

**SOCIALIST REPUBLIC OF VIETNAM  
MINISTRY OF CONSTRUCTION**

**LOCAL WATER SUPPLY AND WASTEWATER  
SECTOR SURVEY**

**TECHNICAL REPORT  
ON  
SEWERAGE PROJECT  
IN DANANG CITY**

**FINAL REPORT**

**January 2015**

**JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)**

**NIPPON KOEI CO. LTD.  
SEWERAGE BUSINESS MANAGEMENT CENTRE  
DOGAN, INC.  
WATER AGENCY INC.  
NIHON SUIDO CONSULTANTS CO., LTD.**

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<b>CR(5)</b>
<b>15-002</b>

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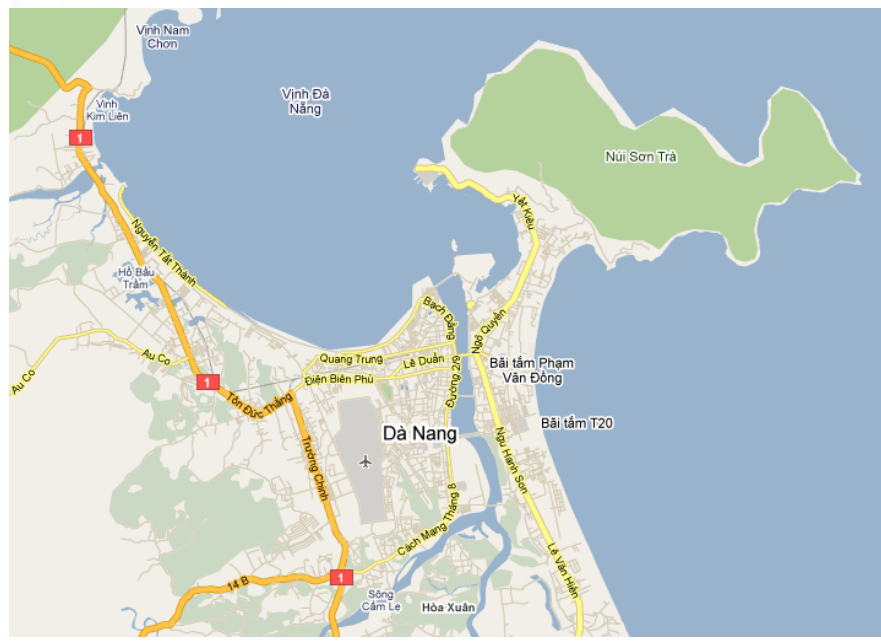
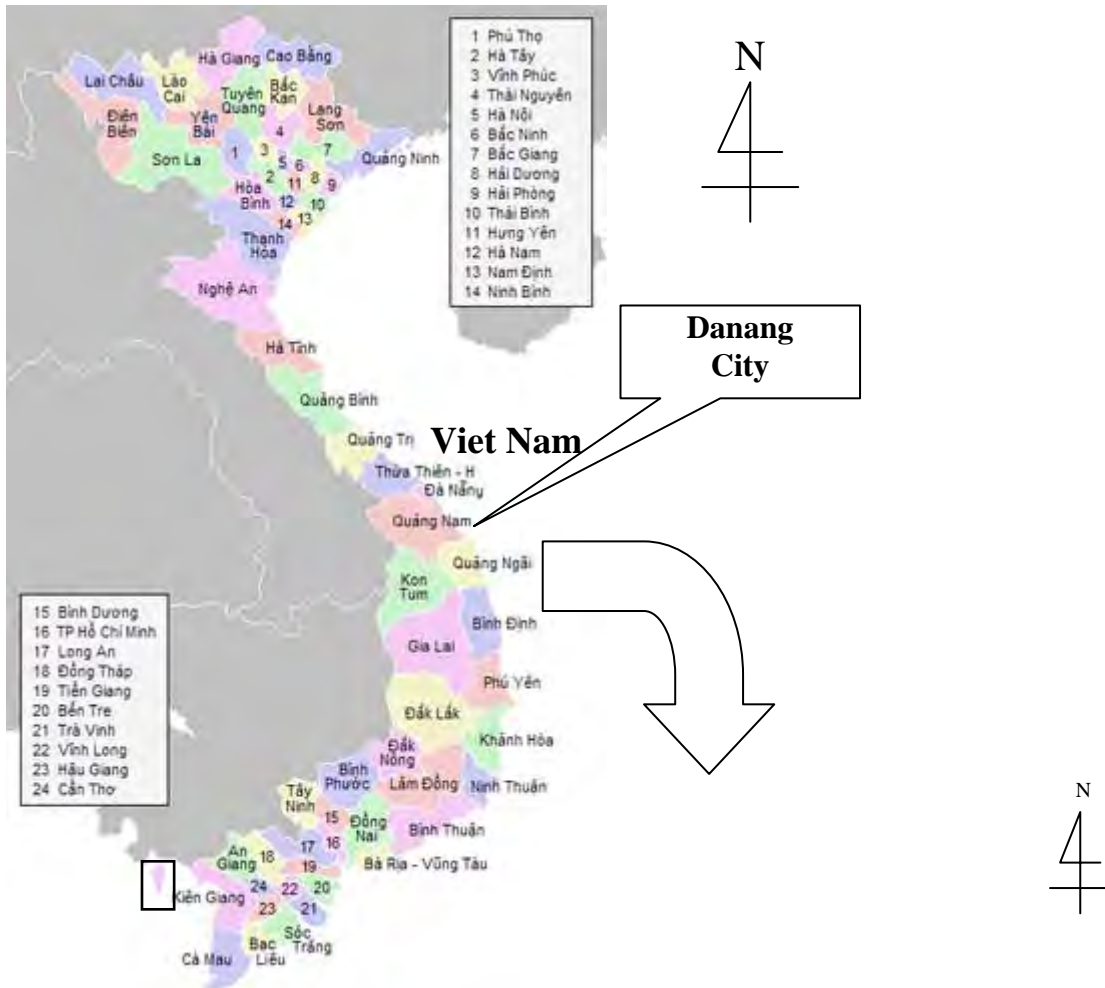
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**EXCHANGE RATE (Fact Finding Mission  
for FY 2014 Japanese ODA Loan Projects)**

USD 1 = JPY 102.6  
USD 1 = VND 21,036



**Location Map of Survey Area**

**LOCAL WATER SUPPLY AND WASTEWATER SECTOR SURVEY  
TECHNICAL REPORT ON  
WASTE WATER PROJECT IN DANANG CITY**

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## **ABBREVIATIONS**

CSO	Combined Sewer Overflow
DAWACO	Danang Water Supply One Member Limited Company
DHTP	Danang Hi-Tech Park
DHTPMB	Danang Hi-Tech Park Management Board
DN	Nominal Diameter
DOC	Department of Construction of Danang
DONRE	Department of Natural Resource and Environment
DOT	Department of Transportation
DPI	Department of Planning and Investment of Danang
DWF	Dry Weather Flow
DWTC	Drainage and Wastewater Treatment Company of Danang
HDPE	High Density Polyethylene Pipe
JICA	Japan International Cooperation Agency
JST	JICA Survey Team
ODA	Official Development Assistance
PIIP	Priority Infrastructure Investment Projects Management Unit
SBR	Sequencing Batch Reactor
USD	US Dollar
VND	Vietnam Dong
W/B	World Bank
WWTP	Wastewater Treatment Plant

## 1. Background

Danang is the fifth largest city in Vietnam in terms of urban population of over one million in 2014 and has a provincial status with a certain degree of administrative autonomy, and is listed as a first class city.

Danang is one of the major port cities in Vietnam and the biggest city on the South Central Coast of Vietnam. The City is situated on the coast of the South China Sea, at the opening end of the Han River. Danang is third biggest economic center in Vietnam following Ho Chi Minh City and Hanoi with a well-sheltered, easily accessible port. National Highways IA and 14B run through the city, providing road connections to Hanoi in the north and Ho Chi Minh City in the south, as well as the Central Highlands and Laos to the west.

The city has grown rapidly in recent years with a higher urbanization ratio than any of Vietnam's other provinces or centrally governed cities. Development is visible and rapid. The city has expanded tremendously in the last ten years, and several multi-story buildings as well as more beach resorts are under construction. Some of the most beautiful and isolated beaches in Vietnam are found here,

The city has a generally higher quality of infrastructure compared to other cities and city leaders have committed to develop the city into a "green" city by 2025, and is pursuing the sustainable development of the wastewater sector.

A wastewater management strategy prepared by World Bank (W/B) fund was approved by Da Nang People's Committee in 2010. The strategy clearly underscores key policies of full cost recovery for operation and maintenance from user charges and expansion of house connections from about 10% in 2010 to about 30% by 2020. City has continued gradual expansion of treatment capacity in line with connection and transmission expansion as well as operation and maintenance of wastewater treatment plants.

Under the above situation, Department of Planning and Investment of Danang (DPI) requested Japan International Cooperation Agency (JICA) to support sewerage development, especially solution of combined sewer overflow (CSO) problem in eastern coastal beach and expansion and rehabilitation of the existing wastewater treatment plants in June, 2014.

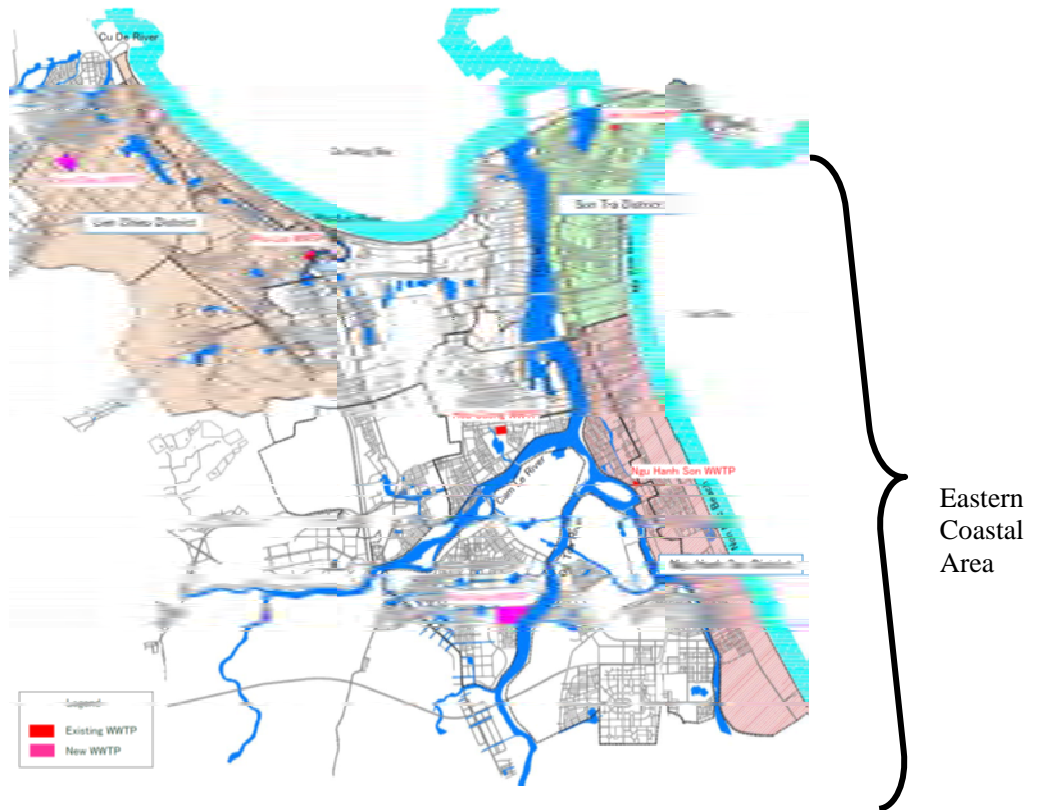
Responding the above request, JICA decided to dispatch survey team to find out the present conditions of sewerage development in Danang city for finding possible support of the Danang city's challenging efforts.

## 2. Objective of the Survey

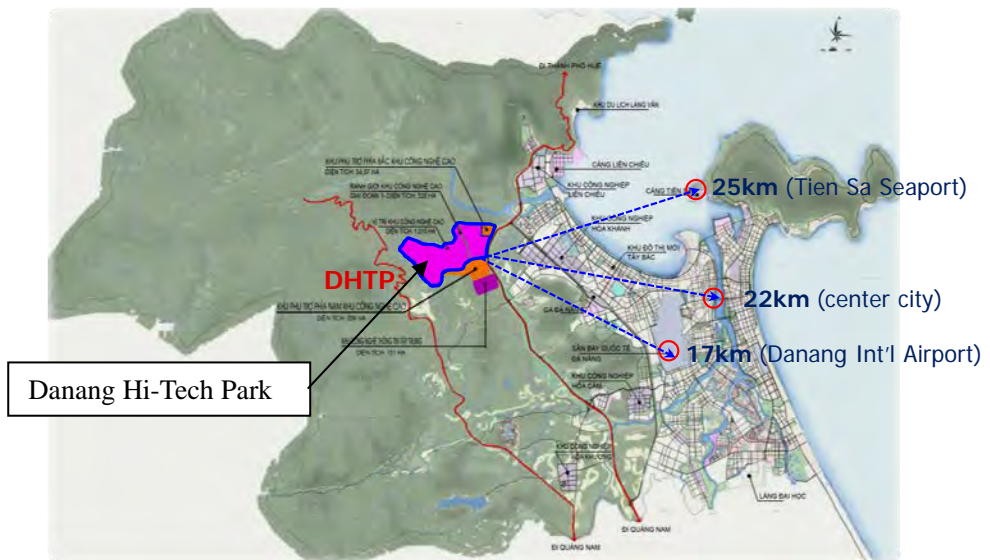
The objectives of the survey are to investigate present status of sewerage system and to collect necessary data and information in Danang to formulate Japanese ODA loan project.

The survey focuses on the Danang city's most concerning issues of combined sewer overflows (CSO) in east coastal area and three wastewater treatment plants (WWTPs) namely Hoa Xuan WWTP, Son Tra WWTP, and Hi-Tech Park WWTP. The location maps of the objective areas are shown in **Figure 2.1**.





Source: JICA Survey Team (JST)



Source : Danang Hi-Tech Park Management Board (DHTPMB)

**Figure 2.1 Location Maps of Survey Area**

### 3. Collected Data and Information

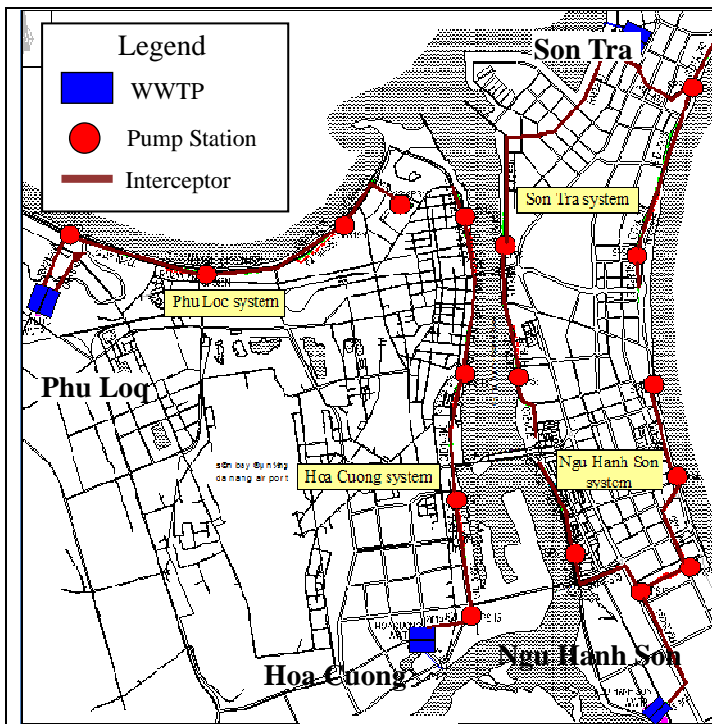
The field surveys were conducted to collect necessary data and information by means of site visit and hearing survey at Danang's authorities concerned from July 21st to August 7th and from September 14th to 24th, 2014. The meetings held, collected data and information are listed in **Annex 1**.

The summary of hearing survey results is as follows. The details of hearing survey are shown in **Annex 2** as minutes of meeting.

- Almost all the authorities concerned alleged that the biggest water environmental issues in Danang city are CSOs at eastern coastal beach and the Phu Loc River and Phu Loc WWTP.
- As far Phu Loc WWTP, Danang CPC decided to replace the existing WWTP to new plant by private participation project in September, 2014. And thus, issue of the Phu Loc River and WWTP are not included in the candidate of components of the project.
- There are several kinds of idea for solution of CSO problem, such as conversion to separate system from combined system, diversion of CSO discharge to Han River, ocean outfall, etc. However it was confirmed that the policy for CSO measures was not established and shared among the authorities concerned.
- Regarding three WWTPs (Hoa Xuan, Son Tra, and Hi-Tech Park), the present situation, future plan and current problems were confirmed.

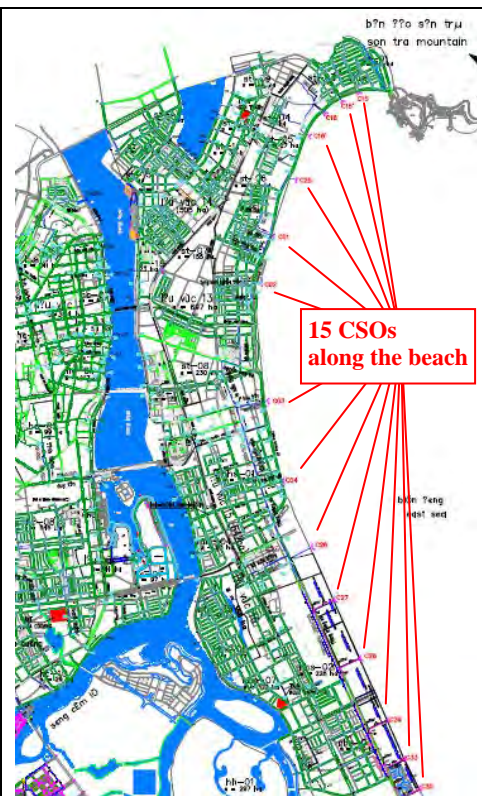
### 4. Current Situation of Sewage System In Danang City

Danang City has combined sewer system. Current combined system was completed in 2006 by W/B fund as shown in Figure 4.1. Generally combined system requires to construct outfall facilities, since wastewater over the capacity occurred in rainfall should be discharged to river or sea. Wastewater collection system in eastern coastal area has 15 outfalls to discharge wastewater to sea along the beach as shown in Figure 4.2.



Source: Feasibility Study for the Da Nang Sustainable City Development Project (2013)

**Figure 4.1 Existing Wastewater Collection System**



Source: JICA study team

**Figure 4.2 Location of Outfalls along the Beach**

The Interceptor system includes the following main infrastructure:

- 15.7 km of gravity pipes,
- 19.4 km of pumping mains,
- 60 diversion chambers, and
- 18 pumping stations.

The collected wastewater is treated at 4 anaerobic wastewater treatment plants (WWTPs) located at 4 different locations in Danang City. Management and operation of the wastewater system is the responsibility of the Danang Drainage and Wastewater Treatment Company (DWTC).

#### 4.1 Eastern Coastal Area

##### (1) Sewerage System

Interceptor constructed by W/B fund in eastern coastal area consists of pressure system by 6 pumping stations, since it is difficult to collect wastewater by gravity flow due to flat land characteristics. The interceptor doesn't take account of storm water, since the capacity of the interceptor is designed in

accordance with only wastewater from households.

During rainfall events the flows in the sewers will become much larger than dry weather flow (DWF). The interceptor will no longer be able to handle all the flow that arrives at the diversion chamber. When that happens, the pumps shut down automatically and all the flow, including wastewater, will go over the weir and flow into the sea through the beach as combined sewer overflow (CSO). This CSO event causes adverse visual and odor effects to tourists in the beach, which is main tourism resource. Danang City tries to tackle with this issue as urgent matter.

**Photo 4.1** shows a typical outfall at eastern coastal beach and **Photo 4.2** shows the situation around the outfalls after high tide period. From the photo it is found that seawater level in high tide period goes higher than outfalls in eastern coastal area. In order to prevent back flow to outfall facilities, flap gates are installed at the discharge points.

Each outfall in eastern coastal area have diversion chamber with overflow weir structure. The overflow weir provides following three functions.

- To lead the flow of wastewater during dry weather into the pumping station
- To overflow all the water during wet weather into the sea
- To prevent back water from the sea into the drainage system during the period of high tide.



Source: DWTC

**Photo 4.1 Outfall on the beach**



Source: DWTC

**Photo 4.2 Outfall on the beach after high tide period**

## (2) Water Usage in Eastern Coastal Area

It is important to understand the present situation of water usage in the region to measure the possible effects of septic tank soak away pit to the direct human health. **Table 4.1** shows the present water usage situation provided by the water provider, Danang Water Supply One Member Limited Company (DAWACO). According to the information in **Table 4.1**, approximately 20 % of residents in the region are still using only groundwater as domestic water use, and the average depth of the well extracting ground water is about 42m under the ground level.

**Table 4.1 Situation of Water Usage**

No	Item	Unit	Total	Note	
I	<b>Son Tra District</b>				
	1	Total of households	Household	36,402	
	2	Total of households using water supply	Household	29,145	80% of total households 10% of this 29,145 households are using both water supply and ground water
	3	Total of households using groundwater	Household	7,257	20% of total households
II	<b>Ngu Hanh Son District</b>				
	1	Total of households	Household	18,930	
	2	Total of households using water supply	Household	14,659	77% of total households 10% of this 14,659 households are using both water supply and ground water
	3	Total of households using groundwater	Household	4,271	
III	Average depth of the well for groundwater	m	41.929		

Source: Danang Water Supply One Member Limited Company (DAWACO)

## 4.2 House Connection Work

Even in the sewerage service area, there are a lot of households which aren't connected to the existing drainage system. In order to boost the connection ratio, pilot project which tries to connect septic tanks of household to existing drainage system is in operation mainly in eastern coastal area.

Current household connection project is a pilot project covering 600 households. The costs of the connections are from USD 200 to USD 500 per household according to the results of the pilot project. The pilot project will be followed by house connection project with 40,000 households to be started in 2015 by W/B fund, and expected to be followed by conversion from combined system to separate system in the future.

## 4.3 Wastewater Treatment Plants

There are 4 WWTPs, Phu Loc, Son Tra, Hoa Cuong, and Ngu Hanh Son in services and Hoa Xuan WWTP just started operation in September, 2014. The present situation of the existing and planned WWTPs is summarized in **Table 4.2**.

**Table 4.2 Existing and Planned WWTPs in Danang City**

Status	Name Of WWTP	Capacity (m <sup>3</sup> /day)	Technical Description	Remarks
Existing	Phu Loc	40,000	Anaerobic Pond	The effluent does not meet the requirements, low capacity (DWTC)
	Son Tra	15,000	Anaerobic Pond	The effluent does not meet the requirements, low capacity (DOC)
	Ngu Hanh Son	10,000	Anaerobic Pond	
	Hoa Cuong	30,000	Anaerobic Pond	
	Hoa Xuan	20,000	Sequence Batch Reactor (SBR)	Start operation in September, 2014
Planned	Lien Chieu	20,000	-	Fund committed by W/B
	Danang Hi-Tech Park	18,000 (4,500 in First Phase)	-	No fund source decided as of September, 2014

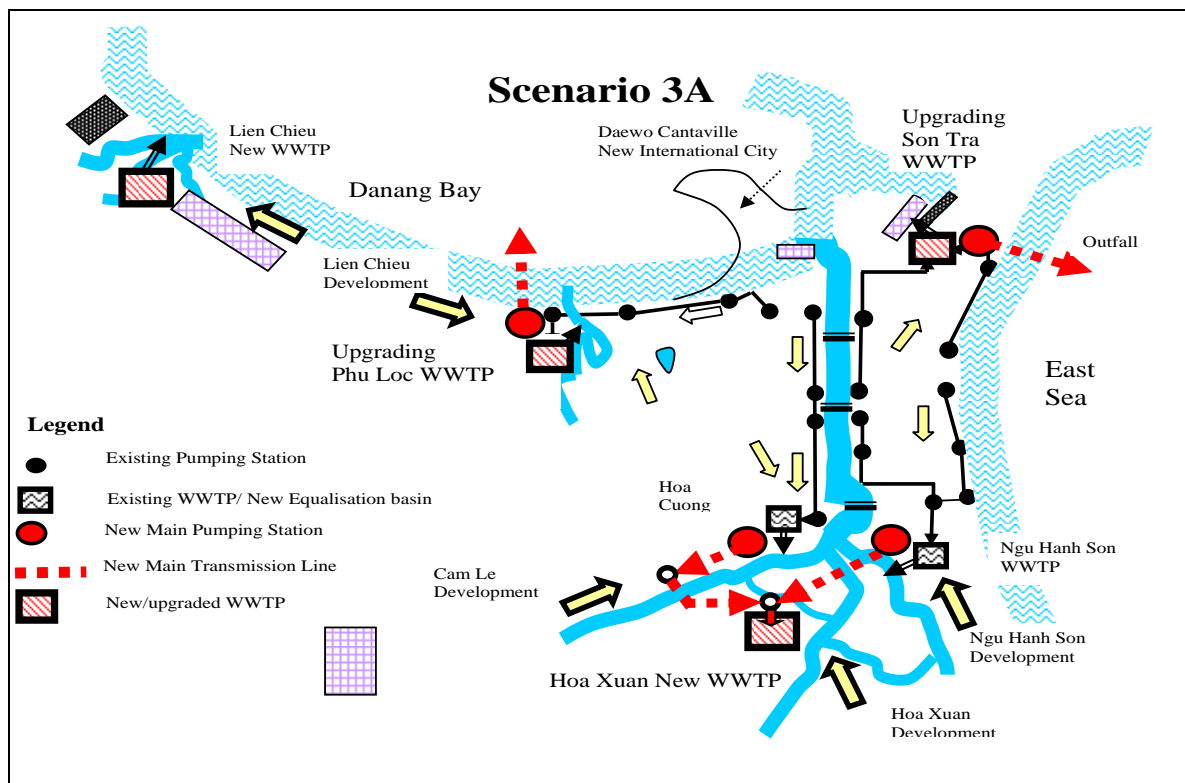
Source : JST

## 5. Construction Plan and Study for Sewerage System

### 5.1 Wastewater Treatment Master Plan

Sewerage development has been supported by W/B, and the wastewater treatment master plan of Danang City was formulated by W/B in April 2009. In 2010, Danang City made the target in which 100 % of collected wastewater is treated up to 2020 in the master plan (No 1866/QD-TT, October, 2010). The overall features of sewerage development in the master plan are illustrated in **Figure 5.1** are;

- Construction of Lien Chieu new WWTP
- Upgrading of Phu Loc, Son Tra WWTPs
- Construction and expansion of Hoa Xuan WWTP and disuse of Hoa Cuong and Ngu Hanh Son



Source: Study on Wastewater Management Strategy in Da Nang, 2009

**Figure 5.1 Proposed Wastewater Systems in Danang City**

### 5.2 Construction Works Committed

According to the master plan and urgent need of improvement of sewerage systems, Danang has planned to construct the facilities listed in **Table 5.1**, which was committed the funding support by W/B.

**Table 5.1 Sewerage Construction Works Committed**

Facilities	Contents	Construction Period	Remarks
Ocean Outfall in Ngu Hanh Son System	2 location of outfall, DN1200mm x 2 HDPE; L=200m each	2016 - 2018	Plan in Annex 3 Construction cost Estimate: USD 1 million each
House Connection mainly in Eastern Coastal Area	40,000 households	2015 - 2018	
Son Tra WWTP	Rehabilitation with capacity of 25,500 m <sup>3</sup> /day	2015 - 2017	Plan in <b>Annex 3</b>
Hoa Xuan WWTP	Expansion from 20,000 m <sup>3</sup> /day to 40,000 m <sup>3</sup> /day	2016 - 2018	
Lien Chieu WWTP	Construction with capacity of 20,000m <sup>3</sup> /d	2016- 2018	

Source : JST

### 5.3 Existing Study and Idea

Some studies are made by PIIP, DOC, and DWTC on possible solution of CSO measures in eastern coastal area as follow.

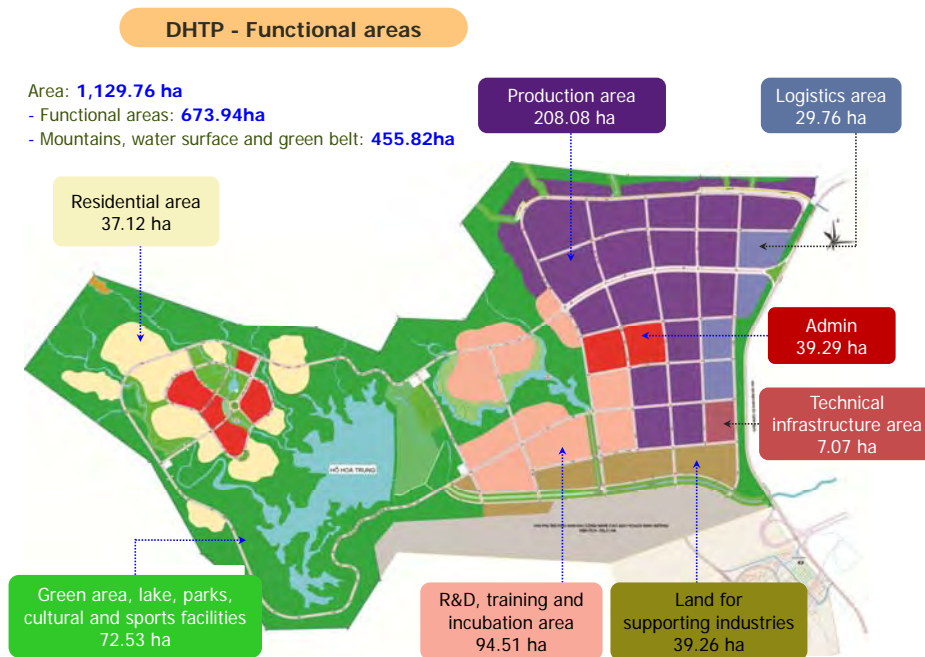
- Diversion of CSO to Tho Quang Dock by pumping
- Diversion of CSO to Tho Quang Dock and Co Co River by pumping
- Diversion of CSO to Tho Quang Dock, Han River and Co Co River by pumping
- Further House connection to increase to 70,000 households from 40,000 households foreseeing future conversion from combined to separate system

### 5.4 Danang Hi-Tech Park WWTP

In addition to the sewerage system in the existing urban area of Danang City, sewerage system in Danang Hi-Tech Park (DHTP) located at 22 km northwest from town center is under construction.

DHTP is the third national Hi-Tech Park project following to Hoa Loc Hi-Tech Park in 1998 and Saigon Hi-Tech Park in 2002. DHTP is managed by Danang Hi-Tech Park Management Board (DHPMB) under Danang CPC established by Prime Minister in 2010.

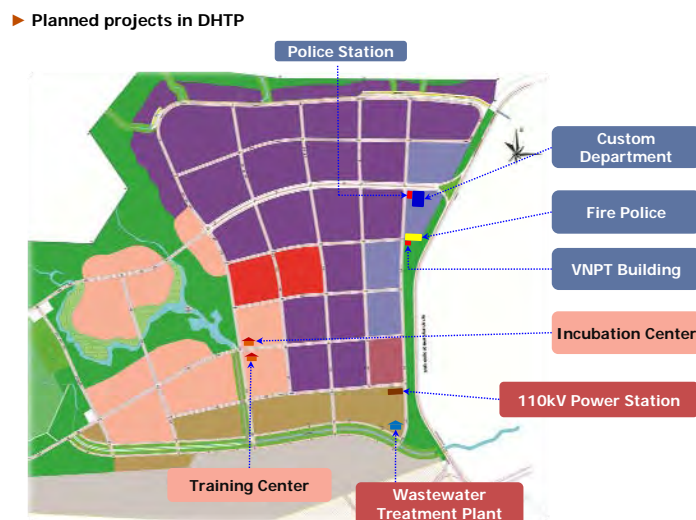
Development area of DHPT is approximately 1,130 ha including natural land, water surface, and green belt of 456 ha as shown in **Figure 5.2**.



Source : DHTPMB

**Figure 5.2 General Plan of Danang Hi-Tech Park**

Wastewater collection system in Phase 1 area of DHTP is being constructed with the other underground utilities. However, DHTPMB has not found the funding source of WWTP construction located in land for supporting industries shown in **Figure 5.3**, though construction of Phase 1 is scheduled to be completed in 2015 and 150 ha of the land has been already handed over to investors including two Japanese companies.



Source : DHTPMB

**Figure 5.3 Location of WWTP in Danang Hi-Tech Park**



According to the Feasibility Study Report prepared by DHTPMB, outline of WWTP in DHTP is summarized in **Table 5.2**.

**Table 5.2 WWTP in DHTP**

Item	Phase 1 (2013 – 2015)	Phase 2 (2016 – 2018)	Phase 3 (2019 – 2020)	Total
Discharge Standard	Column B, QCVN 40:2011/BTNMT (with coefficients $k_q = 0.9$ , $k_f = 0.9$ )			
DHTPMB's Proposal	Column A, QCVN 40:2011/BTNMT (with coefficients $k_q = 0.9$ , $k_f = 0.9$ )			
Treatment Process	MBR (combine activated sludge treatment with a membrane liquid-solid separation process)			
Capacity (m <sup>3</sup> /day)	4,500 m <sup>3</sup>	9,000 m <sup>3</sup>	4,500 m <sup>3</sup>	18,000 m <sup>3</sup>
Construction cost (USD)	11.22 million	5.75 million	3.05 million	20.02 million

Note: Exchange rate of the State Treasury in August 2013: 1USD = 21,036 VND

Source : DHTPMB

## 6. Candidate of Components of ODA Loan Project

DPI proposed the following components of Danang Sewerage Project and s Danang CPC sent a request letter to JICA to consider for formulation of the project.

- CSO measures for eastern coastal area
- House connection mainly in eastern coastal area
- Construction, expansion, or rehabilitation of WWTPs

### 6.1 CSO Measures for Eastern Coastal Area

Danang City tries to tackle CSO in eastern coastal area as urgent issue. CSO measures to be implemented or studied are described in the above **Section 5**. However the required analysis for formulation of a project on effects, advantages, disadvantages, implementation schedule, cost-efficiency etc. has not been conducted yet. Hence Danang is not able to go forward.

Under the above situation, Danang City requests to take the following aspects into consideration in the further study of JICA.

- To Continue to construct house connections and to convert to separate system by 2030
- To take necessary measures of CSO before completion of conversion
- To avoid drainage water flowing through beach, even after completion of separate system

### 6.2 House Connection

Danang City intends to continue additional 30,000 households after the project for 40,000 households funded by W/B and also to try to connect direct connection to public sewer system with elimination of septic tank. However the specific work plan for the connection and further conversion of systems have not determined yet. Further house connection works should be studied taking the above CSO measures and water usage situation of the region into account.

### 6.3 Wastewater Treatment Plants

There are three components as candidates of the project, such as expansion of Hoa Xuan WWTP, rehabilitation of Son Tra WWTP, and construction of DHTP WWTP.

#### 6.3.1 Hoa Xuan WWTP

- Construction with capacity of 20,000 m<sup>3</sup>/day was completed by September 2014 as phase 1 project by W/B fund. Treatment method originally designed with Oxidation Dich was changed to SBR by acceptance of counter proposal of bidder.
- Additional capacity of 20,000 m<sup>3</sup>/day (SBR method, total 40,000 m<sup>3</sup>/day) will be completed by 2017 or 2018 as phase 2 project by W/B fund.
- Hoa Xuan WWTP is planned to be eventually expanded to 320,000 m<sup>3</sup>/day. However, concrete plan after phase 2 is not decided.
- Existing Ngu Hanh Son and Hoa Cuong WWTP will be abolished when Hoa Xuan WWTP would have enough capacity. The schedule of the abolishment is not decided and it depends on the expansion capacity of Hoa Xuan.

#### 6.3.2 Son Tra WWTP

- Rehabilitation for 20,500 m<sup>3</sup>/day for domestic wastewater and 5,000 m<sup>3</sup>/day for fishery wastewater by W/B fund will be completed by 2018.
- Son Tra WWTP is planned to be eventually expanded to 51,000 m<sup>3</sup>/day (41,000 m<sup>3</sup>/day is for domestic and 10,000 m<sup>3</sup>/day is for fishery wastewater). However, concrete plan after the rehabilitation by W/B fund is not decided.

#### 6.3.3 DHTP WWTP

- DHTP WWTP is scheduled to construct in Phase 1 with treatment capacity of 4,500 m<sup>3</sup>/day by 2015
- DHTPMB is promoting investor and two Japanese companies have already registered and many other Japanese companies as well as other foreign companies have expressed interest as listed in Annex 4.

## 7. Formulation of ODA Loan Project

To formulate ODA loan project for CSO measures, further study is required to appraise need, urgency, and effect, as uncertainty factors are involved. When house connection works for 40,000 households funded by W/B is implemented mostly in the coastal area, almost all the households in the area will be covered, and then pollution load in CSO will drastically increase causing the situation bad to worse. In this case, conversion to separate system are hastened. It is recommended that construction of collection sewers connecting to the existing interceptor pumping stations are constructed simultaneously with house connection works by the saved W/B fund of construction of Phu Loc pumping station, transmission pipeline from Phu Loc to Lien Chieu, and reduction of capacity of Lien Chieu WWTP. Therefore, nature of the further works in the area and the progress of the house connection works

should be carefully monitored and analyzed.

Based on the works by W/B fund including the construction works of two locations of ocean outfalls, further environmental improvement project shall be formulated, for instance, completion work of conversion to separate system and/or construction of additional ocean outfalls to improve esthetic view of the beach.

Rehabilitation of the next phase of Son Tra WWTP with capacity of 25,500 m<sup>3</sup>/day and construction of WWTP in DHTP is urgently required, as the results of inflow projection by the review of the existing studies shown in **Annex 5**. While expansion of Hoa Xuan WWTP depends on the requirement and urgency of elimination of the existing two WWTPs of Hoa Cuong and Ngu Hanh Son.

Construction of WWTP in DHTP is the most appropriate project for Japanese ODA loan, since the project will contribute to many Japanese companies to be invested in DHTP as well as Vietnamese citizens. For formulation of loan project, framework proposed in feasibility study would be confirmed including the proposed wastewater treatment process indicated in **Annex 5**.

## 8. Annex

### Annex 1 List of Meeting, Contacted Personnel, and Collected Data and Information

#### List of Meeting

Date	AM	PM
22/07/2014	DPI (Inception Meeting)	DOC (Hearing and data collection)
23/07/2014	PIIP (Hearing and data collection)	DWTC (Hearing and data collection)
24/07/2014	PIIP (Hearing)	
28/07/2014		DONRE, DOT (Hearing and data collection)
29/07/2014	Site Survey with DWTC WWTPs (Hoa Xuan, Phu Loc, Son Tra) CSO (Eastern Coastal Area)	
06/08/2014	Lap up meeting of First Field Survey (DPI, DOC, DOT, DONRE, DWTC)	
23/09/2014	Lap up meeting for of Second Field Survey (DPI, DOC, DOT, DONRE, DWTC)	

#### Contacted Personnel

NAME	DESCRIPTION	PHONE&EMAIL
<b>DPI/ DEPARTMENT OF PLANNING AND INVESTMENT</b>		
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<b>DWTC/ DANANG DRAINAGE AND WASTEWATER TREATMENT COMPANY</b>		
Mr. Mai MA	Director	+84-(0)913.479.823 Maima111dng@gmail.com
Mr. Dang Ngoc VU	Deputy Director	+84-(0)905.697.123 Maima111dng@gmail.com
<b>PIIP/ PRIORITY INFRASTRUCTURE INVESTMENT PROJECTS MANAGEMENT UNIT</b>		
Mr. Hong Vinh HIEN	Vice Director	+84-(0)983.155.076 Vinhvienpiip1@yahoo.com.vn
<b>DANANG WATER SUPPLY COMPANY</b>		
Ks. Bui Tho NINH	Chief Planning – Technology Dept	+84-(0)913.422.456 ninhbui tho@gmail.com

### Collected Data and Information

No.	Issued by/From	To	Date	Title	English version
<b>PIIP</b>					
1	PIIP		4/2014	Feasibility Study for the Da Nang Sustainable City Development Project	Yes
2	PIIP			Cost Estimation for component 1 of infrastructure and wastewater treatment in Sustainable Development Project in Danang City	No
3	PIIP			Drawings for component 1 of infrastructure and wastewater treatment in Sustainable Development Project in Danang City + For stormwater + For waste water	Yes
4	PIIP			Hoa Xuan and Son Tra WWT process	Yes
<b>DPI</b>					
5	Minister	Danang PC	04/12/2014	Decision No:2357/QD-TTg dated 04/12/2014 on adjustment of Master Plan of Danang City to 20130, vision to 2050.	No
6	DPI		7/2012	CDIA report	Yes
7	DPI			Adjustment of Master Plan of Danang City to 2030, vision to 2050.	No
8	DPI		9/2014	<b>Danang Sustainable city development project –Implementation report</b>	Yes
9	DPI			<b>Detailed outline - The investment project using ODA capital – The construction project on the centralized sewage treatment plant in Danang Hi-tech Park</b>	yes
<b>DOC</b>					
10	DOC		2013	Drawings on adjustment of Master Plan of Danang City to 2030, vision to 2050.	No
11	DOC		21/8/2014	No 4845/SXD-QLHT – Solutions of collecting wastewater	yes
<b>DWTC</b>					
12	DWTC			Solutions for CSO in eastern area	No
13	DWTC			Drawings of existing CSO	No
14	DWTC			Record of inflow and outflow of wastewater at WWTPs in Danang in 2013 and 2014 (Discharge and quality)	No
15	DWTC			Drawings	No
<b>DOT</b>					
16	DOT		12/9/2014	No3343/SGTVT-GD&QLCL – Construction of Phu Loc Wastewater treatment	Yes
<b>Danang Water Supply One Member Limited Company (DAWACO)</b>					
17	DAWACO			Water supply data in Son Tra and Ngu Hanh Son	Yes
<b>Danang Hi-tech Park</b>					
18	DHTP			List of Japanese Investor	yes
19	DHTP			List of Foreign Investor	yes
20	DHTP			Overview of Danang Hi-tech park	yes
21	DHTP			FS report for WWTP in DHTP	yes

## Annex 2 Minutes of Meetings

<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p style="text-align: center;"><b>Minutes of Meeting</b> Local water supply and wastewater sector Survey in Vietnam Danang City Sewerage Project</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="font-size: small;">Date: 22nd Jul 2014</td> <td style="font-size: small;">Start: 2 PM</td> <td style="font-size: small;">End: 4.30 PM</td> </tr> <tr> <td colspan="3" style="font-size: small;">Place: DOC Danang</td> </tr> <tr> <td colspan="3" style="font-size: small;">Minute taker: Mr Le Xuan Hoang</td> </tr> <tr> <td colspan="3" style="font-size: small;">Hosted by:</td> </tr> <tr> <td colspan="3" style="font-size: small;">Implemented by:</td> </tr> <tr> <td colspan="3" style="font-size: small;">Participants: + DOC Danang:</td> </tr> <tr> <td colspan="3" style="font-size: small;">- Chief of Infrastructure Management Division, Mr Nguyen Hai Duong</td> </tr> <tr> <td colspan="3" style="font-size: small;">- Deputy Chief of Infrastructure Management Division, Mr Tran Viet Dung</td> </tr> <tr> <td colspan="3" style="font-size: small;">+ The JST</td> </tr> <tr> <td colspan="3" style="font-size: small;">- Chief of Consultants, Dr Kazuhiro Asada</td> </tr> <tr> <td colspan="3" style="font-size: small;">- Assistant Manager, Mr Toru Aoki</td> </tr> <tr> <td colspan="3" style="font-size: small;">- Local consultant, Mr Le Xuan Hoang</td> </tr> <tr> <td colspan="3" style="font-size: small;">- Translator, Ms Nguyen Thi Ngoc Uyen</td> </tr> <tr> <td colspan="3" style="font-size: small;">+ DPI Danang</td> </tr> <tr> <td colspan="3" style="font-size: small;">- Staff of Foreign Economic Relation Division of DPI, Mr Viet Phuong</td> </tr> </table> </div> <p><b>Purpose of meeting:</b> - To collect data and information related to wastewater treatment in Danang for study on preparation survey of JST.</p> <p><b>Content of meeting:</b></p> <p>The meeting was discussed on following issues and also some data requested:</p> <ul style="list-style-type: none"> <li>- Sewerage plan in Danang City</li> <li>- Master Plan of Danang City</li> <li>- Construction Schedule of WWTPs (confirmation of population projection, expansion capacity, construction schedule...)</li> <li>- CSO measures for eastern area</li> <li>- Comments of DOC</li> <li>- Household connections</li> </ul> <p>+ Mr Duong:</p> <ul style="list-style-type: none"> <li>- DOC will provide the decision of approval for master plan and related drawings by soft copies. (Vietnamese version)</li> </ul> <p style="text-align: right; font-size: x-small;">page 1 of 3</p>	Date: 22nd Jul 2014	Start: 2 PM	End: 4.30 PM	Place: DOC Danang			Minute taker: Mr Le Xuan Hoang			Hosted by:			Implemented by:			Participants: + DOC Danang:			- Chief of Infrastructure Management Division, Mr Nguyen Hai Duong			- Deputy Chief of Infrastructure Management Division, Mr Tran Viet Dung			+ The JST			- Chief of Consultants, Dr Kazuhiro Asada			- Assistant Manager, Mr Toru Aoki			- Local consultant, Mr Le Xuan Hoang			- Translator, Ms Nguyen Thi Ngoc Uyen			+ DPI Danang			- Staff of Foreign Economic Relation Division of DPI, Mr Viet Phuong			<ul style="list-style-type: none"> <li>- For the population projection and expansion capacity are included in Master Plan.</li> <li>- Construction schedule of WWTPs: Son Tra WWTP:             <ul style="list-style-type: none"> <li>• Current capacity is 15,000m<sup>3</sup>/day with anaerobic process, this capacity can not meet the demand and the effluent is under required standards as well.</li> <li>• It is going to construct a new WWTP under WB funding with capacity 20,00m<sup>3</sup>/day for domestic wastewater, 5000m<sup>3</sup>/day for fishery wastewater. Now is in bidding contractor selection stage.</li> <li>• The next stage is the expansion for 20,000m<sup>3</sup>/day for domestic waste water and 5000m<sup>3</sup>/day for fishery wastewater.</li> </ul> </li> <li>Hoa Xuan WWTP:             <ul style="list-style-type: none"> <li>• Currently, Hoa Xuan WWTP has capacity 20,000m<sup>3</sup>/day</li> <li>• Expansion to 40,000m<sup>3</sup>/day by WB funding.</li> <li>• Hoa Xuan Catchment: Hoa Xuan Area, A part of Hoa Cuong and Ngu Hanh Son.</li> <li>• Planning for 2018: population is reached 2,5mio in 2030, the demand for expansion of Hoa Xuan WWTP to 320,000m<sup>3</sup>/day. Funding is not available.</li> </ul> </li> <li>- For CSO measures:             <ul style="list-style-type: none"> <li>+ Mr Duong: There are 4 solutions for the eastern area of city Rehabilitation of CSO: which is can not completely solve the problem of discharge waste water to the beach To construct the separate collecting system: seems difficult to implement Collect and discharge stormwater to Han river, wastewater to WWTPs: costly and no specific study up to now Ocean far away discharge: No detailed study on this yet.</li> </ul> </li> </ul> <p>So Mr Duong would like to propose to consultant for study base on these solutions and ideas in order to find out the optimize solution for Danang city.</p> <p>+ Dr Asada: There are many data and information need to be collected for those solution study but for this survey, JST would like to collect as much as possible the data, information</p> <p style="text-align: right; font-size: x-small;">page 2 of 3</p>
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<p>and comments for relevant agencies for the orientation. Later, JICA may dispatch another the team for more detail survey.</p> <p>+ Mr Duong: In the meeting with Danang city on 16.7.2014, Danang City has proposed to JICA for study of 30,000 households connection. The location map and planning will be provided by PIIP.</p> <p>+ Dr Asada: Thank for the cooperation of DOC./.</p> <p style="text-align: right; font-size: x-small;">page 3 of 3</p>																																														

<b>Minutes of Meeting</b>		
Local water supply and wastewater sector Survey in Vietnam Danang City Sewerage Project		
Date: 23rd Jul 2014	Start: 8.00 AM	End: 11.30 AM
Place: PIIIP Office		
Minute taker: Mr Le Xuan Hoang		
Hosted by:		
Implemented by:		
Participants: + PIIIP: <ul style="list-style-type: none"> <li>- Deputy Director of PIIIP, Mr Ong Hong Vinh Hien</li> <li>- Staff of PIIIP, Mr Hung</li> </ul>		
+ The JST <ul style="list-style-type: none"> <li>- Chief of Consultants, Dr Kazuhiro Asada</li> <li>- Assistant Manager, Mr Toru Aoki</li> <li>- Local consultant, Mr Le Xuan Hoang</li> <li>- Translator, Ms Nguyen Thi Ngoc Uyen</li> </ul>		
+ DPI Danang <ul style="list-style-type: none"> <li>- Staff of Foreign Economic Relation Division of DPI, Mr Viet Phuong</li> </ul>		
<p><b>Purpose of meeting:</b> - To collect data and information related to wastewater treatment in Danang for study on preparation survey of JST.</p> <p><b>Content of meeting:</b></p> <p>The meeting was discussed on following issues and also some data was requested:</p> <ul style="list-style-type: none"> <li>• Commitment of WB project</li> <li>• F/S, Pre F/S of drainage system and wastewater treatment since 2012</li> <li>• Implementing schedule of WB project</li> <li>• Studies on ocean fall discharge</li> <li>• Current status and construction schedule of Son Tra and Hoa Xuan WWTPs</li> <li>• Comments on CSO measures</li> <li>• Mr Hien: <ul style="list-style-type: none"> <li>• The commitment of WB in Sustainable Development Project in Danang City is presented in F/S report which will be provided for JST.</li> <li>• For implementing schedule of WB project: <ul style="list-style-type: none"> <li>- Detailed design in 8.2014</li> <li>- Construction by the end of 2015</li> </ul> </li> </ul> </li> </ul>		
page 1 of 3		
<ul style="list-style-type: none"> <li>• There are 15 CSOs along the beach in eastern area of Danang city. In the scope of WB project, 2 of them at My An and My Khe will be chosen for pilot rehabilitation as using 2 HDPE D1200 and 200m in length for far-away discharge. (It is included stormwater and dilute wastewater). Cost estimate for each is 1 million USD, started in 2016.</li> </ul> <p>However, it is considered as a temporary solution due to uncompletely solve the problem of wastewater. For long term, an alternative need to be studied.</p> <p>PIIP will provide drawing of detailed design for this.</p> <ul style="list-style-type: none"> <li>• Current status and construction schedule of Son Tra and Hoa Xuan WWTPs <ul style="list-style-type: none"> <li>- For Son Tra WWTP: detailed design was finished, construction will be started in the beginning of 2015. Capacity in 2015: 25,000 m<sup>3</sup>/day. The planning of expansion is up to 50,000m<sup>3</sup>/day (funding is N/A)</li> <li>- Process: there is 5000m<sup>3</sup>/day of fishery wastewater and 20,000m<sup>3</sup>/day of domestic wastewater is treated by anaerobic pond.</li> <li>- For Hoa Xuan WWTP: it is underconstruction with capacity 20,000m<sup>3</sup>/day. The planning of expansion is up to 40,000m<sup>3</sup>/day in 2016, finished in 2017.</li> <li>- Process: SBR</li> <li>- Planning until 2020: expansion up to 80,000m<sup>3</sup>/day (funding is N/A)</li> <li>- Planning after 2020: expansion up to 320,000m<sup>3</sup>/day</li> <li>- Necessary of investment: for the fast increasing of population in Son Tra area, it is an urgent demand for expansion of Son Tra WWTP than Hoa Xuan WWTP</li> </ul> </li> </ul> <ul style="list-style-type: none"> <li>• CSO: <ul style="list-style-type: none"> <li>CSOs in the eastern area of Danang city was designed in 2004 and there are some problems with them</li> <li>CSOs in the northern area of Danang city was designed on 2008</li> </ul> </li> </ul> <p>For these issues, PIIIP will discuss in more details at 10am on 24.7.2014 in JST office.</p> <ul style="list-style-type: none"> <li>• Dr Asada: <ul style="list-style-type: none"> <li>According the meeting in 16.7.2014, JST would like to ask you to provide following information: the collecting system and area of 30,000 household connection.</li> </ul> </li> <li>• Mr Hien: <ul style="list-style-type: none"> <li>For the wastewater collection: the eastern area of Danang city from Son Tra and Ngu Hanh Son. The purpose is to convert to separating system and stop discharge wastewater to the sea.</li> </ul> </li> </ul>		
page 2 of 3		

For household connection: there are 3 methods for connection: gravity, pumping and vacuum. It is proposed to JST for studied for optimal solution.

• Scope of WB project:

- Household connection for 40,000 houses
- For the remain 30,000 houses: request funding from JICA.
- Management agency for household connection: DWTC

+ Dr Asada would like to ask if there is and comment of PIIP

+ Mr Hien: Hoa Xuan WWTP currently uses SBR process. It is suggested to JST to study on process which is in low-cost of O&M, high effective treatment.

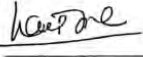

+ Dr Asada: Thank for the cooperation of PIIP./.

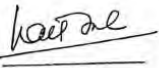



<p style="text-align: center;"><b>Minutes of Meeting</b> Local water supply and wastewater sector Survey in Vietnam Danang City Sewerage Project</p> <table border="1"> <tr> <td>Date: 24th Jul 2014</td> <td>Start: 2.00 PM</td> <td>End: 4.30 PM</td> </tr> <tr> <td colspan="3">Place: DWTC Office</td> </tr> <tr> <td colspan="3">Minute taker: Mr Le Xuan Hoang</td> </tr> <tr> <td colspan="3">Hosted by:</td> </tr> <tr> <td colspan="3">Implemented by:</td> </tr> <tr> <td colspan="3">Participants: + DWTC: - Director of DWTC, Mr Mai Ma - Vice Director of DWTC, Mr Dang Ngoc Vu - Other Staffs of DWTC</td> </tr> <tr> <td colspan="3">+ The JST - Chief of Consultants, Dr Kazuhiro Asada - Assistant Manager, Mr Toru Aoki - Local consultant, Mr Le Xuan Hoang - Translator, Ms Nguyen Thi Ngoc Uyen</td> </tr> <tr> <td colspan="3">+ DPI Danang - Staff of Foreign Economic Relation Division of DPI, Mr Viet Phuong</td> </tr> </table> <p>Purpose of meeting: - To collect data and information related to wastewater treatment in Danang for study on preparation survey of JST.</p> <p>Content of meeting:</p> <p>+ Dr Asada: According to meeting on 16.7.2014, Danang City proposed 5 components as follow:</p> <ul style="list-style-type: none"> <li>- CSO Measures for eastern coast area from Ngo Quyen/Ngu Hanh Son road</li> <li>- Expansion of Hoa Xuan WWTP from the capacity of 40,000m<sup>3</sup>/day (year 2018)</li> <li>- Expansion of Son Tra WWTP from 20,000m<sup>3</sup>/day to 40,000m<sup>3</sup>/day</li> <li>- Re-construction of Phu Loc WWTP (Confirmation of W/B project required)</li> <li>- Construction of wastewater collection system and house Connection (from 40,000 Nos. to 70,000 Nos.)</li> </ul> <p>+ Mr Ma: The priority of Danang city is the alternatives for eastern area. For DWTC has carried out some surveys and proposed some solutions:</p> <p style="text-align: right;">page 1 of 3</p>	Date: 24th Jul 2014	Start: 2.00 PM	End: 4.30 PM	Place: DWTC Office			Minute taker: Mr Le Xuan Hoang			Hosted by:			Implemented by:			Participants: + DWTC: - Director of DWTC, Mr Mai Ma - Vice Director of DWTC, Mr Dang Ngoc Vu - Other Staffs of DWTC			+ The JST - Chief of Consultants, Dr Kazuhiro Asada - Assistant Manager, Mr Toru Aoki - Local consultant, Mr Le Xuan Hoang - Translator, Ms Nguyen Thi Ngoc Uyen			+ DPI Danang - Staff of Foreign Economic Relation Division of DPI, Mr Viet Phuong			<ul style="list-style-type: none"> <li>•Solution 1: Construct an interceptor along the beach to collect stormwater and wastewater, pumping back to Tho Quang Dock. Tho Quang Dock is now polluted area. So this solution may help to increase its self-cleaning capacity. Details of cost estimate is presented in report and will be provided for JST.</li> <li>•Solution 2: Completely collect storm water and waste water to discharge to Tho Quang dock and Co Co river. Details of cost estimate is presented in report and will be provided for JST.</li> <li>•Solution 3: Construct two new pumping stations for My Khe and Phao Lo area, pumping back water to Han river. Details of cost estimate is presented in report and will be provided for JST.</li> <li>•Solution 4: Construct a collecting pipe along the beach, using jacking pipe technology to discharge storm water and waste water to Tho Quang dock, Han river and Co Co river. Cost estimate is N/A.</li> </ul> <p>+ Dr Asada: would like to be provided details and cost estimate for those solutions so that it is easy for JST to study.</p> <p>Moreover, JST would like to know the commitment of WB with Danang city.</p> <p>+ Mr Ma: WB is funding for drainage and household connections. Mr Ma also suggest JST to present more on jacking pipe as it is a technology from Japan.</p> <p>+ Dr Asada: As jacking pipe is a new technology for trenchless pipe installation and many countries are using it. However, it was found out 2 years ago that if the depth has been less than 5 meters, the cost would be higher than the conventional method (digging) In Vietnam, labor cost for digging is less than, the residents are more in cooperation. The special pipe which is used for this technology is going to produced in Vietnam. There are many training course on this technology in Japan. JST will report to JICA on this issue for further study of next team.</p> <p><b>Other comments:</b></p> <p>+ Mr Vu: As Son Tra WWTP will be expanded up to 40,000m<sup>3</sup>/day by WB funding and temporary enough for this area. The most concern now is Phu Loc area as it is a "hot point" of environment in the city.</p> <p>+ Mr Phuong: DPI already submitted the proposal to DPC and now is waiting for approval.</p> <p>+ Mr Ma: Metawater company is now running a WWTP at Phu Loc with capacity 300m<sup>3</sup>/day for pilot and it is high evaluated due to good quality of effluent.</p> <p>+ Dr Asada: Metawater has been awarded a certificate for that technology.</p> <p style="text-align: right;">page 2 of 3</p>
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<p>+ Mr Ma: DWTC always supports JST for any survey study in Danang city.</p> <p>+ Dr Asada: Thank for the meeting and thank for the cooperation from DWTC.</p> <p style="text-align: right;">page 3 of 3</p>																									

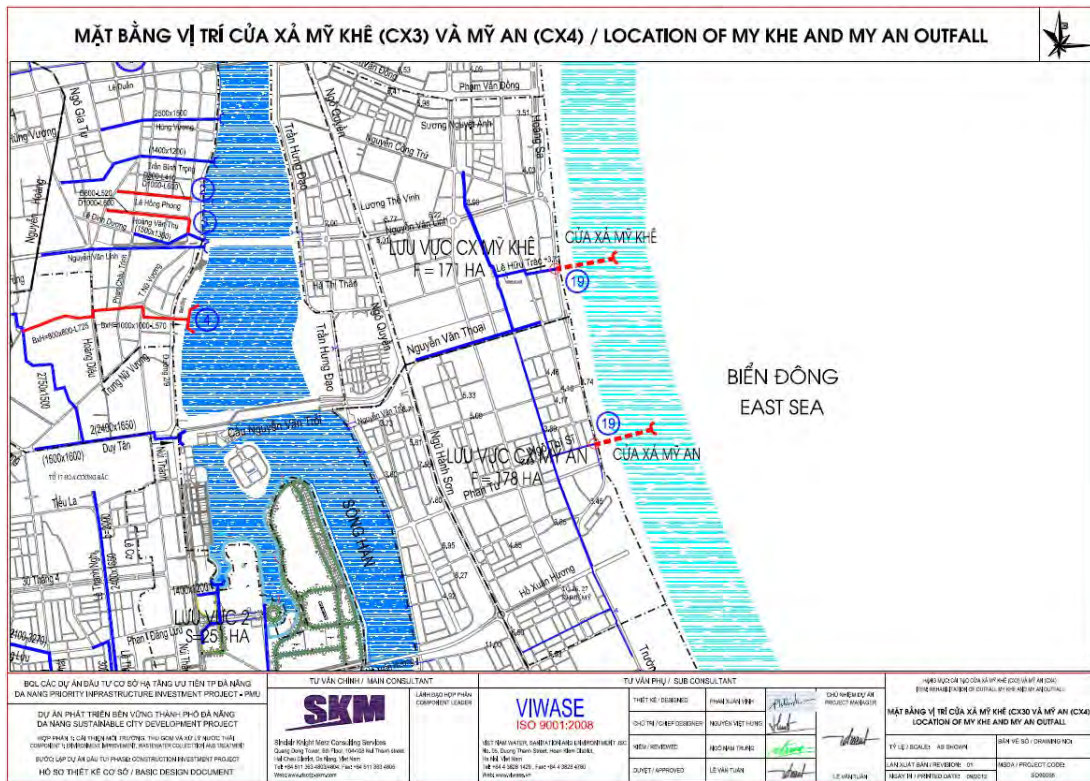
<div style="text-align: center;"> <p><b>Minutes of Meeting</b> Local water supply and wastewater sector Survey in Vietnam Danang City Sewerage Project</p> </div> <table border="1" style="width: 100%;"> <tr> <td>Date: 24th Jul 2014</td> <td>Start: 10.00AM</td> <td>End: 11.00 AM</td> </tr> <tr> <td colspan="3">Place: JST Office</td> </tr> <tr> <td colspan="3">Minute taker: Mr Le Xuan Hoang</td> </tr> <tr> <td colspan="3">Hosted by:</td> </tr> <tr> <td colspan="3">Implemented by:</td> </tr> <tr> <td colspan="3">Participants: + PIIP: - Deputy Director of PIIP, Mr Ong Hong Vinh Hien</td> </tr> <tr> <td colspan="3">+ The JST - Chief of Consultants, Dr Kazuhiro Asada - Assistant Manager, Mr Toru Aoki - Local consultant, Mr Le Xuan Hoang - Translator, Ms Nguyen Thi Ngoc Uyen</td> </tr> <tr> <td colspan="3">+ DPI Danang - Staff of Foreign Economic Relation Division of DPI, Mr Viet Phuong</td> </tr> </table> <p>Purpose of meeting: - To discuss on more details of CSO measures.</p> <p>Content of meeting was in following issues:</p> <p>+ Mr Hien: The main objective of project is to convert to separating system It was practiced in 600 households in Danang city for connecting directly from septic tank to collecting system in front of houses. Based on this successful practice for those pilot households, there are more 40,000 households will be implemented by WB funding. PIIP would like to ask JST for study on connection from household to separating system, remove all septic tank from households. Cost estimation for 1 connection is from 200USD to 500USD. A survey by PIIP shown that 90% of households agreed on connections. Dr Asada: Thank for the information of PIIP. JST will report to JICA and find out the orientation for Danang city.</p> <p style="text-align: right;">page 1 of 2</p>	Date: 24th Jul 2014	Start: 10.00AM	End: 11.00 AM	Place: JST Office			Minute taker: Mr Le Xuan Hoang			Hosted by:			Implemented by:			Participants: + PIIP: - Deputy Director of PIIP, Mr Ong Hong Vinh Hien			+ The JST - Chief of Consultants, Dr Kazuhiro Asada - Assistant Manager, Mr Toru Aoki - Local consultant, Mr Le Xuan Hoang - Translator, Ms Nguyen Thi Ngoc Uyen			+ DPI Danang - Staff of Foreign Economic Relation Division of DPI, Mr Viet Phuong			<p>+ Dr Asada: As I know in WB project, there are some components such as expansion of Son Tra WWTP, expansion of Hoa Xuan WWTP from 20,000m<sup>3</sup>/day to 40,000m<sup>3</sup>/day, study on far-away discharge, collecting wastewater and household connections. Is there any component?</p> <p>+ Mr Son: Basically, 3 projects using WB funding collect most of wastewater which discharged to the beach and Han river.</p> <p>For WWTPs: In future, wastewater from Ngu Hanh Son and Hoa Cuong WWTP will be pumped to Hoa Xuan WWTP.</p> <p>For CSO: It is an urgent request from DPC for rehabilitation of CSO My An and My Khe.</p> <p>+ Dr Asada: would like to know the construction schedule for Son Tra and Hoa Xuan WWTPs.</p> <p>+ Mr Son: For Son Tra WWTP: Currently, Son Tra WWTP has capacity of 5000m<sup>3</sup>/day for fishery wastewater and 20,000m<sup>3</sup>/day for domestic wastewater. It will be finished in 2015.</p> <p>For Hoa Xuan WWTP: As planning, the demand for Hoa Xuan WWTP is 320,000m<sup>3</sup>/day in 2040. It is expected in operation in 9/2014 for capacity of 20,000m<sup>3</sup>/day, SBR process under priority infrastructure investment project.</p> <p>Under sustainable development project, it is expanded up to 40,000m<sup>3</sup>/day using WB funding. Expected finish in 2016.</p> <p>SBR process was recommended by SFC contractor and DPC approved it to replace for oxidation ditch process as planned.</p> <p>+ Dr Asada: would like to know the comments from DOT for CSO and household connection:</p> <p>+ Mr Son: As the city strategy, it will be converted to separating system in Eastern area due to tourist area, low density of residents. It is an advantage compare to the centre of city. DOT would like to ask JST for study on this issue. DPC will select an optimal solution. If there is any needed information or data, DOT is willing to provide for JST.</p> <p>+ Dr Asada: thank you for the cooperation./.</p> <p style="text-align: right;">page 2 of 2</p>			
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<div style="text-align: center;"> <p><b>Minutes of Meeting</b> Local water supply and wastewater sector Survey in Vietnam Danang City Sewerage Project</p> </div> <table border="1" style="width: 100%;"> <tr> <td>Date: 28th Jul 2014</td> <td>Start: 4.00 PM</td> <td>End: 5.30 PM</td> </tr> <tr> <td colspan="3">Place: DOT Office</td> </tr> <tr> <td colspan="3">Minute taker: Mr Le Xuan Hoang</td> </tr> <tr> <td colspan="3">Hosted by:</td> </tr> <tr> <td colspan="3">Implemented by:</td> </tr> <tr> <td colspan="3">Participants: + DOT: - Vice Director of DOT, Mr Son</td> </tr> <tr> <td colspan="3">+ PIIP: - Vice Director of PIIP, Mr Ong Hong Vinh Hien - Staff of PIIP, Mr Hoang</td> </tr> <tr> <td colspan="3">+ The JST - Chief of Consultants, Dr Kazuhiro Asada - Assistant Manager, Mr Toru Aoki - Local consultant, Mr Le Xuan Hoang - Translator, Ms Nguyen Thi Ngoc Uyen</td> </tr> <tr> <td colspan="3">+ DPI Danang - Staff of Foreign Economic Relation Division of DPI, Mr Viet Phuong</td> </tr> </table> <p>Purpose of meeting: - To collect data and information related to wastewater treatment in Danang for study on preparation survey of JST.</p> <p>Content of meeting: The meeting was discussed on following issues:</p> <ul style="list-style-type: none"> <li>&gt; Data Collection of Sewerage related M/P, F/S, and Pre F/S reports prepared since 2012</li> <li>&gt; Sewerage Works Committed by World Bank and its Present Status</li> <li>&gt; Confirmation on Construction Schedule of Hoa Xuan and Son Tra WWTPs and the Present Status</li> <li>&gt; Alternative Study of CSO Measure for eastern area</li> <li>&gt; Collection System and House Connection to be constructed Confirmation of Route of Sewers and Area for House Connection</li> </ul> <p>+ Mr Son: There have been 3 environmental projects using WB funding in Danang city since 2000. PIIP will provide the necessary documents for JST.</p> <p style="text-align: right;">page 1 of 2</p>	Date: 28th Jul 2014	Start: 4.00 PM	End: 5.30 PM	Place: DOT Office			Minute taker: Mr Le Xuan Hoang			Hosted by:			Implemented by:			Participants: + DOT: - Vice Director of DOT, Mr Son			+ PIIP: - Vice Director of PIIP, Mr Ong Hong Vinh Hien - Staff of PIIP, Mr Hoang			+ The JST - Chief of Consultants, Dr Kazuhiro Asada - Assistant Manager, Mr Toru Aoki - Local consultant, Mr Le Xuan Hoang - Translator, Ms Nguyen Thi Ngoc Uyen			+ DPI Danang - Staff of Foreign Economic Relation Division of DPI, Mr Viet Phuong			<p>+ Dr Asada: As I know in WB project, there are some components such as expansion of Son Tra WWTP, expansion of Hoa Xuan WWTP from 20,000m<sup>3</sup>/day to 40,000m<sup>3</sup>/day, study on far-away discharge, collecting wastewater and household connections. Is there any component?</p> <p>+ Mr Son: Basically, 3 projects using WB funding collect most of wastewater which discharged to the beach and Han river.</p> <p>For WWTPs: In future, wastewater from Ngu Hanh Son and Hoa Cuong WWTP will be pumped to Hoa Xuan WWTP.</p> <p>For CSO: It is an urgent request from DPC for rehabilitation of CSO My An and My Khe.</p> <p>+ Dr Asada: would like to know the construction schedule for Son Tra and Hoa Xuan WWTPs.</p> <p>+ Mr Son: For Son Tra WWTP: Currently, Son Tra WWTP has capacity of 5000m<sup>3</sup>/day for fishery wastewater and 20,000m<sup>3</sup>/day for domestic wastewater. It will be finished in 2015.</p> <p>For Hoa Xuan WWTP: As planning, the demand for Hoa Xuan WWTP is 320,000m<sup>3</sup>/day in 2040. It is expected in operation in 9/2014 for capacity of 20,000m<sup>3</sup>/day, SBR process under priority infrastructure investment project.</p> <p>Under sustainable development project, it is expanded up to 40,000m<sup>3</sup>/day using WB funding. Expected finish in 2016.</p> <p>SBR process was recommended by SFC contractor and DPC approved it to replace for oxidation ditch process as planned.</p> <p>+ Dr Asada: would like to know the comments from DOT for CSO and household connection:</p> <p>+ Mr Son: As the city strategy, it will be converted to separating system in Eastern area due to tourist area, low density of residents. It is an advantage compare to the centre of city. DOT would like to ask JST for study on this issue. DPC will select an optimal solution. If there is any needed information or data, DOT is willing to provide for JST.</p> <p>+ Dr Asada: thank you for the cooperation./.</p> <p style="text-align: right;">page 2 of 2</p>
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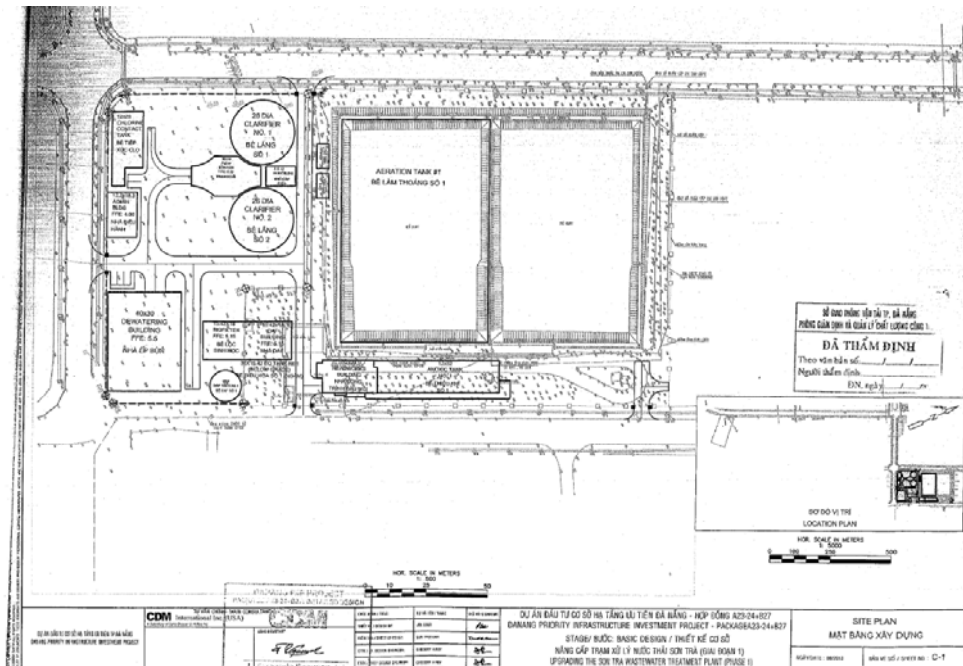
<p style="text-align: center;"><b>BIÊN BẢN CUỘC HỌP GIỮA</b> <b>ĐOÀN KHẢO SÁT CƠ QUAN HỢP TÁC QUỐC TẾ NHẬT BẢN</b> <b>VÀ</b> <b>SỞ KẾ HOẠCH VÀ ĐẦU TƯ THÀNH PHỐ ĐÀ NẴNG</b> <b>VỀ CÁC KẾT QUẢ KHẢO SÁT</b> <b>THOÁT NƯỚC VÀ XỬ LÝ NƯỚC THẢI THÀNH PHỐ ĐÀ NẴNG</b></p> <p style="text-align: center;">Đà Nẵng, ngày 06 tháng 08 năm 2014</p> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">               Ông Trần Văn Sơn              Giám đốc              Sở Kế hoạch và Đầu tư         </div> <div style="text-align: center;">               Ông Kazuhiro Asada              Đoàn Khảo sát JICA              Công ty Tư vấn Nihon Suido         </div> </div>	<p><b>Thời gian</b> : 08:00 - 11:30, ngày 06 tháng 08 năm 2014.</p> <p><b>Địa điểm</b> : Phòng họp Tầng 7, Sở Kế hoạch và Đầu tư, Trung tâm Hành chính, số 24 Trần Phú, thành phố Đà Nẵng.</p> <p><b>Thành phần</b></p> <p><i>Phía thành phố Đà Nẵng:</i></p> <ul style="list-style-type: none"> <li>- Đại diện Sở Kế hoạch và Đầu tư: Ông Trần Văn Sơn, Giám đốc</li> <li>- Đại diện Sở Xây dựng: Ông Nguyễn Hải Đường, Trưởng phòng Quản lý hạ tầng</li> <li>- Đại diện Sở Giao thông Vận tải: Ông Ngô Đình Sơn, Phó phòng Giám định và quản lý chất lượng giao thông</li> <li>- Đại diện Chi cục Bảo vệ Môi trường - Sở Tài nguyên và Môi trường: Ông Phạm Thanh Phúc, Trưởng phòng Kiểm soát môi trường.</li> <li>- Đại diện Công ty Thoát nước và Xử lý nước thải: Ông Mai Mă, Giám đốc</li> <li>- Đại diện Ban Quản lý các dự án đầu tư cơ sở hạ tầng ưu tiên: Ông Hồng Vinh Hiền, Phó ban.</li> </ul> <p><i>Phía Đoàn khảo sát JICA:</i></p> <ul style="list-style-type: none"> <li>- Trưởng Đoàn Khảo sát JICA, Ông Kazuhiro Asada</li> <li>- Trợ lý Giám đốc, Ông Toru Aoki</li> <li>- Tư vấn trong nước, Ông Lê Xuân Hoàng</li> <li>- Điều phối viên, Bà Nguyễn Thị Ngọc Uyên</li> </ul> <p style="text-align: center;"><b>Nội dung cuộc họp</b></p> <p>Tiếp theo cuộc họp với đại diện Cơ quan Hợp tác Quốc tế Nhật Bản (JICA) Ông Taro Katsuragi và Đoàn Khảo sát JICA vào ngày 16 tháng 7 năm 2014, Sở Kế hoạch và Đầu tư và các Sở, Ban ngành liên quan đã cung cấp thông tin và phối hợp với Đoàn Khảo sát JICA tình hình hiện trạng nước thải khu vực phía Đông và các Nhà máy xử lý nước thải (NMXLNT) Sơn Trà, Hòa Xuân và Phú Lộc trên địa bàn thành phố Đà Nẵng;</p> <p>Tại cuộc họp, Sở Kế hoạch và Đầu tư và đại diện các sở ngành liên quan tổ chức cuộc họp với Đoàn Khảo sát JICA với nội dung như sau:</p> <p>Đoàn Khảo sát JICA báo cáo kết quả thu hoạch sơ bộ trong thời gian khảo sát ở Đà Nẵng, hiện trạng của các giếng tích dòng dọc theo khu vực phía Đông thuộc Sơn Trà và Ngũ Hành Sơn, hiện trạng của các NMXLNT Sơn Trà, Hòa Xuân và Phú Lộc, đồng thời đưa ra dự kiến kế hoạch thực hiện dự án hỗ trợ kỹ thuật vào đầu năm 2015 và kế hoạch vốn vay Nhật Bản từ năm 2016 đến 2022. Sau khi trao đổi với Đoàn Khảo sát JICA, Sở Kế hoạch và Đầu tư và đại diện các sở ngành tham dự cuộc họp cùng thống nhất với Đoàn Khảo sát JICA một số nội dung như sau:</p> <p>1. Dự án thoát nước và xử lý nước thải thành phố Đà Nẵng do JICA thực hiện gồm có 2 hợp phần:</p>
<p>- Hợp phần 1: Thoát nước và thu gom nước thải khu vực phía Đông.</p> <ul style="list-style-type: none"> <li>• Hạng mục 1.1: Nghiên cứu xử lý triệt để nước thải từ các giếng tách dòng ra biển ở khu vực phía Đông, đề nghị tư vấn xem xét 4 phương án do Sở Xây dựng nêu ra hoặc lồng ghép giữa các phương án gồm:             <ul style="list-style-type: none"> <li>○ Cải tạo các giếng tách dòng</li> <li>○ Xây dựng hệ thống thu gom riêng ở khu vực phía Đông</li> <li>○ Xây dựng đường ống ngầm đưa nước mưa đổ về sông Hàn</li> <li>○ Xây dựng các cửa xả xả bờ.</li> </ul> </li> <li>• Hạng mục 1.2: Đầu nối các bộ dân khu vực phía Đông với hệ thống thu gom nước thải, số lượng tùy thuộc vào các nghiên cứu sau này của tư vấn JICA.</li> </ul> <p>- Hợp phần 2: Xây dựng, nâng cấp các NMXLNT</p> <ul style="list-style-type: none"> <li>• Hạng mục 2.1: Nâng cấp NMXLNT Hòa Xuân thêm 40.000m<sup>3</sup>/ngày đêm thành tổng công suất là 80.000m<sup>3</sup>/ngày đêm để đưa vào sử dụng năm 2022 tiếp theo Dự án Phát triển Bền vững (DAPTBV) của Ngân hàng Thế giới (WB).</li> <li>• Hạng mục 2.2: Xây dựng NMXLNT Phú Lộc tổng công suất thiết kế 120.000m<sup>3</sup>/ngày đêm đến năm 2040, dự kiến bắt đầu xây dựng từ năm 2019 và đưa vào hoạt động năm 2022, công trình và lịch trình xây dựng độc lập hoàn toàn với DAPTBV.</li> </ul> <p>Giai trình sự tách bạch giữa hợp phần xây dựng NMXLNT Phú Lộc trong phạm vi dự án của JICA với dự án Phát triển bền vững (DAPTBV) của WB như sau:</p> <p>Theo DAPTBV của WB, trạm Phú Lộc sẽ được nâng cấp thành trạm bơm để chuyển nước về Liên Chiểu, theo dự kiến sẽ bắt đầu hoạt động từ năm 2018. Trong dự án của JICA, việc xây dựng NMXLNT Phú Lộc dự kiến bắt đầu thi công từ năm 2019 hoàn toàn tách bạch với DAPTBV và sẽ tiếp nối DAPTBV để đáp ứng nhu cầu xử lý nước thải và giải quyết triệt để vấn đề ô nhiễm hiện nay của khu vực Phú Lộc. Trong quá trình xây dựng NMXLNT Phú Lộc, trạm bơm Phú Lộc vẫn được hoạt động song song để chuyển nước về NMXLNT Liên Chiểu cho đến khi NMXLNT Phú Lộc được đưa vào vận hành.</p> <ul style="list-style-type: none"> <li>• Hạng mục 2.3: Nâng cấp công suất NMXLNT Sơn Trà thêm 25.500m<sup>3</sup>/ngày đêm, gồm 20.500m<sup>3</sup>/ngày đêm cho nước thải sinh hoạt và 5.000m<sup>3</sup>/ngày đêm cho nước thải thủy sản nâng tổng công suất dự kiến cho đến năm 2022 là 51.000m<sup>3</sup>/ngày đêm.</li> </ul> <p>2. Trên cơ sở thống nhất giữa các bên về nội dung nêu tại mục 1, Sở Kế hoạch và Đầu tư báo cáo UBND thành phố xin ý kiến thống nhất chủ trương về các hợp phần đầu tư của dự án thoát nước và xử lý nước thải xin JICA tài trợ. Nếu UBND thành phố đồng ý về chủ trương, UBND thành phố cần có văn bản gửi JICA chậm nhất vào ngày 30/8/2014 để JICA xem xét triển khai thực hiện các bước tiếp theo.</p> <p>Buổi làm việc kết thúc lúc 11 giờ 30 phút cùng ngày./.</p>	

<p style="text-align: center;"><b>MINUTES OF MEETING</b> <b>BETWEEN</b> <b>JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) SURVEY TEAM</b> <b>AND</b> <b>DANANG DEPARTMENT OF PLANNING AND INVESTMENT</b> <b>THE SOCIALIST REPUBLIC OF VIETNAM</b> <b>FOR SURVEY RESULTS ON</b> <b>DRAINAGE AND WASTEWATER TREATMENT IN DANANG CITY</b></p> <p style="text-align: center;">Da Nang, August 06<sup>th</sup>, 2014</p> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">               Mr. Tran Van Son              Director              Department of Planning and Investment         </div> <div style="text-align: center;">               Mr. Kazuhiro Asada              JICA Survey Team              Nihon Suido Consultants         </div> </div>	<p><b>Time</b> : 08:00 - 11:30, August 06<sup>th</sup>, 2014</p> <p><b>Venue</b> : Department of Planning and Investment, 7<sup>th</sup> Floor Meeting room, Administration Centre Building, 24 Tran Phu, DaNang</p> <p><b>Participant</b></p> <p><i>From Da Nang city:</i></p> <ul style="list-style-type: none"> <li>- Representative from Department of Planning and Investment: Mr. Tran Van Son, Director.</li> <li>- Representative from Department of Construction: Mr. Nguyen Hai Duong, Chief of Infrastructure Management Division.</li> <li>- Representative from Department of Transportation: Mr. Ngo Dinh Son, Vice Chief of Transportation Quality Management and Examination Division.</li> <li>- Representative from Environmental Protection Agency, Department of Natural Resources and Environment: Mr. Pham Thanh Phuc, Chief of Environmental Control Division.</li> <li>- Representative from Drainage and Wastewater Treatment Company: Mr. Mai Ma, Director.</li> <li>- Representative from Management Board of Priority Infrastructure Investment Project: Mr. Ong Hong Vinh Hien, Vice Director.</li> </ul> <p><i>From Japan Survey Team:</i></p> <ul style="list-style-type: none"> <li>- Chief of Consultants, Dr. Kazuhiro Asada</li> <li>- Assistant Manager, Mr. Toru Aoki</li> <li>- Local consultant, Mr. Le Xuan Hoang</li> <li>- Coordinator, Ms. Nguyen Thi Ngoc Uyen</li> </ul> <p style="text-align: center;"><b>Content</b></p> <p>Following up with the meeting with the Japan International Cooperation Agency (JICA) represented by Mr. Taro Katsurai and JICA Survey Team (JST) on July 16<sup>th</sup> 2014, Department of Planning and Investment (DPI) and other relevant departments in Da Nang city have provided information and cooperated with the team to examine the current situation of wastewater in the eastern area and Son Tra, Hoa Xuan, and Phu Loc wastewater treatment plants (WWTPs) in Da Nang city;</p> <p>At the meeting, DPI and other relevant departments had the meeting with the JST discussing the following issues:</p> <p>JST presented results from the preliminary survey that had been conducted in Da Nang on the current situation of combined sewage overflows (CSOs) along the eastern area in Son Tra and Ngu Hanh Son district and Son Tra, Hoa Xuan and Phu Loc WWTPs, and proposed the expected plan for implementing technical assistant project in early 2015, as well as plan for seeking loan from Japanese government in the year period 2016-2022. After discussing with JST, DPI and other relevant departments have agreed on the following:</p>
<ul style="list-style-type: none"> <li>- Component 1: Drainage and wastewater collection at the eastern area.             <ul style="list-style-type: none"> <li>• Sub-component 1.1: Study and treat properly wastewater from the CSOs in the eastern area. The city requests JST to consider 4 options suggested by Department of Construction or an integration of the following options.                     <ul style="list-style-type: none"> <li>o Upgrade CSOs;</li> <li>o Construct a separated collection system at the eastern area;</li> <li>o Construct sewer pipelines to pump drain water back to Han river;</li> <li>o Construct pipelines for the ocean-fall-discharge.</li> </ul> </li> <li>• Sub-component 1.2: Households connection with the wastewater collection system in the eastern area. The number of connected households depends on the study to be conducted later by JICA consultants.</li> </ul> </li> <li>- Component 2: Construct and upgrade WWTPs.             <ul style="list-style-type: none"> <li>• Sub-component 2.1: Upgrade capacity of Hoa Xuan WWTP from 40,000m<sup>3</sup>/day night to 80,000m<sup>3</sup>/day night to put into operation in 2020 after the Sustainable Development Project (SDP) by World Bank (WB) completes.</li> <li>• Sub-component 2.2: Construct Phu Loc WWTP with the designed capacity of 120,000m<sup>3</sup>/day night in 2040, expected to start construction in 2019 and operation in 2022. This construction work and its schedule are completely independent with the SDP.</li> </ul> <p><i>Explanation for the independence of JICA scope of Phu Loc WWTP from SDP by WB as following:</i></p> <p>According to the SDP by WB, Phu Loc WWTP will be upgraded to become a pumping station to pump water to Lien Chieu WWTP, expected to operate in 2018. In the scope of JICA project, construction of Phu Loc WWTP is expected to begin in 2019, which is completely independent with SDP. The project sponsored by JICA will treat the wastewater and environmental pollution at Phu Loc area after SDP completes. During the construction time, Phu Loc water pumping station will still be in operation in order to pump water to Lien Chieu WWTP until Phu Loc WWTP is put into operation.</p> <li>• Sub-component 2.3: Upgraded capacity of Son Tra WWTP to 25,500m<sup>3</sup>/day night, including 20,500m<sup>3</sup>/day night for domestic wastewater and 5,000m<sup>3</sup>/day night for seafood wastewater. Totally, expected capacity of Son Tra WWTP is 51,000m<sup>3</sup>/day night until 2022.</li> </li></ul> <p>2. Based on the agreement among all parties in the Component 1 above, DPI will report to Da Nang People's Committee to ask for approval of investment components of Drainage and Wastewater Treatment Project sponsored by JICA. If DPC approves, then DPC needs to send an official letter to JICA at the latest August 30<sup>th</sup> 2014 so that JICA can consider next steps for implementation of the project.</p> <p>The meeting ended at 11h30AM.</p>	

Annex 3 Reference for Sewerage Construction Planned



Ocean Outfall in Ngu Hanh Son System



Rehabilitation Plan of Son Tra WWTP

**Annex 4 List of Possible Investors for DHTP**

**LIST OF JAPANESE INVESTORS COME TO WORK WITH DHTP FROM 2013 TO DATE**

No.	Name
<b>I</b>	<b>INVESTORS</b>
1	Nippon Seiki Co., Ltd.
2	Mori Building Co., Ltd.
3	Premium Agency Inc
4	Sumitomo Mitsui Banking Corp
5	Tokyo Keiki Inc
6	Bank of Tokyo-Mitsubishi UFJ
7	Niwa Foundry Inc
8	Katagiri Industry Co., Ltd.
9	Japan Construction Management Corp
10	The Zenitaka Corp (Representative Office in Hanoi)
11	NTT DATA Corp
12	NEWJEC Inc
13	Dynaon Inc
14	Meinan Partners Co., Ltd.
15	AI Electronic Industry Co., Ltd.
16	Daiku JV Co., Ltd.
17	KAJIMA Corp
18	Sugimoto Corp
19	Takako Industries Inc.
20	Obayashi Corp
21	Cosmo Development Co., Ltd.
<b>II</b>	<b>GORVERNMENT AGENCY AND UNIVERSITY</b>
1	JETRO
2	Small and medium enterprises of Nagoya city Delegation
3	Chamber of Commerce and Industry of Kawasaki
4	OECC and enterprises of Yokohama Delegation
5	The Minister of Economy, Trade and Industry of Japan
6	Government agency and enterprises of Yokohama Delegation
7	Economic Corridor East - West survey Delegation of JETRO
8	Osaka University
9	Senshu University

Source : DHTPMB

**THE LIST OF INVESTORS COME TO WORK WITH DHTPMB  
(As of September, 2014)**

<b>National</b>	<b>Name of Investors</b>
Germany	Continental AG
	Federal Ministry of Economic and Technology
Netherlands	The Universities of Netherlands Delegation
	Investment Consulting Associates (ICA)
	Consulate General of Netherlands Delegation
	Witteveen + Bos
Netherlands + Germany	Tebodin Vietnam Co., Ltd.
Korea	Korean Hi-tech Park Delegation
	Tae-Rim Construction
	Samsung Vietnam
	Infopia
	NFG Inc.
	Logos Law LLC
	UN-HABITAT
	Hannam University
	Chamber of Industry and Trade of Korea
	C&N Vina
	Korea Institute for Industrial Economics and Trade (KIET)
	Seoul City Government Delegation
	KOTRA
	GGGI
	KAI (Korea Aerospace Industries, Ltd.)
	Seoul Institute
	Sungkyunkwan University
	Lado Filter Engineering Co., Ltd,
	The Mayor of Changwon City
	Vietnam Sports Platform (VSP)
The Korean Nutrition Society	
USA	Hareon Solar USA
	Consulate General of Vietnam in San Francisco
	Arizona State University
	IDG Ventures Vietnam
France	Veolia Water Solutions & Technologies Viet Nam
	French Agency for Development - AFD
	EADS
	AIB
	Archetype Vietnam Ltd. (Hanoi Branch)
Austria	Skidata (Kudelski Group)
India	Indian Chamber of Commerce (ICC)
Israel	Ambassador of the State of Israel
UK	Stewardship Consulting
Hungary	S-Group Hungary
Finland	IPP
Romania	The Mayor of Timisoara
Australia	AUSTRADE



## Annex 5 Review of Inflow Projection of WWTPs

### 1. Facility Plan of WWTP

Wastewater inflow of Hoa Xuan, Son Tra, and Danang Hi-Teck Park WWTPs are projected using the data and results of the existing studies to evaluate the timing of the next expansion or construction of WWTPs. Wastewater inflow projection of Hoa Xuan, Son Tra WWTPs takes account of wastewater from residents and tourists, since a few industrial wastewater is generated in the regions.

#### 1.1 Population Projection

##### (1) Projection Scenario in Master Plan

Three scenarios of population production studied in M/P of Danang City are shown in **Table 8.1**.

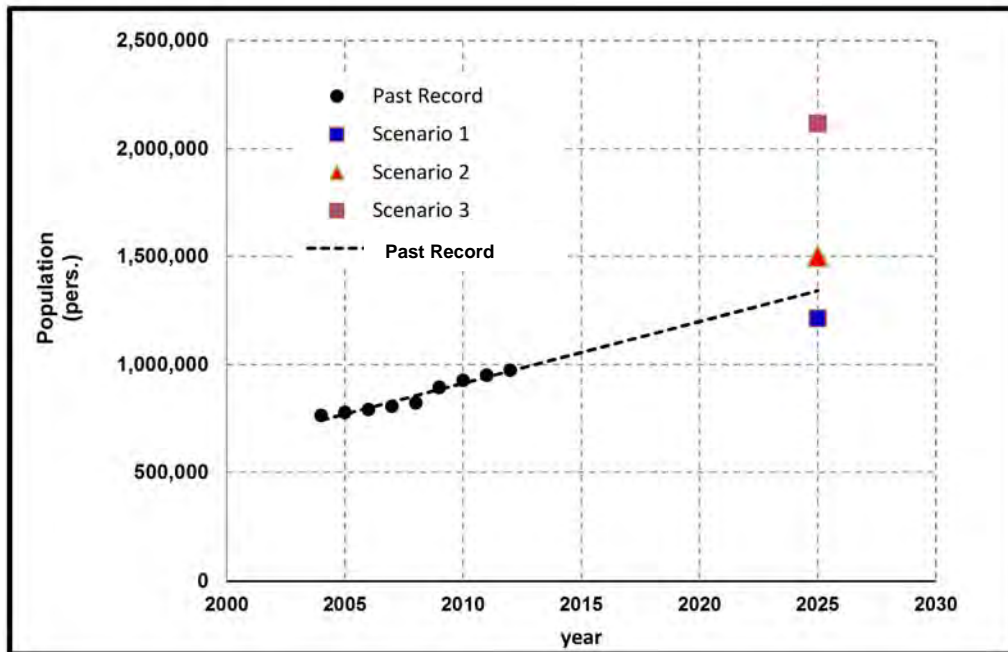
**Table 8.1 Planning Scenario in M/P of Danang City**

Item		【Scenario 1】 Basic Plan	【Scenario 2】 Current Plan	【Scenario 3】 Accelerated Development Plan
Proceeding	Population【2025】 (million pers.)	1.213	1.500	2.117
	Area (ha)	20.572	24.028	25.043
	Density (pers./ha)	59	62	85
Sustainability	【Economic】	Low:	Average:	High:
	•Diversity sector	•Low effective land use	•Natural development	•Concentrated Trading centre and sub-centre
	•Investment attraction	•Low investment attraction	•No competition urban centre	•Strategic location for new careers
	•Impact on areas	•No impact on area	•Connect to the vicinity urban area	•Good connection to the vicinity urban area
	【Socio】	Low:	Average:	Average to high
	•Equality	•Less job opportunities	•Difficult for public transportation	•Strong human resource
	•Careers	•Population reduce		•Services
	•Services			•Strong community
	【Environment】	Low:	Average to high	Average to high
•Pollution	•Pollution expand	•Conservation environment	•No pollution	
•Eco system	•Negative effects on eco-system		•Conservative eco-system	
•Disaster response	•Easy affect by disasters		•Better facilities	

Source: Adjustment of Master Plan of Danang City to 2030, vision to 2050

**Figure 8.1** shows the Population of each scenario in 2025 and past record referenced from statistical year book.

F/S report related to the latest sewerage project adopts scenario 3 which is expected largest population growth among the three scenarios. However, it is thought that scenario 2 is relatively reasonable projection considering the past record as shown in **Figure 8.1**. Therefore, this study adopts scenario 2 to project the future wastewater volume.



**Figure 8.1 Population of Past Record and Projection in M/P**

**(2) Resident Population**

The forecast for the population growth up to year 2030 population is calculated according to the general formula:

$$P_n = P_o \times (1 + Gr)^n$$

Where:

- P<sub>n</sub>: population in year n
- P<sub>o</sub>: population in reference year
- Gr: population growth rete
- n: number of years since reference year

The population growth rate for each district is referenced from M/P<sup>1</sup> and resident population was calculated by the growth rate based on actual population in 2007. The result of population projection is shown in **Table 8.2**.

<sup>1</sup> Adjustment of Master Plan of Danang City to 2030, vision to 2050

**Table 8.2 Resident Population in each WWTPs (unit: pers.)**

Area of WWTP	2007 <sup>1)</sup>	Growth Rate <sup>2)</sup>	2015	2020	2025	2030	Remarks
Hoa Xuan (Existing)	68,320	4.30%	95,680	118,098	145,769	179,923	• Only the area of current Hoa Xuan WWTP
Ngu Hanh Son (Existing)	54,066	5.80%	84,881	112,522	149,165	197,740	• will be integrated into Ho Xuan WWTP
Hoa Cuong (Existing)	148,581	0.80%	158,361	164,797	171,496	178,466	• will be integrated into Ho Xuan WWTP
Hoa Xuan (Planned)	270,967	-	338,922	395,418	466,429	556,129	• Including area of Hoa Cuong WWTP and Ngu Hanh Son WWTP
Son Tra (Existing)	119,969	3.00%	151,973	176,179	204,239	236,769	
Whole Danang City (million pers.)	0.807	3.50%	1.062	1.262	1.500	1.780	

1) STUDY ON WASTEWATER MANAGEMENT STRATEGY IN DA NANG CITY (2009)

2) Adjustment of Master Plan of Danang City to 2030, vision to 2050

### (3) Tourist Population

Population of tourist for each district is estimated by allocating tourist population in Da Nang City to each district based on the population of each district. **Table 8.3** shows the population of tourist in each district.

**Table 8.3 Tourist Population**

Items	Unit	2015 <sup>1)</sup>	2020 <sup>1)</sup>	2025	2030 <sup>2)</sup>
Yearly No of Tourist	(pers./year)	3,500,000	8,100,000	8,943,055	9,873,855
Length of Stay	(days)	2.2	2.4	2.3	2.3
Daily number of Tourist in In Danang City	(Pers./day)	21,096	53,260	57,740	62,219
Daily number of Tourist in Hoa Xuan	(Pers./day)	6,751 (=21,096x338,922/1,062,000)	16,511 (=53,260x395,418/1,262,000)	17,899 (=57,740x466,429/1,500,000)	19,288 (=62,219x556,129/1,780,000)
Daily number of Tourist in Son Tra	(Pers./day)	2,953 (=21,096x151,973/1,062,000)	7,456 (=53,260x176,179/1,262,000)	8,084 (=57,740x204,239/1,500,000)	8,088 (=62,219x236,769/1,780,000)

1) Master Plan on Da Nang city Socio-Economical Development up to 2020

2) Number of tourist per year in 2030 and 2040 is estimated based on a tourist population growth rate of 2%.

## 1.2 Projection of Wastewater Volume

### (1) Calculation Condition

Calculation condition for wastewater projection is shown in **Table 8.4**. Sewerage connection ratio set in F/S report is applied for the wastewater projection. It is thought that households which aren't connected to existing sewer system discharges grey water and the grey water goes to storm drain and finally to WWTP through interceptor. Therefore, grey water from households not connected to sewer system should be taken into account for the wastewater projection. It is estimated based on the assumption that grey water covers 75% of wastewater and the remaining 25% is covered by black water. The same figures of flow/capita (lpcd) studied in F/S report are applied for the projection. On the other hand wastewater of tourist is estimated based on the assumption that water consumption for tourist is same as that for household.

**Table 8.4 Calculation Condition for Projection of Wastewater Volume**

Item	Condition	Remarks
Sewer Connection Ratio	Application of F/S【2013】	-
Breakdown of black and grey water (%)	Black water: 25	•Black water from connected house will be flowed into WWTP. Black water from non-connected house will be penetrated into ground.
	Grey water: 75	•All of Grey water will be flowed into WWTP.
Flow par Capita (lpcd)	【2015-2020】 165	•Application of F/S【2013】 •This lpcd will be applied to both residential and tourist.
	【2020-2025】 170	
	【2025-2030】 175	
	【2030- 】 180	

Calculating formula for wastewater volume is as follows.

$$\begin{aligned} \text{Wastewater Volume} &= \text{Population} \times \text{Connection ratio} \times \text{Flow par Capita} \times 100\% \\ &+ \text{Population} \times (1-\text{Connection ratio}) \times \text{Flow par Capita} \times 75\% \end{aligned}$$

**Table 8.5 Connection Ratio in each Area (as an average)**

Area	2015	2020	2025	2030	Remarks
Hoa Xuan (Existing)	4	36	52	62	•Only the area of current Hoa Xuan WWTP
Ngu Hanh Son (Existing)	53	82	86	88	•will be integrated into Ho Xuan WWTP
Hoa Cuong (Existing)	37	68	72	75	•will be integrated into Ho Xuan WWTP
Hoa Xuan (Planned)	45	75	79	82	•Including area of Hoa Cuong WWTP and Ngu Hanh Son WWTP
Son Tra (Existing)	21	99	99	100	

Source: FEASIBILITY STUDY FOR THE DA NANG SUSTAINABLE CITY DEVELOPMENT PROJECT (2013)

## (2) Wastewater Projection

Based on the above calculation condition, wastewater productions as daily average flow are presented in **Table 8.6** as well as maximum daily flows. Peak factor of 1.2 is used as a conversion factor mentioned in Water Supply - Distribution System and Facilities - Design Standard (TCXD 33-2006).

**Table 8.6 Wastewater Productions of Average Daily Flow and Maximum Daily Flow**

Area	【2015】		【2020】		【2025】		【2030】	
	Average Daily Flow	Maximum Daily Flow	Average Daily Flow	Maximum Daily Flow	Average Daily Flow	Maximum Daily Flow	Average Daily Flow	Maximum Daily Flow
Hoa Xuan (Existing)	12,236	14,684	17,601	21,121	23,404	28,085	30,323	36,388
Ngu Hanh Son (Existing)	11,320	13,584	19,345	23,214	26,504	31,805	36,089	43,306
Hoa Cuong (Existing)	22,387	26,865	26,784	32,141	28,945	34,733	31,166	37,399
Hoa Xuan (Planned)	46,342	55,610	63,725	76,470	78,613	94,335	97,361	116,833
Son Tra (Existing)	20,450	24,540	31,140	37,368	37,064	44,476	44,074	52,889

## 2. Current Situation of Capacity of WWTP

**Table 8.7** shows the current situation of each WWTP capacity.

**Table 8.7 Current Situation of WWTPs Capacity**

WWTP	Capacity (m <sup>3</sup> /day)		
	Existing 【as of Sep.2014】	Under construction/ already scheduled	Remarks
Hoa Xuan	20,000 (under test running)	Additional 20,000 【2018】	320,000 【2040】 (by 2018 to be double of existing)
Ngu Hanh Son	12,000	-	will be abolished and will be integrated into Hoa Xuan 【Implementation schedule is not yet determined】
Hoa Cuong	36,000	-	will be abolished and will be integrated into Hoa Xuan 【Implementation schedule is not yet determined】
Son Tra	15,000	25,500 (5,000 is for fishery out of 25,000)	51,000 【2040】 =25,500×2 (innovating one side now)

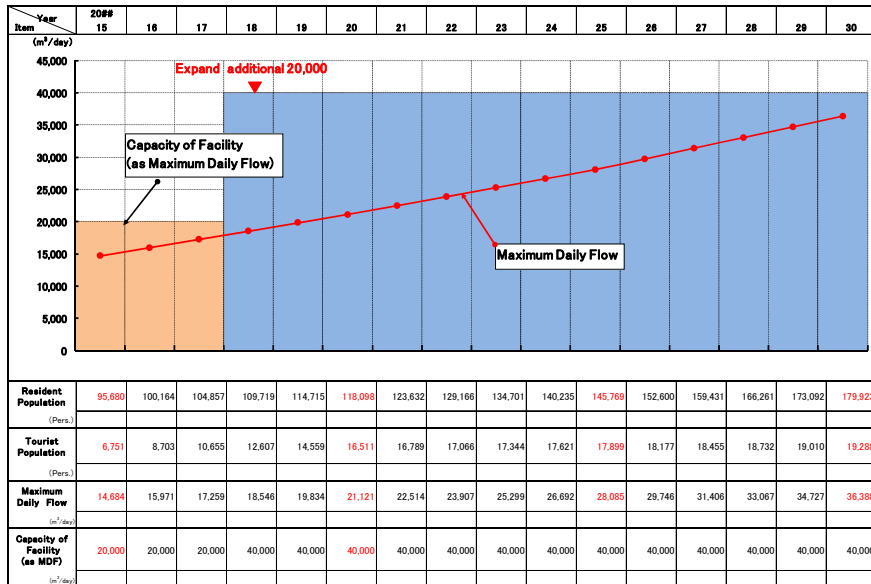
Source: JST

**Figure 8.3** shows the result of the wastewater flow projection and the above capacity information on each WWTPs.

### 3. Expansion Plan WWTP

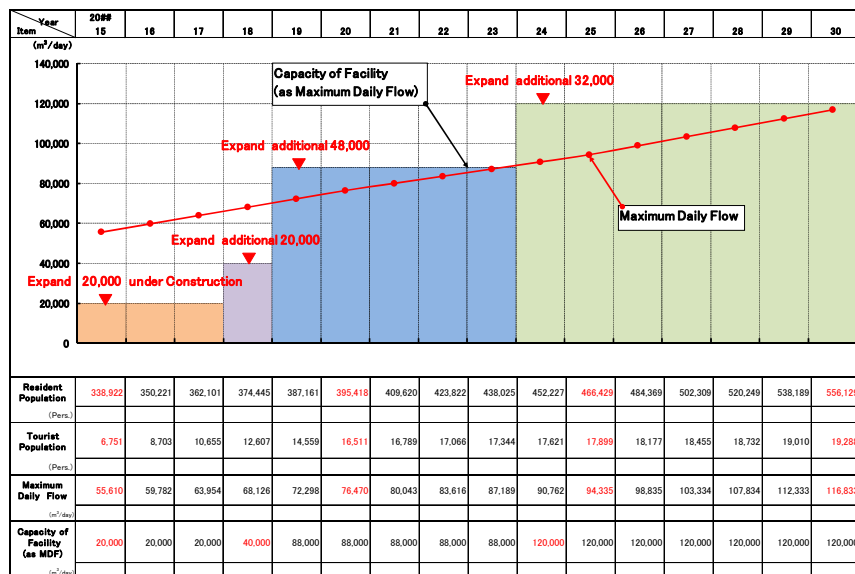
#### (1) Hoa Xuan

In terms of existing capacity of Hoa Xuan WWTP only, total capacity of 40,000 m<sup>3</sup>/day will be required by 2030 as show in **Figure 8.2**.



**Figure 8.2 Wastewater Projection and Capacity of Hoa Xuan WWTP (Existing)**

But when it is taking account of abolishing Ngu Hanh Son WWTP and Hoa Cuong WWTP in the plan ,Hoa Xuan WWTP will have to be expanded another capacity expansion of 48,000 m<sup>3</sup>/day (87,189-40,000=47,189<48,000) by 2018. Furthermore, it should be expanded another expansion of 32,000 m<sup>3</sup>/day by 2024.



**Figure 8.3 Wastewater Projection and Capacity of Hoa Xuan WWTP (Planned)**

(2) Son Tra

Wastewater projection shows that capacity after rehabilitation which will be completed by 2018 isn't enough for suitable management. Therefore, it is needed to expand another capacity of 24,000 m<sup>3</sup>/day successively.

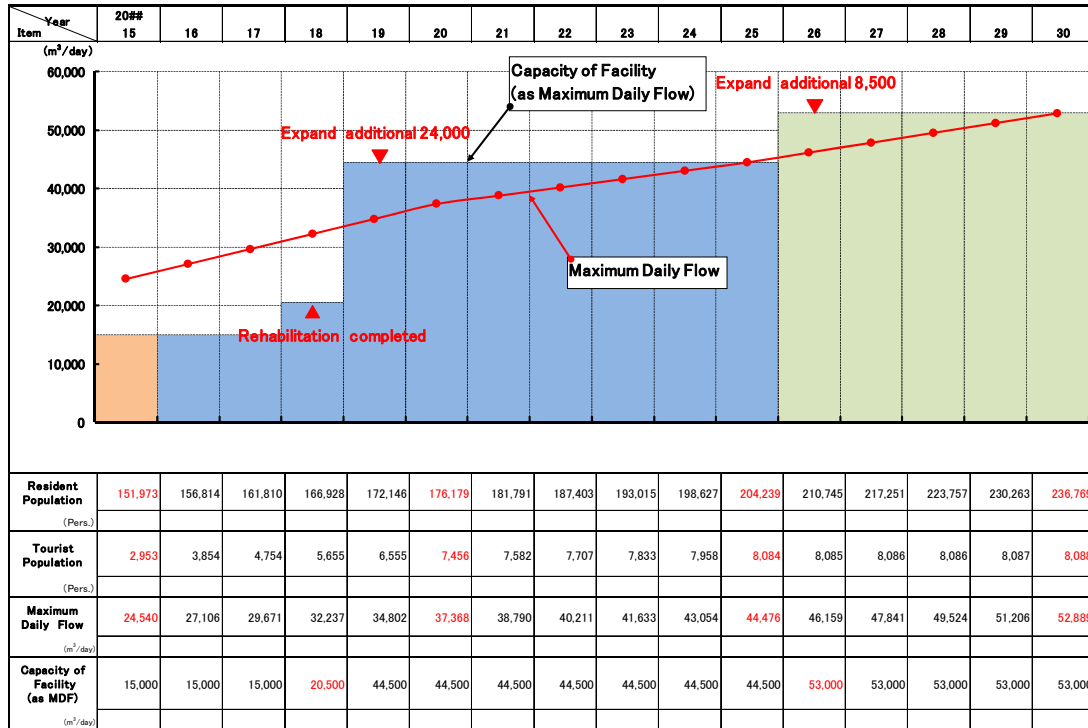
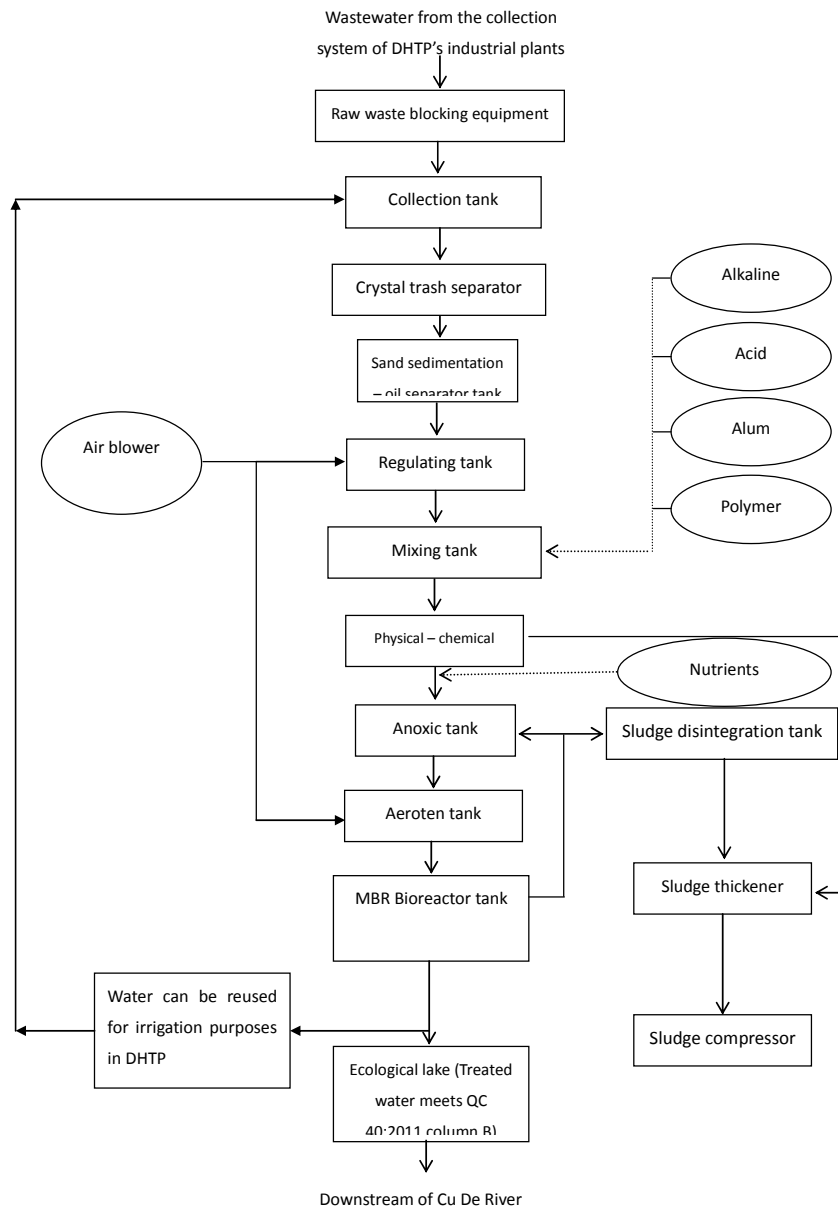


Figure 8.4 Wastewater Projection and Capacity of Son Tra WWTP

#### 4. Danang Hi-Tech Park Centralized Wastewater Treatment Plant

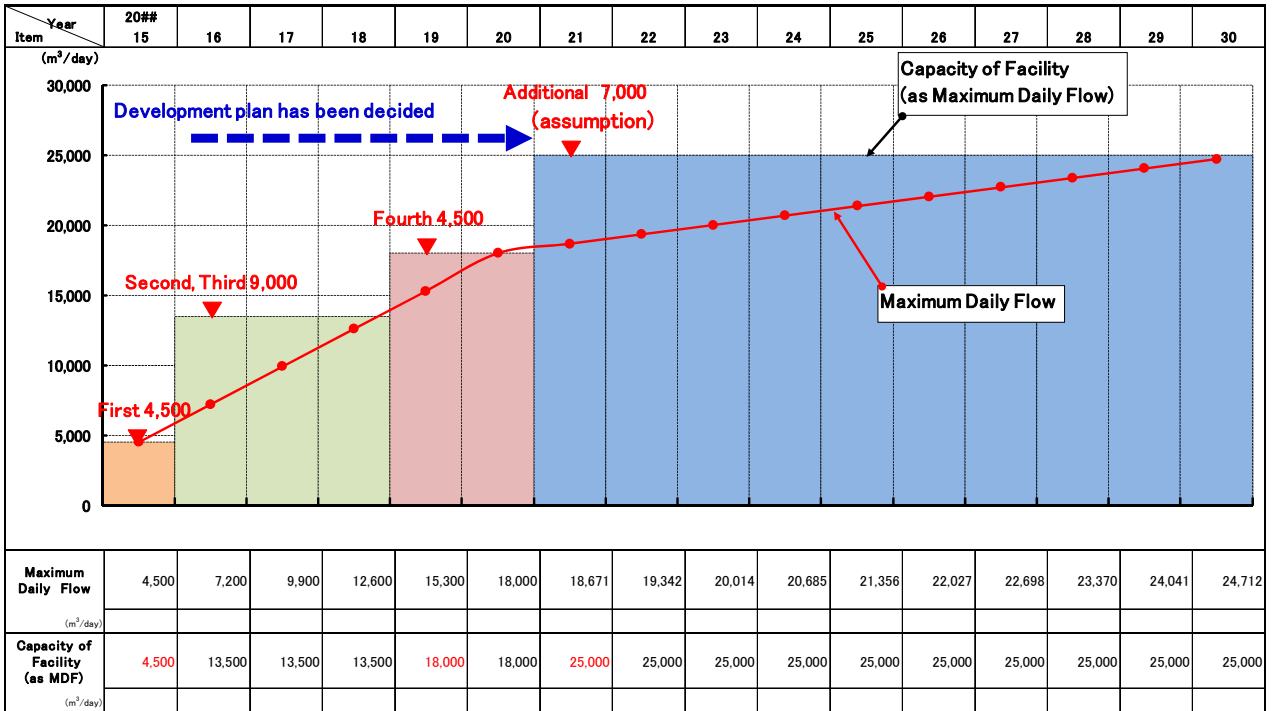
According to a report; Feasibility Report “DANANG HI-TECH PARK Centralized Wastewater Treatment Plant Project Phase1 (2013-2015) “, as a treatment method, MBR technology will be developed to the treatment plant and the plant will have total amount of 24,712 m<sup>3</sup>/day of wastewater consequently. Flow diagram of Proposed MBR (combine activated sludge treatment with a membrane liquid-solid separation process) is presented in **Figure 8.5**.



**Figure 8.5 Treatment Process Proposed in F/S Report**



Development stages in the plan have been divided into three stages and the capacity of the plant will ensure with a total capacity of 18,000 m<sup>3</sup>/day by 2020 as shown in **Figure 8.6**.



**Figure 8.6 Wastewater projection and capacity of Hi-Tech Park WWTP**