
2	Vu Thi Hoai An	Master of water supply and sewage and environment	Vice director	17
3	Dinh Quang Hiep	Engineer of watet supply and sewage	Lecturer	25
4	Duong NGoc Anh	Degree of water supply and sewage and environment	Lecturer	7
5	Nguyen Thi Bich Lien	Master of water, environment, oceanography	Lecturer	5
6	Le Nho KHanh	Diploma of automatic electricity	Lecturer	20
7	Tran Thi Thu Huong	Diploma of accounting	Staff	3
8	Nguyen Thi Thanh Mai	Degree of Chemistry	Officer	
II	**Lecturer of CUWC**			
1	Hoang Quoc Liem	Master of water supply and sewage and environment	Dean of Urban technical,Head of Department of water supply and sewage	17

2	Thach Thanh Minh	Master of water supply and sewage and environment	Vice director of Center of construction consultation	16
3	Khuong Hai Yen	Master of water supply and sewage and environment	Lecturer	15
4	Vu Thi Thu HIen	Master of water supply and sewage and environment	Lecturer	15
5	Nguyen Quoc Tam	Master of automatic electricity	Associate Dean of technology	13
6	Nguyen Van Minh	Master of law, labor safety	Ass Dean	15
7	Nguyen NGoc Nam	Engineer of water supply and sewage	Lecturer	22
8	Bui Thi Van	Degree of Chemistry	Lecturer	25
9	NguyenVan Toi	Degree of welding	Lecturer	28
III	**Occasional lecturers**			
1	Tran Duc Ha	Ass Prof, Phd of water supply and sewage and environment	Former head of Department of CTN and environment, University of Construction	35
2	Nguyen Viet Anh	Ass Prof, Phd of water supply and sewage and environment	Former head of Department of CTN and environment, University of Construction	20
3	Nguyen Van Tin	Ass Prof, Phd of water supply and sewage	University of Construction	35
4	Nghiem Van Khanh	Phd of water supply and sewage and environment	Ass dean of technical infrastructure- University of architecture	12
5	Nguyen Xuan Quyet	MBA of water supply and sewage	Director of Bac Ninh sewage JSC	14
6	Nguyen Trieu Duong	MBA of water supply and sewage	Vietnam Academy of Science and technology	17
7	Nguyen Bang Giang	MBA of Chemistry	Vietnam Academy of Science and technology	25
8		MBA of water supply and sewage	Director of Dong Anh water plant	15
9	Nguyen Xuan Dai	MBA of water supply and sewage	Director of design factory- Fresh water No2 JSC, Hanoi	16
10	Ngo Van Duc	MBA of water supply and sewage	Manager of Planning Dept,Fresh water No2 JSC, Hanoi	

III. TRAINING EXPERIENCE

No	Program	Investor	Time	Remark
1	Enhancement of water supply company	France-Vietnam Technical cooperation project	1997-2004	Water supply and sewage companies in Vietnam
2	Operation of treatment station, pumping station; installation of pipe, analysis of water quality	Water supply and sewage companies in Vietnam	1997-now	Annual training contract,
3	O&M of water supply work for towns	Program of water and sanitation in towns, Vietnam	2010	Program of water and sanitation in towns, Vietnam
4	O&M of urban fresh water supply works	PMU of water supply,sanitation and rural health	2010	Project of water supply, rural health
5	Basic skill training on O&M in WWTP	Wastewater management project-MOC	2011	Wastewater management project-MOC
6	Basic skill training on O&M in WWTP	Wastewater management project-MOC	2011	Wastewater management project-MOC
7	O&M of water supply works for towns, rural in Vietnam	PMU of fresh water supply and Thai Binh rural sanitation	2012	Fresh water supply and Thai Binh rural sanitation project
8	O&M of water supply works for rural	PMU of fresh water supply and Hai Duong rural sanitation	2013	Fresh water supply and Hai Duong rural sanitation project
9	Operation of water treatment work	PMU of fresh water supply and rural sanitation	2013	Fresh water supply and sanitation project
10	O&M of water supply works for towns, rural in Vietnam	PMU of fresh water supply and Thai Binh rural sanitation	2013	Fresh water supply and Thai Binh rural sanitation project
11	Operation of water treatment work	PMU of fresh water supply and rural sanitation, funded by WB, Nam Dinh provine	2013	Fresh water supply and rural sanitation project, funded by WB, Nam Dinh provine
12	Operation of water treatment work	PMU of fresh water supply and rural sanitation, funded by WB, Nam Dinh provine	2013	Fresh water supply and rural sanitation project, loan from WB, Nam Dinh provine
13	Operation of water treatment work	PMU of fresh water supply and rural sanitation, funded by WB, Nam Dinh provine	2013	Fresh water supply and rural sanitation project, loan from WB, Nam Dinh provine
14	O&M of water supply works for towns, rural in Vietnam	PMU of fresh water supply and Thai Binh rural sanitation	2013	Fresh water supply and Thai Binh rural sanitation project
15	O&M of water supply system for small town in Vietnam	Water and sanitation program for small towns in Vietnam	2013	Water and sanitation program for small towns in Vietnam
16	O&M, loss prevention, work management, water supply system finance management for rural centralized water supply stations.	National program of fresh water and rural sanitation for 8 provinces in Hong river delta	2015	National center of fresh water and rural sanitation, MONRE

CUWC
CNEE

Phụ lục 1

SUMMARY OF WORKING RESULT IN 8 MONTHS OF 2016

A. GRENEAL RESULT

No	Content	Number of trainee	Contract Value	Settlement Value	Received fund	Remaining fund	Expense	Revenue	Remark
I	Acitivities of training, fostering	331	926,950,000	926,950,000	810,950,000	116,000,000	601,625,502	325,324,498	
II	Cooperation project	212	1,527,516,750	1,371,073,750	1,274,668,750	96,405,000	1,131,426,000	239,647,750	
	Total	**543**	**2,454,466,750**	**2,298,023,750**	**2,085,618,750**	**212,405,000**	**1,733,051,502**	**564,972,248**	

B. DETAIL RESULT

No	Content	Pursuant to legal document	Counterpart	Time	Venue	Number of trainee	Contract Value	Settlement Value	Received fund	Remaining fund	Expense	Revenue	Remark
I	**Acitivities of training, fostering**					**331**	**926,950,000**	**926,950,000**	**810,950,000**	**116,000,000**	**601,625,502**	**325,324,498**	
1	Fostering of recording monthly water supply bill/data and operation	722015/ HDDT	Certificate	01/01/2016 - 29/01/2016	CUWC	4	12,000,000	12,000,000	12,000,000	0	0	12,000,000	
2	Fostering of Chemical testing	04A2016/ HDDT	Chemical certificate	10/2/2016 - 10/3/2016	CUWC	1	8,000,000	8,000,000	8,000,000	0	3,630,000	4,370,000	
3	Level upgrade of recording monthly water supply bill/data and operation	052016/ HDDT	KDNS Co,ltd Nam Dinh	21/03/2016 - 26/3/2016	CUWC	94	188,000,000	188,000,000	188,000,000	0	154,586,000	33,414,000	
4	Fostering of recording monthly water supply bill/data and operation	062016 - 322016/ HDDT	Certificate	14/03/2016 - 26/3/2016	CUWC	26	78,000,000	78,000,000	78,000,000	0	68,954,000	9,046,000	
5	Level upgrade of recording monthly water supply bill/data and operation	332016/ HDDT	Khanh Hoa water supply and sewage Co,Ltd	28/3/2016 - 02/4/2016	Khanh Hoa	49	149,000,000	149,000,000	149,000,000	0	115,653,502	33,346,498	
6	Level upgrade of recording monthly water supply bill/data and operation	342016/ HDDT	Water supply and construction Daklak Company	28/3 - 02/4/2016	Khanh Hoa	8	16,000,000	16,000,000	16,000,000	0	0	16,000,000	Sum cost ,Class in Khanh Hoa province
7	Fostering of Chemical testing		Nam Dinh College of construction		CUWC	1	5,950,000	5,950,000	5,950,000	0	0	5,950,000	
8	Level upgrade of recording monthly water supply bill/data and operation	362016/ HDDT	Cao Bang water supply Company	19/4 - 23/4/2016 và 25/4 - 29/4/2016	CUWC	26	52,000,000	52,000,000	52,000,000	0	50,615,000	1,385,000	
9	Level upgrade of recording monthly water supply bill/data and operation	372016 - 412016/ HDDT	combined with Cao Bang	06/04/2016 - 29/4/2016	CUWC	5	15,000,000	15,000,000	15,000,000	0	0	15,000,000	
10	Fostering		Domestic water and rural sanitary center, Thanh Hoa	10/5/2016 - 16/7/2016	Thanh Hoa	17	46,000,000	46,000,000	46,000,000	0	2,837,500	43,162,500	
11	Fostering of Chemical testing	422016/ HDDT	Son la water supply JSC	06/02/2016 - 06/3/2016	Son La	40	56,000,000	56,000,000	56,000,000	0	37,725,000	18,275,000	
12	Level upgradation of recording monthly water supply bill/data and operation	452016 - 602016/ HDDT	collection invoice in June	23/5/16 - 18/6/2016	CUWC	15	45,000,000	45,000,000	45,000,000	0	16,700,000	28,300,000	
13	Level upgradation of Operation	432016/ HDDT	Dien Chau water supply JSC	06/06/2016 - 11/6/2016	CUWC	2	4,000,000	4,000,000	4,000,000	0	2,947,500	1,052,500	
14	Fostering of Chemical testing	442016/ HDDT	PMU of rural and urban ODA sector, Ha tinh province	06/06/2016 - 17/6/2016	CUWC	5	54,000,000	54,000,000	54,000,000	0	9,200,000	44,800,000	

No	Content	Pursuant to legal document	Counterpart	Time	Venue	Number of trainee	Contract Value	Settlement Value	Received fund	Remaining fund	Expense	Revenue	Remark
	Level upgrade of recording monthly water supply bill/data and operation	612016/HDDT - 622016/HDDT	Certificate	1/7/2016 - 23/7/2016	CUWC	2	6,000,000	6,000,000	6,000,000	0			
	Level upgrade of recording monthly water supply bill/data and operation	672016/HDDT	TUWASW Co, Ltd	18/7/2016 - 23/7/2016	CUWC	16	32,000,000	32,000,000	32,000,000	0	40,777,000	17,223,000	
	Level upgrade of operation	632016/HDDT - 662016/HDDT	Center of domestic water and rural environemt sanitation of Vinh Phuc	1/7/2016 - 23/7/2016	CUWC	4	20,000,000	20,000,000	20,000,000	0			
15	Fostering of recording monthly water supply bill/data and operation	61 - 67/2016/HĐ ĐT	Individual	08/8 - 29/8/16	CUWC	8	24,000,000	24,000,000	24,000,000	0	16,800,000	7,200,000	Unsettlment
16	Water quality analysis	68/2016/HĐ ĐT	Dien Bien Industry Company	15/8/16 - 01/9/16	CUWC	8	116,000,000	116,000,000	0	116,000,000	81,200,000	34,800,000	Unsettlment
II	**Cooperation project**					**212**	**1,527,516,750**	**1,371,073,750**	**1,274,668,750**	**96,405,000**	**1,131,426,000**	**239,647,750**	
1	Project of water wastage prevention and leakage management	Số LC4	Project NORAD - Enhancement of capacity in water supply field, sanitation and solid management inVietnam, - package LC4	11/01/2016 - 15/01/2016	CUWC	20	329,512,750	329,512,750	329,512,750	0	318,577,000	10,935,750	
2	Wastewater management project,GIZ	012016/ HDDT	Project TOT2 - waste water management program,GIZ	01/11/2016 - 15/01/2016	CUWC	28	239,350,000	239,350,000	239,350,000	0	203,125,000	36,225,000	
3	Wastewater management project,GIZ		Project TOT3 - waste water management program,GIZ	14/03/2016 - 18/3/2016	CUWC	28	170,360,000	154,302,000	154,302,000	0	131,102,000	23,200,000	Decreasing Settlement 16.058.000 đ
4	Poland project		Water supply-sewerage station management, program of water and sanitation in towns of Vietnam		CUWC		84,832,000	84,832,000	84,832,000	0	69,872,000	14,960,000	Decreasing Settlement 14.960.000 đ
5	Project of water supply system O&M	352016/ HDDT	Findland project	28/3 - 01/4/2016 và 11/4 - 15/4/2016	CUWC	46	481,690,000	363,110,000	363,110,000	0	251,945,000	111,165,000	Decreasing Settlement 118.580.000 đ
6	Intern		Student of University of Irrigation	31/5/16 - 04/6/2016	CUWC	65	25,562,000	25,562,000	25,562,000	0	7,400,000	18,162,000	
7	Class ToT4	68/2016/HHĐ ĐT	VWSA projects	01/8/16 - 05/8/16	CUWC	25	196,210,000	174,405,000	78,000,000	96,405,000	149,405,000	25,000,000	Unsettlment

Appendix 8-11 Discussion at the Pilot Training

Outline of Lectures and Discussions of the First Pilot Training

1) Outline of lectures and discussions

Six lectures and discussions were held over two days of training. The lecture texts are included in the reference documents. Photographs from the training are also included in the reference documents.

The main details of discussions are shown below.

a) Day 1 (August 9) Discussions

After the opening ceremony on Day 1, lectures were held in connection to an introduction to sewerage, sewerage administration systems, and sewerage finance systems. The main details of the discussions after the lectures are shown below.

- Ms. An, CUWC

Regarding septic tanks, I have some questions about sludge extraction frequency, sludge extraction managers, sludge disposal sites and treatment methods, and re-usage.

⇒ The frequency of sludge extraction from septic tanks is once or twice a year. The responsibility for extraction is that of the owner of the septic tank, and sludge extracted from the septic tank is transported to human waste treatment plants and wastewater treatment plants where it is treated. It can be used as landfill and cement materials.

- Trainee from Thai Nguyen Province

There are concerns about the **sewerage diffusion rate**, as sewers are being connected to houses despite the fact that some areas in Vietnam do not yet have treatment plants. What is the situation in Japan? If it is the same case, how are **sewerage charges** collected? Also, while there are two types of sewage - domestic sewage and industrial sewage - how are **sewerage charges** collected? Are there two types of rate structure or just one?

⇒ There used to wrongly be sewers without treatment plants in Japan, but that is no longer the case. There are separate rate structures for domestic sewage and industrial sewage, and billing is according to the amount of water supply used and the sewage capacity.

- Trainee from Dong Thap

I have a comment. Listening to the lectures, I realized that the situation of sewerage in Vietnam closely resembles the situation of Japan in the 1950s. Vietnam does not have a sufficient budget for O&M, and it cannot really be called an investment. Can a **beneficiary payment system** be used in Vietnam?

⇒ In Japan, the beneficiary payment system has been established by efforts in order to ensure that the local government has independent funding. Considerable effort is required in order to gain the understanding of citizens.

- Trainee from Dong Nai

Is the use of the **national budget for Project implementation** recommended?

⇒ In Japan, half of the project costs are from a national subsidy. Wastewater treatment plants are two-thirds nationally subsidized. River sewerage treatment plants are 75% nationally subsidized. Sewerage investment is set in the formulation of the 5-year plan, but it keeps on increasing every year. Contributions are made for Japan Sewage Association lobby activities to increase the national budget.

- Trainee from UCCI-HCM

I am greatly interested by PI, which was discussed in the lectures. I'd like to learn more about PI. VSC should translate the Japanese PI Manual into Vietnamese in its R&D activities.

- Ms. Ngoc, Question for GIZ

There was a question about the actual situation in the provinces supported by GIZ. Ms. Ngoc explained how sewerage charges are being collected in some regions, and gave examples of sewage business participation methods and house connection methods.

- Trainee from Thai Nguyen sewerage company

Of **sewerage charges**, what percentage is left for the country and what percentage is left for the O&M company? Also, what can be done to improve the quality of discharge water in the case of an influx of **industrial sewage** that includes heavy metals?

⇒ Sewerage charges are the income of the local government, and payments to O&M companies vary in each city. As for industrial sewage that includes heavy metals, it is necessary to establish removal facilities at the emitting factory in order to reduce the influx concentration at the treatment plant.

- Trainee (location unknown)

What is the difference between anaerobic septic tanks and **septic tanks**? Can septic tanks be used in Vietnam? How should septic tanks be managed? Are there any methods to improve septic tank treated water quality?

⇒ Anaerobic septic tanks use an anaerobic treatment, while septic tanks include aerobic treatment. They can be used after installing an appropriate sludge treatment system. Treatment is safe as long as air can be provided for aeration so that a suitable sludge can be extracted. The usage method varies depending on the situation of the discharge location.

- Trainee from HSDC

The sludge dredged from public irrigation waters such as rivers, lakes and marshes has different characteristics to sewage sludge. Is the treatment of **dredging sludge** required?

⇒ Treatment suited to the condition of the discharge location is required.

b) Day 2 (August 10) Discussions

On Day 2, there were lectures about sewerage planning, sewerage operations and maintenance, and sewerage PR activities. Following that, the main details of the discussions were as follows.

- Trainee from HCM City

I'm interested in **O&M**. We are looking forward to the continued support from Japan for construction, and support from VSC for O&M.

⇒ VSC is considering support for each step of the sewerage project from planning through to O&M, and a conclusion will be reached within a few months.

- Mr. Vinh, Nam Dinh DOC

We're very grateful to the lecturers for giving us so much information about everything from planning through to operations and maintenance. As you know, Nam Dinh is a historic town that used to be a French colony, and most sewerage uses a combined system, but Nam Dinh is aware of the importance of a separated system. However, Nam Dinh does not have a master plan for sewerage, and the water environment in Nam Dinh is a serious problem as there is a serious need to construct a wastewater treatment plant. The Province of Nam Dinh is requesting that JICA supports sewerage planning and provides support that leads to sewerage FS and Project implementation. Through VSC, Nam Dinh Province is hoping for the implementation of a Pilot Sewerage Project.

⇒ Consultation with Nam Dinh has only just started. A support plan will be constructed through discussions.

- Ms. Oanh, HSDC

The **PR** lectures were incredibly interesting. The reason is that PR is Vietnam's major weak point. Is the plan to take up PR as a theme in the VSC technical development functions? Children like to find new things, and they are the target for PR. Yokohama City conducts PR for children very well. I hope that VSC will produce educational leaflets, manuals and guidelines about Vietnam wastewater treatment plants to teach children about the water environment.

⇒ Currently, this is not being considered. Can PR videos be prepared by the VWSA for use in national PR activities?

- Mr. Phuoc, Hue DOC

I was interested in all of the lectures. However, due to limited time, I wasn't able to take in all of the information immediately. If possible, it would be better if a seminar was held for each lecture.

Regarding **sewerage charges**, while the methods of local governments in Japan are preferable, it will take time for the various relevant agencies to implement this in Vietnam.

In Hue, we have started a very simple form of PR. I don't think it is very effective, so we would like to conduct more research into PR.

In Hue, we are concerned about establishing a plan. There is no city planning for Category II cities. Is it possible to implement a **sewerage plan** without a **city plan**?

⇒ Sewerage planning is part of city planning, so a city plan is required.

- Mr. Phuoc, Hue DOC

VSC is incredibly effective in view of the current situation of Vietnam. Through the **technical development functions**, we hope to see the immediate introduction of new Japanese technology in Vietnam. For example, when we went for training in Kyushu, the **deodorization plants** were impressive. There are no bad odours at Japanese treatment plants. Therefore, we greatly anticipate the introduction of deodorization plants to Vietnamese wastewater treatment plants during the design stage by VSC. This is because Vietnamese wastewater treatment plants cause bad odours, especially during summertime. The bad odours make it very difficult to find a location for wastewater treatment plants. Local residents think that the areas around wastewater treatment plants smell bad and are very dirty, which has a damaging effect on the health of people living nearby.

- Mr. Kien, Thai Nguyen

I'm grateful for the lectures, which included lots of necessary information and detailed explanations. We hope to see support from JICA in the regional implementation of the Wastewater Treatment Plant Project. Based on the support request, we hope that VSC will also support **O&M**.

⇒ JICA is currently focusing its efforts on supporting sewerage planning and design. O&M is still under discussion.

- Ms. Giang, Hanoi PMB

I have no complaints about the VSC lecturers or the lectures, and we have been given a lot of information about sewerage in the last two days. Please can you explain some more about the following two points? First, please can you explain the On-site and Off-site plan? Second, please explain the strong points and weak points of Metawater-based high-rate filters.

⇒ In Japan, the On-site and Off-site plans are determined by the population density, the construction costs and operations and maintenance costs.

⇒ Metawater technology has been tested in Da Nang, and it was found that the construction costs and operations and maintenance costs are low.

- Mr. Vi, Ho Chi Minh UCCI

Some wastewater treatment plants in Ho Chi Minh are not in good condition due to improper operations and maintenance. Most HCM treatment plants are supported by JICA in line with Japanese techniques. We hope that VSC has noticed this issue and will research a standardized **operations and maintenance method** for wastewater treatment plants.

⇒ There are some differences in the backgrounds of Japan and Vietnam. Japan has been making improvements for 40 to 50 years. VSC would also like to engage in activities from this perspective.

- Ms. Nguyet, Dong Nai DOC

Vietnam's Government Ordinance 80 and Ministerial Ordinance 04 are rough, and the guidelines that have been published are lacking detail, so I would like to know how we can determine **sewerage charges**. It is difficult for regional governments to apply this in line with the actual situation.

⇒ Japan also struggles with this. In some cities in Japan, sewer savings are used in order to work out the connection costs for each house. While this could be applied in Vietnam, PR is incredibly important. It is important to inform citizens of the need and usefulness of sewerage, and to gain their understanding.

Outline of Lectures and Discussions of the Second Pilot Training

1) Outline of lectures and discussions

Over the 4 days and the 2 courses, a total of 9 lectures, discussions, and site visits were held. The text used in the lectures are included in the reference documents. Also, photographs of the training are included in the reference documents.

The main contents of the discussions were as follows.

a) Lecture

ⅰ) Introduction to sewage works

An outline of sewerage projects was presented in lectures by Ms. Thao Huong of ATI/MOC and Mr. Kawai of the JICA Study Team, during which the following questions and answers were raised and provided.

- Ms. Duong Tran（DOWASEN　Dong Nai）

(Question) How should sewage charges and the price rise roadmap be carried out? This should be covered in the reference documents.

(Answer) (Ms. Thao Huong) Based on the unit price system or expenditure, Circular 06, Decision 590, Decree 80 and Circular 02, PPC needs to be advised to conclude a contract with the consultants, to formulate criteria necessary for matters not covered in the regulations. The asset depreciation method is referred to by the Thai Nguyen sewage company.

- Mr. Hoang Van Tien (Vice Director, HEPCO Hue)

(Question) In sewer and sewage treatment plant projects funded by JICA, accurate information regarding the treated water quality and an evaluation of the economic effects are not obtained. How should the sewage charges roadmap be prepared, and what should be the source of revenue?

- Mr. Nguyen Hai Duong (Vice Director, DOC Da Nang)

(Question for Ms. Thao Huong) The following question was received from a member of the People's Committee: Decree 80 does not clearly indicate the sewage charges. The terminology is not precise. How should the sewage charges be defined and explained so as to obtain agreement? Also, what is the legal basis for the consultant's charges? There is insufficient information on prices, and the legal mechanism is insufficient.

(Answer) (Ms. Thao Huong) For sewage charges, refer to Decree 80, Circular 02 of Article 2, and Article 3 – Clause 4 of Decision 589 regarding price adjustments on April 6, 2016. The sewage charges and their roadmap are an essential condition between JICA and the People's Committee.

- Question for JICA

I would like a comment regarding the implementation of sewerage projects in Vietnam. What is Japan's experience in sewerage planning? What should we take home regarding sewerage planning, and what should we be applying?

(Answer) (JICA Study Team) This will be discussed in the training.

A 4 trillion VND water environment improvement project is being implemented at Da Nang with funding from JICA. It is being planned with an interceptor capacity of 2.5Q＋3 mm/ha rainwater, and when the rainfall exceeds 3 mm, the sewer overflows to the sea, but how can this problem be solved? Also, what is the effect on the environment?

(Answer) (JICA Study Team) We will answer this after obtaining the project information. (This was raised in the discussion on the final day and answered.)

- Mr. Nguyen Tat Hien (Officer, Thai Nguyen Sewage and Urban Infras)

(Question) The semi separate system is adopted, but the BOD of the influent wastewater is low. What should be done to increase the BOD? Should the septic tank be eliminated?

(Answer) (Ms. Thao Huong) From the examples in Buon Me Thuot and Da Lat City, the BOD is raised by a good connection method. If the wastewater is collected in an open channel, it is not possible to eliminate the septic tank.

- Le Vu Tien Hung (BIWASE, Binh Duong)

(Question) Are there differences in the structure of overflow weirs from country to country? What countermeasures against smells should be taken with separate type pump stations?

(Answer) (Kawai) I have not checked whether there are variations in the structure of overflow weirs from country to country. I think the basic structure does not vary. Installation of deodorizing equipment (for example, an activated carbon absorption tower, etc.) can be considered for pump stations. This is an additional cost, but its reliability is guaranteed.

- Mr. Nguyen Thanh Hoang (Officer, Da Nang Priority Infras Investment, Project Planning and Procurement Dept.)

(Questions)

- ✓ How to prevent discharge pipes in the sea from being immersed in sand?
- ✓ In Japan, what are the percentages of combined systems and separate systems?
- ✓ A combined system has been adopted in Tokyo, but does this conflict with the Environmental Protection Act?
- ✓ Are there septic tanks in Japan?

(Answers) (Kawai)

- ✓ This problem also occurs in Japan. Appropriate design and construction is carried out, but normally operations and maintenance is necessary. This issue will be explained in the lecture by Mr. Iida.
- ✓ In Japan of about 1600 cities, about 200 cities have adopted the combined system. Most of the large cities such as Tokyo and Osaka that commenced sewage treatment from an early stage have adopted the combined system.
- ✓ Tokyo and Osaka adopted the combined system prior to the Second World War. The Environmental Protection Act was adopted in 1970, so there is no conflict.
- ✓ In Japan there are no septic tanks as in Vietnam. Watertight toilets from which night soil can be collected were used.

ii) Public relation and public hearing in sewage works

Mr. Kohama of the JICA Study Team presented a lecture regarding public relations and public hearings for sewerage projects, taking specific examples from Japan, such as Yokohama City. Due to the necessity to start on the next event, a question and answer session was carried out during the final discussion time in the afternoon.

b) Sewerage planning and sewer course

i) Outline of Sewage Planning

Mr. Hayashi of the Study Team described the basics of sewerage planning, and Ms. Giang introduced the example of sewerage planning in Hanoi City. The following questions were raised and answered.

(Question) Question regarding combined sewer overflows (CSO) from DOC of Da Nang City

A sewerage development project with a planned investment of 4 trillion VND is in progress. There is strong concern regarding environmental problems at a beach resort due to the CSO. The rainfall strength in Da Nang City is high, so in the 2.5Q+3mm (Q: average quantity of wastewater per day on fine days) interceptor storage system that has been proposed in the sewerage planning (interceptor sewer), water discharge will occur during rainy periods, which will cause pollution to be discharged. What is your advice regarding the appropriate quantity of interception and countermeasures?

(Answer) Concepts in JICA ODA projects (JICA specialist)

- ✓ I have heard that 2.5Q+3mm has been proposed as the planned wastewater quantity for interception and storage taking into consideration cost effectiveness of CSO countermeasures in the Da Nang City sewage treatment project.
- ✓ The Study Team in this training do not have the basis to discuss the pros and cons that have been analyzed for individual projects.

- ✓ The normal CSO countermeasures are a combination of interception, storage, and discharge reduction technologies as measures to improve interceptor sewers, with countermeasures taken against pollutants and disease-producing bacteria.
- ✓ Regarding CSO countermeasures in Da Nang City, information will be shared within the Study Team, and that will be reflected in the training program.

ii) Planning and design of sewers

Mr. Hayashi of the Study team presented a lecture on planning and design of sewers.

iii) Construction and O&M of sewers

Mr. Thanh of VCC presented a lecture on the standards of design and construction of sewers in Vietnam, and Mr. Iida of the Study Team introduced Japanese technologies that were considered could be applied to Vietnam (pipe jacking method, rehabilitation methods, flush gates, etc.). The questions and answers were as follows.

- ➢ Ms. Tran (DOWASEN, Dong Thap)

(Question) In the pipe jacking method, does the HDPE not get damaged during jacking?

(Answer) (Mr. Iida) It does not get damaged.

- ➢ Mr. Tho (CPC, Uong Bi City)

(Question) Is the size of the shield machine the same as the outer diameter of the pipe being jacked, or is it larger?

(Answer) (Iida) It is the same size.

- ➢ Other questions

(Question) What breakdowns occur during pipe jacking, and what countermeasures are taken?

(Answer) Breakdowns are frequently caused by obstructions in the ground, so it is not possible to proceed with excavation. In that case, the obstruction is removed by excavating a shaft from above, to remove the obstacle.

(Question) How is the problem of leakage at joints solved?

(Answer) Washers are installed in the joints to prevent leakage.

(Question) How is excavation through water-bearing strata carried out?

(Answer) The water in the water-bearing stratum is collected with a machine shovel, and transported out of the hole together with the mud.

(Question) What is the maximum length of each jacked pipe?

(Answer) 1 to 2 m.

(Question) What is the material of the manhole covers?

(Answer) Cast iron. The structure of the manholes must be constructed well.

(Question) Can the steel casing be removed and reused?

(Answer) It cannot be reused, because it cannot be removed.

(Question) The ground in Quang Ninh is hard rock. Can it be excavated with a shield machine?

(Answer) Cutters are fitted to the shield machine to suit each type of stratum, so it can excavate it with no problem.

(Question) Can polymer concrete withstand high temperatures? Where can it be purchased?

(Answer) It can withstand up to 50 or 60°C. We are investigating where it can be purchased in Vietnam, but for small quantities it can be purchased from Japan or Malaysia.

(Question) (In SPR) How are small-diameter pipes of 1000 mm and smaller fixed, and how are they subsequently checked?

(Answer) They are fixed using an automatic assembly machine, and they are checked visually or by filling internally with water.

(Question) (In SPR) What do you do when the profile does not tightly engage?

(Answer) That does not occur.

(Question) What is the cost, service life, strength, etc., of SPR?

(Answer) The cost is the same as replacement with a new pipe by open excavation. The corrosion resistance is high.

(Question) In what countries are flush gates used? Can flush gates be flexibly removed?

(Answer) They are used in the Philippines. They can be flexibly installed.

(Question) In what position are the flush gates installed?

(Answer) Flush gates can only be installed within manholes, but it is case-by-case depending on the water flow rate, slope, etc.

(Question) How do you prevent bad odors when there are no septic tanks?

(Answer) It is necessary that the sewer system is airtight and that there is no deposition within the pipe. Vents are installed at manholes. In Da Lat City, a sub-ventilation system was installed.

(Question) What do you do about deposition at places far from the flush gates?

(Answer) Remove it using a vacuum vehicle or a high pressure cleaning vehicle.

(Question) Are there standards for pipe jacking?

(Answer) Pipe-making factories include Hung Vuong in HCM City and Song Day on the outskirts of Hanoi City.

(Question) How are camera mounted vehicles propelled through the pipes?

(Answer) It is necessary to clean the inside of the pipe before the camera survey. Or, to load it on a small boat.

(Question) Should manholes be controlled using a ledger control system, or should a different control system be used?

(Answer) It is best to manage all of the information about manholes in a single ledger.

(Question) HCM City is affected by high tides, so how should sewers be cleaned?

(Answer) Using a high pressure vacuum pump is best.

(Question) Method of design and installation of flush gates: Questions regarding design standards for the presence or otherwise of deposited matter, flow rates, MH structures, flush gate installation locations, and the effect of countermeasures against smells, etc.

(Answer) Interceptor sewers use existing pipe routes, so settlement has advanced, and there is no construction in accordance with design standards for sewers. Due to the degradation of the existing pipe facilities, it is important to separately investigate the locations where deposition can easily occur, and to confirm the cleaning effect by adjusting the water levels.

(Question) Bad odors from sewers: Many complaints are received regarding bad odors from sewers, due to effluent from septic tanks and deposits in pipes. I would like to know about the situation in Japan and experience with countermeasures, such as pipe design, ventilation, cleaning, etc.

(Answer) By appropriately maintaining the flow rate and slope of sewers at the design and construction stage, the occurrence of bad odors is not noticeable. The locations where bad odors occur are known from experience to be at places where pipes have bent, at siphons, etc., and this is dealt with by periodic cleaning.

(Question) Management of sewers: In HCM City, deposits in sewers are left up to chest height, which causes flooding during rainy periods. This affects the tide levels of the river water, dredging must be carried out due to stagnant water, and cleaning and operations and maintenance are issues.

(Answer) Deposition in sewers causes corrosion of the pipes, and accidents due to subsidence of roads. In HCM City a flooding master plan has been formulated, with the desire to increase the safety of the delivery function of sewers by installing new stormwater sewers, constructing bypass sewers, etc. Sewage pipes account for 60% of the sewer system in Japan, and 70-80% in Vietnam, they are laid under public roads, and it is necessary that these facilities are properly operated and maintained. We would like to use this opportunity of VSC training to share information on operations and maintenance of sewers among the cities of Vietnam.

(Question) Pipe jacking standards and construction: I would like to know about the range of application of the pipe jacking methods, standards for pipes, and the system of supply in Vietnam.

(Answer) A pipe jacking video was introduced. Refer to the initiative on pipe jacking adopted for long distance jacking around a curve, at the on-site training the following day (site visit to Song Day).

iv) Site visit of secondary concrete products plant

The secondary concrete products factory of Son Day Construction Materials Joint Stock Company in Bac Ninh City was visited to view the manufacturing process, etc. The process adopted is a vibration,

compression, and compaction method introduced from Denmark (known as Vicon in Japan). A factory to manufacture centrifugally spun concrete pipes was under construction in a joint venture with Japan.

v) Site visit of sewer construction site

Site visits were carried out to the rainwater sewer under construction and the Vinh Niem sewage treatment plant construction site in the "Hai Phong City Environmental Development Project (II) Sewer and Stormwater Drainage Development Facility Development Project" being implemented in Hai Phong City under a JICA loan. The objectives of these projects are:

- Construction of sewage pipes and sewage treatment plant (treatment area: 820 ha, planned population served: 170,000)
- Stormwater drainage facility improvement and new construction (5-year probability flood: 175 mm/12 hours, sewer length: 7.1 km, storm wastewater treatment plant: 12 m^3/s).

The construction sites visited from among these projects were the An Kim Hai water course improvement project under construction as a stormwater drainage facility improvement project, and Vinh Niem sewage treatment works. In the An Kim Hai water course improvement project, the existing water course is being improved with 2 RC box culverts (2×3 m×3 m, L = 3 km). The Vinh Niem sewage treatment plant is a standard activated sludge treatment plant with a processing capacity of 54,000 m^3/day, but in the first phase will be 36,000 m^3/day.

In the conference room of the sewage treatment plant construction site, Nguyen Dinh Khang, Deputy Head of the Hai Phong City PMU gave an outline of the sewerage projects in Hai Phong City and showed a publicity video. The main content of the presentation was as follows.

- In the An Kim Hai water course improvement project, it is difficult to acquire land, so the project is being delayed.
- Construction of the pumping station was scheduled to commence in November 2015, but the land acquisition problem was not solved, so construction has still not commenced. The land to be purchased is 200 ha, and the number of households affected is 2,000.
- The ground conditions are soft soils GL -5 to 6 m (or where shallow, 3 to 4 m), and steel sheet piling retaining walls are being used so as to not affect the nearby houses, but in some cases they have been affected.

After the site visits, the following questions were asked and answers provided.

(Question) Are PR activities being carried out for the city residents?
(Answer) Of course publicity activities are being carried out. The video you have seen has been prepared, and it is broadcast once per month on Hai Phong TV channels. Explanatory

meetings are held in local units, and explanations are also held for individual households, so we have actively undertaken PR activities.

(Question) Will the first phase processing capacity (36,000 m3/day) of the sewage treatment plant be sufficient for processing for the whole city?

(Answer) When both phases are completed, it will be capable of serving a population of 140,000, or about 1/5 of the population of the whole city (730,000). In the master plan for the whole city, treatment plants at 8 locations are necessary, with a total processing capacity of 198,000 m^3/day.

(Question) Is incineration of waste carried out?

(Answer) A target of reuse of 70-80% of waste by 2020 has been set in the Vietnamese Prime Ministerial Ordinance. Landfill disposal cost is 75,000 VND/ton, and in Ho Chi Minh City waste incineration is 400,000 VND/ton, so we do not have the funds for waste incineration. The waste generation rate is 2,000 tons/day, and the landfill site capacity is 2,540,000 tons, so in 5 years they cannot be used. It is planned to have landfill disposal sites at 14 locations by 2025.

(Question) When will Phase 1 be completed?

(Answer) At the end of 2017. There is a possibility of a delay. Land acquisition was carried out in the middle of 2013, but 70 ha was not purchased, procurement of finance for Phase 2 is difficult.

(Question) There is only 1 processing line, and not multiple lines. What will happen when there is a problem? At Bình Dương, a breakdown occurred, and it took 2 months to recover. It would have been better to have 2 lines.

(Answer) The facility is large, so this problem will be dealt with by storage. Hopefully Phase 2 will be completed quickly.

The equipment is imported, but we have spare parts, so it will be ok. For the future we are considering procuring equipment within Vietnam.

(Question) What kind of training should be carried out for PMU staff (Mr. Mori, JICA)?

(Answer)

- Dealing with construction when differences arise between design and construction during construction, and risk management.
- Methods of connecting pipes and manholes, correcting deviations between the bottoms of pipes and manholes, removal of underground objects, and updating sewer data
- Public information and public hearings for residents when purchasing land. One house was purchased after 7 months. Complaints were received from half of the 200 houses to be purchased. Compensation from insurance cost 6,000,000,000 VND. The necessity of prior coordination is important.
- Methods for selecting technologies. Methods of selecting treatment methods with low O&M cost.
- Application of septic tanks

- Sewage treatment on ships
- Application of dispersed biogas systems to rural areas
- Use of effective microorganisms (EM)

(Question) Are sewerage projects more difficult compared to roads or water supply projects?

(Answer) For the relevant department in Hai Phong City, a sewerage project is new. However, the contractors for the construction works have experience in sewerage construction work.

c) Sewage Treatment Course

i) Outline of Wastewater Treatment

Ms. An of CNEE/CUWC gave an overview of sewage treatment, and Dr. Kawaguchi of the Study Team gave an overview of biological treatment. The questions and answers were as follows.

(Question) Regarding ammonia removal, what is the ideal time in an anaerobic condition (retention time in an anaerobic tank)? What is the ideal time for bacteria to convert NH_4-N and NO_3-N (2 stages)?

(Answer) For decomposition of ammonia, set the anaerobic tank time = 70% aerobic tank time.
There are 2 stages, NH_4-N $\rightarrow NO_2$-N, NO_2-N$\rightarrow$ NO_3-N, but they are not considered separately. Calculate the total time for NH_4-N$\rightarrow NO_3$-N.

(Question) In Slide 52, comparing each item for combined systems and separate systems in Vietnam and Japan, why are there such large differences for the separate system in particular?

(Answer) First, the T-N comparison: For the same number of people, the quantity of excretion is the same. However, the reason T-N for separate systems in Japan (37) is about 1/3 of that in Vietnam (94): the quantity of water used per day by a Japanese person (average 250 L/day) = quantity used by 3 Vietnamese persons (80-90 L/day). Compared with the rest of the world, it can be said that Japan uses too much. However, the data for combined systems is virtually the same, so it is considered that the rain dilution factor is about the same. The reasons the BOD is low is because of the installation of septic tanks in Vietnam, and because of the use of flushing toilets in Japan.

Looking at the combined data for Vietnam, the BOD is low, and the nitrogen and phosphorous concentrations are high, so it is considered that operation is difficult. (Dr. Kawaguchi)

There are various factors that are responsible for the differences in incoming water quality between Japan and Vietnam, such as climate, sewer network, sources of discharge, length of sewers, slopes, etc. For example, the pipes for collecting the sewage and delivering it to the treatment plant are almost all old, broken, bent and they have poor slopes at many locations, so the sewage accumulates at these locations, etc. (Ms. An)

(Question) Can the initial settling pond not be considered to be a septic tank in Vietnam?

(Answer) The initial settling pond cannot be considered to be a septic tank. This is because the initial settling is for matter that can settle only (removal of SS), and it does not have the

function of decomposition of organic matter. Conversely, septic tanks have the functions of both settling and decomposition (decay) of organic matter. Also, septic tanks only receive waste water and human excrement from toilets, and do not receive miscellaneous wastewater from daily living, so even if a septic tank was installed for every household, an initial settling pond would be required.

The sludge is continuously extracted from the initial settling pond, and if this was not done it would become anaerobic, the sewage would decay, and bad odors would be generated. Septic tank sludge gradually accumulates on the bottom of the tank, and it is necessary to remove it every several years. (Ms. An)

From the cost point of view, comparing the total cost (individually-borne cost) of installation of a septic tank in each house and removal of sludge every year with the cost of construction of a sewage treatment plant, after 10 years or 20 years, the sewage treatment plant is cheaper. Also, the sewage treatment plant has the role of compliance with effluent standards, and ensuring the safety of the local water environment (removal of pathogenic organisms).

Considering the objectives of the processing, for processing of organic matter only then installation of septic tanks are ok, but they cannot process N and P. However, with a central sewage treatment plant, the BOD is lowered compared with septic tank installation, and the fuel and electricity costs of the treatment plant can be reduced which is good, but when the BOD is low, the concentration of N increases due to anaerobic decomposition of the SS, so the process of removal of N and P becomes more difficult. Therefore, in newly developed residential areas with an existing treatment plant, septic tanks are not needed for the subsequent households. In other words, at the planning stage of new residential areas, the construction of a sewage treatment plant should be given priority. (Dr. Kawaguchi)

(Question) With the hybrid process, how does the addition of a carrier affect the solids retention time (SRT)?

(Answer) There are 2 types of carrier: those in which microorganisms are adsorbed onto the surface, and those in which microorganisms live in the center. Basically the addition of a carrier does not affect the SRT. Of course it affects the concentration of microorganisms in activated sludge. The carrier has the role of retaining the microorganisms so that they do not flow down to the final settling pond, and as a result of carrier addition, the concentration of microorganisms in the tank is increased and the tank is operated in high load, there is little effect on the SRT under aerobic conditions. (Dr. Kawaguchi)

The carrier can be considered to be the home of the microorganisms. There are aerobic conditions on the surface of the carrier and anaerobic conditions in the center of the carrier. The processing capability and N and P processing effects are improved as a result. (Ms. An)

The denitrifying bacterium for which I have developed (patented) one of the carriers is an autotrophic bacterium, so its rate of reproduction is slow. Therefore, as a result of addition, denitrifying bacteria are carried and increased, so the N processing speed is promoted. The

maximum quantity added is up to 20% for aerobic tanks. (Dr. Kawaguchi)

(Question) With a combined system, when the capacity of the treatment plant is exceeded during rain, how is the rainwater treated immediately afterwards?

(Answer) It is temporarily stored underground for example, in a storage tank (regulating reservoir), and processed on fine days. (Dr. Kawaguchi)

(Question) Construction of central sewage treatment plants is essential in urban areas, but what about in those parts of Japan where the population density is low? In those cases, is there a policy regarding grants or subsidies from the central government towards the construction cost of sewage treatment plants? Also, how do you carry out the process of obtaining the understanding of residents to pay for the construction of treatment facilities, abolish septic tanks, and change the treatment used?

(Answer) Of course no one wants to install a septic tank. The cost of installation of a septic tank is borne by the individual, it is installed underground at your home, so there are many risks and environmental problems. However, the use of a septic tank has become a traditional way of thinking for Vietnamese people. (Ms. An)

Septic tanks are used in places where the population density is low. There are grants from the central government for installation of septic tanks, but the cost of operations and maintenance is borne by the local government or the individual. Installation is carried out either directly by the individual or the local government, or by commissioning the work to be done by an association, etc. Normally several hundred people combine to install a septic tank. Septic tanks are connected to flushing toilets, and process human waste together with miscellaneous wastewater.

Traditional Japanese-type toilets and human waste storage tanks have been used from the past. However, there were problems with smells, etc., so people switched to flushing toilets. It order to use a flushing toilet it is necessary to connect to a septic tank or a sewage treatment plant. Therefore, there is no history of installation of septic tanks in Japan. If the Vietnamese people understand the role and benefits of sewage treatment plants, I believe that they will eliminate septic tanks. Details of campaigns for residents in Japan will be described later in the lecture by Mr. Kohama. (Dr. Kawaguchi)

(Question) In Vietnam, sewer pipes include circular pipes and box culverts. What shapes (cross-sections) are the sewers in Japan? In Vietnam, it is considered that if a septic tank is not installed, the sewers will be blocked by sewage.

(Answer) The basic shape of sewers in Japan is various such as circular pipes, box culverts and pipes with an egg-shaped cross-section. With a combined system, the cross-sectional area is greater than that of a separate system, and on fine days the flow rate cannot be ensured, so as a countermeasure against this, frequently a U-shaped groove (invert) is provided in the bottom of the pipe. It is considered that the problem in Vietnam is that the depth of sewer is shallow and the slopes are small, so soil and trash accumulates, which obstructs the rapid flow of the sewage. (Mr. Suzuki)

(Question) After excess sewage has been extracted and placed in a sewage storage pond, how long does it take before the phosphorous returns to the solution from the bacterial cells?

(Answer) After the excess sewage has been extracted, it takes about 1 hour for the phosphorous to elute from the bacterial cells and return to the water. Therefore, it should be promptly concentrated and dewatered. If this is not possible, then a flocculant such as an iron salt should be added. (Dr. Kawaguchi)

ii) Design of mechanical equipment in wastewater treatment plant

Mr. Liem of CNEE/CUWC presented a lecture on pump equipment, and Mr. Suzuki of the Study Team presented a lecture on water treatment mechanical equipment and sewage treatment mechanical equipment. The following were the main questions and answers.

(Question) How is monitoring of pump breakdown carried out?

(Answer) There are various kinds of pumps, but here I will introduce an example for a submersible pump.

Submersible pumps are normally equipped with a temperature rise and immersion detection sensor, and before the breakdown occurs the sensor is activated, and the pump stops. The cause of the immersion is water entering the pump due to degradation of the casing, etc., and causing activation. Also, temperature rise is caused by lowering of the water level due to pump operation, so the submersible pump emerges from the water and operates without being cooled. Also, if the water temperature is high (for raising hot spring water, etc.) it is not cooled, so the temperature rises. In addition, overheating of the electromagnetic contactor can occur due to excessive current flow, when the distance to the installation location of the submersible pump is long and voltage drop is not sufficiently taken into consideration. (Mr. Suzuki)

(Question) Regarding depreciation of equipment, in Vietnam, the temperature and humidity is high, and degradation and breakdown of equipment can easily occur due to moisture and hydrogen sulfide. How can these effects be reduced?

(Answer) During design, the local environmental conditions such as temperature, humidity, etc., must be taken into consideration. (Mr. Kaneko)

Measures to prevent condensation are effective for preventing breakdowns of equipment. Rusting and corrosion of metals starts from sulfides that promote corrosion dissolving in condensation water and lowering the pH. Countermeasures that are effective against hydrogen sulfide include washing with water, odor prevention covers, ventilation, etc. Injection of dry nitrogen to prevent condensation and ingress of sulfides is particularly effective for site operating panels. Raising the temperature within the panel to higher than room temperature is also effective. (Mr. Suzuki)

Proposal from Mr. Thien (HCM City): Close the door and turn on the air conditioning.

iii) Design of electric equipment in wastewater treatment plant

Mr. Kaneko of the Study Team presented a lecture on the electrical equipment at sewage treatment plants. The following are the main questions and answers.

(Question) How should water leakage from sewers be dealt with?

(Answer) It is necessary to judge the necessity from a study of the objectives and an evaluation of the risks when a leak occurs. The following are examples where it has been confirmed whether there is a leak.

An example of confirmation that there is no leakage when pumping water from a pumping station to another pumping station by installing a flow rate meter on the outlet side of the pumping station on the sending side, and also installing a flow rate meter on the receiving side pumping station, and confirming that there is no difference in their cumulative values. (Mr. Kaneko)

(Question) Does the electrical equipment in Vietnam comply with international standards?

(Answer)

I cannot answer this because at present I do not have the necessary Vietnamese documents to make a judgment.

However, whether or not international standards are applied is of course necessary when exporting to foreign countries, but it is not particularly necessary when the equipment is produced and used domestically. There is no problem producing anything based on any specification, but if this is done in such way, production will take a great amount of time and effort.

Therefore, if products are produced to a standard that can be used in common, it can be produced to a quality that is equal to or higher than a general purpose level. (Kaneko)

(Question) The safety standards used for electrical equipment are almost all foreign standards, so when an earth fault is detected during operation, frequently the electrical power supply is stopped, which has an adverse effect on the equipment. What is a good countermeasure against this? In electrical system design on ODA projects, are Vietnamese electrical systems used as reference, and if not, what are the conditions that the design is based on?

(Answer) In order to avoid this kind of breakdown, it is necessary to appropriately adjust the design values during the design of the electrical systems of the sewage treatment plant (it is necessary to apply protection systems adapted to the grounding systems in your country).

At present, it is considered that planning of electrical systems is carried out based on international standards, but I am unable to check whether or not facilities in your country are being planned in this way. (Mr. Kaneko)

iv) Outline of O&M of wastewater treatment plant

Ms. Nga of HSDC presented a lecture on examples of operations and maintenance of sewage treatment

plants in Hanoi City, and Dr. Kim of the Study Team presented a lecture on the important matters in operations and maintenance.

v) Site visit to Truc Bach wastewater treatment plant

Truc Bach sewage treatment plant in Hanoi City was visited in order to understand the actual facilities at a treatment plant. Truc Bach sewage treatment plant commenced operation in 2005, with a planned processing capacity of 3000 m^3/day (current capacity: 2300 m^3/day), and is a circulating type anaerobic aerobic activated sludge method A_2O method (using a carrier). The questions and answers at the treatment plant were as follows.

(Question) How often do events such as the water in the final settling pond overflowing due to fluctuation in the incoming flow rate occur? What flocculant do you use? Are there any problems with its use? Is it an imported product?

(Answer) A regulating pond is installed, so the storage can be adjusted, and if the processing capacity is exceeded, it is discharged directly into the lake.

The flocculant is PAC. There is no problem as long as a rational quantity of PAC is used. However, the quantity of PAC should be reduced when the pH of the sewage is high. Flocculant should not normally be added for the activated sludge method. However, in the case of sewage with a high phosphorus concentration, if flocculant is not used then the phosphorus removal is insufficient, and the sludge will float. The quantity of PAC added is varied as the incoming flow rate fluctuates. It is adjusted after measuring the pH. The PAC is manufactured in Vietnam. When the nitrogen removal function is not operating well then a lot of scum occurs. The settling time in the final settling pond is 3 hours, a little short. (Answer from Mr. Huyen, Operations Manager of the treatment plant, and comment from a specialist)

(Question) Electricity cost, number of persons involved in operations and maintenance, number of engineers, collection of sewage charges, disinfecting, sewage collection pipes, number of effluent pumps, incoming water quality (BOD, N, . . .)

(Answer) Charge for electrical power consumption: about 140 million VND (about ¥700,000) per month depending on the operating capacity. The smaller the scale of the treatment plant, the greater the electrical power charge per m^3.

Number of persons in operations and maintenance: 25 persons (treatment plant only, the collection system is separate), the number of operators is 12. The number of engineers is about 50% (environmental engineers, water supply and sewerage engineers, mechanical engineers, etc.).

Sewage collection system: Explained by reference to a map.

Number of effluent pumps: 2 No. (normally 1 No. is sufficient, and 1 No. is reserve)

Incoming water quality (BOD, N, ...): Nitrogen concentration is high, BOD is low.

The effluent satisfies the B criterion.

Collection of sewage charges: Sewage charges are collected as 10% of the water bills is collected as the environmental protection tax. At present, the operations and maintenance cost comes from the budget of Hanoi City.

The chemical used for disinfecting is 7% sodium hypochlorite. (Answer from Mr. Huyen)

(Question) For 50% sludge return rate, is internal circulation still necessary? For the reaction tanks, why is the aerobic sludge of the final settling pond the first returned to the anaerobic tank? If this is done then perhaps the anaerobic tank becomes an aerobic tank.

(Answer) With 50% sludge return rate, it is only possible to remove 1/3 of the quantity of nitrogen, and remaining 2/3 quantity of nitrogen is removed by internal circulation.

The reaction tanks are divided into 3 tanks, in the order anaerobic, oxygen free, and aerobic, and if the sludge of the final settling pond is not supplied to the first anaerobic tank, the activated sludge within the reaction system becomes gradually depleted.

The return sludge is quite dense with little liquid solution, so even though it is returned to the anaerobic tank, the tank does not become aerobic. However, the anaerobic tank is not completely and continuously in an anaerobic state, so methane fermentation does not occur, and the P removal reaction continues (anaerobic conditions: P from the organic matter is released by the phosphorus accumulating bacteria, and next in the aerobic tank the P is taken up, and removed as excess sludge.) (Comment by JICA Study Team specialist)

(Question) After how many years should the carrier be replaced? How is the residual quantity of carrier in the reaction tank measured? What about the quantity replenished? Price? Can it be easily purchased?

(Answer) The carrier gradually reduces. To measure the remaining quantity, sample the liquid mixture several times, and after the carrier has submerged, obtain the average volumetric percentage. The required quantity – remaining quantity = replenishment quantity.

There is no calculation equation. Using the above method will have a lot of variation, but it is the most accurate method of calculation. The carrier is only manufactured to order, and the cost of 1 m^3 is about ¥100,000. (Dr. Kawaguchi)

(Question) In Japan, are there central monitoring systems (capable of controlling the state of the whole system), and does the monitoring system display the equipment having a fault, the location and cause? Can such a system be introduced into treatment plants with fairly old equipment and machinery?

(Answer) The status is displayed on the central monitoring screen. Of course, refurbishment can be carried out and the system introduces it. (Kaneko)

(Question) In the case when the equipment still operates, but the display screen is broken and does not display, in Japan would such equipment be replaced? Or, would it be replaced when the prescribed number of years has passed?

(Answer) In Japan equipment having a broken display screen will be replaced. Even though it is still functioning, in many cases there can be faults. Periodically (annually, etc.) calibration is carried out, and if the calibration results are outside the allowable range, equipment is

replaced. (Kaneko)

vi) Site visit of Bac Giang wastewater treatment plant

The second site visit to a sewage treatment plant was to the treatment plant in Bac Giang City located to the northeast of Hanoi. Bac Giang sewage treatment plant commenced operation in 2010, it has a total planned capacity of 20,000 m^3/day (currently: 9,500 m^3/day), and uses the circulating biological treatment method (continuous method) A_2O method. The questions and answers at the treatment plant were as follows.

(Question) Electrical power consumption, allocation of operation and monitoring, is wastewater from factories and industrial estates also collected? Is it a separate system or combined system?

(Answer) Electrical power consumption of the treatment plant: 0.2 kW/m3. Divided into 3 shifts and 4 teams, with 24 hours monitoring.

The scope of sewage collection is mainly domestic wastewater within the city, of course this includes small-scale producers and retail shops, but industrial estates are treated in separate locations. Also, each industrial estate must have its own treatment facility. The collection system is separate in part, and combined in part (with storm water outfall chambers). Almost all the new urban areas have a separate system, and the older urban areas have a combined system. (Mr. Dat, Operations Manager of the Treatment Plant)

(Question) Sewage charges

(Answer) Sewage charges are not collected. 10% of the water bills is collected as an environmental protection tax.

However, we do not yet know how the sewage charges will be set and collected in the future, but it is considered that this will start at the earliest in 2019 to 2020.

I have carried out a simple calculation of charges. The result was about 6700 VND/m^3 including the depreciation cost (the current water supply charge: 4800 VND/m^3) (Mr. Dat)

At present, there is a plan to expand treatment plants via the ADB. The results of the design tender have been selected by Vietnam Water, Sanitation and Environment JSC (VIWASE).

(Question) Is there a problem with processing nitrogen and phosphorus? How is sludge treated when the dewatering equipment has a breakdown? What are the future plans?

(Answer) The criteria for both nitrogen and phosphorus indices in the effluent water are satisfied. The plants can treat a load of 300 to 400 T-N (units?) by the design of the processing technology, so actually there is no necessity to install a septic tank.

Regarding sludge dewatering, the introduction of a centrifugal dewatering machine is being considered for the future. The current dewatering machine (belt press) that is broken down is German-made, but operations and maintenance is complex, repair operations must be ordered overseas which are expensive, and take too much time (6 to 7 weeks + 3 months). We have received advice from DANIDA that henceforth it is better not to use a dewatering machine. (Mr. Dat)

Opinion from trainees: There are many people who consider that centrifugal dewatering machines are simple, but from our advice from use on treatment plants, the startup and stopping time is long (15 minutes?). Also, repair, replacement of parts, and operations and maintenance is difficult and complex.

From experience of operations and maintenance: The quality of European equipment is good, but after the warranty period, the repair cost and the cost of replacement of parts is quite high, and frequently the manufacturer has a monopoly on sales. ⇒ The price of Japanese and Korean products is more affordable, and more available. European equipment does not suit the climate of Vietnam. The temperature and humidity is high in Vietnam, so electrical and electronic parts such as sensors, meters, etc., soon breakdown. ⇒ Japan and Korea are Asian countries, so the difference in climate is not so great. Therefore, when installed equipment breaks down, it can be replaced affordably with an item that is affordable and sold on the market in Vietnam or even produced in Vietnam.

(Question) Are there regulations regarding house connections (connections to each house)?

(Answer) In Bac Giang City, there are still no detailed regulations or guidelines regarding house connections. Therefore, each household must bear their own construction cost to the nearest manhole.

With each household carrying out their own construction, there are many bad aspects such as damage to the sewer, poor construction quality, bad appearance, etc.

Regarding sewage and wastewater pump stations, operations and maintenance of these are carried out by the city's Wastewater Management Center, but the sewers are managed by a separate company (Bac Giang City Project Management Company), so at times the coordination does not function well. In particular, when there is a breakdown, allocation of responsibilities and determining the cause can be difficult. Therefore, from next year or the year after that, the Wastewater Management Center will become responsible for sewers. (Mr. Dat)

(Comment from Dr. Kawaguchi)

- ✓ The design of the treatment plant has a special shape that is rare, so it is difficult to adjust the flow rates, and operations and maintenance is difficult. As an example, recently the reaction tank overflowed. (This was because the screens in the center of the reaction tank and the settling pond became blocked by fallen leaves.) Therefore, it is better that tall trees are not growing in the surroundings.

(Comment from Mr. Suzuki)

- ✓ Regarding sludge dewatering method, instead of a centrifugal dewatering machine, for this scale introducing a belt press dewatering machine (the one at Truc Bach treatment plant) is better from the operations and maintenance cost point of view. Or, solar drying is also interesting, and is suitable for the climate in Vietnam. However, to increase the efficiency of solar drying, some measures such as a roof and fans should be taken.
- ✓ According to the Head of the treatment plant, when equipment breaks down the time for

ordering parts, etc., is 6 to 7 weeks, and repair and replacement takes up to 3 months, but looking at the treatment plant as a whole, spare parts could not be seen. Providing 1 spare part for each type leads to stable operation. No effort should be spared in this respect, even if it is difficult for the budget.

(Comment from Mr. Kaneko)

- ✓ The design of the electrical system of the treatment plant is not very good. The cables arriving at the treatment plant from outside are laid along low channels, so there is a high possibility of water ingress.
- ✓ There are no lightning rods. (The SCADA monitoring and control system was struck by lightning and damaged)

vii) Final Discussion

The final lecture time of the training course consisted of a discussion with all the lecturers answering questions from the trainees. The main discussions were as follows.

(Question) To what extent should bad odors be anticipated?

(Answer) The main cause of smells is decay of the sewage under anaerobic conditions. Typical smells are caused by sulfides. To minimize bad odors, the sewage and sludge should be in an anaerobic environment as little as possible. Specifically, it is important that the influent sewage be under aerobic conditions as soon as possible. If it is in an anaerobic environment then the whole treatment plant will smell bad.

(Question) For the methods of treating smells by biological deodorization, how are the initial microorganisms cultivated, and is the effect of these microorganisms maintained?

(Answer) Biological deodorization uses the activities of microorganisms, and it is necessary to feed these organisms (to create conditions in which they can breed).

If activated sludge is dispersed and aerated, the microorganisms will breed. Their main food is hydrogen sulfide (sulfides). Smells cannot be seen, but as a countermeasure against smells by just seeing the track of the sludge process, the smells can be visually sensed. Therefore, visual countermeasures against smells should be taken at facilities.

In deodorization with activated carbon, when moisture adheres to the surface of activated carbon, the microorganisms can breed on it, so there is a certain amount of biological deodorization. However, it cannot be maintained if the wastewater is not properly controlled. Also, when there is too much sulfide in the smell or when the pH is too low, the microorganism activity is reduced so the deodorization process stops. It is important to adjust the pH.

The ultimate countermeasure against bad smells is to prevent the occurrence of bad smells. For this purpose, the necessary and sufficient condition is to not allow sludge to accumulate within the treatment plant as much as possible, and to rapidly process and dispose of it.

(Question) In the separate system, rainwater wastewater and domestic sewage are separated, but in the

event that sewage that includes toxic substances such as wastewater from factories, etc., were to flow into the facility, what would happen?

(Answer) In Japan, this is prohibited, and a separate facility must be provided.

The persons responsible for management of sewage should have the authorities of warning, wastewater planning, and prohibition of wastewater granted by regulations. It is necessary to prevent the inflow from factories through awareness activities and enforcement of laws and regulations, but sometimes oil, etc., flows into the treatment plant. In this case, measures should be taken before it arrives at the facility.

Oil and other volatiles (gasoline, etc.) can cause fires, so care is necessary.

Response in advance: Information collection, cameras, Response after occurrence: Temporary storage, analysis of the stored water and if there is no problem, carry out treatment of the water, Determination of the cause: Where did it come from?

(Question) When there is heavy rain, there is a possibility of flooding. However, what should be done about the case where when the road is flooded and residents open the manholes to discard the domestic wastewater?

(Answer) There are some areas where development of rainwater facilities are not advanced even with separate systems, and residents have connected the rainwater pipes to the sewage pipes. The best thing is to take countermeasures against flooding of the rainwater pipes, but this requires time and expense. It is necessary to carry out awareness activities, and install temporary facilities (retarding reservoirs), and install actual facilities (install rainwater pipes).

(Question) What are the measures for bleeding air (gas) from within the sewer pipes?

(Answer) In Japan smells generally do not occur from manholes. In Japan, the sewers are provided with a slope, so to a certain extent, there is a natural flow rate. On the other hand, in Vietnam, the pipes within the facilities have no slope, so matter accumulates in the pipes and as a result smells occur. These installed pipes should be cleaned. In the case of Vietnam, the cause of bad odors is almost always the deposited matter, and this is caused by reverse flow within the sewers. This can only be corrected by construction.

(Question) In Vietnam, the sewage companies including private companies are not trusted by the users.

(Answer) In Japan, projects are carried out in response to the needs for sewerage, and this has a result that can be seen. (Flushing toilets, prevention of flooding). If there is no trust from the residents, it is necessary to seriously analyze why this is the case.

(Question) Where do the funds for public relations activities come from in Japan?

(Answer) It is paid for from a special account known as the Sewage Account, in other words, from the sewage charges paid by the users and from tax. It is important to ensure the organization system and resources.

(Question) At what stage does JICA become involved in sewerage planning in Vietnam?

(Answer) It is necessary that there be a request from the Vietnamese side (to be confirmed)

(Question) Bac Giang sewage treatment plant is a European type of facility, and when there is a breakdown of the terminals in the control room, replacement with other companies' products is blocked. Therefore, it is necessary to procure from the same European company. What is the situation with Japanese facilities?

(Answer) The parts can be replaced、 if at the ordering stage the part used is indicated on the requirements documents.

(Question) Tell us about the method of planning sewage treatment plants and sewers in rural areas (areas where the population is small compared with cities)?

(Answer) In Japan, sewerage planning areas are defined. The method of defining them takes into consideration the efficiency of individual processing and processing as a group. Therefore, it is not the case that all areas have a treatment plant installed, and in rural areas it may be that processing is carried out using individual septic tanks.

(Question) In Vietnam, is it possible to use the PPP format when constructing sewage treatment plants?

(Answer) At present, only 10% of the water bills is allocated to sewage costs. Currently, the private sector does not provide resources in the form of PPP.

(Question) At present only solar drying is carried out for sludge processing. What is the ideal method of processing?

(Answer) It is necessary to investigate the ideal processing method in accordance with the conditions such as wastewater standards, fluctuations in incoming flow rates, etc., whether the processing method is for processing organic matter only, or for removal of nitrogen and phosphorus, etc., and in accordance with the scale of the treatment plant (personnel cost, operations and maintenance cost).

Countermeasures against smells are necessary for both solar drying and dewatering processes. The area of the floor for solar drying must be taken into consideration. Also, solar drying is affected by the weather, so it is necessary to take measures such as installing a roof and industrial fans.

Various substances are concentrated in sludge processing. Likewise heavy metals are concentrated. In some cases a high concentration of heavy metals remains. Countermeasures against this are essential.

Appendix 8-12 Questionnaire Format after Lecture

Questionnaire for Trainees of Pilot Training for Sewage Works Manager Course Project for ENHANCING MANAGEMENT CAPACITY OF SEWAGE WORKS

Participant Name: Mr./Ms. _____

Lecture/Observation/Practice: _____

Date & Time: _____

Venue: _____

Q1. Was the lecture easy to understand and of satisfactory quality?

← ← Yes, very good			No, poor → →
☐4	☐3	☐2	☐1

Q2. Were you satisfied with the textbooks and materials used in the program?

← ← Yes, very much			No, not at all → →
☐4	☐3	☐2	☐1

Q3. Please write the main points (including key words) of the lecture/observation?

Q4. Please write the questions/comments left unanswered from the lecture/ observation (including key words)?

Q5. Were the lecture/observation adapted to the project?

← ← Yes, very much			No, not at all → →
☐4	☐3	☐2	☐1

Thank you very much for your cooperation!

Appendix 8-13 Questionnaire Format after Training

Questionnaire for participants in 1st pilot training

On

JICA Project for Enhancing Management Capacity of Sewerage Works (Detailed Planning Phase)

Date:_____

Name of trainee _____ Organization _____

1) How would you rate this training overall?
- Excellent
- Satisfactory
- Unsatisfactory
- Poor

2) What did you like best about the training?

Best →

*If any, poor (necessary to be improved) →

3) What kind trainings are you needed?

(What kind trainings would you like to have in the future?)

4) How would you rate the quality of the training textbook/materials?
- Excellent
- Satisfactory
- Unsatisfactory
- Poor

Comment:

5) The meeting room and facilities were adequate and comfortable?

6) Question for trainee, to stay overnight (Accommodation)

How would you rate the accommodation for training?
- Excellent
- Satisfactory
- Unsatisfactory
- Poor

Comment:

7) The time allotted for the training was sufficient?

8) What aspects of the training could be improved?

9) Would you like to join next training (2nd pilot tanning)?

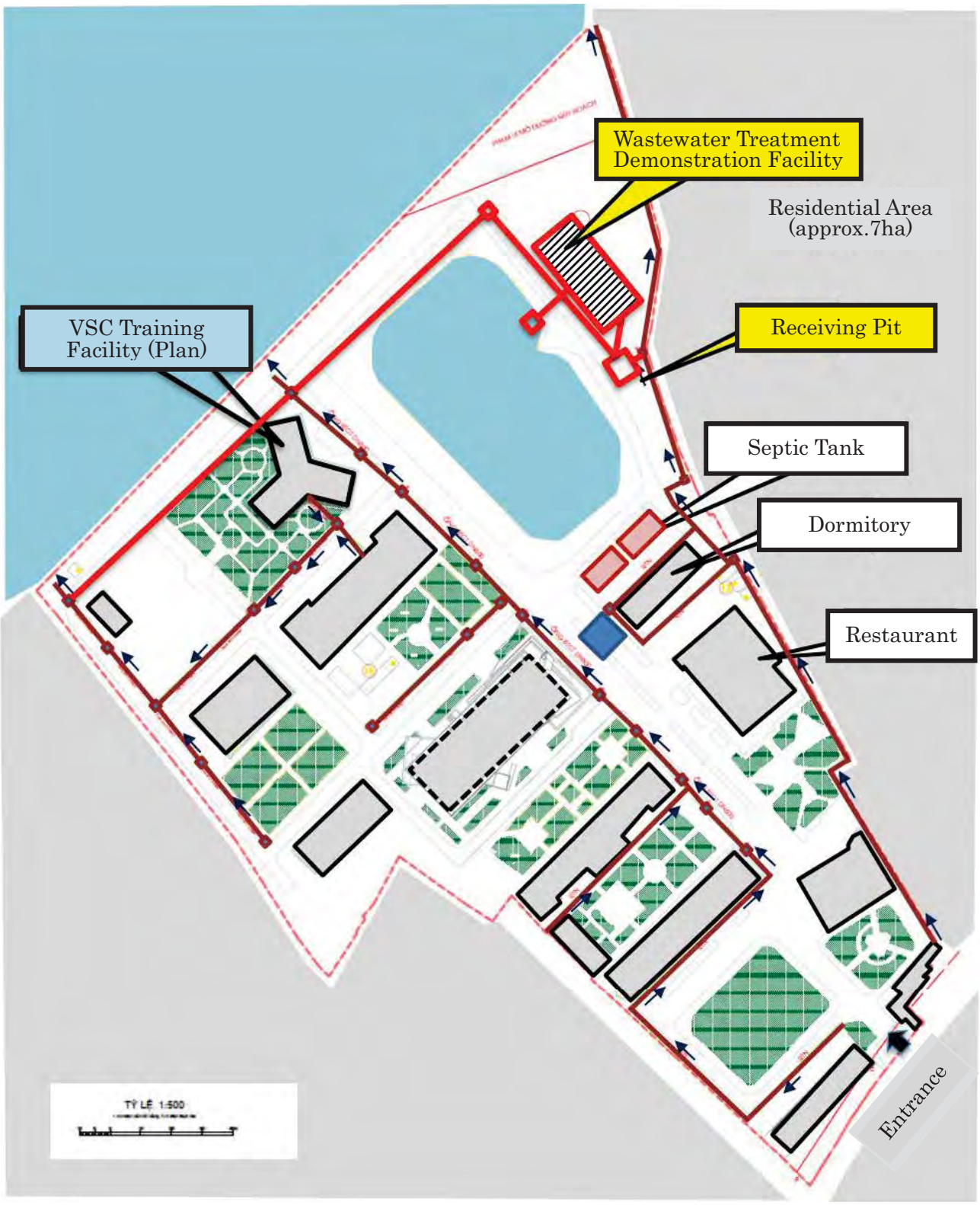
Yes No

10) What, if any, improvements would you suggest or request to VSC?

Please share other comments or expand on previous responses here:

Thank you for your feedback!

Appendix 8-14 Installation Image of Wastewater Treatment Demonstration Facility



Appendix 8-15 Invitation and Application Form for the Training

Attention

Re: Invitation to the First Pilot Training for Sewerage Works Manager Course within the PROJECT FOR ENHANCING MANAGEMENT CAPACITY OF SEWERAGE WORKS

Within the scope of the technical cooperation (TC) for PROJECT FOR ENHANCING MANAGEMENT CAPACITY OF SEWERAGE WORKS (hereafter refer as the Project), "The First Pilot Training for Sewerage Works Manager Course" will be organized in Hanoi from August 8th to 11th, 2016 (see Attachment 1: GENERAL INFORMATION ON "The First Pilot Training for Sewerage Works Manager Course").

ATI of MOC and JICA Vietnam Office would like to invite 20 (twenty) Vietnamese manager who are involved in the sewerage works. JICA will provide a round air ticket from your province to Hanoi.

We would appreciate it if you can select the trainees meeting the above requirements and send the "Application Form for the VSC Training Program" and other required documents (Job Report) filled in by the participants to Mr. Inoue Yakuro (E-mail; yinoue@jat.co.jp) and Ms. Do Thi Nga (E-mail; ngayen@gmail.com) no later than July 27th, 2016.

Thank you and we look forward to receiving your reply

22 July 2016

Administration of Technical Infrastructure
Ministry of Construction

Dr. Nguyen Hoan Tien
Director General, ATI, MOC
Head of PMB, MOC

Attachment 1: GENERAL INFORMATION ON "The First Pilot Training for Sewerage Works Manager Course
Attachment 2: Job Report
Attachment 3: Application Form for the VSC Training Program

Attachment 1

VSC TRAINING PROGRAM

GENERAL INFORMATION ON

The First Pilot Training for Sewerage Works Manager Course

From 8 to 11 August, 2016

This information pertains to one of the pilot training programs of the Vietnam Sewerage Center (VSC) (tentative) based on the Project for Enhancing Management Capacity of Sewerage Works: Detailed Planning Phase implemented by the Japan International Cooperation Agency (JICA). This program, conducted in collaboration with the College of Urban Works Construction (CUWC), aims to enhance management capacity of sewerage works in Vietnam as well as to investigate a feasibility of VSC.

I. Concept

Background

The construction of sewerage system with the development of water supply system in Vietnam is indispensable to enhance public health and prevent water pollution in urban areas.

To conduct water pollution control, there are a lot of sewage works implementing national wide in Vietnam. Sewage works mainly need administrational institutes, financial systems and human resources. Especially, shortage of human resources is one of very serious issue in Vietnam. The Ministry of Construction (MOC) in Vietnam has requested JICA to support improving this present situations.

According to the request from MOC, JICA has started the technical assistance program named "The Project for Enhancing Management Capacity of Sewerage Works: Detailed Planning Phase". In this project MOC and JICA are preparing to establish the Vietnam Sewerage Center (VSC) (tentative) to conduct trainings, project implementation supports and research & development. A pilot training course is planning to investigate a feasibility of the VSC.

For what?

This course aims at providing comprehensive general knowledge on management of sewage works, which will enable trainees to implement sewage works suitable for water pollution control in urban areas, and will provide a candidate of competent trainer in the VSC in the future.

For whom?

Managers from central or local governments or related organizations in charge of urban sewage works planning, and/or regional sewerage facility design and construction works, and/or operation & maintenance.

Target local governments will be considered to future JICA assistance.

II. Description

1. Period of program: 8th to 11th August 2016

2. Objective:

This course aims at providing comprehensive knowledge on management of sewage works, which will enable trainees to implement sewage works suitable for water pollution control in urban areas, and will provide a candidate of competent trainer in the VSC in the future.

3. Eligible / Target Organization :

Administrative organizations concerned with urban sewage works planning and/or sewage facility design, and/or operation & maintenance.

4. Total Number of Participants : 20

5. Language to be used in this project：
Vietnamese with translator (Lecture),
Vietnamese (Textbooks)

6. Contents: This program consists of the following components. Details on each component are given below: (Please note that the topics and schedule may be tentative)

Date	Time	Lecture	Outline of lecture
8 Aug. (Mon)	15:00- 17:00-	Move to CUWC Registration Welcome party	(provided by JICA study team)
9 Aug. (Tue)	8:30- 8:45 - 9:00	Textbook delivery Opening ceremony	Opening speech by MOC and JICA
	9:00 - 9:30	Orientation	Orientation of the program, objectives & targets, introduction of VSC
	9:30-945	Tea Break	
	9:45 - 11:30	Introduction to sewage works	Outlines of sewage works and background (Japan and Vietnam), including recommendation to Vietnam
	11:30-13:30	Lunch	
	13:30-14:30	Administrative systems for sewage works	Introduction of administration/regulation system for sewage works
	14:30-14:45	Tea Break	
	14:45-15:45	Financial system for sewage works	Introduction of financial system in sewage works (water tariff/user charge)
	16:00-17:00	Discussion (1)	Wrap-upping for needs/scope of VSC
10 Aug. (Wed)	8:30-10:00	Sewage work planning (1)	Master planning of sewage works development (experience in Japan), and life cycle of sewage works
	10:00-10:15	Tea Break	
	10:15-11:15	Sewage work planning (2)	Master planning of sewage works in Vietnam
	11:15-13:00	Lunch	
	13:00-14:30	Sewerage system control (Japanese style)	Management, operation & maintenance planning of sewerage system
	14:30-14:45	Tea Break	
	14:45-15:45	Public relation and hearing	Public relation, public hearing and citizen participants in sewage works
	15:45-16:45	Discussion (2)	Summarizing training course/Lesson learned
	16:45-17:15 17:15-	Closing ceremony Farewell party	Speech by MOC, JICA and CUWC. Certification presentation (provided by CUWC)
11 Aug. (Thu)		Leave from CUWC	

III. Administrative Arrangements

1. **Organizer:**
   MOC and JICA, Vietnam Sewerage Center (VSC) PMU
   (1) Contact: Do Thi Nga (Ms.), Senior Assistant to JICA Study Team
   (2) TEL: (+84) 940 770778
   (3) E-mail: ngayen@gmail.com

2. **Expenses:**
   (1) Transportation expenses: The cost of transportation should be borne by a trainee's organization in principle. Otherwise, please consult with MOC on payment
   (2) Accommodation: A hotel near CUWC will be provided by CUWC. Otherwise, trainee should provide his/her accommodation by himself/ herself.
   (3) Transportation service: Transportation service will be provided between the Hanoi Noi Bai Airport and CUWC, or between a hotel and CUWC.
   (4) Registration fee: Registration fee will be free

Appendix 8-16 Wastewater Treatment DB by WB

1. Name of Participating Utilities in Sewerage Performance Indicators – Year 2014

Province	*No.*	*Name of Utility*	*Participation*
		A. Northern Midland and Mountainous Region	
9. Quang Ninh	1)	Ha Long Urban Environment Joint Stock Company - Quang Ninh	**Y**
15. Bac Giang	2)	Urban Drainage Pumping Center - Bac Giang City	**Y**
		Sub-total A = 02 Utilities (Participating: 02)	
		B. Red River Delta Region	
1. Ha Noi	3)	1) Hanoi Water Drainage and Sewerage One Member Limited Company	**Y**
1. Ha Noi	4)	4) Vietnam SFC Company	
3. Bac Ninh	5)	1) Bac Ninh Drainage and Wastewater Treatment One Member Limited Company	**Y**
7. Hai Duong	6)	Hai Duong Urban Works Management Limited Company	**Y**
		Sub-total B = 05 Utilities (Participating: 03; Not participating:02)	
		C. Central Coast Region	
2. Nghe An	7)	Vinh Urban Infrastructure Development and Management	
4. Quang Bình	8)	Quang Binh Environmental and Urban Development One Member Limited Company	**Y**
7. Đa Nang	9)	Da Nang Water Drainage and Wastewater Treatment Company	**Y**
		Sub-total C = 03 Utilities (Participating: 02; Not participating: 01)	
		Sub-total C = 03 Utilities (Participating: 02; Not participating: 01)	
		D. Central Highland Region	
3. Dak Lak	10)	1) Dak Lak Urban Management and Environment One Member Limited Company	**Y**
5. Lam Dong	11)	Lam Dong Water Supply and Sewerage One Member Limited Company (LAWACO)	**Y**
		Sub-total D= 02 Utilities (Participating: 02)	
		E. South East Region	
1. HCMC	12)	1) HO Chi Minh Urban Drainage Company	**Y**
1. HCMC	13)	2) Phu My Hung Development Limited Company	**Y**
2. Binh Duong	14)	1) Binh Duong Water Supply, Sewerage and Environment One Member Limited Company	**Y**
		Sub-total E = 03 Utilities (Participating: 03)	
		F. Mekong River Delta Region	
7. Soc Trang	150	Soc Trang Urban Works One Member Limited Company	**Y**
		Sub-total F = 01 Utility (Participating: 01)	
		Total A+B+C+D+E+F = 15 Utilities (Participating: 13; Not participating: 02)	**13**

2. Cities, Population and WW Service Coverage

Province	No.	Name of Utility	WW Service Coverage in 2014					DoC
			C21	C22	C24	C25	C1.1	
			Number of cities served with waste water treatment services	Name of cities served with WWTPs	Total population of service areas of WWTPs	Total population served by WWTPs	Waste water treatment service coverage	Ratio of urban population served with waste water treatment services
			(#)		('000 people)	('000 people)	%	%
		A. Northern Midland and Mountainous Region						
9. Quang Ninh	1)	Ha Long Urban Environment Joint Stock Company - Quang Ninh	1	Ha Long City	163.757	148.757	90.84	100
15. Bac Giang	2)	Urban Drainage Pumping Center - Bac Giang City	1	Bac Giang City	110.000	100.000	90.91	Grade II: 10; Grade IV: 40; Grade V: 33.3
		Sub-total A = 02 Utilities (Participating: 02)			**273.76**	**248.76**	**90.87**	
		B. Red River Delta Region						
1. Ha Noi	3)	1) Hanoi Water Drainage and Sewerage One Member Limited Company	3	Ha Noi City	143.700	143.700	100.00	NI
1. Ha Noi	4)	4) Vietnam SFC Company	N/I	N/I	N/I	N/I	N/I	
3. Bac Ninh	5)	1) Bac Ninh Drainage and Wastewater Treatment One Member Limited Company	1	Bac Ninh City	178.000	37.800	21.24	70
7. Hai Duong	6)	Hai Duong Urban Works Management Limited Company	1	Hai Duong City	275.000	49.317	17.93	Grade II: 100; Grade IV: 60
		Sub-total B = 05 Utilities (Participating: 03; Not participating:02)	**5**		**596.700**	**230.817**	**38.68**	
		C. Central Coast Region						
2. Nghe An	7)	Vinh Urban Infrastructure Development and Management	N/I	N/I	N/I	N/I	N/I	
4. Quang Bình	8)	Quang Binh Environmental and Urban Development One Member Limited Company	1	Dong Hoi City	115.000	58.700	51.04	31.44
7. Đa Nang	9)	Da Nang Water Drainage and Wastewater Treatment Company	1	Da Nang City	899.000	492.430	54.78	N/I

Province	No.	Name of Utility	WW Service Coverage in 2014					DoC
			C21	C22	C24	C25	C1.1	
			Number of cities served with waste water treatment services	Name of cities served with WWTPs	Total population of service areas of WWTPs	Total population served by WWTPs	Waste water treatment service coverage	Ratio of urban population served with waste water treatment services
			(#)		('000 people)	('000 people)	%	%
		Sub-total C = 03 Utilities (Participating: 02; Not participating: 01)	**2**		**1,014.000**	**551.130**	**54.35**	
		D. Central Highland Region						
3. DakLak	10)	1) Dak Lak Urban Management and Environment One Member Limited Company	1.0	Buon Ma Thuat City	351.000	33.000	9.40	9.77
5. Lam Dong	11)	Lam Dong Water Supply and Sewerage One Member Limited Company (LAWACO)	1.0	Da Lat City	212.000	28.000	13.21	N/I
		Sub-total D= 02 Utilities (Participating: 02)	**2.0**		**563.000**	**61.000**	**10.83**	
		E. South East Region						
1. HCMC	12)	1) Ho Chi Minh Urban Drainage Company	1	HCMC	700.000	545.000	77.86	N/I
1. HCMC	13)	2) Phu My Hung Development Limited Company	1	Phu My Hung	100.000	100.000	100.00	
2. Binh Duong	14)	1) Binh Duong Water Supply, Sewerage and Environment One Member Limited Company	1	Thu Dau Mot City	305.000	137.000	44.92	0.023
		Sub-total E = 03 Utilities (Participating: 03)	**3**		**1,105.000**	**782.000**	**70.77**	
		F. Mekong River Delta Region						
7. Soc Trang	15)	Soc Trang Urban Works One Member Limited Company	1	Soc Trang City	137.588	47.207	34.31	100
		Sub-total F = 01 Utility (Participating: 01)	**1**		**137.588**	**47.207**	**34.31**	
		Total A+B+C+D+E+F = 15 Utilities (Participating: 13; Not participating: 02)	**15**		**3,690.045**	**1,920.911**	**52.06**	

Note: N/I: No information

3. Design Parameters - WWTP: Design Capacity and Treatment Process

Province	No.	Name of Utility	Design Parameters - WWTP: Design Capacity and Treatment Process – Year 2014						
			C37	C40	C42	C3.1	C51	C51A	C51B
			Number of municipal centralized WWTPs in the Province that is under your operation and maintenance	Total design capacity of WWTPs	Waste water treatment process of each WWTP	Land used ratio	The total volume of treated WASTE WATER discharged into:	A- Water resources that used for purpose of domestic water supply	B- Water resources that not used for purpose of domestic water supply
			(#)	m3/day		Ha/1.000m3/ day	m3/year	m3/year	m3/year
		A. Northern Midland and Mountainous Region							
9. Quang Ninh	1)	Ha Long Urban Environment Joint Stock Company - Quang Ninh	4	13,900	Receiving chamber>sewage screen> primary clarifier tank> anaerobic> secondary clarifier> aroten> final clarifier tank> disinfection>Discharge into sea	4.924	3,221,232.0	0	3,221,232.0
15. Bac Giang	2)	Urban Drainage Pumping Center - Bac Giang City	1	10,000	Sewage screen>Grit chamber> Mixing Tank>(Mix COC biological treatment) > Clarifier> Disinfection	0.250	3,300,000.0	0	3,300,000.0
		Sub-total A = 02 Utilities (Participating: 02)	**5**	**23,900**		**2.969**	**6,521,232.0**	**0**	**36,521,232.0**
		B. Red River Delta Region							

Province	No.	Name of Utility	Design Parameters - WWTP: Design Capacity and Treatment Process – Year 2014						
			C37	C40	C42	C3.1	C51	C51A	C51B
			Number of municipal centralized WWTPs in the Province that is under your operation and maintenance	Total design capacity of WWTPs	Waste water treatment process of each WWTP	Land used ratio	The total volume of treated WASTE WATER discharged into:	A- Water resources that used for purpose of domestic water supply	B- Water resources that not used for purpose of domestic water supply
			(#)	m3/day		Ha/1.000m3/ day	m3/year	m3/year	m3/year
1. Ha Noi	3)	1) Hanoi Water Drainage and Sewerage One Member Limited Company	3	48,000	Receiving chamber> sewage screen, grit chamber> stabilization pond> Primary clarifier tank>anaerobic> aerobic pond> aeration tank> secondary clarifier tank> disinfection	0.104	4,280,095.0	0	4,280,095.0
1. Ha Noi	4)	4) Vietnam SFC Company	N/I	N/I	N/I	N/I	N/I	N/I	N/I
3. Bac Ninh	5)	1) Bac Ninh Drainage and Wastewater Treatment One Member Limited Company	1	17,500	Receiving chamber>sewage screen> grit chamber> Sector Tank (Mix Tank)> C-Tech Tank (biological treatment) > retention basin	0.171	1,963,941.0	0	1,963,941.0
7. Hai Duong	6)	Hai Duong Urban Works Management Limited Company	1	13,000	Receiving chamber>sewage screen, splitter >grit chamber>primary clarifier tank> sludge tank> sludge decomposition>Ngoc Chau channel	0.128	1,800,000.0	0	1,800,000.0

Province	No.	Name of Utility	Design Parameters - WWTP: Design Capacity and Treatment Process – Year 2014						
			C37	C40	C42	C3.1	C51	C51A	C51B
			Number of municipal centralized WWTPs in the Province that is under your operation and maintenance	Total design capacity of WWTPs	Waste water treatment process of each WWTP	Land used ratio	The total volume of treated WASTE WATER discharged into:	A- Water resources that used for purpose of domestic water supply	B- Water resources that not used for purpose of domestic water supply
			(#)	m3/day		Ha/1.000m3/ day	m3/year	m3/year	m3/year
		Sub-total B = 05 Utilities (Participating: 03; Not participating:02)	**5**	**78,500**		**0.123**	**8,044,036.0**	**0**	**8,044,036.0**
		C. Central Coast Region							
2. Nghe An	7)	Vinh Urban Infrastructure Development and Management	N/I	N/I	N/I	N/I	N/I	N/I	N/I
4. Quang Binh	8)	Quang Binh Environmental and Urban Development One Member Limited Company	1	10,000	Sewage screen>Grit chamber> aerobic pond>Facultative pond>Maturation Pond>Artificial dam	1.425	1,366,543.0	0	1,366,543.0
7. Da Nang	9)	Da Nang Water Drainage and Wastewater Treatment Company	4	133,129	Wastewater> sewage screen> flow channel> anaerobic > receiving source	0.095	42,648,745.0		42,648,745.0
		Sub-total C = 03 Utilities (Participating: 02; Not participating: 01)	**5**	**143,129**		**0.188**	**44,015,288.0**		**44,015,288.0**
		D. Central Highland Region							

Province	No.	Name of Utility	Design Parameters - WWTP: Design Capacity and Treatment Process – Year 2014						
			C37	C40	C42	C3.1	C51	C51A	C51B
			Number of municipal centralized WWTPs in the Province that is under your operation and maintenance	Total design capacity of WWTPs	Waste water treatment process of each WWTP	Land used ratio	The total volume of treated WASTE WATER discharged into:	A- Water resources that used for purpose of domestic water supply	B- Water resources that not used for purpose of domestic water supply
			(#)	m3/day		Ha/1.000m3/ day	m3/year	m3/year	m3/year
3. DakLak	10)	1) Dak Lak Urban Management and Environment One Member Limited Company	1	8,125	Receiving chamber>sewage screen >grit chamber> flow measurement tunnel>flow splitting chamber > anaerobic A1-A2> air chamber CA1>biological pond F1-1,F2-1> air chamber CA2>stabilization pond M2-1;M2-2 và M1-1,M1-2>interceptor> discharge into receiving source	2.462	1,241,500.0	0	1,241,500.0
5. Lam Dong	11	Lam Dong Water Supply and Sewerage One Member Limited Company (LAWACO)	1	7,400	Receiving chamber> Grit chamber> Imhoff tank > biological filter tank > secondary clarifier tank> Aerobic pond>Maturation pond>Receiving source	1.014	2,900,303.0	0	2,900,303.0
		Sub-total D= 02 Utilities	**2.0**	**15,525**		**1.771**	**4,141,803.0**	**0**	**4,141,803.0**

Province	No.	Name of Utility	Design Parameters - WWTP: Design Capacity and Treatment Process – Year 2014						
			C37	C40	C42	C3.1	C51	C51A	C51B
			Number of municipal centralized WWTPs in the Province that is under your operation and maintenance	Total design capacity of WWTPs	Waste water treatment process of each WWTP	Land used ratio	The total volume of treated WASTE WATER discharged into:	A- Water resources that used for purpose of domestic water supply	B- Water resources that not used for purpose of domestic water supply
			(#)	m3/day		Ha/1.000m3/ day	m3/year	m3/year	m3/year
		(Participating: 02)							
		E. South East Region							
1. HCMC	12)	1) Ho Chi Minh Urban Drainage Company	2	171,000	Primary clarifier tank> aeration tank> secondary clarifier tank> disinfection; gravity sludge thickener> centrifugal sludge thickener > water separator and Compost	0.281	56,510,410	0	56,510,410
1. HCMC	13)	2) Phu My Hung Development Limited Company	2	20,000	Sewage screen> collection tank> fine sewage screen > grit chamber> oxidation ditch with clarifier chamber> disinfection	0.516	1,330,948.0	0	1,330,948.0
2. Binh Duong	14)	1) Binh Duong Water Supply, Sewerage and Environment One Member Limited Company	1	17,650	Receiving chamber>sewage screen>grit chamber with aeration>ASBR>UV disinfection>stabilization pond	0.623	1,844,820.0	0	1,844,820.0
		Sub-total E = 03 Utilities	**5**	**208,650**		**0.332**	**59,686,178**	**0**	**59,686,178.0**

Province	No.	Name of Utility	Design Parameters - WWTP: Design Capacity and Treatment Process – Year 2014						
			C37	C40	C42	C3.1	C51	C51A	C51B
			Number of municipal centralized WWTPs in the Province that is under your operation and maintenance	Total design capacity of WWTPs	Waste water treatment process of each WWTP	Land used ratio	The total volume of treated WASTE WATER discharged into:	A- Water resources that used for purpose of domestic water supply	B- Water resources that not used for purpose of domestic water supply
			(#)	m3/day		Ha/1.000m3/ day	m3/year	m3/year	m3/year
		(Participating: 03)							
		F. Mekong River Delta Region							
7. Soc Trang	15)	Soc Trang Urban Works One Member Limited Company	1	13,181	Receiving chamber> raw sewage screen> fine sewage screen> grit chamber with aeration > secondary clarifier tank> sludge pit> sludge drying bed	0.228	2,310,508.00	0	2,310,508.00
		Sub-total F = 01 Utility (Participating: 01)	**1**	**13,181**		**0.228**	**2,310,508.00**	**0**	**2,310,508.00**
		Total A+B+C+D+E+F = 15 Utilities (Participating: 13; Not participating: 02)	**23**	**482,885**		**0.429**	**124,719,045.0**	**0**	**124,719,045.0**

4. Performance of Wastewater Treatment Plants – Year 2014

Province	No.	Name of Utility	Performance of WWTP						
			C47	C48	C3.3	C3.4	C3.5	C3.6	C53
			Total volume of Waste Water treated in the year	The outside sludge transported to the WWTPs for treatment	Production utilization of capacity	The % of treated waste water samples tested by DoNRE that pass relevant standard	The % of treated waste water samples tested by the Utility that pass relevant standard	Ratio of number of complaints about Waste Water treatment that formally received (by writings, telephone calls) in the year to the population served	Total volume (quantity) of bio solids produced in the year from the WASTE WATER treatment process
			m3/year	m3/year	%	%	%	#/ 1.000 people	Tons of solids / year or m3 / year (plus humidity of sludge)
		A. Northern Midland and Mountainous Region							
9. Quang Ninh	1)	Ha Long Urban Environment Joint Stock Company - Quang Ninh	3,221,232.0	940	63.49	100.0	100.0	0	0
15. Bac Giang	2)	Urban Drainage Pumping Center - Bac Giang City	3,300,000.0	0	90.41	N/I	N/I	0	300.0
		Sub-total A = 02 Utilities (Participating: 02)	**6,521,232.0**	**940**	**74.75**	**100.0**	**100.0**	**0**	**300.0**
		B. Red River Delta Region							
1. Ha Noi	3)	1) Hanoi Water Drainage and Sewerage One Member Limited Company	4,280,095.0	0	24.43	100.0	100.0	0	1,920.0
1. Ha Noi	4)	4) Vietnam SFC Company	0	0	N/I	N/I	N/I	N/I	
3. Bac Ninh	5)	1) Bac Ninh Drainage and Wastewater Treatment One Member Limited Company	1,963,941.0	0	30.75	100.0	100.0	0	865.0
7. Hai Duong	6)	Hai Duong Urban Works Management Limited Company	1,800,000.0	0	37.93	100.00	100.00	0	0

Province	No.	Name of Utility	Performance of WWTP						
			C47	C48	C3.3	C3.4	C3.5	C3.6	C53
			Total volume of Waste Water treated in the year	The outside sludge transported to the WWTPs for treatment	Production utilization of capacity	The % of treated waste water samples tested by DoNRE that pass relevant standard	The % of treated waste water samples tested by the Utility that pass relevant standard	Ratio of number of complaints about Waste Water treatment that formally received (by writings, telephone calls) in the year to the population served	Total volume (quantity) of bio solids produced in the year from the WASTE WATER treatment process
			m3/year	m3/year	%	%	%	#/ 1.000 people	Tons of solids / year or m3 / year (plus humidity of sludge)
		Sub-total B = 05 Utilities (Participating: 03; Not participating:02)	**8,044,036.0**	**0**	**28.07**	**100.0**	**100.0**	**0**	**2,785.0**
		C. Central Coast Region							
2. Nghe An	7)	Vinh Urban Infrastructure Development and Management	0	0	N/I	N/I	N/I	N/I	
4. Quang Binh	8)	Quang Binh Environmental and Urban Development One Member Limited Company	1,366,543.0	0	37.44	66.67	95.83	0	0
7. Da Nang	9)	Da Nang Water Drainage and Wastewater Treatment Company	42,648,745.0	0	87.77	100.0	100.0	0	NI
		Sub-total C = 03 Utilities (Participating: 02; Not participating: 01)	**44,015,288.0**	**0**	**84.25**	**99.93**	**99.87**	**0**	
		D. Central Highland Region							

Province	No.	Name of Utility	Performance of WWTP						
			C47	C48	C3.3	C3.4	C3.5	C3.6	C53
			Total volume of Waste Water treated in the year	The outside sludge transported to the WWTPs for treatment	Production utilization of capacity	The % of treated waste water samples tested by DoNRE that pass relevant standard	The % of treated waste water samples tested by the Utility that pass relevant standard	Ratio of number of complaints about Waste Water treatment that formally received (by writings, telephone calls) in the year to the population served	Total volume (quantity) of bio solids produced in the year from the WASTE WATER treatment process
			m3/year	m3/year	%	%	%	#/ 1.000 people	Tons of solids / year or m3 / year (plus humidity of sludge)
3. DakLak	10)	1) Dak Lak Urban Management and Environment One Member Limited Company	1,861,500.0	4,953	62.77	N/I	100.0	0	0
5. Lam Dong	11)	Lam Dong Water Supply and Sewerage One Member Limited Company (LAWACO)	2,900,603.0	734	107.39	100.00	0	0	734.00
		Sub-total D= 02 Utilities (Participating: 02)	**4,762,103.0**	**5,687**	**84.04**	**100.00**	**1.57**	**0**	**734.00**
		E. South East Region							
1. HCMC	12)	1) Ho Chi Minh Urban Drainage Company	56,510,410.0	0	90.54	N/I	83.33	0	13,234.00
1. HCMC	13)	2) Phu My Hung Development Limited Company	1,984,438.0	0	27.18	N/I	100.00	0	17.00
2. Binh Duong	14)	1) Binh Duong Water Supply, Sewerage and Environment One Member Limited Company	1,944,820.0	6,311	30.19	100.00	100.00	0	437.00
		Sub-total E = 03 Utilities (Participating: 03)	**60,439,668.0**	**6,311**	**79.36**	**100.00**	**88.55**	**0**	**13,688.00**

Province	No.	Name of Utility	Performance of WWTP						
			C47	C48	C3.3	C3.4	C3.5	C3.6	C53
			Total volume of Waste Water treated in the year	The outside sludge transported to the WWTPs for treatment	Production utilization of capacity	The % of treated waste water samples tested by DoNRE that pass relevant standard	The % of treated waste water samples tested by the Utility that pass relevant standard	Ratio of number of complaints about Waste Water treatment that formally received (by writings, telephone calls) in the year to the population served	Total volume (quantity) of bio solids produced in the year from the WASTE WATER treatment process
			m3/year	m3/year	%	%	%	#/ 1.000 people	Tons of solids / year or m3 / year (plus humidity of sludge)
		F. Mekong River Delta Region							
7. Soc Trang	15)	Soc Trang Urban Works One Member Limited Company	2,310,508.0	0	48.02	0	100.00	35.95	540.00
		Sub-total F = 01 Utility (Participating: 01)	**2,310,508.0**	**0**	**48.02**	**0**	**100.00**	**35.95**	**540.00**
		Total A+B+C+D+E+F = 15 Utilities (Participating: 13; Not participating: 02)	**126,092,835.0**	**12,938**	**71.54**	**99.82**	**89.24**	**0.88**	**18,047.00**

5. Electricity Consumption and Staff

Province	No.	Name of Utility	Electricity Consumption and Staff				
			C3.7	C3.8	C3.9	C4.6	C4.7
			Electricity consumption per m3 of waste water treated	Ratio of staff number to the waste water treated capacity	Ratio of staff number per person served	Ratio of training cost to revenue	Training cost per staff
			KWh/m3	Staff/ 1.000m3 day	Staff/1000 people	%	Mil. VND/staff
		A. Northern Midland and Mountainous Region					
9. Quang Ninh	**1)**	**Ha Long Urban Environment Joint Stock Company - Quang Ninh**	**0.428**	**5.892**	**0.3496**	**0**	**0**
15. Bac Giang	**2)**	**Urban Drainage Pumping Center - Bac Giang City**	**0.515**	**2.102**	**0.1900**	**N/I**	**0**

Province	No.	Name of Utility	Electricity Consumption and Staff				
			C3.7	C3.8	C3.9	C4.6	C4.7
			Electricity consumption per m3 of waste water treated	Ratio of staff number to the waste water treated capacity	Ratio of staff number per person served	Ratio of training cost to revenue	Training cost per staff
			KWh/m3	Staff/ 1.000m3 day	Staff/1000 people	%	Mil. VND/staff
		Sub-total A = 02 Utilities (Participating: 02)	**0.472**	**3.974**	**0.2854**	**0**	**0**
		B. Red River Delta Region					
1. Ha Noi	**3)**	**1) Hanoi Water Drainage and Sewerage One Member Limited Company**	**0.652**	**10.575**	**0.8629**	**0**	**0**
1. Ha Noi	**4)**	**4) Vietnam SFC Company**	**N/I**	**N/I**	**N/I**	**N/I**	**N/I**
3. Bac Ninh	5)	1) Bac Ninh Drainage and Wastewater Treatment One Member Limited Company	0.205	2.974	0.4233	0	0
7. Hai Duong	6)	Hai Duong Urban Works Management Limited Company	0.030	1.622	0.1622	N/I	0
		Sub-total B = 05 Utilities (Participating: 03; Not participating:02)	**0.404**	**6.716**	**0.6412**	**0**	**0**
		C. Central Coast Region					
2. Nghe An	7)	Vinh Urban Infrastructure Development and Management	N/I	N/I	N/I	N/I	N/I
4. Quang Bình	8)	Quang Binh Environmental and Urban Development One Member Limited Company	0.079	4.274	0.2726	0	0
7. Đa Nang	9)	Da Nang Water Drainage and Wastewater Treatment Company	0.109	1.575	0.3737	0.86	1.79
		Sub-total C = 03 Utilities (Participating: 02; Not participating: 01)	**0.108**	**1.659**	**0.3629**	**0.77**	**1.65**
		D. Central Highland Region					
3. DakLak	10)	1) Dak Lak Urban Management and Environment One Member Limited Company	0	11.569	1.7879	0	0
5. Lam Dong	11)	Lam Dong Water Supply and Sewerage One Member Limited Company (LAWACO)	0.224	14.345	4.0714	N/I	0
		Sub-total C = 03 Utilities (Participating: 02; Not participating: 01)	**0.137**	**13.260**	**2.8361**	**0**	**0**
		E. South East Region					

Province	No.	Name of Utility	Electricity Consumption and Staff				
			C3.7	C3.8	C3.9	C4.6	C4.7
			Electricity consumption per m3 of waste water treated	Ratio of staff number to the waste water treated capacity	Ratio of staff number per person served	Ratio of training cost to revenue	Training cost per staff
			KWh/m3	Staff/ 1.000m3 day	Staff/1000 people	%	Mil. VND/staff
1. HCMC	12)	1) HO Chi Minh Urban Drainage Company	0.202	1.150	0.3266	0	0
1. HCMC	13)	2) Phu My Hung Development Limited Company	0.440	3.495	0.1900	N/I	0
2. Binh Duong	14)	1) Binh Duong Water Supply, Sewerage and Environment One Member Limited Company	0.442	13.137	0.5109	N/I	0
		Sub-total E = 03 Utilities (Participating: 03)	**0.217**	**1.612**	**0.3414**	**0**	**0**
		F. Mekong River Delta Region					
7. Soc Trang	15)	Soc Trang Urban Works One Member Limited Company	0.077	5.055	0.6779	0.03	0.09
		Sub-total F = 01 Utility (Participating: 01)	**0.077**	**5.055**	**0.6779**	**0.03**	**0.09**
		Total A+B+C+D+E+F = 15 Utilities (Participating: 13; Not participating: 02)	**0.199**	**2.579**	**0.4638**	**0.17**	**0.37**

6. Operation and Maintenance Costs

Province	No.	Name of Utility	Operation and Maintenance Costs				
			C4.1	C.4.2	C4.3	C4.4	C4.5
			Average O & M cost per 1 m3 waste water treated	Power and fuel costs	Labor costs	Chemical costs	Other costs
			VND/m3	%	%	%	%
		A. Northern Midland and Mountainous Region					
9. Quang Ninh	1)	Ha Long Urban Environment Joint Stock Company - Quang Ninh	3,420	35.63	56.86	2.66	4.85
15. Bac Giang	2)	Urban Drainage Pumping Center - Bac Giang City	815	67.66	20.07	6.69	5.58
		Sub-total A = 02 Utilities (Participating: 02)	**2,102**	**41.92**	**49.64**	**3.45**	**4.99**
		B. Red River Delta Region					
1. Ha Noi	3)	1) Hanoi Water Drainage and Sewerage One Member Limited Company	7,535	7.99	42.19	24.08	25.74
1. Ha Noi	4)	4) Vietnam SFC Company	N/I	N/I	N/I	N/I	N/I

Province	No.	Name of Utility	Operation and Maintenance Costs				
			C4.1	C.4.2	C4.3	C4.4	C4.5
			Average O & M cost per 1 m3 waste water treated	Power and fuel costs	Labor costs	Chemical costs	Other costs
			VND/m3	%	%	%	%
3. Bac Ninh	5)	1) Bac Ninh Drainage and Wastewater Treatment One Member Limited Company	2,047	24.82	45.22	5.42	24.54
7. Hai Duong	6)	Hai Duong Urban Works Management Limited Company	377	25.64	69.78	2.17	2.41
		Sub-total B = 05 Utilities (Participating: 03; Not participating:02)	**4,593**	**10.14**	**43.03**	**21.65**	**25.18**
		C. Central Coast Region					
2. Nghe An	7)	Vinh Urban Infrastructure Development and Management	N/I	N/I	N/I	N/I	N/I
4. Quang Bình	8)	Quang Binh Environmental and Urban Development One Member Limited Company	3,307	17.06	29.98	3.47	49.49
7. Đa Nang	9)	Da Nang Water Drainage and Wastewater Treatment Company	946	19.72	44.38	0.94	34.96
		Sub-total C = 03 Utilities (Participating: 02; Not participating: 01)	**1,020**	**19.45**	**42.93**	**1.20**	**36.43**
		D. Central Highland Region					
3. DakLak	10)	1) Dak Lak Urban Management and Environment One Member Limited Company	2,950	6.41	62.90	8.57	22.13
5. Lam Dong	11)	Lam Dong Water Supply and Sewerage One Member Limited Company (LAWACO)	4,031	8.40	41.43	0.52	49.65
		Sub-total C = 03 Utilities (Participating: 02; Not participating: 01)	**3,608**	**7.76**	**48.29**	**3.09**	**40.85**
		E. South East Region					
1. HCMC	12)	1) HO Chi Minh Urban Drainage Company	1,531	29.12	24.17	9.80	36.91
1. HCMC	13)	2) Phu My Hung Development Limited Company	1,232	61.73	0	25.39	12.88
2. Binh Duong	14)	1) Binh Duong Water Supply, Sewerage and Environment One Member Limited Company	6,671	20.50	28.94	7.45	43.11
		Sub-total E = 03 Utilities (Participating: 03)	**1,687**	**28.81**	**24.20**	**9.87**	**37.12**
		F. Mekong River Delta Region					
7. Soc Trang	15)	Soc Trang Urban Works One Member Limited Company	4,602	7.90	20.48	0	71.62

Province	No.	Name of Utility	Operation and Maintenance Costs				
			C4.1	C.4.2	C4.3	C4.4	C4.5
			Average O & M cost per 1 m3 waste water treated	Power and fuel costs	Labor costs	Chemical costs	Other costs
			VND/m3	%	%	%	%
		Sub-total F = 01 Utility (Participating: 01)	**4,602**	**7.90**	**20.48**	**0**	**71.62**
		Total A+B+C+D+E+F = 15 Utilities (Participating: 13; Not participating: 02)	**1,787**	**22.09**	**34.23**	**8.70**	**34.98**

Note: N/I: No information

7. Sewerage Fees and Revenues – Year 2014 (Applicable to WWTPs operated before 2015)

Province	No.	Name of Utility	Fees and Revenues				
			C4.8	C75	C76	C77	C78
			Ratio of approved average sewerage fee to submitted one	Total direct revenue from WASTE WATER and storm water collection and conveyance services under provisions of "O&M Contract"	Total actual revenue received from waste water and storm water collection and conveyance services	Total direct revenue from waste water treatment services under provisions of "O&M Contract"	Total actual revenue received from waste water treatment services
			Ratio	Mil. VND	Mil. VND	Mil. VND	Mil. VND
		A. Northern Midland and Mountainous Region					
9. Quang Ninh	1)	Ha Long Urban Environment Joint Stock Company - Quang Ninh	0.97	9,027.00	9,183.00	9,574.00	9,183.00
15. Bac Giang	2)	Urban Drainage Pumping Center - Bac Giang City	N/I	N/I	N/I	N/I	N/I
		Sub-total A = 02 Utilities (Participating: 02)	**0.97**	**9,027.00**	**9,183.00**	**9,574.00**	**9,183.00**
		B. Red River Delta Region					
1. Ha Noi	3)	1) Hanoi Water Drainage and Sewerage One Member Limited Company	1.00	N/I	N/I	32,432.59	32,248.44
1. Ha Noi	4)	4) Vietnam SFC Company	N/I	N/I	N/I	N/I	N/I
3. Bac Ninh	5)	1) Bac Ninh Drainage and Wastewater Treatment One Member Limited Company	0.21	12,182.00	11,506.00	6,626.00	4,428.00
7. Hai Duong	6)	Hai Duong Urban Works Management Limited Company	1.00	N/I	N/I	N/I	N/I

Province	No.	Name of Utility	Fees and Revenues				
			C4.8	C75	C76	C77	C78
			Ratio of approved average sewerage fee to submitted one	Total direct revenue from WASTE WATER and storm water collection and conveyance services under provisions of "O&M Contract"	Total actual revenue received from waste water and storm water collection and conveyance services	Total direct revenue from waste water treatment services under provisions of "O&M Contract"	Total actual revenue received from waste water treatment services
			Ratio	Mil. VND	Mil. VND	Mil. VND	Mil. VND
		Sub-total B = 05 Utilities (Participating: 03; Not participating:02)	**0.25**	**12,182.00**	**11,506.00**	**39,058.59**	**36,676.44**
		C. Central Coast Region					
2. Nghe An	7)	Vinh Urban Infrastructure Development and Management	N/I	N/I	N/I	N/I	N/I
4. Quang Bình	8)	Quang Binh Environmental and Urban Development One Member Limited Company	1.00	4,159.56	N/I	N/I	N/I
7. Đa Nang	9)	Da Nang Water Drainage and Wastewater Treatment Company	N/I	7,926.00	7,935.00	38,361.00	38,737.00
		Sub-total C = 03 Utilities (Participating: 02; Not participating: 01)	**0.38**	**12,085.56**	**7,935.00**	**42,880.56**	**43,256.56**
		D. Central Highland Region					
3. DakLak	10)	1) Dak Lak Urban Management and Environment One Member Limited Company	0.17	9,266.00	7,924.40	7,254.30	6,181.00
5. Lam Dong	11)	Lam Dong Water Supply and Sewerage One Member Limited Company (LAWACO)	1.00	11,714.00	11,714.00	N/I	N/I
		Sub-total C = 03 Utilities (Participating: 02; Not participating: 01)	**0.55**	**20,980.00**	**19,638.40**	**7,254.30**	**6,181.00**
		E. South East Region					
1. HCMC	12)	1) HO Chi Minh Urban Drainage Company	N/I	N/I	N/I	82,072.00	82,822.00
1. HCMC	13)	2) Phu My Hung Development Limited Company	N/I	N/I	N/I	N/I	N/I
2. Binh Duong	14)	1) Binh Duong Water Supply, Sewerage and Environment One Member Limited Company	1.00	N/I	N/I	N/I	N/I
		Sub-total E = 03 Utilities (Participating: 03)	**0.56**	**-**	**-**	**82,072.00**	**82,822.00**
		F. Mekong River Delta Region					
7. Soc Trang	15)	Soc Trang Urban Works One Member Limited Company	1.00	7,568.60	7,568.60	11,021.30	11,021.30
		Sub-total F = 01 Utility (Participating: 01)	**1.00**	**7,568.60**	**7,568.60**	**11,021.30**	**11,021.30**

Province	No.	Name of Utility	Fees and Revenues				
			C4.8	C75	C76	C77	C78
			Ratio of approved average sewerage fee to submitted one	Total direct revenue from WASTE WATER and storm water collection and conveyance services under provisions of "O&M Contract"	Total actual revenue received from waste water and storm water collection and conveyance services	Total direct revenue from waste water treatment services under provisions of "O&M Contract"	Total actual revenue received from waste water treatment services
			Ratio	Mil. VND	Mil. VND	Mil. VND	Mil. VND
		Total A+B+C+D+E+F = 15 Utilities (Participating: 13; Not participating: 02)	**0.54**	**61,843.16**	**55,831.00**	**191,860.75**	**189,140.30**

8. Economic and Financial Matters

Province	No.	Name of Utility	Revenue of WWT services		Finance		
			C4.9	C4.10	C4.11	C4.12	C4.13
			Average revenue per m3 of WW treated	Ratio of actual revenue to the revenue under the "O&M Contract	Operating cost coverage	Debt service ratio	Gross fixed assets of WWTP per person served
			VND/m3	%	%	%	Mil. VND / 1.000 people
		A. Northern Midland and Mountainous Region					
9. Quang Ninh	1)	Ha Long Urban Environment Joint Stock Company - Quang Ninh	2,972	95.92	86.91	N/I	N/I
15. Bac Giang	2)	Urban Drainage Pumping Center - Bac Giang City	N/I	N/I	N/I	N/I	N/I
		Sub-total A = 02 Utilities (Participating: 02)	**1,468**	**95.92**	**69.85**		
		B. Red River Delta Region					
1. Ha Noi	3)	1) Hanoi Water Drainage and Sewerage One Member Limited Company	7,578	99.43	100.57	N/I	N/I
1. Ha Noi	4)	4) Vietnam SFC Company	N/I	N/I	N/I	N/I	N/I
3. Bac Ninh	5)	1) Bac Ninh Drainage and Wastewater Treatment One Member Limited Company	3,374	66.83	164.79	N/I	N/I
7. Hai Duong	6)	Hai Duong Urban Works Management Limited Company	N/I	N/I	N/I	N/I	N/I

Province	No.	Name of Utility	Revenue of WWT services		Finance		
			C4.9	C4.10	C4.11	C4.12	C4.13
			Average revenue per m3 of WW treated	Ratio of actual revenue to the revenue under the "O&M Contract	Operating cost coverage	Debt service ratio	Gross fixed assets of WWTP per person served
			VND/m3	%	%	%	Mil. VND / 1.000 people
		Sub-total B = 05 Utilities (Participating: 03; Not participating:02)	**4,856**	**93.90**	**105.72**		
		C. Central Coast Region					
2. Nghe An	7)	Vinh Urban Infrastructure Development and Management	N/I	N/I	N/I	N/I	N/I
4. Quang Bình	8)	Quang Binh Environmental and Urban Development One Member Limited Company	3,307	100.00	100.00	N/I	N/I
7. Đa Nang	9)	Da Nang Water Drainage and Wastewater Treatment Company	899	100.98	95.03	N/I	N/I
		Sub-total C = 03 Utilities (Participating: 02; Not participating: 01)	**974**	**100.88**	**95.53**		
		D. Central Highland Region					
3. DakLak	10)	1) Dak Lak Urban Management and Environment One Member Limited Company	3,897	85.20	132.10	50.07	3,687.23
5. Lam Dong	11)	Lam Dong Water Supply and Sewerage One Member Limited Company (LAWACO)	N/I	N/I	N/I	N/I	7,297.43
		Sub-total C = 03 Utilities (Participating: 02; Not participating: 01)	**1,523**	**85.20**	**42.22**	**50.07**	**5,344.37**
		E. South East Region					
1. HCMC	12)	1) HO Chi Minh Urban Drainage Company	1,452	100.91	94.85	N/I	N/I
1. HCMC	13)	2) Phu My Hung Development Limited Company	N/I	N/I	N/I	N/I	N/I
2. Binh Duong	14)	1) Binh Duong Water Supply, Sewerage and Environment One Member Limited Company	N/I	N/I	N/I	N/I	N/I
		Sub-total E = 03 Utilities (Participating: 03)	**1,358**	**100.91**	**80.51**		
		F. Mekong River Delta Region					
7. Soc Trang	15)	Soc Trang Urban Works One Member Limited Company	4,770	100.00	103.66	N/I	N/I

Province	No.	Name of Utility	Revenue of WWT services		Finance		
			C4.9	C4.10	C4.11	C4.12	C4.13
			Average revenue per m3 of WW treated	Ratio of actual revenue to the revenue under the "O&M Contract	Operating cost coverage	Debt service ratio	Gross fixed assets of WWTP per person served
			VND/m3	%	%	%	Mil. VND / 1.000 people
		Sub-total F = 01 Utility (Participating: 01)	**4,770**	**100.00**	**103.66**		
		Total A+B+C+D+E+F = 15 Utilities (Participating: 13; Not participating: 02)	**1,522**	**98.58**	**85.16**	**1.89**	**169.71**

Appendix 8-17 Comments from Local Consultant (VIWASE) on the Training Plan

1. Target participants

Regarding the target participants to the training course, it should include not only government officers such as PPC and DOC, but also officers of state-owned companies such as Drainage Company and even private companies' employees, so as to totally enhance the wastewater management capacity in Vietnam. Since it is observed the number of companies who work for urban development projects has been increasing, the training course shall also target these companies who lack in know-hows on wastewater management.

2. Curriculum

We received the opinion from MOC that stresses not to enhance wastewater management capacity but to speed up the project implementation procedure of sewerage works. This attitude probably stems from the current situation of sewerage development in Vietnam which there is no opportunity due to whole sewerage projects financed by oversea donors. Such donors tend to apply their own technology and products in exchange for finance. In order to develop the sewerage facilities appropriate to condition in Vietnam which significantly differs from ones of developed countries, it is necessary to train the engineers who are familiar with local condition in Vietnam. It is also necessary to train expertized engineers for management class of sewerage works. Sewerage projects are rapidly being implemented in medium and small scale cities as well as large cities. Sewerage system is now spreading to area wide from city center. VSC is indeed required in order to implement sewerage development projects and expertized engineer, who obtains theory as well as local condition of sewerage works, cannot be developed by single training. Accordingly, comprehensive repetitive training is a most important through attractive training courses accordant with various needs.

Result of needs survey detects "zero for water pollution control" among 39 respondents, on the other hand, first needs for flood control followed by environmental improvement. Training project of VSC may not go on as expected due to less acknowledgement on role of sewerage works.

Detailed comments from VIWASE:

Training Curriculum

- The program is good for trainees but the document should be more attractive by adding more photos and video clips for further information.
- Should send to trainees the PPT file in both Vietnamese and English (some trainees can learn English from the courses and after that), and the course is more international.
- Should add a topic of sustainable sewerage and drainage system for sewer course.
- Should have time for discussion and some workshops that trainees can report about their problems and how to solve. From the course, we can collect many interesting document from the companies.

3. Localization of training materials

To make the lectures more suitable to Vietnam, highly skilled lecturers and appropriate materials are essential.

With regards to the lecturers, a personnel system shall be developed in which the highly skilled human resources will be dispatched from MOC, CNEE, Drainage Company and some excellent consulting firms. A preferential personnel treatment is also needed in order to attract the expertized lecturers.
Regarding the training materials, the core technology is universal. However, it is necessary to take into account on the specific conditions of sewerage system in Southeast Asia and in Vietnam which is stretching from north to south. For the core technology, training know-hows and the training materials accumulated by Japan Sewage Works Agency over a long term had better be utilized. For the specific conditions in Vietnam, the experts in Vietnam and Japan will work together for providing training materials which is appropriate to Vietnam. In this part of specific condition, the database developed in Research and Development function shall be utilized.
Training materials shall be provided in 2017 through utilizing the resource of local consultants.

4. Lecturers training plan

Lecturers training program shall consist of the following components: preparation of training materials and execution of training in collaboration with Japanese lecturers, training in Japan, data collection of specific condition in Vietnam, execution of training by Vietnamese lecturers and post evaluation of lecture. Two pilot trainings in the first year shall cover all mentioned above. In Japan Sewage Works Agency, the period of personnel assignment is normally around 3 years, and it is required to make clear of activities and issues on training of Vietnamese lecturers as soon as possible.

5. Revenue and expenditure plan

VSC is planned to be established in January 2018. Therefore, until then, VSC employees' salary is not needed to be disbursed from VSC's account. Provisional works shall soon be concluded such as announcement of trainee application which imposes planned tuition fees.
In order to ensure personnel expenses of VSC in 2018 and all along, announcement on advantages and certification system of training course as well as detailed operation plan shall be provided at the same time.

Detailed comments from VIWASE:

Budget

1) Training budget

- Teaching remuneration: for estimation, it should be 150 USD/day and one day more for preparation to recruit good and experienced lecturers.
- Travelling fee and perdiem, accommodation fee for the course outside of Hanoi
- Assistance/ translation fee for the course taught by foreigner lecturer.
- Field trip cost
- Business trip budget seems to be small

2) Lecture contents, other comments

- O&M is also important for the personnel who are in charge of planning and design, therefore lecture on O&M should be added.

- Regarding the trainings for private companies, relatively large companies which are able to manage the training fees should be considered as the target. Since it is observed the number of companies who work for urban development projects including sewerage development has been increasing, needs from these companies should also be taken into consideration.

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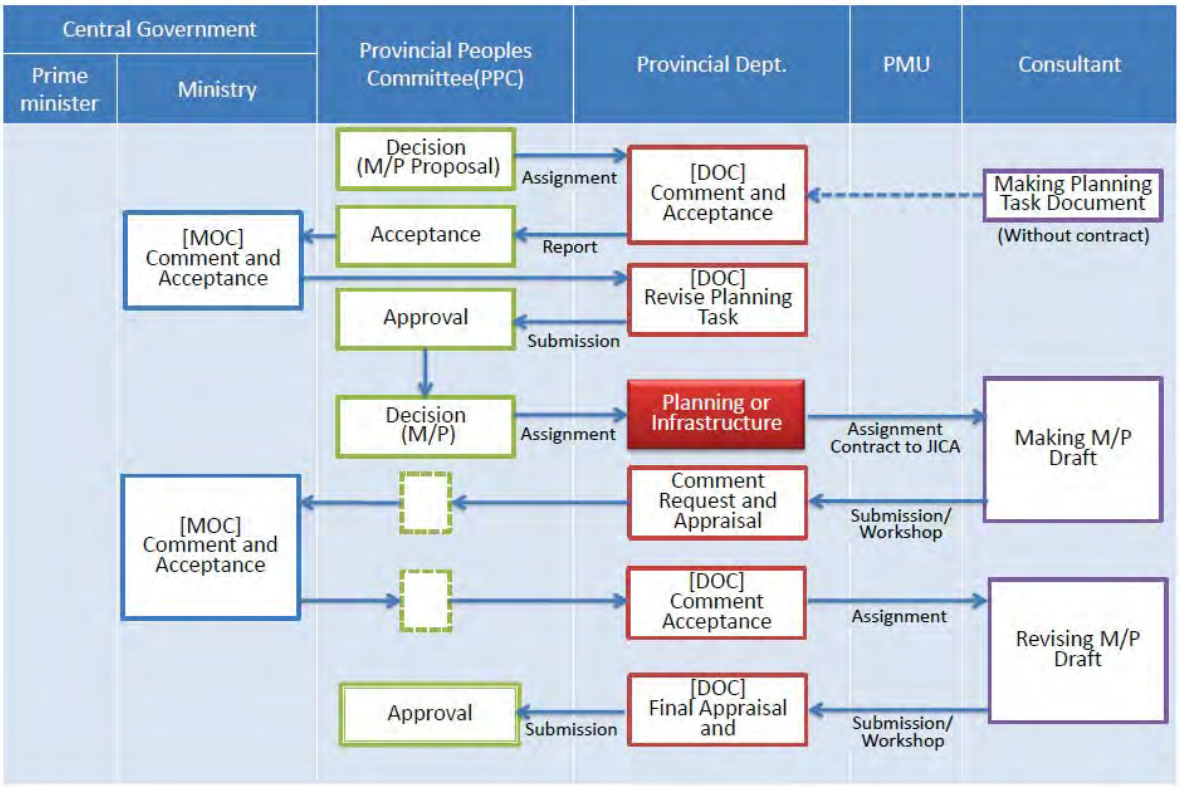
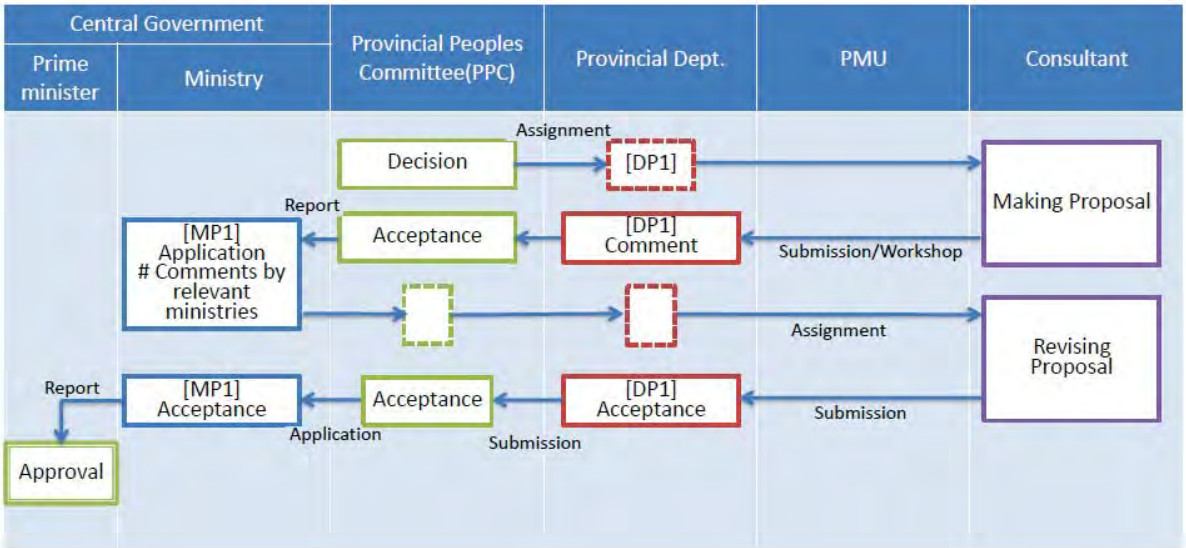
Appendix 8-18 Flow Chart for Procedure of Plan

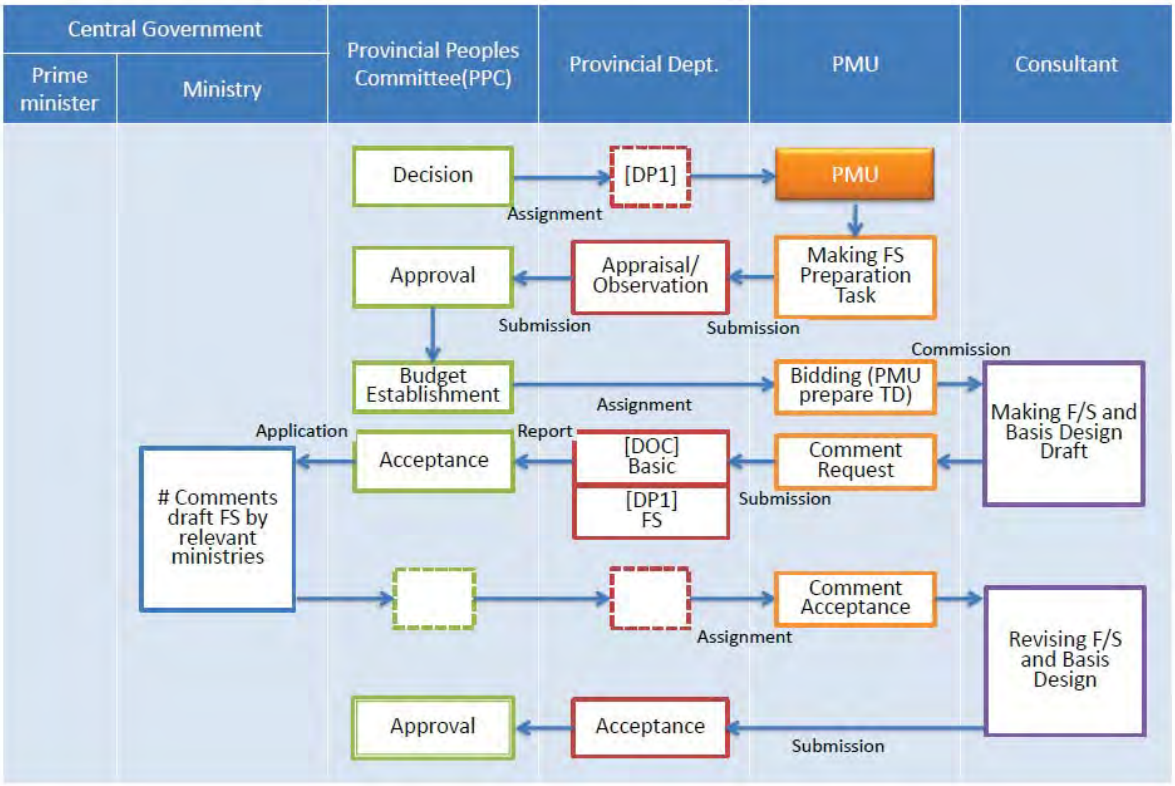
1. Sector Master Plan



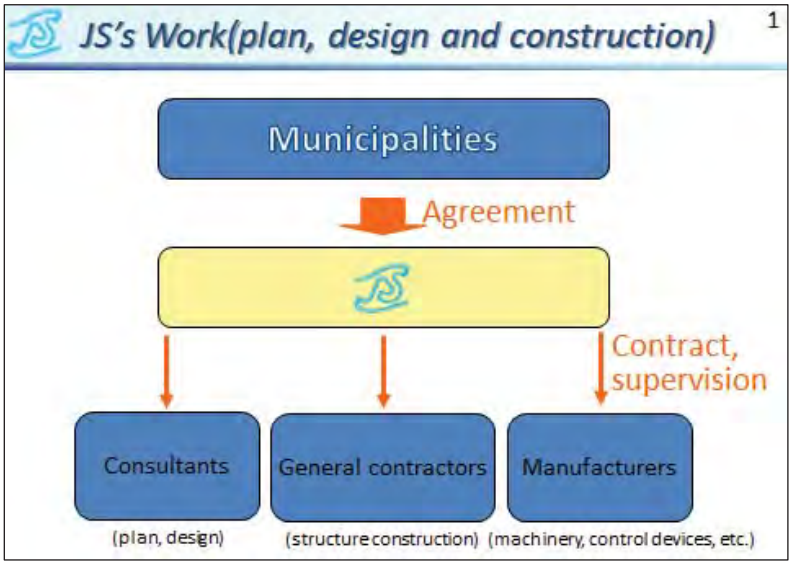
2. Project Proposal

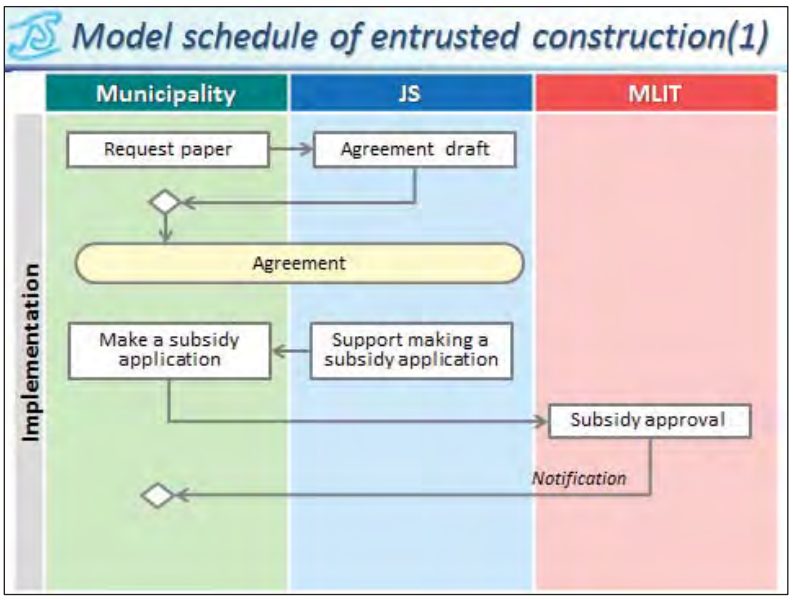


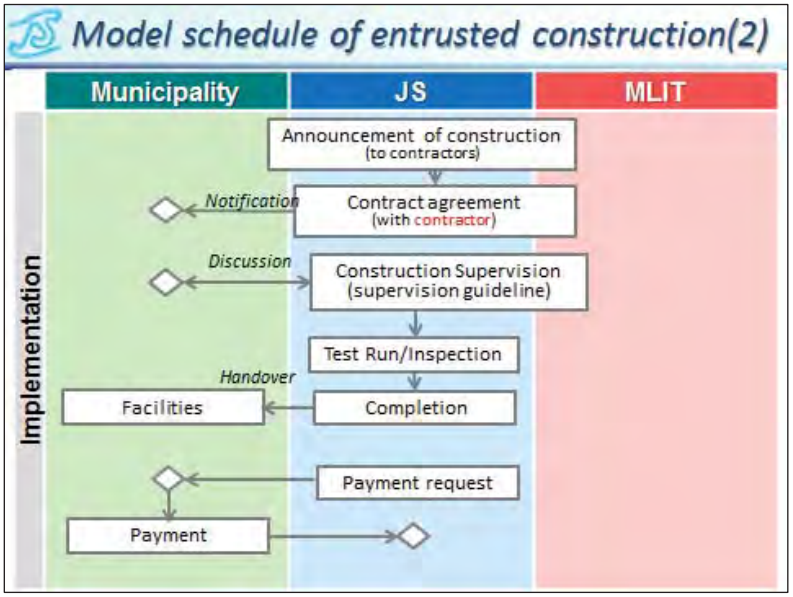
3. Feasibility Study (categorization B)



Appendix 8-19 Project Implementation Flow Chart of Japan Sewage Works Agency







Appendix 8-20 Trial Balance Sheet of Revenue and Expenditure Plan

Revenue and Expenditure Plan of 2017

	Revenue	(VND)	Expenditure	(VND)	R-E (VND)
Training	Training Fee	400,000,000	Training Cost	246,825,000	153,175,000
PIS					0
R&D			R&D Committee	150,000,000	∆ 150,000,000
Total					3,175,000

Revenue and Expenditure Plan of 2018

	Revenue	(VND)	Expenditure	(VND)	R-E (VND)
Training	Training Fee	1,800,000,000	Training Cost	493,650,000	1,306,350,000
PIS					0
R&D			Committee	300,000,000	∆ 300,000,000
General			Salary	636,000,000	∆ 636,000,000
			Business trip	2,250,000	∆ 2,250,000
			Web const.	100,000,000	∆ 100,000,000
			Communication	24,000,000	∆ 24,000,000
			Others	10,000,000	∆ 10,000,000
Total					234,100,000

Salary of VSC staff

	VND/month	person
Director	10,000,000	1
Head of Division	7,000,000	3
Accountant	7,000,000	1
Officer	5,000,000	3

Revenue and Expenditure Plan from 2019

	Revenue	(VND)	Expenditure	(VND)	R-E (VND)
Training	Training Fee	1,800,000,000	Training Cost	493,650,000	1,306,350,000
PIS					0
R&D			Committee	75,000,000	∆ 75,000,000
General			Salary	636,000,000	∆ 636,000,000
			Business trip	2,250,000	∆ 2,250,000
			Communication	24,000,000	∆ 24,000,000
			Others	10,000,000	∆ 10,000,000
Total					559,100,000

Appendix 8-21 Members of JCC and PMB

MINISTRY OF CONSTRUCTION
ADMINISTRATION OF TECHNICAL INFRASTRUCTURE

SOCIALIST REPUBLIC OF VIET NAM
Independence - Freedom - Happiness

No. 34/QD-HTKT

Hanoi, April 04th, 2016

Translation

DECISION

On appointment of members to participate in the Technical Assistance Project for "Enhancing Management Capacity of Sewerage Works in the Socialist Republic of Vietnam" granted by Japanese Governments

DIRECTOR GENERAL OF THE ADMINISTRATION OF TECHNICAL INFRASTRUCTURE

Pursuant to the Decision 997/QD-BXD dated 09 October 2013 of the Ministry of Construction stipulating functions, duties, authorities and organization structure of the Administration of Technical Infrastructure;

Pursuant to the Decision 220/QD-BXD dated 11 March 2016 of the Minister of Construction approving the Document of TA Project for "Enhancing management capacity of Sewerage Works in the Socialist Republic of Vietnam" granted by Japanese Government;

At the proposal of the Head of Drainage and Wastewater Treatment Management Division,

DECIDES:

Article 1 Appoint the following members to participate in the Joint Coordinating Committee (JCC) of the TA Project "Enhancing the management capacity of Sewerage Works in the Socialist Republic of Vietnam" chaired by Vice Minister Phan Thi My Linh in order to implement the Project as stated on the approved Project Document.

- Mr. Nguyen Hong Tien - Director General - Administration of Technical Infrastructure
- Mrs. Nguyen Thi Bich Hue - Deputy Director General - International Cooperation Department
- Mr. Le Dong Thanh - Deputy Director General - Planning and Finance Department
- Mrs. Nguyen Thi Nga - Deputy Director General – Organization and Personnel Department
- Mr. Bui Hong Hue - Dean – College of Urban Works Construction (CUWC)
- Ms. Tran Thi Thao Huong - Rank of Deputy Director General – Head of Drainage and Wastewater Treatment Management Division, Administration of Technical Infrastructure

Article 2 Appoint the following members to participate in the Project Management Board (PMB) of the TA Project "Enhancing the management capacity of Sewerage Works in the Socialist Republic of Vietnam" in order to implement the Project as stated on the approved Project Document.

- Mr. Nguyen Hong Tien - Director General - Administration of Technical Infrastructure – Head of PMB
- Ms. Tran Thi Thao Huong - Rank of Deputy Director General – Head of Drainage and Wastewater Treatment Management Division, Administration of Technical Infrastructure – Deputy Head of PMB
- Mr. Nguyen Ngoc Duong - Deputy Head of Drainage and Wastewater Treatment Management Division, Administration of Technical Infrastructure
- Mr. Nguyen Vu Bao Minh - Official – International Cooperation Department
- Ms. Nguyen Hong Nhung - Deputy Head of General Affairs, Planning and Finance Department
- Mr. Nguyen Van Tien - Head of Training Division – Organization and Personnel Department
- Ms. Nguyen Thi Hoai Thu - Head of General Affairs, Ministry's Office
- Mrs. Nguyen Thu Dung - Chief Accountant, Administration of Technical Infrastructure
- Mrs. Vu Thi Hoai An - Lecturer, College of Urban Works Construction (CUWC)
- Mrs. Pham Thi Thanh Thuy - Accountant, Administration of Technical Infrastructure
- Mr. Do Manh Quan - Official, Drainage and Wastewater Treatment Management Division, Administration of Technical Infrastructure
- Mr. Ngo Van Yen - Official, Drainage and Wastewater Treatment Management Division, Administration of Technical Infrastructure
- Mr. Pham Ngoc Chinh - Official, Drainage and Wastewater Treatment Management Division, Administration of Technical Infrastructure
- Mrs. Pham Thi Huong - Official, Drainage and Wastewater Treatment Management Division, Administration of Technical Infrastructure

Article 3 This Decision takes effect from the march 15th, 2016. The officials named in the Article 1 and Article 2 are responsible for implementation this Decision./.

To:
- As stated on the Article 3
- Archives

DIRECTOR GENERAL
(Signed and sealed)
Nguyen Hong Tien

Appendix 8-22　Reference List for Literature Survey

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Appendix 8-23 Existing certificate system

Certificate system	・THE CONSTRUCTION LAW No. 50/2014/QH13 ・Circular No. 17/2016/TT-BXD "INSTRUCTIONS ON CAPACITY OF ORGANIZATIONS, INDIDUALS INVOLVED IN CONSTRUCTION ABILITIES" ・Decree No. 59/2015/ NĐ-CP

Existing certificate system in Vietnam

Regulated entities: This Circular applies to agencies, organizations, and individuals at home and abroad carrying out construction in the territory of Vietnam.
(Circular 17. Chapter I. Article 1. Scope and regulated entities)
1. Individuals as prescribed in Clause 3, Article 148 of the Law on Construction in 2014 should attain practice certificates for participating in construction activities in the following areas:
a) Construction survey including topographical survey; geological and hydrographical investigations;
b) Construction planning designing.
c) Construction designs include architectural designs; structural designs; electrical and mechanical designs; water supply and drainage designs; ventilation – heat supply & release designs; communications network designs; fire safety designs.
d) Construction supervision includes supervision of civil work construction, installation of equipment and technological equipment of works;
dd) Construction inspection.
e) Construction valuation.
(Circular 17. Chapter I. Article 1. Practice certificates. Clause 1)
1. Organizations should attain capacity certificates when engaging in following activities:
a) Construction survey including topographical survey; geological and hydrogeological survey;
b) Formulation of construction planning
c) Construction designs and design verifications includes architectural design; structural designs; electrical and mechanical designs; water supply and drainage designs; ventilation – heat supply and release designs; communications network designs; fire safety designs.
d) Formulation and verification of construction investment projects
dd) Construction investment project management
e) Construction work
g) Construction supervision includes supervision of civil work construction, installation of equipment and technological equipment of works;
h) Construction inspection.
i) Construction cost management and verification
(Circular 17. Chapter I. Article 10. Capacity certificates. Clause 1)

Practice certificate (individuals)
Construction practice certificate is a document certifying practice capability granted by a competent agency to individuals prescribed in Clause 3, Article 148 of this Law who have adequate professional qualifications relevant to and experiences about the field of practice. **(Chapter VIII. Article 149. Clause 1. Construction practice certificates: Construction Law)**
Holders of titles and individuals independently practicing construction activities who are required to possess practice certificates include labor safety supervisor; project manager, individual personally participating in project management; construction planning design manager; construction survey manager; construction design or design verification manager; site chief commander; construction supervisor; construction appraiser; and construction valuator. Practice certificates shall be classified into class I, class II and class III. **(Construction Law, Chapter VIII. Article 148. General provisions on capability condition of organizations and individuals in construction activities. Clause 3)**
1. Individuals as prescribed in Clause 3, Article 148 of the Law on Construction in 2014 should attain practice certificates for participating in construction activities in the following areas: a) Construction survey including topographical survey; geological and hydrographical investigations; b) Construction planning designing. c) Construction designs include architectural designs; structural designs; electrical and mechanical designs; water supply and drainage designs; ventilation – heat supply & release designs; communications network designs; fire safety designs. d) Construction supervision includes supervision of civil work construction, installation of equipment and technological equipment of works; e) Construction inspection. f) Construction valuation. **(Circular 17. Chapter I. Article 3. Clause 1. Practice certificate)**
To be granted a construction practice certificate, an individual must meet the following conditions: a/ Possessing professional qualifications relevant to the content of application for a practice certificate; b/ Having a working period and experience relevant to the content of application for a practice certificate; c/ Having passed a test on professional experience and legal knowledge related to the field of practice. **(Construction Law. Chapter VIII. Article 149. Construction practice certificates)** Each individual shall be issued a license for construction practice if he/she meets requirements below: 1. Having civil dispositive capacity as prescribed; obtaining residence permit in Vietnam if he/she is a foreigner or overseas Vietnamese. 2. Having qualifications and year's experience in conformity with the application for license, in particular: a) Class I: Obtaining a bachelor's degree with appropriate major and year's experience in conformity with the application for license that is valid for at least 7 years; b) Class II: Obtaining a bachelor's degree with appropriate major and year's experience in conformity with the application for license that is valid for at least 5 years; c) Class III: Obtaining a bachelor's degree and year's experience in conformity with the application for license that is valid for at least 3 years; or obtaining a college degree or junior college degree and year's experience in conformity with the application for license that is valid for at least 5 years. 3. Passing examination in occupational experience and relevant legal knowledge. **(Decree 59. Chapter IV. Article 45. General requirements for issuance of license for construction practice)**
Individuals conducting construction activities must have diplomas and training certificates relevant to their construction jobs granted by lawful training institutions. **(Construction Law, Chapter VIII. Article 148. General provisions on capability condition of organizations and individuals in construction activities. Clause 1)** Each individual shall be issued a license for construction practice if he/she meets requirements below: 1. Having civil dispositive capacity as prescribed; obtaining residence permit in Vietnam if he/she is a foreigner or overseas Vietnamese. 2. Having qualifications and year's experience in conformity with the application for license, in particular:

a) Class I: Obtaining a bachelor's degree with appropriate major and year's experience in conformity with the application for license that is valid for at least 7 years;
b) Class II: Obtaining a bachelor's degree with appropriate major and year's experience in conformity with the application for license that is valid for at least 5 years;
c) Class III: Obtaining a bachelor's degree and year's experience in conformity with the application for license that is valid for at least 3 years; or obtaining a college degree or junior college degree and year's experience in conformity with the application for license that is valid for at least 5 years.
3. Passing examination in occupational experience and relevant legal knowledge.
(Decree 59. Chapter IV. Article 45. General requirements for issuance of license for construction practice)

Determination of appropriate specialties and experience as prescribed in Clause 2, Article 45 of the Decree No. 59/CP as foundations for considering issue of practice certificates shall be carried out by the Testing Council in following principles:
1. Specialties of individuals shall be considered as appropriate when disciplines or content of the training program attended by such individuals are appropriate for the areas under request for the issue of practice certificates as prescribed in Article 16 hereof.
2. Experience of individuals who make requests for the issue of practice certificates is the total period of time such individuals have been participating in construction in the areas appropriate for the areas under request for the issue of practice certificates.
3. For individuals whose experience in construction is insufficient since the date of university graduation but previously were awarded college or vocational school degrees and did spend some time in construction activities, the experience shall be determined as the total period of time such individuals participated in construction since the date of graduation from colleges or vocational schools as foundations for the issue of Class II and III practice certificates.
4. For individuals working in state management agencies, experience is the total period of time such individuals have participated in state management tasks in relation to the areas under request for the issue of practice certificates.
(Circular 17. Chapter I Article 6. Principles of determining appropriate specialties and experience for issue of practice certificate)

Each individual shall be issued a license for construction practice if he/she meets requirements below:
1. Having civil dispositive capacity as prescribed; obtaining residence permit in Vietnam if he/she is a foreigner or overseas Vietnamese.
2. Having qualifications and year's experience in conformity with the application for license, in particular:
a) Class I: Obtaining a bachelor's degree with appropriate major and year's experience in conformity with the application for license that is valid for at least 7 years;
b) Class II: Obtaining a bachelor's degree with appropriate major and year's experience in conformity with the application for license that is valid for at least 5 years;
c) Class III: Obtaining a bachelor's degree and year's experience in conformity with the application for license that is valid for at least 3 years; or obtaining a college degree or junior college degree and year's experience in conformity with the application for license that is valid for at least 5 years.
3. Passing examination in occupational experience and relevant legal knowledge.
(Decree 59. Chapter IV. Article 45. General requirements for issuance of license for construction practice)

1. One application should be submitted to the issuing agency as prescribed in Article 5 hereof.
2. Within three working days since receipt of the application, the testing unit shall be responsible for inspecting adequacy and eligibility of the application prior to submission to the Testing Council for decision. In case the application is found inadequate or ineligible, the testing unit shall give notification to the individual for supplements.
3. Testing shall be carried out on a quarterly or irregular basis as decided by the Testing Council in accordance with demands for issue of certificates. Five days prior to the date of testing, the Testing Council shall give notification on the website of the time and venue of the testing including testing codes of individuals.
(Circular 17. Chapter II Article 15. Sequential order and procedures for issue of practice certificate. Clause 1,2&3)

1. The Testing Council is established under the decision of competent agencies as prescribed in Clauses 1 and 2, Article 5 hereof (herein 'the issuing agency'):
a) Depending on areas under request for the issue of practice certificates, head of the issuing agency shall make decision on composition, organizational structure and number of members of the Testing Council as appropriate in which president and standing executive members shall be head and officials and civil servants of the issuing agency respectively.
b) Other executive members joining the Testing Council shall be officials and civil servants who have specialties appropriate for the areas considered for the issue of practice certificates and experts in relevant areas invited by the Testing Council.
2. The Testing Council as prescribed in Clause 3, Article 5 hereof shall be established under the decision of heads of socio-occupational organizations with organizational structure and number of members in conformity with the areas considered for issue of practice certificates in which president and executive members of the Testing Council shall be head and members of the socio-occupational organization respectively.
3. President of the Testing Council shall make decision on establishment of the testing unit as an assistant apparatus to the Council. The testing unit includes a head (as member of the Testing Council), and other members (as officials and civil servants of the issuing agency or members of socio-occupational organizations (in case the issuing agency is the socio-organizational organization)).
4. The Council shall hold several offices concurrently and work in accordance with the regulation decided by president of the Council as prescribed in Clause 5 of this Article.
5. Operation regulations of the Testing Council and regulations on testing performance and issuing practice certificates shall be published on the website by the Ministry of Construction.
(Circular 17. Chapter II Article 7. Testing Council)

1. Testing shall be carried out in the form of tests.
2. The test includes 15 questions on professional knowledge and 10 questions on knowledge of law on the areas under request for issue of practice certificates which are randomly taken from the set of questions as prescribed in Clause 4 of this Article. Testing period is 30 minutes at the maximum.
3. Maximum score for each test is 100 points of which maximum score for professional knowledge and knowledge of law is 60 points and 40 points respectively. Any individual that achieves from 80 points and over shall be granted the practice certificate.
If an individual is exempted from doing the test in professional knowledge, the test in knowledge of law should reach at least 32 points.
4. The set of questions and instructions on facilities serving performance testing shall be published by the Ministry of Construction on the website.
(Circular 17. Chapter II Article 8. Testing performance for issue of practice certificates)

3. Testing shall be carried out on a quarterly or irregular basis as decided by the Testing Council in accordance with demands for issue of certificates. Five days prior to the date of testing, the Testing Council shall give notification on the website of the time and venue of the testing including testing codes of individuals.
5. Collection and use of testing fees are instructed by the Ministry of Construction; fees for testing performance and issuing practice certificates are instructed by the Ministry of Finance. Individuals who submit requests for the issue of practice certificates should fulfill obligations for paying relevant fees and charges. Fees and charges shall be in no case refunded.
(Circular 17. Chapter II Article 15. Clause 3&5)

1. Class I practice certificates: Construction Management Department affiliated to the Ministry of Construction.
2. Class II, III practice certificates: the Service of Construction:
a) For individuals as members of a construction organization headquartered in the locality;

b) For individuals that have permanent residence or register residence in the locality.
3. For a socio-occupational organization that is involved in construction across the country and meets following requirements, its individual members shall be considered for the issue of Class II, III practice certificates
(Circular 17. Chapter I. Article 5. Authority's right to issue practice certificates. Clause 1, 2 &3)

4. If individuals make request for the issue of practice certificates of different classes, the competent agency that issues practice certificates of highest class shall issue practice certificates to such individuals.
5. Practicing period corresponding to each area is five years. When the certificate expires, the individual may make a request for re-issue of the practice certificate as prescribed hereof.
(Circular 17. Chapter I. Article 5 Authority to issue capacity certificates. Clause 4&5)

1. Practice certificates shall be re-issued or amended in following cases:
a) Existing certificates expire.
b) Make amendments and supplements to practice areas.
c) Existing certificates are torn or damaged.
d) Existing certificates are lost.
2. Requirements for re-issue, amendments, supplements to practice certificates:
a) A written request according to the form in Annex 01 enclosed herewith submitted to the issuing agency;
b) Attach existing certificates which are torn or damaged or expire;
c) Copy of diplomas, certificates and written declaration of experience in the areas under request for amendments and supplements;
d) Do not violate regulations on construction and relevant law provisions;
3. Sequential order and procedures for re-issue, amendments, supplements to practice certificates:
a) For the cases as prescribed in Points a and b, Clause 1 of this Article: sequential order and time for the issue of practice certificates are the same as the cases of renewal.
b) For the cases as prescribed in Points c and d, Clause 1 of this Article: sequential order is the same as that for the cases of renewal but testing is not required and the time for consideration is no more than 25 days (in case of Class I certificates) and 15 days (in case of Class II and III certificates).
4. Content and validity of a practice certificate as follows:
a) Content and validity is the same as existing certificates that are lost, torn and damaged.
b) Note supplements to practice areas according to validity period of existing certificates in case of amendments and supplements.
c) In case of expiration, content and validity of the practice certificate is instructed the same as the cases of renewal.
5. Authority to re-issue practice certificates, make amendments and supplements thereto is instructed in Article 5 hereof.
6. Individuals who submit application for the re-issue or supplements to practice certificates should fulfill obligations for paying relevant fees and charges. Fees and charges shall be in no case refunded.
(Certificate 17. Chapter II. Article 17. Re-issue, amendments and supplements to practice certificates)

Practice certificate codes refer to an eight-digit series used to manage construction practice certificates of individuals (hereinafter referred to as practice certificates). Practice certificate codes shall be granted and managed by the Ministry of Construction. Individuals that participate in construction and apply for the issue of practice certificates for the first time as prescribed hereof shall be granted a code of practice certificate. Practice certificate codes shall remain unchanged even though requests for renewal, amendments or supplements to the issued certificates are made.
(Circular 17. Chapter I. Article 2. Clause 1. Interpretation of terms)

Capacity (capability) certificate

Organizations should attain capacity certificates when engaging in following activities:
a) Construction survey including topographical survey; geological and hydrogeological survey;
b) Formulation of construction planning
c) Construction designs and design verifications includes architectural design; structural designs; electrical and mechanical designs; water supply and drainage designs; ventilation – heat supply and release designs; communications network designs; fire safety designs.
d) Formulation and verification of construction investment projects
e) Construction investment project management
f) Construction work
g) Construction supervision includes supervision of civil work construction, installation of equipment and technological equipment of works;
h) Construction inspection.
i) Construction cost management and verification
(Circular 17. Chapter I. Article 10. Capacity certificate)

1. Organizations that apply for capacity certificates (applicants) shall submit one application as prescribed in Article 12 hereof in person or by post to the issuing agency.
2. Within ten days since receipt of the application, the issuing agency shall carry out examination and inspection of the application and give notification to the applicant.
3. Organizations carrying out evaluation and issue of capacity certificates:
a) The Testing Council shall be responsible for carrying out evaluation of construction capacity of the applicant according to Article 22 hereof and make the submission to the issuing agency for decision.
Time for evaluation and issue of capacity certificates is no more than 15 days (Class I), 10 days (Classes II and III) since receipt of the application.
b) Within three working days since the decision on the issue of capacity certificates is issued, the issuing agency as prescribed in Clause 2, Article 12 hereof shall be responsible for submitting a written request for the issue of capacity certificate codes according to the form in Annex 15 enclosed herewith to the Ministry of Construction. Within five working days since receipt of the written request, the Ministry of Construction shall be responsible for issuing the codes, integrating information for management of the issued practice certificates and publishing information about construction capacity on the website as prescribed in Clause 1, Article 26 hereof.
4. Collection and use of fees and charges (including re-issue, supplements and amendments) are instructed by the Ministry of Finance. Applicants shall fulfill obligations for paying relevant fees and charges. Fees and charges shall be in no case refunded.
(Circular 17. Chapter III. Article 21. Sequential order and procedures for issue of capacity certificates)

1. Class I capacity certificates: Construction Management Department affiliated to the Ministry of Construction.
2. Class II, III capacity certificates: the Service of Construction.
(Circular 17. Chapter I. Article 12. Clause 1 & 2. Authority's right to issue practice certificates)

5. Validity period of a capacity certificate is five years. Any organization with the capacity certificate that expires or needs to make amendments or supplements to the certificate may file procedures for re-issue as prescribed hereof.
(Circular 17. Chapter I. Article 12. Clause 5. Authority to issue capacity certificates)

Article 23. Re-issue or amendments, supplements to capacity certificates
1. Capacity certificates shall be re-issued, amended or supplemented in following cases:

a) Old certificates expire
b) Amendments and supplements to activities
c) Existing certificates are torn or damaged.
d) Existing certificates are lost.
2. Requirements for re-issue or amendments, supplements to capacity certificates:
a) Submit a written request according to the form in Annex 03 enclosed herewith to the issuing agency;
b) Attach existing certificates which are torn or damaged or expire;
c) Attach documents as prescribed in Clauses 2, 3 and 4, Article 20 hereof in case of requesting amendments or supplements to activities;
d) Do not violate regulations on construction and relevant law provisions;
3. Time limit for re-issue, or amendments and supplements to capacity certificates is instructed the same as cases of renewal.
4. Content and validity of a capacity certificate as follows:
a) Content and validity is the same as existing certificates that are lost, torn and damaged.
b) Specify amendments according to validity period of existing certificates in case of amendments, supplements.
c) In case of expiration, content and validity of the capacity certificate is instructed the same as cases of renewal.
5. Authority to re-issue capacity certificates, make amendments and supplements thereto is instructed in Article 12 hereof.
(Circular 17. Chapter III. Article 23. Re-issue or amendments, supplements to capacity certificates)

Capacity certificate codes refer to an eight-digit series used to manage construction capacity certificates of organizations (hereinafter referred to as capacity certificates). Capacity certificate codes shall be granted and managed by the Ministry of Construction. Individual organizations that participate in construction and apply for the issue of capacity certificates for the first time as prescribed hereof shall be granted a code of capacity certificate. Capacity certificate codes shall remain unchanged even though requests for renewal, amendments or supplements to the issued certificates are made.
(Circular 17. Chapter I. Article 2. Clause 2. Interpretation of terms)