QUANG NAM PROVINCIAL PEOPLE’S COMMITTEE
HOI AN CITY PEOPLE’S COMMITTEE
SOCIALIST REPUBLIC OF VIETNAM

PREPARATORY SURVEY ON WATER QUALITY IMPROVEMENT PROJECT FOR JAPANESE BRIDGE AREA IN HOI AN CITY, QUANG NAM PROVINCE, SOCIALIST REPUBLIC OF VIETNAM

FINAL REPORT

February 2015

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

NIHON SUIDO CONSULTANTS CO., LTD.

PREFACE

Japan International Cooperation Agency (JICA) decided to conduct the preparatory survey and entrust the survey to Nihon Suido Consultants Co., Ltd.

The survey team held a series of discussions with the officials concerned of the Government of Vietnam, and conducted a field investigation. As a result of further studies in Japan, the present report was finalized.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of Vietnam for their close cooperation extended to the survey team.

March, 2015

Masami Fuwa
Director General,
Global Environment Department
Japan International Cooperation Agency

Summary

1 Overview of the Socialist Republic of Vietnam

(1) Natural Conditions

The Socialist Republic of Vietnam (hereinafter referred to as "Vietnam") is the easternmost country on the Indochina Peninsula, having boundaries with China in the north, Laos and Cambodia in the west, and the South China Sea in the east. The total land mass is 331,000 km^2, extending over 1,700 km between the latitudes 8.35^o and 23.4^o N.

In general, the country's climate is hot and humid, but varies considerably from place to place because of the differences in latitude and the marked variety in topographic relief. Hoi An City is located in Quang Nam Province, 30 km south of Da Nang. The city of 6,000 ha has a population of about 90,000 (as of 2011). It is recognized as a World Heritage Site by UNESCO because the ancient part of the city is an exceptionally well-preserved example of a SE Asian trading port dating from the 15th to 19th century. Hoi An City is a popular tourist destination in Vietnam.

Hoi An City has a tropical monsoon climate with the rainy season from September to January and the dry season from February to August. Annual precipitation is about 2,045 mm. In October and November precipitation is significant (between 550 mm and 1,000 mm) and flooding often occurs. The average temperature is about 26^{o}C, with a high of 33.5^{o}C from June to August and dropping to 18.5^{o}C from December to February.

(2) Socio Economic Conditions

Vietnam has been experiencing rapid economic growth since the introduction of the Doi Moi (Renovation) reforms in 1986. The reforms led to the development of the country's "socialist-oriented market economy" and its opening up to foreign investment. GDP reached USD 155,820 million or USD 1,902 per capita in 2013 and Vietnam became one of the middle income countries in 2010.

The development of urban infrastructure including sewage treatment and solid waste management systems have not kept pace with the rapid economic growth and urbanization. The huge increase in discharge of untreated domestic, commercial and industrial wastewater is polluting public water bodies and affecting the sanitary conditions in the cities.

2 Background of the Project

Decision No. 35/1999/QD-TTg issued by the Prime Minister approved the orientation of Vietnam's urban drainage and sewerage development to the year 2020. The specific objectives include: expanding overall service coverage of sewerage systems to 80-90%; to 90-100% for Hanoi, HCM City and Grade II cities, urban areas in important regions of economic/tourist development, industrial estates, and export processing zones.

Decision No. 1930/2009/QD-TTg expands the approval to include industrial parks and extends the planning horizon to 2025, with a vision towards 2050. The targets for wastewater treatment that would meet set standards were also introduced:

- By 2015:
  Build sewage collection and treatment systems for Grade I-III urban centers for the collection and treatment of 40-50% of wastewater.
- By 2020:
  Extend the 2015 target coverage to 60%.
  By 2025:
  Grade I-IV urban centers to have consolidated sewage collection and treatment systems; the percentage of wastewater collected and treated to reach 70-80%.
- Vision towards 2050:
  In big Grade I-IV urban centers, drainage systems to be constructed for rain water, all wastewater to be collected and treated.

Hoi An as a Grade II city, followed the national orientation and started sewerage planning in 2001. The city's Division of Natural Resources and Environment (DONRE) prepared the sewerage development vision. Agence Française de Développement (AFD) funded the "Project for Solid Waste, Wastewater Treatment and Environmental Protection in Hoi An" (AFD Project), to provide a service coverage of 40% of the urban area by 2010. However, the construction of the facilities is still on-going as of 2014.

Hoi An City is a popular sight-seeing destination, visited by 1.4 million tourists per year. It has a special relationship with Japan, as symbolized by the Japanese Bridge, one of its main attractions. There is no sewerage system in the city. Water quality in the Japanese Bridge canal has a BOD_5 measurement of 250 mg/L, 5 times the national water quality standards of 50 mg/L, leading to unsightly conditions and odor problems. The "Hoi An City Urban Development Master Plan, 2013" stipulates that sewerage development to improve the water environment is a priority.

JICA conducted the "Data Collection Survey on Sewerage Management in Hoi An" in June, 2012, and recommended measures for improvement of water quality in the Japanese Bridge

Canal.

Following the Survey, in May, 2013, the Vietnamese government requested Japanese Grant Aid for the construction of a sewage treatment plant and rehabilitation of the Japanese Bridge Canal.

3 Results of Preparatory Survey and Project Scope

(1) Survey Results

JICA survey team went to Vietnam four times to conduct the preparatory survey.

First field survey	December 12th, 2013	to	January 17th, 2014
Second field survey	February 12th, 2014	to	March 14th, 2014
Third field survey	June 5th, 2014	to	June 22nd, 2014
Fourth field survey	December 7th, 2014	to	December 13th, 2014

The survey team carried out studies on facilities design of sewerage treatment plant, rehabilitation of Japanese Bridge Canal, equipment required for operation and maintenance (O&M) of the system, and training for management and O&M staff. The scope of the project, as discussed with the Vietnamese side, is summarized in **Table S3-1**.

Table S3-1 Requested and Designed Components

Item	Requested Components	Designed Components
Sewage Treatment Plant (STP)	Treatment capacity: 2,000 m^3/day (daily maximum) with sludge treatment	Treatment capacity: 2,000 m^3/day(daily maximum) with sludge treatment Administration building (floor area: 284 m^2)
The Japanese Bridge Canal	Upgrade with concrete and cover : 2.0 km	Rehabilitation with concrete (partly covered and compound section) : 1.68 km Dredging: 99 m
Equipment Supply	A convertible truck Inspection equipment for water quality control A personal computer and a printer for data logging	A canopy truck
Training	-	Operation and maintenance of STP Maintenance of the Japanese Bridge Canal Sewerage financial management planning

(2) Project Components

The details on the construction of the STP, rehabilitation of the Japanese Bridge Canal, procurement of equipment, and capacity building are as follows.

1) Construction of STP and Rehabilitation of Japanese Bridge Canal

Sewerage Treatment Plant (STP)

Facility		**Structural Feature and Dimension**	**Quantity**
Treatment Facility	Inflow Channel	Body : RC, Channel :W 1,000	2 channels
		Screen : Stainless Steel, Opening 20 mm x W 1,000	2
	Equalization Tank	Body : RC, Storage capacity : 400 m^3	1
		Pump : Submersible, 0.8 m^3/min. x 12 m	3 (1 stand by)
	Floating Sponge Filtrating tank (FSF)	Body : Steel, 2 m x 2 m x 3.5 m (depth)	2
	High-rate Trickling Filter (HTF)	Body : Steel, φ7 m x 1.8 m (depth)	2
	Final Solids-liquid Separation Tank (SLS)	Body : Steel, w 4.25 m x L 10.0 m x 3.0 m (depth)	2
	Disinfection Tank	Body : Steel : Ultraviolet radiation disinfection	1
	Sludge Thickener	Body : Steel, φ3.6 m x 3 m (depth)	1
	Dehydrator	Type：Screw Press, 30 kg-DS/h	1
	Deodorization Apparatus	Activated carbon adhesion tower, 30 m^3/min.	1
	Generator	Diesel engine, 125KVA	1
Administration Building		Management room, inspection room, workers room, laboratory, toilet etc.	1

RC: Reinforced Concrete

Japanese Bridge Canal

Facility	**Structure**	**Section**	**Cross Section**	**Length**
Japanese Bride Canal	Reinforced Concrete	Section a	W 2,100 mm x H 1,500 mm	L=560 m
		Section b-1	W 1,600 mm x H 800 mm	L=100 m
		Section b-2	W1,200 mm x H 1,000 mm	L=50 m
		Section c	W 2,400 mm x H 900 mm	L=510 m
		Section d	W 2,000 mm x H 1,100 mm	L=160 m
		Section e	W 2,400 mm x H 1,100 mm	L=90 m
		Section f	W 3,000 mm x H 1,000 mm	L=90 m
		Section g	W 2,300 mm x H 1,700 mm	L=70 m
		Section h	W 2,600 mm x H 1,300 mm	L=50 m
Total				1680 m

2) Equipment Procurement

Item	**Purpose**	**Quantity**
Canopy Truck	Transportation of sludge to prevent odor from escaping	1

3) Training

Key Areas	**Training Topics**
Operation and Maintenance of Sewage Treatment System (STP)	Preparation of operation and maintenance (O&M) plan. Preparation of Terms of Reference (TORs) to hire contractor for capacity building for the operators of the STP.
Maintenance of the Japanese Bridge Canal	Preparation of regular inspection and cleaning plan. Preparation of inspection and cleaning manuals and records. Implementation of maintenance activities.
Sewerage Financial	Securing adequate O&M budget.

Key Areas	Training Topics
Management Planning Assistance	Preparation of accounting documents. Estimation of annual cash flow and preparation of future budget.

4 Project Implementation Schedule and Construction cost

(1) Implementation Schedule

The project will be implemented 3 years.

Detailed design	4 months
Tender and contract agreement	4 months
Concurrence of contract agreement	1 month
Construction and equipment supply	18 months
(Civil and architectural works	18 months)
(Mechanical and electrical works	4 months)
Testing of facility	6 months after construction
Capacity building	12 months after construction

(2) Cost estimate

The project cost for the Vietnamese side is JPY 0.029 million. Cost items include the expenditures for electrical power line, city water, and telephone line to STP, land lease for temporary access, fence and gate installation, commission fees to the Japanese bank, and mine detection.

5 Project Evaluation

(1) Adequacy of the Project

Contribution to National and Local Development Goals

The construction of the sewage treatment plant and rehabilitation of the Japanese Bridge Canal will contribute to the realization of the goals set in the Decision No. 35/1999/QD-TTg, Decision No. 1930/2009/QD-TTg, and Hoi An City Urban Development Master Plan, 2013, to develop the sewerage systems and improve the water environment, in Vietnam and specifically in Hoi An.

Urgency of Project Implementation

The sewage treatment plant will treat wastewater from the new residential estate not served by the AFD Project. The AFD project is delayed and untreated wastewater is still being discharged into the canal. The continuing pollution of the canal will seriously damage the living environment and the tourism industry.

The construction of the STP and rehabilitation of the Japanese Bridge Canal, will prevent further pollution of the water body, eliminate unpleasant odor and restore the scenic environment.

Project Beneficiaries

The population in the new residential estate, areas in Tan An ward outside of the AFD project, and residents in the Japanese Bridge Canal basin, about 11,700 people, will benefit from the project.

Compliance with Japan’s Assistance policy for Vietnam

Assistance for strategic economic development (effective use of policy support tools) is one of the policies stated in the “Infrastructure System Export Strategy of Japan (amended in 2014). Technical cooperation and Grant Aid are also important pillars of Japan’s international assistance policy.

The sewage treatment technology to be used in the project was awarded the first certificate of technology verification for foreign countries by the Japan Sewage Works Agency. The technology promotes public and private cooperation. The approach would strengthen the international competitiveness of Japanese companies.

Japanese assistant policy for Vietnam centers on support for solving urban problems caused by rapid economic development and industrialization, as stipulated in the JICA country analysis paper and Vietnamese aid policy (December, 2012).

(2) Effectiveness

Effectiveness of the project is confirmed by the following quantitative and qualitative outcomes.

Quantitative Outcomes

The measurable outcomes include population covered by the sewage treatment system, the amount of wastewater treated and the improvement in water quality of the canal, as shown in **Table S5-1**.

Table S5-1 Quantitative Outcomes

Indicator	Baseline Data (2014)	Target value in 2020 【3 years after completion】
Population served by STP (person)	0	11,700
Treatment amount (m^3/day)	0	1,900
Discharge BOD_5 concentration (mg/L)	-	30

Note : Treatment amount is the estimated treatment volume and not the treatment capacity. Appendix p.A6-28

Qualitative Outcomes

- Improvement in water quality would lead to better living environment of the surrounding area and the general health of the population.
- Preservation of tourist attractions would stimulate regional economic development.

There is no comprehensive investigation on the impact on tourism with the improvement of water environment in Vietnam. However, the “SAPROF of Hue City Water Environment Improvement Project, 2007, Japan Bank for International Corporation” estimated that their project resulted in 1% increase of tourist visits, with each tourist contributing VND 3,890,000 to the local economy.

The project will fulfill its objectives and bring environmental and economic benefits to the city.

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FINAL REPORT

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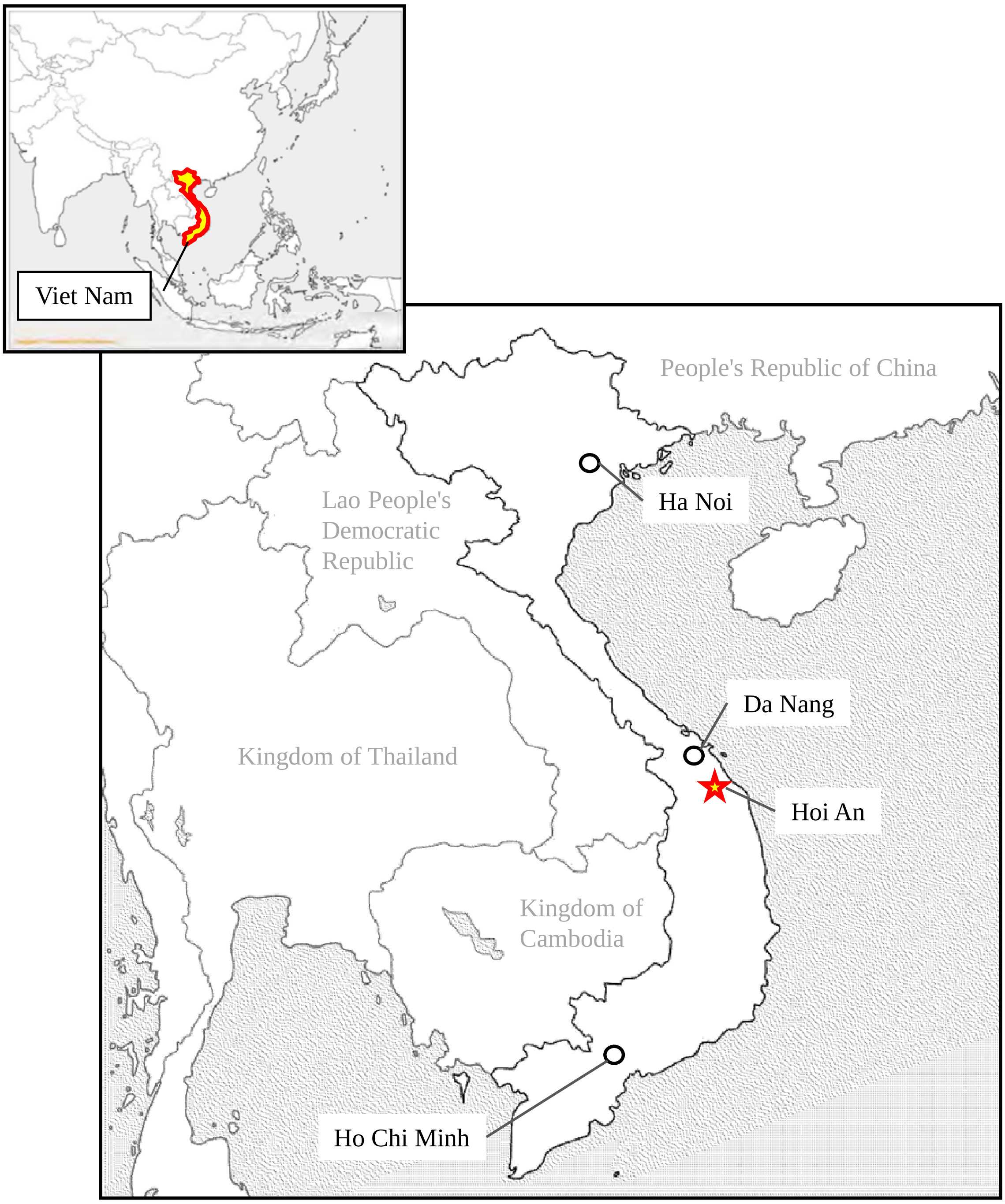
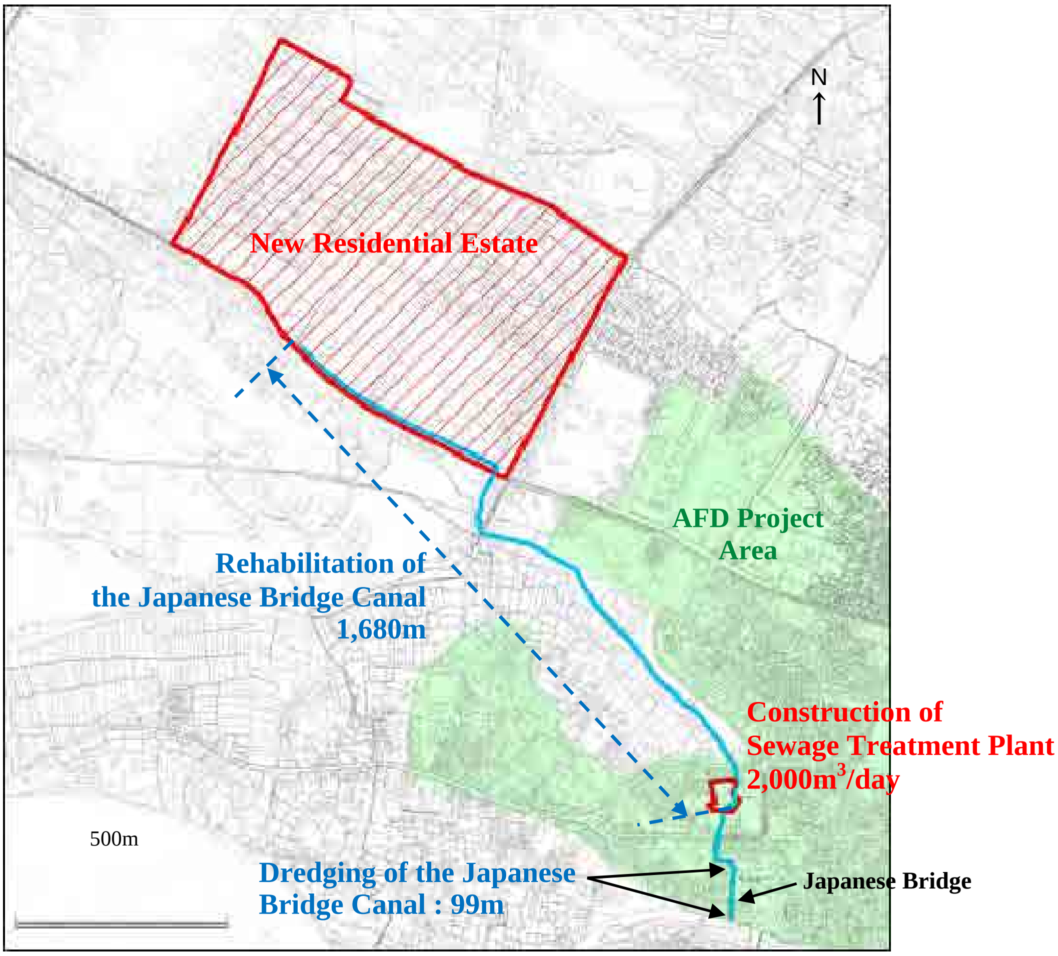


Location Map

Project Site



(AFD Project: "Project for Solid Waste, Wastewater Treatment and Environmental Protection in Hoi An" by Agence Française de Développement)

Perspective of Sewage Treatment Plant

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Abbreviations

AFD	Agence Française de Développement
ARP	Abbreviated Resettlement Plan
Cam Pho Ward PC	Cam Pho Ward People's Committee
CSRP	Compensation, Support and Resettlement Plan
Detailed-EIA	Detailed Environmental Impact Assessment
DOFP	Division of Finance - Planning
EIA	Environmental Impact Assessment
E/N	Exchange of Notes
FS/R	Feasibility Study Report
G/A	Grant Agreement
HCMMP	Hoi An Centre for Monuments Management and Preservation
Hoi An CPC	Hoi An City People's Committee
Hoi An DONRE	Division of Natural Resources and Environment, Hoi An City
Hoi An DUM	Division of Urban Management, Hoi An City
IRP	Investment Report for the Project
JICA	Japan International Corporation Agency
JOCV	Japan Overseas Cooperation Volunteer
JST	JICA Survey Team
LFDC	Land Fund Development Center
MBR	Membrane Bioreactor
M/D	Minutes of Discussion
ODA	Official Development Assistance
O&M	Operation and Maintenance
PMU	Project Management Unit
Pre-EIA	Preliminary Environmental Impact Assessment
Pre-F/S	Preliminary Feasibility Study
PWC	Public Works Company, Hoi An City
Quang Nam DOC	Department of Construction, Quang Nam Province
Quang Nam DONRE	Department of Natural Resources and Environment, Quang Nam Province
Quang Nam PPC	Quang Nam Provincial People's Committee
RAP	Resettlement Action Plan
RBC	Rotating Biological Contactor
SBR	Sequencing Batch Reactor
SH/M	Stakeholder Meeting
STP	Sewage Treatment Plant
W/Q	Water Quality
WSDE	Hoi An Water Supply and Drainage Enterprise

Chapter 1 Background of the Project

1.1 Project Background

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JICA conducted the "Data Collection Survey on Sewerage Management in Hoi An" in June, 2012, and recommended measures for improvement of water quality in the Japanese Bridge Canal.

Following the Survey, in May, 2013, the Vietnamese government requested Japanese Grant Aid for the construction of a sewage treatment plant and rehabilitation of the Japanese Bridge Canal. JICA survey team was in Vietnam in December, 2013 to conduct a preparatory survey for the formulation of the Grant Aid project.

1.2 Natural Conditions

(1) Topographical Survey

1) Purpose

Topographical survey at the project site was carried out to gather the information required for the design and construction of the STP. Line survey was conducted to confirm the existing longitudinal conditions for the rehabilitation of the Japanese Bridge Canal.

2) Survey Locations and Activities

Survey locations and activities are shown in **Table 1.2-1**.

Table 1.2-1 Topographical Survey Locations and Activities

Type of Survey	Location	Area /Distance	Activity
Topographical Survey	Sewage Treatment Plant	0.4 ha	- Contour line; every 1.0 m - Plan view (1/500)

Type of Survey	Location	Area /Distance	Activity
	Japanese Bridge Canal	4.2 ha	- Plan view (1/500)
Line Survey	Japanese Bridge Canal	2.1km	- Plan view (1/500) - Longitudinal section (horizontal 1/500, vertical 1/100) - Cross section (1/100, 100 m)

(2) Soil Investigation

1) Purpose

Soil conditions around the proposed project site were investigated to gather the information required for the foundation design and for determining the appropriate method of erecting the temporary retaining structures during the construction period.

2) Survey Locations and Activities

Survey locations and soil investigation activities are shown in **Table 1.2-2**. and **Figure 1.2-1**

Table 1.2-2 Soil Investigation Locations and Activities

Survey Activities	STP site	Japanese Bridge Canal
Machine Boring (including Standard Penetration Tests, Sampling)	160 m (3 sites x 55 m)	45 m (3 sites x 15 m)
	No. of Samples	
Laboratory Test *	80	21
Consolidation Test	16	
Unconfined Compression	16	
Triaxial Compression	12	
(2 directions) Electrical Prospecting	2	
Field permeability	2	
*specific gravity, moisture content, grain-size analysis, Atterberg limits, internal friction angle, unit weight		

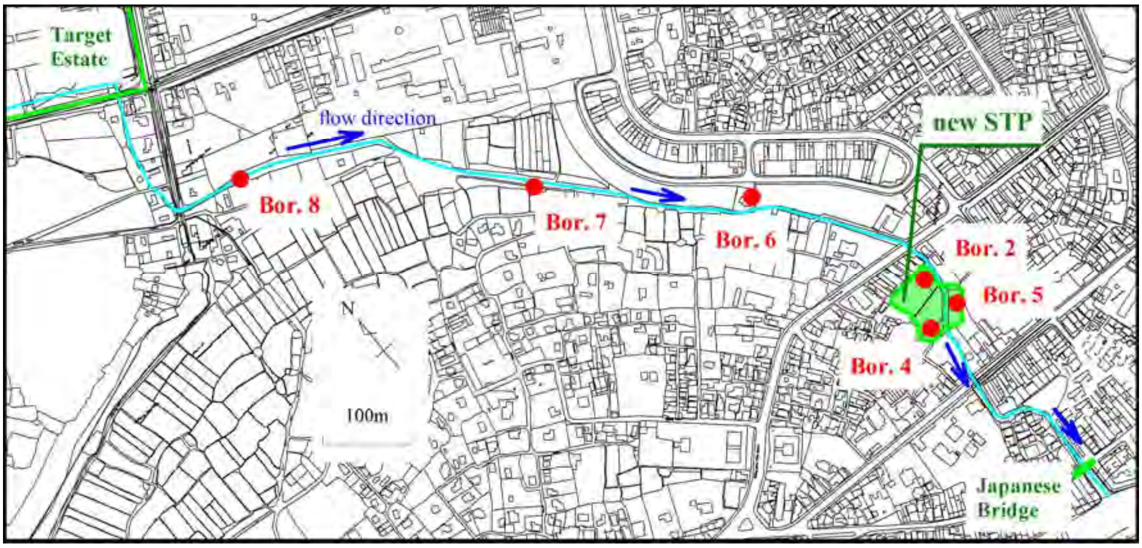


Figure 1.2-1 Soil Survey Locations

3) Results of Soil Investigation

a) STP Site

Every sample taken from the boreholes showed a dense sand layer (N value ≥ 30) with a uniform thickness of 5 m, situated 50 m from the ground surface. Above the dense sand layer are layers of sand, silt and clay.

The silt layer is at 20 m from the ground surface, and has an N value of 7. Consolidation is still taking place. No ground water is detected 0.5 m from ground level in all 3 borehole samples.

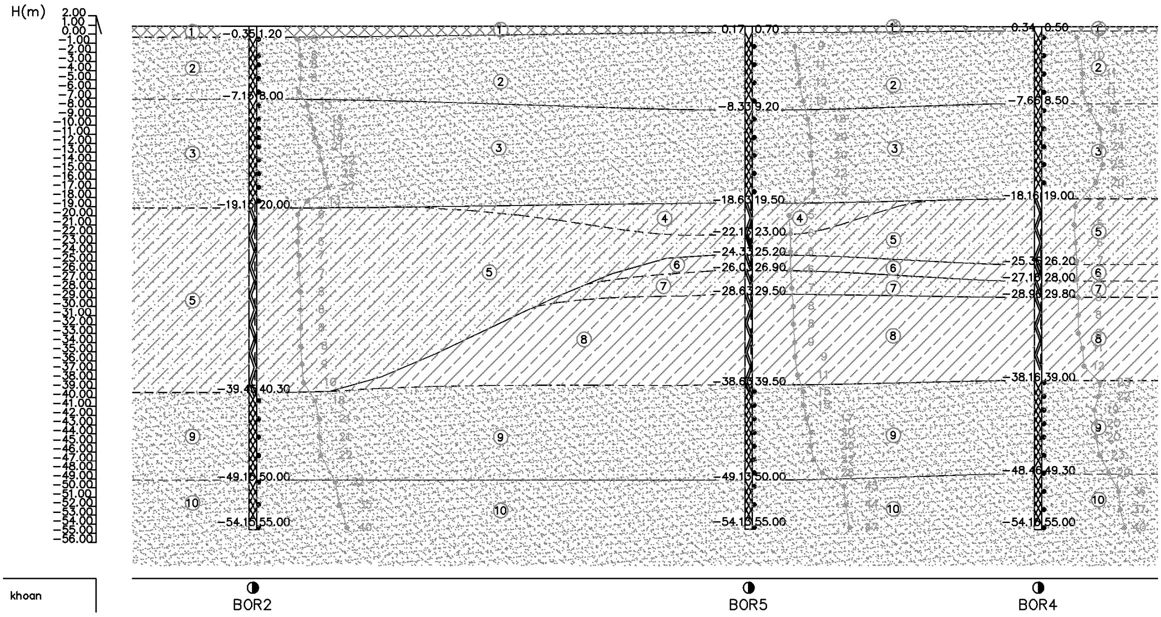


Figure 1.2-2 Longitudinal Section of Soil Survey at STP Site

b) Japanese Bridge Canal

Every sample from the boreholes has a sand or sandy silt layer (N value ≥ 10), with a uniform thickness of 15 m. Ground water is detected at 0.5 to 1.0 m from ground surface in each borehole.

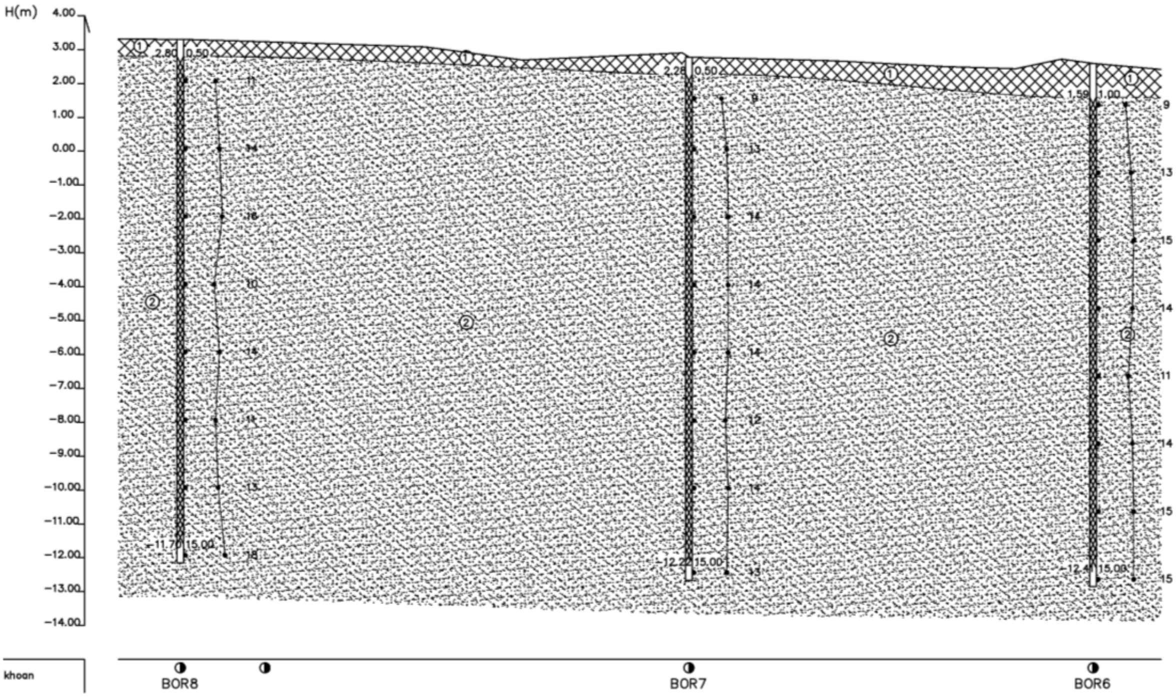


Figure 1.2-3 Longitudinal Section of Soil Survey at Japanese Bridge Canal

(3) Flow Measurement and Water Quality Survey

1) Purpose

Flow measurement and water quality surveys around the STP site and the Japanese Bridge Canal were conducted to determine the target water quality for design of the treatment process. The measurements taken at the Japanese Bridge Canal will form the base line data for future evaluation of project outcome.

The inflow volume and concentrations from the AFD project area were also investigated.

2) Survey Locations and Activities

Survey locations and activities are shown in **Table 1.2-3**, **Figure 1.2-4** and **Figure 1.2-5**

Table 1.2-3 Survey Locations and Activities

Type of Survey	Location	Frequency
Flow measurement Survey	STP site	4 time / day
	Japanese Bridge Canal at Japanese Bridge	4 time / day
Water Quality Survey	Japanese Bridge Canal	4 sites
	Inflow point and outflow point at the retention pond	2 sites
	Inflow from AFD area	7 sites

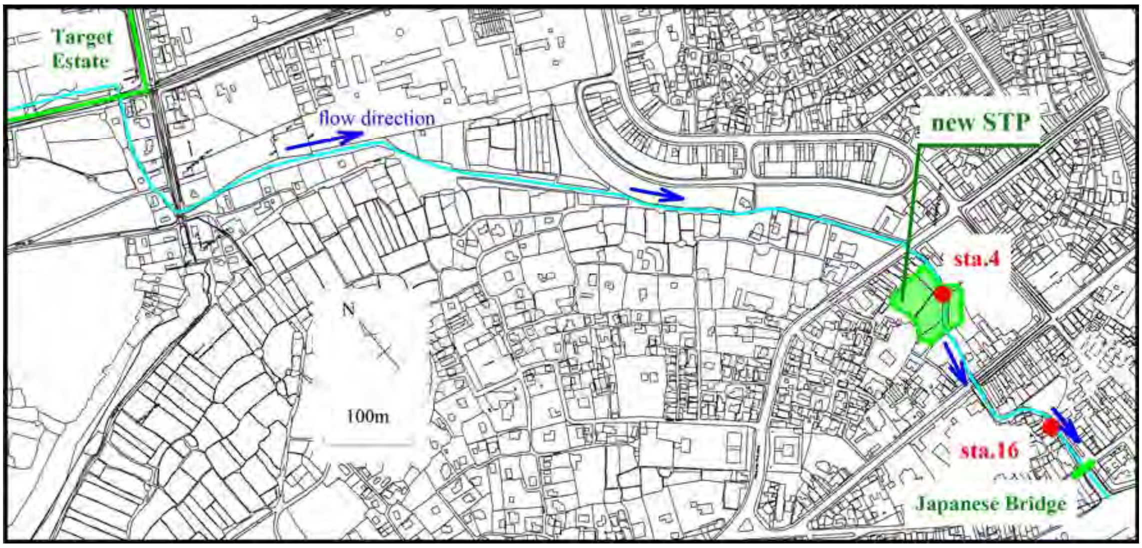


Figure 1.2-4 Flow Measurement Survey Locations

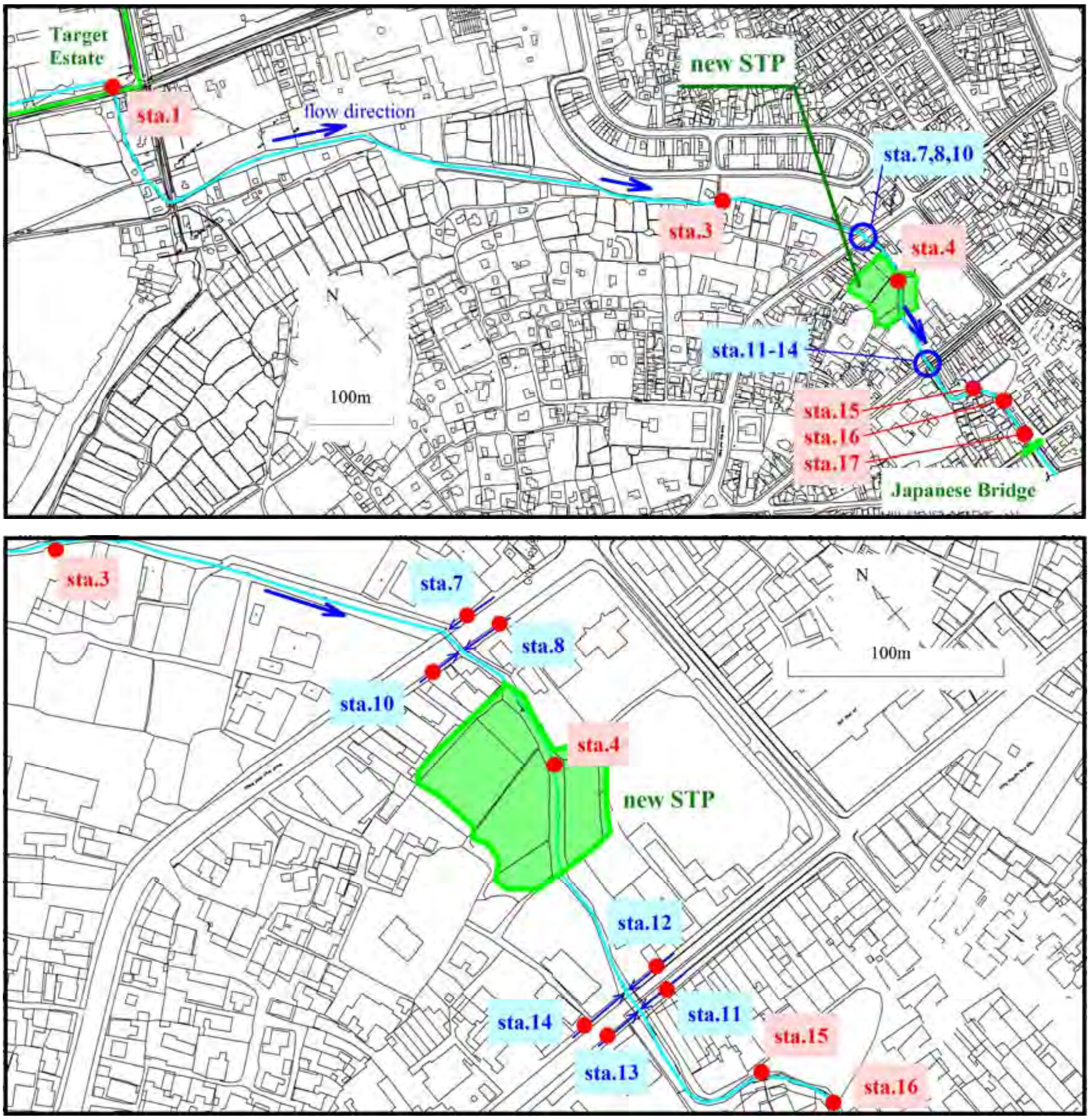


Figure 1.2-5 Locations of Water Quality Survey (upper map: overall; lower map: around the STP site)

3) Water Quality Parameters

Survey locations and parameters studied are shown in **Table 1.2-2**, **Figure 1.2-4** and **Figure 1.2-5**

Table 1.2-4 Water Quality Survey Parameters

No.	Item	Unit	Sta. group A	Sta. group B
1	pH	-	O	X
2	EC	µS/cm	O	X
3	Dissolved Oxygen (DO)	mg/l	O	X

No.	Item	Unit	Sta. group A	Sta. group B
4	Total Suspended Solid (TSS)	mg/l	O	O
5	COD	mg/l	O	O
6	BOD_5 (20 ^OC)	mg/l	O	O
7	Ammonia (NH+4) (as N)	mg/l	O	X
8	Nitrite (NO_2^-) (as N)	mg/l	O	X
9	Nitrate (NO_3^-) (as N)	mg/l	O	X
10	Phosphate (PO_4^{3-}) (as P)	mg/l	O	X
11	Total oils & grease	mg/l	O	X
12	Surfactants	mg/l	O	X
13	Total Coliforms	MPN/100ml	O	X
Sta. group A：Japanese Bridge Canal, Sta. wq1,3,4, 5, 15, 16 (All indicator) Sta. group B：inflow from AFD project area, Sta. wq7, 8, 10, 11, 12, 13, 14 (only TSS, COD, BOD5)				

4) Results

The survey was conducted on February 15, 2014. According to the Quang Nam Hydrological Center the antecedent rain event was January 29th, 2014 and the precipitation recorded was 0.2 mm.

a) Flow Measurements

The results of the flow measurements are shown in **Table 1.2-5**.
Four measurements were taken per day at each location at the proposed STP site and near the Japanese Bridge Canal. The flow fluctuation is confirmed for each location, showing peak flows at night time when water usage is high during dinner preparation and when people are taking their showers.
The daily average flow is about 1,350 m^3/day at the STP site. The positive and negative flows at the Japanese Bridge indicate tidal influence.

Table 1.2-5 Results of Flow Measurement Survey

Station	time	velocity (m/s)	Flow Area (m^2)	Flow (m^3/hr)	(m^3/day)
Sta.4	14:10	0.049	0.199	35.1	842
	15:37	0.063	0.224	50.8	1,219
STP	16:59	0.071	0.224	57.3	1,375
	19:45	0.091	0.249	81.6	1,958
	Average				1,349
Sta.16	10:12	0.036	1.224	158.6	3,806
	13:03	-0.014	1.496	-75.4	-1,810
Near	16:10	0.096	1.384	478.3	11,479
Japanese	19:10	-0.020	1.720	-123.8	-2,971
Bridge	Average				2,626

b) Water Quality Survey

The results of the water quality survey are shown in **Table 1.2-6**. The results from the JICA survey conducted in 2012, are included for reference. BOD in the Japanese Bridge Canal is higher than that recorded in 2012. The average BOD at the Japanese Bridge Canal was 65 mg/L. The increase of EC caused by high tide was observed at the outflow point of the retention pond (sta.16).This is not a factor upstream of the retention pond.

Table 1.2-6 Results of Water Quality Survey

Japanese Bridge Canal (including Retention Pond)

	Sampling station		STA 1		STA 3		STA 4		STA 15		STA 16		STA 17	
2014 Survey Results	Time of sampling		14:31		14:14	19:58	14:10	19:45	14:58	19:25	15:10	19:04	10:12	19:10
	Tide condition		Low		Low	High	Low	High	Low	High	Low	High	Low	High
	pH		7.6		7.6	7.6	7.5	7.5	-	7.3	-	7.1	7	7.1
	EC	µS/cm	813		923	866	387	815	-	963	-	3440	4010	3580
	DO		0.7		0	0	0.07	0.4	-	3.1	-	3.8	5.7	3.2
	TSS	mg/L	40		36	32	189	34	45	113	21	26	42	29
	COD	mg/L	384		336	349	480	336	324	150	198	264	138	84
	BOD5	mg/L	252		175	199	247	198	144	96	112	143	73	54
	Amoniac –N	mg/L	42.5		42	41.5	31.5	8.5	-	29	-	3.7	0.4	3.9
	NO2- - N	mg/L	0.019		0.025	0.021	0.028	0.024	-	0.028	-	0.017	0.035	0.019
	NO3-	mg/L	3.3		5.8	5.1	3.5	3	-	5.4	-	0.5	1.2	0.8
	PO4-	mg/L	8.8		10.3	9.5	7.9	6.9	-	7.4	-	1.2	5.9	1.3
	Oil and grease	mg/L	7.3		4.9	7.1	7.2	8.4	-	3.1	-	2.5	7.8	9.7
	Surfactant	mg/L	2.7		2.1	4.7	4.3	4.1	-	3.6	-	1.2	1.2	1.1
	Total coliforms	MPN/ ml	350		1,600	1.6	330	230	-	920	-	920	13	7.9
2012	TSS	mg/L	242	270	1450	1300	244	135	233	150	223	106	207	79
	COD	mg/L	134	102	1284	703	230	147	122	122	98	86	110	39
	BOD5	mg/L	196	244	192	202	50	48	41	70	59	11	57	4.1

Inflow from AFD area

	Sampling station		STA 7	STA 8	STA 10	STA 11	STA 12	STA 13	STA 14
2014	Time of sampling		13:35	13:54	13:48	11:41	11:49	11:30	11:19
	Tide condition		Low	Low	Low	Low	Low	Low	Low
	TSS	mg/L	9.1	169	17	29	47	41	382
	COD	mg/L	60	642	36	384	420	312	3360
	BOD5	mg/L	48	361	18	96	193	170	1259

The average BOD and TSS at the proposed STP site (STA.4) are as follows: BOD: 220 mg/L, TSS: 110 mg/L (BOD: average of 247 and 198, TSS: average of 189 and 34).
For comparison, the inflow concentrations of STPs operating at Da Nang city and Ho Chi Minh city are shown in **Table 1.2-7**.

Table 1.2-7 Examples of inflow concentrations at other cities in Viet Nam

Parameters	Da Nang 1	Da Nang 2	Ho Chi Minh
BOD_5 (mg/l)	120	160	44
TSS (mg/l)	210	240	92

The BOD and TSS at the STP site (Sta.4) are higher than the values shown in **Table 1.2-7**. The sewerage systems in Da Nang and Ho Chi Minh cities are located near the shore, and the ground water level is relatively high. Ground water infiltrates the sewerage system through pipe connections, thus lowering the inflow concentrations. The interceptor system in Ho Chi Minh city has many outfalls connecting to the pipeline network. River water gets into the sewerage system through these outfalls at high tide even with flap gates installed at each outfall. The dilution by river water lowers the inflow concentration.

Ground water does not infiltrate the existing drainage and Japanese Bridge Canal because this drainage system is not deep. The inflow from the AFD area contains a high pollution load from the many hotels and restaurants in town. These factors contribute to the higher concentration of the inflow.

Although the concentrations observed at the survey locations are higher than the other cities, they are valid for site conditions and will be adopted for the design inflow concentration. (**Table 1.2-8**)

Table 1.2-8 Design inflow Concentration

Parameter	Results (mg/L)	Design Inflow (mg/L)	Remark
BOD	247	220	Average at sta.4
	198		
SS	189	110	Average at sta.4
	34		

1.3 Environmental and Social Considerations

(1) Categorization under JICA Guidelines

The project is classified as Category B because the Project is not located in a sensitive area, nor has it sensitive characteristics, nor falls it into sensitive sectors under the Guideline, and its potential adverse impacts on the environment are not likely to be significant.

(2) Outline of Environmental and Social Considerations

- Land for STP construction was acquired from three private owners and a public entity. Hoi An CPC has approved the land acquisition and associated costs (Decision No.781/QD-UBND, dated April 10th, 2014). Compensation to private land owners was paid on April 23rd, 2014. The land acquisition process and compensation were completed according to Vietnamese laws and JICA Guidelines.
- The project sites are all on agricultural and developed lands. There are no protected habitats of endangered species according to Hoi An DONRE and the EIA report approved by Quang Nam Province.
- The project sites are located in Zone II-A, a buffer zone that provides additional protection to the old urban area designated as a World Heritage site. The implementation of the project will follow the building regulations intended to mitigate the effect of impacts for the historical protection area.
- Mitigation measures would be implemented for waste disposal, control of noise, vibration and odor during the construction and operational phases, because the project sites are located next to hotels, kindergarten, restaurants, shops and houses. Consensus building with concerned residents and development of monitoring system would also be required.
- No possible gender specific adverse impacts are expected.

The Monitoring Form and Environmental Checklist for environmental and social considerations are shown in **Appendices 6.1** and **6.2**.

The draft Environmental Management Plan and Monitoring Plan based on the approved EIA report and JICA Guidelines are shown in **Tables 1.3-1** and **1.3-2**. The Entitlement Matrix for resettlement according to Vietnamese laws and JICA Guidelines is shown in **Table 1.3-3**.

(3) Stakeholder Meeting

The Stakeholder Meeting with concerned agencies, residents and businesses was held on March 6th, 2014 at Hoi An CPC. The opinions and concerns from participants are summarized as follows.

- Would the operation of the STP generate odor and noise that would affect the nearby households?
- During the construction, noise and dust must be minimized as much as possible to mitigate impacts for the children in the kindergarten.
- What are the contingency measures to deal with emergencies or system failures?
- Compensation should be based on negotiation with affected households.
- How long would the temporary approach road for construction be in place?

(4) Reflection to Facilities and Procurement Plan

- The construction of the treatment facilities would comply with the regulations for the historical protection area. Construction materials (e.g. roof material, paint, wooden fittings, etc.) and design would be determined in consultation with Hoi An Centre for Monuments Management and Preservation (HCMMP).
- The building structures would be designed keeping in mind the past flood levels and height restrictions for the historical protection area.
- Gravity thickening and dewatering, the most economical process, would be adopted for sludge treatment process. Dewatered sludge would be disposed of at the Khanh Son disposal site in Da Nang.
- The STP would be enclosed to prevent noise, vibration and odor from reaching nearby hotels, kindergarten, restaurants, shops and houses.
- Activated carbon adsorption would be adopted for odor control because it is reliable, relatively inexpensive, and requires little space.
- For rehabilitation of the Japanese Bridge Canal, the inside of the canal would be divided into two sections to separate storm water and sewage. The design would take into account Vietnamese sewer design criteria, collection characteristics of the sewage, nature of maintenance management, need for odor control, wet weather conditions, and construction costs.

(5) Required Procedures borne by Recipient Country

- Land acquisition and costs for the STP site were approved by Hoi An CPC (Decision No.781/QD-UBND, dated April 10th, 2014). Compensation to private land owners was paid on April 23rd, 2014.
- The compensation cost for STP site was estimated to be double the official land price and market price of crops. The market land price in Hoi An City is 100 to 150 % of official land price according to LFDC. Therefore, the compensation is equivalent to the full replacement cost and higher than the market price.
- Approval of the EIA report for the project was issued by Quang Nam Province, according to Decision No.1643/QD-UBND dated May 29th, 2014.
- Hoi An CPC conducted consensus building with residents as shown in the Minutes of Meeting for Community Participation and the Opinions from Cam Pho Ward PC (Letter No 86/CV-UBND dated April 3rd, 2014) attached to the approved EIA report.

Table 1.3-1 Draft Environmental Management Plan

Phase	Impact sources	Mitigation measures	Implementation time	Responsible/ Implementing agencies	Supervisor
Preparation phase	Project location	- Reasonable site plans and constructional items.	When the project is approved.	Hoi An CPC	Hoi An DONRE
	Land acquisition and compensation activities	- Replace or compensate lost assets according to current regulations of GOV and JICA guideline.	Before building the STP	Hoi An CPC	Hoi An DONRE Cam Pho Ward PC
	Protected Areas, Heritage and Landscape	- Building design according to the regulations for the historical protection area, based on the agreement from Hoi An Centre for Monuments Management and Preservation. (Its design was already conducted.)	Before building the STP	Hoi An CPC	Hoi An DONRE
Construction phase	Dust generation from transportation	- The transportation vehicles are covered by canvas. - Do not exceed the limitation speed. - Spraying water during transportation. - Fencing at construction sites.	During construction phase	Hoi An CPC Contractor	Quang Nam DONRE Hoi An DONRE Cam Pho Ward PC Thanh Ha Ward PC Tan An Ward PC Minh An Ward PC
	Dust generation from the ground leveling and other construction activities	- Screening the construction area. - Reasonable distance between construction site and camping site. - Applying modern and mechanized construction methods.	During construction phase	Hoi An CPC Contractor	Quang Nam DONRE Hoi An DONRE Cam Pho Ward PC Thanh Ha Ward PC Tan An Ward PC Minh An Ward PC
	Exhausted gas from equipment, constructional machineries and transportation vehicles	- Parking at right places and turn off engines. - Do not exceed designed capacity of machineries. - Regularly maintaining of machineries. - Using clean fuel to run engine (Diesel Oil).	During construction phase	Hoi An CPC Contractor	Quang Nam DONRE Hoi An DONRE Cam Pho Ward PC Thanh Ha Ward PC Tan An Ward PC Minh An Ward PC
	Noise from transportation vehicles,	- Do not transfer constructional materials from transportation vehicles at the same time. - Do not make transportation at rush hours.	During construction phase	Hoi An CPC Contractor	Quang Nam DONRE Hoi An DONRE

Phase	Impact sources	Mitigation measures	Implementation time	Responsible/ Implementing agencies	Supervisor
	machineries and equipment	- The high vibration machines must have the right platform which is fit for their capacities. - Fencing at construction sites.			Cam Pho Ward PC Thanh Ha Ward PC Tan An Ward PC Minh An Ward PC
	Production of solid wastes, and waste construction fluids (e.g., oils) causing soil and surface water pollution	- Implement solid waste collection and disposal program. - Contain waste liquids for regular disposal with solid wastes in a designated landfill.	During construction phase	Hoi An CPC Contractor	Quang Nam DONRE Hoi An DONRE Cam Pho Ward PC Thanh Ha Ward PC Tan An Ward PC Minh An Ward PC
	Wastewater generated from daily activities of workers and construction site	- Using public toilet in the beginning of construction phase then use the toilet which is built inside the plant area. - Grit chamber is installed for turbid water treatment. (Its design was already conducted.)	During construction phase	Hoi An CPC Contractor	Quang Nam DONRE Hoi An DONRE Cam Pho Ward PC Thanh Ha Ward PC Tan An Ward PC Minh An Ward PC
	Construction activities affect the local socio-economy	- To provisionally register for temporary staying of workers. - To enhance the consciousness of workers in terms of security and social evils. - The transportation vehicles have to follow the local safety regulations.	During construction phase	Hoi An CPC Contractor	Quang Nam DONRE Hoi An DONRE Cam Pho Ward PC
	Accidents / Worker & public injury	- Keep a reasonable distance among construction items for further fire and explosions protection. - Follow workplace health and safety regulations in Vietnam. - Use sufficient signage and fencing at construction sites. - Consultation with local health authority.	During construction phase	Hoi An CPC Contractor Hoi An DoLISA Hoi An DoH	Quang Nam DONRE Hoi An DONRE Cam Pho Ward PC Thanh Ha Ward PC Tan An Ward PC Minh An Ward PC

Phase	Impact sources	Mitigation measures	Implementation time	Responsible/ Implementing agencies	Supervisor
	Worker and public health problems	- Ensure proper hygiene in worker camps. - Workers should be tested for communicable diseases. - Locate worker camp away from residential areas.	During construction phase	Hoi An CPC Contractor Hoi An DoH	Quang Nam DONRE Hoi An DONRE Cam Pho Ward PC Thanh Ha Ward PC Tan An Ward PC Minh An Ward PC
Operational phase	Exhausted gases generated from the transportation activities.	- The parking is located far away the operator house. - The trucks used for transferring materials or sludge are guided carefully to park at right places.	Before and during operation phase	Hoi An CPC PWC	Quang Nam DONRE Hoi An DONRE Cam Pho Ward PC
	Odor from the anaerobic digestion tank and sludge tank.	- Regularly observing the treatment tanks to immediately handle out when incidents happen. - Monitor complaints on odor from surrounding residents and businesses, and results of response to complaints. - Activated carbon adsorption process is installed for odor treatment. (Its design was already conducted.)	Before and during operation phase	Hoi An CPC PWC	Quang Nam DONRE Hoi An DONRE
	Noise from operation house (aeration pumps, pumps, electrical generators)	- Put all machines in closed house. - Operating house is built with soundproof construction. - Installation of modern machines. - Monitor complaints on noise from surrounding residents and businesses, and results of response to complaints.	During operation phase	Hoi An CPC PWC	Quang Nam DONRE Hoi An DONRE Cam Pho Ward PC
	Domestic wastewater of workers	- Domestic wastewater from daily activities of workers in the plant flows to the equalization tank for further treatment. - Sanity wastewater firstly flows to the 3-part digestion tank, then goes to the equalization tank for further treatment.	During operation phase	Hoi An CPC PWC	Quang Nam DONRE Hoi An DONRE Cam Pho Ward PC
	Overflow rain water	- To build rainwater collection pipes by reinforced concrete for discharging to the canal.	During operation phase	Hoi An CPC PWC	Quang Nam DONRE Hoi An DONRE Cam Pho Ward PC

Phase	Impact sources	Mitigation measures	Implementation time	Responsible/ Implementing agencies	Supervisor
	- Wastes from garbage filter - Waste sand and floating compounds from the sand sediment tank. - Excess sludge from sludge tank.	- Wastes from garbage filter are daily collected by operation workers. - Waste sand and floating compounds are collected into stored tank. - Waste sludge is stored in sludge compressed tank. - Periodically collection and transportation of wastes to disposal site.	During operation phase	Hoi An CPC PWC	Quang Nam DONRE Hoi An DONRE Cam Pho Ward PC
	Domestic solid wastes from workers	- Putting big trash at reasonable places to store garbage and wastes	Before operation phase	Hoi An CPC PWC	Quang Nam DONRE Hoi An DONRE Cam Pho Ward PC
	Ecological environment affection	- To treat the wastewater adapted the permissible limitation of standard QCVN 14:2008/BTNMT before discharging to environment. - To plant trees around the project area. - To educate the workers for environmental protection consciousness.	During operation phase	Hoi An CPC PWC	Quang Nam DONRE Hoi An DONRE Cam Pho Ward PC
	Accidents / Worker & public injury	- Follow workplace health and safety regulations in Vietnam. - Consultation with local health authority. - To develop reasonably operating procedures and ensure the smoothly connection between operational staff and the leader.	During operation phase	Hoi An CPC Hoi An DoLISA	Quang Nam DONRE Hoi An DONRE Cam Pho Ward PC

Table 1.3-2 Draft Monitoring Plan

Summary of Impact / Mitigation	**Monitoring Indicators**	**Location**	**Frequency**	**Environmental Standard**	**Responsibility** Supervision / Implementation	**Reporting**
Pre-Construction Phase						
Resettlement & physical asset loss / Resettlement Plan	See Abbreviated Resettlement Plan (ARP)	See ARP	See ARP	See ARP	See ARP	See ARP
Construction Phase						
M-1: Air Quality and Noise	Microclimate, noise, dust, NO_2, SO_2,CO, NH_3, H_2S	01 sample at the STP area	4 times/year	QCVN 05:2013/BTNMT, QCVN 06:2009/BTNMT	Hoi An CPC / Environmental Consultant	Monitoring reports submit quarterly to Quang Nam PPC, Quang Nam DONRE and JICA
M-2: Wastewater quality	pH, BOD_5, COD, TSS, NO_3^-, NH_4^+, T-N, T-P, Cu, Zn, Ni, As, Pb, coliforms	01 domestic wastewater sample	4 times/year	QCVN 14:2008/BTNMT	As above	As above
M-3: Solid Waste	Amount of waste and disposal site	Areas around construction site	Continuously	N/A	As above	As above
M-4: Accidents /Worker & public injury	Number of accident, and worker & public injuries	All construction site locations	Continuously	N/A	As above	As above
M-5: Worker and public health problems	Incidence of sexually transmitted & other communicable diseases	Worker camp and nearby community	4 times/year	N/A	As above	As above
M-6: Land Leased for Temporary Approach Road during Construction	Progress of public consultation, compensation payment and land leased	Areas around construction site	4 times/year	N/A	As above	As above
Operation Phase						
M-7: Air quality and Noise	Microclimate, noise, dust, NO_2, SO_2,CO, NH_3, H_2S	01 sample at the WWTP are and 01 sample outside STP area	2 times/year	QCVN 05:2013/BTNMT, QCVN 06:2009/BTNMT	Hoi An CPC / PWC / Environmental Consultant	Monitoring reports submit yearly to Quang Nam PPC, Quang Nam DONRE and JICA
M-8: Wastewater quality	pH, BOD_5, COD, TSS, NO_3^-, NH_4^+, T-N, T-P, Cu, Zn, Ni, As, Pb, coliforms	01 sample of effluent after treated in STP	4 times/year	QCVN 14:2008/BTNMT	As above	As above
M-9: Ground water quality	pH, TDS, COD, Hardness, Fe, As, SO_4^{2-}, Mn, NO_3^-, NH_4^+, Cd, Cu, Zn, Hg, coliforms	01 ground water sample at residential area near STP area	2 times/year	QCVN 09:2008/BTNMT	As above	As above

M-10: River water quality	pH, BOD_5, COD, TSS, NO_3^-, NH_4^+, Cu, Zn, Ni, As, Pb, Coliforms	01 sample of Hoi An River	2 times/year	QCVN 08:2008/BTNMT	As above	As above
M-11: Solid waste quality	As, Cd, Hg, Pb	01 sample of sludge	4 times/year	QCVN 07: 2009/BTNMT	As above	As above
M-12: Solid waste amount	Amount of domestic waste and dewatered sludge, Disposal site	STP	Continuously	N/A	Hoi An CPC / PWC	As above
M-13: Noise and Odor	Complaints from surrounding residents and businesses, and results of response	STP	Continuously	QCVN 07: 2009/BTNMT	As above	As above
M-14: Accidents /Worker & public injury	Number of accident, and worker & public injuries	STP	Continuously	N/A	As above	As above

Table 1.3-3 Entitlement Matrix for Resettlement

No	Impact	Level of Impact	Eligible Persons	Entitlements	Implementation Issues
I. LAND					
1	Productive land (agricultural land)	Losing 20% or more of total landholding (Entire land affected or the remaining unaffected portion is not viable for productive use)	a. Owners with LURC (Land User Rights Certificate), eligible to acquire LURC according to Government regulations	(i) Due to limitation of agricultural land, affected households will be compensated by cash for the lost land at replacement cost which is equivalent to the current market price and free from transaction costs (e.g., taxes, certification, administration costs); (ii) If loss is equivalent to 20% or more of total agricultural land: assistance for livelihood restoration programs will be provided; (iii) Assistance for PAPs (Project Affected Persons) whose productive land is affected, see item III below. (iv) Compensation for non-land affected assets, see item II below.	Affected households to be notified at least 3 months prior to the date that the land will actually be acquired by the Project.
		Temporary loss	Land users regardless of tenure status.	(i) Cash compensation based on average productivity of three years multiplied by the duration of using time. The amount of the compensation will not be less than the minimum wage for those whose labor is displaced from the affected land. (ii) Full restoration of affected land to pre-impact conditions. (iii) PAPs being thus displaced for periods in excess of one year will be entitled to participate in vocational training programs.	Temporary impacts will be minimized by reducing the area used, utilizing areas being permanently acquired for the project where feasible, and reducing the period of temporary acquisition as far as possible.
2	Public land			(i) No compensation for affected public land. The project will be supported for the acquired public land of the commune or ward by decision of the PPC. (ii) Compensate for the non-land assets according to the market price.	
II	**STRUCTURES, CROPS & TREES**				
3	Houses and other structures	Houses and other structures partially	Owner of structures regardless of tenure status	(i) Cash compensation at replacement cost equivalent to current market prices without depreciation or	

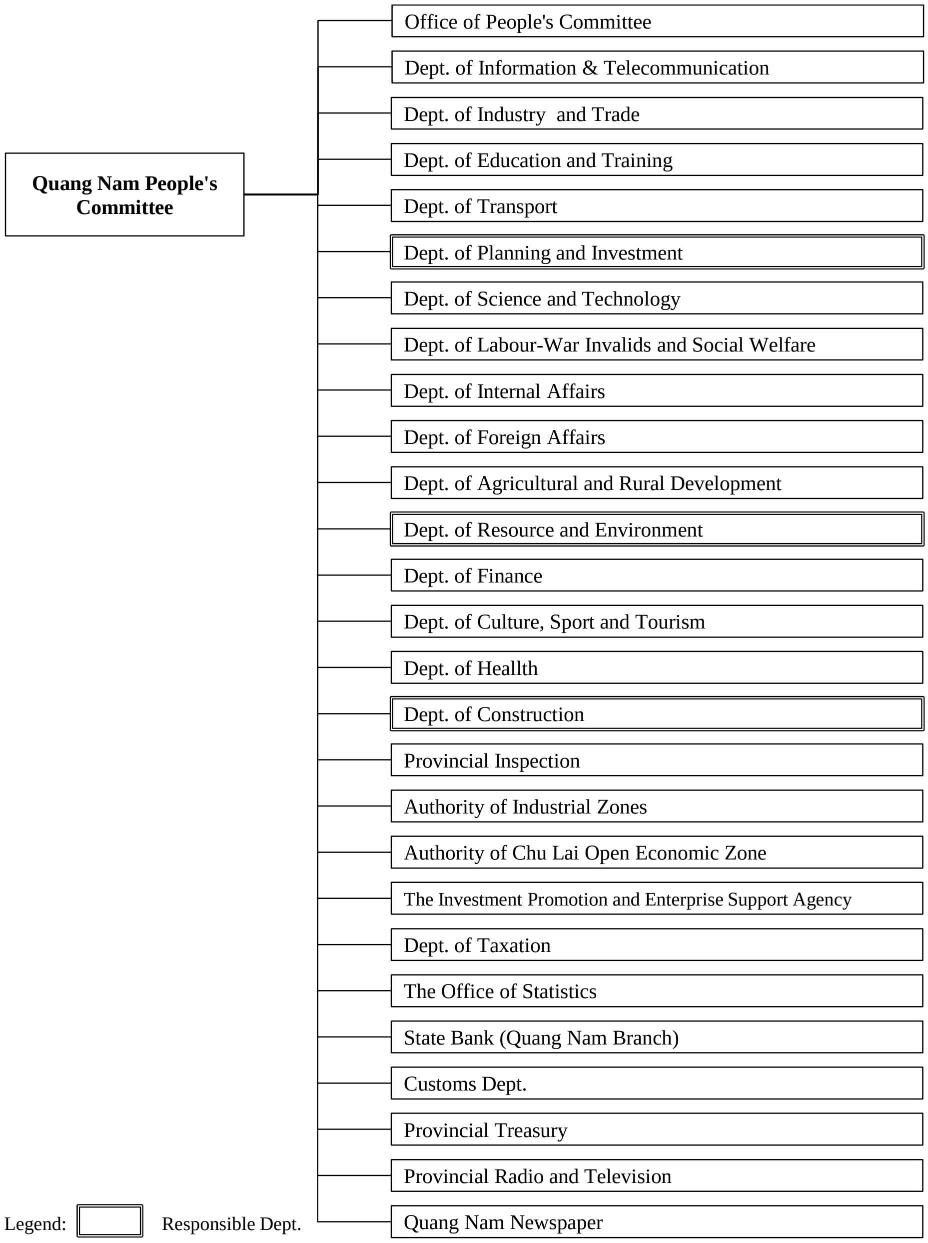
No	Impact	Level of Impact	Eligible Persons	Entitlements	Implementation Issues
		affected and the remaining is still used		deductions for salvaged building materials for the affected portion at the time of compensation. (ii) Compensate for repair cost equal to the actual cost of repair (materials and labor).	
4	Crops, trees, and aquaculture products	Loss of or damage to trees/crops	Owners regardless of tenure status	(i) Cash compensation for annual crops and aquaculture products equivalent to current market value of crops/aquaculture products at the time of compensation; (ii) For perennial crops and trees, cash compensation at replacement cost equivalent to current market value given the type, age and productive value (future production) at the time of compensation. (iii) Timber trees are compensated by cash, based on diameter at breast height at current market value.	PAPs have the right to use salvageable trees. PAPs will be notified at least 3 months prior to land acquisition. PAPs will receive cash compensation based on market cost of ripened crops/fruit for any unharvested crops that were planted prior to the land acquisition announcement.
III	**ASSISTANCE**				
5	Loss of income/ livelihood due to loss of agricultural land	Losing 20% or more of total agricultural land	PAPs whose farming land is directly affected	***Life Stabilization subsidies*** (i) losing 70-100% of agricultural land: Cash grant at VND 300.000 per person per month for a period of 12 months if not required to relocate and for a period of 24 months or more if required to relocate. (ii) losing 30-<70% of agricultural land: Cash grant at VND 300.000 per person per month for a period of 6 months if not required to relocate and for a period of 12 months or more if required (iii) losing less than 30% of agricultural land: Cash grant at VND 300.000 x acquired agricultural area/current agricultural area x 4 months x number of members	
6	Support for affected agricultural land located within or next to residential area or wards	Affected land is located within or next to residential area or wards	Eligible owner	***Support for agricultural land*** Assistance equivalent to 40% of average price of residential land (at replacement cost), depending on the land position, in the locality of the affected land. The maximum area calculated for this assistance is not larger than 5 times the quota of residential land allocation in the local.	

No	Impact	Level of Impact	Eligible Persons	Entitlements	Implementation Issues
IV	**SPECIAL ASSISTANCE**				
7	Progressive Bonus		Affected households who hand over their affected land to the project on time	The relocated PAPs who hand over their affected land on time shall receive an incentive bonus of VND5million per household	
8	Special assistance for 1 bicycle shop illegally occupying and doing business on the Japanese Bridge Canal	Temporary loss of income	1 bicycle shop	Hoi An CPC will consider support for the 1 bicycle shop with consensus building, such as storage of the asset in construction works, minimization of area and period for temporary loss.	

1.4 Organization Structures

1.4.1 Organizations and Personnel

(1) Quang Nam Provincial People's Committee



Source: Website of Quang Nam PPC

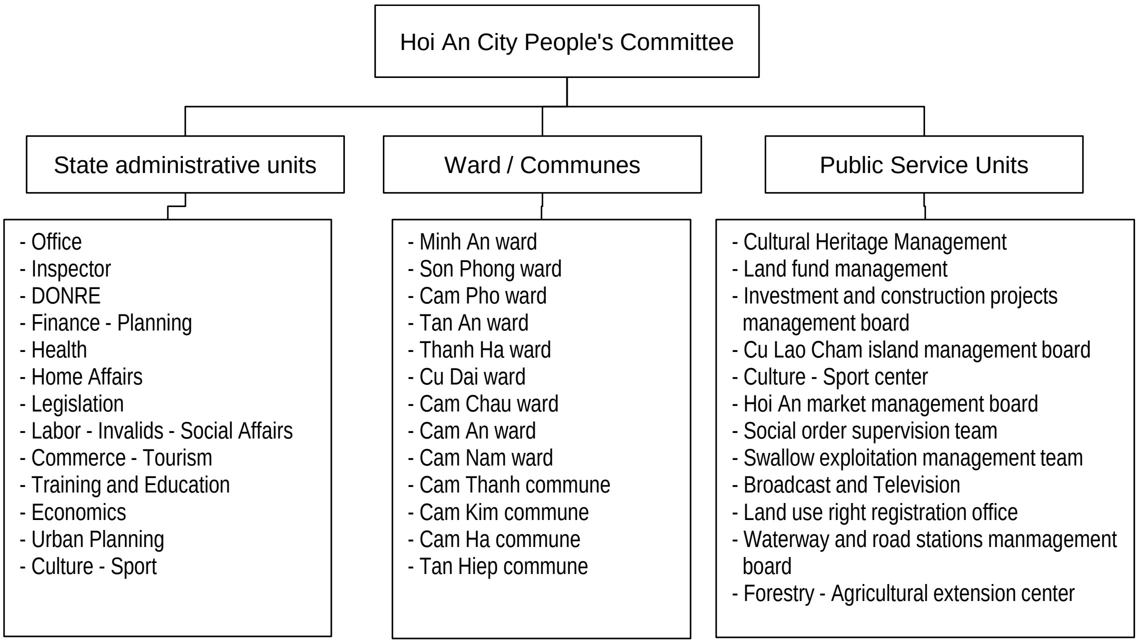
Figure 1.4.1-1 Organizational Chart of Quang Nam PPC

Figure 1.4.1-1 shows the organizational chart of Quang Nam Provincial People's Committee (Quang Nam PPC), the highest competent authority for this project. Quang Nam PPC will approve the project and STP construction, sign agreement documents, as well as supervise and evaluate the project.

(1) Hoi An City People's Committee

The implementing agency of this project is Hoi An City People's Committee (Hoi An CPC). **Figure 1.4.1-2** shows the organizational chart of the Hoi An CPC. The Division of Natural Resources and Environment (DONRE) of the State Administrative Units is responsible for executing this project.

The Department of Urban Planning (also with the State Administrative Units) supervises the management of the sewers and drains in Hoi An City. With the approval of the Hoi An CPC, the Division of Finance – Planning (DOFP) would contract out the O&M services of the STP to the Public Works Joint Stock Company (PWC). DOFP with the support of the Department of Urban Planning would monitor the outsourced activities. The Project Management Unit (PMU) for this project would be established with 16 members in March 2015. The members would include the Vice Director of the Hoi An CPC, as a representative, the Director of the DONRE, representatives from other concerned divisions of the Hoi An CPC, People's Committee of Cam Pho Ward, and PWC.



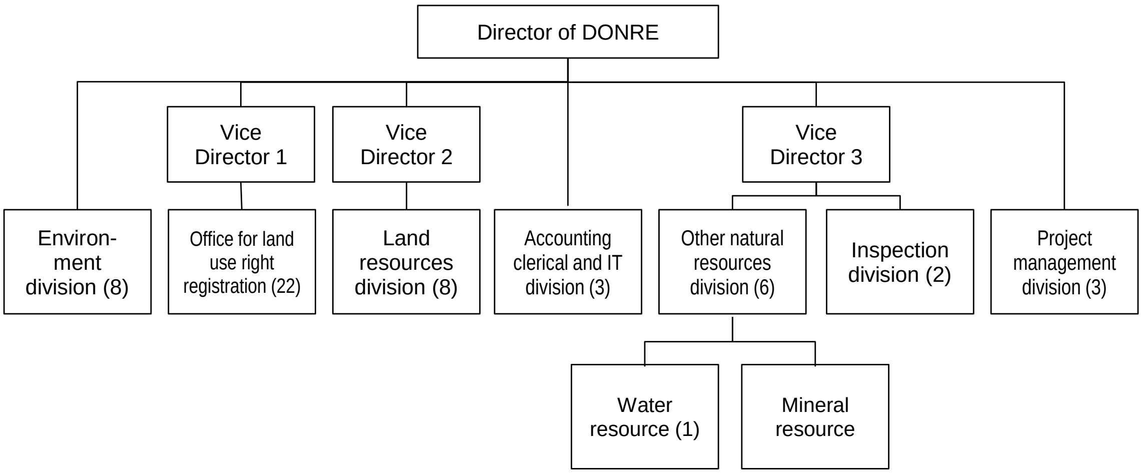
Source: Hoi An CPC

Figure 1.4.1-2 Organizational Chart of Hoi An CPC

(2) Division of Natural Resources and Environment, Hoi An City

Figure 1.4.1-3 shows the organizational chart of DONRE. The number of staff in each division is shown in parenthesis.

DONRE had 46 staff members as of February 2014. Some of the staff members hold positions in more than one division. The Environment Division evaluates environment-related documents and prepares environmental plans. The Office for Land Use Right Registration issues land use rights. The Land Resources Division prepares land use plans. The Water Resource Section approves the water use rights of groundwater and surface water, and the Mineral Resource Section deals with the use of sand as a construction material. The Inspection Division monitors all the issues concerning the environment, including the quality of industrial wastewater.



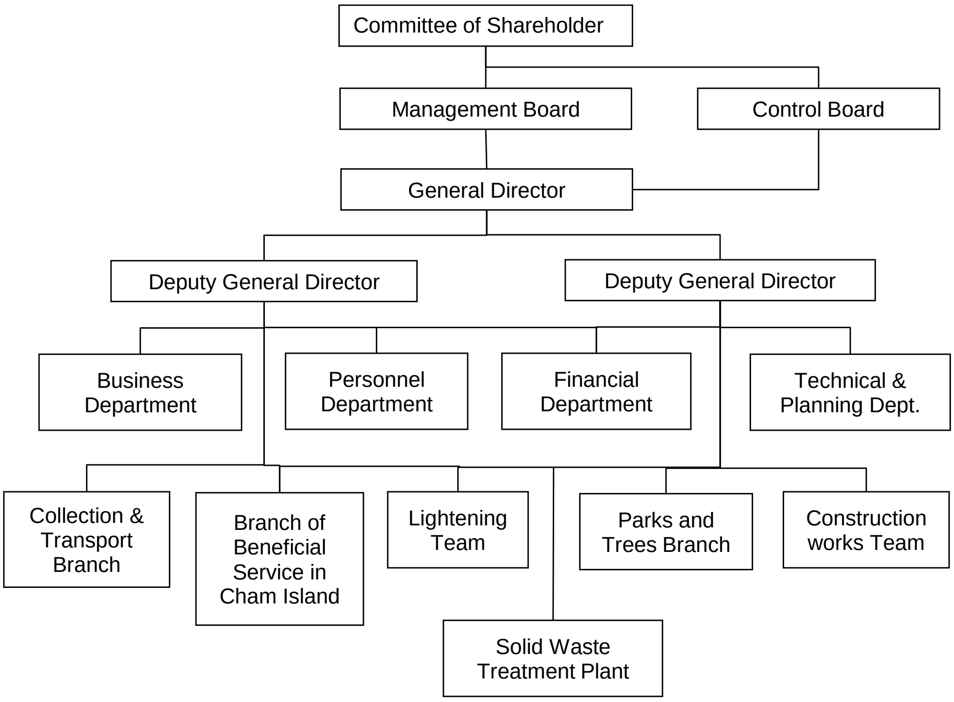
Source: DONRE

Figure 1.4.1-3 Organizational Chart of DONRE

DOFP with the assistance from the Department of Urban Planning is responsible for repairs and replacement of sewerage facilities. It would review the Terms of Reference and costs for repairs and replacement submitted by PWC, revise these if necessary, and then seek Hoi An CPC approval before allocating the required budget. The cleaning and dredging of the Japanese Bridge Canal after rehabilitation would continue to be outsourced to PWC.

(3) Public Works Joint Stock Company, Hoi An City

PWC would be responsible for the operation and maintenance (O&M) of the sewerage facilities to be constructed in this project. **Figure 1.4.1-4** shows its organizational chart.



Source: PWC

Figure 1.4.1-4 Organizational Chart of PWC

PWC used to be a public corporation owned by Quang Nam PPC. It became a limited company in May 2010 and eventually incorporated as a joint stock company in August 2013. 51% of its shares are owned by Quang Nam PPC and the rest by individual investors and staff members of PWC. PWC has four major duties: 1) collection and transportation of solid waste, 2) maintenance of roadside trees, 3) maintenance of street lights and 4) cleaning, dredging and maintenance of the sewers and drains.

PWC had a staff of 236 as of January 2014. **Table 1.4.1-1** shows their composition. It is characterized by the high proportion of unskilled workers (69%) and staff members under the age of 30 years (42%). This staff composition suggests the existence of sufficient potential for improvement of technical capability with the provision of various types of training.

Table 1.4.1-1 PWC Staff Composition by Gender, Educational/Technical Background and Age

Gender	Number	%	Educational/technical background	Number	%	Age	Number	%
Male	154	65	Managers	4	2	Under 30	99	42
Female	82	35	College graduates	30	13	30 - 39	72	31
			Vocational School graduates	15	6	40 - 49	53	22
			Skilled labor	23	10	50 - 59	12	5
			Unskilled labor	164	69			
Total	**236**	**100**	**Total**	**236**	**100**	**Total**	**236**	**100**

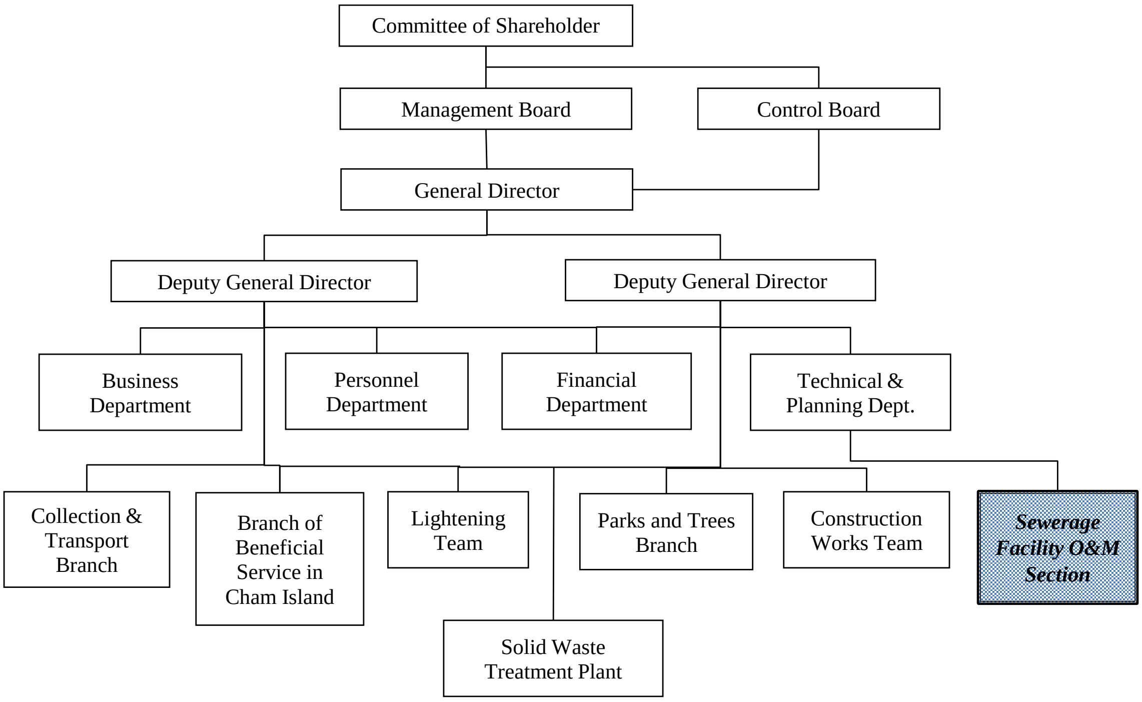
Source: Data compiled by JST from the reference materials provided by PWC

Nine workers of the Construction Works Team clean, dredge and maintain the sewers and drains in the city. Two workers of the Solid Waste Treatment Plant operate and maintain the simple sewerage treatment facility at the Hoi An General Hospital. The Technical & Planning Department deals with residents' complaints of odor from sewers and drains, requests relevant departments to take remedial actions and coordinates these efforts as required. The department also supervises the work of the Construction Works Team.

PWC does not have a department to operate and maintain sewerage treatment facilities at present. It plans to establish the "Sewerage Facility O&M Section" under the Technical & Planning Department (**Figure 1.4.1-5,** Official letter from Hoi An CPC to JICA, N0.1383/UBND, 26th May, 2014, Appendices, p. A7-3).

The O&M of the facilities would be conducted by PWC under a contract with the Hoi An CPC. A separate contract (Refer to p. 2-51, "2.4 Project Operation Plan") covers PWC's responsibility for the replacement of equipment every 20 years.

The procedure for outsourcing of O&M and replacement of equipment would be as follows:
DOFP with the support from the Department of Urban Planning would outsource the O&M of STP. PWC would prepare the Terms of Reference (TORs) and the cost of the outsourced activities. DOFP would check the TORs and cost, revise these as required, and seek the approval from Hoi An CPC. Hoi An CPC will pay PWC for the contract amount every year. The replacement of equipment would follow a similar but separate process. PWC would be paid the replacement expenditure at the time of approval.



Source: JST

Figure 1.4.1-5 PWC Organizational Chart with New O&M Section

1.4.2 Finance and Budget

(1) Quang Nam PPC

Table 1.4.2-1 shows the fiscal balance of Quang Nam PPC for the last four years. The total revenue of Quang Nam PPC in 2012 was 10,605 billion VND (51.8 billion JPY). The total expenditures exceeded the total revenue for the entire four-year period.

Table 1.4.2-1 Fiscal Balance of Quang Nam PPC

Unit: billion VND

	Year	2009	2010	2011	2012
1	**Total revenue**	**4,726**	**7,571**	**10,449**	**10,605**
2	**Total expenditures**	**7,205**	**9,148**	**13,148**	**14,146**
I	Expenditure on development investment	1,739	1,973	3,351	4,406
II	Operating expenditure	2,796	3,494	4,611	6,339
III	Other expenditure	2,670	3,681	5,186	3,401

Source: "Quang Nam Statistical Yearbook 2012," Quang Nam Statistical Office

(2) Hoi An CPC

Table 1.4.2-2 shows the fiscal balance of Hoi An CPC for the last four years. The fiscal year begins in January and ends in December. The total revenue in 2013 was 910.8 billion VND (4.45 billion JPY). Fiscal surplus (excess of revenue over expenditure) was recorded for all four years. The total expenditures was between 65 to 75% of total revenue. Staff salaries and office expenses accounted for 30 to 39% of total revenue. The proportion of the investment expenditures to total revenue was stable at between 33 to 35%. The revenue surplus was approximately 1.15 billion JPY in 2013. The surplus is either partially returned to Quang Nam PPC to be used by local People's Committees, or for Hoi An CPC's investment budget next year, or accumulate internally in Hoi An CPC, or for occasional staff bonus. The Deputy Director of DOFP confirmed that the financial position of Hoi An CPC is very sound because of the ample revenue from taxes from factories and stores, the land use fees and the admission fees at Hoi An Old Town, and careful expenditure management. Hoi An City receives subsidies from UNESCO, non-governmental organizations and the Government of Vietnam through the provincial government, for the maintenance of the World Heritage Site. This is the reason why Hoi An City receives funding from Quang Nam Province despite its fiscal surplus.

Table 1.4.2-2 Fiscal Balance of Hoi An CPC

Unit: billion VND

	Year	2010	%*	2011	%	2012	%	2013	%
1	**Total Revenue**	**607.67**	**100**	**639.97**	**100**	**657.28**	**100**	**910.82**	**100**
I	Revenue from state budget	509.19	84	544.98	85	506.56	77	705.16	77
II	Revenue from provincial budget	98.48	16	94.99	15	150.72	23	205.66	23
2	**Total Expenditures**	**397.01**	**65**	**431.69**	**67**	**490.04**	**75**	**675.02**	**74**
I	Investment expenditures	210.73	35	216.43	34	230.17	35	335.34	36
II	Staff salary & office expenses, etc.	182.80	30	211.05	33	255.78	39	325.79	36
III	Other expenditures	3.48	1	4.21	1	4.09	1	13.89	2

*: Proportion of each item of the revenue and expenditure to the total revenue set at 100%

Source: Data compiled by JST from the "Hoi An City Statistical Yearbooks," Division of Statistics, Hoi An City

The budget allocation from Hoi An CPC to DONRE and the other divisions is decided on the basis of expected revenue, situations at the wards and communes and proposals submitted by the divisions. The divisions submit their proposals every July and have individual discussions with DOFP by October. When the preparation of the final draft of the budget, Hoi An CPC would examine the proposals. The approved proposals are examined by the People's Council. When a proposal is approved by the People's Council, Hoi An CPC would issue a letter of approval to DOFP and DOFP would proceed with the project.

The Hoi An CPC has to approve the budget for the project and O&M expenses. To be in time for budget allocation for a certain year, the application for the project approval would have to be submitted to Hoi An CPC with the cost estimates by September of the previous year.

PWC would cover the cost of O&M and replacement of the sewerage system to be constructed in this project with the money disbursed from Hoi An CPC (Official letter from Hoi An CPC to

JICA, No. 1383/UBND, dated 26th May, 2014). This cost estimated at 1.867 billion VND (9.15 million JPY) per year corresponds to 0.2% of Hoi An CPC's total revenue or 0.8% of its surplus in 2013. Therefore, it is considered that Hoi An CPC should be able to bear the estimated cost.

As in other cities in Vietnam, an environmental protection fee is collected as an additional 5 to 8% of the water charge. The fees in Hoi An City are collected by Quang Nam PPC. Hoi An CPC has to ask Quang Nam PPC for reimbursement. In addition to the lack of direct control, the amount collected would not be sufficient to cover the O&M budget for this project.

(3) DONRE

Table 1.4.2-3 shows the expenditures of DONRE for the last five years. The (initial) budget is not available, but is supposed to be almost the same as the expenditures every year for the five-year period. The total expenditures in 2012, 4 billion VND (20 million JPY), is about 0.8% of the total expenditures of Hoi An CPC.

Table 1.4.2-3 Expenditures of DONRE, Hoi An City

Unit: billion VND

Year	2009	2010	2011	2012	2013
Expenditures	1.520	2.738	3.020	4.010	4.720
Salary, office expenses, etc.	0.700	0.768	1.200	1.600	1.800
Expense for land management	0.220	0.770	0.320	0.610	0.520
Expense for environmental protection	0.600	1.200	1.500	1.800	2.400

Source: DONRE, Hoi An City

(4) PWC

Tables 1.4.2-4 and **1.4.2-5** show the financial statements of PWC for 2008, 2009 and 2010. The statements after PWC became a joint stock company (in 2011) are not available. PWC recorded net profit after taxes in all three years. The Managing Director confirmed that PWC recorded net profit in 2011 and 2012. The financial condition of the company is sound. The short-term liabilities consist of arrears, accrued expenses payable and salaries payable and no loans.

Table 1.4.2-4 Profit and Loss Statement of PWC

Unit billion VND

No.	Year	2008	2009	2010
1	Sales of goods and services	7.188	22.647	14.391
2	Costs of goods sold	5.798	17.845	12.179
3	General / administrative costs	0.671	3.248	0.962
4	**Gross profit / loss**	**0.719**	**1.554**	**1.25**
5	Financial revenue / costs	0	0.035	0.058
6	**Operating profit / loss**	**0.719**	**1.589**	**1.308**

Unit billion VND

No.	Year	2008	2009	2010
7	Other revenue / costs	0.345	0.005	0.408
8	**Net profit / loss before tax**	**1.064**	**1.594**	**1.716**
9	Corporate income tax	0.217	0.287	0.429
10	**Net profit / loss after tax**	**0.847**	**1.307**	**1.287**

Source: Data compiled by JST from the data obtained in the Data Collection Survey on Wastewater Management in Hoi An, Vietnam

The revenue from contracts with Hoi An CPC accounts for most of the revenue. As the financial condition of Hoi An CPC is good, PWC is not likely to have any problems to be paid. **Table 1.4.2-6** shows the amounts paid to PWC for the outsourcing contracts. Hoi An CPC reported 44.3 billion VND (220 million JPY) as the amount paid to PWC in 2013. The total revenue of PWC in 2013 would be more than this amount. The revenue of PWC appears to be increasing rapidly, approximately twofold from 2009 and threefold from 2010.

In 2013 Hoi An CPC paid PWC 0.138, 13.8 and 4.9 billion VND (0.67, 67 and 24 million JPY) for the dredging of drains, cleaning of the city including rivers, and O&M of the solid waste treatment plant, respectively.

The financial condition of PWC is sound and its revenue source is stable. In addition, 51% of its shares are owned by Quang Nam PPC. PWC should be able to provide the services in a sustainable manner.

Table 1.4.2-5 Balance Sheet of PWC

Unit: billion VND

No.	Year	2008	2009	2010
	ASSETS			
A	**Current Assets**	**3.719**	**15.309**	**7.294**
1	Cash and cash equivalent	0.675	6.190	1.268
2	Short-term receivables	0.920	4.258	4.843
3	Inventories	0.352	0.805	0.872
4	Other current assets	1.772	4.056	0.311
B	**Long-Term Assets**	**12.557**	**8.849**	**7.474**
1	Fixed assets	5.401	8.586	7.270
2	Other long-term assets	7.156	0.263	0.204
	TOTAL ASSETS	**16.276**	**24.158**	**14.768**
	LIABILITIES & EQUITY			
A	**Liabilities**	**2.667**	**13.438**	**6.159**
1	Short-term	2.667	13.308	6.137
2	Long-term	0.000	0.130	0.022
B	**Equity**	**13.609**	**10.720**	**8.609**
1	Owner's equity	1.649	5.616	6.427
2	Other resources and funds	11.960	5.104	2.182

Unit: billion VND

No.	Year	2008	2009	2010
	TOTAL LIABILITIES & EQUITY	**16.276**	**24.158**	**14.768**

Source: Data compiled by JST from the data obtained in the Data Collection Survey on Wastewater Management in Hoi An, Vietnam

Table 1.4.2-6 Payments to PWC by Hoi An CPC for Outsourced Activities

Unit: billion VND

No	Contracted Activities	2011	2012	2013
I	**Public utility activities**	**21.255**	**27.996**	**37.709**
1	City and river cleaning, removal of garbage, washing the roads	8.217	11.113	13.783
2	Collecting, transporting, treating solid waste	7.608	9.212	9.458
3	Dredging drainage system	0.676	0.390	0.138
4	Tree maintenance	3.920	4.579	6.490
5	Lighting	0.834	1.321	1.518
6	O&M of solid waste treatment plant	0.000	1.381	4.863
7	Collecting, transporting, classifying solid waste at source for Minh An, Son Phong, Cam Pho, Tan An	0.000	0.000	0.833
8	Clean up after typhoon and flooding in 2013	0.000	0.000	0.626
II	**Urban city lighting**	**2.507**	**2.995**	**3.512**
III	**Subsidization for electricity price in Cham Island**	0.000	0.000	**3.105**
	TOTAL	**23.761**	**30.991**	**44.327**

Source: Hoi An CPC

1.4.3 Technical Capability

(1) Public Works Joint Stock Company, Hoi An City (PWC)

Two staff members of the Solid Waste Treatment Plant of PWC (**Figure 1.4.1-4**) operate and maintain a small-scale (120 m^3/day) sewerage treatment facility at a hospital in Hoi An City. One of them is a college graduate specialized in water resources, water supply and wastewater treatment. The other is a graduate from a (two-year) vocational training school. They also received training from the contractor of the facility. PWC has no experience in the O&M of full-scale sewerage treatment facilities. The Construction Works Team of PWC is carrying out cleaning and dredging of the sewers and drains for wastewater and rainwater.

The O&M of the facilities in this project would be contracted to PWC (Official letter from Hoi An CPC to JICA, No. 1383/UBND, dated 26th May 2014). PWC has been operating and maintaining a small-scale sewerage treatment facility and a solid waste treatment plant in recent years. It also has facilities to make simple repair of machinery. To build on the existing capability a new O&M section can be established in PWC.

With the exception of the manager who is a college graduate specialized in bridge and road construction, all the staff members of the Construction Works Team are general laborers. They have at least seven-years of work experience and received in-house training in areas of basics waterworks and drainage, worker safety and hygiene, electric welding, plastic welding, basics of electric circuits, pipes and their accessories and installation of pumps and other equipment.

The Technical and Planning Department (**Figure 1.4.1-4**) provides guidance to the Construction Works Team and monitors its activities. A construction engineer, an environmental engineer and a college graduate specialized in drainage are working in the department.

The Construction Works Team of PWC cleans and dredges the sewers, drains and canals (a total length of approximately 40 km) once every year in compliance with the contract with Hoi An CPC. When PWC receives a complaint from residents, it submits a proposal for additional cleaning and dredging and implements the cleaning and dredging upon approval from Hoi An CPC.

The Construction Works Team owns the trucks for the transportation of sludge, tools to draw up sludge manually (rakes and shovels), crowbars (to lift concrete covers), large buckets, and other tools (see the photos below) for cleaning and dredging.

 Sludge scraping and removal	 Truck for transporting sludge	 Sludge removed from a drain canal

The Construction Works Team has sufficient capacity to clean the roadside sewers, drains, and canals with covers using the tools mentioned above and the technical know-how acquired from the training and past experience. The fact that solid waste and sludge are found in the Japanese Bridge Canal means that it has not been cleaned sufficiently. The Manager of the Technical and Planning Department explained that the 9 members of the Construction Works Team can only manage to clean and dredge the canal once every two to three years. This is insufficient for the amount of wastewater, solid waste, bamboo branches and grass getting into the canal every day. It is necessary to prepare a comprehensive cleaning and dredging plan for all the sewers, drains, and canals, including the Japanese Bridge Canal, in Hoi An City and to consider additional staff allocation and employment of temporary workers as required.

In conclusion, PWC is the appropriate organization in which to establish a section for the O&M of the sewerage facilities of this project. Appropriate training for its staff members would be required.

Chapter 2 Contents of the Project

2.1 Basic Concept of the Project

2.1.1 Purpose of the Project

The development of urban environmental infrastructure, including sewage treatment and solid waste management in Vietnam has not kept pace with the country's rate of urbanization and the rapid growth of its industry and tourism sectors. Consequently, water quality of most rivers and waterways flowing through urban areas are seriously degraded.

Decision No. 35/1999/QD-TTg issued by the Prime Minister approved the orientation of Vietnam's urban drainage and sewerage development to the year 2020. The specific objectives include: expanding overall sewerage service coverage to 80-90%; to 90-100% for Hanoi, HCM City and Grade II cities, urban areas in important regions of economic and tourist development, industrial estates, export processing zones.

Decision No. 1930/2009/QD-TTg expands the approval to include industrial parks and extends the planning horizon to 2025, with a vision towards 2050. By the target year all Grade I-IV cities will have wastewater collection and treatment systems, 70 – 80% of domestic wastewater in urban areas will be collected and treated, and effluent discharge will meet the set standards.

The "Hoi An City Urban Development Master Plan, 2011" stipulates that sewerage development is a priority. This commitment remains unchanged in the amended master plan "Master Plan of General Construction, March 2013".

The Division of Natural Resources and Environment, Hoi An City (DONRE) prepared the Sewerage System Development Vision, shown in **Figure 2.1-1**, which identifies the wastewater collection areas. The "Project for Solid Waste, Wastewater Treatment and Environmental Protection in Hoi An"(AFD Project) funded by Agence Française de Développement (AFD) is located in area A. The target area of this JICA Grant Aid project falls within the areas identified in the Vision, at the location of a new residential estate, outside of the AFD project area.

The project would develop the wastewater treatment facilities and improve the water quality in the Japanese Bridge Canal and its surrounding areas in Hoi An City.

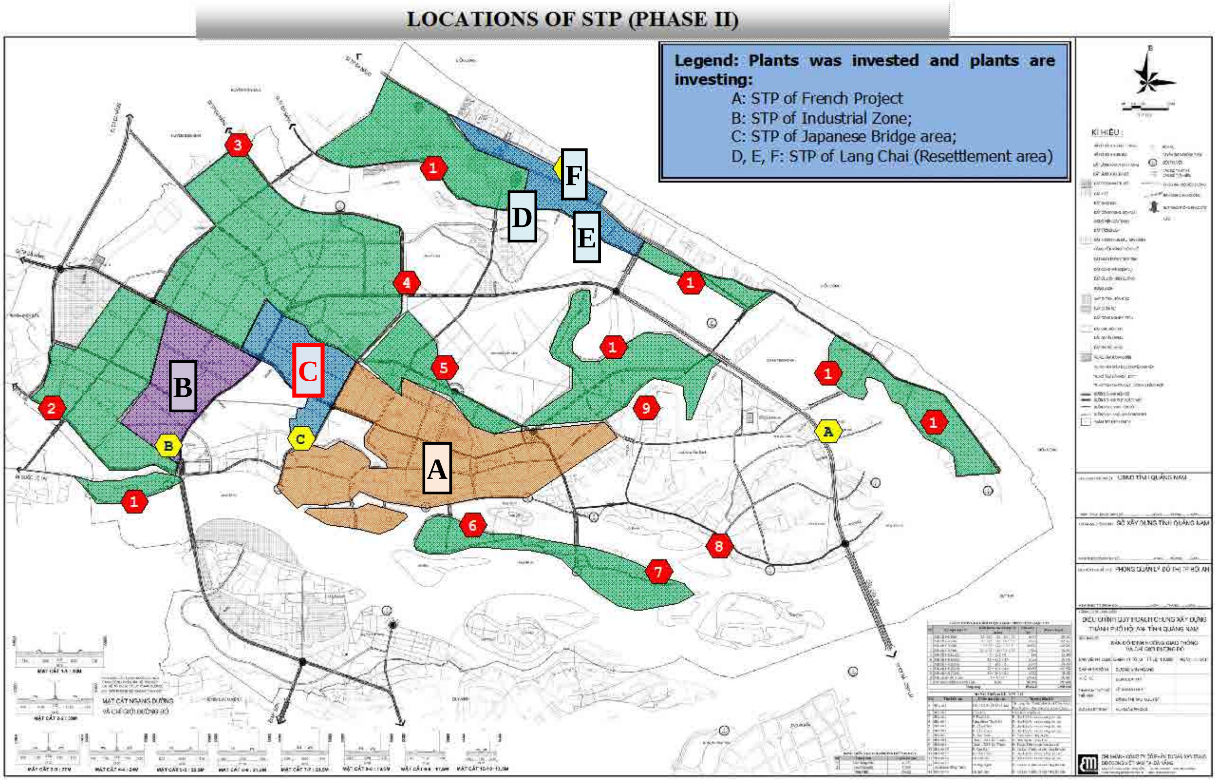


Figure 2.1-1 Sewerage System Development Vision

2.1.2 Description of the Project

This project would develop sewerage facilities in Hoi An City and rehabilitate the Japanese Bridge Canal. There would also be assistance for capacity building to train staff on the operation and maintenance of the sewage treatment plant (STP) and drainage facilities, and financial management of the sewerage system. A canopy truck for transportation of the sludge generated at the STP would also be supplied.

2.2 Outline Design of the Japanese Assistance

2.2.1 Design Policy

(1) Design Targets

The sewage treatment system would be constructed based on the following design targets.

a. The system would serve a new residential estate, outside of the service area of the AFD Project.
b. The scope of work would meet the requirements for JICA Grant Aid project.
c. Land acquisition, as-built drawings for water distribution, power supply to the STP site, construction of gates and fences are excluded from the scope of work under the JICA Grant Aid project.
d. Equipment procured would only be those required for the operation and maintenance of the project.
e. PWC and Hoi An CPC staff would be trained to conduct proper operation and management of the facilities.

(2) Natural Environmental Conditions

The facilities would be designed taking into consideration the natural conditions, such as temperature, rainfall and flooding events, direction and force of wind, possibility of earthquakes and river water level. Construction is scheduled mainly from September to December, during the periods not seriously hampered by heavy rain.

(3) Socio-economic Conditions

The old urban area of the Hoi An city is an exceptionally well-preserved example of a South-East Asian port dating from the 15th to the 19th century, with buildings that display a unique blend of local and foreign influences. It is recognized as a World Heritage Site by UNESCO in 1999. Hoi An City has a thriving tourism industry. The regulations for new construction projects are strictly defined to preserve the important tourist attractions. The design of the STP would be undertaken in close coordination with the Hoi An Centre for Monuments Management and Preservation (HCMMP), and with approval from Hoi An CPC.

(4) Legislative Requirements, Regulations and City Master Plan

Decree No. 12/2009/ND-CP requires that a feasibility study with EIA be approved before project investment can proceed. This project was approved by Decision No. 2558/QD-UBND dated August 20th, 2014 issued by Quang Nam PPC.

The design of the sewage treatment facilities would follow the Vietnamese regulations for buffer zone for STPs (QCVN07-2010/BXD) and standards for effluent water quality (QCVN14-2008/BTNMT). The facilities would meet the requirements and objectives stated in Hoi An City's "Master Plan of General Construction, March, 2013".

(5) Utilization of Local Contractors

Contractors based in Hanoi and Ho Chi Minh have sewage treatment plant construction experience. Others in Da Nang City have worked with relatively large projects. These contractors will be engaged under the supervision of the Japanese contractor.

(6) Operation and Maintenance

Public Works Joint Stock Company (PWC) staff is already carrying out O&M for the small scale sewage and drainage facilities at the hospital. They would need more training for the operation and management of the facilities to be constructed and rehabilitated in this project.

(7) Facilities and Equipment

Durability, energy efficiency, simple and low cost maintenance are important criteria for the selection of equipment. Other desirable features include ease of sourcing spare parts locally and ability to prolong the life cycle of the equipment with regular maintenance.

Given the warm humid climate the treatment units should be made of steel for easy maintenance and replacement. The steel fabrication in factories would have the advantage of guaranteed quality.

The entrance to the STP would not be designed for moving very large pieces of equipment since this is not expected to be a frequent occurrence. Instead the ALC wall of the building can be easily demolished and rebuilt if necessary.

(8) Construction and Procurement Method and Schedule

Soil tests indicate that 42 m piles cast-in-situ would be required for the foundations of the sewage treatment facilities and the administration building. Cast - in - place concrete piles (all-casing method) would be used to minimize construction noise for nearby hotels, kindergarten and tourist traffic. Additional soil tests would also be conducted at the detailed design stage to confirm the earlier findings and the foundation design can be revised if necessary.

The project implementation would be flexible enough to take advantage of accelerated time table if the project unfolds smoothly, as well as deal with rain delays.

Heavy construction equipment would not use the existing approach road. A temporary access road would be constructed on the south-east side of the STP site. The land for the temporary access road should be leased, and the approach path to the nearby hotel, Tea Garden Homestay, should be also secured during the construction period.

2.2.2 Basic Plan (Construction Plan / Equipment Plan)

2.2.2.1 General Features

The Vietnamese side put forward the following requests:

- Construction of wastewater treatment facilities
    - Capacity of 2,000 m^3/day
    - With attached sludge treatment facilities
- Rehabilitation of 2 km of the open section of the Japanese Bridge Canal
- Operation and maintenance equipment
    - Open truck
    - Equipment for water quality testing
    - Personal computer and printer for data logging

Japanese Grant Aid is offering the project components shown in **Table 2.2.2.1-1.**

Table 2.2.2.1-1 Requested and Designed Components

Item	Requested	Grant Aid Offers
Sewage Treatment Plant (STP)	Treatment Capacity: 2,000 m^3/day (daily maximum) with sludge treatment	Treatment Capacity: 2,000 m^3/day (daily maximum) with sludge treatment Administration building (Floor area: 284 m^2)
The Japanese Bridge Canal	Upgrade with concrete and cover: 2.0 km	Rehabilitation with concrete cover and an interceptor section): 1.68 km Dredging: 99 m
Equipment Supply	Open truck Water quality testing equipment A personal computer and a printer for data logging	A canopy truck
Soft component	-	Operation and Maintenance Guidance of STP Maintenance Guidance of the Japanese Bridge Canal Sewerage Financial Management Planning Assistance

The project would build a new STP in the North West area of the city to treat wastewater from a new residential estate. The Japanese Bridge Canal would be rehabilitated with an interceptor section to divert most of the wastewater to the STP in order to improve the water quality of the Japanese Bridge Canal. Under the project, equipment for O&M of the STP would also be provided and assistance with capacity building would also be arranged to ensure that the project would be operated sustainably after construction.

More detailed explanation of the Grant Aid offers, especially as to where these differ from the Vietnamese side requests is as follows.

- The sewage treatment process is proposed to be Pre-treated Trickling Filtration (PTF) with sludge treatment. The choice is based on the available space, cost versus performance, and ease of O&M.
- The STP facilities are enclosed in order not to distract from the view of the World Heritage Site.
- 1.68 km of the Japanese Bridge Canal would be rehabilitated. A partition wall would be installed to make an interceptor section which collects wastewater effectively. A cover would be installed at the location where odor may be generated in the dry season.
- The canal section where rehabilitation is not required would be dredged.
- Wastewater collection system downstream of the STP would be constructed by Hoi An City. The served area of the system will be covered by an AFD project in the future.
- A canopy truck would be supplied for the transportation of sludge. The covered truck is better for odor control. Equipment for water quality testing, a personal computer and a printer for data logging would be provided when equipping the administration building.
- Training by Soft Component would be provided to ensure that staff have the capability to operate and manage the new facilities in the long term.

Justification for the decisions on the project components are explained in detail in the appendices listed in **Table 2.2.2.1-2**.

Table 2.2.2.1-2 Appendices with Justification for Decisions on Designed Components

Item	Designed Components	Appendices
Sewage Treatment Plant (STP)		
	Sewage volume	Appendix 6.3 Estimation of Sewage Water Flow for Treatment
	Sewage treatment	Appendix 6.4.1Water Improvement Measures Appendix 6.4.2 Sewage Treatment Process
	Sewage disposal method	Appendix 6.4.3 Sludge Disposal
	Other treatment processes	6.4.4 Other Treatment Systems
	Treatment processes, sewage and sludge treatment	6.4.5 Description of Sewage and Sludge Treatment Units
	Capacity calculations	Appendix 6.8 Process Unit Capacity Calculation
	Administration building	Appendix 6.7 Outline Design Drawings

Item	Designed Components	Appendices
	Floor level	Appendix 6.4.7 Flood Water Level and Measures
	Ground level	Appendix 6.4.8 Ground Level in STP
	Location of access road	Appendix 6.4.6 Access Road
	Material of tanks	Appendix 6.4.9 Material of Tanks
Japanese Bridge Canal		
	Rehabilitation measures	Appendix 6.5 Study of Collection System of Wastewater
Equipment Supply / canopy truck		
	Generated sludge volume	Appendix 6.8 Process Unit Capacity Calculation
	Capacity of canopy truck	3.2.4.2(3) Procurement of Canopy Truck
Soft component		
	Soft component	Appendix 5 Soft Component (Technical Assistance) Plan

The design horizon is 2020. The served population and wastewater flow for the STP is estimated as shown in **Table 2.2.2.1-3** and the STP capacity of 2,000 m^3/day is confirmed as indicated in **Figure 2.2.2.1-1**.

Table 2.2.2.1-3 Served population and wastewater flow for STP

	Area	2015	2020	2025	2030
Served population (persons)	New residential area	573	4,870	5,635	6,929
	AFD project area	7,854	6,855	4,938	1,689
	Total	8,427	11,725	10,573	8,618
Wastewater flow (daily maximum flow m^3/day)	New residential area	93	790	914	1,124
	AFD project area	1,274	1,112	801	274
	Total	1,367	1,902	1,715	1,398

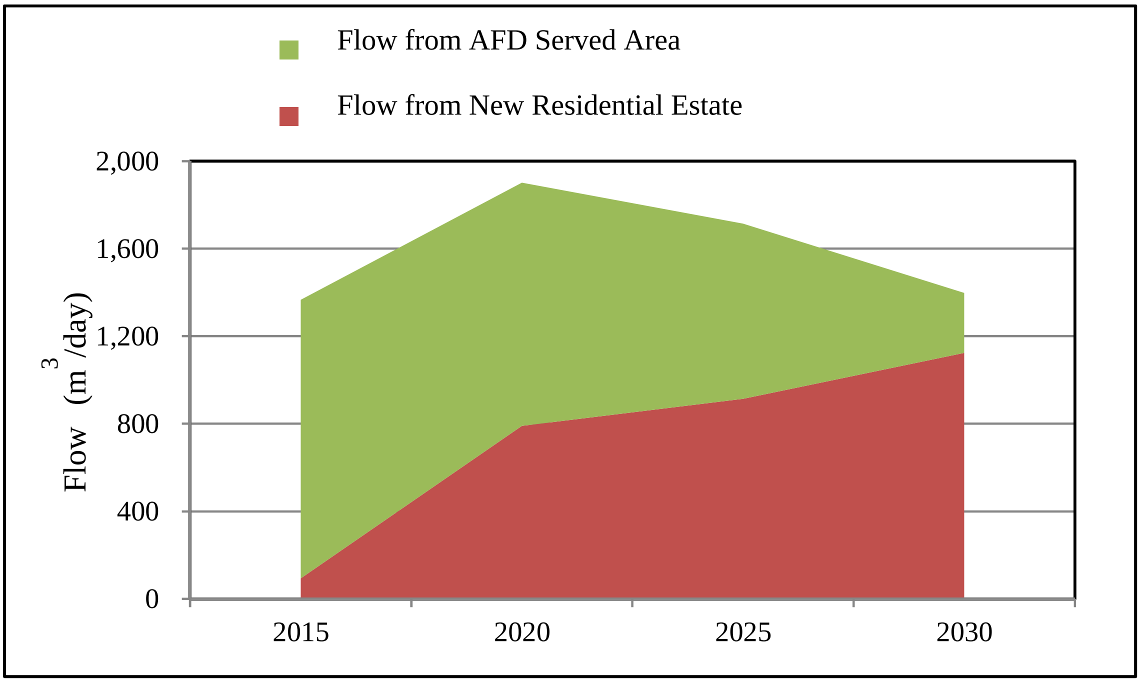


Figure 2.2.2.1-1 Wastewater to be treated by STP

2.2.2.2 Project Components

The project consists of the construction of the STP, rehabilitation of the Japanese Bridge Canal, equipment supply, and capacity building. The locations of project components are illustrated in **Figure 2.2.2.2-1**.

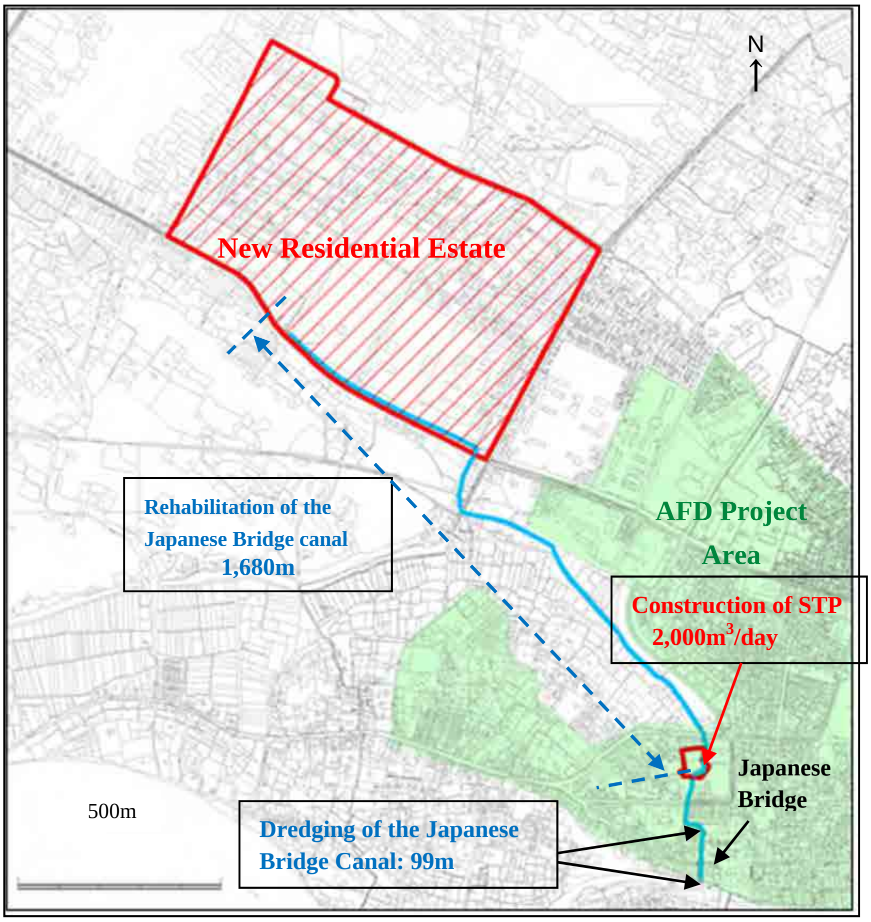


Figure 2.2.2.2-1 Facility Plan

Table 2.2.2.2-1 General Information on Project Components

Item	Contents
Sewage Treatment Plant (STP)	Treatment capacity: 2,000 m^3/day (daily maximum) with sludge treatment Administration building (floor area: 284 m^2)
Japanese Bridge Canal	Rehabilitation with partial concrete cover and interceptor section: 1.68 km Dredging: 99 m of canal not being rehabilitated and regulation pond
Equipment Supply	A canopy truck
Capacity Building	Operation and Maintenance of STP Maintenance of the Japanese Bridge Canal Financial Management Planning for Sewerage Systems

The following laws and regulations are applicable to the planning and design of the STP and rehabilitation of the Japanese Bridge Canal:

- ➢ QCVN14-2008/BTNMT : Water Quality Standards for Domestic Wastewater Discharge
- ➢ CVN722:2002 : Treated Water Quality Standards of STP
- ➢ QCVN07-2010/BXD : Buffer Zone Regulation of STP
- ➢ TCVN7957/2008 : Design criteria for drainage network

The exterior of the building would comply with the requirements stipulated in Act No.2337/2006/QD-UBND which regulates the designs of buildings in the historical protection area:

- Sloping roof and traditional tile material
- Building height is normally no higher than 10.5 m, however, permission has been granted for a height of 13.5 m for the STP building.
- Exterior color should be yellow

2.2.2.3 Planning for Project Implementation

(1) Construction of Sewage Treatment Plant (STP)

1) Site Preparation

The 3,600 m^2 site for the STP is agricultural land surrounded with homes and hotels in the Cam Pho Ward. The site is in Zone II-A which is a buffer zone for the historical protection area. The structures in the area must comply with the requirements in Act No. 2337/2006/QD-UBND for the preservation of the historical landscape. The STP must be housed in a building that complies with the requirements under the Act, including those for soundproofing, odor control, and protection against vibration.

The ground level is about +1.0 M (+0.45 to +2.56 M), lower than the surrounding roads at +2.40 M. This has to be raised for the construction of the STP. The highest recorded flood level is +4.30 M, but flooding to this level rarely occurs. If the ground level is raised to this elevation, it would be higher than the neighboring hotels (at +2.90 M) by 1.3 M. This would not be favorable aesthetically and would require a 20 m long access road with a 10% incline. It would be sufficient to raise the ground level to +2.90 M only, to be safe enough from flooding, to keep the cost down, and preserve the landscape.

- ・ Raised ground level: + 2.90 M (present level + 0.45 to + 2.56 M)
- ・ Maximum height of STP building: + 15.90 M (Height of building from that of Tran Hung Dao Street + 13.5 m)
- ・ Area of STP site： 3,572.1 m^2 (public land 793.3 m^2 + private land 2,778.8 m^2)

The treatment facilities would be housed in a building at the center of the site occupying an area of about 800 m^2 (=21.9 m x 36.8 m) without the required buffer area. A buffer area is not required for the administration building. Therefore it can be located in the northwest part of the site, away from the canal and access roads for maintenance (See **Figure 2.2.3-1**).

This Grant Aid project will build the facilities for wastewater treatment and the access roads for maintenance. The Vietnamese side will be responsible for landscaping and installation of entrance gate and fence around the STP site.

2) Architectural Details

i) Building Plan

Table 2.2.2.3-1 shows the treatment facilities, their required space and locations.

Table 2.2.2.3-1 Location and Space Requirement of Treatment Facilities

Facilities	Function	Required area (m^2)
Lower level of ground floor (total area 550 m^2)		
Inflow channel	Gates and screens to remove large debris	30
Equalization tank	Control water flow in sewage wet well	220
Sludge storage tank	Storage of backwash wastewater and thickener effluent	90
Final sedimentation tank	Separation of solids from reactor effluent.	70
Treated water tank	UV disinfection and storage of treated water	86
Front chamber	Prevent foul-air discharge from the hopper area containing dewatered sludge	8
Truck yard	Loading dock for dump trucks	46
Upper level of ground floor (total area 835 m^2)		
Sewage processing facilities	Solid-liquid separation tank, trickling filter, final solid-liquid separation tank	530
Electrical room	Substation facilities, housing MCCs	60
Hopper area of dewatered sludge	For sludge thickening tank, sludge dewatering equipment, hopper of dewatered sludge	200
Power generator	Source of power supply	30
Front chamber	Prevent foul-air discharge from the hopper area of dewatered sludge	3
Entrance hall	Entrance to sewage processing, sludge dewatering and electrical facilities	12

Figure 2.2.2.3-1 shows the layout of the building.

- Building of STP:

: Total floor area 924.78 m^2 (lower level of ground floor 62.12 m^2 + upper level of ground floor 862.66 m^2)
: Building area 893.00 m^2
: Structure area 569.26 m^2 (underground tanks)
: Floor area 1,494.04 m^2 (=building area + structure area)

Private homes are located north of the STP site, hotels to the east, and a kindergarden to the south. Sludge dewatering facilities which may produce odor would be located at the north end of the site away from the kindergarten. Treatment facilities would be located to take advantage of gravity flow with the inflow equalization tank at the highest elevation, followed by the solid-liquid separation tank, trickling filter, final sedimentation tank and the treated water disinfection tank. There would be a distribution chamber at the upper end in the southeast area along the direction from the canal.

Two service entrances for delivery of equipment and material and for transportation of dewatered sludge would be located on the west side away from the tourist attractions in the east. Lifting devices (hocks or hoist rail) would be available at these entrances. On the rare occasion when very large equipment has to be moved, the brick wall on the west side can be demolished and rebuilt.

The loading dock for trucks transporting dewatered sludge and the front chamber would be on the lower level of the ground floor. Screenings would be loaded onto dump trucks at the service entrance on the west side. The containers for the screenings would be lifted manually or by hoist rail from the bar screen equipment (automatic or manual).

The layout and size of the rooms of the administration building are shown in **Table 2.2.2.3-2**.

Table 2.2.2.3-2 Administration Building Plan

Rooms	Function	Required area (m^2)
Ground floor (total area 122 m^2)		
Garage	Parking for 4 vehicles	74
Warehouse	Storage for spare parts and chemicals	30
Stair well	Access to first floor	18
1st floor (total area 128 m^2)		
Manager's office	Office space for manager	16
Control room	For surveillance monitors and PCs	20
Change room	For changing and resting	20
Laboratory	For water quality testing and analysis	18
Lavatories		10
Corridor		30
Stair well	Access to ground floor	14

According to the above requirements, the size of the administration building would be as follows:

- Total floor area :283.88 m2 (ground floor 139.39 m2 + 1st floor 144.49 m2)
- Architectural area :188.10 m^2

ii) Elevation Profile of Treatment Facilities

The entrances to the buildings would be higher than 4.3 m (highest flood level recorded in the past) to avoid flooding of the facilities, except for the access level of vehicles.

＜Elevation of STP＞

- Truck yard floor level : + 3.10 M (ground height + 0.20 m)
- Ground floor level (general) : + 4.90 M
- Ground floor level (hopper room floor): + 6.10 M (truck yard floor level +3.00 m)
- Top level of eaves beam : + 10.60 M (ground floor level + 5.70 m)
- Top level of ridge : + 15.578 M < 15.90 M (max. allowable height)

The garage and warehouse would be located on the ground floor for easy access when handling heavy equipment or parts. The control room, laboratory and manager's office would be on the 1st floor which is higher than the highest flood level, to avoid any possible risk of flooding.

＜Elevation of Administration building＞

- Ground floor level : + 2.95 M (Ground height + 0.05 m)
- 1st floor level : + 6.95 M (Ground floor level + 4.00 m)
- Top level of eaves beam : + 10.45 M (1st floor level + 3.50 m)
- Top level of ridge : + 12.093 M < 15.90 M (max. allowable height)

iii) Structural Planning

＜Foundation structures＞

Natural ground settlement is still taking place at the STP site. Soil stabilization to a depth of 40 m would be required if raft foundations were used. Since this is not practical, pile foundation should be used. Piles have to reach the sandy gravel bed layer with an average N value of >30, located at 52 m below the design ground level (at + 2.4 m).
In selecting pile foundations, the followings factors were considered.

1. Low noise and low vibration is required to minimize impact to schools.
2. Precast concrete piles are not suitable because it would be difficult to protect pile toes from damage when driving is expected to be through hard soil layers.
3. Further residual settlement is anticipated therefore friction piles are not suitable. Bearing capacity should be based on supporting pile not friction.
4. The all-casing pile method is locally available.
5. Limited space favors the all-casing method as opposed to the Reverse Pile method which would require more space.
6. Pile depth is 53 m (which is quite deep), but it is possible to drive the casing, according to local contractors.

Structure would be supported on pile foundations made by the caste-in-place concrete pile (all-casing method).

＜Building Structures＞
Reinforced concrete or steel are possible choices as building material. Reinforced concrete is selected because of its cost advantage and durability. Concrete blocks would be used for building walls. As explained earlier, the west wall would be demolished and rebuilt for moving very large equipment which do not fit through the service entrances. This may be only once every 10-15 years when equipment has to be replaced. Water tanks would be built in accordance with construction standards for water tight concrete structures.
Vietnam experiences very few earthquakes. There is fewer structural criteria compared to requirements in Japan. However, the STP building needs a stronger foundation because of the soft soil layer. The designed structure would correspond to strength required to withstand a Level 1 seismic event: standard shear power coefficient of 0.2 in Japan.

iv) Equipment planning

Air conditioning, ventilation and odor control are planned as follows:

Table 2.2.2.3-3 Plan for Air conditioning, Ventilation and Odor Control

Compartment	Function	Ventilation
Lower level of ground floor		
Inflow channel	Gate and screen to separate large debris	Forced flue by electric fan and odor control
Equalization tank	Control water flow in wet well	
Sludge storage tank	Storage of backwash wastewater and thickened effluent	
Final sedimentation tank	Solid-liquid separation of effluent from reactors	N/A
Treated water tank	UV disinfection units and storage of treated water	N/A
Truck yard	Loading dock for dump trucks	Forced flue by electric fan (change over to odor control at the time of truck-loading)
Upper level of Ground floor		
Sewage processing facilities	Solid-liquid separation tank, trickling filter, final solid-liquid separation tank	Forced flue by electric fan
Electric room	Substation facilities, installation of MCCs	Air conditioning
Hopper area of dewatered sludge	Sludge thickening tank, sludge dewatering equipment, Hopper for dewatered sludge	Forced flue by electric fan and odor control
Power generator	Installation of power generator	Forced flue by electric fan

Table 2.2.2.3-4 Plan for Air conditioning and Ventilation in Administration building

Compartment	Function	Ventilation
Ground floor		
Garage	Parking space for 4 vehicles	N/A

Compartment	Function	Ventilation
Ware house	Storage room for spare parts and chemicals	Forced flue by electric fan
Stair well	Access to 1st floor	N/A
1st floor		
Manager’s office		Air conditioning
Control room	Surveillance monitors and PCs	
Change room	For changing and resting	
Laboratory	For water quality testing and analysis	
Lavatories		Forced flue by electric fan
Corridor		N/A
Stair well	Access to ground floor	N/A

There would be air conditioning in the control room, manager’s office, change room, and laboratory. Wet wells producing foul air and generator room which requires ventilation for engine operation would be ventilated by electric fan.

For the STP building, potable water supply will be delivered to single points at the loading dock, the sludge hopper bay at the dewatering process and the sewage processing compartment (South side near inflow channel). Wastewater would be collected in the floor sump and returned to the equalization tank located upper stream of STP. In the administration building, potable water will be delivered to the laboratory. Wastewater would be returned to the inflow channel.

Lighting fixtures will be installed all over the STP and administration buildings. Outdoor lighting would also be provided along the access roads within the STP site.

v) Building Materials

The building materials required for buildings in Zone II-A which is a buffer zone for historical protection area, are as follows:

- Traditional sloped and tiled roof
- Wood front fixtures
- Exterior color should be yellow

The exterior finish of the STP facilities would be concrete. The finish on the inside surfaces would be as follows:

- Entrance hall floor: painted concrete
- Inflow channel, equalization tank, inside of sludge storage tank: rust resistant coating
- Fixtures (outside): made of wood
- Fixtures (inside): made of steel

The Administration building shall be painted with a mortar finish. The finish of the control room, and lavatories would be as follows:

- Lavatory floor & wall: 100 mm^2 porcelain tiles
- Control room floor: raised floor (H=300), anti-static tiles
- Fixtures: made of wood

3) Sewage Treatment Processes

Sewage treatment method using pre-treated trickling filtration (PTF) is comprised mainly of three processes which are floating sponge filtration to increase the efficiency of solid-liquid separation, high rate trickling filtration to increase BOD removal in a small space, and final sedimentation to remove organic materials and solid particles. PTF combines physical solid-liquid separation and biochemical treatment and does not need aeration. The system saves energy and space. This method is given the International Technology Certificate by the Japan Sewage Works Agency.

- **Sewage treatment flow**

Sewage → 1) Screen → 2) Equalization tank (& lift pump well)→ 3) Floating sponge filtration tank → 4) High rate trickling filtration tank → 5) Final sedimentation tank → 6) Disinfection water tank (UV disinfection) → Effluent discharge

- **Sludge treatment flow**

Backwash wastewater from 3) Floating sponge filtration tank, 4) High rate trickling filtration tank, and 5) Final sedimentation tank → 7) Sludge thickener → 8) Dehydrator → 9) Sludge hopper → Removed for disposal by canopy truck

Flow diagram of STP process is shown in **Figures 2.2.2.3-1** and **2.2.2.3-2**.

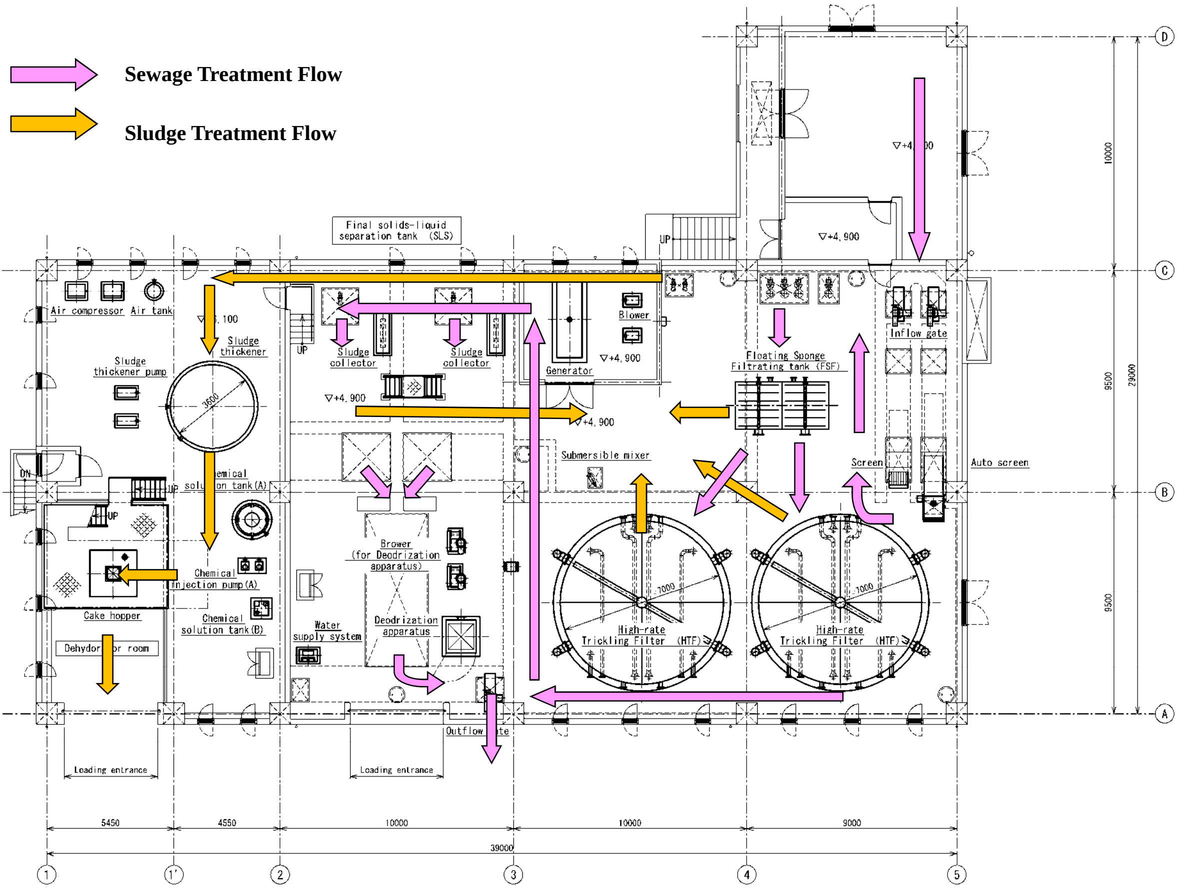


Figure 2.2.2.3-1 Flows of Sewage and Sludge Treatment

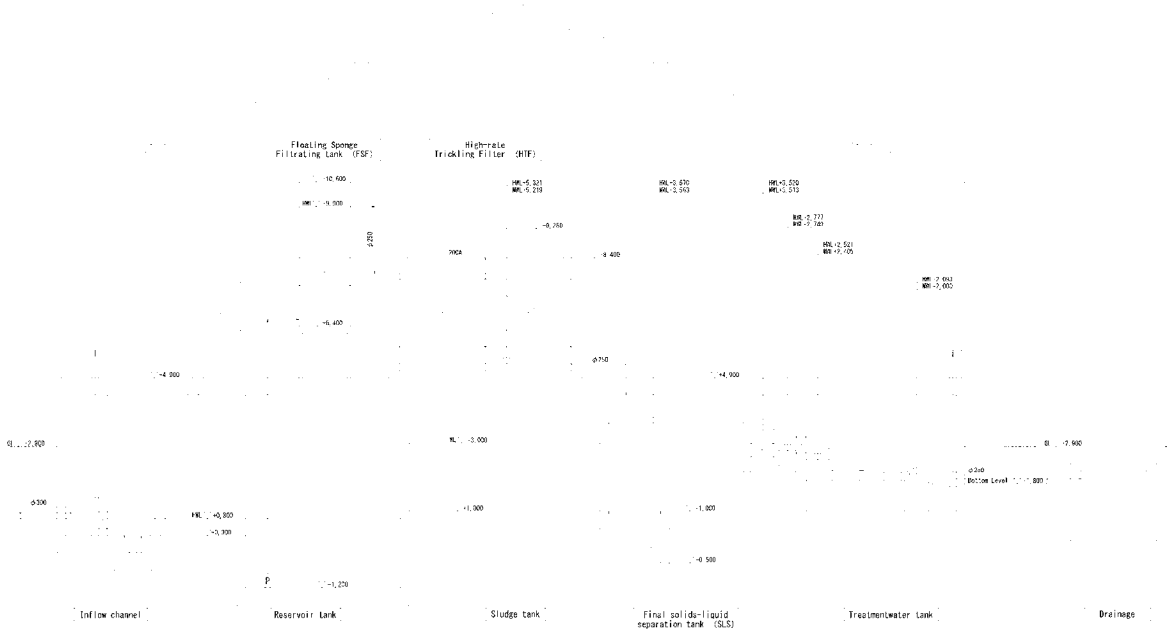


Figure 2.2.2.3-2 Flow Diagram of Sewage Treatment Plant

(2) Rehabilitation of the Japanese Bridge Canal

1) Current Situation

- Relatively large amounts of wastewater are being discharged from hotels in the AFD project area. Discharge from the new residential estate is still small at the moment because of low connection rates and leakage from the earth drains.
- Relatively clean irrigation water also flows into the canal. The agricultural areas in the vicinity play an important role in mitigating flooding conditions.
- The slope of the canal is irregular. Some sections have reverse slopes and depressions, causing stagnation of flow and odor problems during dry season.
- The 100 m with the open channel and masonry wall needs to be dredged and cleaned.

2) Route of Canal

Route of canal is the same as the present canal route because of the rehabilitation of the existing Japanese Bridge Canal.

3) Cross Section / Structure

The work required along the length of the canal would be as follows:

- Adjust the slope to prevent stagnation of flow and to achieve the minimum flow velocity of 0.7 m/s to meet the Vietnamese standard, TCVN7957:2008. The maximum flow velocity is 4.0 m/s.
- Invert levels would be kept the same or lower than the present level to accommodate the present inflow to the Japanese Bridge Canal.

An interceptor section would be installed as shown in **Figure 2.2.2.3-3,** to divert most of the wastewater to the STP and allow the cleaner irrigation water and rain water to overflow the weir and bypass the STP. If the overflow spills over to the farm land, flooding should not be a problem since the water would be absorbed into the ground.

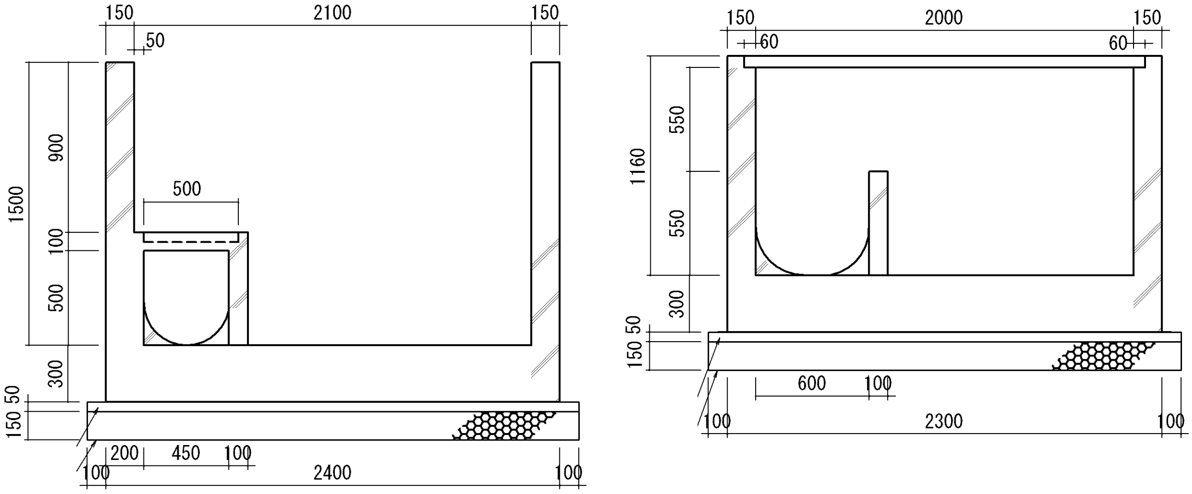


Figure 2.2.2.3-3 Interceptor Section for Japanese Bridge Canal

The flow capacity for the covered portion of the interceptor is 10 times the hourly maximum of dry weather flow. A small amount of storm water can be accommodated in the covered section so that odor generation is prevented during short rain periods. Cleaning of the covered section is conducted in the same manner as with the existing drains by using a rake. Openings are at 5 m intervals for easy cleaning. Garbage dumping at the open sections is a concern. Regular cleaning and public education on environmental protection would be required.

(3) Procurement Plan

A four-ton canopy truck would be provided to transport dewatered sludge to the disposal site at Khanh Son in Da Nang.

2.2.3 Outline Design Drawing

(1) Construction of STP

The floor plan and cross section of the STP are shown in **Figures 2.2.3-1** and **2.2.3-2.**.

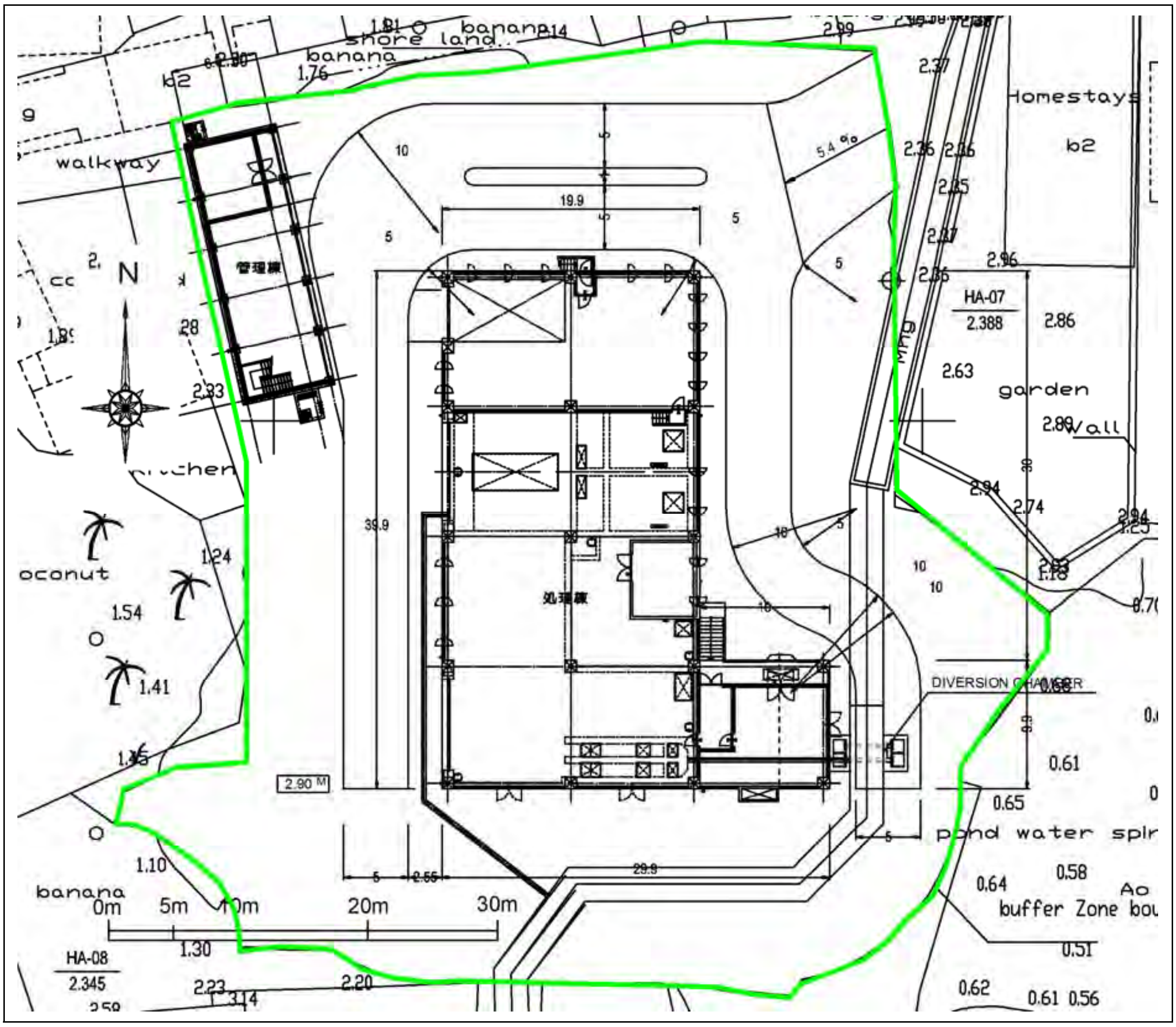


Figure 2.2.3-1 Plan view of STP

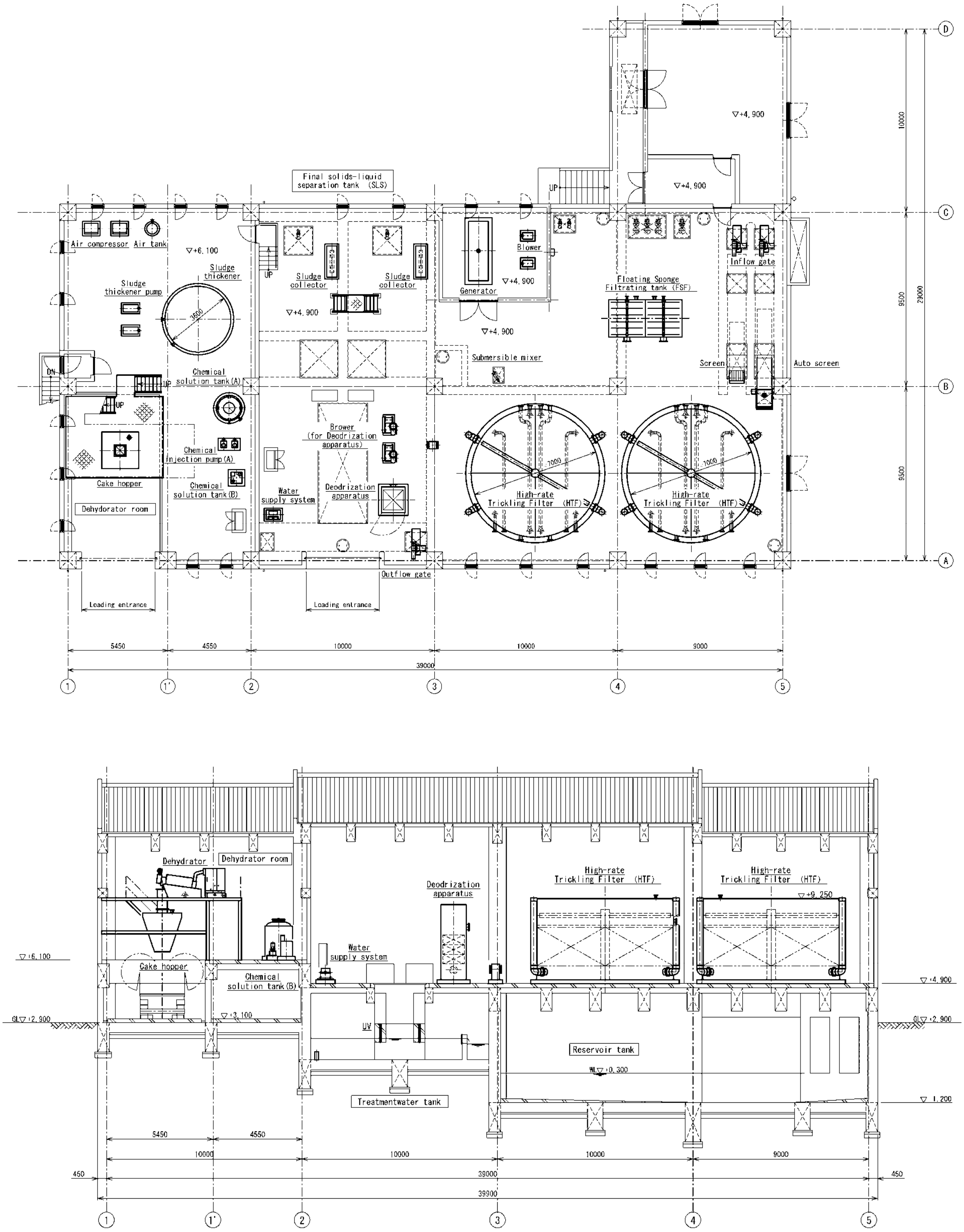


Figure 2.2.3-2 Cross Section of STP

(2) Rehabilitation of the Japanese Bridge Canal

Figure 2.2.3-3 shows the location of the section of the Japanese Bridge Canal to be rehabilitated and **Figure 2.2.3-4** shows cross section drawings with the design of the interceptor section.

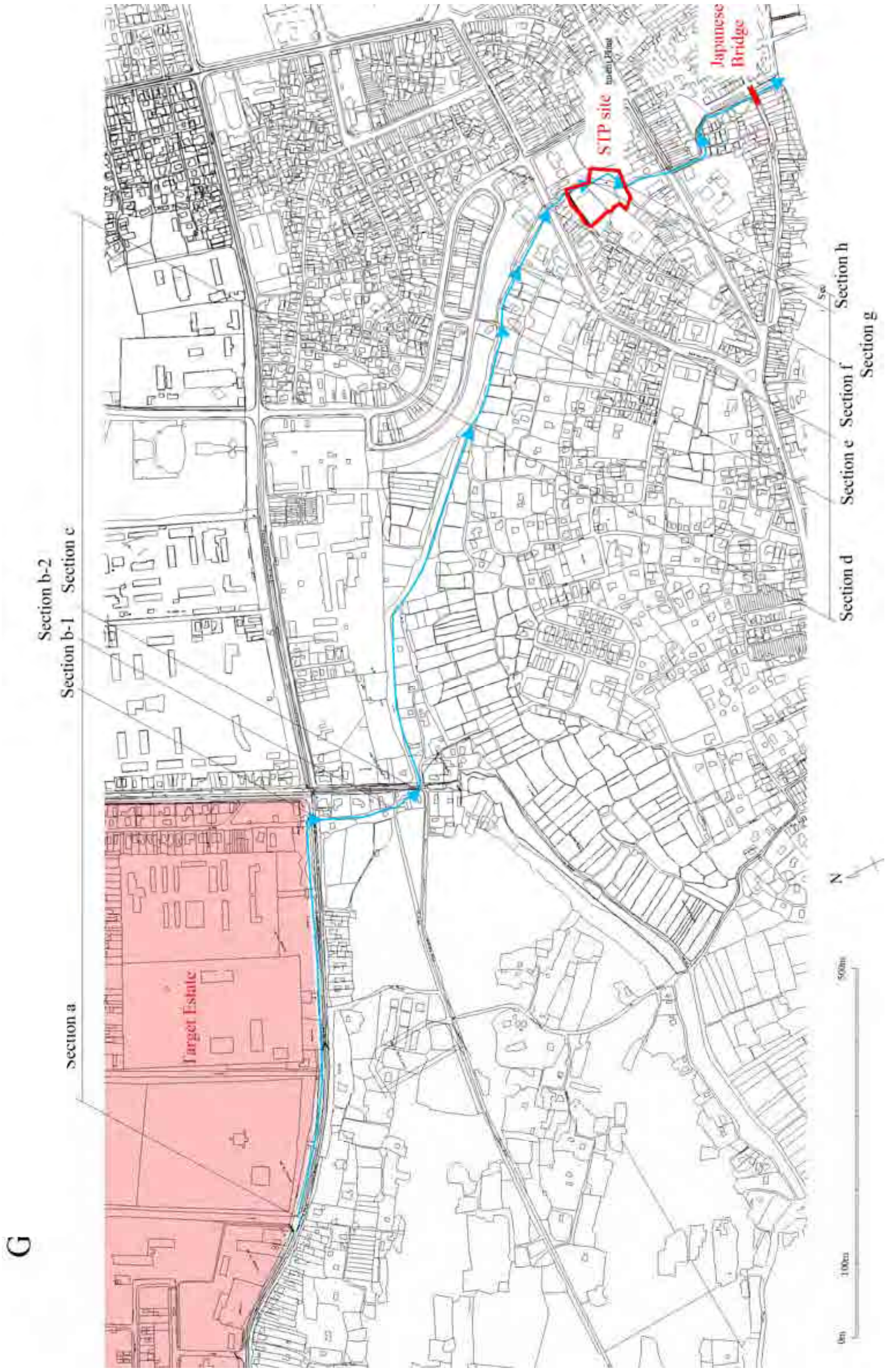


Figure 2.2.3-3 Location of the Section of the Japanese Bridge Canal to be Rehabilitated

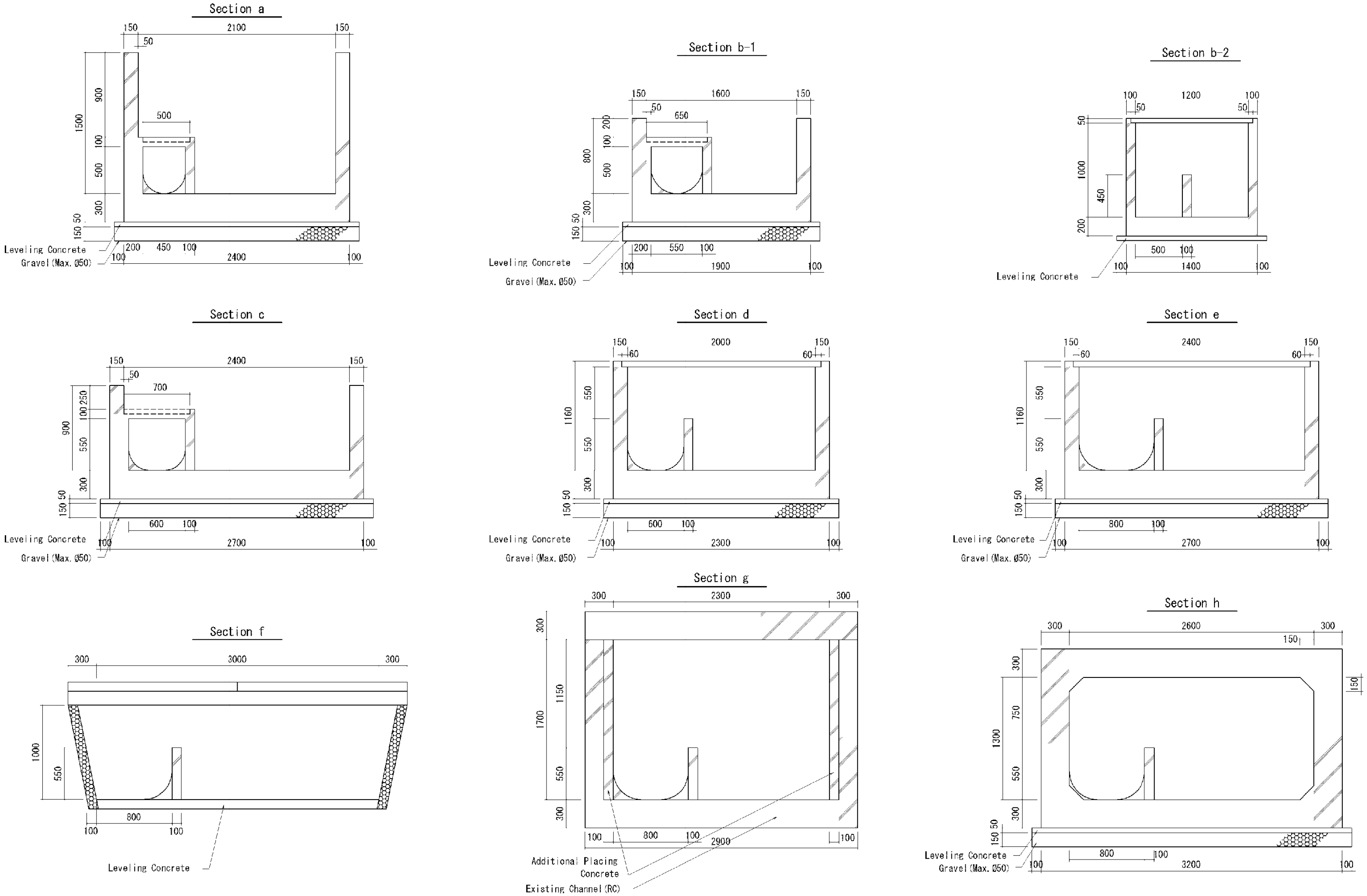


Figure 2.2.3-4　Cross Section Drawings of the Design of the Interceptor Section

The following design drawings are also prepared.

List of Design Drawings

No.	Facility	Title
A1	Rehabilitation of the Japanese Bridge Canal	General Map
A2	Rehabilitation of the Japanese Bridge Canal	Plan and Profile
A3	Rehabilitation of the Japanese Bridge Canal	Cross Section
B1	Sewage Treatment Plant	General Layout
B2	Sewage Treatment Plant	Flow Diagram of Sewage Treatment Plant
B3	Sewage Treatment Plant	Treatment Plant Building Elevation
B4	Sewage Treatment Plant	Treatment Plant Building Section
B5	Sewage Treatment Plant	Treatment Plant Building Plan
B6	Sewage Treatment Plant	Administration Building Elevation, Section
B7	Sewage Treatment Plant	Administration Building Plan
B8	Sewage Treatment Plant	Mechanical Process Flow Diagram
B9	Sewage Treatment Plant	Mechanical Plan View
B10	Sewage Treatment Plant	Mechanical Section
B11	Sewage Treatment Plant	Electrical Wiring Diagram
B12	Sewage Treatment Plant	Electrical Single Line Diagram
B13	Sewage Treatment Plant	Electrical Instrumentation Flow Diagram

2.2.4 Implementation Plan

2.2.4.1 Implementation Policy

(1) Organization for Project Implementation

Figures 2.2.4.1-1 to **2.2.4.1-4** show the organizations involved at each stage of project implementation, starting with the highest level and the beginning of the process.

1) E/N, G/A, DD, Tendering Stage

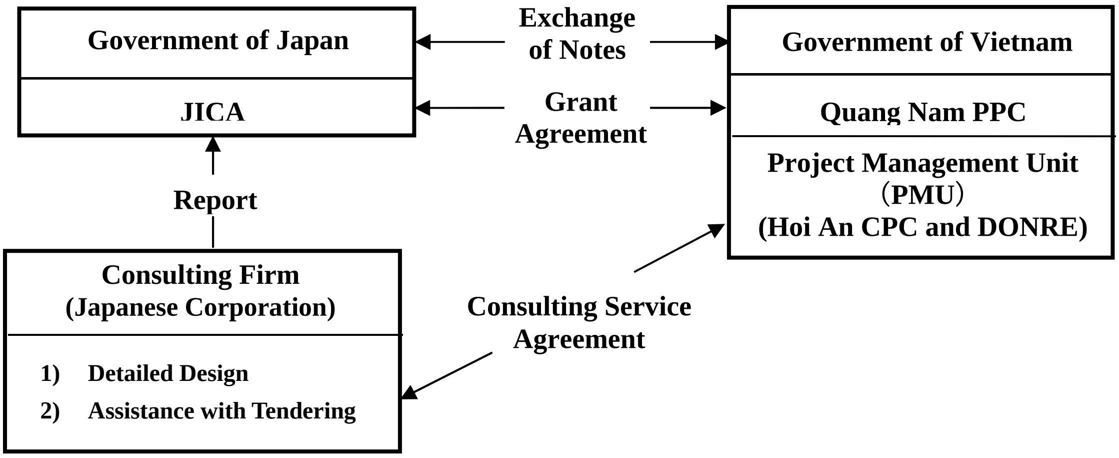


Figure 2.2.4.1-1 Organization of E/N, G/A, DD, and Tendering

2) Construction of Facilities and Procurement of Equipment Stage

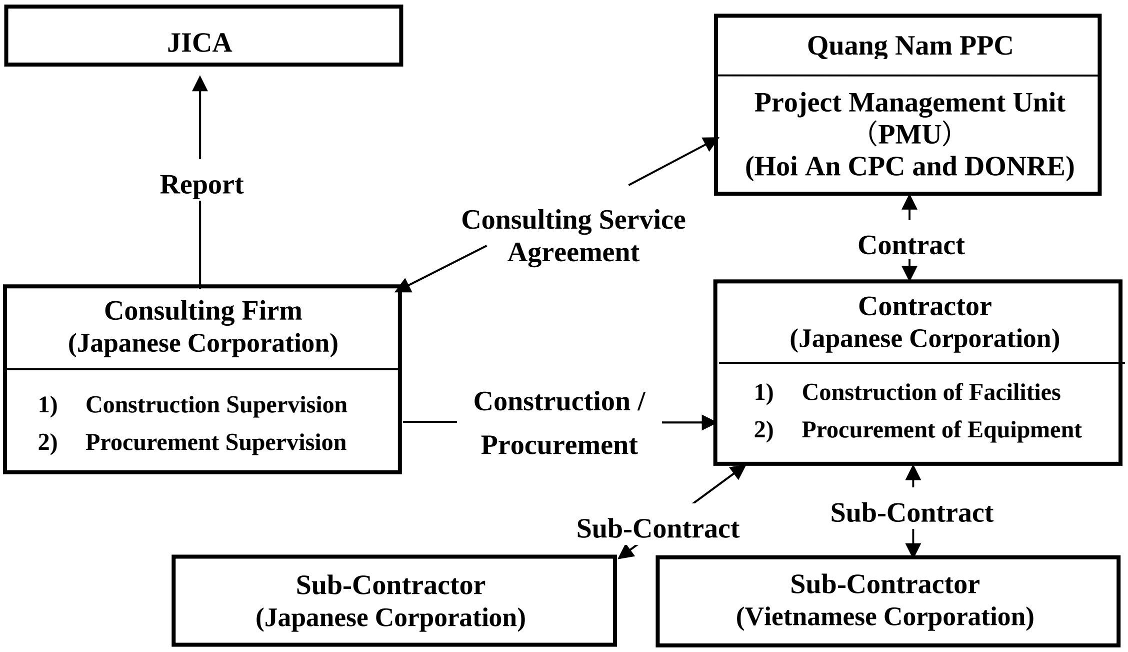


Figure 2.2.4.1-2 Construction and Procurement Stage

3) Trial Operation Stage

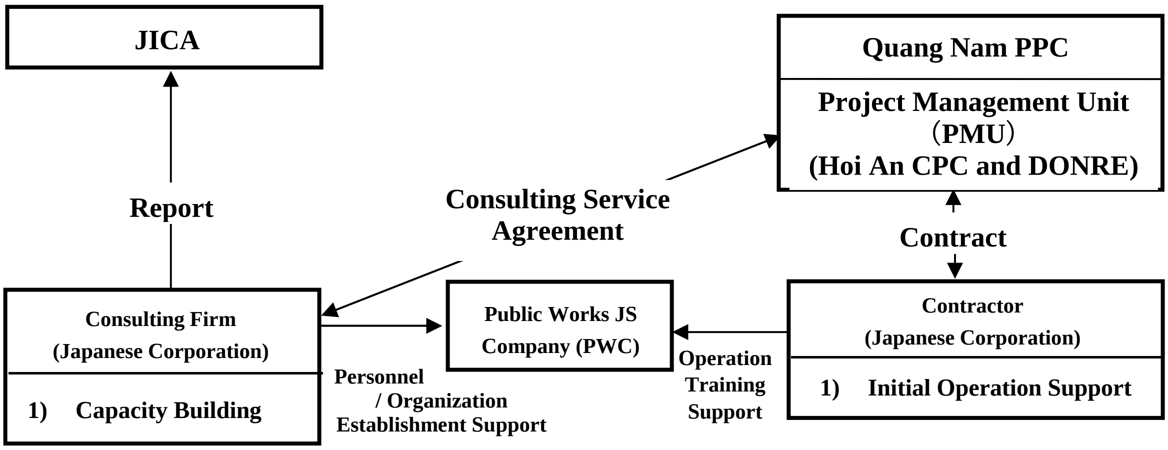


Figure 2.2.4.1-3 Trial Operation Stage

4) O&M and Equipment Replacement

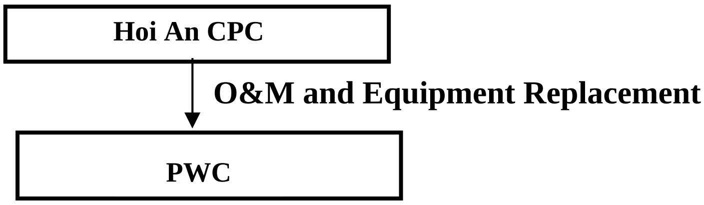


Figure 2.2.4.1-4 O&M and Equipment Replacement

(2) Involved Agencies

Quang Nam Provincial People's Committee (Quang Nam PPC) has the signing authority for the project. Hoi An City People's Committee (Hoi An CPC) is the implementing agency. Hoi An CPC's Division of Natural Resources and Environment (DONRE) works with the Japanese side to execute the project. The Project Management Unit (PMU), consist of staff from Hoi An CPC and DONRE, will be established following the signing of the Grant Agreement (G/A) between JICA and Quang Nam PPC. The Public Works Joint Stock Company (PWC) will operate and maintain the new facilities.

(3) Consulting Firm

A Japanese consulting firm will prepare the detailed design and supervise the construction of the work financed by the Japanese side.

(4) Construction Contractor

The construction contractor should also be a Japanese corporation. The contractor would mainly carry out civil construction of the sewage treatment plant and rehabilitation of the Japanese

Bridge Canal, as well as procurement of equipment. The company should be in the business of designing and building water and wastewater treatment plants, with sufficient capacity and experience, and capable of dispatching qualified engineers for the undertaking.

(5) Japanese Experts

It is necessary to dispatch Japanese engineers with expertise in the construction of treatment facilities, installation of electrical and mechanical equipment, conducting trial operations and testing the water-tightness of structures. The following engineers are needed to be dispatched as Japanese experts:

Facility Construction
- Site Representative Manager
- Civil Engineer (Sewage Treatment Plant)
- Architect
- Civil Engineer (Rehabilitation of the Japanese Bridge Canal)
- Mechanical Engineer
- Electrical Engineer

O&M Support
- Mechanical Engineer
- Electrical Engineer

2.2.4.2 Implementation Conditions

(1) Rehabilitation of the Japanese Bridge Canal and Dredging

A total length of 1.68 km of the Japanese Bridge Canal upstream from the new STP will be rehabilitated. The following conditions should be taken into consideration during the construction.

- The available construction area is within the walls of the canal. Expansion of the canal width or construction of new facilities beyond this area would be difficult.
- There are private houses and hotels adjoining the canal. In some areas, the canal walls have become part of the foundations for houses.
- A temporary approach road would be needed during construction. The land for the road should be leased.
- Garbage has been dumped inside the canal and in its surroundings, and contaminated soil has also accumulated around the canal. Removal of the garbage and treatment of the contaminated soil should be undertaken before starting any construction work.

- During construction, the flow would be stopped using sand bags, and the water pumped downstream.
- Dredging would be carried out manually without the use of heavy equipment to prevent any damage to the canal structure.

(2) Construction of Sewage Treatment Plant (STP)

The new STP will be constructed on a water spinach field located 300 m upstream from the Japanese Bridge. The following requirements should be taken into consideration:

- Temporary Access Road
    - Land to be improved by repeated surface compaction
    - Laminated steel plates to be put down

- Temporary Pipe Arrangement for the Japanese Bridge Canal
    - Arrange for dewatering with temporary pipe and pump for the Japanese Bridge Canal section inside the STP site during construction of STP

- Temporary Enclosure
    - Erect temporary fence in order to prevent noise, spreading dust, and people coming in from outside. Temporary fence should be able to withstand strong wind.

- Piling
    - Important to consider pile location, perpendicular line, quality control for the materials.

- Building Construction (1F)
    - Require earth retaining walls with drainage.
    - Important to achieve uniform settlement, and have sufficient compacting when pouring concrete.

- Surrounding Area
    - Improve land by repeated surface compaction
    - Construct retaining wall.

- Building Construction (2F)
    - Construct main frame with columns and joists, walls and roof with bricks

- Concrete
    - Important to cure sufficiently in order to prevent damage when installing

equipment.

- Installation of Equipment
    - Set temporary platform for bringing in equipment. Confirm equipment rotation and levelling in the setting of equipment, and fixing by anchor bolt.
    - Confirm carefully grounding of electrical equipment.

- Installation of Water Supply and Power Receiving Equipment
    - Coordinate with the GOV on the installation of water and power supply equipment.

(3) Procurement of Canopy Truck

Sludge produced through sewage treatment would be dewatered and transferred to Khan Son disposal site in Da Nang. A 4-ton canopy truck would be procured by the project for the transportation of the sludge. The truck would make the trip, with a load of 3.2 tons (0.8 t x 4 days), twice a week for the disposal of the 0.8 ton of sludge produced daily.

2.2.4.3 Scope of Works

The construction in the rehabilitation of the Japanese Bridge Canal and STP will be covered by Japanese Grant Aid. Power, city water, telephone, and drainage system from outside to the STP site will be conducted by the Vietnamese side. While the construction of a temporary approach road to the construction site will be carried out by the Japanese side, the costs for leasing the land shall be borne by the Vietnamese side. After the completion of the construction of new STP, the installation of fence and gate surrounding the site shall be carried out by Vietnamese side.
Details of obligations by the Vietnamese side are described in the following **Chapter 2.3**.

Table 2.2.4.3-1 Scope of Work

Components	Implementing Side
1. STP	
Construction	Japan
Power to site	Vietnam
City water, telephone, and drainage to site	Vietnam
Installation of fence and gate	Vietnam
Construction of a temporary approach road	Japan
Land leasing for a temporary approach road	Vietnam
2. Rehabilitation of the Japanese Bridge Canal	
Construction	Japan
Construction of a temporary approach road	Japan
Land leasing for a temporary approach road	Vietnam
Collection of wastewater from the downstream area of STP	Vietnam

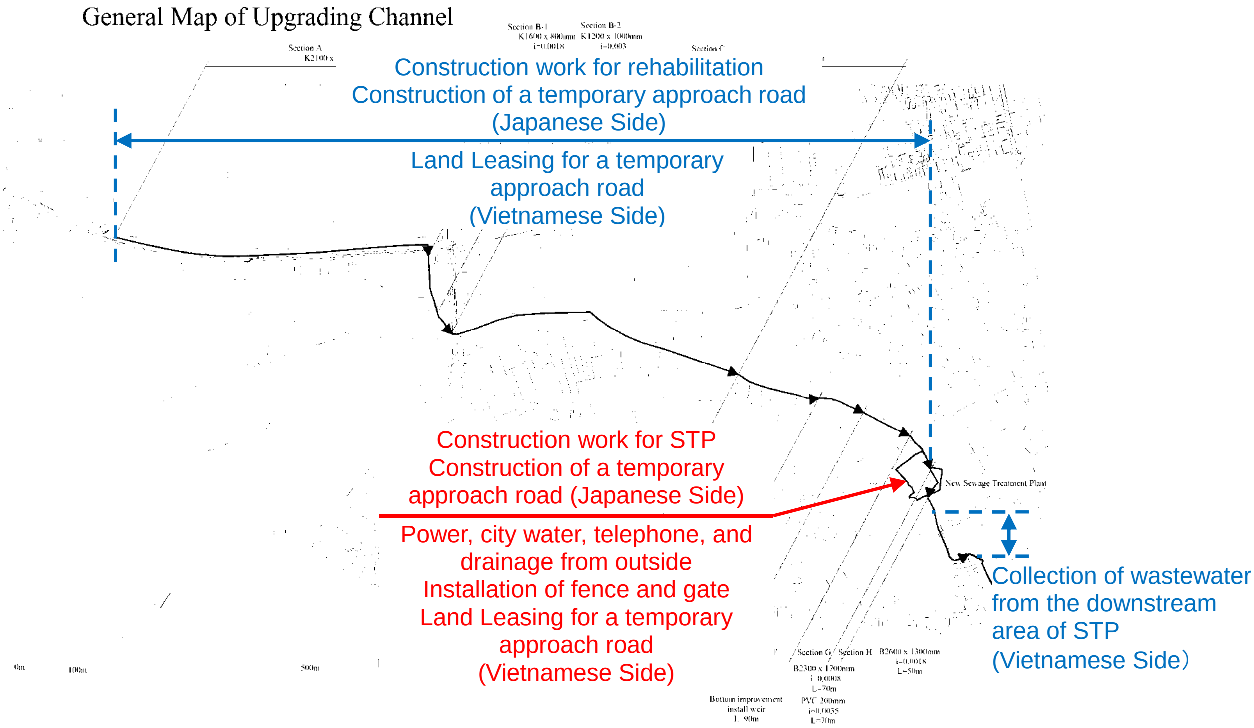


Figure 2.2.4.3-1 Scope of Work

2.2.4.4 Consultant Supervision

It is necessary to deploy one resident engineer to supervise the construction from the start to the inauguration of the facilities. Various specialists would also be dispatched at various times to supervise the construction of the different treatment facilities.

The selected consultant will perform the following supervisory work:

1) Check and approval of shop drawings
2) Factory inspection of major equipment and materials
3) Construction supervision
4) Final inspection
5) Trial operation and evaluation of facility performance
6) Inspection of construction materials
7) Reporting of construction progress to both Japan and Vietnamese sides
8) Technology transfer for operation and maintenance of the facilities
9) Assistance for the Vietnamese side on the necessary procedures for the execution of Japanese Grant Aid Project.

The following specialists will be dispatched.

(1) Project Manager

Scope of work:

- Prior to the commencement of the construction work, hold a meeting between the Vietnamese implementation agencies, consultant and contractors to confirm the list of obligations for each party, scope of the project, and implementation schedule.
- Confirm completion of work and evaluate whether the project is completed satisfactorily.
- Assist the implementing agency in the hand over to the Vietnamese side.

(2) Resident Engineer

The resident engineer will stay in Hoi An City and supervise all aspects of the construction work in the project, especially with respect to quality control and progress. The engineer will assist and instruct the contractor and submit monthly progress reports to the Vietnamese side. The scope of work is as follows:

- Maintain tender documents, drawings, standards, specifications, results of survey and soil investigation, and documents prepared and submitted by the contractor.
- Check and approve construction schedule, plan and shop drawings.
- Inspect and approve materials and equipment for the project.
- Inspect and approve construction work executed by the contractor.
- Monitor and manage the construction progress.
- Inspect safety features.
- Hold regular or ad-hoc meetings with the Vietnamese side, consultant, and contractor.
- Check and approve as-built drawings.
- Assist with the work to be carried out by the Vietnamese side.
- Check shop drawings, supervise construction activities as well as test procedures, provide instruction and advice.

(3) Specialists

Different specialists will be needed at various stages of the construction phase. They will also help with technology transfer during the trial operation period. They will perform the following tasks during their project assignment:

> Check shop drawings, perform general supervision, supervise trial operation, provide instruction and advice in their respective fields of expertise.

The specialists to be dispatched are:

a) Civil Specialist (Sewage Treatment Facility)

b) Architect

c) Mechanical and Electrical Specialist

d) Specialist for procurement of equipment

2.2.4.5 Quality Control Plan

The construction of the facilities has to follow the technical specifications in the detailed design prepared by the consultant. **Table 2.2.4.5-1** shows the quality control plan with indicators, control methods, and applicable standards.

Table 2.2.4.5-1 Quality Control Plan

Category	Item	Target Requirement	Method of Control	Applicable Standards	Frequency of Test	Records	Remarks
Mechanical and Electrical Equipment	Equipment panel	Conform to specifications	Observation Shop drawing Test report		When received; factory inspection	Record Test Result Table Approval Drawings	In the presence of Consultant
Pipe Material	Ductile cast iron pipe	Conform to standards	Shop drawing		For each pipe laying section	Approval Drawings	
		Type	Observation		For each type、when received	Record	In the presence of Consultant
Concrete Material	Reinforcing bars	Type of re-bar（deformed, round）	Observation	JIS G 3112 JIS G 3117	When received; for each type		In the presence of Consultant
		Conform to standards	Test report			Test Result Table	
	Cement	Type of cement	Observation	JIS R 5210	When received.	Record	In the presence of Consultant
		Conform to standards	Test report			Test Result Table	
	Water	Piped water or clear river Water	Observation	－	When mixed	Concrete Mixture Table	In the presence of Consultant
		Water quality（river Water）	Water quality test	JIS A 5308 Appendix 9	Before mixture design	Test Result Table	
	Aggregates	Maximum diameters of aggregates	Observation	Reinforced concrete： 25mm	When Received.	Record	In the presence of Consultant
		Grain size	JIS A 1102	JIS A 5005	Before mixture design	Test Result Table	
	Concrete mixture	Conform to standards	Test Report	JIS A 6201-6207	When received	Test Result Table	When necessary.
	Storage of materials	Place and storage conditions	Observation	－	When necessary.	Report	In the presence of Consultant

Category	Item	Target Requirement	Method of Control	Applicable Standards	Frequency of Test	Records	Remarks
Concrete Placing Work	Concrete design mixture （major structures）	Test mixture	Confirmation of quality	28 day strength：21N/mm2 Slump:10.0±2.5cm Air Content:±1.5% W/C Ratio : less than 65% (less than 55% for water retaining structure Cement:: more than 270kg/m^3)	Once before placing	Test Result Table	In the presence of Consultant
	On-site concrete mixture	Water content of small aggregate surface	JIS A 1111,1125	－	Each mixing	Test Result Table	In the presence of Consultant
		Grain size of aggregate	JIS A 1102	JIS A 5005	When received	Test Result Table	
		Temperatures of water and aggregates	Temperature measurements	－	Each mixing	Test Result Table	In the presence of Consultant
		Water and cement volumes		Error: less than1％			
	Slump	Conform to specifications	JIS A 1101	10.0±2.5cm	Each placing	Test Result Table	In the presence of Consultant
	Air	Conform to specifications	JIS A 1128	±1.5%	Each placing	Test Result Table	In the presence of consultant
	Compressive Strength	Laboratory	－	Approval of Consultant	Prior to the test	－	
		Sampling	JIS A 1132	7 day strength: 3 pcs 28 day strength：3 pcs	Every 50 m^3 placing or once per day once for one consecutive placing work	－	In the presence of consultant
		Conform to specifications	JIS A 1108	Design strength= 24 N/mm2	Every 50 m^3 placing or once per day once for one consecutive placing work	Test Result Table	
	Leakage Test （ALL Tank）	Conform to specifications	Water level measurement, observation	No water level draw-down after 24 hours	After the structure is constructed	Test Result Table	In the presence of consultant

2.2.4.6 Procurement Plan

(1) Procurement of Materials and Equipment

Construction materials and equipment would be, in principle, procured in Vietnam and Japan. Sourcing of materials and equipment would take into account the following:

- Meeting quality requirement
- Locally sourced products are of acceptable quality and can be supplied in the quantity needed

- Easy to operate and maintain, spare parts are readily available
- Appropriate price
- Available after-sale service

The construction materials (e.g. cement, sand and steel bar) would be procured in Vietnam. Mechanical and electrical equipment would be procured from Japan. The procurement plan is shown in **Table 2.2.4.6-1**.

Table 2.2.4.6-1 Procurement of Construction Materials and Equipment

Name of Material	Source of Procurement			Remarks
	Japan	Vietnam	Third Countries	
1. Construction Material				
Ready Mixed Concrete		✔		
Sand and Gravel		✔		
Cement		✔		
Steel Bar		✔		
Formwork Wooden Plate		✔		
Wood		✔		
Steel Sheet Pile and H-shape Steel Pile		✔		
Galvanized Steel Plate		✔		
Paints		✔		
Lubricant		✔		
Fuel		✔		
Synthetic Wood Lid	✔			
Scaffolding and Support		✔		
2. Equipment				
Pumps	✔			
Sewerage Treatment Equipment	✔			
Electrical Equipment and Panels	✔			
Monitoring and Control Devises	✔			

(2) Transportation Plan

Transportation plan for materials and equipment is as follows:

1) Materials and equipment procured in Japan:
   i) delivered to Yokohama Port by manufacturer,
   ii) sea transportation to Da Nang Port,
   iii) land transportation by truck to Hoi An City and stockyard.

2) Materials and equipment procured in Thailand:
   i) to Da Nang, or Ha Noi, or Hue by manufacturer,
   ii) land transportation by truck to Hoi An City and stockyard.

Route of land transportation to Da Nang and Hoi An is shown in **Figure 2.2.4.6-1**.

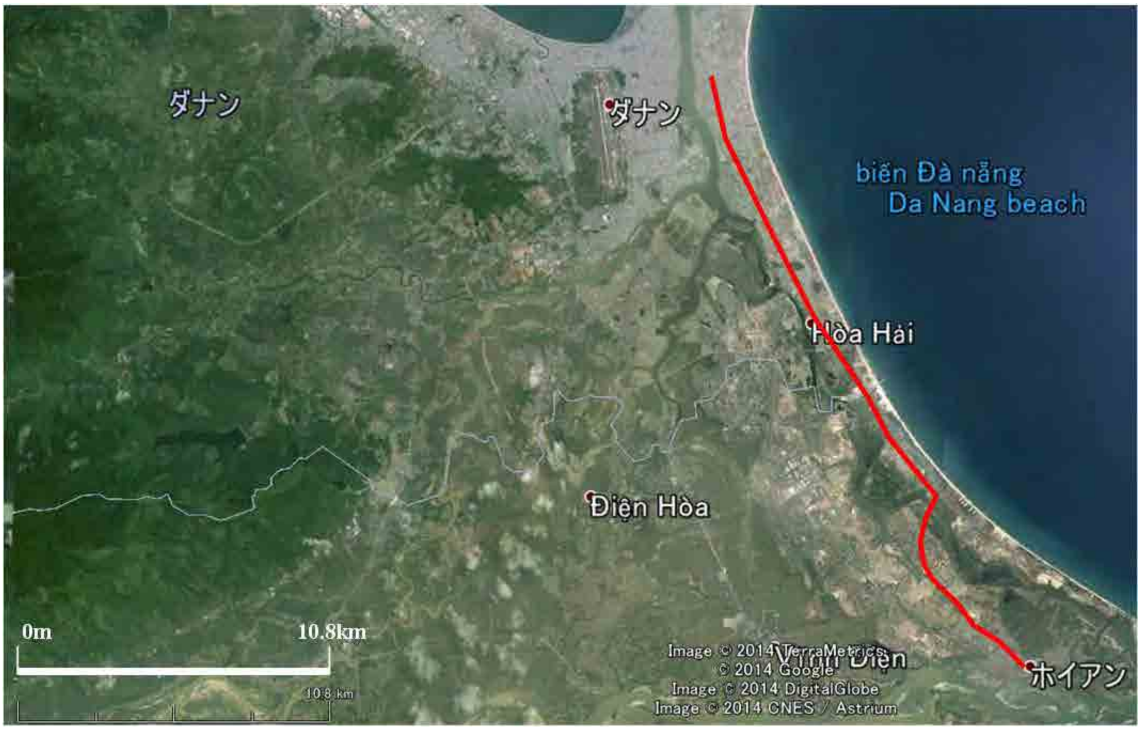


Figure 2.2.4.6-1 Route for land transportation to Da Nang and Hoi An

2.2.4.7 Operational Guidance Plan

Vietnam has no previous experience in the operation of the sewage treatment plant to be constructed by this Project. After completion of the facilities, the contractor would dispatch engineers to check the operating conditions and to transfer the technical know-how on the operation and maintenance of the equipment. The basic objective of this “Total Test Operation” is to realize the condition to be able to generate stable treated water for one month after cleaning of tank.

The engineers would guide the measurements of raw and treated wastewater volumes, as well as sludge weight, start up and shut off of equipment and pumps, opening and closing of valves. In case of malfunctions, they would guide for the trouble shooting. They would also help with the management of the integrated operation of the treatment facilities, support the establishment and use of information database, and preparation of O&M manuals. Furthermore, guidance on daily operational routines would be provided, including O&M record keeping, preparation of tracking forms and response to warning signals.

In the Total Test Operation, several engineers, such as; electrical engineer and mechanical engineer, are planned to be dispatched for 1 month commissioning (Total Test Operation 1) and 6 month after that (Total Test Operation 2) intermittently.

2.2.4.8 Soft Component (Technical Assistance) Plan

Details of Soft Component (Technical Assistance) Plan are described in “Appendices 5 Plan of Soft Component”.

In many developing countries, the STPs funded and built by donors may not be properly operated or maintained after commissioning because of the lack of technical expertise, problems with equipment procurement and securing the proper operational budget. The facilities may end up in disrepair or disuse.

In order to operate and maintain the sewerage facilities constructed by this project perpetually, and to continue generating benefits of this project by improving water quality of the Japanese Bridge Canal, the project’s O&M staff and the department of PWC for cleaning and maintaining the sewer must have adequate technical skill to perform their tasks fully by the time of completion of the project facilities. Furthermore, in order to generate necessary budget enough for staff allocation, O&M, and replacement of equipment, financial responsible sections of PWC and other related organizations must have the skills of financial planning and budget control.

Proposed Soft Components cover 3 fields of activity. Following sentences explain the outline of these Soft Components.

1. Operation and Maintenance Guidance of Sewage Treatment System
2. Maintenance Guidance of the Japanese Bridge Canal
3. Sewerage Financial Management Planning Assistance

(1) Operation and Maintenance Guidance of Sewage Treatment System

In Hoi An City, there is currently no fully-fledged Sewage Treatment Plant, nor any experience of O&M of the STP in PWC. Therefore, O&M staff of newly established O&M section of this project and the other related PWC staff shall be trained through Soft Component regarding O&M of the Sewage Treatment System.

During the Total Test Operation period, the contractor will carry out the training on how to operate individual mechanical equipment, guidance on combination operation of the equipment of STP, support on establishment of facility information database and guidance on how to use it, and support on preparation of the O&M manual and O&M record format. On the other hand, the consultants shall conduct support on planning of O&M organization through the Soft Component. In concrete, job demarcation among sewerage sector related agencies of Hoi An CPC and PWC, preparation support and explanation of job description of them. Furthermore, the Soft Component shall assist the preparation of Terms of Reference (TOR) of training on C/P by contractor during Total Test Operation.

(2) Maintenance Guidance of Japanese Bridge Canal

The PWC Construction Works Team responsible for cleaning and dredging of sewers and drains has the capability to carry out the maintenance of the Japanese Bridge Canal. However, the maintenance has not been carried out in sufficient regularity. There is no dedicated maintenance plan, as a result not enough workers are allocated to the required tasks.

Therefore, in this Project, a Soft Component for improving the capacity of inspection and cleaning of the Japanese Bridge Canal shall be conducted, targeting the Construction Works Team and the Technical & Planning Department of the PWC, which is to plan and guide cleaning and dredging works, the other related staff of Hoi An CPC and PWC. This includes learning how to allocate staff, prepare easy to understand manuals, report daily tasks in proper format, awareness raising of senior management when more workers may be required.

(3) Sewerage financial management planning assistance

In Hoi An City, this project will establish a sewerage system with a STP in the first place. If the budgetary system is not established properly to allocate an adequate annual O&M and replacement budget, there is a possibility that the entire sewerage system would be lost due to the breakdown of equipment in the near future.

The PWC also carries out collection and transportation of solid waste, conservation of roadside trees, maintenance of street lights, and so on. In the event that the O&M section of the STP falls under the remit of the PWC, a budget and actual expenditure for the O&M section shall be compiled for the PWC as a whole. Therefore, income and expenditure status for the sewerage service alone becomes unclear. In order for an adequate sewerage budget to be allocated continuously to the O&M section, income and expenditure for the sewerage service must be calculated precisely every year, and then, any surplus or deficiency must be reflected in future budget plans.

Training would be provided on financial management of sewerage systems for managers in the O&M section, Finance Department and Division of Finance ‐ Planning and other involved personnel at Hoi An CPC, responsible for the budget planning and accounting for the O&M

section.

In this Soft Component, the following guidance and support shall be provided; guidance on the importance of budgetary arrangements for sewerage O&M and equipment replacement costs, guidance on preparation and routine use of accounting documents, preparation of annual income - expenditure format exclusively, support on budget request for the next fiscal year, support on preparation of future budget plan including replacement cost.

2.2.4.9 Implementation Schedule

Figure 2.2.4.9-1 shows that the detailed design period will be about 4.0 months; pre-qualification, tendering, negotiation, and contract signing period will be about 4.0 months; verification by JICA will be about 1.0 month after signing of the contract; procurement and construction will be 18 months; commissioning will be 1 month before completion of STP construction; verification of commissioning will be 6 month after completion of STP construction. Technical assistance on capacity building will be 15 months.

The estimated periods for procurement and construction take into consideration the possible loss of work days in the rainy season from September to December. It would be preferable that the substructure of the STP be completed before the beginning of the rainy season.

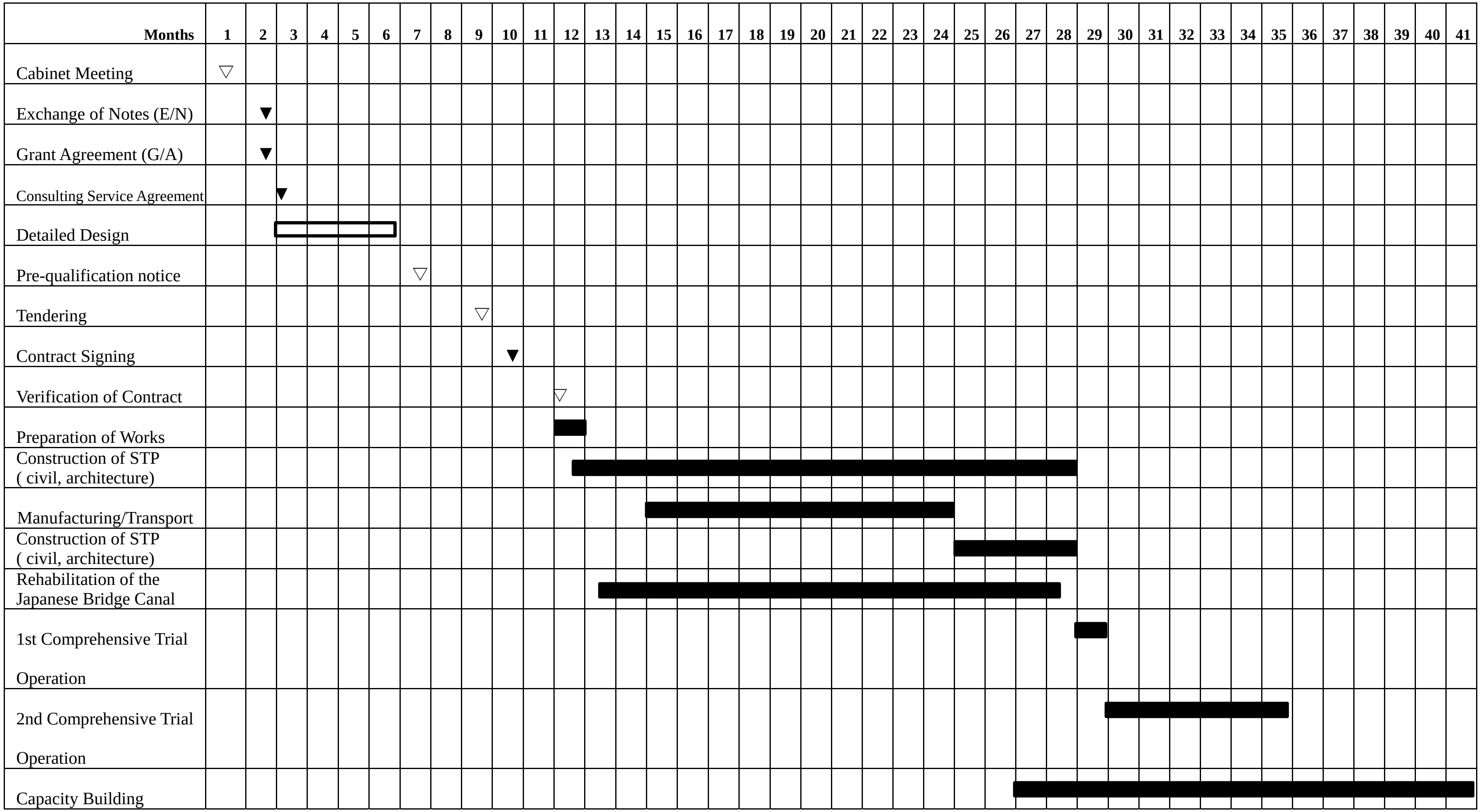


Figure 2.2.4.9-1 Implementation Schedule

2.3 Obligations of Recipient Country

2.3.1 Responsibilities of the Vietnamese Side

The required tasks for the Vietnamese side are shown in **Tables 2.3.1-2**, **2.3.1-3** and **2.3.1-4** for completed ones and those to be carried out before tendering, during the construction and after the construction of STP. While the project is in the buffer zone in the World Heritage area and does not need to obtain the permission from UNESCO, the Vietnam side would share the information of the project with UNESCO before project implementation.

Table 2.3.1-1 Responsibilities Completed by the Vietnamese Side

	Action	Status
1	Land Acquisition and Compensation	Land acquisition and costs for the STP site were approved by Hoi An CPC (Decision No.781/QD-UBND, dated April 10th, 2014). Payment of compensation to private land owners was completed on April 23rd, 2014.
2	Approval for Environmental Impact Assessment	Approval of the EIA report for the Project was issued by Quang Nam Province, according to Decision No.1643/QD-UBND dated May 29th, 2014.
3	Consensus Building with Residents	Hoi An CPC conducted consensus building with residents,.The Minutes of Meeting for Community Participation and Opinions from Cam Pho Ward PC is attached to the approved EIA report.
4	Authorization for Project Implementation	Approval of Pre-F/S Report for the Project was issued by Quang Nam Province, according to Decision No.2558/QD-UBND dated August 20th, 2014.

Table 2.3.1-2 Actions Required on the Vietnamese Side (Before Contract Tendering)

	Action	Timing
1	Establish Project Management Unit (PMU)	March 2015
2	Make banking arrangements	Just after E/N
3	Engagement of Consultants	
4	Inform UNESCO	
5	Secure permission to lease land for temporary approach road to the STP site	After the engagement of consultants and before contract tendering.
6	Secure permission to lease land for temporary approach road to the Japanese Bridge Canal	
7	Arrange temporary storage area for construction materials	
8	Arrange site for soil disposal	
9	Clear area of landmines	
10	Confirm detailed design with Hoi An Centre for Monuments Management and Preservation	After detailed design and before tendering
11	Explain the project to nearby residents	
12	Approve detailed design	Before tendering

Table 2.3.1-3 Actions Required in the Vietnamese Side During Construction

	Action	Timing
1	Obtain Permit for Construction	After signing construction contract
2	Explain construction activities to nearby residents	
3	Assign new staff for O&M	
4	Train staff for O&M	
5	Select trainees for capacity building	
6	Enforce safe construction practices	During construction
7	Monitor impacts on the environment	
8	Secure sludge disposal site	Before trial operation
9	Connect power and water supply, and telephone line to project site	
10	Install fences and gates around the project site	Before the completion of construction
11	Construct a collection system for wastewater from the downstream area of the STP plant	Before the completion of construction (based on the Letter No. 824/UBND dated April 4th, 2014)

Table 2.3.1-4 Actions Required on the Vietnamese Side After Construction

	action	Timing
1	Environmental Monitoring	During the operation of STP
2	O&M of STP	
3	Securing the budget of STP	
4	Capacity Development of Staff	

Tax arrangement, expected assistance and support from the Vietnamese side are shown in **Table 2.3.1-5**.

Table 2.3.1-5 Tax Arrangement, and Expected Assistance and Support from the Vietnamese Side

	Items	Description
1	Custom	Facilitate smooth custom procedures when products and materials are imported to Vietnam.
2	Tax Exemption	Grant tax exemption on the purchase of products and the services for the project.
3	Embarkation and Disembarkation	Facilitate documentation and visa arrangements for staff dispatched from the Japanese side for the project.

2.3.2 Land Acquisition and Compensation

No land acquisition is required for the rehabilitation of the Japanese Bridge Canal. Land acquisition from three private owners (totaling around 2,800 m^2), and one public entity (around 800 m^2), is required for STP construction. No resettlement is required in either project.

Land acquisition and costs for the STP site were approved by Hoi An CPC (Decision No.781/QD-UBND, dated April 10th, 2014). Payment of compensation to private land owners was completed on April 23rd, 2014.

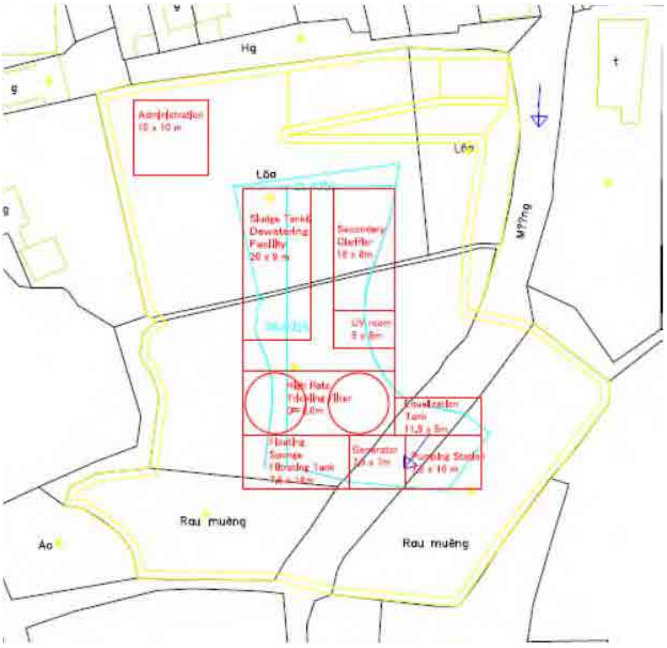
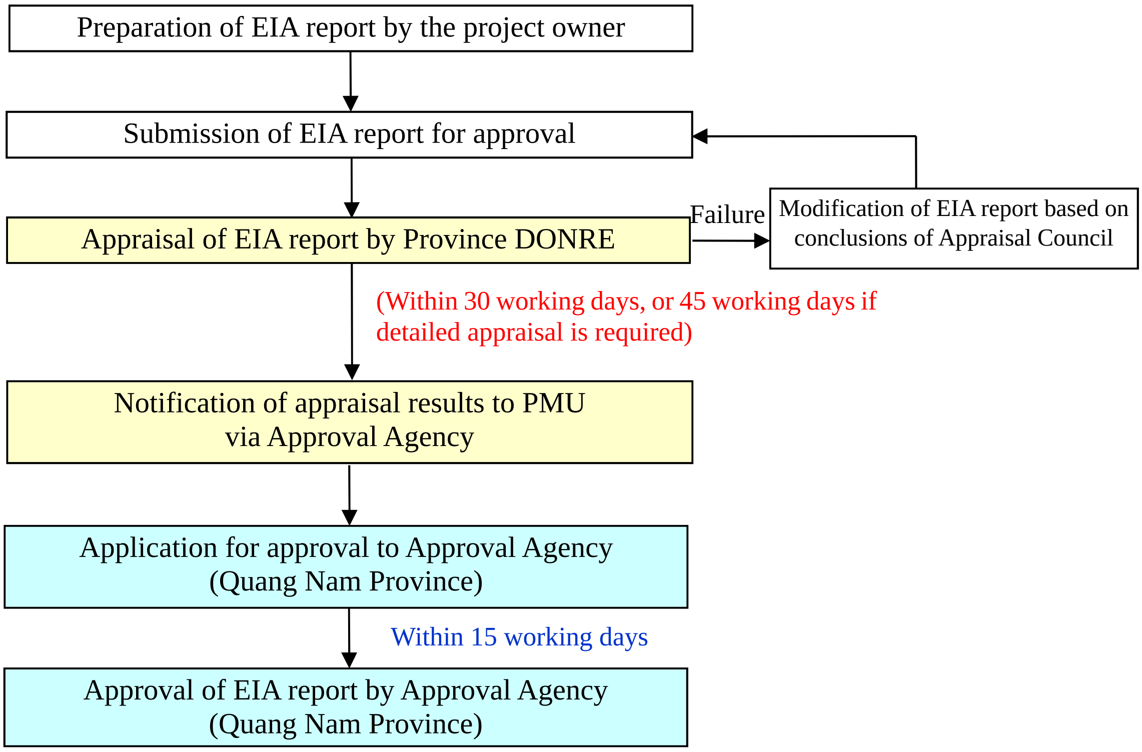


Figure 2.3.2-1 STP Site and Layout

2.3.3 Approval for Environmental Impact Assessment

According to Decree No. 29/2011/ND-CP, if a project is located in a World Heritage Site the appraisal and approval authority for the EIA report is the Ministry of Natural Resources and Environment (MONRE). However, the project area is not located in the World heritage Site (Zone I of the historical preservation area) but in Zone II-A which is a buffer zone for historical preservation area. Therefore, the appraisal authority for EIA report is the Department of Natural Resources and Environment in Quang Nam Province (Province DONRE) and the approval authority for EIA report is Quang Nam Province (according to Letter No: 268/STNMT-BVMT dated March 28th, 2014 issued by Quang Nam Province to Hoi An CPC).

The procedure for appraisal and approval of the EIA report in the project is shown in **Figure 2.3.3-1**.



(Source: JICA Survey Team)

Figure 2.3.3-1 Procedure for Appraisal and Approval of EIA Report

Approval of the EIA report for the Project was issued by Quang Nam Province, according to Decision No.1643/QD-UBND dated May 29th, 2014.

2.3.4 Consensus Building with Residents

Hoi An CPC conducted consensus building with residents. The following documents are records of the consensus building effort and these are attached to the approved EIA report.

1) Minutes of Meeting on Community Participation

- Participants: land owners of the planned STP site, concerned residents and business enterprises (hotels and kindergarten)
- Outcome: acceptance of the project and request for environmental consideration

2) Opinions from Cam Pho Ward PC (Letter No 86/CV-UBND dated April 3rd, 2014)

- The EIA report is appropriate for evaluation of environmental impacts for residents and society concerned.

- Acceptance of mitigation measures mentioned in the EIA report and request for their implementation.

2.3.5 Authorization for Project Implementation

Pre-F/S Report for the Project was prepared and submitted to the Department of Planning and Investment (DPI), Quang Nam PPC for review and for forwarding to Quang Nam Province PPC for approval.

Approval of Pre-F/S Report for the Project was issued by Quang Nam Province, according to Decision No.2558/QD-UBND dated August 20th, 2014.

2.3.6 Establishment of Project Management Unit (PMU)

The Project Management Unit (PMU) would be established for project implementation in Vietnam in December 2014.

2.3.7 Establishment of Operation and Management (O&M) Unit

Letter No.1383/UBND dated May 26th, 2014 issued by Hoi An CPC, confirmed that an operation and maintenance (O&M) unit for the new STP will be established in the Public Works Joint Stock Company. The new O&M management framework should be organized as soon as the contract between the PMU and the contractor is verified by JICA. The details of the organization is discussed in **Chapter 2.4**.

2.3.8 Power and Water Supply to the Project Site

Installation of substation facilities at the STP site will be included in Japanese Grant Aid, and installation of power lines from outside to the new substation facility will be carried out by the Vietnamese side. The construction of facilities for water supply, a telephone line, and drainage inside the STP site will be done by Japanese Grant Aid, and those from outside the site will be constructed by the Vietnamese side.

2.3.9 Land Leased for Temporary Approach Road during Construction

(1) STP

A temporary approach road to the STP during the construction phase is planned for the east side of the STP on private land. This road is mentioned in the approved EIA, and Hoi An PPC is preparing for the leasing of this land.

(2) Rehabilitation of the Japanese Bridge Canal

It is necessary to secure a temporary approach road and a temporary stock yard, as well as cut down some of the bamboo forest.

The land required for a temporary approach road is shown in **Figure 2.3.9-1**.

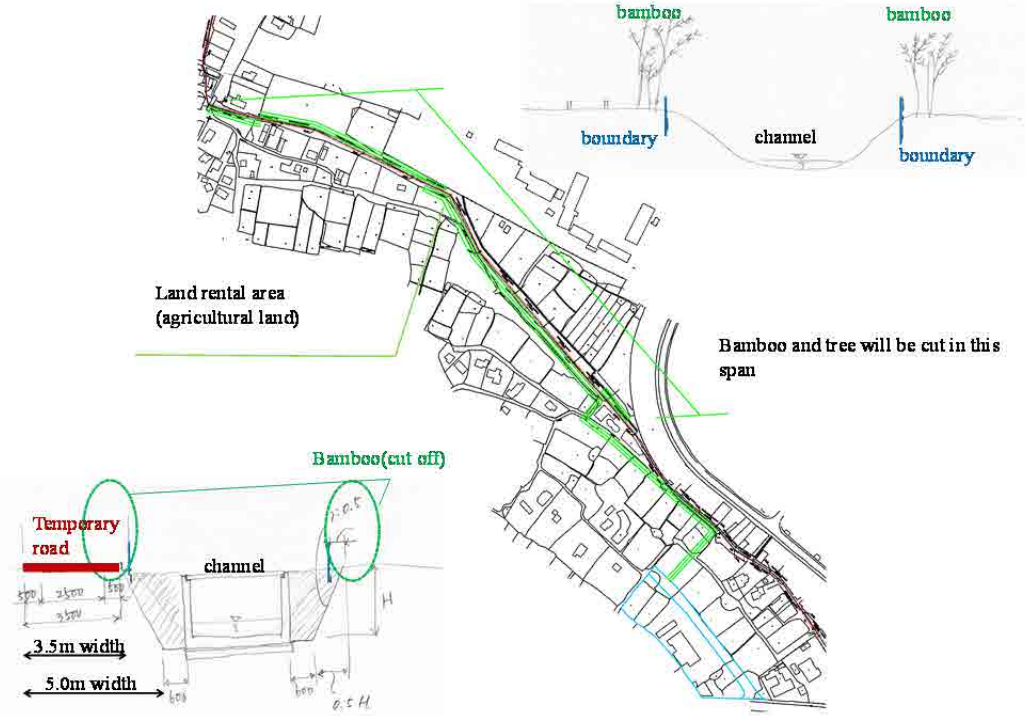


Figure 2.3.9-1 Temporary Approach Road for Rehabilitation of the Japanese Bridge Canal

2.3.10 Installation of Fence and Gate around the Project Site

After construction is completed for the new STP, the Vietnamese side will install a fence and gate around the STP site..

・Fence：H 1.6 m x 250 m, brick and mortar
・Gate：H 1.8 m x 6 m, painted steel

2.3.11 Collection System for Wastewater from Area Downstream of STP

The wastewater from PHAN CHU TRINH Street located downstream of the new STP will be collected by the “Project for Solid Waste, Wastewater Treatment and Environmental Protection in Hoi An”(AFD Project) when this project is completed in the future. In the meantime, the untreated wastewater is discharged into the Japanese Bridge Canal. The wastewater from the surrounding area of LAI VIEN KIEU Pond outside of the AFD Project area is also flowing into the Japanese Bridge Canal downstream of the new STP.

It is necessary to collect and transmit the wastewater to the new STP, in order to improve the water quality in the Japanese Bridge Canal. It is proposed that a (480 m) pipe be installed for this purpose as shown in **Figure 2.3.11-1**. The estimated cost for this pipeline is about 4,012 million VND (VND 1 = 0.0048855 JPY).

The construction for collection system of wastewater downstream of the STP is not included in this project, and will be conducted by the Vietnamese side, as stated in Letter No.824/UBND dated April 4th, 2014 issued by Hoi An CPC.

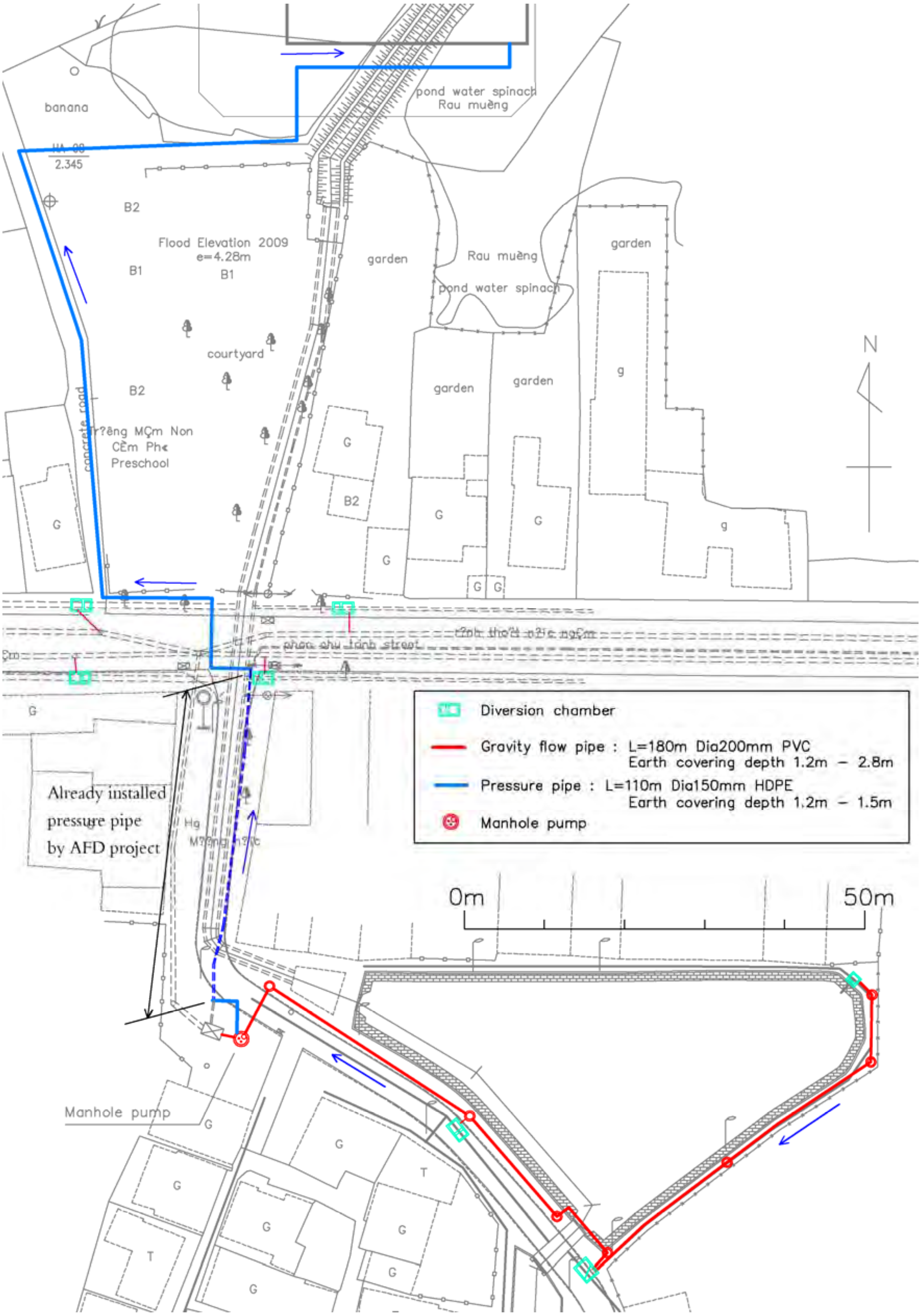


Figure 2.3.11-1 Proposed Collection of Wastewater from Area Downstream of STP

2.3.12 Design Evaluation

Design evaluation takes place at the F/S stage and again at the detailed design evaluation stage. Quang Nam PPC evaluates the design at the F/S and detailed design stages. The Ministry of Construction advises Quang Nam PPC when required, in this process.

A Japanese and Vietnamese research group evaluated and recommended the use of the Pre-treated Trickling Filtration Process (PTF), a new sewage treatment technology used in Da Nang. The PTF process is described in the F/S report. This is approved by Quang Nam PPC (Approval letter on August 20th, 2014 No: 2558/QD-UBND). The Vietnamese side will take the necessary steps to get the approval for the detailed design of the project even though the PTF process has not been fully evaluated at provincial level.

2.4 Project Operation Plan

2.4.1 Tasks and Responsible Section for Operation and Maintenance

The general operation and maintenance (O&M) tasks of the sewerage service industry are shown in **Table 2.4.1-1**.

Table 2.4.1-1 General O&M Tasks of Sewerage Service Industry

No.	Major Tasks
1	General affairs
2	Budget control
3	Asset management
4	Guidance on private sewer*
5	Monitoring and guidance on office drainage
6	Maintenance of Sewer System
7	Maintenance of drain
8	Maintenance of pumps and Sewage Treatment Plant (STP)
9	Tasks related to water quality control
10	Management of Sewerage Ledger
11	Tasks related to Environmental Preservation
12	Environmental Education
13	Improvement of resident’s consciousness for connecting to sewer
14	Other tasks

Note: *; Private sewer: Sewer facility from private land / building to public sewer system.
Source: prepared by JST

In this project, the Hoi An CPC shall have the responsibility to secure the required budget. PWC will conduct the O&M of the facilities. The O&M capacity of the project for both parties shall be improved with the assistance by Soft Component.

Table 2.4.1-2 shows the O&M tasks after construction completion. The table shows the allocation of tasks to each responsible section in the PWC, including the new O&M section to be established.

Table 2.4.1-2 Responsibility of Hoi An CPC and PWC for Sewerage O&M Tasks

Organization	Responsible Section	Major Tasks
Hoi An CPC	Division of Finance - Planning	Secure budget
PWC	Personnel Dept.	General affairs
	Financial Dept.	General affairs, budget preparation, budget control
	Business Dept.	Public relation, customer relations
	Several Depts. of PWC	Environmental preservation, and related responsibilities
	New O&M Section	Budget execution, public relations Asset management (including management of sewerage ledger) O&M planning & implementation, for pumping station and treatment facility. Water quality control Understanding and improvement of safety and hygiene control
	Technical & Planning Dept.	Public relations, assset management (management of sewerage ledger), Guidance on private sewer Monitoring and guidance on office drainage Planning & supervision of maintenance of sewer system Planning & supervision of maintenance of drain
	Construction Works Team	Inspection and cleaning of drain and sewer

Source: prepared by JST

Tasks of general affairs, budget control and tasks related to environmental protection in **Table 2.4.1-1** are assumed to be carried out by existing sections in the PWC, depending on their necessities. Regarding draft budget preparation, financial statement preparation, and budget execution control, the Financial Dept., PWC, takes main responsibility for the tasks, with partial assistance of the new O&M section. On the other hand, in terms of maintenance (inspection and cleaning) of drains and sewers, Construction Works Team of PWC has already been conducting the tasks under the supervision of Technical & Planning Dept.

An environmental protection fee between 5 and 8% of the water bill is charged in Hoi An City, as in other cities in Vietnam. In Quang Nam Province, a single water supply enterprise covers the entire province. Therefore, the collected environmental protection fee is controlled by Quang Nam PPC without allocation to Hoi An CPC. Because of the small size of the fund (8% or less of water charge) and the no direct control of the fund by Hoi An CPC, it is difficult to make environmental protection fee to be sufficient source of fund for O&M costs of this project.

The financial condition of Hoi An CPC is sound with significant revenue surplus in the last several years. On the other hand, this project does not cover house connections, therefore there are no expected benefits to households in terms of improved sanitation. Rather the benefits are more evident with respect to water quality improvement for public water bodies and preservation of tourism attraction. The costs of achieving these improvements should not be charged to individual households. It is more reasonable to use tax revenue to cover the costs of sewerage service.

Furthermore, it is the obvious orientation of the Hoi An CPC that the costs for O&M and replacement of sewerage facilities shall be covered not by sewerage charge but government budget (tax revenue). Hoi An CPC has sufficient budget to do so.

Hoi An CPC would pay PWC the annual O&M expenditures and for the replacement of equipment which is expected to be once every 20 years. The O&M costs are estimated to be 1.867 billion VND (9.156 million JPY) per year. Equipment replacement cost is estimated to be 67.728 billion VND (332 million JPY) to be incurred once every 20 years (**Table 2.4.1-3)**.

Table 2.4.1-3 Breakdown on Equipment Replacement Cost

Item	Cost (million JPY)	Remark
Gate, Screen	25	Mechanical
Pump	2	Mechanical
Water Treatment Equipment	215	Mechanical
Sludge Treatment Equipment	23	Mechanical
Odor Control System	14	Mechanical
Additional Pipe	15	Mechanical
Control Panel etc.	16	Electrical
Instrumentation devices	15	Electrical
Architectural Apparatus	7	Architectural
Total	332	

Source: prepared by JST

The procedure to secure the budget for O&M and equipment replacement costs are as follows:
O&M costs of STP shall be paid to PWC every year by Hoi An CPC in accordance with the outsourcing contract. In other words, PWC would prepare a draft contract which will be checked and revised by DOFP. Hoi An CPC would approve the contract and the associated costs. The contract amount may be revised according to actual expenditures. Equipment replacement cost of STP will also be paid to PWC by Hoi An CPC at once in accordance with outsourcing contract separate from O&M contract. Replacement outsourcing contract prepared by PWC will be checked and revised by DOFP and will be decided with the final approval of Hoi An CPC.

2.4.2 Additional Staff and Training for Operation and Maintenance

(1) Additional Staff

The Personnel Dept. and the Financial Dept. will have increased workloads through adding a sewerage service. Nevertheless, according to the PWC, it is not necessary to increase the number of staff for the moment. PWC staff in these Depts. will remain unchanged. **Figure 2.4.3-2** shows the staff to be assigned to the new O&M section. The number of additional staff for the Construction Works Team would be determined during the Soft Component, since it is necessary to understand an actual working condition in the field, to consider the space for efficiency improvement, and to consider the opinions of related staff.

(2) Training

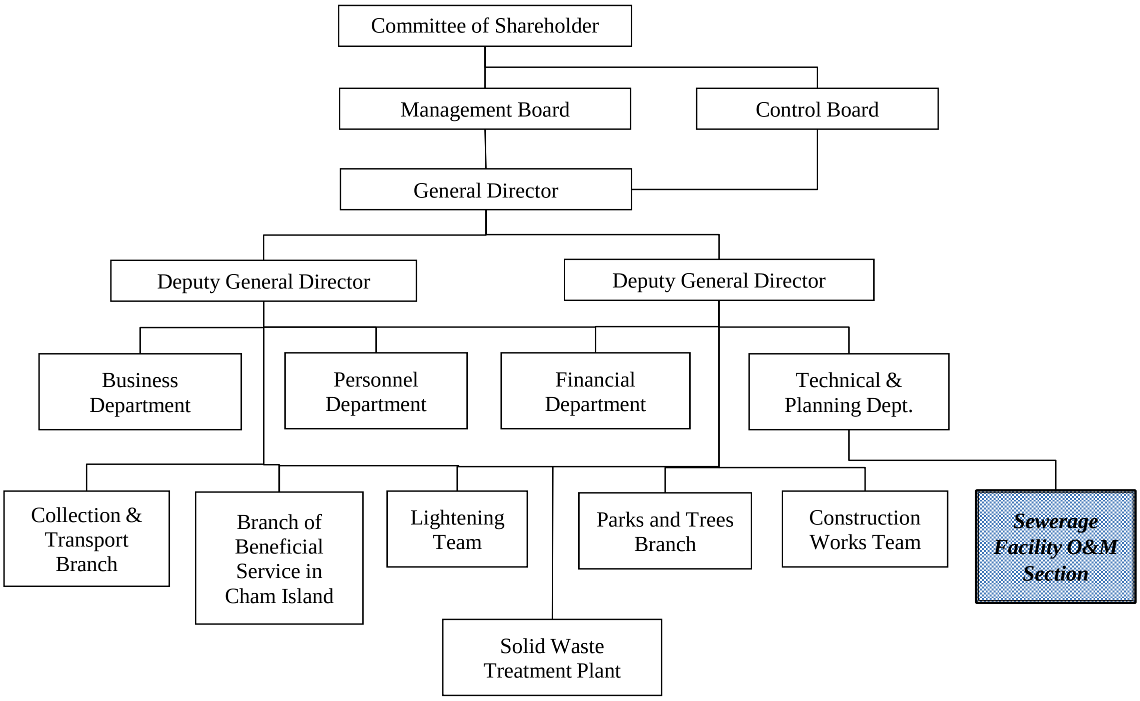
PWC shall provide necessary basic training targeting specific existing sections. However, in terms of sewerage accounting and sewerage financial planning, a Soft Component of training for the Financial Dept., and other related staff will be provided, with regard to the importance of the tasks.

The staff of new O&M section shall be trained through Total Test Operation and Soft Component to improve the O&M skill, as is described in “2.2.4.8 Soft Component (Technical Assistance) Plan”. The Construction Works Team and related staff shall be trained through Soft Component to improve the maintenance skill of Japanese Bridge Canal, as is described in the same section.

2.4.3 Operation and Maintenance Structure

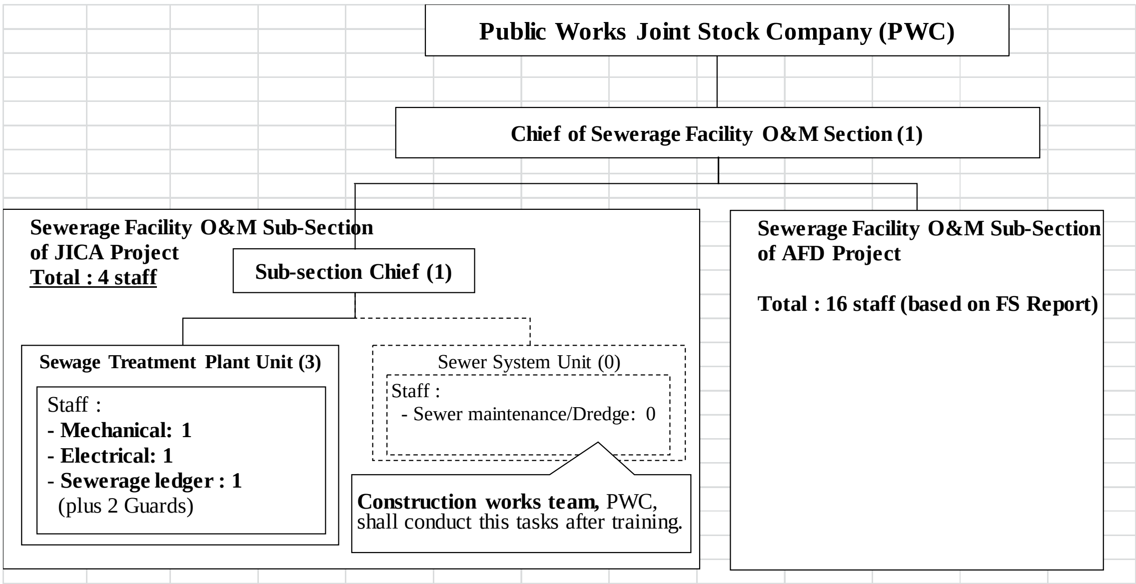
(1) New O&M Section

Based on **Table 2.4.1-2**, a new O&M section would be established, under the Technical & Planning Department in the PWC as shown in **Figure 2.4.3-1**, and **Figure 2.4.3-2**.



Source: prepared by JST

Figure 2.4.3-1 New O&M Section in PWC



Note: Numbers in brackets ( ) shows the number of staff. Chemist / Laboratory task for the JICA Project shall be conducted by Chemist/Laboratory staff attached to the French Project on a duty-trip basis. But it is preferable that the Sub-section Chief should have a background in water quality/chemical knowledge.

Source: prepared by JST

Figure 2.4.3-2 Operation and Maintenance Structure of this Project (New O&M section)

(2) Considerations in Establishing the New O&M Section

➢ Separation of O&M section from that of the AFD Project

The O&M section of this project should be organized separately from that of the AFD Project, even though both sets of O&M tasks would be contracted to the PWC. This is necessary because the treatment process and capacity of the projects are different. However a single manager could oversee the O&M of the 2 treatment facilities (refer to **Figure 2.4.3-2**), and to ensure that where reasonable, some tasks such as, water quality analysis can be centralized.

➢ Sub-section Chief with the basic knowledge of water quality testing

For this Project, a full-time water quality testing staff would not be required. The Sub-section Chief, preferable an engineer with a water quality background, could be appointed. He/she would carry out daily sampling and testing for the basic water quality parameters. The other parameters shall be tested at the AFD Project's water quality laboratory or outsourced to a water quality institution in Da Nang City. In order to reflect water quality test results on sewage treatment, the Sub-section Chief is advisable to have a basic knowledge about water quality.

➢ Sewerage ledger shall be operated by all O&M section staff

A full time staff may not be required to maintain the sewerage ledger and operation of the computer. This responsibility could be shared by 3 workers on 3-24 hour shifts (Mechanical, Electrical, Sewerage ledger). These 3 workers would be trained to conduct STP operations, cleaning, and sewerage ledger searching. Facility drawings and specification would be submitted electronically and documents stored in the computer by the contractor. All of the staff in the O&M organization would be able to access the data when needed, for instance during facility repair. Staff should be able to access, enter and revise data by themselves. Sewerage ledger staff is expected to respond to trouble or more complicated operation of it.

- **Timing of the Establishment of O&M Section and Completion of Basic Training**

Hoi An CPC has to establish the O&M section and assign 4 staff (Sub-section Chief, Mechanical, Electrical, and Sewerage ledger staff), and complete the basic training, prior to starting the Soft Component.

2.5 Project Cost Estimation

2.5.1 Initial Cost Estimation

(1) Project Cost borne by Vietnamese Side

Total project cost borne by the Vietnamese side is estimated to be 5,828 million Vietnam DONG (Mil VND). **Table 2.5.1-1** shows the cost breakdown.

Table 2.5.1-1 Cost Covered by the Vietnamese Side

Item	Cost (million VND)	Cost equivalent to JPY（ million JPY）
Electrical power line, city water, telephone line to STP	1,001	4.9
Land lease for temporary access	3,200	15.6
Fence and gate installation	1,018	5.0
Commission fees to the Japanese Bank	409	2.0
Clearing of Land Mines	200	1.0
Total	5,828	28.5

Note:

- Tax and duties in Vietnam are not included.
- Other costs borne by the Vietnam side are roughly estimated at 21.7 billion VND, including project administrative and management cost, investment cost for sewerage collection system at the downstream area of the STP, commissioning fees etc.
- Responsibilities of each side under Grant Aid are outlined in **Table 2.5.1-2**.

Table 2.5.1-2 Government Responsibilities under Japanese Grant Aid

No.	Items	Japan	Vietnam
1	To ensure prompt unloading and customs clearance of the products at ports of disembarkation in the recipient country and to assist internal transportation of the products		
	1) Sea or air transportation of equipment from Japan to the recipient country	●	
	2) Tax exemption and custom clearance at the port of disembarkation		●
	3) Transportation from port of disembarkation to project site	●	
2	To ensure that customs duties, internal taxes and other fiscal levies which may be imposed by the recipient country with respect to the purchase of the products and the services be exempted		●
3	To facilitate the entry and stay of Japanese nationals whose services may be required in connection with the supply of the products and services for the project		●
4	To ensure that the facilities and equipment be maintained and used properly and effectively in the implementation of the project		●
5	To bear all the expenses, other than those covered by the Grant Aid, necessary for the implementation of the project		●
6	To bear the following commissions paid to the Japanese bank for banking services based upon the agreement on the Banking Arrangement		
	1) Advising commission of Authorization to pay		●

No.	Items	Japan	Vietnam
	2) Payment commission		●

(2) Conditions for Cost Estimate

1) Time of Estimates: July, 2014
2) Exchange Rates: US$1= JPY 103.22
VND 1 = JPY 0.0048855

2.5.2 Operation and Maintenance Cost

Operation and Maintenance (O&M) costs for the sewerage facilities constructed by this project are calculated as shown in **Tables 2.5.2-1** and **2.5.2-2**.

Hoi An CPC would pay PWC the O&M costs as will be stipulated in the outsourcing contract. Hoi An CPC has a revenue surplus of 235.8 billion VND (1.16 billion JPY) in the year 2013. The O&M costs are estimated to be 1.867 billion VND, excluding replacement cost, representing 0.8% of the Hoi An CPC revenue surplus. Even including equipment replacement cost, which is required once every 20 years, the total costs are only 30% of the Hoi An CPC revenue surplus. Hoi An CPC is expected to be able to cover both annual O&M and equipment replacement costs.

Table 2.5.2-1 O&M Costs for Sewerage Facilities constructed by this Project (not including equipment replacement cost required every 20 years)

Cost Items	Amount	Unit
Personnel costs	28.00	million VND / month
Electricity costs	27.40	million VND / month
Repair costs	75.60	million VND / month
Water quality analysis costs	4.00	million VND / month
Sludge treatment and disposal costs	19.10	million VND / month
Replacement costs	0.00	million VND / month
Other costs	1.50	million VND / month
Total	**155.60**	**million VND / month**
	1,867.20	**million VND / year**
in Japanese Yen	**0.763**	**million JPY / month**
	9.156	**million JPY / year**

Note: Replacement costs (67.728 billion VND) must be paid additionally once every 20 years.
All costs do not reflect price escalation. Mechanical & electrical equipment, and so on, must be replaced once every 20 years. Exchange rate: 204 VND/JPY.

Table 2.5.2-2 O&M Costs for Sewerage Facilities constructed by this Project (Including average equipment replacement cost)

Cost Items	Amount	Unit
Personnel costs	28.00	million VND / month
Energy costs	27.40	million VND / month
Repair costs	75.60	million VND / month
Water quality analysis costs	4.00	million VND / month
Sludge treatment and disposal costs	19.10	million VND / month
Replacement costs	282.20	million VND / month
Other costs	4.40	million VND / month
Total	**440.70**	**million VND / month**
	5,288.39	**million VND / year**
in Japanese Yen	**2.160**	**million JPY / month**
	25.920	**million JPY / year**

Note: Replacement costs show the average amount over 20 years. All costs do not reflect price escalation.
Exchange rate: 204 VND/JPY.

Chapter 3 Project Evaluation

3.1 Preconditions

Land Acquisition

Land acquisition from a public entity (about 800 m^2) and three private owners (total 2,800 m^2) is required. These acquisitions and related costs were approved in Decision No.781/QD-UBND dated 10th April, 2014. Hoi An CPC paid the compensation to the private owners on 23rd April, 2014.

Land acquisition is not necessary for the rehabilitation of the Japanese Bridge Canal. No resettlement is required for the STP construction or the canal rehabilitation.

Land Lease for Temporary Approach Road during Construction

Land lease for a temporary approach road during construction of the STP and rehabilitation of the Japanese Bridge Canal was confirmed at the meeting involving JICA, Quang Nam PPC and Hoi An PPC (Minutes of Discussion, 11th December, 2014).

Authorization for Project Implementation

Pre-F/S Report for this project was prepared for securing the authorization for project implementation. The Department of Planning and Investment reviewed the report which was subsequently approved by Quang Nam PPC in Decision No.2558/QD-UBND dated 20th August, 2014.

EIA Approval

Quang Nam PPC approved the EIA in Decision No. 1643/QD-UBND dated 29th May, 2014.

Tax Exemption and Customs Procedure

The adoption of tax exemption was confirmed in meetings involving JICA, Quang Nam PPC and Hoi An PPC (Minutes of Discussion dated 19th December, 2013).

Establishment of PMU

PMU with representation from Hoi An CPC, DONRE and other agencies should be established immediately after the Grant Agreement (G/A) is signed.

Authorization to Proceed with Construction

The Vietnamese side received the approvals for construction of the STP, rehabilitation of the Japanese Bridge Canal and site for soil disposal during construction (Minutes of Discussion dated 11th December, 2014).

Connection of Power Line and Water Supply Pipe

Japanese Grant Aid will be used for the installation of the power line and substation facilities inside the STP. The power line to the STP will be installed by the Vietnamese side. Japanese Grant Aid will be used to install the water supply pipe in the STP. The Vietnamese side will install the pipe to the STP. These separate responsibilities were confirmed in Minutes of Discussion dated 19th December, 2013.

Lease of Temporary Approach Road During the Construction

The Vietnamese side will lease the temporary approach road (private land at the east side of STP) and area for the temporary storage of construction materials.

3.2 Necessary Inputs by Recipient Country

Establishment of O&M Section and Allocation of Staff

After the construction contract is signed, the new O&M section would be established in PWC, according to the official letter No.1383/UBND, dated 26 May, 2014, from Hoi An CPC. Staff including mechanical and electrical engineers, sewerage ledger operator, and a manager (section chief) would be assigned to the new O&M section. The new staff would be trained under the capacity building component of this project.

Budget Provision

Mechanical equipment such as pumps require replacement every 20 years. The replacement costs can be significant and must be recognized and anticipated in the budget requests to Hoi An CPC. Otherwise it happens that the necessary replacement work cannot be carried out. Therefore, it is indispensable for sewerage industry to provide relevant budget continuously.

Contract of equipment replacement of sewage treatment facility will be drafted by PWC before the replacement work is required, then submitted to DOFP for reviewing. Hoi An CPC will make final approval for it. This procedure must be conducted without delay.

Financial condition of Hoi An CPC is sound. However, if it becomes not sound in the future, it may be necessary to consider the partial introduction of sewerage tariff.

Wastewater Collection System Downstream of STP

The AFD project, “Project for Solid Waste, Wastewater Treatment and Environment Protection in Hoi An” is being implemented downstream of the STP. Before the completion of this project, untreated wastewater is discharged into the Japanese Bridge Canal. Untreated wastewater from the surrounding area of LAI VIEN KIEU pond located outside the AFD Project area is also flowing into the Japanese Bridge Canal.

It is necessary to collect and convey the wastewater to the new STP to protect the water quality in the Japanese Bridge Canal. The construction of the collection system for wastewater from the downstream area of the STP is not included in this project, but will be carried out by the Vietnamese side, according to Letter No.824/UBND dated 4th April, 2014 issued by Hoi An CPC.

3.3 Important Assumptions

The desired project outcomes can only be achieved if the following assumptions remain true:

- Serious natural disasters will not occur.
- Serious deterioration of economy will not occur.
- Land development and city plan will not be changed significantly.
- The collection system of wastewater from the downstream area of the STP will be constructed.
- Necessary O&M budget will be approved and staff will be assigned to the new O&M section.

3.4 Project Evaluation

3.4.1 Relevance

Project Beneficiary Population

The residents in the new residential estate and other areas in Tan An ward outside of the AFD project area and the Japanese Bridge Canal basin (approximately 14,550 people) will benefit from this project.

Urgency of Project Implementation

Untreated wastewater from the new residential estate and from the area supposed to be served by the unfinished AFD project is polluting the water in the Japanese Bridge Canal. The deterioration of the living environment and adverse effects to the tourism industry are serious concerns. Wastewater treatment and odor control to be delivered by this project are urgently required.

Consistency between the Project and Vietnamese Planning

Decision No. 35/1999/QD-TTg issued by the Prime Minister approved the orientation of Vietnam's urban drainage and sewerage development to the year 2020. The specific objectives include: expanding overall service coverage of sewerage systems to 80-90%; to 90-100% for Hanoi, HCM City and Grade II cities, urban areas in important regions of economic/tourist development, industrial estates, and export processing zones.

Decision No. 1930/2009/QD-TTg expands the approval to include industrial parks and extends the planning horizon to 2025, with a vision towards 2050. By 2025 all Grade I-IV cities would have wastewater collection and treatment systems. 70 – 80% of domestic wastewater in urban areas would be collected and treated, with the effluent meeting the discharge standards.

The "Hoi An City Urban Development Master Plan, 2013" stipulated that the sewerage development to improve water environment is a priority.

The project will contribute to the realization of the above national and local sewerage system development plans.

Compliance with Japan's Assistance Policy for Vietnam

Assistance for strategic economic development (effective use of policy support tools) is one of the policies stated in the "Infrastructure System Export Strategy of Japan (amended in 2014). Technical cooperation and Grant Aid are also important pillars of Japan's international assistance policy.

The sewage treatment technology to be used in the project was awarded the first certificate of technology verification for foreign countries by the Japan Sewage Works Agency. The technology promotes public and private cooperation. The approach would strengthen the international competitiveness of Japanese companies.

Japanese assistant policy for Vietnam centers on support for solving urban problems caused by rapid economic development and industrialization, as stipulated in the JICA country analysis paper and Vietnamese aid policy (December, 2012).

3.4.2 Effectiveness

Effectiveness of the project is confirmed by the following quantitative and qualitative effects.

(1) Quantitative Outcomes

The measurable outcomes include population served by the sewage treatment system, the amount of wastewater treated and the improvement in water quality of the canal, as shown in **Table 3.4.2-1**.

Table 3.4.2-1 Quantitative Outcomes

No.	Indicator	Baseline Data (Year 2014)	Target (Year 2020) （3 years after completion of the project）
1	Population served by STP(person)	0	11,700
2	Treatment amount (m^3/day)	0	1,900
3	Discharge BOD_5 concentration (mg/L）	-	30

Note: Treatment amount is the estimated treatment volume and not the treatment capacity.

(2) Qualitative Outcomes

- The wastewater treatment system would improve the water quality in the Japanese Bridge Canal and the public health environment of the surrounding area.
- The scenic environment would be restored at the Japanese Bridge Canal area. The attraction to tourist would stimulate regional economic development.

There is no comprehensive investigation on the impact on tourism with the improvement of water environment in Vietnam. However, the “SAPROF of Hue City Water Environment Improvement Project, 2007, Japan Bank for International Corporation” estimated that their project resulted in 1 % increase of tourist visits, with each tourist contributing VND 3,890,000 to the local economy.

The project will fulfill its objectives and bring environmental and economic benefits to the city. It is concluded that the adequacy of the project is highly evaluated and effectiveness of the project is expected.

Appendix.1

Member List of the Survey Team

Appendix 1 Member List of the Survey Team

JICA Officials

1. Leader: Mr. Kenichi YAMAMOTO (for Inception Meeting)
Senior Representative, JICA Vietnam Office

2. Leader: Mr. Kazunao SHIBATA (for explanation of Draft Report)
Director, Environmental Management Team 2, Environmental Management Group, Global Environment Department, JICA

3. Hatsuka NAITO
Assistant Director, Environmental Management Division 1/2, Environmental Management Group, Global Environment Department, JICA
Office for Design and Cost Examination, Financial Cooperation Implementation Department, JICA

4. Satoshi YAMAMOTO
Senior Project Formulation Advisor, JICA Vietnam Office

5. Nguyen Vu Tiep
Program Officer, JICA Vietnam office

Consultant Members

6. Chief Consultant/ Sewerage Planning Specialist: Mr. Kazuhiro ASADA
Nihon Suido Consultants, Global Headquarters

7. Deputy Chief Consultant: Mr. Takashi HOSHINO
Nihon Suido Consultants, Global Engineering Department 1

8. Sewerage Treatment Facility Plan & Design Specialist: Mr. Tetsuo WADA
Nihon Suido Consultants, Global Engineering Department 2

9. Sewer Pipeline Plan & Design / Public Education Specialist: Mr. Yoshinobu NAKAJIMA
Nihon Suido Consultants, Global Engineering Department 2

10. Procurement / Construction Plan / Cost Estimation Specialist: Mr. Akira OGURO
Nihon Suido Consultants, Global Engineering Department 2

11. O&M Planning / Financial Planning Specialist: Mr. Daizo IWATA
Nihon Suido Consultants, Global Engineering Department 1

12. Environmental & Social Considerations Specialist: Mr. Tatsuya TOBE
Nihon Suido Consultants, Global Engineering Department 2

13. Architectural Design /Cost Estimation: Mr. Shinichi SASAKI
Nihon Suido Consultants, Global Engineering Department 2

Appendix.2

Study Schedule

Appendix 2 Study Schedule

First Survey Schedule in Vietnam

No	Date	JICA	Consultant						
		Mr. K Yamamoto, Ms. Naito, Mr. S Yamamoto, Mr. Tiep	Mr. Asada	Mr. Hoshino	Mr. Wada	Mr. Nakajima	Mr. Oguro	Mr. Iwata	Mr. Tobe
1	2013/12/12		NRT→HAN→DAD						
2	2013/12/13	Meeting with Hoi An CPC / Hoi An DONR							NRT→HAN→DAD
3	2013/12/14	Site Visit							Site Visit
4	2013/12/15	Site Visit							Site Visit
5	2013/12/16	Meeting with Hoi An CPC / Hoi An DONR							Data Collection
6	2013/12/17	Internal Meeting / Data Collection							Same as on the left
7	2013/12/18	Site Visit to the Plant in Da Nang							
8	2013/12/19	Meeting with Hoi An DONRE Signing of M/D with Quang Nam PPC		DAD→HAN→VTE					Meeting with Hoi An DONRE
9	2013/12/20	Report to Embassy HAN→NRT	Site Visit						Data Collection
10	2013/12/21		Reporting						Data Collection
11	2013/12/22		Site Visit						Site Visit
12	2013/12/23		Internal Meeting		Internal Meeting				Same as on the left
13	2013/12/24		Internal Meeting DAD→HAN→NRT		Meeting with subcontractor Site Visit				
14	2013/12/25				Data Collection Meeting with concerned agencies Meeting with subcontractor				
15	2013/12/26								
16	2013/12/27								
17	2013/12/28				Reporting				
18	2013/12/29			VTE→HAN	Site Visit				
19	2013/12/30			Meeting with subcontractor HAN→DAD	Data Collection Meeting with concerned agencies Data Analysis				
20	2013/12/31			Internal Meeting					
21	2014/1/1			Site Visit					
22	2014/1/2			Meeting with concerned agencies Data Analysis					
23	2014/1/3								
24	2014/1/4			Reporting					
25	2014/1/5			Site Visit					
26	2014/1/6			Meeting with Hoi An DONRE Meeting with concerned agencies Data Analysis Site Visit					
27	2014/1/7								
28	2014/1/8								
29	2014/1/9								
30	2014/1/10								
31	2014/1/11			Reporting					
32	2014/1/12			Site Visit					
33	2014/1/13			Meeting with Hoi An DONRE Meeting with concerned agencies Data Analysis					
34	2014/1/14								
35	2014/1/15								
36	2014/1/16			DAD→HAN Site Visit to the Plant in Da Nang					
37	2014/1/17			Report to JICA Vietnam Office HAN→NRT	HAN→NRT				Report to JICA Vietnam Office HAN→NRT
38	2014/1/18								

(NRT: Narita, HAN: Hanoi, DAD: Da Nang, VTE: Vientiane)

Second Survey Schedule in Vietnam

No	Date	JICA	Consultant						
		Mr. K Yamamoto, Ms. Naito, Mr. S Yamamoto, Mr. Tiep	Mr. Asada	Mr. Hoshino	Mr. Wada	Mr. Nakajima	Mr. Oguro	Mr. Iwata	Mr. Tobe
1	2014/2/12			NRT→HAN					
2	2014/2/13			HAN→DAD		NRT→HAN →DAD	NRT→HCM →DAD	NRT→HCM →DAD	NRT→HAN →DAD
3	2014/2/14			Internal Meeting		Internal Meeting	Internal Meeting	Internal Meeting	Internal Meeting
4	2014/2/15			Site Visit		Site Visit	Site Visit	Site Visit	Site Visit
5	2014/2/16			Reporting		Reporting	Reporting	Reporting	Reporting
6	2014/2/17			Meeting with Hoi An CPC/DONRE		Meeting with Hoi An CPC/DONRE (Progress Report)			
7	2014/2/18			Data Collection		Data Collection	Data Collection	Data Collection	Data Collection
8	2014/2/19			DAD→HAN →VTE		Data Collection	Data Collection	Data Collection	Data Collection
9	2014/2/20					Data Collection	Data Collection	Data Collection	Data Collection
10	2014/2/21					Data Collection	Data Collection	Data Collection	Data Collection
11	2014/2/22					Site Visit	Site Visit	Site Visit	Site Visit
12	2014/2/23				NRT→HAN →DAD	Reporting	Reporting	Reporting	Reporting
13	2014/2/24				Internal Meeting	Internal Meeting	Internal Meeting	Internal Meeting	Internal Meeting
14	2014/2/25				Data Collection	Data Collection	Data Collection	Data Collection	Data Collection
15	2014/2/26				Data Collection	Data Collection	Data Collection	Data Collection	Data Collection
16	2014/2/27				Reporting	Reporting	Reporting	Reporting	Reporting
17	2014/2/28				Reporting	Reporting	Reporting	Reporting	Reporting
18	2014/3/1				Site Visit	Site Visit	Site Visit	Site Visit	Site Visit
19	2014/3/2			VTE→HAN →DAD	Reporting	Reporting	Reporting	Reporting	Reporting
20	2014/3/3		NRT→HAN →DAD	Reporting	Reporting	Reporting	Reporting	Reporting	Reporting
21	2014/3/4		Internal Meeting	Internal Meeting	Internal Meeting	Internal Meeting	Internal Meeting	Internal Meeting	Internal Meeting
22	2014/3/5		Reporting	Reporting	Reporting	Reporting	Reporting	Reporting	Reporting
23	2014/3/6		Stakeholder Meeting						
24	2014/3/7		Reporting	Reporting	Reporting	Reporting	Reporting	Reporting	Reporting
25	2014/3/8		Site Visit	Site Visit	Site Visit	Site Visit	Site Visit	Site Visit	Site Visit
26	2014/3/9		Reporting	Reporting	Reporting	Reporting	Reporting	Reporting	Reporting
27	2014/3/10		Reporting	Reporting	Reporting	Reporting	Reporting	Reporting	Reporting
28	2014/3/11		Meeting with Hoi An CPC/DONRE (Technical Meeting)						
29	2014/3/12		Meeting with Hoi An CPC/DONRE (Technical Note)						
			Reporting	DAD→HAN	Reporting	Reporting	Reporting	Reporting	Reporting
30	2014/3/13		Reporting DAD→HAN	Meeting with subcontractor	Reporting DAD→HAN	Reporting DAD→HAN	Reporting DAD→HCM	Reporting DAD→HCM	Reporting DAD→HAN
31	2014/3/14		HAN→NRT	HAN→NRT	HAN→NRT	HAN→NRT	HAN→NRT	HAN→NRT	HAN→NRT

(NRT: Narita, HAN: Hanoi, DAD: Da Nang, VTE: Vientiane)

Third Survey Schedule in Vietnam

No	Date	Consultant						
		Mr. Asada	Mr. Hoshino	Mr. Wada	Mr. Nakajima	Mr. Oguro	Mr. Iwata	Mr. Tobe
1	2014/6/5						NRT→HAN →DAD	
2	2014/6/6						Meeting with PWC	
3	2014/6/7						Site Visit	
4	2014/6/8						Site Visit	
5	2014/6/9		NRT→HAN (Meeting with subcontractor)→DAD			NRT→HAN (Meeting with subcontractor)→DAD	Data Collection & Analysis	
6	2014/6/10		Meeting with Hoi An CPC/DONRE			Meeting with Hoi An CPC/DONRE	Meeting with Hoi An CPC/DONRE	
7	2014/6/11		Reporting			Data Collection & Analysis	DAD→HAN	
8	2014/6/12		DAD→HAN Data Collection & Analysis			DAD→HAN Data Collection & Analysis	HAN→NRT	
9	2014/6/13		HAN→NRT			Data Collection & Analysis		
10	2014/6/14					HAN→NRT		
11	2014/6/15							
12	2014/6/16							
13	2014/6/17							
14	2014/6/18	HCM→DAD		NRT→HAN →DAD				NRT→HAN →DAD
15	2014/6/19	Meeting with Hoi An CPC/DONRE		Meeting with Hoi An CPC/DONRE				Meeting with Hoi An CPC/DONRE
16	2014/6/20	DAD→HCM		Data Collection & Analysis				Data Collection & Analysis
17	2014/6/21			DAD→HAN				DAD→HAN
18	2014/6/22			HAN→NRT				HAN→NRT

(NRT: Narita, HAN: Hanoi, DAD: Da Nang, HCM: Ho Chi Minh)

Fourth Survey Schedule in Vietnam

No	Date	JICA	Consultant						
		Mr. Shibata, Ms. Naito, Mr. Tiep	Mr. Asada	Mr. Hoshino	Mr. Wada	Mr. Nakajima	Mr. Oguro	Mr. Iwata	Mr. Tobe
1	2014/12/7	NRT→DAD	NRT→DAD		NRT→DAD			NRT→DAD	
2	2014/12/8	Meeting for Minutes, Explanation of Draft Report	Meeting for Minutes, Explanation of Draft Report		Meeting for Minutes, Explanation of Draft Report			Meeting for Minutes, Explanation of Draft Report	
3	2014/12/9	Meeting for Minutes, Explanation of Draft Report	Meeting for Minutes, Explanation of Draft Report		Meeting for Minutes, Explanation of Draft Report			Meeting for Minutes, Explanation of Draft Report	
4	2014/12/10	Meeting for Minutes	Meeting for Minutes		Meeting for Minutes			Meeting for Minutes	
5	2014/12/11	Meeting for Minutes DAD→HAN	Meeting for Minutes DAD→HAN		Data Collection & Analysis, Meeting with concerned agencies			Data Collection & Analysis, Meeting with concerned agencies	
6	2014/12/12	Report to JICA Vietnam Office	Report to JICA Vietnam Office		Meeting with concerned agencies DAD→HAN			Data Collection & Analysis, Meeting with concerned agencies	
7	2014/12/13	HAN→NRT	HAN→NRT		HAN→NRT			DAD→NRT	

(NRT: Narita, HAN: Hanoi, DAD: Da Nang, HCM: Ho Chi Minh)

Appendix.3

List of Parties Concerned
in the Recipient Country

Appendix 3 List of Parties Concerned in the Recipient Country

Quang Nam PPC

Department of Housing and Urban Planning (DHUP)

Mr. Dinh Van Thu	Vice Chairman
Mr. Nguyen Ngoc Nam	

Construction Department

- Mr. Nguyen Phu

Department of Planning and Investment of Quang Nam

- Mr. Nguyen Hoang Thanh

Hoi An CPC

Mr. Le Van Giang	Chairman
Mr. Nguyen Van Dung	Vice Chairman
Mr. Tran Van Nhan	Staff
Ms. Lam Thi Hong Nhung	Staff

Division of Natural Resources and Environment

Mr. Nguyen Van Hien	Division Head
Mr. Nguyen Thanh Son	Chief of Environmental Team
Mr. Le Dai Quang	Member of Environmental Team
Ms. Tran Thi My Anh	Member of Environmental Team
Ms. Tran Thi Van	Member of Environmental Team
Mr. Tran Trung Loc	Member of Environmental Team
Mr. Nguyen The Phuong	Member of Environmental Team
Mr. Nguyen Chi Tam	Member of Environmental Team
Mr Nguyen Manh Ha	Member of Environmental Team

Cam Pho ward PC

- Mr Truong Thi Thu Tra

Hoi An Center for Cultural Heritage Management Preservation

- Mr Vo Dang Phong

PMU of French Project

Mr Tran Quang Khanh	Chief Technician

Hoi An Public Works Company Jsc.,

- Mr Tran Huu Ngoc

Appendix.4

Minutes of Discussions

Appendix 4 Minutes of Discussions

4.1 Minutes of Discussions on Preparatory Survey (Inception Meeting)

MINUTES OF DISCUSSIONS
THE PREPARATORY SURVEY ON
WATER QUALITY IMPROVEMENT PROJECT FOR JAPANESE BRIDGE AREA, IN HOI AN CITY, QUANG NAM PROVINCE, SOCIALIST REPUBLIC OF VIETNAM

In response to the request from the Government of Vietnam, the Government of Japan decided to conduct a Preparatory Survey (hereinafter referred to as "the Survey") on Water Quality Improvement Project for Japanese Bridge Area, in Hoi An city, Quang Nam province (hereinafter referred to as "the Project") and entrusted the study to the Japan International Cooperation Agency (hereinafter referred to as "JICA").

JICA sent to Vietnam the Preparatory Survey Team (hereinafter referred to as "the Team"), which is headed by Mr. Kenichi YAMAMOTO, Senior Representative, JICA Vietnam Office, and is scheduled to stay in Hoi An city, Quang Nam province of Vietnam from 13th to 19th December, 2013.

The Team held a series of discussions with the concerned officials of Vietnam and conducted a field survey.

In the course of discussions and field survey, both sides confirmed the main items described on the attached sheets. The Team will proceed to further works and prepare the Preparatory Survey Report.

Hoi An, 19th December, 2013

山本賢一

Mr. Kenichi Yamamoto
Leader
Preparatory Survey Team
Japan International Cooperation Agency
Japan

Mr. Dinh Van Thu
Vice Chairman
Quang Nam Provincial People's Committee
Vietnam

Mr. Nguyen Van Dung
Vice Chairman
People's Committee of Hoi An City,
Quang Nam province
Vietnam

ATTACHMENT

1. Objective of the Project

The objective of the Project is to improve water quality in Japanese Bridge Channel by constructing a sewerage system around Japanese Bridge Channel and discharging treated waste water into the Channel.

2. Project Site

The Project site is Hoai Pho group, Cam Pho precinct, Hoi An city. The location of site is shown in Annex-1. If it is changed, the project will be cancelled accordingly. Hoi An city People's Committee (hereinafter referred to as "Hoi An CPC") promised they should have enough consultation for surrounding residents in a proper manner at appropriate timings.

3. Responsible and Implementing Agency

The line agency is the Quang Nam Provincial People's Committee (hereinafter referred to as "Quang Nam PPC") and responsible agency is Hoi An CPC, and the implementing agency is the Division of Natural Resources and Environment of Hoi An City (hereinafter referred to as "Hoi An DONRE"). Organization chart is shown in Annex-2.

4. Items Requested by the Government of Vietnam

Following the discussions with the Team, the items described in Annex-3 were finally requested by the Government of Vietnam. Both sides confirmed that the appropriateness of the final components of the Project would be decided by the Japanese side.

In addition, both sides agreed that the possibility to introduce another sewage treatment system which can be easily operated and less expense is also studied during the Survey.

Vietnamese side understood that some of the items may be procured in Japan as a result of the Survey.

5. Japan's Grant Aid Scheme

(1) The Vietnamese side understood the Japan's Program Grant Aid Schemes explained by the Team, as described from Annex-4 to 6.

(2) The Vietnamese side will take necessary measures, as described in Annex-6-1 for smooth implementation of the Project by Japan's Grant Aid.

(3) JICA will request the Vietnamese side if any other undertakings are needed based on the result of this Survey.

6. Objective of the Survey

The Team explained that the objective of the Survey is to collect information to ensure the appropriateness of the Project.

7. Schedule of the Survey

(1) The consultant members of the Team will continue the 1st period of the survey in

Vietnam until the 17th of January, 2014.

(2) The Team explained that the schedule of the Survey as follows. However, it is subjected to change based on the progress of the Survey. Both sides understand that the timeline described below is the latest schedule for completion of the survey.

February to March 2014	: 2nd Survey
March to May 2014	: approval of the feasibility study report in Vietnam
June 2014	: 3rd Survey
October 2014	: 4th Survey to explain draft Preparatory Survey Report
December 2014	: Submission of the final report

(3) Both side agreed the demarcation of works described in Annex-6-2. The details of the demarcation will be discussed and finalized in the 1st stage of the Survey. Also both sides confirmed that if necessary procedure of Vietnamese side is completed earlier that the schedule, Japanese side will accelerate its works accordingly.

(4) The Team explained that the implementation of the Preparatory Survey is not the commitment of the funding approval of the Project by the Government of Japan.

8. Other Relevant Issues

(1) Inception Report

The contents of Inception Report that the Team explained was understood and accepted in principle by the Vietnamese side.

(2) Arrangements for the Survey

As a response to the request by the Team, the Vietnamese side agreed to assign necessary number of counterpart personnel for the Survey and provide all the data and information relevant to the Project for the smooth implementation of the Survey. The Vietnamese side also agreed to provide an appropriate office space for the Team.

(3) Undertakings by both sides

Both sides agreed to make sure the progress of the Project by deciding the items to be implemented and their monitoring methods for each stage of the Project period. The details will be discussed during the 1st survey and recorded as the minutes of meetings.

(4) Implementation, operation and maintenance cost for the Project

The cost necessary for the Project, in addition to those described in Annex-6-1, such as operation and maintenance will be assessed in the Survey. The Vietnamese side assures that appropriate cost will be funded from the annual public utility budget of the Hoi An city.

(5) Other Undertakings of the Vietnamese side

Although general undertakings of both sides are shown in Annex-6-1, the Team emphasized the responsibilities of the Vietnamese side to execute following matters and the Vietnamese side agreed to it.

1) Tax Exemption

Both sides confirmed that import tax, customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the purchase of the products and the services will be exempted. The Vietnamese side will take necessary measures for tax exemption, if any.

2) Necessary measures for Operation and Maintenance of facilities and equipment
The Vietnamese side will take any necessary measures and allocate the necessary budget, if any, to operate and maintain the facilities and equipment which would be provided by the Project.

(6) Safety and Security

The Vietnamese side agreed to take measures to secure the safety of the members of the Team over the survey period.

(7) Careful Handling of the Survey Reports

The Team explained that certain information in both the draft and the final reports of the Survey should be dealt with confidentially until the tender is closed when the Project proceeds to actual implementation stage, since disclosure of the information would affect fairness of tender procedure. The Vietnamese side understood the sensitivity in dealing with the Survey reports and agreed on careful handling of the reports for achieving fair tendering.

(8) Environmental Impact Assessment (EIA), Preliminary EIA and Land Acquisition and Resettlement Action Plan

Both sides agreed that the Vietnamese side will take necessary measures regarding environmental impacts and land acquisition for implementation of the Project according to the relative laws and acts in Vietnam and JICA's Guidelines for Environmental and Social Considerations.

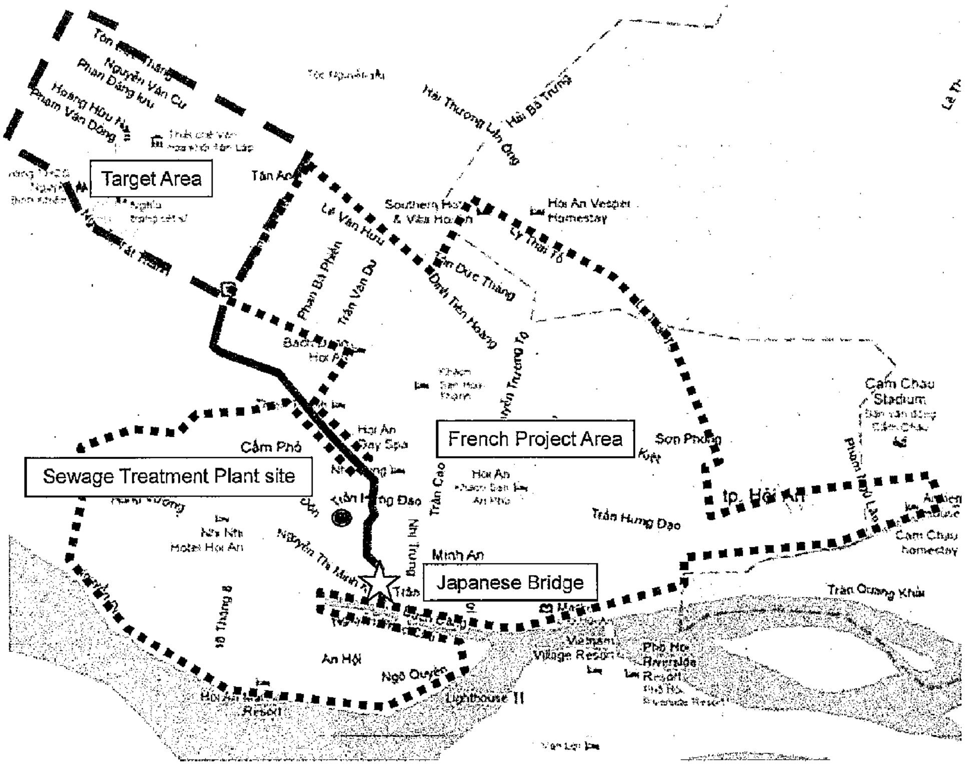
End

ANNEXES

Annex-1	Map of Vietnam
Annex-2	Organization Chart of Hoi An CPC and Hoi An DONRE
Annex-3	Requested Components of the Project
Annex-4 and 5	Japan's Grant Aid Scheme for General Projects
Annex-6-1	Major Undertakings by Each Government for General Projects
Annex-6-2	Demarcation of both sides related to the Project

4


Hoi An City


Target Area
French Project Area
Sewage Treatment Plant site
Japanese Bridge
Tôn Đức Thắng
Nguyễn Văn Cừ
Phan Đăng Lưu
Hoàng Hữu Nam
Phạm Văn Đồng
Tân An
Lê Văn Hưu
Phan Bá Phiến
Trần Văn Dư
Hải Thượng Lãn Ông
Hai Bà Trưng
Lý Thái Tổ
Tôn Đức Thắng
Đinh Tiên Hoàng
Southern Hotel & Villa Hoi An
Hoi An Vesper Homestay
Cẩm Phô
Cẩm Châu Stadium
Sơn Phong
tp. Hội An
Trần Hưng Đạo
Trần Cao Vân
Nhị Trưng
Minh An
Nguyễn Thị Minh Khai
Trần Quang Khải
Cẩm Châu homestay
An Hội
Ngô Quyền
18 Tháng 8
Lighthouse II
Hoi An Riverside Resort
Vietnamese Village Resort
Nhi Nhi Hotel Hoi An
Hoi An Day Spa
Phố Hội Riverside Resort

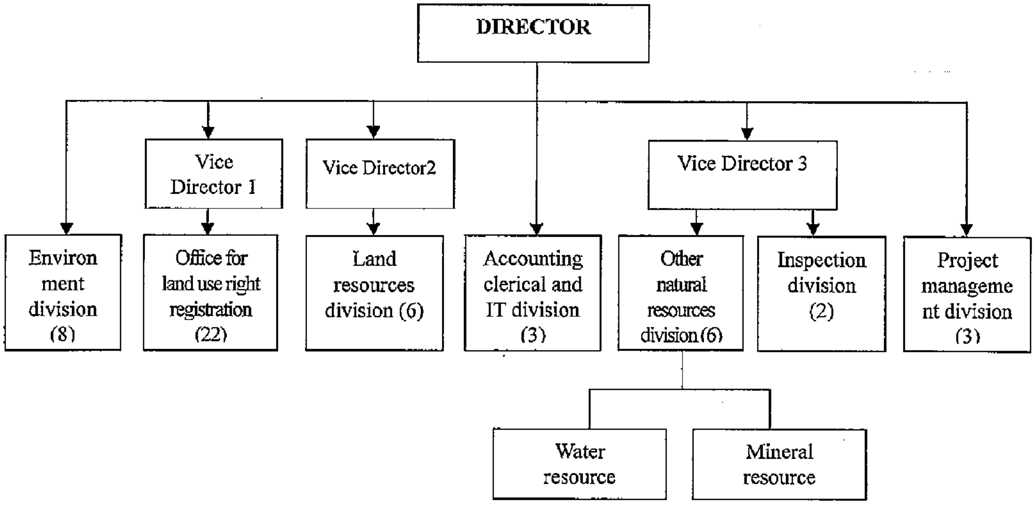
Annex-2

Hoi An CPC Organization Chart

HOIAN CPC

- State administrative units
  - Office (25)
  - Inspector (8)
  - DONRE (25)
  - Finance – Planning (20)
  - Health (6)
  - Home affairs (16)
  - Legislation (7)
  - Labor – Invalids – Social affairs (15)
  - Commerce – Tourism (18)
  - Training and Education (7)
  - Economics (24)
  - Investment management (29)
  - Culture – Sport (17)
- Ward/Communes
  - Minh An ward (17)
  - Son Phong ward (17)
  - Cam Pho ward (22)
  - Tan An ward (23)
  - Thanh Ha ward (21)
  - Cua Dai ward (20)
  - Cam Chau ward (19)
  - Cam An ward (22)
  - Cam Nam ward (20)
  - Cam Thanh commune (21)
  - Cam Kim commune (14)
  - Cam Ha commune (18)
  - Tan Hiep commune (18)
- Public service units
  - Cultural heritage management (77)
  - Land fund management (21)
  - Investment and construction projects management board (16)
  - Cu Lao Cham island management board (10)
  - Culture – Sport center (162)
  - Hoi An market management board (26)
  - Social order supervision team (45)
  - Swallow exploitation management team (78)
  - Broadcast and Television (10)
  - Land use right registration office (22)
  - Waterway and road stations management board (18)
  - Forestry – Agricultural extension center (7)

Hoi An DONRE Organization Chart



Annex-3

Request Components of the Project

No	Items	Quantity
1	Wastewater treatment facilities - Capacity of 2,000 m3/day - Attached sludge treatment facilities - Sequencing Batch Reactor Process is requested	1 set
2	Upgrading Open Canal (so called Japanese Bridge Channel)	About 2 Km
3	Operation and Maintenance Equipment - A convertible truck, - Inspection equipment for water quality control, - A personal computer and a printer for data logging	1 Set
4	Training of the Hoi An members	If Necessary

These items are subject to change based on the Survey Results.

Operation and Maintenance Equipment will be procured, if necessary procedure of Vietnamese side is completed earlier that the schedule.

The possibility to introduce more effective system for sewage treatment and sewage collection are also studied during the Survey.

Annex-4

JAPAN'S GRANT AID for General Projects

The Government of Japan (hereinafter referred to as "the GOJ") is implementing the organizational reforms to improve the quality of ODA operations, and as a part of this realignment, a new JICA law was entered into effect on October 1, 2008. Based on this law and the decision of the GOJ, JICA has become the executing agency of the Grant Aid for General Projects, for Fisheries and for Cultural Cooperation, etc.

The Grant Aid is non-reimbursable fund provided to a recipient country to procure the facilities, equipment and services (engineering services and transportation of the products, etc.) for its economic and social development in accordance with the relevant laws and regulations of Japan. The Grant Aid is not supplied through the donation of materials as such.

1. Grant Aid Procedures

The Japanese Grant Aid is supplied through following procedures :

- Preparatory Survey
  - The Survey conducted by JICA
- Appraisal &Approval
  - Appraisal by the GOJ and JICA, and Approval by the Japanese Cabinet
- Authority for Determining Implementation
  - The Notes exchanged between the GOJ and a recipient country
- Grant Agreement (hereinafter referred to as "the G/A")
  - Agreement concluded between JICA and a recipient country
- Implementation
  - Implementation of the Project on the basis of the G/A

2. Preparatory Survey

(1) Contents of the Survey

The aim of the Preparatory Survey is to provide a basic document necessary for the appraisal of the Project made by the GOJ and JICA. The contents of the Survey are as follows:

- Confirmation of the background, objectives, and benefits of the Project and also institutional capacity of relevant agencies of the recipient country necessary for the implementation of the Project.
- Evaluation of the appropriateness of the Project to be implemented under the Grant Aid Scheme from a technical, financial, social and economic point of view.
- Confirmation of items agreed between both parties concerning the basic concept of the Project.
- Preparation of an outline design of the Project.
- Estimation of costs of the Project.

The contents of the original request by the recipient country are not necessarily approved in their initial form as the contents of the Grant Aid project. The Outline Design of the Project is confirmed based on the guidelines of the Japan's Grant Aid scheme.

JICA requests the Government of the recipient country to take whatever measures necessary to achieve its self-reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the organization of the recipient country which actually implements the Project. Therefore, the implementation of the Project is confirmed by all relevant organizations of the recipient country based on the Minutes of Discussions.

(2) Selection of Consultants

For smooth implementation of the Survey, JICA employs (a) registered consulting firm(s). JICA selects (a) firm(s) based on proposals submitted by interested firms.

(3) Result of the Survey

JICA reviews the Report on the results of the Survey and recommends the GOJ to appraise the implementation of the Project after confirming the appropriateness of the Project.

3. Japan's Grant Aid Scheme

(1) The E/N and the G/A

After the Project is approved by the Cabinet of Japan, the Exchange of Notes (hereinafter referred to as "the E/N") will be singed between the GOJ and the Government of the recipient country to make a pledge for assistance, which is followed by the conclusion of the G/A between JICA and the Government of the recipient country to define the necessary articles to implement the Project, such as payment conditions, responsibilities of the Government of the recipient country, and procurement conditions.

(2) Selection of Consultants

In order to maintain technical consistency, the consulting firm(s) which conducted the Survey will be recommended by JICA to the recipient country to continue to work on the Project's implementation after the E/N and G/A.

(3) Eligible source country

Under the Japanese Grant Aid, in principle, Japanese products and services including transport or those of the recipient country are to be purchased. When JICA and the Government of the recipient country or its designated authority deem it necessary, the Grant Aid may be used for the purchase of the products or services of a third country. However, the prime contractors, namely, constructing and procurement firms, and the prime consulting firm are limited to "Japanese nationals".

(4) Necessity of "Verification"

The Government of the recipient country or its designated authority will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be verified by JICA. This "Verification" is deemed necessary to fulfill accountability to Japanese taxpayers.

(5) Major undertakings to be taken by the Government of the Recipient Country

In the implementation of the Grant Aid Project, the recipient country is required to undertake such necessary measures as Annex6-1.

(6) "Proper Use"

The Government of the recipient country is required to maintain and use properly and effectively the facilities constructed and the equipment purchased under the Grant Aid, to assign staff necessary for this operation and maintenance and to bear all the expenses other than those covered by the Grant Aid.

(7) "Export and Re-export"

The products purchased under the Grant Aid should not be exported or re-exported from the recipient country.

(8) Banking Arrangements (B/A)

a) The Government of the recipient country or its designated authority should open an account under the name of the Government of the recipient country in a bank in Japan (hereinafter referred to as "the Bank"). JICA will execute the Grant Aid by making payments in Japanese yen to cover the obligations incurred by the Government of the recipient country or its designated authority under the Verified Contracts.

b) The payments will be made when payment requests are presented by the Bank to JICA under an Authorization to Pay (A/P) issued by the Government of the recipient country or its designated authority.

(9) Authorization to Pay (A/P)

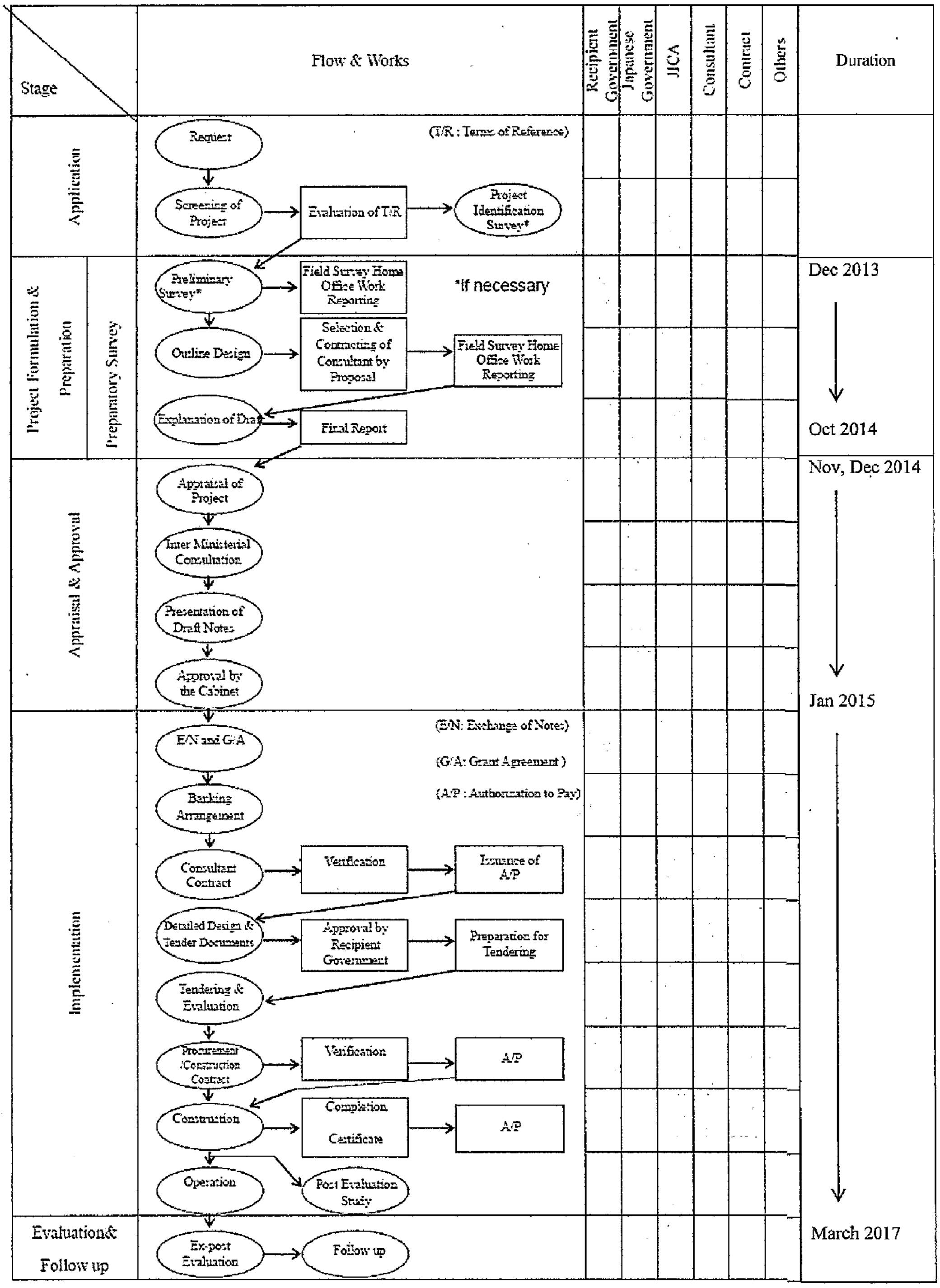
The Government of the recipient country should bear an advising commission of an Authorization to Pay and payment commissions paid to the Bank.

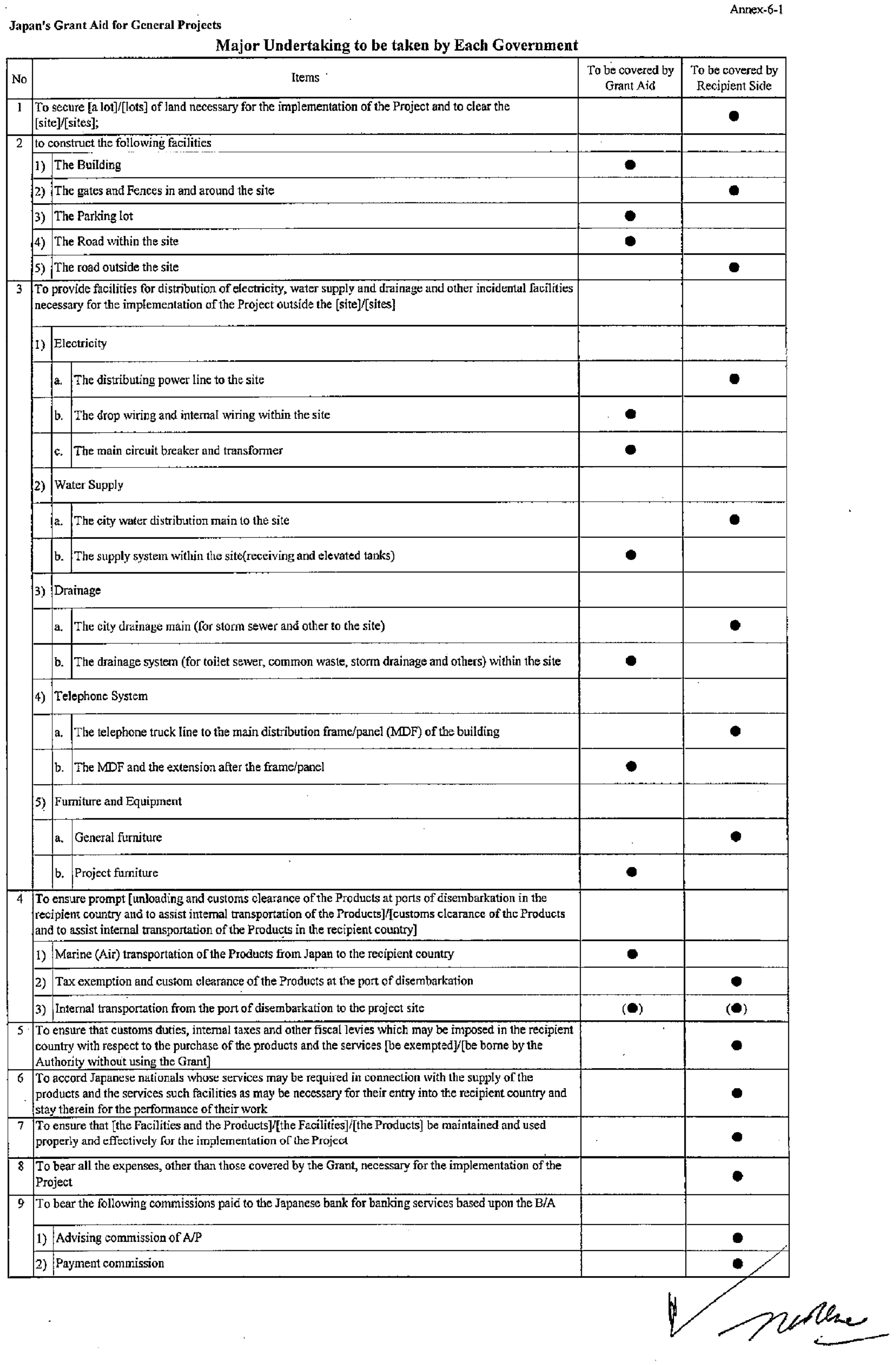
(10) Social and Environmental Considerations

A recipient country must carefully consider social and environmental impacts by the Project and must comply with the environmental regulations of the recipient country and JICA socio-environmental guidelines.

Annex-5

FLOW CHART OF JAPAN's GRANT AID PROCEDURES





Annex-6-1

Japan's Grant Aid for General Projects

Major Undertaking to be taken by Each Government

No	Items	To be covered by Grant Aid	To be covered by Recipient Side
1	To secure [a lot]/[lots] of land necessary for the implementation of the Project and to clear the [site]/[sites];		●
2	to construct the following facilities		
	1) The Building	●	
	2) The gates and Fences in and around the site		●
	3) The Parking lot	●	
	4) The Road within the site	●	
	5) The road outside the site		●
3	To provide facilities for distribution of electricity, water supply and drainage and other incidental facilities necessary for the implementation of the Project outside the [site]/[sites]		
	1) Electricity		
	a. The distributing power line to the site		●
	b. The drop wiring and internal wiring within the site	●	
	c. The main circuit breaker and transformer	●	
	2) Water Supply		
	a. The city water distribution main to the site		●
	b. The supply system within the site(receiving and elevated tanks)	●	
	3) Drainage		
	a. The city drainage main (for storm sewer and other to the site)		●
	b. The drainage system (for toilet sewer, common waste, storm drainage and others) within the site	●	
	4) Telephone System		
	a. The telephone truck line to the main distribution frame/panel (MDF) of the building		●
	b. The MDF and the extension after the frame/panel	●	
	5) Furniture and Equipment		
	a. General furniture		●
	b. Project furniture	●	
4	To ensure prompt [unloading and customs clearance of the Products at ports of disembarkation in the recipient country and to assist internal transportation of the Products]/[customs clearance of the Products and to assist internal transportation of the Products in the recipient country]		
	1) Marine (Air) transportation of the Products from Japan to the recipient country	●	
	2) Tax exemption and custom clearance of the Products at the port of disembarkation		●
	3) Internal transportation from the port of disembarkation to the project site	(●)	(●)
5	To ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the purchase of the products and the services [be exempted]/[be borne by the Authority without using the Grant]		●
6	To accord Japanese nationals whose services may be required in connection with the supply of the products and the services such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work		●
7	To ensure that [the Facilities and the Products]/[the Facilities]/[the Products] be maintained and used properly and effectively for the implementation of the Project		●
8	To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project		●
9	To bear the following commissions paid to the Japanese bank for banking services based upon the B/A		
	1) Advising commission of A/P		●
	2) Payment commission		●

Annex-6-2

Demarcation of both sides related to the Project

No.	Items	Roles of CPC	Roles of JST
1.	Methodology for sewage collection system	Providing data and information to JST	Field survey and proposing the method
2.	Methodology for W/Q improvement at JPN Bridge	Providing data and information to JST	Field survey and proposing the method
3.	Stakeholder meeting (SH/M)	Hosting SH/M	Supporting explanation from technical aspects
4.	Land acquisition & abbreviated resettlement action plan (ARAP)	ARAP preparation and proceeding approval for ARAP	Assisting ARAP preparation consigning to local company
5.	Project component and design direction	Meeting and discussion with JST	Conducting topo., geo. and socio economic surveys consigning to local company
6.	Detailed EIA Report	Providing information for IP/R, and Preparing EIA report	Assisting EIA preparation consigning to local company
7.	Investment project report (IP/R)	Providing information for IP/R, and Preparing IP/R	Assisting IP/R preparation consigning to local company
8.	Framing for operation and maintenance (O&M) plan	Preparing O&M plan	Assisting O&M plan preparation
9.	Framing for training of O&M staff	Preparing training plan	Assisting training plan preparation including soft component plan
10.	Framing for financial budget plan for O&M	Preparing financial budget plan for O&M	Assisting financial budget plan preparation
11.	Consensus-building for land acquisition & compensation plans	Obtaining statement of mutual agreement with the land owners	Monitoring and advising for the consensus building
12.	Consensus-building with residents living in the vicinity of new treatment plant	Obtaining statement of mutual agreement with the residents	Monitoring and advising for the consensus building
13.	Considering measures for connecting to the collection system from outlets (after the Project implementation from technical and economic aspect)	Proposing methodology, budget, etc.	Field survey and assisting the method, cost estimation, etc.
14.	Approval for detailed EIA	Detailed EIA preparation and proceeding approval for EIA	Monitoring and advising for the approval
15.	Approval for Project implementation	Proceeding approval for IP/R and Project implementation	Monitoring and advising for the approvals
16.	Approval for sewage financial budget plan for O&M	Proceeding approval for sewage financial budget plan for O&M	Monitoring and advising for the approval
17.	Obligations by the Client (Hoi An CPC) before the contract of construction for the Project	Installation of gate and fence, construction of access road to the site, securing land such as dumping site, stock yard, etc., facility for power line, city water, city gas, telephone line to the site, etc.	Field survey and advising to CPC and other relevant organizations; then JST will requests appropriate documents to assure the obligations from those organizations, etc.
18.	O&M training before operation of facilities constructed	Preparing O&M staff	Preparing the training plan for O & M

4.2 Technical Note on Preparatory Survey (Second Field Survey)

TECHNICAL NOTE
ON
PREPARATORY SURVEY (SECOND FIELD SURVEY)
FOR
WATER QUALITY IMPROVEMENT PROJECT
FOR
JAPANESE BRIDGE AREA,
IN
HOI AN CITY, QUANG NAM PROVINCE,
SOCIALIST REPUBLIC OF VIETNAM

MARCH 12, 2014

This Technical Note was prepared for the purpose of confirming the technical and fundamental matters on the Second Field Survey, which the JICA Preparatory Survey Team carried out from February 13 to March 12. The Confirmed matters are attached hereto.

It should be noted that this technical note does not mean the commitment of the project scope, project implementation, design and method to be implemented. The final project scope, project implementation, designs, etc. will be decided by the Government of Japan (GOJ) as explained in "Japan's Grant Aid Scheme" during the last Inception Meeting.

Mr. Kazuhiro Asada
Chief Consultant
JICA Preparatory Survey Team
Nihon Suido Consultants Co., Ltd. (NSC)

Mr. Le Van Giang
Chairman
Hoi An City People's Committee (Hoi An CPC)

Mr. Nguyen Van Hien
Chief of Division
Division of Natural Resources and Environment,
Hoi An City (Hoi An DONRE)

1. Planning /Design Condition
(1) Survey area: Catchment Area of Japanese Bridge Channel (5 Wards of: Tan An, Minh An, Cam Pho, Thanh Ha, Cam Ha)
(2) Target Year: Year 2030

2. Design Standards
(1) Design criteria for the latest Vietnam Standards
(2) Japanese standards are also referred to and applied
(3) Other international standards relevant to the study, if any

3. Wastewater Facilities

JICA Preparatory Survey Team (JST) proposed the following new Sewage Treatment Plant (STP) and upgrading of the existing open channel, Japanese Bridge Channel, to Hoi An CPC and DONRE; these however will be further analyzed and may be changed in the homework in Japan due to some reasons.

(1) New Sewage Treatment Plant (STP)

New STP location will be approximately 300m upstream from Japanese Bridge, the same premise proposed by Vietnamese side. Quang Nam Provincial People's Committee (Quang Nam PPC) and JICA agreed on the Minutes of Discussions on 19th December, 2013 that if the Project site is changed, the Project will be cancelled accordingly; proposed location of STP site is shown in **Attachment 1, *Location of Project Area.*** JST proposed the STP of an Advanced Energy Saving Wastewater Treatment Process for new STP facility, and Hoi An CPC and DONRE agreed with the proposal. As of the end of Second Field Survey, the differences between the Request from the Government of Vietnam (June 2012) and proposal from JST are as following table.

	Request (June 2012)	Proposal from JST (March 2014)
Wastewater Treatment Facilities	- Capacity of 2,000 m^3/day - Sludge treatment facilities - Sequencing Batch Reactor Process	- Capacity of 2,000 m^3/day - Sludge treatment facilities - Advanced Energy Saving Wastewater Treatment Process

Hoi An CPC and DONRE assures to obtain necessary approval(s) from the concerned organizations for the construction of STP facilities.

(2) Upgrading of the Existing Open Channel

JST investigated with DONRE on the route of upgrading of open channel, Japanese Bridge Channel, and confirmed requests by Hoi An CPC and DONRE. JST conducted a line survey for the channel during the First Field Survey and estimated necessary length for upgrading channel. As the results, the differences between the Request (June 2012) and proposal from JST are as following table.

	Request (June 2012)	Proposal from JST (March 2014)
Upgrading Open Channel	- About 2.0km	- 1,590 km for upgrading (including extension part of 560m)

JST will continue to study the following request by Hoi An CPC and DONRE in views of reasonableness, technical appropriateness, economical and investment efficiency, etc. during the Study in Japan.

- Sewage Collection: from downstream of proposed STP site.

4. Procurement of the Equipment

In the Request (June 2012), the procurement of operation and maintenance equipment of: a convertible truck, inspection equipment for water quality control (1 set), a personal computer and a printer for data logging was included. In the Minutes of Discussions on 19th December, 2013, both Quang Nam PPC and JICA agreed that necessary operation and maintenance equipment will be procured, if necessary procedure of Vietnam side is completed earlier that the schedule.

5. Training of the Hoi An Members

Currently, no STP exists in Hoi An City. Therefore it is deemed necessary some training of Hoi An members for operation and maintenance for new STP to be constructed. Based on the desires from Hoi An CPC and DONRE, the following training items will be examined by JST and then determined by JICA as Soft Components.

- Operation & Maintenance of STP / Treatment process
- Maintenance of Drain / Channel
- Sewerage financial management
- Public Relations and Environmental Education

These are tentative proposals and the final decision requires JICA's approval based on the necessity and priority evaluations.

Target group of 2 tentative soft components are supposed as follow: Financial Department of PWC for "Sewerage financial management", Environment division of DONRE and Technical and Planning Department of PWC for "Public Relations and Environmental Education". Trained members for Soft Components must be selected before the implementation for these soft components as well as for the other soft components.

6. Other Relevant Issues

(1) Approval for Social and Environmental Consideration

Hoi An CPC and DONRE explained to JST that examination of Pre-EIA was finished and agreed in the end of 2013. Then, it is next expected the Detailed-EIA report will be completed by Construction and Environmental Engineering JSC. - CEEN by the end of March. CPC and DONRE explained that the prepared Detailed EIA will be approved by Quang Nam PPC by the end of May, 2014. However, JICA has concerns about the description in Decree 29/2011/ND-CP that EIA of the project using the land of world heritage shall be appraised and approved by the Ministry. Therefore, Hoi An CPC and JST will jointly confirm the approval agency as soon as possible.

(2) Approval for Project Implementation
Hoi An CPC, DONRE, and JST confirmed that it is expected the Investment Report for the Project (IRP) will be submitted from CEEN by the end of March, and approved by Quang Nam PPC by the end of May, 2014.

(3) Land Acquisition for new STP
The Compensation, Support and Resettlement Plan (CSRP) will be prepared by Land Fund Development Center (LFDC), and then will be approved by Hoi An CPC by the end of April, 2014. Hoi An CPC, DONRE, and JST confirmed that land acquisition for STP site will be completed by the end of April, 2014 also with the investment by Hoi An CPC and execution by DONRE.

(4) Consensus-building with Residents and Land Owners
Hoi An CPC, DONRE, and JST confirmed that Hoi An CPC and DONRE ensures the Consensus-building of Residents vicinity of new STP site and Land Owners by the end of April, with some evidences such as written informed consent.

(5) Establishment of O&M Organization
Hoi An CPC, DONRE, and JST confirmed that CPC and DONRE ensures O&M Organization will be established before construction, the end of November, 2015. Hoi An CPC will submit the letter to JICA by the end of May, 2014, to confirm in which organization an O&M entity of the Project belongs to with the organization chart of the O&M entity.

(6) Securing Budgetary Source for O&M Costs
Hoi An CPC, DONRE and JST confirmed that CPC and DONRE secures the budgetary source for O&M costs for the operation of new facilities and equipment constructed and procured by the Project. Hoi An CPC shall submit the letter to JICA by the end of May, 2014 to confirm the necessary O&M costs of facilities / equipment by this Project shall be secured in the budget of Hoi An CPC every year with the brief document to show sound financial condition of Hoi An CPC.

(7) Execution and Monitoring for Items (1) to (6)
Hoi An CPC and DONRE will execute those action items of (1) to (6), and JST will monitor

the progresses during Study in Japan. When JICA confirmed those items of (1) to (6) were completed with some evidences, JST will be mobilized to Hoi An again and continue the Third Field Survey in Vietnam for the Project.

(8) Roles of Line, Responsible, and Implementation Agency for the Project
Quang Nam Province is the Line Agency, who will conclude the Grant Agreement with JICA; Hoi An CPC is the Responsible Agency, who is in charge of the Project management, and DONRE is the Implementing Agency, who will directly act for the Project coordination.

PMU, who will make agreement and contract for the Consulting Service and Construction, will be established for the Project after the Exchange of Notes expected in January 2015. The PMU will consist of members of: Hoi An CPC and DONRE.

(9) Securing Lands
Hoi An CPC, DONRE, and JST confirmed that, in addition to the land acquisition for STP site, CPC and DONRE will be required securing the following lands during the construction stage.

- Temporary stock yard and site
- Suitable disposal area for the surplus soil
- Temporary approach roads to construction sites

(10) Others
Hoi An CPC, DONRE, and JST confirmed that CPC and DONRE will carry out the following installation in timely manner:

- Gate and fence surrounding of the STP site. (at the end of construction stage)
- Power line, city water, telephone line to STP site. (before construction stage)

Special construction regulations shall be further discussed with JST in the Third Field Survey in Vietnam.

In addition to the above, the Government of Vietnam is required Banking Arrangement (B/A) and Authorization to Pay (A/P) arrangements, and VAT, custom duties, internal tax, and other fiscal levies shall be exempt or borne by the Government of Vietnam during Project Implementation.

Necessary costs to be borne by the Government of Vietnam will be examined in the Study of Japan.

Regarding "6. Other Relevant Issues" above, the demarcation of CPC & DONRE and JST and milestone schedules are shown in **Attachment 2,** ***Demarcation of Both Sides related to the Project***, and **Attachment 3,** ***Further Schedule***.

Attachments

- Attachment 1: Location of Project Area
- Attachment 2: Demarcation of Both Sides related to the Project
- Attachment 3: Further Schedule

4.3 Minutes of Stakeholder Meeting

MINUTES OF STAKEHOLDERS' MEETING

BIÊN BẢN CUỘC HỌP CÁC BÊN LIÊN QUAN

1. Meeting information/*Thông tin cuộc họp*:

- Date/*Ngày*: 06/03/2014
- Meeting 1 (Authorities concerned)/: 08:00am – 09:00am
  Cuộc họp thứ nhất (Các cơ quan có liên quan): 08:00am – 09:00am
- Meeting 2 (Authorities and residents concerned, 09:00am – 10:00am
  Cuộc họp thứ hai (Các cơ quan và người dân có liên quan): 09:00am – 10:00am
- Location: Hoi An CPC meeting room
  Địa điểm: Phòng họp UBND Thành phố Hội An

2. Content/*Nội dung*:

Meeting between stakeholders: representatives from government offices, people and businesses in the project area for environmental and social considerations

Họp giữa các bên liên quan: đại diện các cơ quan chính quyền, nhân dân và các doanh nghiệp đóng tại địa bàn dự án để bàn về các vấn đề môi trường và xã hội.

3. Participants (See the list attached)

Thành phần tham dự *(xem file đính kèm)*

- Nuihon Suido Consultants (NSC): Dr. Asada and members

Đơn vị tư vấn nước ngoài: Tiến sỹ Asada và các thành viên

- National Consultant (Subcontractor): Representatives of CEEN-Construction and Environmental Engineering, JSC

Đơn vị tư vấn trong nước (tư vấn phụ): Công ty Cổ phần Kỹ thuật Môi trường và Xây dựng.

- Hội An CPC/*Đơn vị thành phố Hội An:*
  - Mr. Lê Văn Giảng, Chairman of CPC, Coordinator of the Meeting
    Ông Lê Văn Giảng, chủ tịch ủy ban thành phố Hội An, chủ trì cuộc họp
  - Mr. Nguyễn Văn Hiền: Head of DONRE and members
    Ông Nguyễn Văn Hiền: Trưởng phòng môi trường TP Hội An và các thành viên
  - Huynh Ty: Director of Land Fun Development Center
    Ông Huỳnh Ty: Giám đốc TT PTQĐ
  - Representatives of City People's Council and Father Front, Women's Union, City Commerce and Tourism Division, Hoi An City Division of Economic, Center for Cultural Heritage Management and Reservation.
    Đại diện TT HĐND TP, UB MTTQ, Hội Phụ nữ, Phòng TM&DL Thành phố, Phòng Kinh tế Hội An và Trung tâm QL Bảo tồn Di sản Tp.Hội An.
  - Representatives of People's Committee of Cẩm Phô, Thanh Hà, Tân An ward

Đại diện lãnh đạo UBND phường Cẩm Phô, Lãnh đạo UBND phường Thanh Hà, Lãnh đạo UBND phường Tân An.

- Representatives of affected households (For Meeting 2: from 9am to 10 am)

Đại diện các hộ dân chịu ảnh hưởng của Dự án (tham dự cuộc họp thứ 2: từ 9am đến 10am)

- All of landowners of sewage treatment site (agricultural land): Mr.Cau, Ms.Suu, Ms. Sao
  Tất cả các chủ sở hữu của các lô đất thuộc hiện trường nhà máy XLNT (đất nông nghiệp): Ông Cầu, Bà Sáo, Bà Sửu.
- Owner of Tea Garden Homestay, Head of Cam Pho Kindergarten, Owner of Huy Hoang Hotel, and some other residents living near the STP area.
  Chủ Homestay Tea Garden, Hiệu trưởng trường Mẫu Giáo Cẩm Phô, Chủ KS Huy Hoàng

3. Contents/*Nội dung*

- ***Meeting 1: Meeting with concerned agencies***

Cuộc họp 1: Cuộc họp giữa các cơ quan có liên quan

Contents of the meeting/*Nội dung cuộc họp*:

- Introduction of the Project Scope to have mutual agreement on key contents of the Project
  Giới thiệu với các bên liên quan về Phạm vi Dự án để đạt được sự đồng thuận về các nội dung chủ chốt của Dự án.
- Presentation on environment and social issues of the Project, and discussion and agreement on environmental and social considerations of the Project
  Báo cáo tình hình môi trường và xã hội của dự án, thảo luận và đi đến nhất trí với việc xem xét các vấn đề xã hội của Dự án.

➢ Process of the meeting/*Quá trình họp*:

- Mr. Lê Văn Giảng (Chairman of CPC): Opening address of the meeting
  Ông Lê Văn Giảng (Chủ tịch HĐND tỉnh): Phát biểu khai mạc
- Mr. Nguyễn Văn Hiền (Head of DONRE): Report on the Project progress and introduction of the contents of meeting.
  Ông Nguyễn Văn Hiền: Báo cáo Tiến độ Dự án và giới thiệu nội dung cuộc họp.
- Dr Asada: Introduction of the Project
  Tiến sỹ Asada: Phát biểu, mô tả dự án
- Mr.Tobe: Presentation on environment and social issues of the Project
  Mr. Tobe: Trình bày các vấn đề về môi trường và xã hội của dự án

➢ Question and Answer/*Hỏi – Trả lời*:

Questions/*Hỏi*	**Answers/*Trả lời***
Mr. Lê Văn Giảng (Chairman of CPC): Could the Consultant present the solutions to collect	Dr. Asada (NSC): Possible technical solution for collecting wastewater from the downstream of the STP is that grey water can be sent to STP by

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wastewater in the downstream of the STP? *Ông Lê Văn Giảng: Đề nghị đơn vị tư vấn làm rõ giải pháp thu gom nước thải phía hạ lưu của nhà máy xử lý?*	manhole type pump station, after separating grey water from storm water. *Tiến sỹ Asada (NSC): Giải pháp kỹ thuật khả thi đối với việc thu gom nước thải ở khu vực hạ lưu nhà máy là nước thải sinh hoạt có thể chuyển về Nhà máy XLNT thông qua các trạm bơm đặt ở hố ga sau khi tách nước thải sinh hoạt ra khỏi nước mưa.*
Mr. Hung (City Finance Division): Is there any possibility of odors and noise affecting the households around the STP by the operation of STP? *Mr. Hùng (Phòng Tài chính Thành phố): Khi đưa nhà máy này vào hoạt động, liệu tiếng ồn và mùi hôi từ hệ thống xử lý nước thải có ảnh hưởng đến các nhà dân xung quanh hay không?*	Mr. Tobe (NSC): According to the design of STP, there is little noise and odor around STP in operation phase as a result of closed building and deodorization process. The noise and odor will less than the required limitation on environmental standard in VN. *Mr. Tobe (NSC): Theo thiết kế của nhà máy, sẽ có một chút tiếng ồn và mùi xung quanh khu vực nhà máy trong giai đoạn vận hành như là kết quả của quá trình khử mùi trong hệ thống nhà kín. Tiếng ồn và mùi phát sinh đều sẽ thấp hơn tiêu chuẩn về các thông số môi trường cho phép của Việt Nam hiện hành.*
Mr. Hien (Head of DONRE): How long the temporary road for construction will last for? How much does it cost for the temporary rented land? Who will pay for that? It should not be included in the land compensation budget funded by CPC. Is there any construction method for channel to mitigate temporary land occupation? If temporary land occupation is required, compensation plan should be arranged for this matter. *Mr. Hiền: Việc xây dựng đường tạm phục vụ cho công tác xây dựng nhà máy xử lý sẽ kéo dài trong thời gian bao lâu, chi phí thuê đất*	Dr. Asada (NSC): Rental for temporary access to STP site will be imposed to CPC, and detailed requirement of temporary lands for construction will be presented in draft final report of this survey. *Tiến sỹ Asada (NSC): UBND Thành phố chịu trách nhiệm thuê đất tạm thời để tiếp cận khu vực nhà máy XLNT, và yêu cầu chi tiết về đất thuê phục vụ cho thi công sẽ được trình bày trong bản dự thảo báo cáo cuối cùng của cuộc khảo sát này.*

tạm thời như thế nào, ai chi trả? Ngân sách này không bao gồm trong chi phí bồi thường đất do UBND thành phố chi trả. Biện pháp thi công kênh hở như thế nào để ít chiếm đất? Trường hợp có chiếm đất thì phải tính toán trước để có phương án bồi thường.	

- ***Meeting 2: Meeting with concerned households and businesses***

Cuộc họp 2: Cuộc họp giữa các hộ dân có liên quan và các đơn vị kinh doanh

Contents of the meeting/*Nội dung cuộc họp*:

- Introduction of the Project Scope to have mutual agreement on key contents of the Project
  Giới thiệu với các bên liên quan về Phạm vi Dự án để đạt được sự đồng thuận về các nội dung chủ chốt của Dự án.
- Presentation on environment and social issues of the Project, and discussion and agreement on environmental and social considerations of the Project
  Báo cáo tình hình môi trường và xã hội của dự án, thảo luận và đi đến nhất trí với việc xem xét các vấn đề xã hội của Dự án.

➢ Process of the meeting/*Quá trình họp*:

- Mr. Lê Văn Giảng (Chairman of CPC): Opening address of the meeting
  Ông Lê Văn Giảng (Chủ tịchUBND TP Hội An): Phát biểu khai mạc
- Mr. Nguyễn Văn Hiền (Head of DONRE): Report on the Project progress and introduction of the contents of meeting.
  Ông Nguyễn Văn Hiền: Báo cáo Tiến độ Dự án và giới thiệu nội dung cuộc họp.
- Dr Asada: Introduction of the Project
  Tiến sỹ Asada: Phát biểu, mô tả dự án
- Mr.Tobe: Presentation on environment and social issues of the Project
  Mr. Tobe: Trình bày các vấn đề về môi trường và xã hội của dự án

➢ Question and Answer/*Hỏi và trả lời*:

Questions/Hỏi	**Answers/Trả lời**
Nguyễn Sửu (Household nearby STP site): I agree with the land acquisition. However, my house's wastewater now is being discharged into the STP area. I would like to request to solve wastewater discharge of my house if the STP is	Mr. Le Van Giang (Chairman of CPC): The Consultant doesn't have responsibility to answer this question. Wastewater will be discharged into common wastewater system. CPC will handle this issue.

constructed. *Cô Nguyễn Sửu (hộ ở gần NMXLNT): Đồng ý để thành phố thu hồi đất. Tuy nhiên, nước thải nhà tôi hiện đang xả ra khu vực nhà máy. Tôi muốn yêu cầu giải quyết việc xả nước thải của nhà tôi nếu nhà máy được xây dựng?*	*Mr. Le Van Giang (Chủ tịch UBND Thành phố): Tư vấn không có trách nhiệm trả lời câu hỏi này. Nước thải sẽ được thoát ra hệ thống cống chung. UBND Thành phố sẽ giải quyết vấn đề này.*
Mr.Cau (Household): Thank the City and JICA for conducting the Project. I agree with land acquisition for the Project implementation. I would like to know how much the land you need to acquire. How is the compensation policy? *Chú Cầu: Cảm ơn thành phố cũng như tổ chức JICA đã thực hiện dự án, đồng ý cho thu hồi đất để thực hiện dự án, muốn biết diện tích thu hồi là bao nhiêu, vấn đề giải tỏa và đền bù như thế nào?* Mr.Cau's Wife: I agree with land acquisition for Project implementation. We request not to acquire the remaining land that is out of the project area. Compensation should be based on negotiation with affected households. *Cô (Vợ chú Cầu): Đồng ý cho thu hồi đất để thực hiện dự án, phần đất còn lại không nằm trong phạm vi dự án thì đề nghị để lại cho gia đình. Vấn đề đền bù phải theo thỏa thuận với hộ gia đình.*	Mr. Le Van Giang (Chairman of CPC): Compensation policy will be based on the government regulations on compensation, support, and site clearance. *Mr. Giảng (Chủ tịch UBND Thành phố): Vấn đề gải tỏa và đền bù sẽ theo các qui định của nhà nước về chính sách giải tỏa đền bù.* Mr.Hien (Head of DONRE): For the acquisition of land, compensation will be transparent and based on the leadership of the CPC. Number of land to be acquired will be discussed directly with the households when benchmark is made. *Mr. Hiền (Trưởng phòng TNMT): Đối với trường hợp thu hồi đất, sẽ làm công khai và theo chỉ đạo của ủy ban thành phố, diện tích thu hồi bao nhiêu sẽ làm việc trực tiếp với hộ gia đình khi tiến hành cắm mốc.*
Mr.Cau: In case of malfunction of wastewater treatment system, how will the contingency be solved? *Chú Cầu: Trong trường hợp hệ thống xử lý nước thải bị sự cố, phương án dự phòng sẽ như thế nào để giải quyết sự cố.*	Dr. Asada (NSC): Before and after the STP start running, Japanese experts will train Vietnamese staff for the operation and maintenance of STP including countermeasures for emergency case. As a result, they will have enough capacity to solve any problems of STP including emergency case. *Dr. Asada (NSC): Trước và sau khi hệ thống đi vào hoạt động, các chuyên gia Nhật Bản sẽ huấn luyện cho các các bộ quản lý và vận hành của Việt Nam*

	về vận hành hệ thống xử lý nước thải, bao gồm cả việc xử lý các tình huống khẩn cấp. Kết quả là họ sẽ có đủ năng lực để xử lý bất kỳ sự cố nào của NMXLNT, bao gồm cả tình huống khẩn cấp.
Mr.Yen (Head of Kindergarten): I'm very happy for implementation of the Project. During the construction, noise and dust must be mitigated as much as possible to the level not to affect the children in the kindergarten. *Chị Yến: Vui mừng khi dự án được thực hiện, vấn đề tiếng ồn và bụi trong quá trình thi công phải được khắc phục tốt nhất để không ảnh hưởng đến trẻ nhỏ.*	Mr. Tobe: During the construction, watering on road and construction site will be conducted to mitigate the dust, and the low-emission and low-noise equipment will be installed to mitigate dust and noise. *Mr. Tobe (NSC): Trong quá trình xây dựng, việc tưới nước sẽ được thực hiện để giảm bụi, đồng thời sử dụng các thiết bị máy móc có tiếng ồn và khí thải thấp để giảm thiểu bụi và tiếng ồn.*

4. Conclusion

Stakeholders including affected households and businesses agreed with project implementation and expressed their support for the Project.

Affected households also agreed with land acquisition for the public goal.

In construction and operation phases, project management unit shall make due considerations to dust, noise and odor around project site.

Các bên liên quan, bao gồm cả các hộ bị ảnh hưởng, nhất trí với các nội dung của cuộc họp và bày tỏ sự ủng hộ đối với Dự án.

Các hộ bị ảnh hưởng cũng đồng ý với việc thu hồi đất cho mục đích công. Trong quá trình xây dựng và giai đoạn vận hành, ban quản lý dự án sẽ có các biện pháp để giảm thiểu bụi, tiếng ồn và mùi tại khu vực dự án.

On behalf of Hoi An People's Committee	On behalf of JICA Survey Team
Thay mặt UBND TP Hội An	*Thay mặt nhóm khảo sát JICA*
CHAIRMAN/ CHỦ TỊCH	PROJECT MANAGER/GIÁM ĐỐC DỰ ÁN
Mr Le Van Giang	Dr Kazuhiro Asada

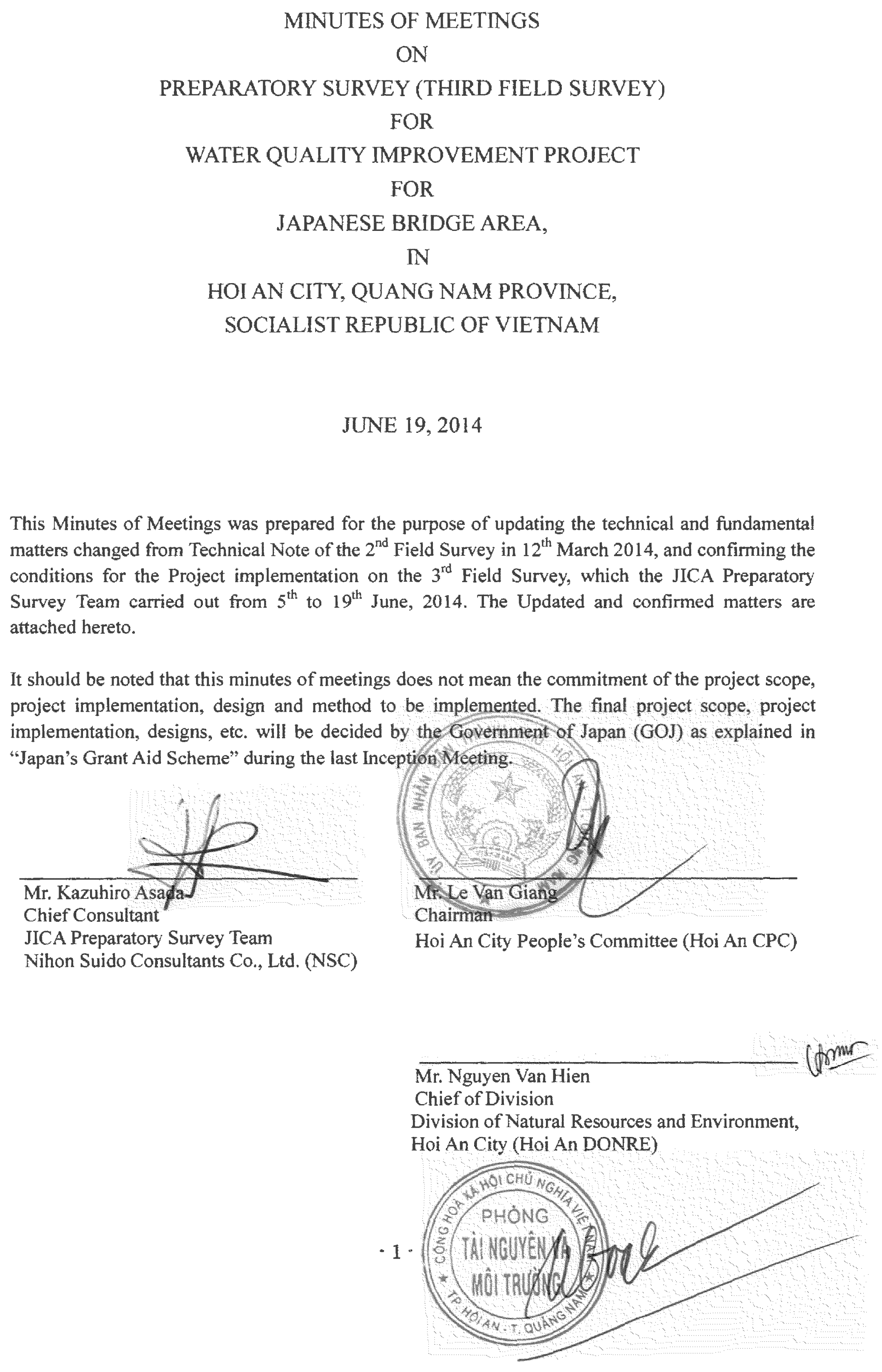
6

ATTENDANT SHEETS/DANH SÁCH THAM DỰ HỌP
(Hội An, 06/03/2014)

No/ Stt	Name/Họ và tên	Affiliation & Position/Chức danh & Cơ quan
A.	**List of concerned agencies/Danh sách các cơ quan có liên quan**	
1	Lê Văn Giảng	Chairman of CPC *Chủ tịch UBND tỉnh*
2	Nguyễn Văn Dũng	Vice Chairman of CPC *Phó Chủ tịch UBND tỉnh*
3	Đỗ Lai	Vice Head of Urban Management Division *Phó Phòng QLĐT Thành phố*
4	Nguyễn Văn Tú	Vice Chairman of Thanh Ha PC *Phó Chủ tịch UBND huyện Thanh Hà*
5	Lê Viết Phúc	Head of DOLISA *Phó Phòng LĐTBXH*
6	Trần Thị Thanh Nga	Hoi An City Youth Union *Đoàn Thanh niên Thành phố Hội An*
7	Đinh Hoa	Tan An Ward PC *UBND Phường Tân An*
8	Phan Văn Lưu	People's Council *Hội đồng Nhân dân*
9	Lê Chơi	Chairman of City Father Front *Chủ tịch UBMT Tổ quốc*
10	Đinh Hùng	Vice Head of Finance and Planning Division *Phó Phòng Tài chính – Kế hoạch*
11	Huỳnh Ty	Director of Land Fund Development Center *Giám đốc Trung Tâm Phát triển Quỹ đất*
12	Nguyễn Văn Hiền	Head of DONRE *Trưởng phòng Tài nguyên Môi trường*
13	Trần Thị Thu Hoà	Vice Chairman of Women's Union *Phó Chủ tịch Hội LHPN*
14	Trần Văn Nhân	Vice Chairman of the Office Division of CPC *Phó Chánh Văn phòng UBND Thành phố*
15	Nguyễn Minh Lý	Vice Chairman of the Office Division of People's Council *Phó Chánh Văn phòng HĐND Thành phố*
16	Nguyễn Thị Ngọc Dung	Vice Head of Commerce and Tourism Division *Phó phòng Thương mại và Du lịch*
17	Võ Duy Trung	Staff of Hoi An Center for Cultural Heritage Management and Reservation *Cán bộ Trung tâm Bảo tồn Di tích Văn Hoá thành phố Hội An*
18	Phạm Thị Thanh Ngọc	Staff of Economy Division *Cán bộ Phòng Kinh tế*

19	Lâm Thị Hồng Nhung	Staff of Administrative Office – CPC *Cán bộ Văn phòng – UBND Thành phố*
20	Nguyễn Thanh Sơn	Staff of DONRE *Cán bộ Phòng TN-MT*
21	Lê Đại Quang	Staff of DONRE *Cán bộ Phòng TN-MT*
22	Trần Trung Lộc	Staff of DONRE *Cán bộ Phòng TN-MT*
23	Ngô Nguyên Thọ	Vice Chairman of Cam Pho CPC *Phó Chủ tịch UBND Phường Cẩm Phô*
24	Huynh Quang Ha	Land Officer – Cam Pho ward Cán bộ địa chính Phường Cẩm Phô
25	Nguyễn Thị Thanh Xuân	Environment Officer - Cam Pho ward Cán bộ Môi trường – Phường Cẩm Phô
B	**List of concerned households & businesses/Danh sách các hộ gia đình và đơn vị kinh doanh có liên quan**	
26	Hồ Viết Hoà	Tea Garden Homestay - *Cơ sở Lưu trú Vườn Trà*
27	Nguyễn Tuấn Lợi	Household *(hộ gia đình)*
28	Đặng Văn Cầu	Land Owner (STP) – *Hộ sở hữu đất khu vực nhà máy*
29	Phạm Thị Yến	Kindergarten - *Nhà trẻ*
30	Nguyễn Viết Tuấn	Hotel – *Khách sạn*
31	Nguyễn Thị Sửu	Land Owner (STP) – *Hộ sở hữu đất khu vực nhà máy*
32	Dương Thị Sáo	Land Owner (STP) – *Hộ sở hữu đất khu vực nhà máy*
33	Nguyễn Hà	Household, 111 Tran Hung Dao, Hoi An – *Hộ gia đình tại số 111 Trần Hưng Đạo*
34	Dương Văn Hiếu	Vinh Huong Hotel 3 – Khách sạn Vĩnh Hưng 3
35	Trần Văn Chương	Thuy Duong Hotel 3 – Khách sạn Thuỳ Dương 3

4.4 Minutes of Meetings on Preparatory Survey (Third Field Survey)



MINUTES OF MEETINGS
ON
PREPARATORY SURVEY (THIRD FIELD SURVEY)
FOR
WATER QUALITY IMPROVEMENT PROJECT
FOR
JAPANESE BRIDGE AREA,
IN
HOI AN CITY, QUANG NAM PROVINCE,
SOCIALIST REPUBLIC OF VIETNAM

JUNE 19, 2014

This Minutes of Meetings was prepared for the purpose of updating the technical and fundamental matters changed from Technical Note of the 2nd Field Survey in 12th March 2014, and confirming the conditions for the Project implementation on the 3rd Field Survey, which the JICA Preparatory Survey Team carried out from 5th to 19th June, 2014. The Updated and confirmed matters are attached hereto.

It should be noted that this minutes of meetings does not mean the commitment of the project scope, project implementation, design and method to be implemented. The final project scope, project implementation, designs, etc. will be decided by the Government of Japan (GOJ) as explained in "Japan's Grant Aid Scheme" during the last Inception Meeting.

Mr. Kazuhiro Asada
Chief Consultant
JICA Preparatory Survey Team
Nihon Suido Consultants Co., Ltd. (NSC)

Mr. Le Van Giang
Chairman
Hoi An City People's Committee (Hoi An CPC)

Mr. Nguyen Van Hien
Chief of Division
Division of Natural Resources and Environment,
Hoi An City (Hoi An DONRE)

PHÒNG TÀI NGUYÊN VÀ MÔI TRƯỜNG

1. Completion of Land Acquisition for new STP site and EIA Approval
JICA Preparatory Survey Team (JST) and Hoi AN CPC (CPC) confirmed that land acquisition for new STP site was completed by payment to land owners with the bills on 23rd April, and that EIA approval was obtained from Quang Nam PPC (PPC) with a letter, No.1643/QD-UBND on 29th May, 2014 (See Attachment 1).

2. Establishment of O&M Organization and Securing Budgetary Source for O&M Costs
JST and CPC confirmed that the O&M Organization would be established in Public Works Joint Stock Company (PWC), and that the budgetary source for O&M costs and replacement costs for the newly constructed facilities and equipment would be secured from the annual budget of CPC every year, by the letter from CPC, No. 1383/UBND on 26th May, 2014 (See Attachment 2).

3. Required Documents for Investment Project (F/S) Report Approval
JST submitted to Hoi An DONRE on 10th and 11th June the following documents requested from DONRE by the letter, No.149/CV-TN&MT on 3rd June, 2014 (See Attachment 3).

- Resister license of main consultant and local consultant
- Contract (or other documents) between main consultant and local consultant related to project establishment
- Capacity profile of local consultant
- Drawings (set 2) of Investment Project need to be signed and sealed by consultant and investor

Regarding the remaining requirement, "Letter from JICA assign the main consultant to be responsible for project establishment", JST explained to CPC about the Japan Grant Aid scheme that JICA would not be able to commit any thing including to assign any consultant during this preparatory survey. Only after the Grant Agreement (G/A) between JICA and PPC followed by the Exchange of Notes (E/N), it would be able to obtain from JICA.

CPC also understood the scheme of Japan Grant Aid explained above by JST, and proposed to send a letter to Department of Planning and Investment (DPI) of PPC for special measures for the approval of F/S report without assign letter of consultant from JICA. If the reply from DPI is negative, they would consider another alternative, such as obtaining the approval of F/S report as soon as after the G/A.

4. Procurement of Equipment

The procurement of Equipment listed in the Request (June 2012), which was pended in the Technical Note of 2nd Field Survey on 12th March, 2014, will be considered in the next study in Japan (the 2nd Study in Japan) with JICA's suggestion and comments. The result will be reported to CPC in the next field survey, Explanation/Discussion of Draft Final Report expected in October, 2014.

5. Training of the Hoi An Members

In the Technical Note of the 2nd Field Survey, JST proposed four (4) activities as Soft Components. However, as the result of 1st Study in Japan during April and May, 2014, JST proposed three (3) activities listed below. CPC showed their consensus to the proposal.

- Operation & Maintenance of STP / Treatment process
- Maintenance of Drain / Channel
- Sewerage financial management

These are still tentative proposals and the final decision requires JICA's approval based on the necessity and priority evaluations. The result will be reported to CPC in the next field survey, Explanation/Discussion of Draft Final Report.

6. Consensus-building with Residents

CPC has already obtained two documents, the Minute of Meeting for Community Participation and the letter No 86/CV-UBND dated 3rd April from Cam Pho Ward People's Committee. Moreover, EIA is not approved without consensus building with residents surrounding of STP site, so CPC considers that the consensus with residents have been already built.

7. Building of STP

JST explained CPC that the height of building for STP would become higher than the regulated height of 10.5m. In this regard, JST will discuss with Hoi An Center for Monument Management & Preservation (HCMMP) on 19th June, 2014. Based on the discussion, CPC approved that the height for STP should be maximum 13.5m despite the regulation.

8. Sewage Collection: from downstream of proposed STP site

JST and CPC confirmed that sewage collection system from downstream of proposed STP site will be separated from the Water Quality Improvement Project for Japanese

Bridge Area, and CPC will establish the project themselves independently, as CPC's letter, No. 824/UBND, on 4th April 2014 (See Attachment 4).

9. Securing Lands

Hoi An CPC, DONRE, and JST confirmed that, in addition to the land acquisition for STP site, CPC and DONRE will be required securing the following lands during the construction stage.

- ➢ Temporary stock yard and site
- ➢ Suitable disposal area for the surplus soil
- ➢ Temporary approach roads to construction sites

These locations and feasibilities of acquisition will be examined by CPC and DONRE, and further discussed with JST in the Forth Field Survey (Explanation / Discussion of Draft Final Report), in Vietnam.

10. Approval Procedure for Temporary Approach Roads to STP sites

Approval procedure for the construction of temporary approach road to STP site will be examined by CPC and DONRE, and further discussed with JST in the Forth Field Survey (Explanation / Discussion of Draft Final Report), in Vietnam.

Attachments

- Attachment 1: Letter, No.1643/QD-UBND on 29th May, 2014, for EIA Approval from Quang Nam PPC
- Attachment 2: Letter, No. 1383/UBND on 26th May, 2014, for O&M Organization and Budgetary Source for O&M Costs from Hoi An CPC
- Attachment 3: Letter, No.149/CV-TN&MT on 3rd June, 2014, for Required Documents for Investment Project (F/S) Report Approval from Hoi An DONRE
- Attachment 4: Letter, No. 824/UBND, on 4th April 2014, for Sewage Collection: from downstream of proposed STP site from Hoi An CPC
- Attachment 5: Tentative Further Schedule

4.5 Minutes of Discussions on Preparatory Survey (Explanation of Draft Report)

MINUTES OF DISCUSSIONS
FOR
THE PREPARATORY SURVEY ON
WATER QUALITY IMPROVEMENT PROJECT
FOR JAPANESE BRIDGE AREA IN HOI AN CITY,
QUANG NAM PROVINCE, SOCIALIST REPUBLIC OF VIETNAM
(EXPLANATION OF DRAFT REPORT)

From December 2013, to June 2014, Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched a preparatory survey team on the Project for Water Quality Improvement Project for Japanese Bridge Area in Hoi An city, Quang Nam province (hereinafter referred to as "the Project"), the Socialist Republic of Vietnam (hereinafter referred to as "Vietnam"), and through discussions, field surveys, and technical examination of the results, JICA prepared the Draft Preparatory Survey Report (hereinafter referred to as "Draft Report").

In order to explain the contents of the Draft Report and to consult with the officials concerned of the Government of Vietnam (hereinafter referred to as "the GOV"), JICA sent the Draft Report Explanation Team (hereinafter referred to as "the Team") to Vietnam, which is headed by Mr. Kazunao SHIBATA, the Director of the Environmental Management Team 2, Global Environment Department, JICA, from 8th to 11th December, 2014.

As a result of the discussions, both parties confirmed the main items described in the attached sheets.

Quang Nam, 11th December, 2014

柴田和直

Mr. Kazunao Shibata
Leader
Draft Report Explanation Team
Japan International Cooperation Agency
Japan

Mr. Dinh Van Thu
Vice Chairman
Quang Nam Provincial People's
Committee
Vietnam

Mr. Nguyen Van Dung
Vice Chairman
People's Committee of Hoi An City,
Quang Nam province
Vietnam

ATTACHMENT

1. Contents of the Draft Report

The Vietnamese side agreed and accepted in principle the contents of the Draft Report explained by the Team. The outline of the Draft Report is attached in Annex 4.

2. Japan's Grant Aid Scheme

The Vietnamese side understood the Japan's Grant Aid Scheme, as attached in Annex 1 to 3, and will take the necessary measures as described in the Annexes. The Vietnamese side will also allocate necessary budget for smooth implementation of the Project, as a condition for the Japanese Grant Aid to be implemented.

3. Tentative Schedule of the Project and the Survey

JICA will complete the Final Report in accordance with the confirmed items and send it to the Government of the Vietnam by February, 2015.

4. Confidentiality of the Project

(1) Detailed Specifications

Both sides confirmed all the information related to the Project including detailed specifications of the facilities, equipment and other technical information shall not be released to any other party (ies) before the signing of all the contract(s) for the Project.

(2) Project Cost Estimate

The Team explained to the Vietnamese side the estimated project cost to be borne by the Government of Japan (hereinafter referred to as "the GOJ") and the GOV in Annex 5. The Team also explained that it is a provisional estimate and would be further examined by the GOJ for the approval of the Grant. The Vietnamese side understood that the project cost estimate is subjected to be modified.

Both sides agreed that the project cost estimate should never be duplicated in any form nor disclosed to any other party(ies) before the signing of all the contract(s) for the Project. This confidentiality of the estimated project cost is necessary to ensure fairness of the tender procedure.

5. Other Relevant Issues

(1) Responsible and Implementing Agency

The responsible agency of the Project is the Quang Nam Provincial People's Committee (hereinafter referred to as "Quang Nam PPC"), and the implementing agency is Hoi An City People's Committee (hereinafter referred to as "Hoi An CPC").

Hoi An CPC bears the full responsibility including administration, coordination and supervision of the Project.

Hoi An CPC will be the owner of the facilities and equipment provided under the Project and will be also responsible to acquire necessary budget and coordinate with the relating locality offices to ensure the operation and maintenance of the facilities and equipment.

Public Works Joint Stock Company, Hoi An City (hereinafter referred to as "PWC") will be responsible to operate and maintain them.

(2) Undertakings of the Vietnamese Side

Both sides confirmed that the GOV would carry out the issues shown in Annex 3 and 4 in accordance with the implementation schedule of the Project in addition to the previous minutes.

Main undertakings by the Vietnamese side are as follows: (The detail is described in Annex 6.)

a. Environmental and Social Consideration

i) Guidelines to be applied

Both sides confirmed that the Project is subject to the "JICA Guidelines for Environmental and Social Considerations" (April 2010) (hereinafter referred to as the "Guideline").

ii) Environmental Category

Both sides confirmed that the Project is classified as Category B because the Project is not located in a sensitive area, nor has it sensitive characteristics, nor falls it into sensitive sectors under the Guideline, and its potential adverse impacts on the environment are not likely to be significant.

iii) Environmental Impact Assessment (EIA)

Both sides confirmed that EIA approval was obtained from Quang Nam PPC with the Decision No.1643/QD-UBND dated on May 29th, 2014.

iv) Land Acquisition and Compensation

Both sides confirmed that land acquisition and compensation for new sewerage treatment plant (STP) site was completed by the payment to land users on April 23rd, 2014, in accordance with JICA's Guideline and Vietnamese laws.

v) Environmental Checklist

Both sides confirmed information on environmental and social considerations including major impacts and relevant mitigation measures are summarized in the Environmental Checklist attached as Annex 4 (Appendix 2). The Vietnamese side confirmed they will inform JICA of any major changes which may affect environmental and social considerations made for the Project by revising the Checklist in a timely manner.

vi) Environmental Monitoring

The Vietnamese side confirmed that environmental monitoring will be conducted based on the Environmental Monitoring Plan (Annex 4 Table 1.3-2) under assistance of Project Management Consultant in order to minimize possible negative environmental/ social impacts based on the Environmental Management Plan (Annex 4 Table 1.3-1).

The Vietnamese side agreed that the results of environmental monitoring will be provided to JICA as a part of Quarterly Progress Report (QPR) by filling in the Monitoring Form for construction attached as Annex 4 (Appendix 1) on a quarterly basis during construction.

After the completion of the Project, The Vietnamese side confirmed the Monitoring Form for operation attached as Annex 4 (Appendix 1) will be submitted to JICA semiannually or annually for 3 years.

In case JICA finds that there is a need for improvement in a situation with respect to environmental considerations after the agreed monitoring period, JICA may request to extend the period of monitoring and reporting until JICA confirms the issues have been properly addressed in accordance with the agreement between The Vietnamese side and JICA.

vii) Disclosure of Monitoring Result

JICA will disclose the monitoring results conducted by the Vietnamese side on its web site to the extent that they are made in public in Vietnam. JICA may also disclose further information, when third parties request, with permission of the Vietnamese side.

viii) Land Lease

The land lease for a temporary approach road and a stock yard for STP and rehabilitation of the Japanese Bridge Canal during construction will be carried out by the Vietnamese side, in accordance with JICA's Guideline and Vietnamese laws.

b. Construction permission for the STP plant

- Acquisition of the permission for the construction of STP plant and the Japanese Bridge Canal, and for the use of dumping site during the construction phase;
- Confirmation of Hoi An CPC's agreement on the Detailed Design based on the comments from related departments, including Hoi An Center for Monuments Management, prior to its submission to relevant authorities of the Province for approval;
- Confirmation of the approval on the Detailed Design by relevant authorities of the Province ;
- While the Project is in the buffer zone in the World Heritage area and does not need to acquire the permission from UNESCO according to its definition, the Vietnam side will have responsibility to share the information on the contents of the Project with UNESCO before the project implementation.

c. Sewer Lines Construction taken by Hoi An CPC

The Construction of a collection system of wastewater from the downstream area of the STP plant will be taken by Hoi An CPC before the completion of STP construction, according to the Letter No. 824/UBND dated April 4th, 2014, complying the regulations of the Vietnamese Government and UNESCO. The basic design and estimated cost of the collection system is described in Annex 4 (Figure 3.11-1).

d. Preparation of necessary infrastructures, water and electricity at the STP site

The Vietnamese side agreed to prepare the following infrastructure for smooth operation of the STP plant constructed by the Project:

- Electrical power distribution to the STP site;
- City water supply to the STP site;
- Landline telephone connection to the STP site;
- Construction of main and sub gates, fences and security and/or reception box construction in/around the STP site.
- Construction of access road from the main road to the STP site.

e. Allocation of necessary budget and staffs for the operation and maintenance of the wastewater treatment plant and Japanese Bridge Canal.

The Vietnamese side agreed to secure and allocate necessary budget and staffs for proper, effective and sustainable operation and maintenance for wastewater treatment plant and Japanese Bridge Canal as described in Annex 4 and 6.

The Team recommended the recruitment of four (4) engineers at PWC for proper operation and maintenance of STP facilities and equipment. However, the Vietnamese side explained the difficulty in recruiting such number of engineers. Both sides agreed that at least the Sub-Section Chief should be a mechanical engineer and the other three staffs can also be skilled technicians, and all the four staffs should be permanent staffs.

f. Procedure for Banking Arrangement and Authorization to Pay

The Vietnamese side agreed to take necessary procedures for issuing Authorization to pay (A/P) required for payments to the Japanese consultant and/or contractor(s) and to bear the following commission fees to a bank in Japan for the banking services based upon the Banking Arrangement (B/A) at the time of commencement of the Project (April 2015).

- Advising commission of A/P
- Payment commission

g. Tax exemption

The Vietnamese side agreed to ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the Socialist Republic of the Vietnam with respect to the purchase of the products and the services arising from the Project activities be exempted.

For smooth process of tax exemption, the Vietnamese side suggested the Japanese side submission of the list of local procurement (describing items and their quantities) before the procedure, and the Team understood it.

(3) The Contents of the Supplied Items and Constructed Facilities

The Team explained that the total Project cost has not been finalized and is subjected to change. In case of any change of the Project cost, the contents of the supplied items and constructed facilities may also be changed. The Vietnamese side understood it.

(4) Technical Assistance

The Team explained that the contents of the technical assistance as "Soft Component" would focus on the subjects as described in Annex 4, and the Vietnamese side agreed on it.

The Vietnamese side committed to assign responsible staff and operators before the Soft Component starts as described in the Draft Report.

(5) Structural design of the canal

The Vietnamese side requested the section between the upper end of Japanese Bridge Canal and the Bus stop (560m) to be closed canal, because there is a plan of road expansion along the section. Both sides agreed to review the structural design during the Detailed Design phase.

ANNEXES

Annex-1	JAPAN'S GRANT AID for General Projects
Annex-2	Flow chart of Japan's Grant Aid procedures
Annex-3	Major Undertakings to be taken by each side
Annex-4	Draft Preparatory Survey Report
Annex-5	Project Cost Estimate
Annex-6	Special Items to be taken by Vietnamese Side

Appendix.5

Soft Component (Technical Assistance) Plan

Appendix 5 Soft Component (Technical Assistance) Plan

PREPARATORY SURVEY
ON
WATER QUALITY IMPROVEMENT PROJECT FOR JAPANESE BRIDGE AREA IN HOI AN CITY,
QUANG NAM PROVINCE,
SOCIALIST REPUBLIC OF VIETNAM

Soft Component (Technical Assistance) Plan

January 2015

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
NIHON SUIDO CONSULTANTS CO., LTD

PREPARATORY SURVEY
ON
WATER QUALITY IMPROVEMENT PROJECT FOR JAPANESE BRIDGE AREA IN HOI AN CITY,
QUANG NAM PROVINCE,
SOCIALIST REPUBLIC OF VIETNAM

Soft Component (Technical Assistance) Plan

Table of Contents

1. Background to the Soft Component Plan

The aim of the "Water Quality Improvement Project for the Japanese Bridge Area, Hoi An City, Quang Nam Province, Socialist Republic of Vietnam" is to improve the water quality in the Japanese Bridge Canal by way of collecting and treating sewage and drainage by improving the existing open canal and by constructing a sewage treatment facility (2,000m^3/day) using the Pre-treated Trickling Filtration (PTF).

The Public Works Joint Stock Company (hereinafter referred to as "PWC") of Hoi An City is planning to establish an operation and maintenance (hereinafter referred to as "O&M") section, which shall be responsible for the O&M of the sewage treatment facility.

In many developing countries, O&M was not properly implemented even though a sewage treatment facility had been constructed. Therefore, it is often seen that the sewage treatment facility was left broken once it was damaged. This is caused by financial problem, technical problem of the O&M staff, and procurement problem of damaged material and equipment.

In order to improve the water quality in the Japanese Bridge Canal by utilizing the sewage treatment facilities constructed by this project continuously, the O&M section of this project and the staff carrying out O&M of the sewers and drains must have an adequate technical capabilities, while the staff carrying out financial management must also be sufficiently capable of doing their job.

There are a number of training options available to improve the technical capability of the staff, such as internal training within PWC; training by public and private agencies in Vietnam; training by the contractor during Total Test Operation (1st and 2nd commissioning)[1]; and Soft Component. It is important to use the appropriate option as necessary in each case, in order to improve skills efficiently.

Table 1-1 shows the enterprise management, facility O&M tasks, necessary training methods and Soft Component plan.

Table 1-1 General Tasks, Training Methods and Soft Component Plan

No.	General Tasks	Training Items / Notes	Training Methods	Soft Component Plan (Draft)
1	Facility operation (including sludge treatment)	Operation of sewage treatment facility	Guidance on operation of STP with pump, sludge treatment/disposal, O&M record format preparation, etc., shall be provided during the contractor's Total Test Operation. **Support on the establishment of O&M organization shall be provided by the Soft Component**.	**Operation and Maintenance Guidance of Sewage Treatment System**
2	Maintenance & Inspection, repair of facilities	Maintenance of sewage treatment facility & drain/canal	Guidance in maintenance of the sewage treatment facility shall be included in the Total Test Operation by the contractor. **Training for planning the cleaning & dredging of the sewers and drains, staff allocation (increase) plan, etc. shall be conducted by Soft Component.**	**Maintenance Guidance of the Japanese Bridge Canal**

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[1] The period of ordinary commissioning by the contractor to familiarize the local Sewage Treatment facility operators with O&M is called the "1st commissioning". The six-month period thereafter during which the contractor determines the optimal operation conditions is called the "2nd commissioning". These operations are collectively called the Total Test Operation.

No.	General Tasks	Training Items / Notes	Training Methods	Soft Component Plan (Draft)
3	Water quality test & analysis	Simple testing is carried out directly. Other parameters are outsourced.	Generally, the training is conducted by organizations in Vietnam. Operation of the sewage treatment facility in accordance with the test results shall be covered in the contractor's Total Test Operation.	
4	Connection of houses to public sewer	Construction: private Quality control: public	In this project, connection to houses is not yet planned: therefore, training for quality control shall not be conducted.	
5	Recording & management of sewerage facility information (facility ledger)	Facility information management	There is no sewer network in this project and the sewage treatment facility is the main facility. Therefore, it is included in the contractor's Total Test Operation.	
6	Procurement & control of materials/equipment	Procurement plan/inventory control	As yet there is little by way of materials/equipment to be procured and managed. Therefore, this shall be included in the contractor's Total Test Operation.	
7	Accounting, financial planning, tariff revision plan (accounting and finance)	General accounting, sewerage financial plan, setting of sewerage tariff	Training in accounting shall be carried out in Vietnam. There will be no training in the setting of sewerage tariffs, as there is no plan to establish a sewerage tariff. **As PWC engages in the other field than sewerage, the Soft Component should be conducted to clarify the revenue - expense only for sewerage and to support on budget request procedure.**	**Sewerage Financial Management Planning Assistance**
8	Tariff billing and collection	Outsourcing to water supply company, if necessary	Training shall not be carried out as a sewerage tariff is not yet planned.	
9	Public relations and customer service	PR, house connection promotion, citizen awareness	Excluded from the Soft Component, as it has already been conducted there. Also it is difficult to change peoples' opinions within a short period of time.	

Source: Prepared by JST

Consequently, the proposed Soft Component covers 3 fields of activity. The following table gives an outline of these fields within the proposed Soft Component.

Table 1-2 Outline of Soft Component

No.	Soft Component Plan	Outline of Assistance
1	O&M Guidance of Sewage Treatment System	Support on establishment of the O&M organization Assist the preparation of Terms of Reference (TOR) of training by contractor during Total Test Operation
2	Maintenance Guidance of Japanese Bridge Canal	Assistance for institutional arrangement for inspection and cleaning of the Japanese Bridge Canal Assistance for preparation of inspection and cleaning manual and record format Guidance on actual implementation of the above manual
3	Sewerage Financial Management Planning Assistance	Guidance on understanding of importance of financial arrangement for sewerage Guidance on preparation of daily accounting formats of sewerage works and implementation of them Guidance on preparation of annual revenue – expense report and future budget plan

Source: Prepared by JST

(1) O&M Guidance of Sewage Treatment System

PWC has no experiences of O&M of full-fledged STP, since there is no such a facility in Hoi An City. Therefore, the staff of the O&M section to be established within PWC and the other relevant PWC and Hoi An CPC staff (referred to below as C/P) shall be trained through the Soft Component with respect to the O&M of the sewage treatment facility.

During the Total Test Operation period, the contractor will carry out the training on how to operate individual mechanical equipment, guidance on combination operation of the equipment, support on establishment of facility information database and guidance on how to use it, and support on preparation of the O&M manual and O&M record format. On the other hand, the consultants shall conduct support on establishment of O&M organization through the Soft Component. In concrete, job demarcation among sewerage sector related agencies such as PWC and Hoi An CPC, preparation and explanation of job description. Furthermore, TOR of training by contractor during Total Test Operation shall be prepared with the support of Soft Component consultant.

(2) Maintenance Guidance of Japanese Bridge Canal

The Construction Works Team, PWC, is responsible for cleaning and dredging of the drain/canal. The Team is considered to have sufficient skills to cope with the cleaning of drains. However, masses of garbage and sludge have accumulated in the Japanese Bridge Canal. One of the reasons for this situation is that there is no relevant overall maintenance plan (including cleaning and dredging) designed specifically for Hoi An City as a whole, and therefore the number of staff, including laborers, allocated is insufficient.

In this project, therefore, a Soft Component for improving the capacity for inspection and cleaning of the Japanese Bridge Canal shall be provided, targeting the Construction Works Team and the Technical & Planning Dept. of the PWC, which will plan and supervise the cleaning and dredging works, with the other related staff of PWC and Hoi An CPC (referred to below as C/P).

In this Soft Component, the training covers assistance for institutional arrangement for inspection and cleaning of the Japanese Bridge Canal; and assistance in the preparation of an easy-to-understand manual with record formats for the inspection and cleaning of the Japanese Bridge Canal, and guidance on an actual usage of them. If the additional staff is considered to be necessary for inspection and cleaning, this Soft Component shall assist the awareness raising activities to the management class of PWC and Hoi An CPC (if necessary).

(3) Sewerage Financial Management Planning Assistance

In Hoi An City, this project will establish a sewerage system with a sewage treatment facility for the first time. If a proper budgetary system is not established to allocate an adequate annual O&M and replacement budget, there is the possibility of the entire sewerage system being lost due to the breakdown of equipment in the not too distant future.

The PWC also collects and transports solid waste, looks after roadside trees, maintains street lights, etc. In the event of the O&M section of the sewage treatment facility coming under the jurisdiction of the PWC, the budget and actual expenditure for the O&M section shall be incorporated in the PWC as a whole. Therefore, the income and expenditure status of the sewerage service alone would be unclear. In order to allocate relevant budget to sewerage service, revenues and expenditures of O&M only for sewerage should be recorded every year precisely, and these must be reflected on the future budget plan.

Therefore, the Soft Component shall be provided to improve sewerage financial management skills by targeting those who are expected to be responsible for the budget planning and closing of accounts for the O&M section, namely, the management level of the PWC, the management of the O&M section, the staff of the Finance Department of PWC, and the Division of Finance – Planning of Hoi An CPC, and the other related staff (referred to below as C/P).

In this Soft Component, the activities include a guidance on the importance of budgetary arrangements for sewerage O&M and replacement; training in preparation of daily accounting formats for a sewerage service and actual use of them; guidance on the preparation of an annual income - expenditure report specific to a sewerage service; support on budget request procedure; support on preparation of future budget plan including replacement cost; etc.

2. Purpose of the Soft Component

The purpose of the Soft Component is “The facilities improved in this project are used effectively and durably.”

3. Outputs of the Soft Component

The outputs of the Soft Component will be as follows;

1) O&M Guidance of Sewage Treatment System
Now: The PWC does not have enough staff members with the capacity to undertake O&M for the sewage treatment facility.
Output: The C/P will be able to plan O&M system for the sewage treatment facility constructed in this project continuously.

2) Maintenance Guidance of Japanese Bridge Canal
Now: The Japanese Bridge Canal is not kept sufficiently clean, so that garbage and sludge accumulate in it.
Output: The C/P will be able to improve the condition of cleaning at the Japanese Bridge Canal.

3) Sewerage Financial Management Planning Assistance
Now: The PWC lacks experience in the financial management of a sewerage service.
Output: The C/P will understand the importance of budgetary arrangements for sewerage services and be able to prepare an annual income - expenditure report for the sewerage service.

4. Evaluation of Achievement of Outputs

Table 4-1 shows how the level of achievement of the Soft Component can be evaluated for each field and output.

Table 4-1 Means of Verification of Achievement of Soft Component for each Field and Output

Field	Output	Items to Check the Achievement	Means of Verification
O&M Guidance of Sewage Treatment System	The C/P will be able to plan O&M system for the sewage treatment facility constructed in this project continuously.	1. Has the O&M system been established? 2. The contents of training by contractor during Total Test Operation is decided?	1. Job demarcation document of each agency 2. Job description of each agency 3. TOR of training by contractor during Total test operation

Maintenance Guidance of Japanese Bridge Canal	The C/P will be able to improve the condition of cleaning at the Japanese Bridge Canal.	1. Has an inspection and cleaning staffing plan been prepared? 2. Has an inspection and cleaning manual for the Japanese Bridge Canal been prepared? Can the facility be inspected and cleaned following the manual? 3. Is an inspection and cleaning record for the Japanese Bridge Canal prepared and kept?	1. Existence of an inspection and cleaning staffing plan 2. Existence of an inspection and cleaning manual for the Japanese Bridge Canal and a practical skills check record 3. Existence of an inspection and cleaning record
Sewerage Financial Management Planning Assistance	The C/P understands the importance of budgetary arrangements for sewerage services and prepares an annual income - expenditure report for the sewerage service.	1. Can the C/P prepare daily accounting documents for sewerage income and expenditure? 2. Can the C/P prepare an annual income - expenditure report? 3. Can the C/P prepare a budget plan for replacements? 4. Has a flow chart for securing a budget been prepared and recognized by the parties concerned?	1. Existence of accounting formats 2. Existence of annual income - expenditure statement 3. Existence of draft future budget plan 4. Existence of budget request procedure flow chart 5. Short test

5. Activities of the Soft Component (Input Plan)

Table 5-1 shows the details of the activities (input plan) implemented under this Soft Component. Note that man-months of local interpreter are posted as 4.80 MM. As described in “7. Implementation Schedule of the Soft Component,” the local operations of the three Japanese experts are divided into two or three sessions. In between these sessions, the C/P staff shall review drafts of manual and format for themselves and carry out self-training and other activities.

Table 5-1 Activities of the Soft Component (Input Plan)

Field	Outputs	Activities	Required input
O&M Guidance of Sewage Treatment System	The C/P will be able to plan O&M system for the sewage treatment facility constructed in this project continuously.	1. Support on preparation of job demarcation of each organization related to sewerage service 2. Support on preparation of job description of each organization related to sewerage service 3. Preparation of TOR for capacity enhancement of sewage treatment facility operators by the contractor	Sewage treatment facility O&M expert (Japanese consultant): One person x 2.0 M/M Interpreter / translator (local staff): One person x 2.0 M/M
Maintenance Guidance of Japanese Bridge Canal	The C/P will be able to improve the condition of cleaning at the Japanese Bridge Canal.	1. Assistance in planning the inspection and cleaning system (staffing) of the Japanese Bridge Canal[*1] 2. Assistance in the preparation of an easy to understand and serviceable manual with record format for the inspection and cleaning of Japanese Bridge Canal, and on-the-job training in use of the manual	Sewer and drain maintenance expert (Japanese consultant): One person x 1.5 M/M Interpreter / translator (local staff): One person x 1.5 M/M
Sewerage Financial Management Planning	The C/P understands the importance of budgetary arrangements for	1. Lectures and guidance on the importance of budgetary arrangements for the O&M of sewerage works 2. Support on preparation of the daily	Sewerage works financial planning expert (Japanese consultant):

Assistance	sewerage services and prepares an annual income - expenditure report for the sewerage service.	accounting formats and annual income - expenditure report for the sewerage service, with the actual input training by using them 3. Guidance in the preparation of a future budget plan for O&M costs, including equipment replacement costs 4. Support on preparation of operation flow chart for budgetary arrangements for replacement costs, and assistance on the actual use of it.	One person x 2.0 M/M Interpreter / translator (local staff): One person x 1.3 M/M

Note:

*1: The assistance also covers preparation of an inspection and cleaning rotation plan for Hoi An City and, if required, proposals to PWC and Hoi An CPC, regarding staff increases, hiring of temporary workers, and outsourcing.

Table 5-1 shows the staff assignment plan for this Soft Component.

	Field of Expertise	Name	Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**Man/month**	
																				Total	
																				Vietnam	Japan
Japanese engineers	Sewerage Treatment Facility O&M Expert			1.0 ■		1.0 ■														2.00	0.00
	Sewer and Drain Maintenance Expert						1.0 ■		0.5 ■											1.50	0.00
	Sewerage Financial Planning Expert						0.7 ■				0.6 ■							0.7 ■		1.30	0.00
																				4.80	0.00
Local staff	Interpreter / translator			1.0 ■		1.0 ■	1.0 ■		0.5 ■		0.6 ■							0.7 ■		4.10	0.00
																				0.00	0.00
																				4.10	0.00
Reports					△ Implementation Status Report			△ Implementation Status Report				△ Implementation Status Report							△ Completion Report		

Legend：Work in Vietnam ■

Table 5-1 Soft Component Staff Assignment Plan

6. Procurement Method of Resources for the Soft Component Implementation

In this Soft Component, the following three engineers shall be dispatched to Vietnam. The sewage treatment system (Pre-treated Trickling Filtration process) to be developed in this project has almost never been operated in Vietnam. There are few local experts with knowledge of the O&M of this process. Therefore, the operation of this facility by local human resources only would be difficult, taking into consideration also the current state of the Japanese Bridge Canal with respect to cleaning and the environmental awareness of the residents. The employment of Japanese consultants is advisable. Therefore, this Soft Component shall comprise direct assistance by Japanese consultants.

1) Sewage Treatment Facility O&M Expert

One Japanese consultant well versed in all aspects of O&M of a sewage treatment facility shall be dispatched to Vietnam. The consultant shall not provide guidance in how to operate individual machines or electrical equipment (which is to be provided by the contractor) but shall assist in the planning of the O&M structure (organization) for the sewerage service. Specifically, the assistance shall cover the support on preparation of job demarcation and description (or tasks assigned) of each organization related to sewerage service, support on preparation of weekly O&M staffing table for new O&M section, and the support on preparation of TOR for capacity enhancement of sewage treatment facility operators by the contractor. This kind of knowledge and know-how is available to the Japanese consultant.

2) Sewerage and Drainage Facility Maintenance Expert
One Japanese consultant well versed in maintenance of sewer and drain shall be dispatched to Vietnam. The assistance shall cover the support on planning of inspection and cleaning organization, support on inspection and cleaning rotation planning including the other sewers and drains, and, if required, the preparation of proposals to PWC and Hoi An CPC concerning staff increases or the hiring of temporary workers, etc. The expert will also provide assistance in the preparation of an easy-to-understand manual with a record format for the inspection and cleaning of the Japanese Bridge Canal, and on-the-job training in use of the manual. The expert must have knowledge on maintenance of sewer and drain and be efficient in carrying out a wide range of operations, such as delivering lectures, preparing manuals and examining record formats. Thus, a Japanese consultant is required for this work.

3) Sewerage Financial Planning Expert
One Japanese consultant well versed in the financial planning of sewerage works shall be dispatched to Vietnam. The assistance shall cover guidance in the importance of budgetary arrangements for O&M of sewerage works, guidance in the preparation of a future budget plan for O&M costs including equipment replacement costs, assistance in the preparation of an accounting formats and income - expenditure report for the sewerage service only and guidance in input to these documents, and assistance in the formation of operating procedures for budgetary arrangements for O&M and replacement. The expert must be informed in the Japanese financial system for sewerage facilities and have extensive knowledge of the state of O&M of sewerage facilities, the financial and organizational situation, etc., in developing countries. Therefore, the participation of a Japanese consultant is the most appropriate.

7. Implementation Schedule of the Soft Component

Figure 7-1 shows the overall implementation schedule (draft). Figure 7-2 shows the Soft Component schedule (draft).

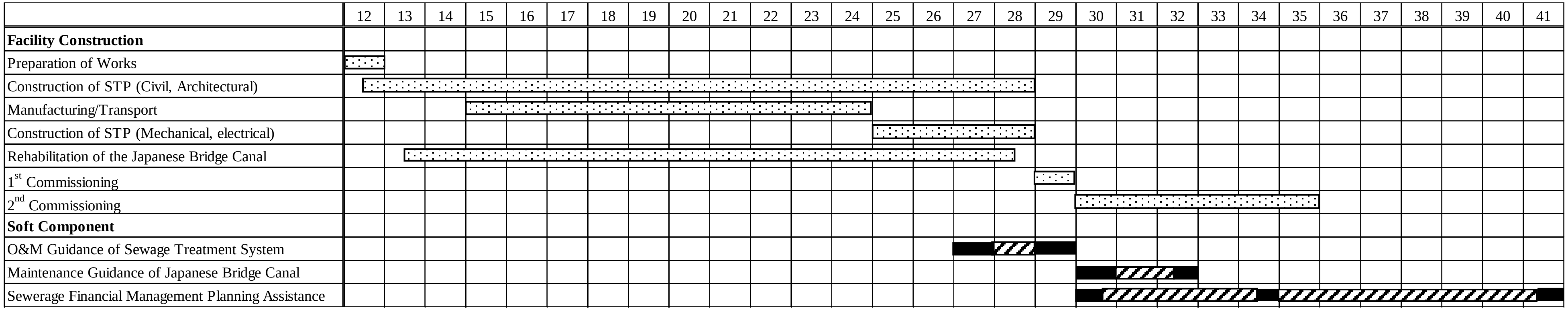
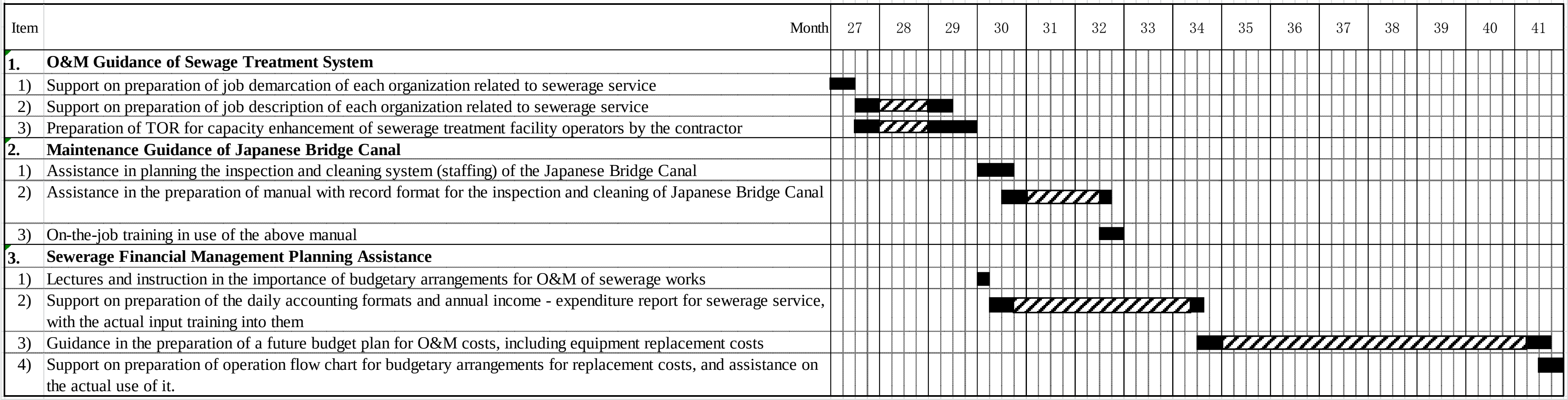


Figure 7-1 Overall Implementation Schedule (Draft)



Legend: Japanese experts and local staff ■ C/P work ▨

Figure 7-2 Soft Component Schedule (Draft

During the preparation of the job demarcation and description, manuals, record formats and income - expenditure report, it should take some time for the C/P staff to study and review the drafts to be corrected. Therefore, the dispatch of Japanese experts to Vietnam shall be divided into several sessions; twice for the sewage treatment facility O&M expert, twice for the sewer and drain maintenance expert, and three times for the sewerage financial planning expert. In between these sessions, the C/P staff shall study and confirm the content of the various manuals and formats.

8. Products (manual, formats, files, reports, etc.) of the Soft Component

The products of the Soft Component are as follows:

- Operation and Maintenance Guidance of Sewage Treatment System

Lecture materials, Job demarcation and description of each organization related to sewerage service, and TOR for capacity enhancement of sewage treatment facility operators by the contractor

- Maintenance Guidance of Japanese Bridge Canal

Lecture materials, record formats, and manuals for the inspection and cleaning of the Japanese Bridge Canal

- Sewerage Financial Management Planning Assistance

Lecture materials, daily accounting formats and income - expenditure report for the sewerage service, budget plans for O&M and equipment replacement, and flow chart for budgetary arrangements

Furthermore, there are the following reports to be submitted:
- Soft Component Implementation Status Report
- Soft Component Completion Report

These reports shall be written in compliance with the “Soft Component Guidelines (3rd Edition)” (October 2010) by Japan International Cooperation Agency. The Soft Component Completion Report shall include the guidance that has been given (activity achievements) and the results (output achievement status, future issues and proposals, etc.).

9. Estimated Project Cost of the Soft Component

This Soft Component includes a total of 5.50 M/M for Japanese consultants and a total of 4.80 M/M for local interpreter / translator. Therefore, the estimated project cost is approximately JPY 16.2 million as shown in Table 9-1.

Table 9-1 Estimated Project Cost of Soft Component (in million JPY)

Direct labor costs	4.5
Direct costs	5.9
Overhead costs	5.8
Total for this Soft Component	16.2

10. Obligations of Recipient Country

The O&M section, the target of this Soft Component, must have a relevant number of staff members. The required number of persons must be recruited and assigned by the Vietnamese side. The assignment of persons of the target group of this Soft Component, including the PWC's basic staff education to new recruits, should be completed before the commissioning by the contractor and the implementation of the Soft Component.

Note that there must be staff members with knowledge of water quality control (persons in charge at the O&M section) involved in the O&M guidance of Sewage Treatment system. Unless the staff members have acquired know-how in basic water quality testing and understanding of analysis results before the start of commissioning, it will be difficult to achieve the outputs of O&M guidance of Sewage Treatment system with the above-mentioned input and during the given period of time. Using water quality analysis organization of Da Nang City and so on, the Vietnamese side must ensure that the persons in charge at the O&M section receive training of water quality analysis such as water quality testing and sampling so as to acquire the required technologies and skills.

Appendix.6.1

Monitoring Form for Environmental and Social Considerations

Appendix 6.1 Monitoring Form for Environmental and Social Considerations

Monitoring Results of Water Quality Improvement Project for Japanese Bridge Area
(Construction Phases)

M-1. Monitoring Results of Air Quality and Noise

Station Name:____________________

Date:____________________________

No.	Parameters	Unit	Measured Value	Environmental Standard(1)
1	Temperature	^oC		-
2	Humidity	%		-
3	Wind speed	m/s		-
4	Noise	dBA		70(2)
5	Total particulate matter	mg/m^3		0,3
6	CO	mg/m^3		30
7	SO_2	mg/m^3		0,35
8	NO_2	mg/m^3		0,2
9	NH_3	mg/m^3		0,2(3)
10	H_2S	mg/m^3		0,042(3)

(1) QCVN 05: 2013/BTNMT: National technical regulation on ambient air quality
(2) QCVN 26:2010/BTNMT: National technical regulation on noise
(3) QCVN 06:2009/BTNMT: National technical regulation on some hazardous substances in ambient air

M-2. Monitoring Results of Wastewater Quality

Station Name: ____________________

Date: ____________________________

No.	Parameters	Unit	Measured Value	Environmental Standard(1)
1	pH	-		5 - 9
2	TSS	mg/l		100
3	BOD_5	mg/l		50
4	COD	mg/l		-
5	T-N	mg/l		-
6	T-P	mg/l		-
7	Nitrate	mg/l		50
8	Ammonia	mg/l		10
9	Cu	mg/l		-
10	Zn	mg/l		-
11	Ni	mg/l		-
12	As	mg/l		-
13	Pb	mg/l		-
14	Coliforms	MPN/ 100ml		5000

(1) QCVN 14:2008/BTNMT: National technical regulation on domestic wastewater

M-3. Monitoring Results of Solid Waste

Location Name: ____________________

Category of Waste: __________________

No.	Date	Amount of Solid Waste	Unit	Disposal Site
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

M-4. Monitoring Results of Accidents / Worker & Public Injury

Location Name: ____________________

No.	Date	Category (Accidents / Worker & Public Injury)	Outline	Results of Treatment
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

M-5. Monitoring Results of Worker and public health problems

Date: ____________________

No.	Location	Category of Health Problems	Number of Patients	Measures
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

M-6. Monitoring Results of Land Leased for Temporary Approach Road during Construction

Date: ______________________________

Monitoring Reporter: ________________

No.	Item	Progress	Responsible Agency
1	Public Consultation		
2	Compensation Payment		
3	Land Leased		
4			
5			

Monitoring Results of Water Quality Improvement Project for Japanese Bridge Area
(Operation Phase)

M-7. Monitoring Results of Air Quality and Noise

Station Name:____________________

Date:____________________________

No.	Parameters	Unit	Measured Value	Environmental Standard[1]
1	Temperature	^oC		-
2	Humidity	%		-
3	Wind speed	m/s		-
4	Noise	dBA		70[2]
5	Total particulate matter	mg/m^3		0,3
6	CO	mg/m^3		30
7	SO_2	mg/m^3		0,35
8	NO_2	mg/m^3		0,2
9	NH_3	mg/m^3		0,2[3]
10	H_2S	mg/m^3		0,042[3]

(1) QCVN 05: 2013/BTNMT: National technical regulation on ambient air quality
(2) QCVN 26:2010/BTNMT: National technical regulation on noise
(3) QCVN 06:2009/BTNMT: National technical regulation on some hazardous substances in ambient air

M-8. Monitoring Results of Wastewater Quality

Station Name: ____________________

Date: ____________________________

No.	Parameters	Unit	Measured Value	Environmental Standard(1)
1	pH	-		5 – 9
2	TSS	mg/l		100
3	BOD_5	mg/l		50
4	COD	mg/l		-
5	T-N	mg/l		-
6	T-P	mg/l		-
7	Nitrate	mg/l		50
8	Ammonia	mg/l		10
9	Cu	mg/l		-
10	Zn	mg/l		-
11	Ni	mg/l		-
12	As	mg/l		-
13	Pb	mg/l		-
14	Coliforms	MPN/ 100ml		5000

(1) QCVN 14:2008/BTNMT: National technical regulation on domestic wastewater

M-9. Monitoring Results of Ground Water Quality

Station Name: ____________________

Date: ____________________________

No.	Parameters	Unit	Measured Value	Environmental Standard(1)
1	pH	^{o}C		5.5 - 8.5
2	TDS	mg/l		1,500
3	COD	mg/l		4
4	Hardness	mg/l		500
5	Fe	mg/l		5
6	As	mg/l		0.05
7	Sulfate	mg/l		400
8	Mn	mg/l		0.5
9	Nitrate	mg/l		15
10	Ammonia	mg/l		0.1
11	Cd	mg/l		0.005
12	Cu	mg/l		1
13	Zn	mg/l		3
14	Hg	mg/l		0.001
15	Coliforms	MPN/ 100ml		3

(1) QCVN 09:2008/BTNMT: National technical regulation on groundwater quality

M-10. Monitoring Results of River Water Quality

Station Name:_______________________

Date:_______________________________

No.	Parameters	Unit	Measured Value	Environmental Standard(1)
1	pH	-		5.5 - 9
2	TSS	mg/l		50
3	BOD_5	mg/l		15
4	COD	mg/l		30
5	Nitrate	mg/l		10
6	Ammonia	mg/l		0.5
7	Cu	mg/l		0.5
8	Zn	mg/l		1.5
9	Ni	mg/l		0.1
10	As	mg/l		0.05
11	Pb	mg/l		0.05
12	Coliforms	MPN/ 100ml		7,500

(1) QCVN 08:2008/BTNMT: National technical regulation on surface water quality, column B1 applies to surface water used for irrigation purposes or other purposes, not for domestic use.

M-11. Monitoring Results of Solid Waste Quality

Station Name:____________________

Date:____________________________

No.	Parameters	Unit	Measured Value	Environmental Standard(1)
1	As	mg/l		2
2	Cd	mg/l		0.5
3	Hg	mg/l		0.2
4	Pb	mg/l		15

(1) QCVN 07: 2009/BTNMT: National technical regulation on hazardous waste thresholds

M-12. Monitoring Results of Solid Waste Amount

Location Name: STP

Category of Waste:

No.	Date	Category	Amount	Disposal Site
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

M-13. Monitoring Results of Complaints on Noise and Odor

No.	Date	Name	Complaints	Results of Response
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

M-14. Monitoring Results of Accidents / Worker & Public Injury

Location Name: STP

No.	Date	Category (Accidents / Worker & Public Injury)	Outline	Results of Treatment
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Appendix.6.2

Environmental Checklist

Appendix 6.2 Environmental Checklist

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
1 Permits and Explanation	(1) EIA and Environmental Permits	(a) Have EIA reports been already prepared in official process? (b) Have EIA reports been approved by authorities of the host country's government? (c) Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied? (d) In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?	(a) Y (b) Y (c) N (d) N/A	(a)(b) The EIA report was prepared and was approved by Quang Nam Province on May 29, 2014. (c) No conditions added. (d) No additional environmental permits are required according to Vietnamese regulations.
	(2) Explanation to the Local Stakeholders	(a) Have contents of the project and the potential impacts been adequately explained to the Local stakeholders based on appropriate procedures, including information disclosure? Is understanding obtained from the Local stakeholders? (b) Have the comment from the stakeholders (such as local residents) been reflected to the project design?	(a) Y (b) Y	(a) By holding the stakeholder meeting, adequate explanation was done and stakeholders agreed the project basically. (b) Comments were stated and requests were submitted from the stakeholders and countermeasures will be disclosed.
	(3) Examination of Alternatives	(a) Have alternative plans of the project been examined with social and environmental considerations?	(a) Y	(a) Alternative plans are partially explained in the stakeholder meeting and fully described in the report.
2 Pollution Control	(1) Water Quality	(a) Do pollutants, such as SS, BOD, COD contained in effluents discharged by the facility operations comply with the country's effluent standards? (b) Does untreated water contain heavy metals?	(a) Y (b) N	(a) As a result of installation of new sewerage treatment plant in this project, the pollutants discharged from new sewerage treatment plant will comply with the country's effluent standards. (b) The current untreated water in the channel doesn't contain heavy metals based on the water quality survey.
	(2) Wastes	(a) Are wastes, such as sludge generated by the facility operations properly treated and disposed in accordance with the country's regulations?	(a) Y	(a) The sludge generated by the sewerage treatment plant will be dried, transferred to Hoi An waste treatment plant, according to the current design.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
	(3) Soil Contamination	(a) If wastes, such as sludge are suspected to contain heavy metals, are adequate measures taken to prevent contamination of soil and groundwater by leachates from the wastes?	(a) N/A	(a) The current untreated water in the channel doesn't contain heavy metals based on the water quality survey.
	(4) Noise and Vibration	(a) Do noise and vibrations generated from the facilities, such as sludge treatment facilities and pumping stations comply with the country's standards?	(a) Y	(a) All facilities will be installed indoors and noise will not reach the boundary of the site.
	(5) Odor	(a) Are adequate control measures taken for odor sources, such as sludge treatment facilities?	(a) Y	(a) All facilities will be installed indoors and odor will not reach the boundary of the site. In addition, the proper solid waste collection & disposal system will be developed, and the deodorization facility will be installed, according to the current design.
3 Natural Environment	(1) Protected Areas	(a) Is the project site or discharge area located in protected areas designated by the country's laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas?	(a) N	(a) The sites are located in Zone II-A which is a buffer zone for historical area. So the building is designed with consideration for landscape based on the regulation for Zone II-A.
	(2) Ecosystem	(a) Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)? (b) Does the project site or discharge area encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions? (c) If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on the ecosystem? (d) Is there a possibility that the amount of water used (e.g., surface water, groundwater) by project will adversely affect aquatic environments, such as rivers? Are adequate measures taken to reduce the impacts on aquatic environments, such as aquatic organisms?	(a) N (b) N (c) N/A (d) N	(a) The sites are all within developed lands. (b) There are no protected habitats of endangered species according to Hoi An DONRE and the EIA report approved by Quang Nam Province. (c) As above (d) The aquatic environments will be improved as a result of installation of new sewerage treatment plant in this project.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
4 Social Environment	(1) Resettlement	(a) Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement? (b) Is adequate explanation on compensation and resettlement assistance given to affected people prior to resettlement? (c) Is the resettlement plan, including compensation with full replacement costs, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement? (d) Is the compensations going to be paid prior to the resettlement? (e) Is the compensation policies prepared in document? (f) Does the resettlement plan pay particular attention to vulnerable groups or people, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples? (g) Are agreements with the affected people obtained prior to resettlement? (h) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan? (i) Are any plans developed to monitor the impacts of resettlement? (j) Is the grievance redress mechanism established?	(a) Y (b) Y (c) Y (d) Y (e) Y (f) Y (g) Y (h) Y (i) Y (j) Y	(a) The land acquisition for the planned STP site of approximately 0.36 ha is required. And the compensation for land owners was completed on April 23, 2014 according to JICA guideline and Vietnamese regulations. (b) Hoi An CPC had conducted the consensus building with land owners of STP site as shown in Minutes of Meeting for Community Participation on March 10, 2014. (c) The CSRP (Compensation, Support and Resettlement Plan) including the compensation for land owners based on the full replacement costs was prepared. (d) The compensation for land owners was completed on 23 April, 2014, before the resettlement. (e) The CSRP was prepared by LFDC (Land Fund Development Center) and approved by Hoi An CPC on April 10, 2014. (f) The households of land owners include woman, children and elderly, so the necessity of support for them was considered in the preparation of CSRP through the consensus building. (g) The agreements with the land owners obtained prior to resettlement and were included in the CSRP. (h) Hoi An CPC implemented and completed the compensation for land owners by April 23, 2014. The budget for appraisal and implementation is also included in the CSRP. (i) Hoi An DONRE has implemented the monitoring for the impacts of resettlement. (j) The grievance redress mechanism is assured in the Vietnamese regulations and also CSRP.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
	(2) Living and Livelihood	(a) Is there a possibility that the project will adversely affect the living conditions of inhabitants? Are adequate measures considered to reduce the impacts, if necessary?(b) Is there a possibility that the amount of water used (e.g., surface water, groundwater) by the project will adversely affect the existing water uses and water area uses?	(a) N (b) N	(a)(b) The land use in the sewerage treatment plant site will be changed, but the sanitation and living environment will be improved as a result of installation of new sewerage treatment plant in this project. Construction activities can cause inconvenience to inhabitants but the countermeasures for impact minimization were agreed in the stakeholder meeting. The land acquisition of the planned STP is required, but no adverse impacts the living conditions of land owners are expected as a result of the compensation for them based on full replacement cost.
4 Social Environment	(3) Heritage	(a) Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage? Are adequate measures considered to protect these sites in accordance with the country's laws?	(a) N	(a) The sites are located in Zone II-A which is a buffer zone for historical area. So the building is designed with consideration for landscape based on the regulation for Zone II-A.
	(4) Landscape	(a) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?	(a) N	(a) The sites are located in Zone II-A which is a buffer zone for historical area. So the building is designed with consideration for landscape based on the regulation for Zone II-A.
	(5) Ethnic Minorities and Indigenous Peoples	(a) Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples? (b) Are all of the rights of ethnic minorities and indigenous peoples in relation to land and resources respected?	(a) N/A (b) N/A	(a) No ethnic minorities or indigenous peoples inhabit in the site according to DoLISA (Department of Labour, Invalids and Social Affairs). (b) As above

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
	(6) Working Conditions	(a) Is the project proponent not violating any laws and ordinances associated with the working conditions of the country which the project proponent should observe in the project? (b) Are tangible safety considerations in place for individuals involved in the project, such as the installation of safety equipment which prevents industrial accidents, and management of hazardous materials? (c) Are intangible measures being planned and implemented for individuals involved in the project, such as the establishment of a safety and health program, and safety training (including traffic safety and public health) for workers etc.? (d) Are appropriate measures taken to ensure that security guards involved in the project not to violate safety of other individuals involved, or local residents?	(a) Y (b) Y (c) Y (d) Y	(a) Labour Laws No.10/2012 QH13 dated June 18th, 2012 will be complied with. (b) Law as above stipulates safety considerations (c) Adequate program will be held by consultation with DoLISA (d) As above
5 Others	(1) Impacts during Construction	(a) Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)? (b) If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce impacts? (c) If construction activities adversely affect the social environment, are adequate measures considered to reduce impacts? (d) If the construction activities might cause traffic congestion, are adequate measures considered to reduce such impacts?	(a) Y (b) N/A (c) Y (d) N	(a) Any possible impacts are considered and mitigations are suggested in the EMP (b) The sites are all within developed lands and no impacts on ecosystem are expected. (c) Construction activities can cause inconvenience to inhabitants and the countermeasures for impact minimization were agreed in the stakeholder meeting. (d) The construction activities might cause traffic congestion will be limited.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
	(2) Monitoring	(a) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts?(b) What are the items, methods and frequencies of the monitoring program?(c) Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)?(d) Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?	(a) Y (b) Y (c) Y (d) Y	(a) The monitoring plan was prepared according to the EMP. (b) The monitoring contents were decided by consultation between the proponent and authorities. (c) The monitoring plan includes such components. (d) As above
6 Note	Note on Using Environmental Checklist	(a) If necessary, the impacts to transboundary or global issues should be confirmed (e.g., the project includes factors that may cause problems, such as transboundary waste treatment, acid rain, destruction of the ozone layer, or global warming).	(a) N/A	(a) The project does not have possibility of significant adverse impacts on transboundary or global environmental issues.

1) Regarding the term “Country’s Standards” mentioned in the above table, in the event that environmental standards in the country where the project is located diverge significantly from international standards, appropriate environmental considerations are required to be made.

In cases where local environmental regulations are yet to be established in some areas, considerations should be made based on comparisons with appropriate standards of other countries (including Japan's experience).

2) Environmental checklist provides general environmental items to be checked. It may be necessary to add or delete an item taking into account the characteristics of the project and the particular circumstances of the country and locality in which the project is located.

Appendix.6.3

Estimation of Sewage Water Flow for Treatment

Appendix 6.3 Estimation of Sewage Water Flow for Treatment

Sewage flow to be treated is generated in the target residential estate which is developed after "Project for Solid Waste, Wastewater Treatment and Environmental protection in Hoi An (AFD Project)" and the present urban area from where sewage comes in Japanese Bridge Canal at the moment and in the future, and is estimated based on the population and unit domestic water supply rate.

6.3.1 Population Projection of Hoi An City and a New Residential Estate

1) Population of Hoi An City

Population records of Hoi An City for the past 10 years are obtained and the population in 2012 was 91,993. Population growth was about 9,500 during the last decade.

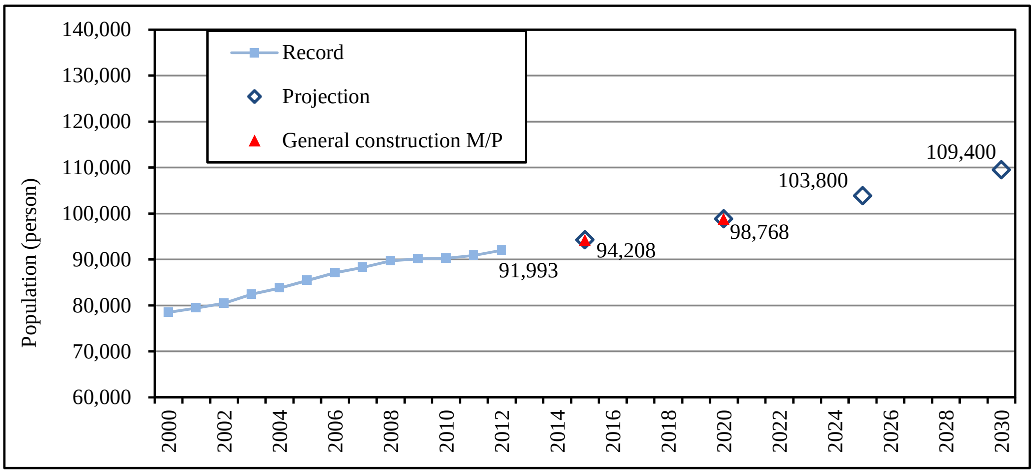
Future populations were estimated for 2015 and 2020 categorising wards and Communes into urban and non-urban groups in "Master Plan of General Construction, March 2013" (the M/P). The M/P will be approved by Hoi An CPC and Quang Nam PPC. Population projection to be used for estimation of sewage flow should coincide with the projection in the M/P.

In the M/P, population was projected with annual growth of 0.9% from 2011 to 2015 and 0.95% from 2015 to 2020. Future populations are projected up to the year 2030 based on the present (2012) population of 13 wards and communes with annual growth of 1.0% from 2020 to 2025 and 1.05% from 2025 to 2030 flowing the assumption in the M/P. Populations in 2025 and 2030 are projected by the same manners of the M/P as shown in **Table 6.3.1** and **Figure 6.3.1**.

Table 6.3.1 Population Projection of Hoi An City

Year	Record (person)	Increase (person)	Growth Ratio (%)		Projection （person）	Remarks
			Annual	2003 Ratio		
2003	81,652	-	-	100.0%		
2004	83,186	1,534	101.9%	101.9%		
2005	83,804	618	100.7%	102.6%		
2006	84,260	456	100.5%	103.2%		
2007	84,801	541	100.6%	103.9%		
2008	85,981	1,180	101.4%	105.3%		
2009	90,135	4,154	104.8%	110.4%		
2010	90,268	133	100.15%	110.6%		
2011	91,069	801	100.89%	111.5%		
2012	91,993	924	101.01%	112.7%		
2015			100.90%	115.4%	94,208	The M/P
2020			100.95%	121.0%	98,768	The M/P
2025			101.00%	127.1%	103,800	
2030			101.05%	134.0%	109,400	

Source: JST

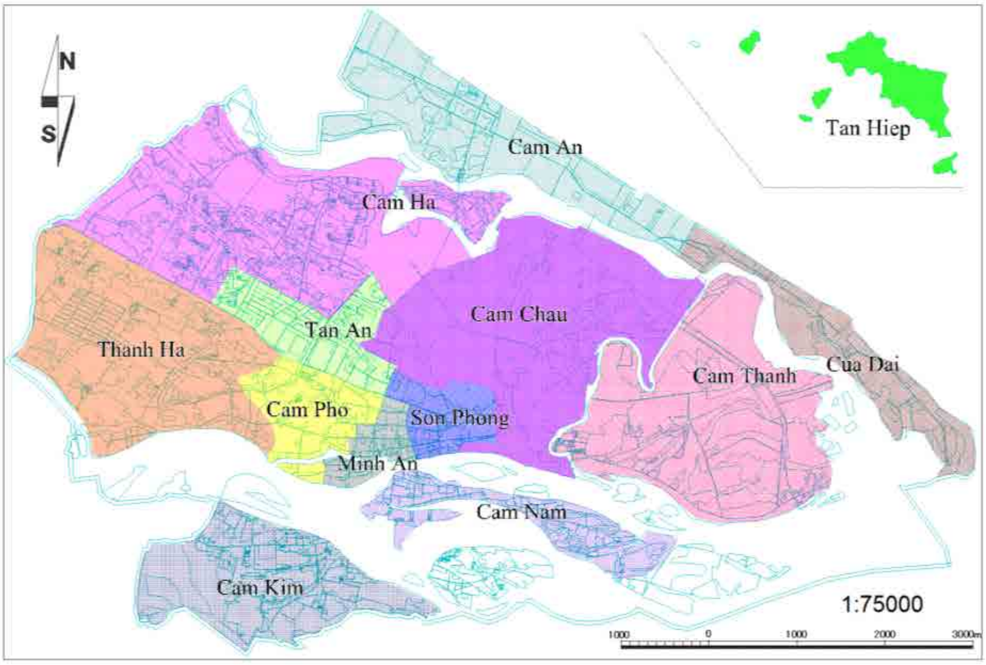


Source: JST

Figure 6.3.1 Population Projection of Hoi An City

2) Population by Ward and Commune

Wards and Communes are divided into two groups of Urban and Non-urban in the M/P. Wards and Communes of the Hoi An city are shown in Figure 3.2. Nine (9) wards of Minh An, Tan An, Cam Pho, Thanh Ha, Son Phong, Cam Chau, Cua Dai, Cam An, and Cam An are categorized as Urban, and the other 4 Wards and Communes are as Non-urban.



Source: JST

Figure 6.3.2 Ward and Commune in Hoi An City

Since the population ratio of Urban and Non-urban groups in the 2020 are 80% and 20% respectively in the M/P, the future population ratios after 2020 are also applied the same ratios for Urban and Non-urban groups.

Future populations by Wards and Communes are estimated in the following procedure.

- Population ratios of urban and non-urban are 80% and 20% respectively.
- For Wards and Communes in which population has decreased or stagnated from the previous year, future population is determined as same as the population in 2012.
- For, population ratio of each Ward or Commune in 2012 is calculated.
- Future populations are distributed by the above ratio to the Wards and Communes in which population has increased from the previous year.

Estimated future population by Ward or Commune is summarized in **Table 6.3.2** and **Table 6.3.3**.

Table 6.3.2 Estimated Population by Ward/Commune (2030)

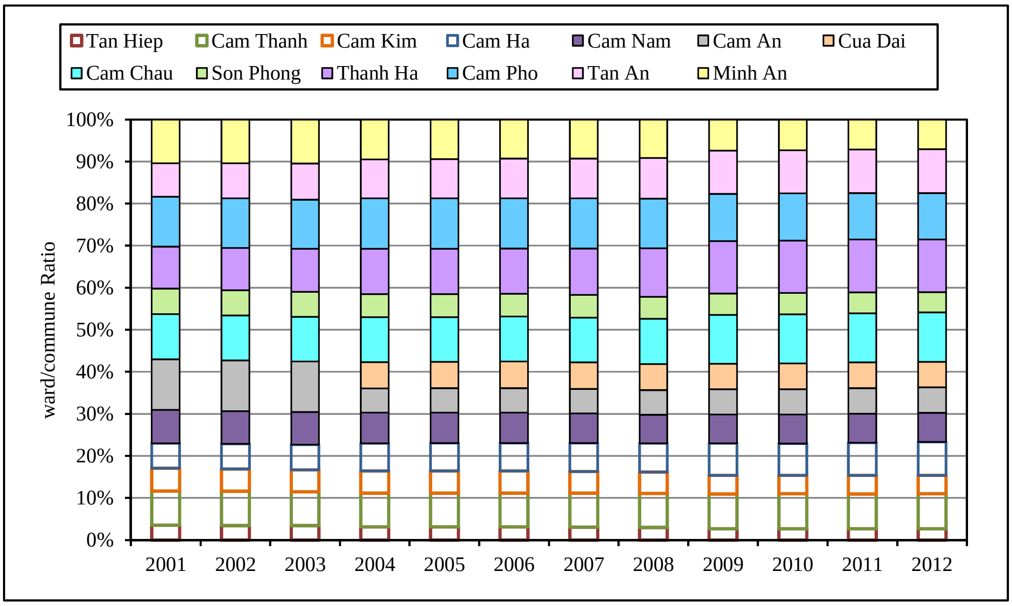
Ward / Commune		Population Record (person)		Population in 2030 (person)					
		2003	2012	Trend	Group	Decreasing or Equal Group	Increasing Group		Result
						Population	Population Ratio	Population	
1	Minh An	8,611	6,527	Decrease	80%	6,400	—	—	6,400
2	Tan An	7,131	9,563	Increase		—	0.256	14,000	14,000
3	Cam Pho	9,635	10,157	Equal		10,300	—	—	10,300
4	Thanh Ha	8,403	11,514	Increase		—	0.307	16,800	16,800
5	Son Phong	4,935	4,470	Decrease		4,400	—	—	4,400
6	Cam Chau	8,766	10,774	Increase		—	0.288	15,700	15,700
7	Cua Dai	(5,230)	5,610	Equal		5,600	—	—	5,600
8	Cam An	(4,845)	5,573	Increase		—	0.149	8,100	8,100
9	Cam Nam	6,372	6,328	Equal		6,200	—	—	6,200
Sub-Total Urban		58,698	70,516		87,500	32,900	1.000	54,600	87,500
10	Cam Ha	4,992	7,318	Increase	20%	—	1.000	7,900	7,900
11	Cam Kim	4,284	4,068	Decrease		4,000	—	—	4,000
12	Cam Thanh	6,634	7,656	Equal		7,600	—	—	7,600
13	Tan Hiep	2,807	2,435	Decrease		2,400	—	—	2,400
Sub-Total Non-urban		18,717	21,477		21,900	14,000	1.000	7,900	21,900
Total		77,415	91,993		109,400				109,400

Since Cua Dai and Cam An had merged in 2003, the value in 2004 was put into parenthesis.
Source: JST

Table 6.3.3 Estimated Population by Ward/Commune (2020 and 2025)

Ward / Commune		Population in 2020 (person)				Population in 2025 (person)			
		Group	Increasing Group		Result	Group	Increasing Group		Result
			Population Ratio	Population			Population Ratio	Population	
1	Minh An	80%	—	—	6,400	80%	—	—	6,400
2	Tan An		0.256	11,800	11,800		0.256	12,800	12,800
3	Cam Pho		—	—	10,300		—	—	10,300
4	Thanh Ha		0.307	14,200	14,100		0.307	15,400	15,400
5	Son Phong		—	—	4,400		—	—	4,400
6	Cam Chau		0.288	13,300	13,300		0.288	14,400	14,400
7	Cua Dai		—	—	5,600		—	—	5,600
8	Cam An		0.149	6,900	6,900		0.149	7,500	7,500
9	Cam Nam		—	—	6,200		—	—	6,200
Sub-Total Urban		79,000	1.000	46,200	79,000	83,000	1.000	50,100	83,000
10	Cam Ha	20%	1.000	6,700	6,700	20%	1.000	6,800	6,800
11	Cam Kim		—	—	3,800		—	—	3,800
12	Cam Thanh		—	—	7,100		—	—	7,100
13	Tan Hiep		—	—	2,200		—	—	2,200
Sub-Total Non-urban		19,800	1.000	6,700	19,800	20,800	1.000	6,800	19,900
Total		98,800			98,800	103,800			102,900

Source: JST



Inside in white of the Legend are Wards/Communes of Non-urban

Source: JST

Figure 6.3.3 Transition of population by Ward/Commune

6.3.2 Sewage Flow Generated in New Residential Estate

1) Equation of Sewage Flow Estimate

Daily average flow generated in the catchment area of Japanese Bridge Canal (Q_{ave}) is calculated by the following equation.

Q_{ave} (m^3/d)= Pc × q × R× (1+C_m)

Where Pc: Population of catchment area (person)

q : Domestic water consumption per capita (m^3/d/capita)

R : Sewage recovery ratio (80% of domestic water supply flow)

C_m: Commercial and public use ratio (20%)

2) Domestic Sewage flow

Unit rate of water supply obtained from the records of the past three years are 100 L / day /capita on an average. While there are many houses in the target residential estate, which use well water only or piped water and well water together at present. Therefore, there is more actual water consumption than the unit rate of water supply data.

Table 6.3.4 Water Consumption Data During Recent Three Years

	Item	Unit	2010	2011	2012
1	Total Population of Hoi An City	person	88,978	89,960	90,816
2	Water supplied population	Person	19,865	21,862	23,549
3	Water supply rate	%	22.3	24.3	25.9
4	Total connection	household	4,425	4,927	5,323
5	Total water supply	m^3/year	1,974,175	2,033,473	2,228,572
6	Total water consumption	m^3/year	1,457,225	1,505,243	1,585,841
7	Average domestic water consumption	liter/capita/day	105	99	96

Source: Water Supply and Drainage Enterprise

Under the above situation, unit ratio of domestic water consumption is employed as 130L /day/capita based on the Decree No.88:2007/ND-CP for determination of sewage charge although there is no data on well water consumption and the number of wells. In the case of no piped water, 4 m^3/cap/day water consumption is used for sewage volume in the article 51 of above Decree No.88.

3) Ratio of Commercial and Public Use

Water Supply and Drainage Enterprise (WSDE) in Hoi An employs 16.4% of domestic water use as the ratio of commercial and public use for future plan, while water supply design standard (TCXDVN 33-2006) recommends 25%. Since the new residential estate has not so many commercial and public facilities, 20% of domestic water use is employed for the ratio of commercial and public use

4) Fluctuation

Pump operation records of WSDE indicated daily maximum flow of 1.3 times of daily average flow. Based on the above information, daily fluctuation of 1.3 (daily maximum/ daily average) and hourly maximum of 1.5 (hourly maximum/ daily maximum) are employed.

5) Sewage flow Generated in New Residential Estate

The population in the new residential estate is estimated distributing the population of Tan An Ward by the ratio of livable area except the memorial park and schools, etc. The new residential estate occupies 55% of livable area in Tan An ward. The population of the new residential estate is estimated as 7,700 persons (14,000x0.55) in 2030. Since there are no tourists accommodation in the new residential estate, sewage flow by tourist is not counted. The sewage flow generated in the new residential area is estimated by the above equation in each year as shown in **Table 6.3.5**.

Table 6.3.5 Sewage flow Generated in the Target Residential Estate

Year	Population of Tan An Ward (person)	Ratio of Livable area (%)	Objective Population (c)=(a)x(b) (person)	Unit Water Use (d) (m^3/day/ Capita)	Ratio of Commercial and Public Use (e) (%)	Sewage flow (m^3/day)	
						Daily Average (f)=(c)x(d)x (1+(e))x0.8	Daily Maximum (g)=(f)x1.3
2015	10,400	0.55	5,720	0.13	20%	714	928
2020	11,800	0.55	6,490	0.13	20%	810	1,053
2025	12,800	0.55	7,040	0.13	20%	879	1,142
2030	14,000	0.55	7,700	0.13	20%	961	1,249

Source: JST

6.3.3 Sewage Flow Generated in AFD Project

The sewage flow generated in the area served by AFD Project and the catchment area of Japanese bridge canal is estimated in the same manner as the above using the ratio of livable area of each ward/commune as shown in **Table 6.3.6**.

Table 6.3.6 Population of Japanese Bridge Catchment Area in AFD Project

Ward/ Commune	Catchment Area (ha)	Population of Ward/commune			
		2015	2020	2025	2030
Minh An	6.77	6,400	6,400	6,400	6,400
Cam Pho	60.37	10,300	10,300	10,300	10,300
Thanh Ha	117.85	12,500	14,100	15,400	16,800
Cam Ha	24.22	6,700	6,700	6,800	7,900
Total	209.21	35,900	37,500	38,900	41,400
-	Ratio of livable Area	Population of Catchment Area			
Minh An	0.104	670	670	670	670
Cam Pho	0.512	5,280	5, 280	5, 280	5, 280
Thanh Ha	0.130	1,630	1,840	2,010	2,190
Cam Ha	0.039	270	270	270	310

Ward/ Commune	Catchment Area (ha)	Population of Ward/commune			
		2015	2020	2025	2030
Total	-	7,850	8,060	8,230	8,450

Source: JST

Sewage flow generated in AFD Project area is calculated as shown in **Table 6.3.7** using the population of catchment area in **Table 6.3.6**.

Table 6.3.7 Sewage Flow Generated in the Area Served by AFD Project

Year		2015	2020	2025	2030
Population of Catchment Area (person)		7,850	8,060	8,230	8,450
Sewage Flow Generated (m^3/day)	Daily Average	980	1,006	1,027	1,055
	Daily Maximum	1,274	1,308	1,335	1,372

Source: JST

6.3.4 Sewage Flow for Treatment

Although very few amount of sewage flow of about 10 m^3/day is flowing from the drain of the new residential estate at the moment. However, about 60% of households have connected and wastewater form houses except toilet flow is discharging to the existing road side drain according to the questionnaire result of the previous JICA survey. Moreover, the connection rate of the over flow from septic tanks is 30%, and thus wastewater in the drain supposed to be stagnated in the drains of the target residential estate.

When the Japanese bridge canal is improved with this project and the drains of the new residential estate are cleaned, sewage flow from the estate shall be 60% or more of the sewage generated in the estate. Furthermore, 96 % of the residents have willing for connection according to the same questionnaire results.

If connection with the existing sewer is promoted following the connection promotion of the AFD project, connection rate will further increase gradually. On the other hand, when the fund of house connection in the AFD project area becomes available, the connection rate of the AFD project will increase drastically, and then sewage flow from the AFD Project area to Japanese bridge canal will decrease.

Under the above situation the future connection ratios of the estate and the AFD Project area are assumed and sewage flow rates for treatment are estimated as shown in **Table 6.3.8**.

Table 6.3.8 Sewage flow for Treatment

Year	Sewage Generated (Daily Maximum：m^3/day)		Connection Ratio		Sewage Flow for Treatment (Daily Maximum：m^3/day)		
	New Residential Estate	AFD Project Area	New Residential Estate	AFD Project Area	New Residential Estate	AFD Project Area	Total
2015	928	1,274	0.10	1.00	93	1,274	1,367
2020	1,053	1,308	0.75	0.85	790	1,112	1,902
2025	1,142	1,335	0.80	0.60	914	801	1,715
2030	1,249	1,372	0.90	0.20	1,124	274	1,398

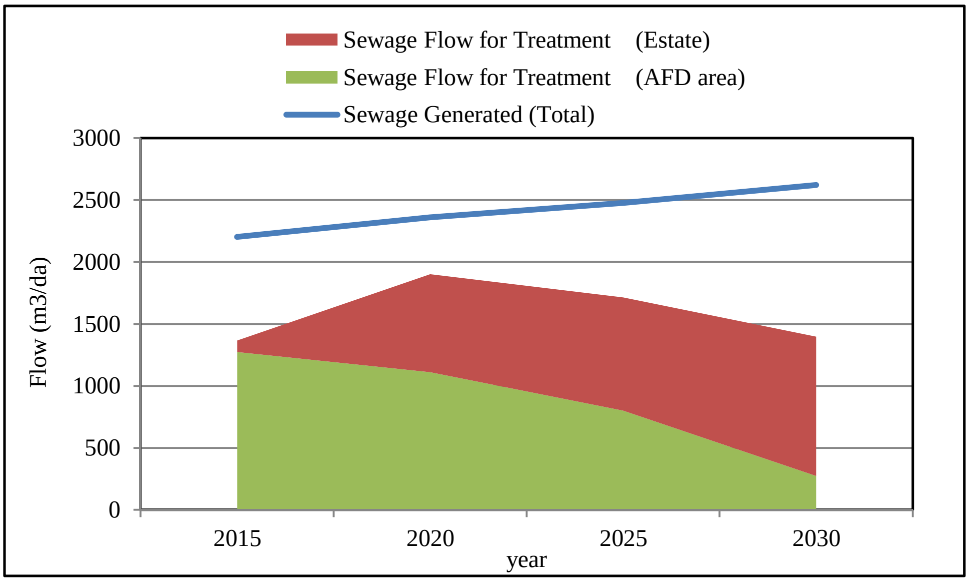
Source: JST

2020. The served population and wastewater flow of STP is estimated as shown in **Table 6.3.9** and STP capacity of 2,000m^3/day is confirmed as indicated in **Figure 2.2.2.1-1**.

Table 6.3.9 Served population and wastewater flow of STP

	Area	2015	2020	2025	2030
Served population (persons)	New Residential Area	573	4,870	5,635	6,929
	AFD Area	7,854	6,855	4,938	1,689
	Total	8,427	11,725	10,573	8,618
Wastewater flow (daily maximum flow m^3/day)	New Residential Area	93	790	914	1,124
	AFD Area	1,274	1,112	801	274
	Total	1,367	1,902	1,715	1,398

The relationship between sewage flow and sewage treatment flow is presented in **Figure 6.3.4**.



Source: JST

Figure 6.3.4 Relationship between Sewage Flow and Sewage Treatment Flow

Appendix.6.4

Study of Treatment Method

Appendix 6.4 Study of Treatment Method

6.4.1 Water Improvement Measures

Study on the improvement of water quality for the Japanese Bridge area compared four (4) measures: “Sewage Treatment Process”, “flush system”, “dredging”, and “direct river water purification system”. **Table 6.4.1-1** presents the outlines of these measures.

Table 6.4.1-1 Outline of Water Improvement Measures

	Sewage Treatment Process	**Flush System by pumping Hoi An river water into the upper part of polluted channel water under the Japanese Bridge**	**Dredging**	**Direct River Water Purification System (Gravel Contact Oxidation method)**
Photo				
Description	It is possible to remove 80% of pollution loads. A delay in the project could occur due to land acquisition, such as in the French project.	The channel water quality is improved by flushing the polluted channel under the Japanese Bridge with Hoi An river water.	The channel water quality is improved by dredging sediment in the channel. This does not require land acquisition, but frequent dredging is required due to continuous sedimentation..	This system improves water quality by channeling polluted water through gravels on which microorganisms remove the pollutants. Since this system is built near the channel, land acquisition and construction cost are incurred. Applicable influent BOD is less than 20mg/L in the Guidance.
Evaluation	○	△	△	×
	Though land acquisition is required, this method is able to surely improve water quality.	It is impossible to continuously pump up river water while the water level is lower than the pump set level. Also, irrigation water cannot be used while it is being used for agricultural water; it is impossible to adopt as a permanent measure.	It is able to tentatively improve the capacity of flow in the channel and prevent water quality deterioration by removing deposit and sediment; however, there is no effect for improvement of water quality. It is not able to apply for the fundamental measure.	Since BOD in the water flow of the the Japanese Bridge Channel is 100mg/L, it is beyond the range of applicable influent BOD, (less than 20mg/L), for the Guidance, this can not be adopted.

Source: JST

The Flush System, by pumping Hoi An river water, is not a good prospect for a fundamental improvement to water quality, because it is impossible to continuously pump up water while the river level is lower than pump set level caused by tide, especially in the dry season. The idea of using irrigation water as a flushing system is also unfeasible, since the water could not be utilized in the flushing system while it is utilized for irrigation (the period is around half of the month).

Dredging is able to marginally improve the capacity of flow in the channel and delay water quality deterioration by removing deposits and sediment; however, there is no improvement effect on water quality.

The Direct River Water Purification System (Gravel Contact Oxidation method) is difficult to apply to the Japanese Bridge Channel, in which the BOD of water flow exceeds 100mg/L, since applicable influent BOD of the Direct River Water Purification System should be less than 20mg/L and applicable influent SS of that should be less than 30mg/L, as per the "Guidance of Direct River Water Purification System" issued by the Japan Institute of Country-Ecology and Engineering (JICE). The suitability of this method to Hoi An is unclear in terms of treatment quality although a Japanese company has conducted a pilot-scale experiment in Bac Ninh province under low influent water quality (about BOD 35 mg/L).

Among the above four (4) alternatives, "**Sewage Treatment Process**" was deemed the most suitable measure.

6.4.2 Sewage Treatment Process

Sewage treatment processes including recently developed and Pre-treated Trickling Filtration process are evaluated based on sewage volume, land area, and the procurement under japan grant aid program.

Six sewage treatment processes, including Pre-treated Trickling Filtration (PTF) process, Sequencing Batch Reactor (SBR) process, Biological Aerated Filter process, Membrane Biological Reactor (MBR) process, Rotating Biological Contactors (RBC) process, and Trickling Filter (TF) process are presented in **Table 6.4.2-1**.

PTF Process is included in comparison because this process is experimented as a small scale sewage treatment process with low energy consumption by Vietnamese and Japanese study group in Da Nang City and got certificate from Japan sewerage Agency as efficient treatment process in some certain conditions. . The SBR process is considered because Hoi An City requests this process and this is well developed and popular in Japan. The RBC process is considered because a Japanese company conducted pilot scale experiment in Hanoi to examine its adoptability, sponsored by the Japan Ministry of Health, Labor and Welfare. Additionally, the TF process is considered in order to compare with an PTF process.

These processes are evaluated in terms of layout feasibility, electricity consumption, O&M costs and construction costs.

Table 6.4.2-1 Sewage Treatment Processes

Process	Photo	Outline
Pre-treated Trickling Filtration (PTF) Process		This system removes BOD and SS by three components which are a floating sponge filtration, a high-rate trickling filter, and a final separation tank. Du to there being no aeration, and small facilities, energy consumption is low and required land space is small. A pilot plant study is now being conducted in Da Nang.
Sequencing Batch Reactor (SBR) Process		This system is one of the activated sludge processes and utilizes a fill and draw reactor. This system is carried out in one reactor in the following sequence: fill, reaction (aeration), settle and draw.
Biological Aerated Filter Process		This system removes BOD and SS by distributing sewage from the top of a tank with filter media and injecting air from the bottom. Treated water comes from the bottom. This system consists of a primary sedimentation tank, biological aerated filter and treated water tank.
Membrane Biological Reactor (MBR) Process		Organic substances are removed by microorganisms and the separation of water and microorganisms is conducted by filter instead of sedimentation tank. MF membrane is used to remove E-coli. The process consists of pretreatment facility, equalization tank, and reactor. This process requires small space because of no secondary sedimentation.
Rotating Biological Contactors (RBC) Process		This process uses biological filters. Treatment is conducted by rotating disks, contacting sewage and microorganisms on disks, and removing organic substances by aerobic treatment. The process consists of primary sedimentation, RBC and secondary sedimentation.
Trickling Filter (TF) Process		This process uses biological filters. Treatment is conducted when the sewage distributed by an arm comes in contact with microorganisms on filters. The Arm is mounted on a pivot in the center of the filter and revolves in a horizontal plane. The process consists of primary sedimentation, TF and secondary sedimentation.

Source: JST

Table 6.4.2-2 shows the comparison of each process in terms of layout feasibility, electricity consumption and so on. **Table 6.4.2-3** shows the layout. Based on the layout figures, facilities of RBC process and TF process is not placed with the buffer zone conditions. Therefore, further studies such as O&M costs and construction costs of these processes are not conducted.

In the comparison, electric consumption of SBR process, biological aerated filter process, and MBR process is calculated based on the standard designs of Japan Sewage works Agency. That of PTF process and RBC process is come from manufacturer data. That of TF process is calculated based on "Japanese Sewage Treatment Design guideline, 1972). O&M cost and construction cost present percentage value based on those of PTF process. Those costs of SBR process, biological aerated filter process, and MBR process are calculated based on the standard designs of Japan Sewage works Agency. That of PTF process and RBC process is come from manufacturer data.

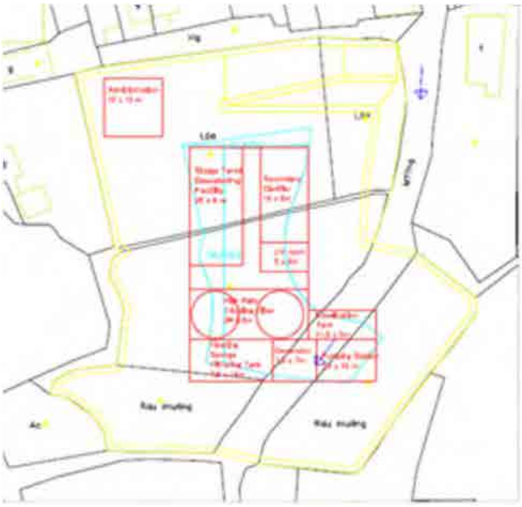
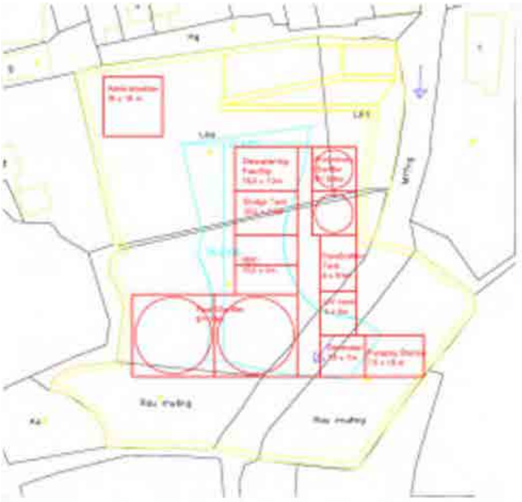
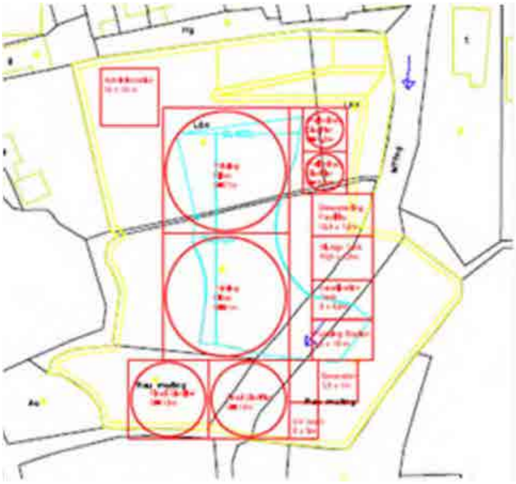
Table 6.4.2-2 Comparison of Treatment Processes

	Pre-treated Trickling Filtration (PTF) Process	**Sequencing Batch Reactor (SBR) Process**	**Biological Aerated Filter Process**	**Membrane Biological Reactor (MBR) Process**	**Rotating Biological Contactors (RBC) Process**	**Trickling Filter (TF) Process**
Required Space (m^2)	930 (=20x39.5 +12x11.5)	990 (=18x38.5 +9x24+11.5x 7)	870 (=39.5x18.5 +11.5x12)	770 (=18.5x37.5 +10x7.5)	1,200 (=20.5x39+ 17.5x14+11 .5x7)	1,990 (=44x32+ 14x33+ 4.5x36.5)
Electricity consumption (kw/year)	202,000	577,000	316,000	705,000	212,000	202,000
O&M Costs	100%	200%	130%	240%	—	—
Construction Costs	100%	110%	120%	200%	—	—
Evaluation	○ Required area and electric consumption are small. O&M costs are not expensive. Also O&M is easy because of few operational factors.	× Required area is large and buffer zone is not secured. Also O&M costs are expensive due to high electricity consumption. High O&M skills required due to many operational factors.	△ Although required area is small, O&M costs are high due to high electricity consumption. O&M is relatively easy due to few operational factors.	× Although required area is small, O&M cost is high due to high electricity consumption. High O&M skills are required due to many operational factors.	× Large area is required and then buffer zone is not secured. O&M is relatively easy due to few operational factors.	× Large area is required and then buffer zone is not secured. O&M is relatively easy due to few operational factors.

Note: Required areas of SBR and biological aerated filter processes are calculated based on the standard design of Japan Sewage Agency.
The areas required for PTF process and MBR are calculated based on manufacturer data.
RBC is evaluated based on manufacturer data and the standard design of Japan Sewage Agency.

Based on the comparisons, Pre-treated Trickling Filtration (PTF) process is adopted due to low O&M costs and easy maintenance.

Table 6.4.2-3 Layout of Facilities

	
Pre-treated Trickling Filtration (PTF) Process	**Sequencing Batch Reactor (SBR) Process**
	
Biological Aerated Filter Process	**Membrane Biological Reactor (MBR) Process**
	
Rotating Biological Contactors (RBC) Process	**Trickling Filter (TF) Process**

6.4.3 Sludge Disposal

In the STP site, sludge treatment such as a sludge drying bed cannot be conducted due to the small STP area and buffer zone regulations. Therefore, sludge is dewatered at the STP and moved to a dumping site.

As for a dumping site, Hoi An PWC stated that sludge produced in this project cannot be dumped at the Hoi An dumping site, and the dumping place for sludge produced in the French project is not yet decided. Currently, as septic tank sludge in Hoi An is disposed of at the Khanh Son disposal site in Da Nang according to Hoi An PWC, sludge from this project is also designated to be dumped at the Khanh Son disposal site.

Outline of the Khanh Son disposal site is as follows:

- Commission year: 2007 (Design Operation length: 15 years)
- Area: 13.83ha
- Capacity: 670ton/day
- Total disposed capacity: 4.1 million m^3
- Disposed volume until year 2012: 1.1 million m^3
- Capacity accepted in year 2012 : 3.0 million m^3
- Dumping fee: 1,000,000VND/t

Photo 6.4.3-1 Hoi An Dumping Site

	
Sorted garbage	Sorting process
	
Compost Production Facility	Dumping Site

6.4.4 Other Treatment System

The sewage treatment system consists of pretreatment, pumping and equalization, before PTF process (Main Treatment units: floating sponge filtration, high-rate trickling filter and final separation), disinfection, sludge treatment and odor treatment. In this section other treatment units than PTF process are selected.

Pretreatment (Screen)

This STP has only bar screens (width 20mm) and sand pumps for the protection of pumps because the capacity of the STP (2000m^3/day) is a relatively small. Sand and screenings which are not removed are collected in the final separation tank. Screen collected in pretreatment is collected by a mesh basket and moved manually to a canopy truck.

Equalization Tank

An equalization tank is built due to small sewage flow depending on residents' living habits. The equalization tank is designed for 4 hour capacity (400m^3) based on the following flow pattern (source: Japan Sewerage design guideline).

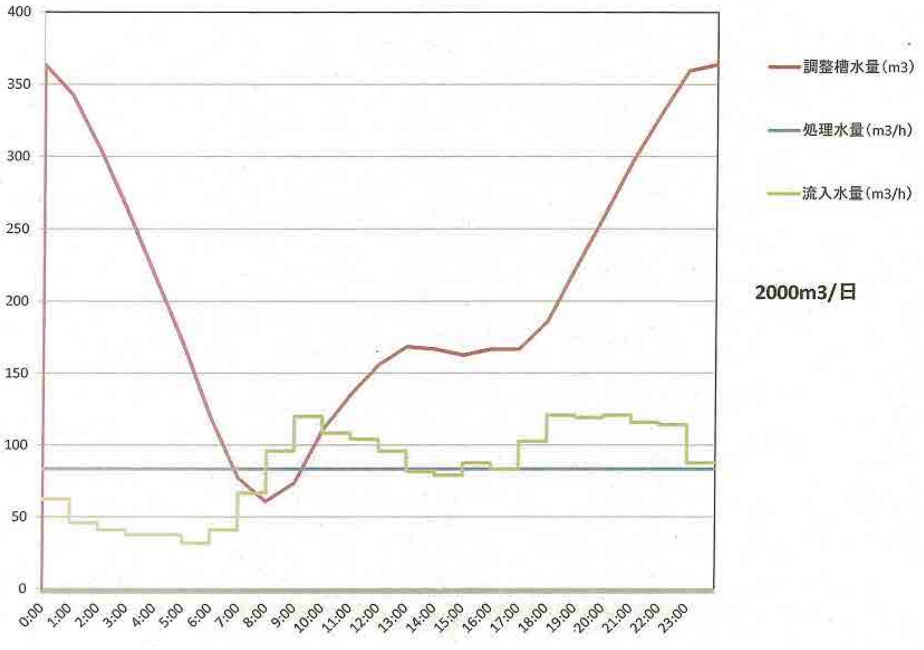
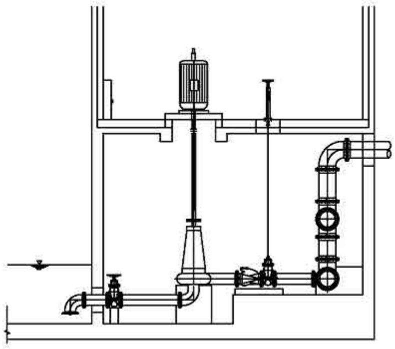
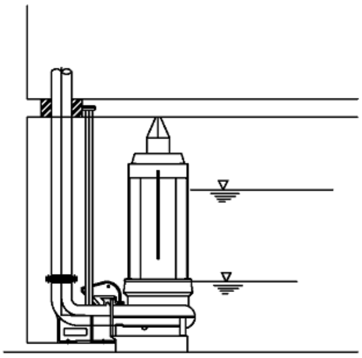


Figure 6.4.3-1 Sewage Flow Pattern and Equalization Capacity

Pumping

There are two types of pump: submersible pump and vertical shaft drive pump. Due to space limitations and noise considerations for surrounding houses, a submersible pump is selected due to its small space requirements and low noise.

Table 6.4.4-2 Pump Type Evaluation

Items	Vertical Shaft drive Pump	Submersible Pump
Schematic diagram		
O&M	Easy	Necessary to pull pumps from a well
	○	△
Noise	Medium	Very low
	△	○
Required space	Large	Small (Installing in a well))
	△	○
Evaluation		○

Source: JST

Sewage Treatment

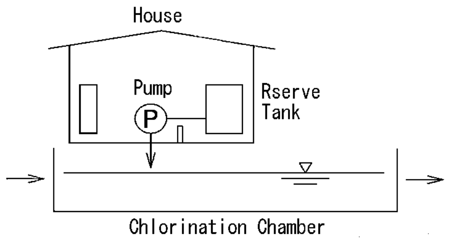
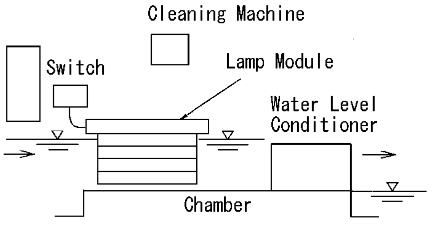
PTFA process is selected in 6.4.2. This system consists of a floating sponge filtration, high rate trickling filter, and final separation tank. These function as follows:

- Floating sponge filtration: removal of SS and BOD by filtration
- High rate trickling filter: removal of soluble BOD by microorganisms on the trickling filters
- Final separation: Removal of SS by sedimentation and filtration.

Disinfection

UV radiation is selected due to its low space requirements and no chemical odors.

Table 6.4.4-3 Comparison for Disinfection Methods

Disinfection Methods	Chlorination	UV Radiation
Figure		
Facility	Simple	Small Complex
	○	△
Treated water	Chlorine smell	Odorless
	△	○
Necessary Area	Large (Contact time is long)	Small (Contact time is short)
	△	○
Evaluation		○

Source: JST

Sludge Treatment (thickening/dewatering)

Minimal sludge treatment is conducted in the STP because of the small space and the prevention of odor problem. In the STP, only thickening and dewatering are conducted to reduce the volume of sludge, and therefore the frequency of sludge transportation decreases.

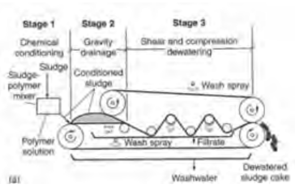
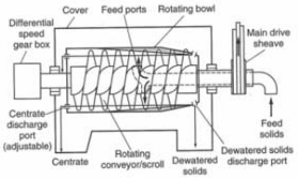
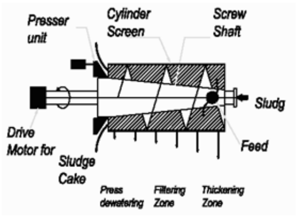
Since sludge produced from sewage treatment units (floating sponge filtration, a high rate trickling filter, and final separation tank) has different properties, a sludge tank is built to equalize these properties.

Moreover, a thickening tank is built to thicken the sludge in the event that sludge concentration is very low. Although there are two thickening types - gravity type and mechanical type, gravity thickening is selected due to its low construction and O&M costs (including electricity).

For dewatering, there are three types - belt filter press, centrifuge, and screw press.

Based on the evaluation of **Table 6.4.4-4**, screw press type is selected due to its low noise, and relatively easy O&M.

Table 6.4.4-4 Dewatering Machines

Items	Belt Filter Press	Centrifuge	Screw Press
Schematic diagrams			
Noise & Vibration	Low	High	Low
	○	△	○
Operation	Many inspection points	Few inspection points	Few inspection points
	△	○	○
Maintenance	・Necessity of changing filters ・High electricity cost	・Necessary to change parts because of high rotation ・High electricity cost	・Wear is low, despite rotation ・Low electricity cost
	○	△	○
Evaluation			○

Source: JST

Sludge Hopper

Sludge produced from this project is 0.84 m^3/day based on 5 working days (annually about 218m^3), based on the capacity calculation.

Assuming that 2 times per a week is transporting times to reduce the emission of odor through transportation, the capacity of the hopper is 4m^3.
The capacity of hopper=0.84m^3/day×5day/2times＝2.1m^3→ 4m^3

Sludge Tank

Sludge from PTF process is detained in one day for equalization of sludge volume and homogenization of sludge constituent. Sludge thank volume is 120m^3 because sludge production per one day is 118.6m^3.

Odor Treatment

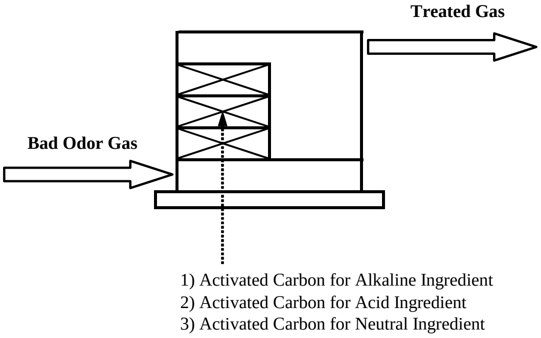
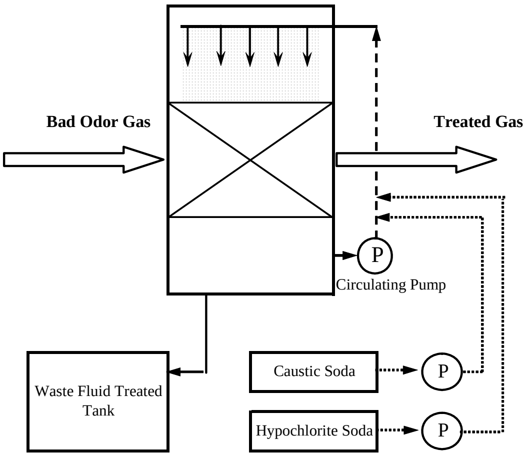
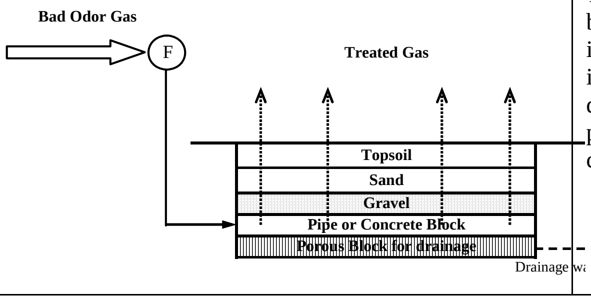
Odor prevention measure is to prevent the odor emission by that facilities producing odor are built inside the a building.

Sewage treatment system which is the source of odor is built inside a building for the prevention of odor emission because many houses are built around the STP site.

Dewater treatment is conducted because there are houses nearby. Sources of odor include the inflow sewer, equalization tank, floating sponge filtration, high rate trickling filter, sludge tank, sludge container and cake conveyer.

There are three odor treatment processes. **Table4.3.8** present outlines of the processes.

Table 6.4.4-5 Outlines of Odor Treatment Process

Process	Flow	Description
Activated Carbon Adsorption		This process removes odor compounds by passing them through beds of Activated carbon. This process can treat many odor compounds.
Chemical Scrubber		This process removes odor compounds by using alkali or acid solutions. This process can treat many odor compounds.
Bio-Filter		This process removes odor compounds by passing them through an earth filter in which the odor compound is absorbed in water contained in the soil and then degraded by microorganisms. This process cannot treat many kinds of odor compounds.

Source: JST

Table 6.4.4-6 shows each process evaluated. Based on the evaluation, the activated carbon adsorption process is selected due to its reliable treatment ability, low space requirements, and relatively inexpensive cost.

Table 6.4.4-6 Comparison of Odor Treatment Processes

Process	Activated Carbon Adsorption	Chemical Scrubber	Bio-Filter
Compounds to be removed			
H_2S	○	○	○
NH_3	○	○	○
CH_3SH	○	○	X
$(CH_3)_2S$	○	○	X
CH_3SSCH_3	○	○	X
$(CH_3)_3N$	○	○	○
Required Space (m^2)	60	220	250
O&M Cost	100%	150%	40%
Capital Cost	100%	150%	110%
Evaluation	○ This process can treat various odor compounds, and space required is the lowest among odor treatment processes. Also, O&M costs are lower than the chemical Scrubber process.	△ Although this process can treat various compounds, space required is larger than that for the Activated Carbon Adsorption process. O&M costs are more expensive than others.	X This process requires the largest area. Although O&M costs are lowest, this process cannot treat many compounds.

Note: Required Space is calculated based on manufacturers' data and the Standard design of Japan Sewage Agency. Cost is based on manufacturers' data.

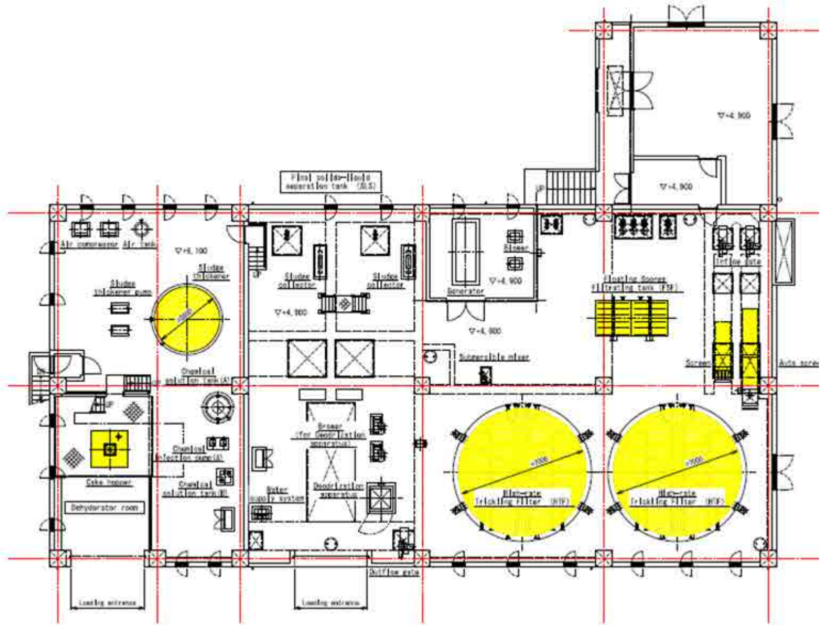
Facilities with odor treatment are as follows;
(Underground)

- Screen, Equalization Tank, Sludge Tank

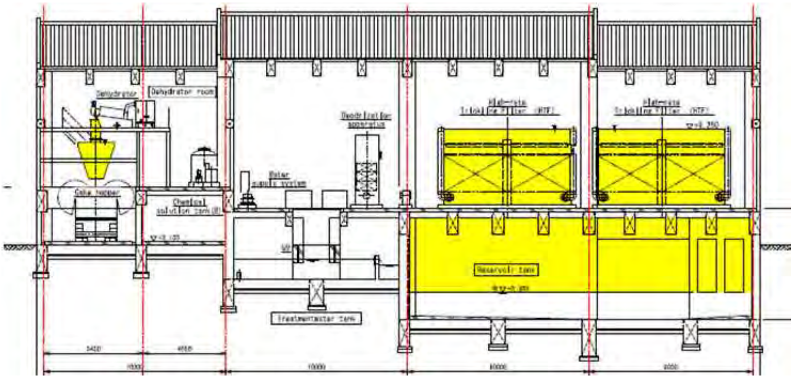
(1st Floor)

- Screen, Equalization Tank, Sludge Tank, Floating Sponge Filtration, High Rate Trickling Filter, Sludge Ticking Tank, Sludge Hopper

The area of odor treatment highlighted in yellow is presented in **Figure 6.4.4-1**.



Plan for Odor Treatment Area



Cross Section of Odor Treatment Area

Figure 6.4.4-1 Odor Treatment Area

<u>Necessity of Generator</u>

Every year 40 times power failures occur in Hoi An City. The maximum hour of failure is 12 hours. Therefore, generator should be installed.

Table 6.4.4-7 Power Failure Data

	Year 2012			Year 2013		
No.	Date	Time	Duration (hrs)	Date	Time	Duration (hrs)
1	2012/2/18	06h30-17h00	10.5	2013/1/4	07h00 - 17h00	10.0
2	2012/2/26	06h30-17h00	10.5	2013/1/5	07h00 - 17h00	10.0
3	2012/3/1	07h00-17h00	10.0	2013/1/17	07h00 - 17h00	10.0
4	2012/3/21	06h30-17h00	10.5	2013/1/24	07h00 - 17h00	10.0
5	2012/4/8	06h30-11h30	5.0	2013/1/26	06h00 - 14h00	8.0

	Year 2012			Year 2013		
No.	Date	Time	Duration (hrs)	Date	Time	Duration (hrs)
6	2012/4/11	06h30-17h00	10.5	2013/2/2	05h30 - 17h00	11.5
7	2012/4/21	06h30-16h30	10.0	2013/2/8	00h00 - 01h00	1.0
8	2012/4/24	06h30-16h30	10.0	2013/2/20	07h00 - 17h00	10.0
9	2012/4/26	06h30-17h00	10.5	2013/2/21	06h00 - 14h00	8.0
10	2012/5/8	09h30-12h30	3.0	2013/2/22	07h00 - 17h00	10.0
11	2012/5/8	13h30-15h30	2.0	2013/2/25	07h00 - 17h00	10.0
12	2012/5/10	06h30-16h30	10.0	2013/2/26	07h00 - 17h00	10.0
13	2012/5/23	06h30 - 16h30	10.0	2013/2/27	07h00 - 17h00	10.0
14	2012/5/24	06h30-16h30	10.0	2013/2/28	07h00 - 17h00	10.0
15	2012/5/25	06h30 - 16h30	10.0	2013/2/29	07h00 - 17h00	10.0
16	2012/5/28	06h30-16h30	10.0	2013/4/2	07h00 - 17h00	10.0
17	2012/5/29	06h30-16h30	10.0	2013/4/5	07h00 - 17h00	10.0
18	2012/5/30	06h30-16h30	10.0	2013/4/8	07h00 - 17h00	10.0
19	2012/6/5	06h30 - 16h30	10.0	2013/4/9	07h00 - 17h00	10.0
20	2012/6/9	05h00 - 07h00	2.0	2013/4/10	07h00 - 17h00	10.0
21	2012/6/13	08h00 - 11h30	3.5	2013/4/11	07h30 - 08h30	1.0
22	2012/6/16	06h30 - 16h30	10.0	2013/4/12	07h00 - 17h00	10.0
23	2012/6/29	06h00 - 07h00	1.0	2013/4/28	06h00 - 17h00	11.0
24	2012/7/19	06h00 - 11h30	5.5	2013/5/17	07h00 - 17h00	10.0
25	2012/7/22	07h00 - 17h00	10.0	2013/5/21	07h00 - 17h00	10.0
26	2012/7/29	12h00 - 16h30	4.5	2013/6/8	09h00 - 11h00	2.0
27	2012/7/30	06h00 - 16h30	10.5	2013/6/12	07h00 - 15h00	8.0
28	2012/8/4	12h00 - 16h30	4.5	2013/6/16	09h00 - 10h00	1.0
29	2012/8/10	06h00 - 16h30	10.5	2013/7/7	10h00 - 12h00	2.0
30	2012/8/13	06h00 - 16h30	10.5	2013/7/12	06h30 - 16h30	10.0
31	2012/9/18	06h30 - 07h30	1.0	2013/7/26	09h00 - 11h00	2.0
32	2012/9/19	06h30 - 17h00	10.5	2013/8/3	07h00 - 17h00	10.0
33	2012/10/1	07h30 - 12h30	5.0	2013/9/14	07h00 - 08h00	1.0
34	2012/10/14	06h00 - 07h00	1.0	2013/10/5	07h00 - 14h00	7.0
35	2012/10/25	07h00 - 17h00	10.0	2013/11/2	07h00 - 12h00	5.0
36	2012/10/30	07h00 - 12h00	5.0	2013/11/3	05h00 - 15h30	10.5
37	2012/11/3	11h00 - 14h00	3.0	2013/10/18	07h00 - 15h00	8.0
38	2012/11/8	07h00 - 17h00	10.0	2013/11/5	07h30 - 16h00	8.5
39	2012/11/9	07h00 - 16h00	9.0	2013/11/6	07h30 - 16h00	8.5
40	2012/11/22	07h00 - 17h00	10.0	2013/11/10	05h00 - 17h00	12.0
41	2012/12/4	07h00 - 08h30	1.5	2013/11/24	05h00 - 17h00	12.0
42	2012/12/14	07h00 - 17h00	10.0	2013/11/29	09h30 - 10h30	1.0
43	2012/12/27	07h00 - 17h00	10.0	2013/12/17	09h00 - 11h00	2.0
	Maximum in 2012		10.5	Maximum in 2013		12.0

Source: Vietnam Electricity (EVN)
Note: 2days Power failures from November 15 to 16, 2013 occurred by Typhoon No.15.

Capacity of a generator is estimated based on the power of the sewage treatment units because other units are not required for 24 hour working. The specifications of the generator are as follows;

Power: 125 kVA

Engine Type: Deiseal Type (Diesel oil)

Oil Tank: with a generator

6.4.5 Description of Sewage and Sludge Treatment Units

1) Treatment Flow

The sewage treatment system consists of pretreatment, pumping and equalization, before an advanced low energy sewage treatment process (Main Treatment units: floating sponge filtration, high-rate trickling filter and final separation), disinfection, and sludge treatment.

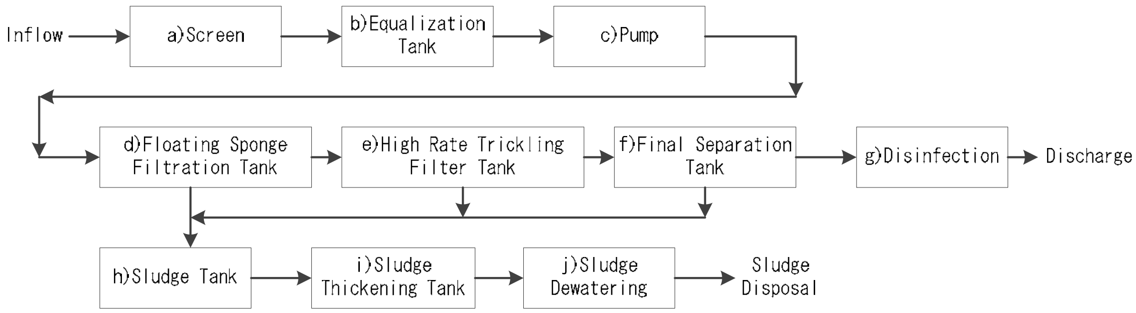


Figure 6.4.5-1 Treatment Flow

Each treatment unit is presented in **Table 6.4.5-1**.

Figure 6.4.5-1 Function of Each Treatment Unit

	Treatment Unit	Function
a	Screen	To remove small materials such as wood, fiber, and food waste for the protection of pump and floating sponge filtration unit.
b	Equalization Tank	To store wastewater which is overt than 2,000m^3/d(83.3 m^3/h) flow when wastewater increases due to rain and so on.
c	Pump	To lift sewage to Floating Sponge Filtration.
d	Floating Sponge Filtration Tank	To remove SS such as debris in sewage.
e	High Rate Trickling Filter Tank	To remove BOD in sewage.
f	Final Separation Tank	To remove SS derived from the biofilm of trickling filter.
g	Disinfection	To inactivate pathogen in treated water.
h	Sludge Tank	To store sludge from Floating sponge filtration and final separation tanks.
i	Sludge Thickening Tank	To increase the solids content of sludge by removing a portion of the liquid fractions.
j	Sludge Dewatering	To dewater the sludge from sludge thickening Tank.

2) Theory and Operational Characteristic

a) Screen

Screen removes particles in sewage. Screen works 24 hours because cleaning is carried out during operation.

b) Equalization Tank

Equalization tank stores the sewage flow which is over than treatment capacity and cuts the peak of sewage flow. A pump is installed to prevent the sedimentation of sewage by intermit tent mixing sewage in the tank.

c) Pump

Pump lifts sewage from the equalization tank to the top of floating sponge filtration through the bottom. 24 hour continuous operation is designed.

d) Floating Sponge Filtration Tank

Floating sponge filtration remove SS by filtering sewage through sponge material for the prevention from clogging the nozzle of trickling filter.

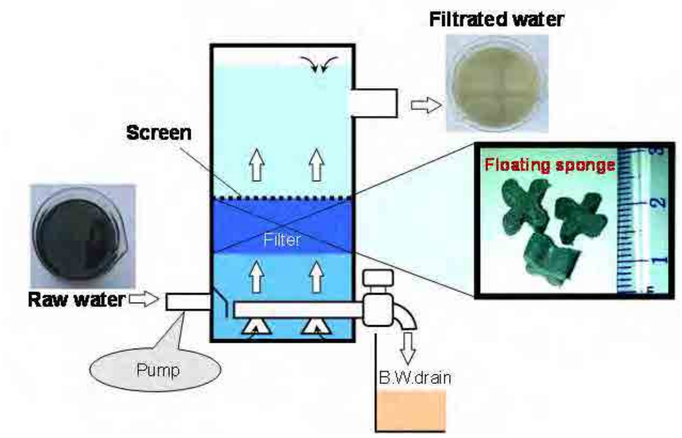


Figure 6.4.5-2 Schematic Drawing of Floating Sponge Filtration Tank

Sewage flows from the bottom to the top by pump. After filtration, sewage flows to high rate trickling filter by gravity. Backwash is carried out to clean sponge materials by using treated water of floating sponge filtration. SS is taken out by backwash and backwashed water is stored in the sludge tank. Backwash time is about one minute. During backwash, treatment is stopped.

e) High Rate Trickling Filter

Treatment theory is the same as trickling filter. Organic substances are removed by bio-film. Plastic material with high porosity is used for tricking filter to increase surface area although rock is used in typical trickling filter.

Sewage is distributed by arms mounted on a pivot in the center of the filter. Sewage flows from the top to bottom through the filters, and flows to final separation tank by gravity.

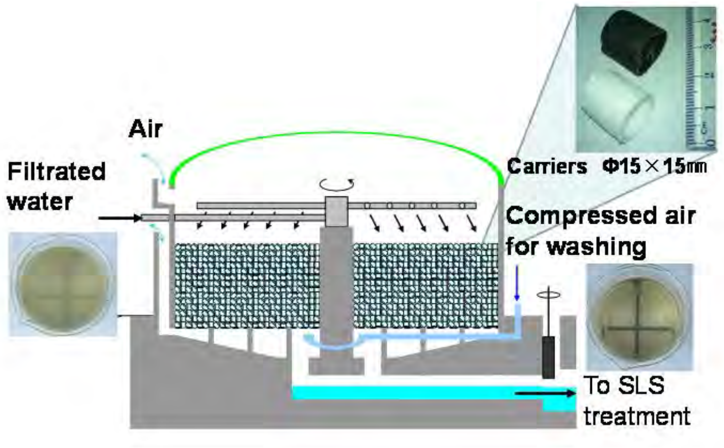


Figure 6.4.5-3 Schematic Drawing of High Rate Trickling Filter

Frequently filling trickling filter tank with sewage from floating sponge filtration tank is carried out to kill larva. After filling, backwash is carried out. Wastewater by backwash is stored in the sludge tank. It takes about 30minitues for filling and backwash.

f) Final Separation Tank

SS is removed by sedimentation and is removed by filtration. SS removed by filter media is cleaned by air blowers. Treated water quality decreases during air blower. Therefore, treated water during air blower is stored in the sludge tank.

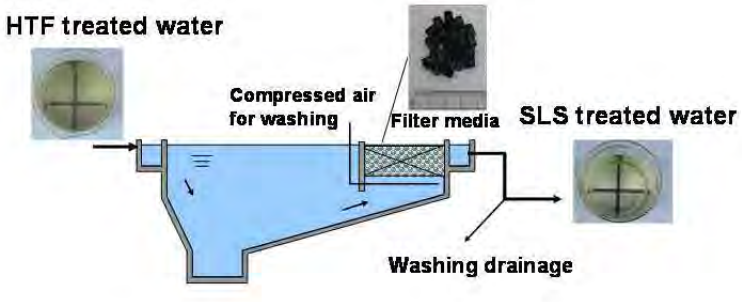


Figure 6.4.5-4 Schematic Drawing of Final Separation Tank

g) Disinfection Tank

UV radiation is adopted for the inactivation of pathogen and water safety. Radiation time is about two seconds.

Cleanings the lamp of UV is carried out once in a month for removing bio film.

h) Sludge Tank

Wastewater due to backwash from floating sponge filtration tank, high rate trickling filter tank and final separation tank is stored.

i) Sludge Thickening Tank

Wastewater stored in the sludge tank is separated to sludge and a portion of the liquid fractions by gravity. Sludge thickening tank which is the odor source is covered and odor is treated.

j) Sludge Dewatering

Screw press process is adopted. Sludge is dewatered by rotating screw with coagulation chemicals.

Cleaning is carried out after dewatering. Dose of chemical is determined in trial operation stage.

6.4.6 Access Road

Location of the access road is studied. **Figure 6.4.6-1** shows the area surrounding the STP site and **Photo 6.4.6-1** shows buildings surrounding the STP site.

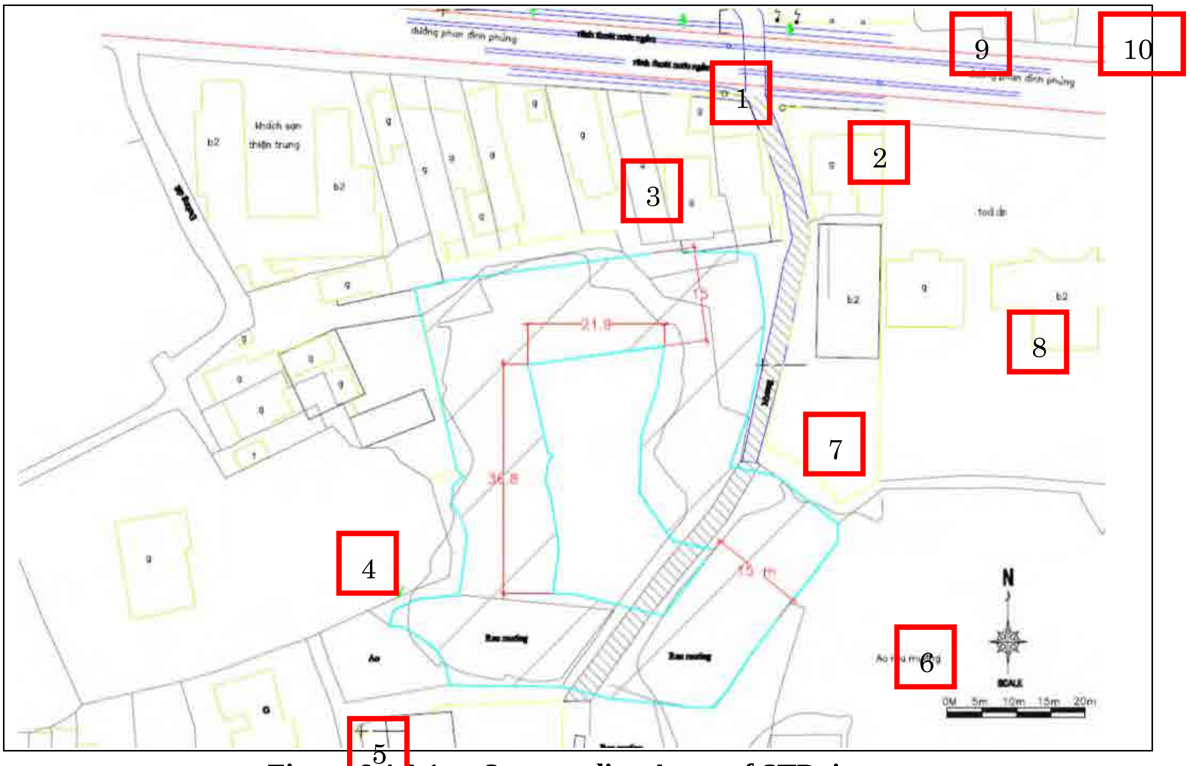


Figure 6.4.6-1 Surrounding Areas of STP sites

Photo 6.4.6-1 Buildings surrounding STP Site

		
1. Entrance road of planned STP site (3m width of cannel)	2. Entrance road	3. Buildings at the northern side of planned STP Site
		
4. Bush at western side of Planned STP	5. Kindergarten at the southern side of planned STP	6. Water spinach at the eastern side of planned STP
		
7. Channel flowing in planned STP site	8. Buildings at northeastern side of Planned STP	9. Tran Hung Dao Street connecting to the entrance road
		
10. Cross section of Tran Hung Dao Street and Hai Ba Truing Street		

Based on the situation, there are four possibilities for an access road presented in **Figure 6.4.6-1**.

- Case A: Existing channel route
- Case B: Existing road route
- Case C: Existing south road route
- Case D: New road in water spinach field

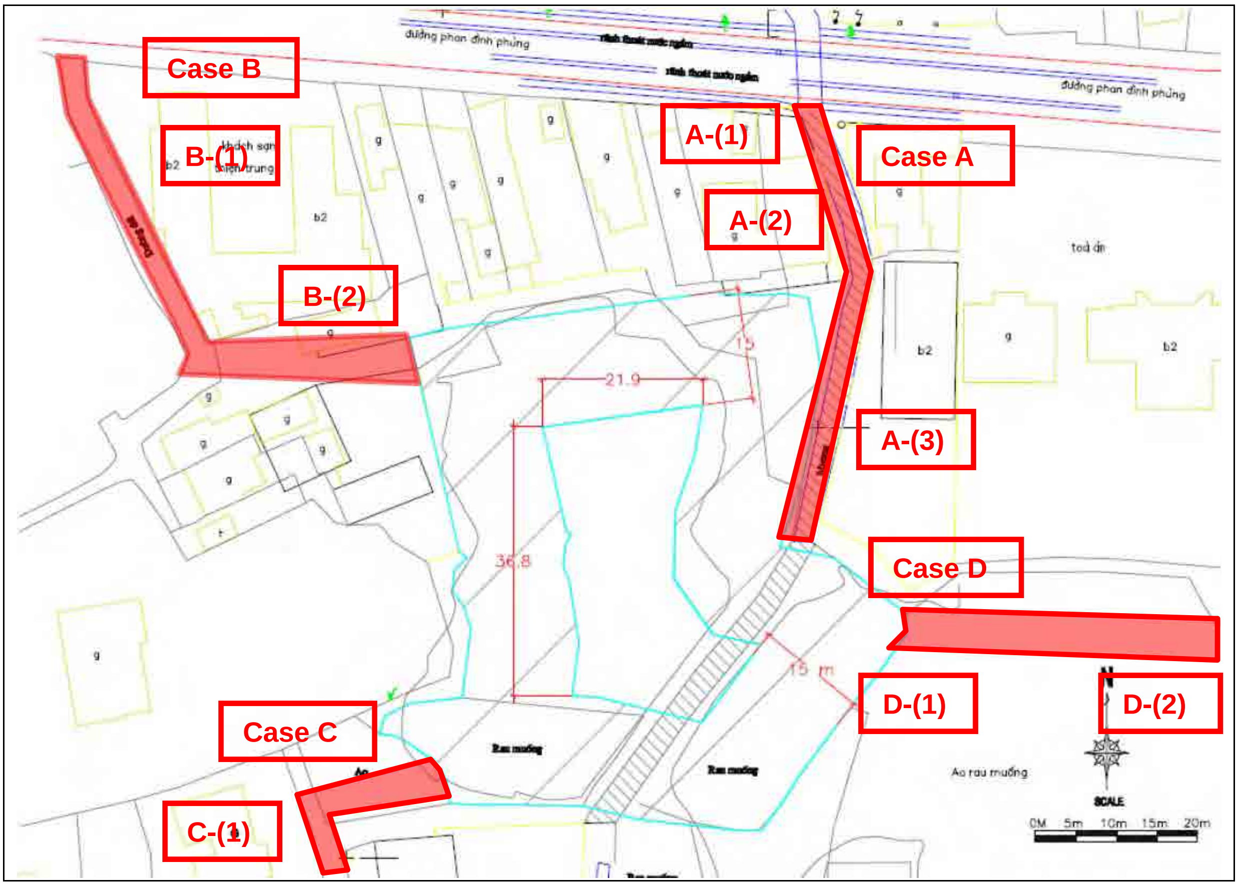


Figure 6.4.6-2 Access Road Route

Photo 6.4.6-2 shows the existing situations and **Table 6.4.6-1** shows the comparisons of each route.

Photo 6.4.6-2 Existing situations of Access Road Routes

		
A-(1)	A-(2)	A-(3)
		
B-(1)	B-(2)	B-(3)

C-(1)

D-(1)

D-(2)

Table 6.4.6-1 Comparisons of access road routes

Items	Case A	Case B	Case C	Case D
Width of existing road	3.0m	2.9m	2.1m	Any width is possible.
Road connection to access road	Tran Hung Dao Street (Zone II-A which is a buffer zone for historical protection area)	Tran Hung Dao Street (Zone II-A which is a buffer zone for historical protection area)	Phan Chau Trinh Street (Historical Protection Area: Zone I)	Hai Ba Trung Street (Zone II-A which is a buffer zone for historical protection area)
Land Acquisition	No	Necessity	Necessity	Necessity
Resettlement	No	Necessity	Necessity	No
Evaluation	○	X	X	X
Note	No land acquisition and no resettlement are required.	Land acquisition and resettlement are required because planned road does not connect to the STP site.	Access road connects to Phan Chau Trinh street in Zone I of Historical Protection Area. To widen the road, land acquisition and resettlement are required.	Land acquisition and resettlement are necessary. Connection road is located in Zone I.

Based on the evaluation, Case A is the most suitable because of wide road and no land acquisition and or resettlement. Since this case uses the channel as an access road, the urban management division requests structural improvement of the channel for trucks over 1 ton. Therefore, as a 4ton covered truck is used as a sludge truck in this project, the channel is upgraded.

6.4.7 Flood Water Level and Measures (1st Floor Level)

1) STP site conditions

The STP site is surrounded by houses. In the facility plan, odor control and the location of an access road are considered due to any negative effect of the STP and its construction. **Figure 6.4.7-1** shows the location of the STP and the buffer zone.

Layout area of the STP is around 800 m^2 (=21.9mx36.8m) without buffer zone, while the total area is around 0.36 ha.

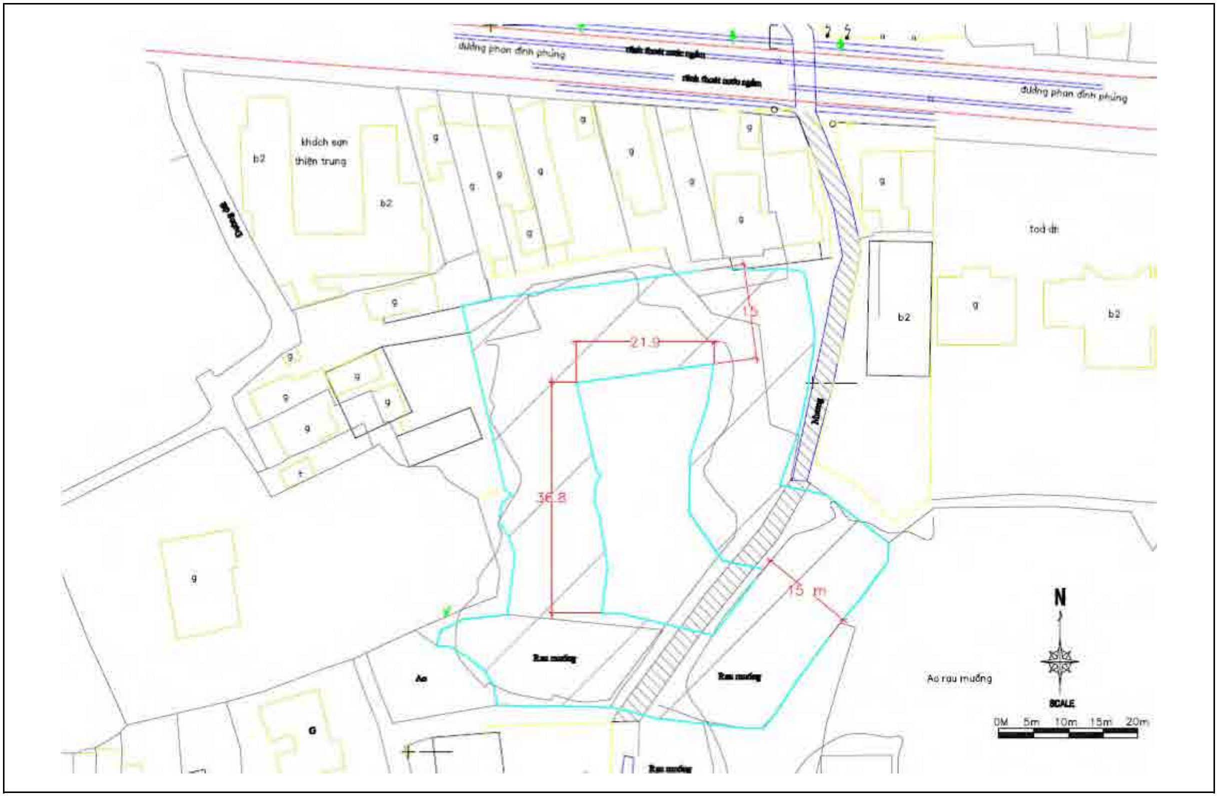


Figure 6.4.7-1 STP site and Buffer zone

2) Flood Water Level

During November 2013, Typhoon No. 30 (Haiyan) caused the first floor to be under water in Hoi An. Moreover, every year floods occur in Hoi An. Therefore, flood water level is considered in the STP design.

Table 6.4.7-1 shows the water levels measured at a Hydro-meteorological Center over 7 years. This measuring point is located on Cam Nam Island. It is not in the center of Hoi An.

Table 6.4.7-1 Flood Water Level (on Cam Nam Island)

year	Flood Water Level	Note
2007	3.20 m	
2008	Over than 2.16 m	
2009	3.28 m	
2010	2.20 m	
2011	2.85 m	
2012	No significant flood	
2013	2.70 m	
Maximum	3.28 m	Year 2009

Source：Hydro-meteorological Center

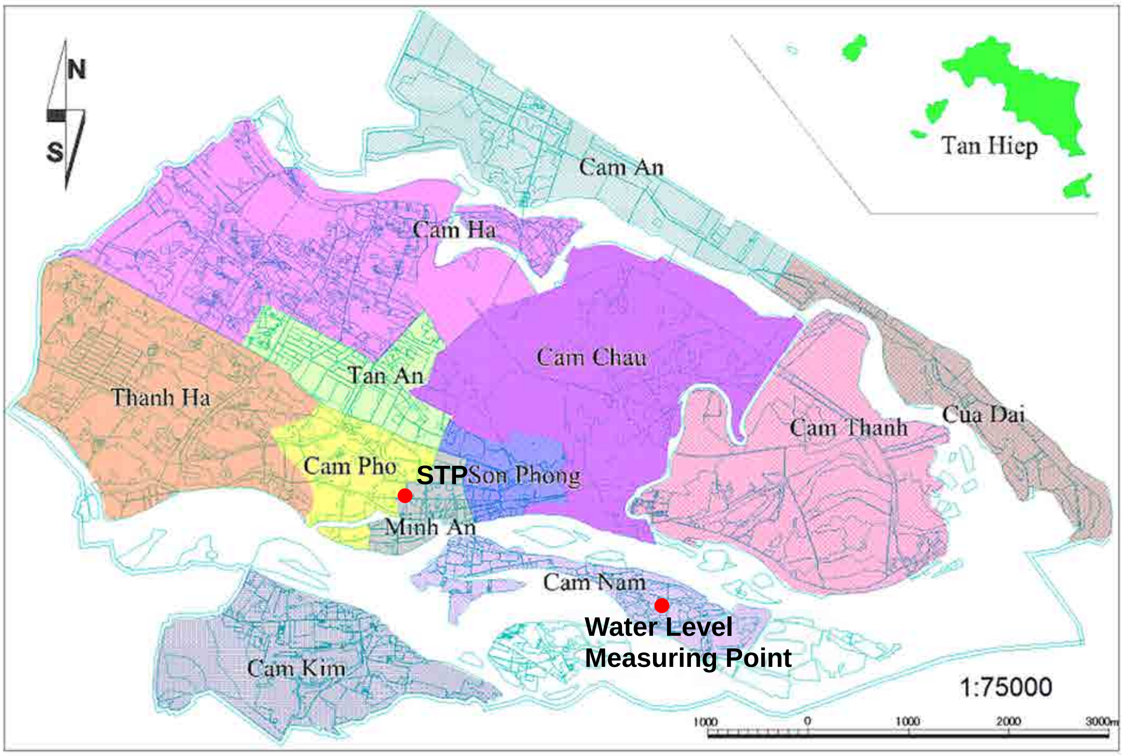


Figure 6.4.7-2 Measuring Point

There is no statistical data on floods in the center of Hoi An. Based on interviews; the flood in 2009 was the worst for 10 years. This information concurred with the year of high water level on Cam Nam Island, recorded by a Hydro-meteorological Center. Based on the site survey, the water level in the center of the city is 4.28M. Therefore, 4.3M as a flood water level is set for STP design.

Photo 6.4.7-1 Photo of Flood Record at Kindergarten near STP

	
Record Plate on the wall of Kindergarten	Flood Record Plate(Flood Level 4.28m in 2009)

3) Measures for Flood (1^{st} Floor Level)

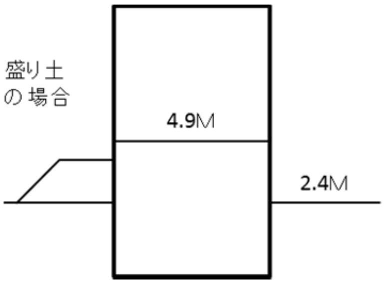
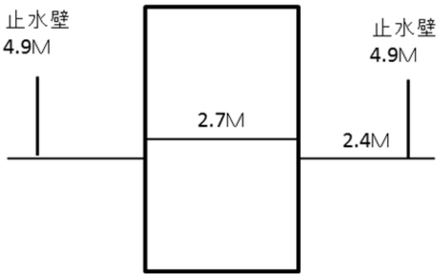
According to the heritage code, ground level is the same as that of the nearest street, Trang Hung

Dao Street. This level is 2.4M. Therefore, at 4.3 M flood water level, measures for flood are necessary.

There are two measures for flood which are: A) Raising the floor level above flood water level, or B) Banks to protect buildings from flood.

Table 6.4.7-2 shows the comparisons of measures. Floor level and bank height level are set at 4.9M (=4.3M + 0.6m) including 0.6m as a margin based on the Japan River Structure Regulations.

Table 6.4.7-2 Comparisons of Measures

Measures	**A) Higher Floor level than that of Flood**	**B) Bank with general floor level**
Schematic drawing		
Height	Total building height is higher because the first floor level is high.	Total building level is lower than A) plan.
	△	○
Reliability	Mechanical and electrical equipment is safeguarded because it is set above flood level.	It is necessary to install a waterproof door in the bank. With the possibilties that forgetting to close door or door malfunction may occur, there is a relatively high possibility of flood.
	○	×
Evaluation	○	×

In cost comparisons, both cases have the same O&M costs because of the same specification of pumps based on the following calculations.

A) Case

$Ps = 0.163 \cdot \gamma \cdot Q \cdot H/0.65 = 0.163 \cdot 1.0 \cdot 0.8 \cdot 12/0.65 = 2.32$

Ps：Pump power (kw)

γ：density of fluid(kg/l)

Q：Pumping water volume (m^3/minute)

H：Height (m)

0.65：Pump efficiency

$P = Ps \times 1.15 = 2.67 \rightarrow 3.7$kw

P：Pump power (kw)

1.15：1+0.15（margin）

B) Case

Assuming height is 2m lower than A) case,
Ps＝0.163・1.0・0.8・（12-2）/0.65＝2.01
P＝Ps×1.15＝2.31→3.7kw (On specification, 2.2 kw is just lower than 3.7kw)
Power is the same as A) case, and O&M costs are the same. Also, B) case needs additional construction costs of waterproof doors.

Therefore, A) case is selected in terms of low cost and the high reliability of flood prevention because all equipment is installed above flood level.
Based on above, 1st floor level is 4.9M.

6.4.8 Ground Level in STP

Ground level in STP is studied in terms of the possibility of the installation of equipment.
There are two cases in which one is ground level is the same as that of surrounding buildings or other is 4.7M based on the 1st floor level 4.9M.

Figure 6.4.2-4 shows the layout of sludge treatment equipment at 4.7M ground level.

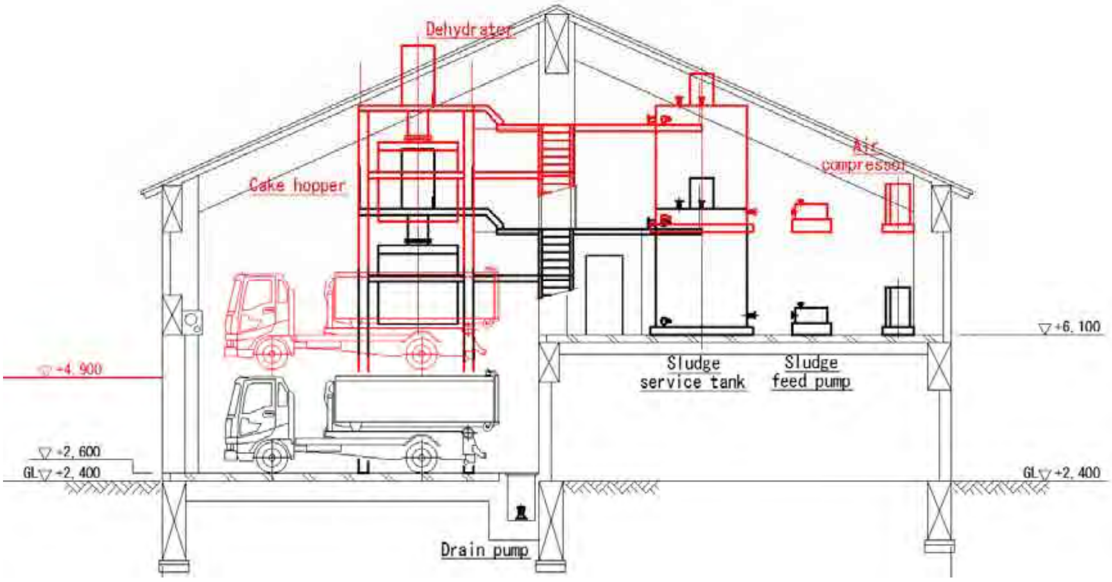


Figure 6.4.8-1 Layout of sludge room in the case of 4.7M ground level

Based on the layout, the sludge treatment equipment cannot be installed inside the buildings. The height of roof is not be changed because of Heritage code Class II-A regulation (In this case a height of 13.5 m is approved by Hoi An PC even though the general regulations of 10.5m apply). Therefore, the ground level in STP is decided based on the surrounding buildings.

The ground level of surrounding buildings is higher than present ground level because of the prevention of rain invasion. According to the survey data, the average ground level of surrounding buildings is 2.9M which is 0.5m higher than the present ground level. Then, the ground level in STP is 2.9M in terms of rain water invasion.

Average hotel ground level = ((2.96+2.86+2.63+2.89+2.94+2.74+2.93+2.94)/8 =2.86M→2.9M).

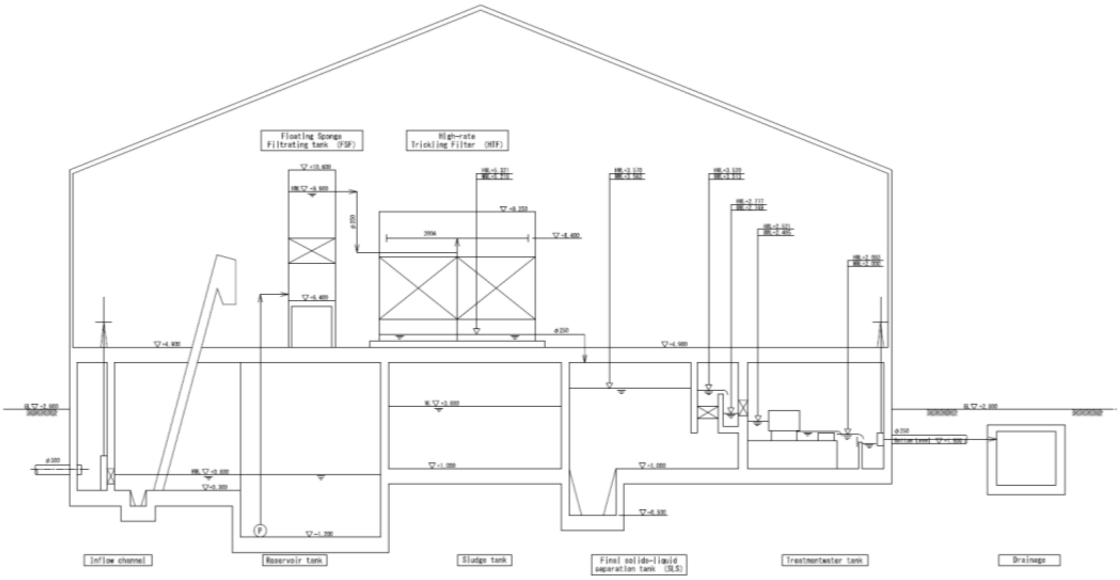


Figure 6.4.8-2 Ground Level and Equipment Level

As for the administration building, on the first floor there is a parking lot and a warehouse which does not suffer severe damage by flood. The second floor, housing the electrics, management room, and water analysis room, is set higher than flood water level.

6.4.9 Material of Tanks

Appearance of STP should be considered because Hoi An has the historically preserved area for World's Cultural Heritage. Also, there are height regulation and buffer zone regulation. Therefore, all sewage equipment is installed inside the building and the compact layout of equipment is required.

Based on above, in terms of height regulation and hydraulic elevation, equalization tank, final separation tank, disinfection tank, and sludge tank are built under ground. Floating sponge filtration tank, high rate trickling filtration tank, and sludge thickening tank are built on the 1st floor.

As for material, reinforced concrete is widely used based on the low construction cost and good durability although the weight of reinforced concrete is heavier than steel. Therefore, reinforced concrete is the priority material for tanks.

Reinforced concrete is used for equalization tank, final separation tank, disinfection tank, and sludge tank because those are built as one of underground structure. On the other hand, reinforced concrete for floating sponge filtration tank, high rate trickling filtration tank, and sludge thickening tank which are built on the 1st floor has the following demerits.

PVC material is not used as main material in terms of durability on impact. Reinforced concrete or steel are selected as material.

1) At the replacement, equipment should be divided into small parts inside thanks. Also, it takes a time to replace equipment under small area with many pipes and air ducts and need to pay attention on the damage of other equipment.

2) It needs to pay attentions on the safety of workers during construction because working space overlaps the transportation routes.

3) Because of limited working space, it is difficult to take safety measures such as lights, ventilation, wastewater treatment, cover the protection sheet against falling objects and falling protection fence.

Based on above disadvantages, the comparisons between reinforced concrete and steel are conducted. Figure 6.4.9-1 shows the comparisons. In terms of reliable replacement, steel is adopted as main material for floating sponge filtration tank, high rate trickling filtration tank, and sludge thickening tank.

Table 6.4.9-1 Comparison between reinforced Concrete and Steel

	Reinforced Concrete	Steel
Quality of Construction	Quality of anti-corrosion coating is unstable because of on-site painting.（△）	Quality is stable because of factory products （○）.
Replacement	Work space is limited at the replacement, and operation space overlaps replacement work space（△）.	Whole equipment including tank is replaced at replacement. Then, transportation rote is secured by removing whole equipment. It is possible minimize the overlap area with operation space （○）.
Construction Cost	155million Yen（○）	160million Yen（△）
Life Cycle Cost (LCC)	366million Yen/50years （○）	368million Yen/50years （○）
Evaluation		Under limited work space, replacement is more reliable than reinforced concrete in terms of construction quality, and workability including safety although there is no cost advantage （○）.

(Replacement)
In the case of steel, at the replacement a tank is disassembled and taken out by broken brick wall. By broken wall, overlap areas with operation work space and replacement work space are minimized. Comparing with concrete, each unit of equipment is replaced without big damages to other equipment.

(Transportation Route)
In the case of concrete, the replacement of equipment and working tools are carried out from the upper space of thank at the replacement and coating. Because there is other equipment above floating sponge filtration tank, high rate trickling filtration tank, and sludge thickening tank, hoist rail, chain block as well as a hook are necessary to take equipment out from tanks. At this case, working space is presented in Table 6.4.9-2.

Table 6.4.9-2 Working Space above Tanks

Unit	Upper Level of Tank	Lower Level of Hoist Rail	Working Space*
Floating Sponge Filtration tank	＋10.7 M	＋12.1 M	0.7 m
High Rate Trickling Filtration tank	＋9.3 M	＋12.0 M	2.0 m
Sludge Thickening Tank	＋9.2 M	＋12.2 M	2.3 m

*Working space = Lower Level of Hoist Rail – Upper Level of Tank –(Height of hoist rail:200mm＋Height of Chain Block: 500m

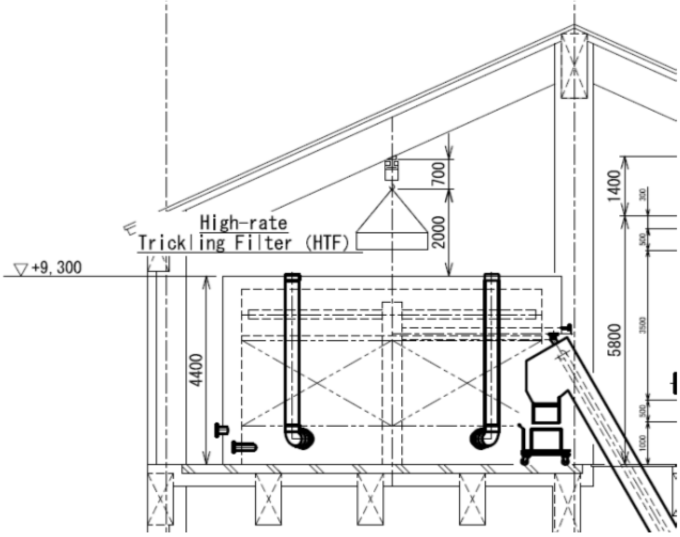


Figure 6.4.9-1 Cross section of High Rate Trickling Filtration tank

Figure 6.4.9-2 to 4 show the relationship between hoist rails (green color), ducks and pipes (blue color). It is necessary to move equipment and machines between air duct and tanks by disassembling equipment into small parts (Length: 1m to 2m, width: 0.4 to 1m) by transportation route (red line).

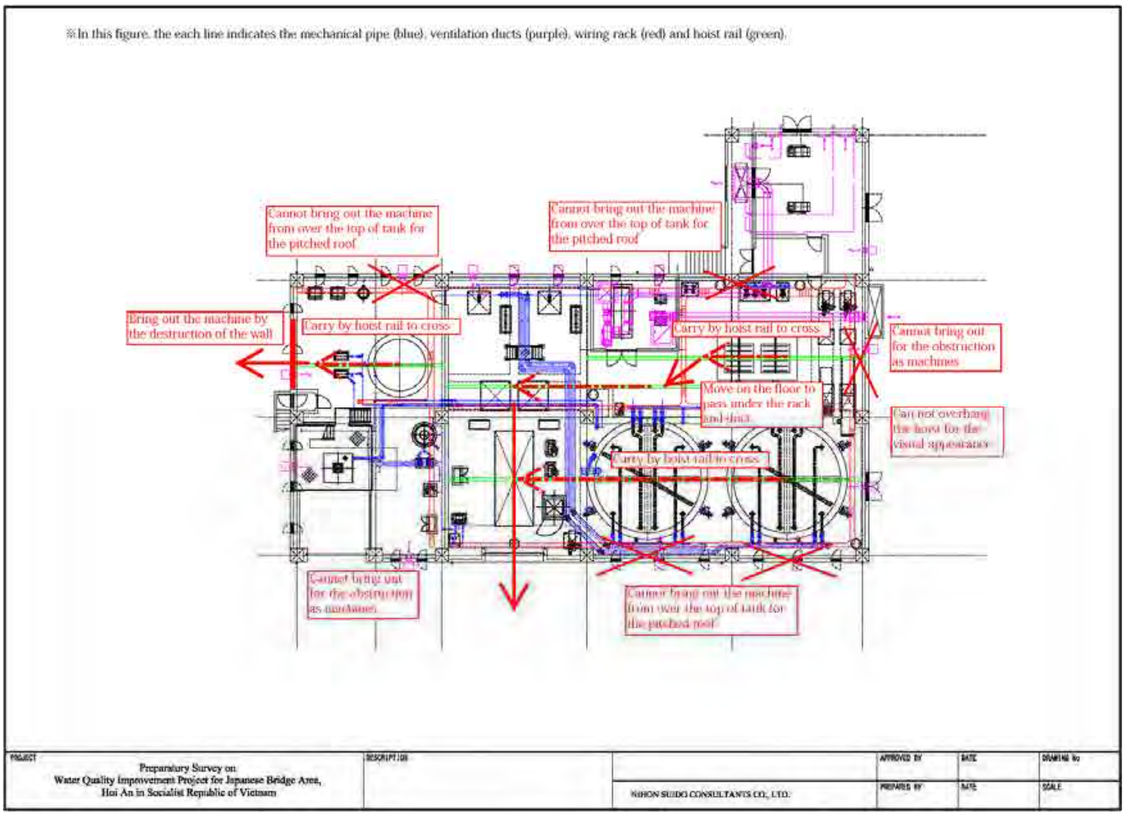

※In this figure, the each line indicates the mechanical pipe (blue), ventilation ducts (purple), wiring rack (red) and hoist rail (green).

Figure 6.4.9-2 Transportation Route in the Case of Reinforced Concrete (Layout Plan)

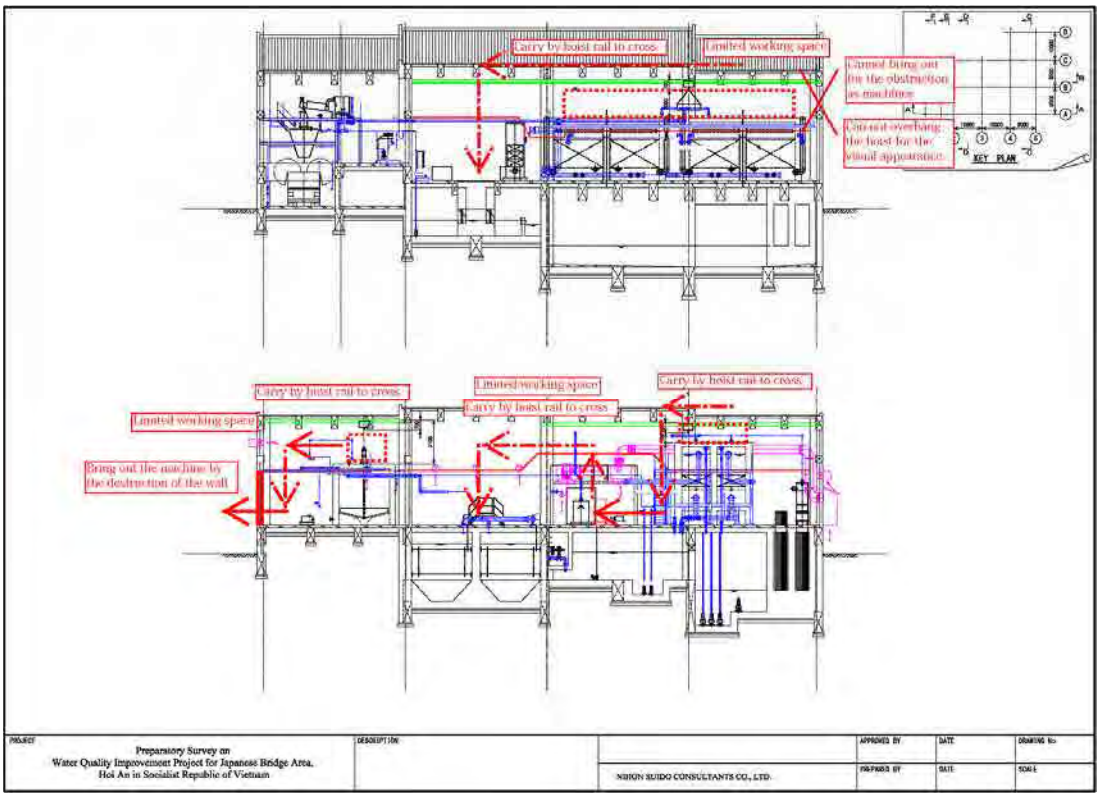


Figure 6.4.9-3 Transportation Route in the Case of Reinforced Concrete (Cross Section 1)

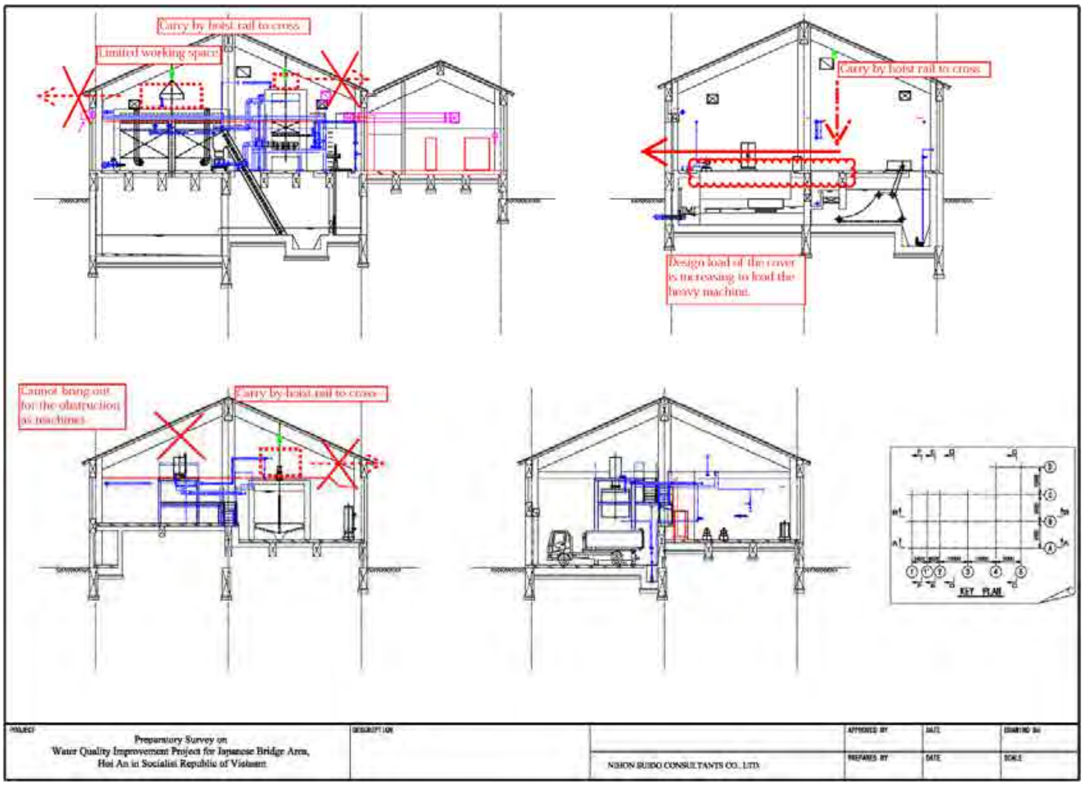


Figure 6.4.9-4 Transportation Route in the Case of Reinforced Concrete (Cross Section 2)

Transportation of equipment and machines is not carried out by only hoist rail because of pipes, other equipment and accessory, and electric lines. Equipment and machines are moved on the floor to avoid them at some places.

In the case of steel, although brick walls are broken to make service entrances, all parts of equipment and machines are transported by hoist rail.

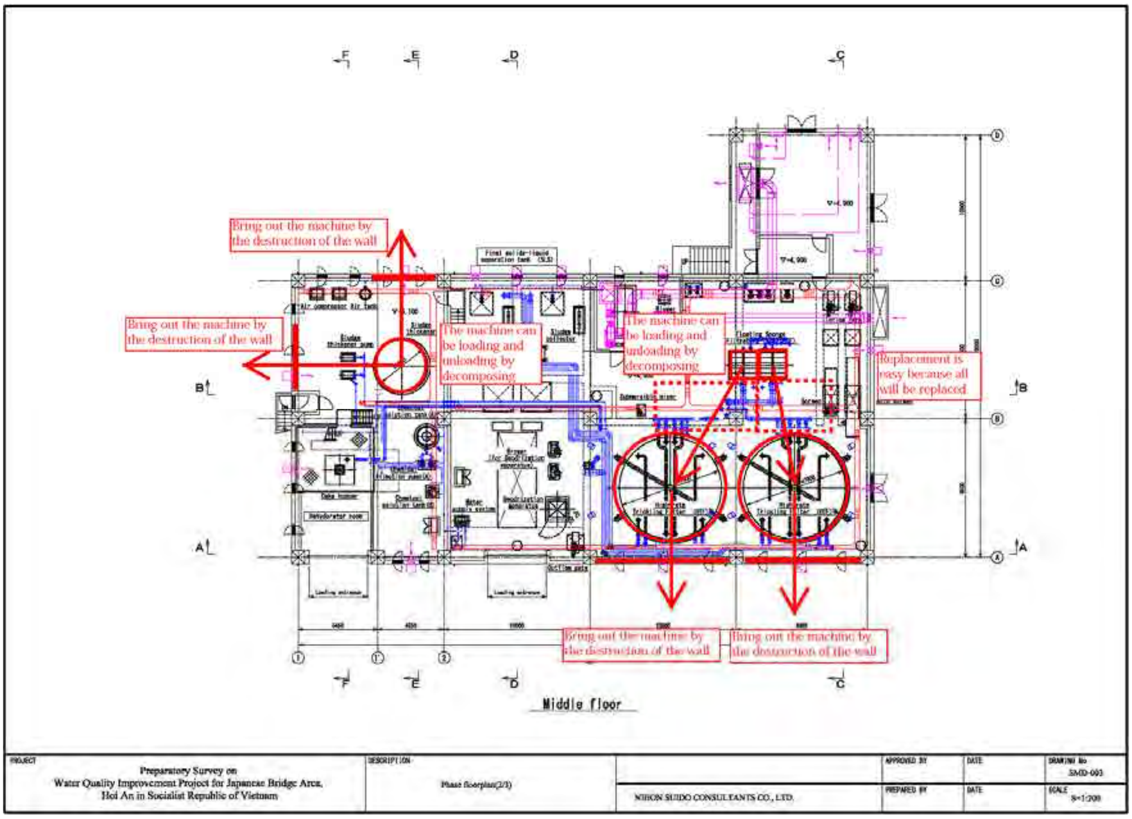


Figure 6.4.9-5 Transportation Route in the Case of Steel (Layout Plan)

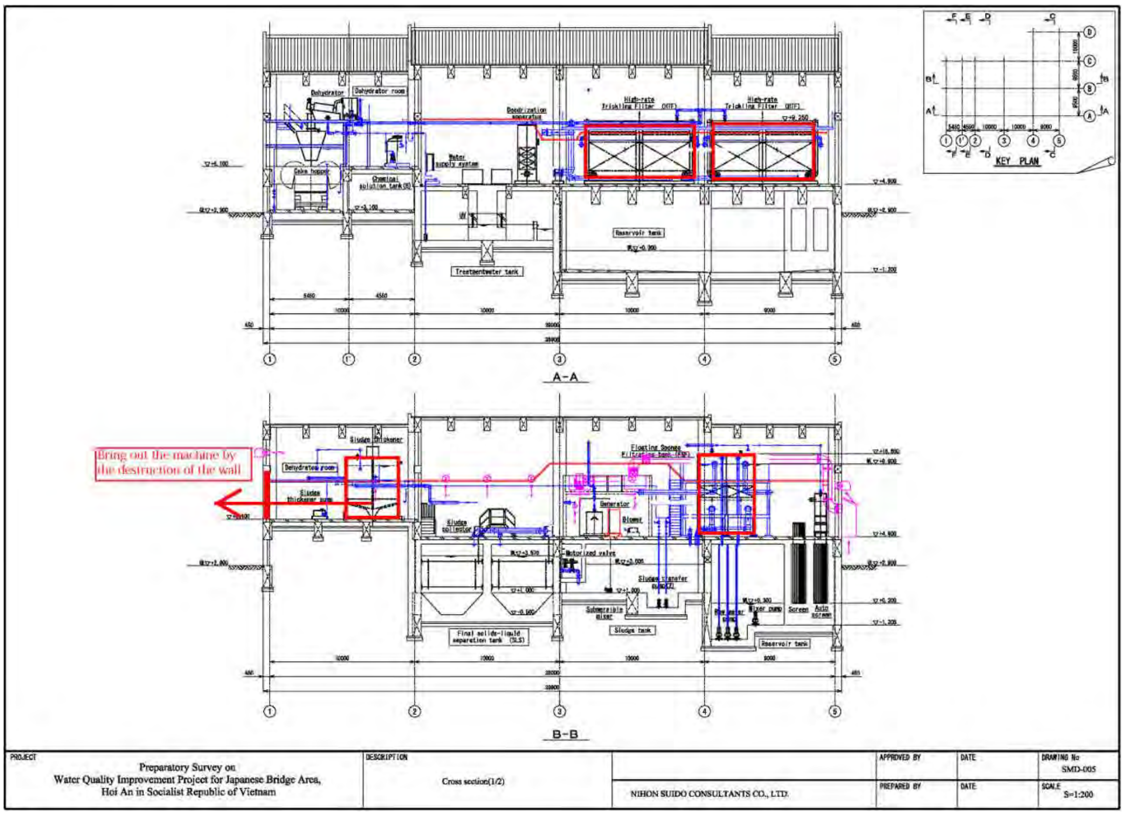


Figure 6.4.9-6 Transportation Route in the Case of Steel (Cross Section 1)

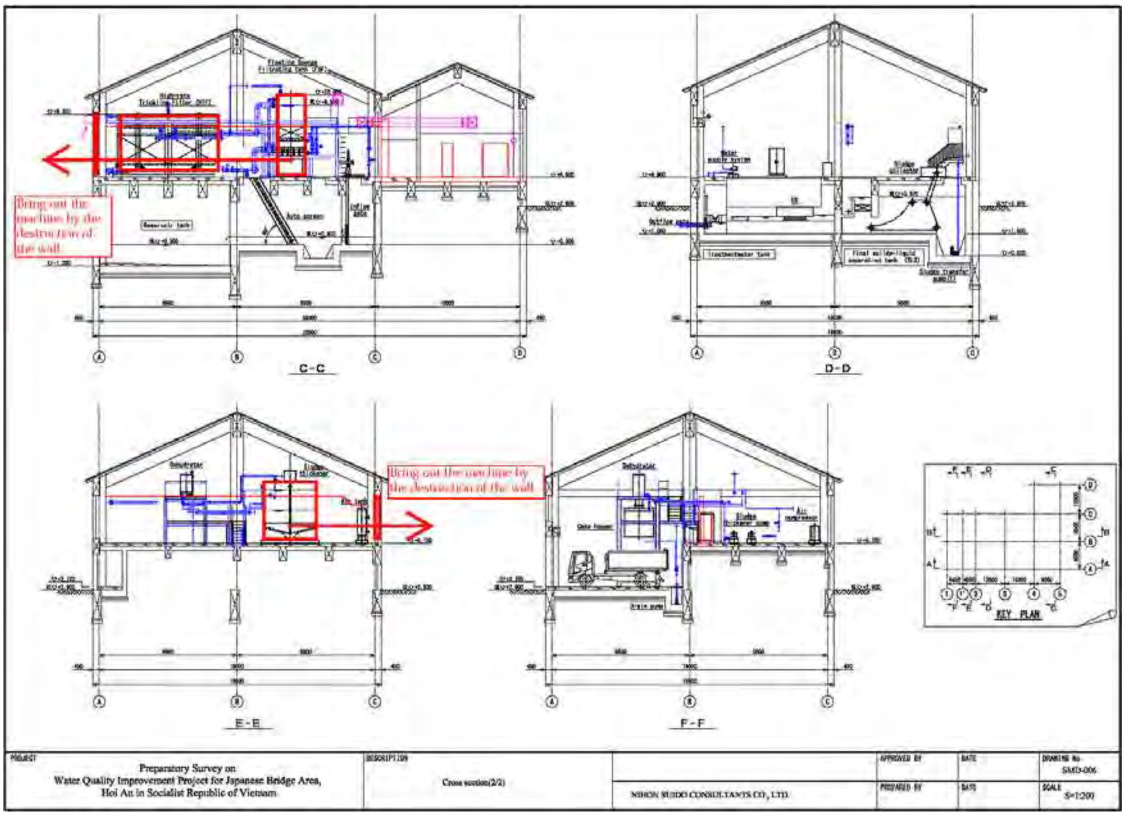


Figure 6.4.9-7 Transportation Route in the Case of Steel (Cross Section 2)

(Construction Cost and LCC)

Construction costs of steel and reinforced concrete are presented as follows.

Table 6.4.9-3 Construction Cost in the case of Reinforced Concrete

		Million Yen
Reinforced Concrete Tank (Floating sponge filtration tank, High rate trickling filtration tank, Sludge thickening tank)	Additional Volume of reinforced concrete	7
	Additional pile	9
	Additional anti-corrosion coating	7
	Opening Reinforcement	2
Additional equipment (Floating sponge filtration tank, High rate trickling filtration tank, and Sludge thickening tank)		130
Construction Cost		155

Table 6.4.9-4 Construction Cost in the case of Steel

	Million Yen
Steel tank (Floating sponge filtration tank, High rate trickling filtration tank, and Sludge thickening tank)	30
Additional equipment (Floating sponge filtration tank, High rate trickling filtration tank, and Sludge thickening tank)	130
Construction Cost	160

The cost of Steel is 3% (5 million Yen) higher than reinforced concrete.

LCC is calculated based on the construction cost.
The assumptions are as follows.

- Replacement cost is calculated based on discount equation. Each replacement cost is expressed by the present value. Life cycle year is 50 years.
  - S: Construction Cost
  - n: number of year in the future
  - r: inflation rate, 4.8%
  - $(1+r)^{-1}$: Discount rate, 0.9542
  - $M = r/((1+r)^{n}-1) \cdot S$: Present Value at n year
- In the case of reinforced concrete, existing paint and corroded concrete parts are removed and those parts are repaired at the replacement of anti-corrosion. Also, scaffolding works which are two times the replacement cost of equipment are included.
- The removal cost for equipment is not included instead of that the scraped equipment revenue is not included.
- Annual maintenance cost (painting and small repairs) is 1.5% of equipment cost.

Table 6.4.9-5 Replacement Cost, Present Value, and LCC in the Case of Reinforced Concrete

	Construction Cost	Service Life	Present Value	LCC
Frame Construction （Reinforced Concrete, pile）	16	50	0.09	5
Coating	14	10	1.13	57
Opening Reinforcement	2	20	0.07	4
Replacement at every 20 years	130	20	4.02	201
Annual maintenance Cost(1.5%of equipment cost)	2.0	1	2.00	100
			7.31	366

*LCC is accumulated cost during 50 years.

Table 6.4.9-6 Replacement Cost, Present Value, and LCC in the Case of Steel

	Construction Cost	Service Life	Present Value	LCC
Tank Replacement	30	20	0.93	47
Equipment Replacement	130	20	4.02	201
Annual maintenance Cost(1.5%of equipment cost)	2.4	1	2.40	120
			7.35	368

The LCC of Steel is almost 1% (2 million Yen) higher than reinforced concrete.

6.4.10 Study on the Reduction of Greenhouse Effect Gas by Sewage Treatment

The deduction of greenhouse effect gas is studied based on the UNFCCC/CCNUCC III.I./Version08.

Base line emission is calculated by the following equation which is stpilated in UNFCC/CCNUCC III.I./Version08.

$$BE_y = BE_{ww,treatment,y} + BE_{ww,discharge,y} + BE_{s,treatment,y} + BE_{s,final,y}$$

Where:

BE_y	Baseline emissions in the year *y* (tCO_2e)
$BE_{ww,treatment,y}$	Methane produced in the anaerobic baseline wastewater treatment system(s) that is/are being replaced with the biological aerobic system(s) (tCO_2e): 0 because at present sewage treatment is not conducted aerobicall or anaerobically.
$BE_{ww,discharge,y}$	Methane emissions on account of inefficiencies in the baseline wastewater treatment systems and presence of degradable organic carbon in the treated wastewater discharged into river/lake/sea etc. (tCO_2e)
$BE_{s,treatment,y}$	Methane produced in the baseline sludge treatment system(s) (tCO_2e): 0 because of no sewage treatment at present
$BE_{s,final,y}$	Baseline methane emissions from anaerobic decay of the final sludge produced (tCO_2e): 0 because there is no collection and disposal of sludge at present.

In base line emission calculation, $BE_{ww,discharge,y}$, methane emissions on account of inefficiencies in the baseline wastewater treatment systems and presence of degradable organic carbon in the treated wastewater discharged into river/lake/sea etc, is a baseline emission because of no sewage treatment at present. Therefore, the baseline emission is 93 t as CO_2/year (BE_y = 0+ 93+ 0 + 0).

The calculation is as follows;

$$BE_{ww,discharge,y} = Q_{ww,y} * GWP_{CH4} * B_o * UF_{BL} * COD_{ww,discharge,BL,y} * MCF_{ww,discharge,BL}$$

$$= 1{,}500 \times 365 \times 21 \times 0.21 \times 0.94 \times 410 \times 10^{-6} \times 0.1 = 93 \text{ t as } CO_2/\text{年}$$

Where:

$Q_{ww,y}$	Volume of treated wastewater discharged in year *y* (m^3): 1,500×365(m^3/y) because of 1,500 m^3/d as daily average flow
GWP_{CH4}	Global Warming Potential for CH_4 (value of 21)
B_o	Methane producing capacity for the wastewater (IPCC default value of 0.21 kg CH_4/kg COD)
UF_{BL}	Model correction factor to account for model uncertainties (0.94)
$COD_{ww,discharge,BL,y}$	Chemical oxygen demand of the treated wastewater discharged into sea, river or lake in the baseline situation in year *y* (tonnes/m^3): 410×10^{-6}(tonnes/m^3) because actual COD of cannal water at the STP site is 410 mg/L
$MCF_{ww,discharge,BL}$	Methane correction factor based on the discharge pathway (e.g., into sea, river or lake) of the wastewater (fraction) (MCF value as per below table): (0.1) because of "Discharge of wastewater to sea, river or lake".

Table 6.4.10-1 IPCC default values for Methane Correction Factor (MCF)

Type of wastewater treatment and discharge pathway or system	MCF value
Discharge of wastewater to sea, river or lake	0.1
Aerobic treatment, well managed	0
Aerobic treatment, poorly managed or overloaded	0.3
Anaerobic digester for sludge without methane recovery	0.8

Anaerobic reactor without methane recovery	0.8
Anaerobic shallow lagoon (depth less than 2 meters)	0.2
Anaerobic deep lagoon (depth more than 2 meters)	0.8
Septic system	0.5

Source: UNFCC/CCNUCC III.I./Version08

Project activity emissions are calculated by the following equation based on UNFCC/CCNUCC III.I./Version08.

$PE_y = PE_{power,y} + PE_{ww,treatment,y} + PE_{ww,discharge,y} + PE_{s,treatment,y} + PE_{s,final,y}$

Where

PE_y	Project activity emissions in year *y* (tCO_2e)
$PE_{power,y}$	Emissions on account of electricity or fossil fuel consumption in the year *y* (tCO_2e)
$PE_{ww,treatment,y}$	Methane emissions from the biological aerobic wastewater treatment in the year *y* (tCO_2e)
$PE_{ww,discharge,y}$	Methane emissions on account of inefficiencies in the project wastewater treatment systems and presence of degradable organic carbon in the treated wastewater discharged into river/lake/sea etc. (tCO_2e)
$PE_{s,treatment,y}$	Methane produced in the project sludge treatment system(s) (tCO_2e) : 0 because only dewatering is conducted and sludge treatment such as a digestion is not conducted. The electricity of dewatering is considered in $PE_{power,y}$ calculation.
$PE_{s,final,y}$	Methane emissions from anaerobic decay of the final sludge produced in year *y* (tCO_2e)

Each term is calculated as below.

$PE_{power,y}$ is 86.86t as CO_2/year（$=202{,}000\times86.86\times10^{-3}$）because of yearly electrical consumption, 202,000kWh/y based on manufacture data and CO_2 emission per kwh, 0.43 0.43kg as CO_2/kwh based on 2010 International Energy Agency.

$PE_{ww,treatment,y}$ is 0 t as CO_2/y because of 0 as MCF value on the assumption that aerobic treatment is well managed.

$$PE_{ww,treatment,y} = \sum (Q_{ww,k,y} * COD_{removed,k,y} * MCF_{aerobic,k}) * B_o * UF_{PJ} * GWP_{CH4}$$
$$=1{,}500\times365\times(410\text{-}50)\times10^{-6}\times0\times0.21\times0.94\times1.21=0 \text{ t as } CO_2/y$$

Where:

$Q_{ww,k,y}$	Volume of the wastewater treated by the aerobic system *k* during the year *y* (m^3): 1,500×365(m^3/y)
$COD_{removed,k,y}$	Chemical oxygen demand removed by the aerobic system *k* in year *y* (tonnes/m^3)
$MCF_{aerobic,k}$	Methane correction factor for the aerobic wastewater treatment system *k* (MCF value for well managed aerobic biological systems, or for poorly managed or overloaded systems as per above table): 0 on the assumption that aerobic treatment is well managed.
UF_{PJ}	Model correction factor to account for model uncertainties (1.06)

$PE_{ww,discharge,y}$ is 12.79 t as CO_2/y as below calculation.

$$PE_{ww,discharge,y} = Q_{ww,y} * GWP_{CH4} * B_o * UF_{PJ} * COD_{ww,discharge,y} * MCF_{ww,discharge}$$
$$=1{,}500\times365\times21\times0.21\times1.06\times50\times10^{-6}\times0.1=12.79 \text{ t as } CO_2/y$$

Where:

$Q_{ww,y}$	Volume of wastewater treated in the year *y* (m^3): 1,500×365(m^3/y)
UF_{PJ}	Model correction factor to account for model uncertainties (1.06)
$COD_{ww,discharge,y}$	Chemical oxygen demand of the final treated wastewater discharged into sea, river or lake in the year *y* (tonnes/m^3): 50 mg/L is adopted based on QCVN 24:2009/BTNMT: Nationa Technical Regulation on Industrial wastewater because of no COD regulation in QCVN14-2008/BTNM: Nationa Technical Regulation on Domestic wastewater. Then,

	COD is 50×10^{-6}(tonnes/m^3).	
$MCF_{ww,discharge}$	Methane correction factor based on discharge pathway of the wastewater (MCF value in above table for sea, river and lake discharge):(0.1)	(fraction)

$PE_{ww,discharge,y}$ is 121.8 t as CO_2/y as below calculation.

$$PE_{s,final,y} = S_{final,PJ,y} * DOC_s * MCF_s * UF_{PJ} \quad * DOC_F * F * 16/12 * GWP_{CH4}$$

$$= 32.85 \times 0.5 \times 1.0 \times 1.06 \times 0.5 \times 0.5 \times 16/12 \times 21 = 121.8 \text{ t as } CO_2/\text{年}$$

Where:

$S_{final,PJ,y}$	Amount of dry matter in final sludge generated by the project wastewater treatment systems in year *y* disposed on a landfill (tonnes): yearly sludge volume is 32.85 t/y（=0.12×1,500/2,000×365）at daily average flow because of 0.12 t/day at daily maximum flow
DOC_s	Degradable organic content of the untreated sludge generated in the year y (fraction, dry basis). It shall be estimated using default values of 0.5 for domestic sludge and 0.257 for industrial sludge.
MCF_s	Methane correction factor of the landfill that receives the final sludge, estimated as described in AMS-III.G: (1.0 based on AMS-III.G/Version01)
UF_{PJ}	Model correction factor to account for model uncertainties (1.06)
F	Fraction of CH_4 in biogas (IPCC default of 0.5)

Based on above calculations, the project activity emissions is 221 t as CO_2/year (PE_y＝86.86 + 0 + 12.79 + 0 + 121.8).

Comparing with emissions of baseline (93 t as CO_2/y) and project activity (221 t as CO_2/y), the reduction of greenhouse effect gas is not found by this grant project because project activity emission is bigger than baseline emission.

Also, sequencing batch rector (SBR) process produces 248.11 t as CO_2/year (=577,000×0.43×10^{-3}) of $PE_{power,y}$ based on 577,000 kWh/year (manufacture data) of annual electricity consumption and 0.43 0.43kg as CO_2 emission per kwh (Source: 2010 International Energy Agency) assuming methane gas productions from sludge treatment in SBR and PTF is same. Since pre-treated trickling filtration (PTF) process has 86.86 t as CO_2/year of $PE_{power,y}$, the reduction of greenhouse effect gas by PTF is 161.25 t as CO_2/year (=248.11 – 86.86).

Appendix.6.5

Laws and Standards to be applied to the Facilities of the Project

Appendix 6.5 Laws and Standards to be applied to the Facilities of the Project

QCVN14-2008/BTNMT：Water Quality Standards for Domestic Wastewater Discharge

No.	Item	Unit	A	B
1.	pH		5 – 9	5 – 9
2.	BOD_5 (20 ^oC)	mg/l	30	50
3.	Total suspended solids(TSS)	mg/l	50	100
4.	Total dissolved solids (TS)	mg/l	500	1,000
5.	Sulfide (H_2S)	mg/l	1	4
6.	Ammonia nitrogen (NH_4^+-N)	mg/l	5	10
7.	Nitrate nitrogen (NO_3^--N)	mg/l	30	50
8.	Mineral oil, vegetable oil	mg/l	10	20
9.	Total surface-active substances	mg/l	5	10
10.	Phosphate phosphorus (PO_4^{3-}-P)	mg/l	6	10
11.	Total coliforms	MPN/100ml	3,000	5,000

Note:A:Applies for discharge into a resource which is used by the water treatment plant
B:Apply for discharge into a resource which is not used by the water treatment plant
Source: QCVN 14-2008/BTNM

TCVN722:2002：Treated Water Quality Standards of STP

Item	Preliminary treatment- Level 1	**Secondary treatment- Level 2**	Tertiary treatment- Level 3
(1)	(2)	(3)	(4)
pH	6 to 9	6 to 9	6 to 9
BOD (mg/l)	100 to 200	10 to 30	5 to below 10
SS (mg/l)	100 to 150	10 to 30	5 to below 10
Total Nitrogen (mg/l)	20 to 40	15 to 30	3 to 5
Total Phosphorous (mg/l)	7 to 15	5 to 12	1 to 2
note: Quality level of Tertiary treatment-Level 3 in the column 4 is the result of advance, complex treatment process. Encourage investment and apply this technology.			

Source: TCVN 7222:2002

QCVN07-2010/BXD : Buffer Zone Regulation of STP

No.	項目	Buffer zone (m) based on capacity (×1000m³/day)			
		< 0.2	0.2 － 5	5 － 50	>50
1.	Pumping Station	15	20	25	30
2.	Sewage Treatment Plant				
a.	Physical treatment (with sludge drying bed)	100	200	300	400
b.	Biological treatment (with sludge drying bed)	100	150	300	400
c.	Biological treatment without sludge drying bed (but with sludge drying equipment, or sludge treatment equipment)	10	15	30	40
d.	Underground sewage filter yard	100	150	300	500
e.	Natural plant treatment	50	200	400	1,000
f.	Lagoon	50	200		
g.	Aerated lagoon	50	150		

Source: QCVN-07:2010/BXD

Appendix.6.6

Process Unit Capacity Calculation

Appendix 6.6

Process Unit Capacity Calculation

Item	Calculation
1. Design Parameters	
1-1 Design Flow rate	
(1) Average Daily Flow rate (DA)	1,500 m^3/d = 1.0 m^3/min = 0.017 m^3/sec
(2) Maximum Daily Flow rate (DM)	2,000 m^3/d = 1.4 m^3/min = 0.023 m^3/sec
(3) Maximum Hourly Flow rate (HM)	3,000 m^3/d = 2.1 m^3/min = 0.035 m^3/sec
1-2 Influent Wastewater Quality	
(1) BOD	220 mg/L
(2) SS	110 mg/L
1-3 Removal Efficency (Total System)	
(1) BOD	87.0 %
(2) SS	73.0 %
1-4 Effluent Wastewater Quality	
(1) BOD	30 mg/L
(2) SS	30 mg/L
2. Raw Water Pump	
(1) Pump Volume	
the rate of operation	90%
Maximum Daily Flow rate (DM)	1.4 m^3/min ÷ 90% = Qmax
(2) Pump Distribution Q1	= 1/2Qmax (0.8 m^3/min) x 2 pumps
(3) Pump Head	
a) Specification for Pressure Pipe	
Diameter	ϕ 125 mm
Number	2 pipe
Highest Level (the end of pipe)	+9.900 M
Length	15 m

Item	Calculation
b) Head Loss at Pressure Pipe (PP)	
Pumping Flow rate (Maximum)	Q = 1/2Qmax = 0.8 m^3/min = 0.013 m^3/sec
Cross Section	A = 0.125 m^2 × π × 1/4 = 0.012 m^2
Velocity	V = 0.013 / 0.012 = 1.1 m/sec
i) Friction Loss Normal	hf = 10.666 x (0.013 / 110 $)^{1.85}$ x $0.125^{-4.87}$ x 15 = 0.217 m
ii) Outlet	ho = 1.0 x 1.1 ^2 / 2g = 0.06 m
Total	H = hf + ho = 0.28 m
c) Head Loss around Pump	H = 2.00 m
d) Static Head	H = (Highest Level) - (Pumping Level) = +9.900 M - 0.300 M = 9.600 m
e) Dynamic Head	H = (Static Head) + (Pressure Pipe) + (Around Pump) = 9.600 + 0.28 + 2.00 = 11.877 m → 12 m
(4) Motor Power	
Pumping Flow rate Q	0.8 m^3/min
Shaft Power	$Ps = \frac{0.163 \cdot \gamma \cdot Q \cdot H}{0.65} =$ 2.32 kw
Motor Power	P = Ps x (1 + α) = 2.32 x (1 + 0.15) = 2.67 kw → 3.7 kw
(5) Specification of Pump	
	Type Submersible pump
	Diameter 125 mm
	Flow rate 0.8 m^3/min
	Pump head 12 m
	Motor power 3.7 kw
	Number 3 pumps (including standby)

Item	Calculation
3. Reservoir tank	
Maximum Daily Flowrate	= 2,000 m^3/d = 83.33 m^3/h
Retention Time	= 4 hrs
No. of Tank	= 1 tank
Req. Volume	= 2,000 m^3/d ÷ 24 h × 4 h ÷ 1 tank = 333 m^3/tank
Depth	= 1.5 m
Req. area for reservoir tank	= 222 m^2

Item	Calculation
4. Floating Sponge Filtrating tank (FSF)	
4-1 Floating Sponge Filtrating tank	
Overflow rate	= 300 $m^3/m^2/d$
Required Area for settling	= 2,000 m^3/d ÷ 300 $m^3/m^2/d$ = 6.7 m^2
Number of Tank	= 2 Tanks
Req. Area for one settling Tank	= 6.7 m^2 ÷ 2 Tanks = 3.4 m^2
Water Depth	= 3.5 m
Filter Media Height	= 0.6 m
Shape of Tank	Square
Size of Tank	
Process	FSF
Width	= 2 m
Length	= 2 m
Number of Tank	= 2 Tanks
Area for one settling Tank	= 4.0 m^2/tank > 3.4 OK
Volume	= 4.0 m^2/tank × 3.5 m = 14.0 m^3/tank
Retention Time	= 14.0 m^3/tank × 2 Tanks ÷ 2,000 m^3/d × 24 = 0.34 hrs

Item	Calculation
4-2 Air Compressor and Air Tank	
(1) Air Compressor	
Req. Air Volume	= 4.0 m^2/tank × 1.0 m/min × 4 s ÷ 60 × 10^3 × 2 tanks = 533 L
Backwash Interval	= 5.0 h = 300 min
Discharge Rate	= 533 L ÷ 300 min = 1.8 L/min → 20 L/min
Sepicifaciton	Type Oil-free Bebicon Air Compressor Discharge Rate 20 L/min Max Pressure 0.85 MPa Motor power 0.2 kw Number 2 units (including standby)
(2) Air Tank	
Req. Volume of Air Tank	$= 533\ \text{L} \times \frac{1}{(0.85\text{MPa} - 0.5\text{MPa}) \times 10} \times (1+\alpha)$ = 152.38 × (1+0.2) = 183 L = 0.2 m^3/tank
Shape of Tank	Circle
Height	= 1.0 m
Diameter	= 0.5 m
Specification	Type Steel plate Cylindrical Tank Volume 0.2 m^3 Pressure 0.98 MPa Number 1 tank

Item	Calculation
5. High-rate Trickling Filter (HTF)	
Design Parameters	
Maximum Daily Flowrate	＝ 2,000 m^3/d
Overflow rate	＝ 30 $m^3/m^2/d$
Required Area for settling	＝ 2,000 m^3/d ÷ 30 $m^3/m^2/d$ ＝ 67 m^2
Number of Tank	＝ 2 Tanks
Req. Area for one settling Tank	＝ 67 m^2 ÷ 2 Tanks ＝ 34 m^2
Water Depth	＝ 4.15 m
Diameter	＝ 7 m
Filter Media Height	= 1.8 m
Shape of Tank	Circle
Size of Tank	
Process	HTF
Diameter	＝ 7.0 m
Area	＝ π／4 × 7.0 × 7.0 ＝ 38.5 m2
Number of Tank	＝ 2 Tanks
Area for one settling Tank	＝ 38.5 m^2/tank > 34 OK

Item	Calculation
6. Final solids-liquid separation tank (SLS)	
Design Parameters	
Maximum Daily Flowrate	＝ 2,000 m^3/d
6-1 SLS (Sedimentation Part)	
Overflow rate	＝ 30 $m^3/m^2/d$
Required Area for settling	＝ 2,000 m^3/d ÷ 30 $m^3/m^2/d$ ＝ 66.7 m^2
No. of basin	＝ 2 basins
Req. Area for one settling basin	＝ 66.7 m^2 ÷ 2 basins ＝ 33.3 m^2
Depth of basin	＝ 3.0 m
Width	＝ 4.25 m
Length	＝ 33.3 m^2 ÷ 4.25 m ＝ 7.8 m
Shape of basin	Square
Size of Tank	
Process	SLS
Width	＝ 4.25 m
Length	＝ 8.0 m
Area	＝ 4.25 × 8.0 ＝ 34.0 m2
Volume	＝ 34.0 m^2/basin > 33.3 OK
Number of basin	＝ 2 basins
Overflow rate	＝ 2,000 m^3/d ÷ (34.0 m^2/basin × 2 basins) ＝ 29.4 $m^3/m^2/d$
Retention Time	＝ (3.0 m × 34.0 m^2/basin × 2 basin × 24) ÷ 2,000 m^3/d ＝ 2.4 hrs

Item	Calculation
6-2 SLS (Filter Part)	
Overflow rate	＝ 120 $m^3/m^2/d$
Required Area for settling	＝ 2,000 m^3/d ÷ 120 $m^3/m^2/d$ ＝ 17 m^2
No. of basin	＝ 2 basins
Req. Area for one settling basin	＝ 17 m^2 ÷ 2 basins ＝ 8.5 m^2/basin
Depth of basin	＝ 3.0 m
Width	＝ 4.5 m
Length	＝ 8.5 m^2 ÷ 4.5 m ＝ 1.9 m
Filter Media Height	＝ 0.7 m
Shape of basin	Square
Size of Tank	
Process	SLS
Width	＝ 4.5 m
Length	＝ 2.0 m
Area	＝ 4.5 × 2.0 ＝ 9.0 m2
Number of basin	＝ 2 basins
Volume	＝ 9.0 m^2/basin > 8.5
Overflow rate	＝ 2,000 m^3/d ÷ (9.0 m^2/basin × 2 basins） ＝ 111.1 $m^3/m^2/d$ ＜ 120 $m^3/m^2/d$

Item	Calculation
7. Blower for HTF and SLS air-wash	
High-rate Trickling Filter (HTF)	
Air volume	= 0.6 $Nm^3/(min.m^2)$ × 38.5 m^2/basin ÷ 4 part/basin
	= 5.77 Nm^3/min/basin
Final solids-liquid separation tank (SLS)	
Air volume	= 0.38 $Nm^3/(min.m^2)$ × 9.0 m^2/basin
	= 3.42 Nm^3/min/basin
	There for Air Volume of Blower 3.4 Nm^3/min × 3 units
Specification	Type Root Blower
	Air Volume 3.4 Nm^3/min
	Discharge Pressure 30 KPa
	Motor power 2.7 kw
	Discharge Bore 65 A
	Number 3 units

Item	Calculation
8. Sludge Treatment	
8-1 Sludge Recovery	
(1) Sludge Tank	
Maximum Daily Flowrate	＝ 120 m^3/d
assumed value	FSF 0.28% 8 m3 4 times／d
	HTF 0.02% 40 m3 2 times／d
	SLS 0.20% 0.825 m3 8 times／d
	＝ 8 × 4 ＋ 40 × 2 ＋ 0.825 × 8
	＝ 118.6 → 120
Number of Tank	＝ 1 tank
Retention Time	＝ 1 day
Req.Volume	＝ 120 m^3/d × 1 day ＝ 120 m^3/tank
Depth	＝ 1.5 m
Width	＝ 10 m
Length	＝ 10 m
Volume	＝ 1.5 m × 10 m × 10 m
	＝ 150 m^3 > 120 OK
(2) Suldge Transfer Pump	
① SLS Sludge Transfer Pump	
Solid Weight	＝ 0.05 ds-t/d
Solid Concentration	＝ 0.5 %
Sludge Volume	＝ 0.05 ds-t/d ÷ 0.5 % × 10^2 ＝ 10 m^3/d
Pump Volume	＝ 10 m^3/d ÷ 80 min/d ＝ 0.13 m^3/min
Head loss	H ＝ 4 m
Shaft Power	$Ps=\dfrac{0.163 \cdot \gamma \cdot Q \cdot H}{0.65}$ = 0.14 kw
Motor Power	P = Ps x (1 + α)
	= 0.14 x (1 + 0.15)
	= 0.16 kw → 0.4 kw

Item	Calculation
Specification of Pump	Type Submersible pump
	Diameter 50 mm
	Flow rate 0.13 m^3/min
	Pump head 4 m
	Motor power 0 kw
	Number 2 pumps
② Waste Sludge Transfer Pump	
Maximum Daily Flowrate	＝ 120 m^3/d
Pump Volume	＝ 120 m^3/d ÷ 15 hr/d ＝ 0.13 m^3/min
Head loss	H ＝ 7 m
Shaft Power	$Ps=\frac{0.163\cdot\gamma\cdot Q\cdot H}{0.65}=$ 0.23 kw
Motor Power	P = Ps x (1 + α)
	= 0.23 x (1 + 0.15)
	= 0.26 kw → 0.40 kw
Specification of Pump	Type Submersible pump
	Diameter 50 mm
	Flow rate 0.13 m^3/min
	Pump head 7 m
	Motor power 0.4 kw
	Number 2 pumps (including standby)

Item	Calculation
8-2 Sludge Thickening	
(1) sludge Thickener	
Maximum Daily Flowrate	＝ 120 m^3/d
Number of Tank	＝ 1 tank
Retention Time	＝ 0.25 d
Req.Volume	＝ 120 m^3/d × 0.25 d ÷ 1 tank ＝ 30 m^3/tank
Water Depth	＝ 3 m
Diameter	＝ 3.6 m
Area for one thickener	＝ 10.2 m^2/tank
(2) Sludge Thickener Pump	
Solid Concentration	＝ 1.0 %
Sludge Volume (OUT)	＝ 0.12 ds-t/d ÷ 1.0 % × 10^2 ＝ 12 m^3/d
Pump Volume	＝ 12 m^3/d ÷ 360 min/d ＝ 0.033 m^3/min ⇒ 0.04 m^3/min
Head loss	H ＝ 5 m
Shaft Power	$Ps=\dfrac{0.163 \cdot \gamma \cdot Q \cdot H}{0.65}$ = 0.055 kw
Motor Power	P = Ps x (1 + α) = 0.055 x (1 + 0.15) = 0.063 kw → 0.4 kw
Specification of Pump	Type Suction Screw Pump Diameter 40 mm Flow rate 0.04 m^3/min Pump head 5 m Motor power 0.4 kw Number 2 pumps (including standby)

Item	Calculation
8-3 Sludge Dewatering	
(1) Sludge Service Tank	
Daily Flowrate	= 0.04 m^3/min
Retention Time	= 4 hrs
Req.Volume	= 0.04 m^3/d x 60 × 4 hrs = 9.6 m^3
Number of Tank	= 1 tank
Water Depth	= 2.5 m
Diameter	= 2.3 m
Volume	= 2.5 m × π × 2.3 ^2 ÷ 4 m^2 = 10.4 m^3 > 9.6 OK
Sludge Mixer Power	= 3.7 kw
Tank Volume / Sludge Volume	= 10.4 m^3 ÷ 12 m^3/d = 0.9 d
(2) Sludge Feed Pump	
Solid Concentration	= 0.6 ～ 1.0 %
Operation Conditions	= 6 hrs in one day and 5 days in a week
Capacity of Dehydrator	= 30 kg−ds/hrs
Pump Volume	= 30 kg−d ÷ 0.006 ÷ 60 = 0.083 m^3/min ⇒ 0.09 m^3/min
Head loss	H = 2.5 m
Shaft Power	$Ps=\frac{0.163 \cdot \gamma \cdot Q \cdot H}{0.65}=$ 0.06 kw
Motor Power	P = Ps x (1 + α) = 0.06 x (1 + 0.15) = 0.071 kw → 0.40 kw
Specification of Pump	Type Suction Screw Pump Diameter 40 mm Flow rate 0.09 m^3/min Pump head 2.5 m Motor power 0.4 kw Number 2 pumps (including standby)

Item	Calculation
(3) Dehydrator	
Solids (IN)	＝ 0.12 ds-t/d
assumed value	FSF 0.28% 8 m3 4 times／d
	HTF 0.02% 40 m3 2 times／d
	SLS 0.20% 0.825 m3 8 times／d
	＝ 0.28% × 8 × 4 ＋ 0.02% × 40 × 2 ＋
	0.20% × 0.825 × 8
	＝ 0.1188 → 0.12
Operation Conditions	＝ 6 hrs in one day and 5 days in a week
Solids	＝ 0.12 ds-t/d ÷ 6 hrs/d × 10^3 × 7 / 5
	＝ 28 kg-DS/h → 30 kg-DS/h
Dewatering capacity	＝ 30 kg-DS/h
Specification	Type Multi-displate Screw Press
	Cylinder unit 300 ϕ (SUS304)
	Size 0.95mW×3.5mL×1.55mH
	Motor Power 1.0 kw
	Number 1 set
(4) Chemical injection pump (A)	
Dewatering capacity	＝ 30 kg-DS/h
Injection rate	＝ 1.0 %
Solution concentration	＝ 0.2 %
Req.Volume	＝ 30 × 0.01 ÷ 0.002 ÷ 1000 ＝ 2.5 L/min
Flexibility	= 0.5 ～ 1
Pump Volume	= 1.25 ～ 2.5 L/min
(5) Chemical solution Tank (A)	
Daily Flowrate	＝ 2.50 L/min
Retention Time	＝ 2 days = 12 hrs
Req.Volume	＝ 2.50 L/min x 60 × 12 hrs ＝ 1.8 m^3
	⇒ 2.0 m^3
Number of Tank	＝ 1 tank

Item	Calculation
(6) Chemical injection pump (B)	
Dewatering capacity	＝ 30 kg-DS/h
Injection rate	＝ 15.0 ％
Solution density	＝ 1.45
Req.Volume	＝ 30 × 0.15 ÷ 1.45 ÷ 1000 ＝ 3.103 L/h
Flexibility	= 0.5 ～ 1.5
Pump Volume	= 0.026 ～ 0.078 L/min ⇒ 20 ～ 80 ml/min
(7) Chemical solution Tank (A)	
Daily Flowrate	＝ 0.08 L/min
Retention Time	＝ 5 days = 30 hrs
Req.Volume	＝ 0.08 L/min x 60 × 30 hrs ＝ 140 L ⇒ 150 L
Number of Tank	＝ 1 tank
(8) Cake Container	
sludge amount per a day	＝ 0.12 ds-t/d × 7 d ／ 5 d ＝ 0.168 ds-t/d
water content	80%
Maximum Daily Flowrate	＝ 0.168 ／ (1 － 80%) ＝ 0.84 m^3/d
Retention Time	＝ 4 days
No of Container	＝ 1 tank
Req.Volume	＝ 0.84 m^3/d × 4 days ＝ 3.36 m^3/tank ⇒ 4 m^3/tank

Item		Calculation
8.4 Drain pump		
(1) Pump Volume	Q	0.1 m^3/min
(2) Pump Distribution	P	= Q (0.1 m^3/min) x 1 pump
(3) Pump Diameter		V = 2 m/sec D = 146 x (0.1 / 2.0) ^ (1/2) = 32.6 mm Therefore Pump Diameter is as follows; D = 65 mm
(4) Head loss	H	= 15 m
(5) Motor Power		
Pumping Flow rate		0.1 m^3/min
Shaft Power		$Ps=\frac{0.163 \cdot \gamma \cdot Q \cdot H}{0.65}$ = 0.38 kw
Motor Power		P1 = Ps1 x (1 + α) = 0.38 x (1 + 0.15) = 0.44 kw → 2.2 kw
(6) Specification of Pump		Type Submersible pump Diameter 65 mm Flow rate 0.1 m^3/min Pump head 15 m Motor power 2.2 kw Number 1 pump
8.5 Water supply system		
(1) Dehydrator washing		= 10.0 L/15sec = 40 L/min
(2) Chemical solution		= 2000.0 L/20mi = 100 L/min
(3) Pump Volume		= 40 + 100 = 140 L/min

Item	Calculation
9. Deodorization apparatus	
Req. deodorization air flowrate	
Inflow channel	= 2 m^3/min
Reservoir tank	= 3 $m^3/m^2/h$ × 222 m^2/tank ÷ 60 min = 11.1 m^3/min
Floating Sponge Filtrating tank	= 3 $m^3/m^2/h$ × 4 m^2/tank ÷ 60 min ×2 tank = 0.4 m^3/min → 2 m^3/min
High-rate Trickling Filter	= 3 $m^3/m^2/h$ × 38.5 m^2/tank ÷ 60 min ×2 tank = 3.9 m^3/min
Sludge tank	= 3 $m^3/m^2/h$ × 100 m^2/tank ÷ 60 min = 5 m^3/min
Sludge service tank	= 3 $m^3/m^2/h$ × 7.1 m^2/tank ÷ 60 min = 1 m^3/min → 2 m^3/min
Cake conveyer	= 0.5 × 4.6 × 0.5 m^3/conveyer × 7 times/h ÷ 60 min = 0.2 m^3/min → 2 m^3/min
Total air flowrate	= 28.0 m^3/min → 30 m^3/min
Specification of Pump	Type Activated carbon type deodorizing system Air flowrate 30 m^3/min Blower power 3.7 kW Size 2,500mmW×4,200mmL×3,600mmH Number 1 unit

Item	Calculation					
10. Disinfection						
Maximum Daily Flowrate	＝	1,000	m^3/d	x	2	units
Average inactivation rate	≧	99.9	%			
Ultraviolet transmittance	＝	70	%			
Ultraviolet radiation dose	≧	300	J/m^2			
Ultraviolet intensity	＝	131	W/m^2			
Radiation time	＝	2.3	s			

Appendix.6.7

Study of Wastewater Collection System

Appendix 6.7 Study of Wastewater Collection System

6.7.1 Overview of Japanese Bridge Channel

The Japanese Bridge Channel has various functions including discharging storm water, agricultural drainage from the surrounding agricultural land and discharging wastewater and domestic effluent near the channel.
The land of the channel itself is owned by the government and managed by Hoi An City.

Through the site survey along the Japanese Bridge Channel, the flow conditions or characteristics of each section were summarized in **Table 5.1**, **Figure 5.1** and **Figure 5.2**.
General flow conditions are shown as below;

- The slope of target channel is gentle and there are many water stagnations in portions with irregular slope or depressed inverts. The odor problem is caused by not only open channel but also water stagnation. The water stagnation causes the decomposition of waste water in channel.
- Most of wastewater flowing through the existing open channel is generated in hotel areas of AFD project at the moment. The wastewater generated in the new residential estate sinks into underground at the non-concreted channel (Section A) built in the south of ne new residential estate.
- There are extensive agricultural fields close to the upstream channel and these fields are functioning as retention reservoir and eliminating flooding conditions especially at the downstream catchment area of the canal. The capacity of channel is not increase by upgrading in this project. So this function as retention should continue being used in future.

Conditions for construction works are shown as below;

- The width of the Japanese Bridge channel for repair is only between the each outside of wall of existing open channel. Therefore, it is unable to expand the width of the open channel itself or to build a new facility along the open channel.
- Private houses and hotels are located by the Channel, and building foundation is used as the side wall of the open channel in some section.
- As there is no space for vehicles by the Japanese Bridge channel, it is necessary to consider leased land along the channel to secure access route for construction machinery.
- There are many trash around the Japanese Bridge channel and the surrounding area, and the sediment nearby is polluted by wastewater. As preparation for the work, it is necessary to remove trash around the open channel and treat polluted sediment.
- During the rehabilitation of open channel period, temporary submergible pump will be needed to drain the wastewater to downstream at the upstream of the site.

Table 5.1(1) Outline of Japanese Bridge Channel

	Section A（added section）	Section B	Section C	Section D	Section E
Channel condition	Soil ditch (covered with weed) Bottom: soil	Open ditch (masonry on the side) Bottom: soil	Soil ditch Bottom: soil	Open ditch (masonry on the side) Bottom: masonry	Open ditch (masonry on the side) Bottom: masonry
Dimension（mm）	O7000-4000 x 1000	O4000-1000 x 1000	O4500-2000 x 900	O2800 x 800	O3000-2500 x 1000
Length (m)	560	140	510	160	90
Flow condition	Stagnated, penetrated and disappeared	Stagnated	Stagnated	Stagnated	Flowing smoothly
Inflow condition	Wastewater is discharged from the existing drainage facility of housing.	A small amount of wastewater is discharged from houses on both sides. A small amount of agricultural effluent is flowing at downstream.	None. Dumped trash can be seen.	A small amount of agricultural effluent is flowing in at the upstream. A small amount of wastewater is discharged from hotels along the left bank.	A large amount of wastewater is discharged from the hotel town at the upstream of this section. A small amount of wastewater is flowing in from houses along the left bank.
Space for construction	The right side of the open channel is the main street and there is adequate space for construction.	There are many houses and field and no adjacent streets on both sides. Need to lease land for construction work.	Fields on both sides and no adjacent streets. Need to lease land for construction work.	There are hotels on the left side and fields on the right side, and no adjacent streets. Need to lease land for construction work.	There are hotels on the left side and fields on the right side, and no adjacent streets. Construction space is very limited and it is difficult to construct by construction machines.
Cross intersection, etc.	Crossing roads, small bridge attached to a shops on the left side	None	None	Telegraph poles in the open channel.	Electric poles in the channel site

O: Open ditch (Upper side – bottom side x height), K: Covered open ditch (width x height), B: Rectangle culvert (width x height)

Table 5.1(2) Outline of Japanese Bridge Channel

	Section F	Section G	Section H	Section I	Section J
Channel condition	Masonry open ditch (with cover) Bottom: masonry	Concrete open ditch Bottom: concrete	Soil ditch (covered with weed) Bottom: soil	Concrete culvert Bottom: unclear	Open ditch (bank walls are landscape-friendly) Bottom: masonry
Outline sectioning （mm）	K3000 x 1000	K2500 x 1500	O2400-1800 x 800	B1700 x 2200	O6000 x 2400
Section length (m)	90	60	50	110	120
Flow condition	Flowing smoothly	Flowing smoothly	Flowing smoothly	Flowing smoothly (at low tide condition)	Flowing smoothly (at low tide condition)
Inflow condition	Agricultural drainage is flowing at the upstream of this section in irrigational period. A small amount of wastewater is flowing in from houses and shops on the left.	Wastewater from shops, etc. is flowing in via the existing drainage facility at the end of upstream.	None	Wastewater from shops, etc. is flowing in via the existing drainage facility at the south side of a kindergarten.	None
Working space	There are hotels on the left side and private house on the right side. No streets are adjacent. Construction space is very limited and it is difficult to construct by construction machines.	Shops on both sides and no streets are adjacent. Construction space is very limited.	Both sides are the land for sewage treatment plant. Adequate working space.	Shops on both sides and no streets are adjacent. Part of the channel goes through a playground. No working space.	Sideway and Planting are developed at the both banks of channel. There is no construction space.
Cross intersection, etc.	None	Main road. Underground facilities of other utilities.	None	Main road. Underground facilities of other utilities.	Japanese Bridge

O: Open ditch (Upper side – bottom side x height), K: Covered open ditch (width x height), B: Rectangle culvert (width x height)

Figure 5.1(1) Outline of Japanese Bridge Channel

Figure 5.1(2) Outline of Japanese Bridge Channel

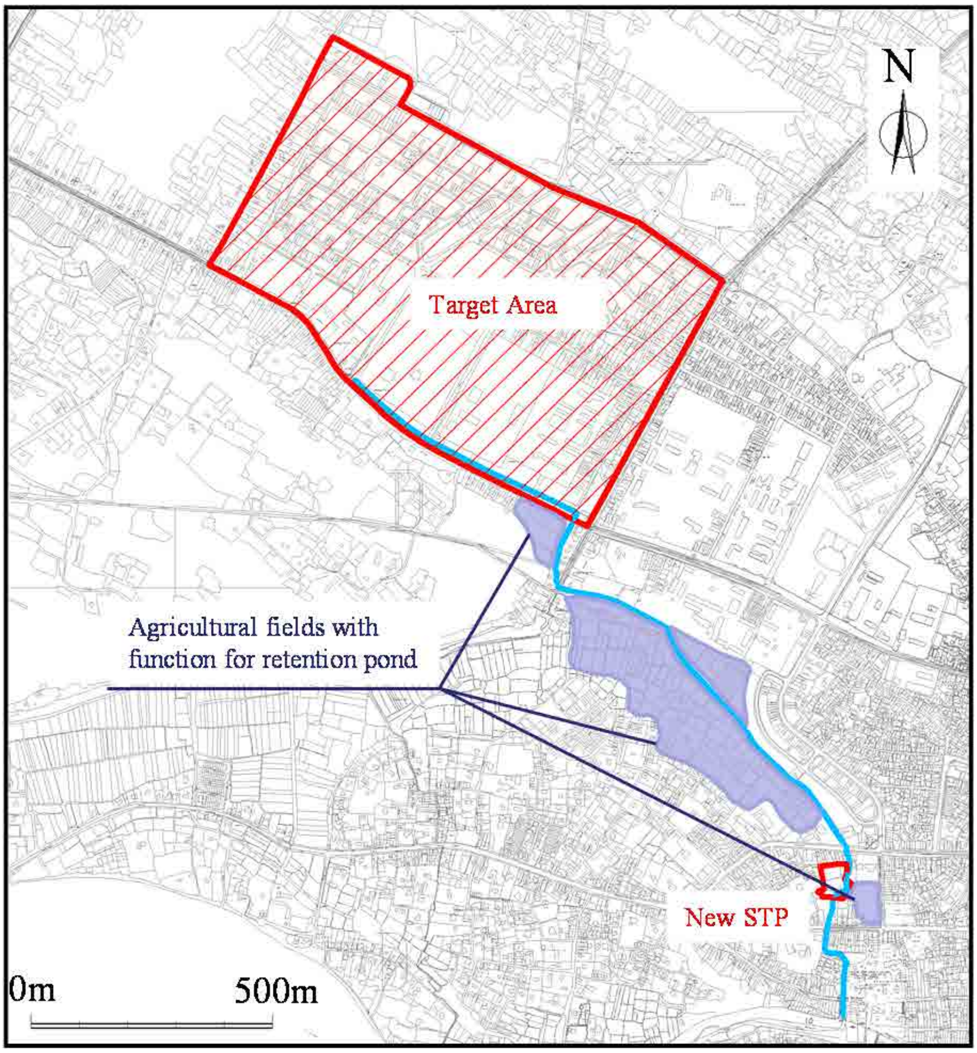
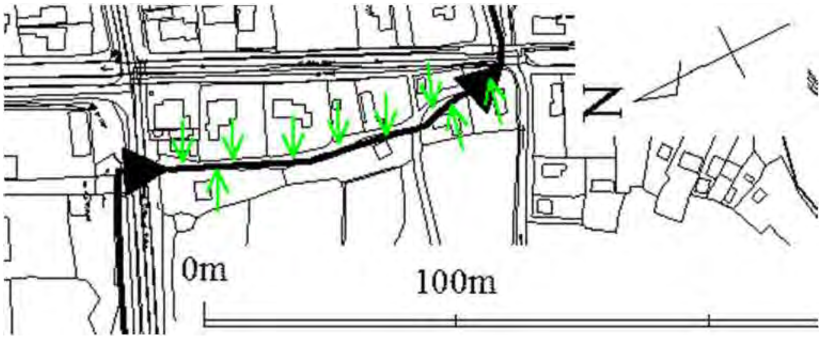
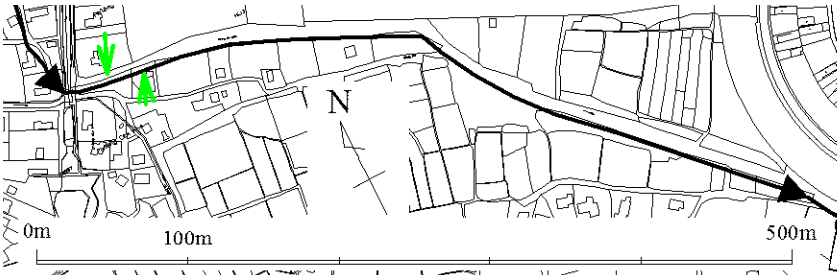


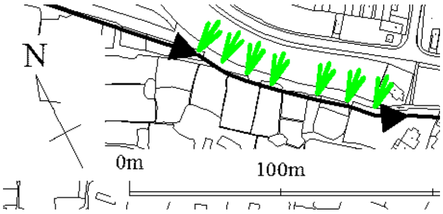
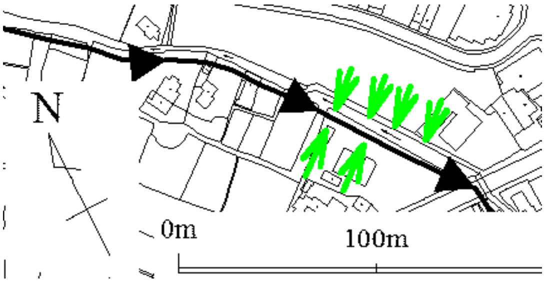
Figure 5.2 Agricultural Fields with Function for Retention Pond

6.7.2 Distribution of Inflow Points

Inflow points and status of wastewater by section are shown below.

Table 5.2 Inflow Status of Wastewater by Section

Section	Inflow condition Legend; ⬅ Relatively large quantity of wastewater ← Wastewater from individual house
A	・Inflow points of wastewater are the 5 points shown in the figure below. ・Water flows in through the existing drainage facility in the housing estate. These existing drainage facilities have almost same function as combined sewer pipeline. ・There are no house discharging their wastewater directly to the open channel. 
B	・Wastewater from houses adjacent to the open channel flow into the open channel individually. 
C	・Wastewater from houses adjacent to the open channel flow into the open channel individually. ・The number of inflow points are very few. 

Section	Inflow condition Legend; ⬅ Relatively large quantity of wastewater ← Wastewater from individual house
D	・Wastewater directly flows in from the back of hotels that are adjacent to the left bank. 
E	・A large volume of wastewater flows in via the existing drainage system from the hotel town (French project area) at the upstream of the this section E in dry weather. The storm water also flow into this section from hotel town as this existing drainage has a function of combined sewer. ・Wastewater directly flows in from the back of hotels that are adjacent to the left bank. 
F	・Wastewater directly flows in from hotels that are adjacent to the left bank and from back door of the houses along the right bank. 

6.7.3 Study of Collection System of Wastewater

(1) Points to consider

Points to consider in the examining the method of wastewater collection are as follows.

1) Collecting wastewater in an efficient manner in order to contribute to the improvement of water quality, which is the objective of this project. Agricultural drainage that flows

into the Japanese Bridge Channel should be separated as much as possible.

2) Maintaining the flood control basin function in heavy rain period, which can be seen in the current status of the Japanese Bridge Channel.
3) Collecting wastewater that currently flows into the Japanese Bridge Channel as much as possible.
4) Construction working plan should be feasible.
5) Because of the width of the existing open channel is limited and there are no land for increasing the capacity of channel, the rehabilitated capacity of the channel is almost same as existing.

(2) Comparison and consideration of wastewater collection method

The following two basic policies can be considered regarding the wastewater collection method.
a) Collecting wastewater by rehabilitating the Japanese Bridge Channel as a trunk sewer.
b) Collecting wastewater by installing new intercepting sewer from the points with large inflow.

Based on the above two considerations, the following four plans are examined.

Plan A:	Rehabilitation of Japanese Open channel to covered channel or box culvert.
Plan A':	Rehabilitation of Japanese Open channel to covered channel or box culvert. Difference from Plan A is to set a vertical weir to separate agricultural drainage in 2 sections. (Figure 5-4 on the following page)
Plan D1:	Wastewater from the target estate area is collected by intercepter sewer installed under the existing road separately from the Japanese Bridge Channel. At the downstream of intercepter sewer, collected wastewater is pumped to new STP by manhole type pumping station. Wastewater generated in the hotel town flow into the aforementioned separated sewer which was installed by French project via existing drainage.
Plan D2:	Wastewater from the target estate area is collected by intercepter sewer installed under the existing road separately from the Japanese Bridge Channel. It is necessary to install one manhole pumping station near the STP same as Plan D1. In this plan D2, Wastewater generated in the hotel town flow into the existing drainage. Before inflow to Japanese Bridge Channel, the wastewater collected at new diversion chamber and flow to the new intercepter sewer.

Table 5.3 shows the characteristic comparison of these three plans.
Plan D1 that utilize the sewer pipelines of French project is not feasible due to the longitudinal relation. The bottom level of the existing drainage that flow into Japanese Bridge Channel is 1.35. However the level of the French sewer pipeline is 1.53.

Plan D2 would be more realistic as a plan to build a new intercepter sewer.

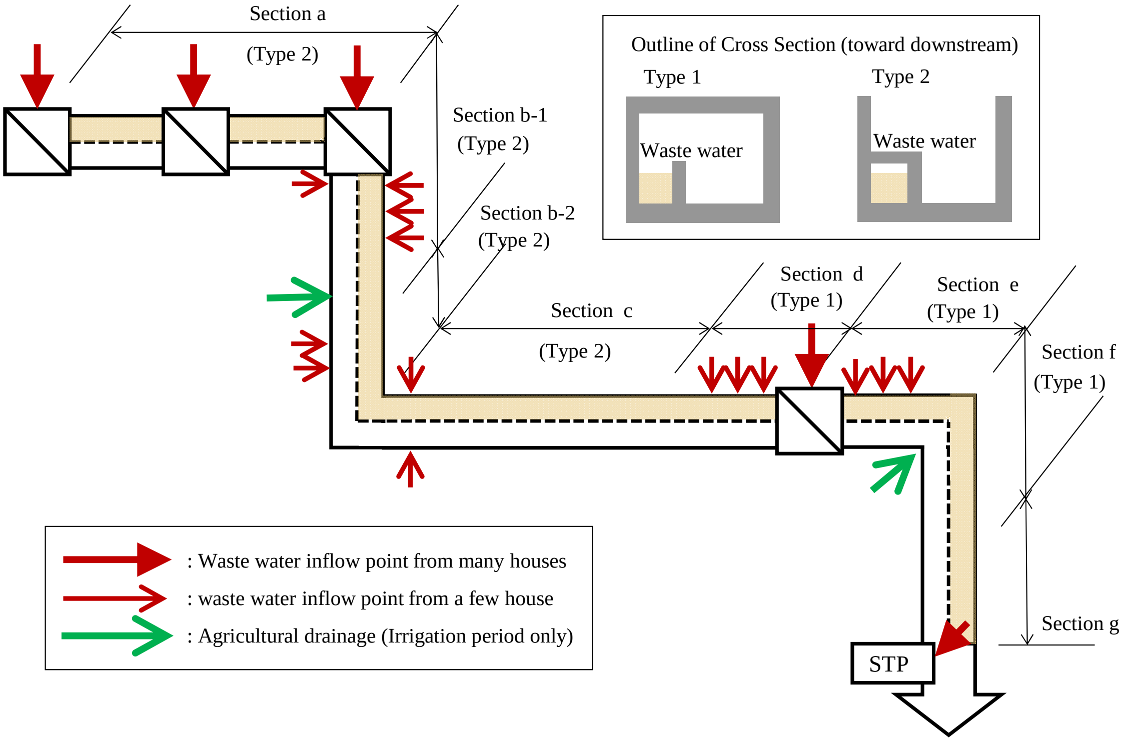


Figure 5.3 Cross-section of each section in Plan A' and inflow point

The targets for more detailed comparison including the cost are plan A' and Plan D2 because of the total cost of Plan A and A' are almost equal and Plan A' has better function than Plan A.

Table 5.4 shows the comparison of facility and costs about Plan A' and D2.

The cost of case D2 includes the casting base concrete of existing Japanese Bridge Channel to solve the stagnation or negative slope for smooth flow.

Table 5.3 Outline comparison of 3 plans

	Case A: Rehabilitation of Japanese Channel (1 section)	Case A': Rehabilitation of Japanese Channel (2 section)	Plan D2: Installation of new intercepter sewer
Outline	✓ Rehabilitation of the existing open channel (covering) ✓ All the section are covered ✓ No heed to install the diversion chamber from existing inlet. ✓ Same as the first request.	✓ Repair the existing open channel (covering) ✓ Odor problem will be mitigated at dry weather and small rainfall ✓ it has a possibility of remaining odor problem after hard rainfall	✓ Installing the intercepter sewer under the road away from the Japanese Bridge Channel. ✓ Installing the diversion chamber at the end of downstream of the housing area ✓ Wastewater needs to be collected separately using other pipeline at Section d where wastewater flows into the Japanese Bridge Channel.
Advantages	✓ Covering the channel or installing the culvert is highly effective for preventing odor.	✓ Covering the channel and installing the culvert is highly effective for preventing odor. ✓ Because of the adapting open channel in some section, the quantity of the facility is lowest than other 2 plan.	✓ Agricultural effluent and wastewater are not mixed during the irrigation period and the effect of water quality improvement is higher than Plan A.
Collection and treatment of wastewater	✓ Agricultural drainage mixes in wastewater on dry weather during the irrigation period ✓ Treatment efficiency is not high as low concentrated wastewater inflowing STP.	✓ Agricultural drainage does not mix in wastewater during the irrigation period ✓ Highly concentrated wastewater can be treated.	✓ Confluent sewage can be collected at inflow points of the channel. The concentration of collected wastewater is the highest and most efficient of the 3 plans.
Maintenance	✓ The channel is maintained by scraping dirt using the hoe (same cleaning method as the existing drainage channel in Hoi An city) ✓ Maintenance is difficult as there is no street adjacent to the channel (unable to park vehicles alongside) ✓ Opening maintenance (removing clogged dirt) for flood control function is necessary.	✓ The channel is maintained by scraping dirt using the hoe ✓ Maintenance is difficult as there is no street adjacent to the channel (unable to park vehicles alongside)	✓ A high-pressure washing vehicle is necessary for cleaning intercepter sewer. ✓ Maintenance of both the Japanese Bridge Channel and pipeline is necessary. ✓ Increasing the frequency of the Japanese Bridge Channel cleaning depending on the state after rainfall event.
Odor	✓ Generally mitigated.	✓ Storm water which is not more than 10 fold dilution flows down the covered channel and the effect of odor improvement is high.	✓ Storm water which is more than 1Q flows down the Japanese Bridge Channel. Therefore, it is very likely that odor is not distinctly improved.
Workability	✓ It is necessary to lease land for construction work along the channel.	✓ It is necessary to lease land for construction work along the channel.	✓ Separated sewer pipelines by French project are already installed both side of the main road around hotel town. Therefore, the intercepting sewer of this project should be installed in the middle of the road.

Table 5.4 Comparison of 2 plans: facility outline and costs

Facility outline and costs

case A' : Rehabilitation of Japanese Channel

1. Grant Aid Project

■Rehabilitation of Japanese Channel

Section	Dimension (mm)	Length (m)	Unit cost (kJYP/m)	Cost (kJYP)	Remark
a	K2000*1500	560	81	45,000	Rehabilitation
b-1	K1500*800	100	57	6,000	Rehabilitation
b-2	K1000*1000	50	51	3,000	Rehabilitation
c	K2300*900	510	72	37,000	Rehabilitation
d	K1900*1100	160	68	11,000	Rehabilitation
e	K2300*1100	90	75	7,000	Rehabilitation
f	K3000*1000	90	45	4,000	Rehabilitation
g	B2300*1700	70	84	6,000	Rehabilitation
h	B2600*1300	50	84	4,000	Rehabilitation
total		1,680		123,000	

123 mil. JYP

・Intercepter sewer
Dia 200mm,L=90m, 4 million yen

case D2 : Installing new intercepter sewer

1. Grant Aid Project

■Interceptor Pipe

Dimension (mm)	Length (m)	Unit cost (kJYP/m)	Cost (kJYP)	Remark
φ200mm (ground)	200	23	5,000	section d
φ200mm (Dp<2.5)	370	46	17,000	section a
φ200mm (Dp>2.5)	240	50	12,000	section a
φ250mm (Dp<4.0)	475	52	25,000	
φ250mm (Dp>4.0)	845	76	64,000	
	2,130		123,000	

・Manhole pump: 1 place
Dia150mm x 1.38m3/min x 9m x 5.5kw x 2 pumps (including 1 stand by pump)
7.5 million yen

・Pressure pipe
Dia 150mm, L=90m, 4 million yen

■Rehabilitation of Japanese Channel

Section	Dimension (mm)	Length (m)	Unit cost (kJYP/m)	Cost (kJYP)	Remark
a	K2000*1500	560	7.7	4,000	Casting base con.
b-1	K1500*800	100	5.8	1,000	Casting base con.
b-2	K1000*1000	50	3.9	200	Casting base con.
c	B2300*900	510	8.9	5,000	Casting base con.
d	B2300*900	160	18.9	3,000	Casting base con.
e	B2500*1000	90	19.6	2,000	Casting base con.
g	K2500*1500	70	84	6,000	Rehabilitation
h	B2500*2000	50	84	4,000	Rehabilitation
total		1,590		25,200	

25 mil. JYP

	case A’ : Rehabilitation of Japanese Channel	case D2 : Installing new intercepter sewer

case A’ : Rehabilitation of Japanese Channel

2. Vietnamese Project

■Wastewater collection at downstream area of the treatment plant

Two kind of facilities are need, one is the collecting pipe to around the pond by gravity pipe. another is manhole type pumping station and its pressure pipe to STP.

- Pipeline facility

Dimension (mm)	Length (m)	Unit cost (kJYP/m)	Cost (kJYP)
φ80mm (Dp<1.5)	250	30	8,000
φ200mm (Dp<2.5)	205	46	9,000
φ200mm (Dp>2.5)	25	50	1,000
	480		18,000

- Manhole type pump: 1 place

Dia 100 mm x 1.38m^3/min x 7m x 3.7kw x 2pumps (including 1 stand by pump)

7.5 million yen

case D2 : Installing new intercepter sewer

2. Vietnamese Project

■Wastewater collection at downstream area of the treatment plant

All wastewater generated from downstream are collected by gravity flow pipe and flow to STP.

- Pipeline facility

Dimension (mm)	Length (m)	Unit cost (kJYP/m)	Cost (kJYP)
φ200mm (Dp<2.5)	110	46	5,000
φ200mm (Dp>2.5)	110	50	6,000
φ200mm (Dp>4.0)	180	70	13,000
	400		24,000

- Manhole pump

None

Summary of total cost

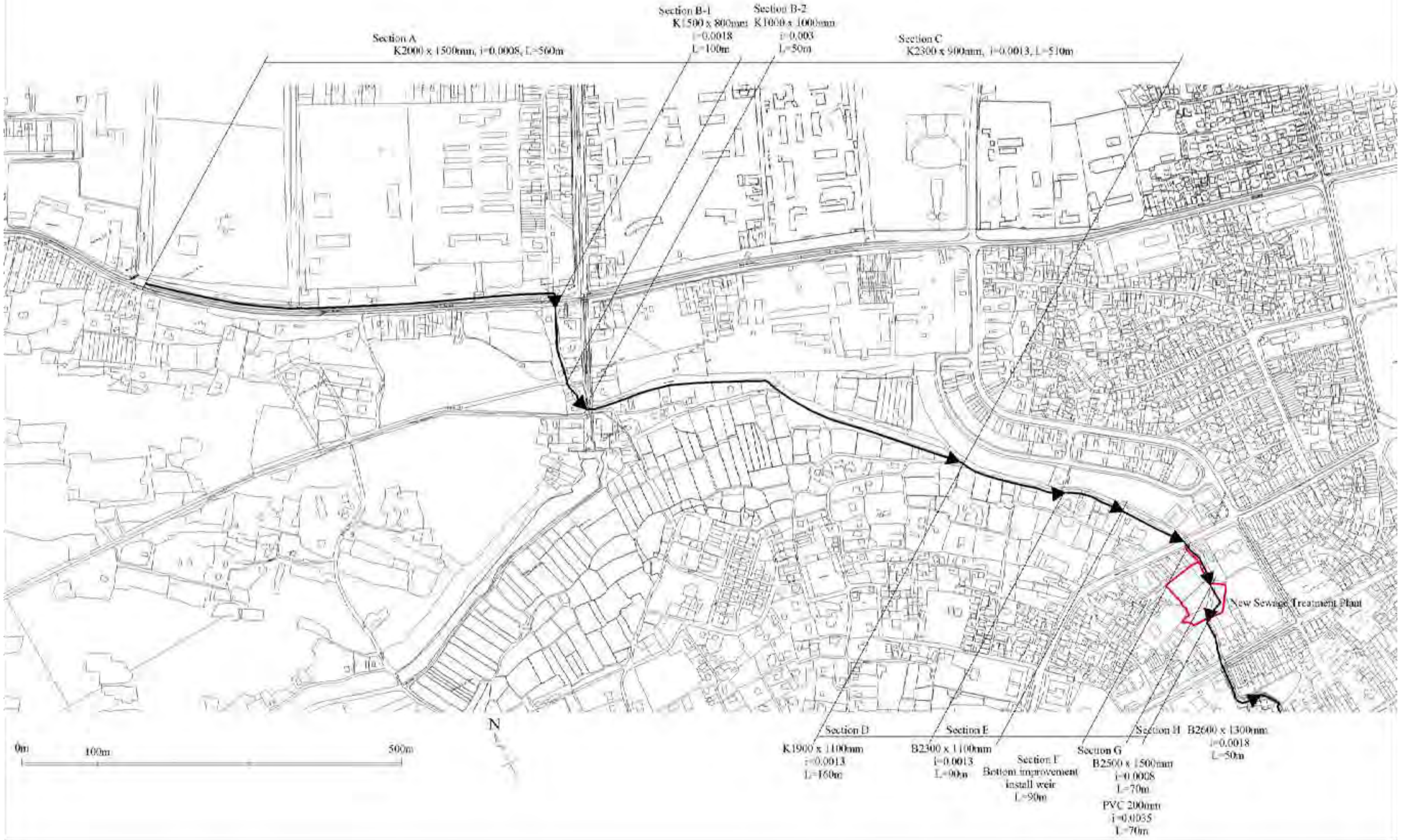
Item			case A'	case D2	Remark
This Grant Aid Project	Construction cost (Mil. JYP)	Rehabilitation of Channel	123	25	
		Intercepter	4	127	
		Manhole Pump	0	7.5	
		total	127	160	
	Maintenance cost (Mil. JYP/year)	Manhole Pump	0	0.5	Electricity fee only
		total	0	0.5	
Vietnamees Side	Construction cost (Mil. JYP)	Intercepter	18	24	
		Manhole Pump	7.5	0	
		total	25.5	24	
	Maintenance cost (Mil. JYP/year)	Manhole Pump	0.5	0	Electricity fee only
		total	0.5	0	
Grand total	Construction cost	(Mil. JYP)	153	184	
	Maintenance cost	(Mil. JYP/year)	0.5	0.5	Electricity fee only

Based on the comparison and discussion mentioned above, case A' (repairing the existing open channel) is better as the method of wastewater collection for the following reasons.

- Although case D2 is an essentially good system for water quality improvement as the objective of this project, case A' is also able to offer similar functions at a lower cost.
- In case A', water in wet weather can flow down the sewage even after relatively large-scale rainfalls. Therefore, it is more effective than case D2 in terms of mitigating odor problem form open channel as first requested.

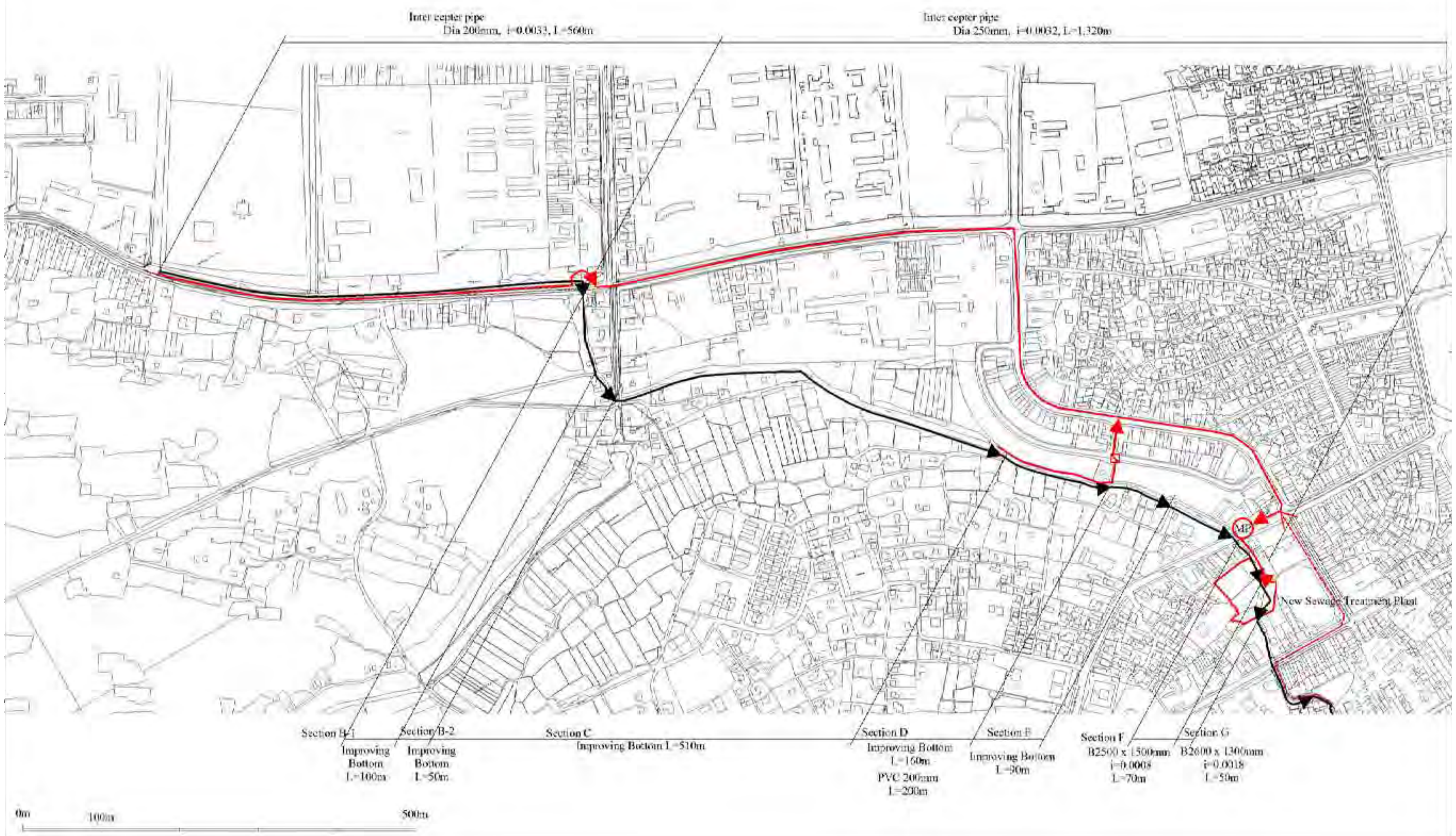
General Map of Upgrading Channel

Case A'



General Map of Upgrading Channel

Case D2



Appendix.6.8

Study on Collection System of astewater from Downstream Area of STP

Appendix 6.8 Study on Collection System of Wastewater from Downstream Area of STP

6.8.1 State of downstream area of the Japanese Bridge Channel

Collection of wastewater around the downstream area of the treatment plant is divided broadly into two areas according to the development status of the AFD project sewer: south of a kindergarten along the Phan Chau Trinh street and the area around the Lai Vien Kieu pond.

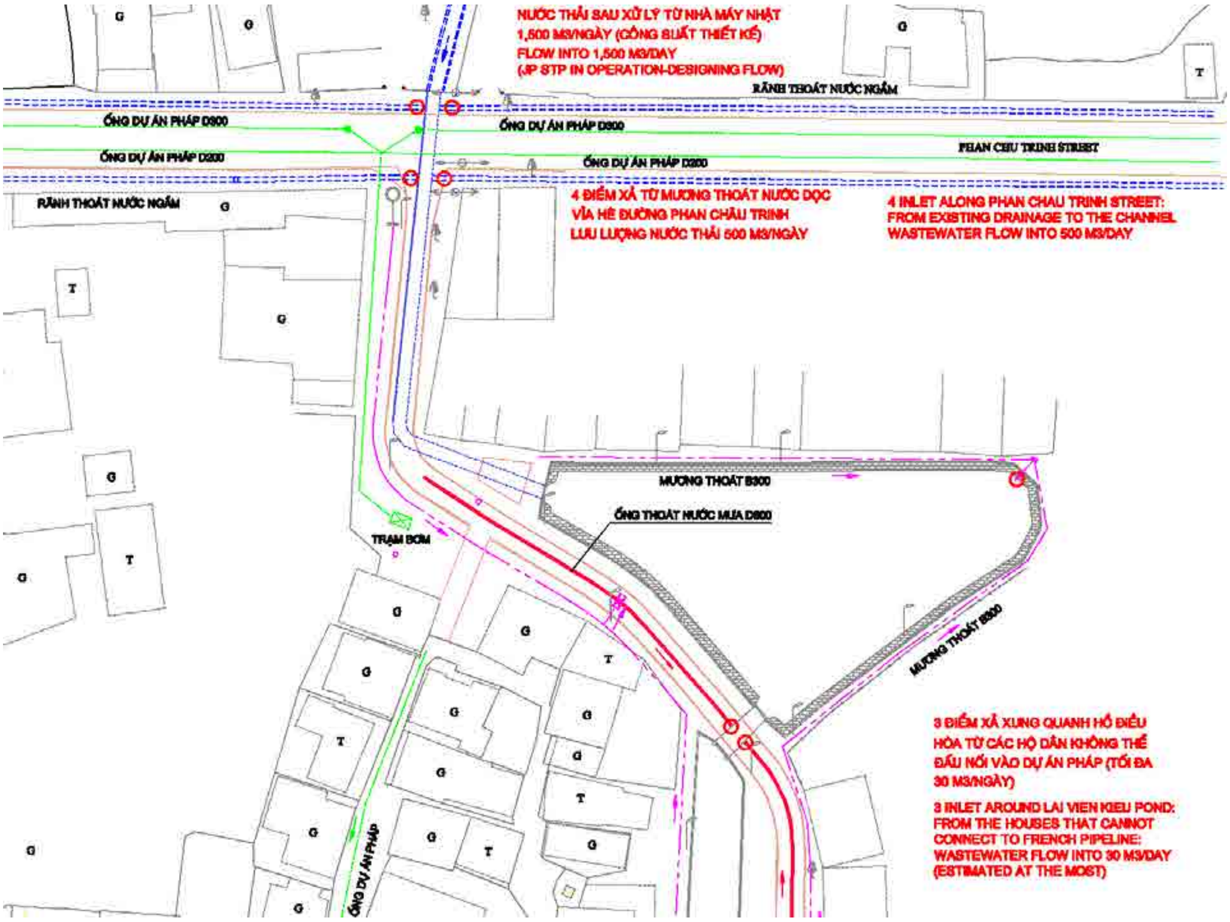


Figure 6.8.1 Discharge Points around Downstream Area of STP of this Project

a. South of a kindergarten (along Phan Chu Trinh street)

On dry weather, wastewater flows into the Japanese Bridge Channel through the four main the existing channels, which is shown with a blue dash line. This wastewater is discharged without treatment. Total volume of wastewater in the four systems is about 550m^3/day. Most of the wastewater that flows in the existing channel is generated from the AFD project area. Separated sewer pipeline of the AFD project is already installed under nearby roads as shown in green solid lines (pump and treatment plant downstream have yet to be completed).

b. Around the Lai Vien Kieu Pond

Houses to which the main pipe is connected in the AFD project are those along the green solid lines. AFD Project Management Unit (PMU) explained that other houses are treated in the same way as those outside the project. This means that areas excluded in the project are scattered within the sewage project area. AFD PMU has not presented a material that shows areas excluded in the project.

The number of houses outside the French project area around the pond is not more than 50. If the number of people per household is 4.4 (person/ household) based on the water supply document, the population that hasn't been connected to the main pipe around the reservoir would be 220. The average volume of wastewater discharged is assumed to be about 30m^3/day (220 people x 0.13m^3/day).

Outline of the existing condition of downstream from Japanese STP is described as below **Figure 6.8.2**.

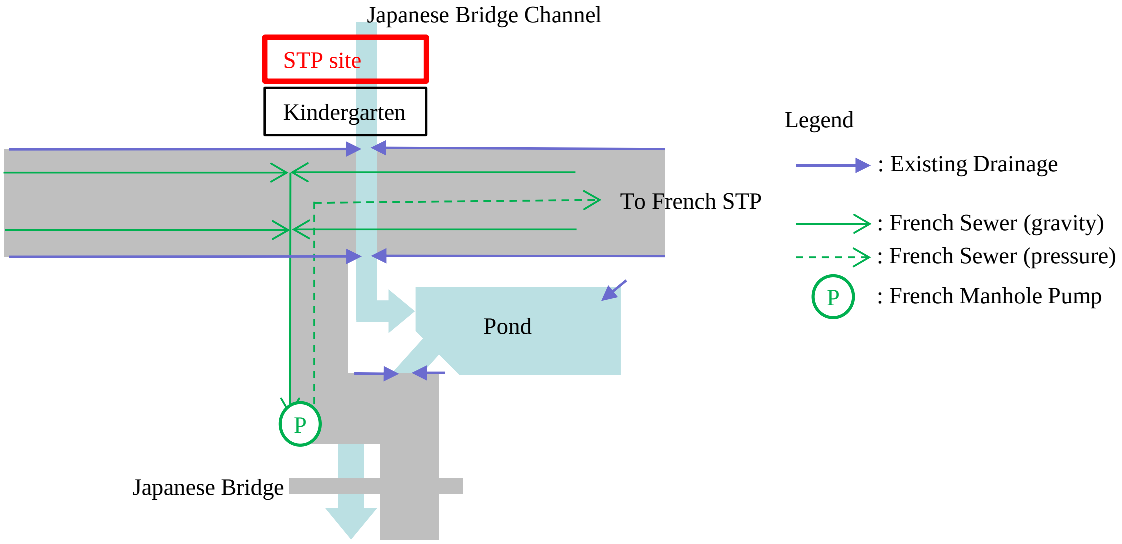


Figure 6.8.2 Outline of existing condition

6.8.2 Suggestion of the wastewater collection from downstream site

As the basic policy for downstream wastewater collection, it is considered reasonable to use the method of pumping wastewater into the treatment facility only on dry weather by establishing a diversion chamber in the existing channel, taking into account that it is unclear when all households will be connected to the separated sewer pipeline by French project.

Three collection plans are created based on the commencing time of service and the progress of connection to the main pipeline in the French project. **Table 6.8.1** shows the outline of facilities required for each plan.

Table 6.8.1 Alternatives for downstream wastewater collection method

	Case 1（Figure 6.8.4）	Case 2（Figure 6.8.5）	Case 3（Figure 6.8.6）
Outline	All wastewater is collected at a diversion chamber and flow into a manhole pumping station near the pond. Collected wastewater is conveyed to sewage treatment plant of this project.	Wastewater along PHAN CHU TRINH street is collected at a diversion facility, flow into the French project sewer and then into the French project treatment plant. Wastewater around LAI VIEN KIEU pond is intercepted at a diversion facility and pumped into the treatment plant of this project through a manhole pump.	Wastewater along PHAN CHU TRINH street is collected at a diversion chamber, flows down the French project sewer and is discharged into the French project manhole pump. Wastewater around LAI VIEN KIEU pond is intercepted at a diversion chamber, and pumped into the sewage treatment plant of this project through a manhole pump. The pressure pipe which has already been installed by the French project is partially used.
Required facilities	No. of diversion chamber: 7 Gravity flow pipe: Dia 200mm, L=230m Manhole pump: 1 place Pressure pipe: Dia 150mm. L= 250m	No. of diversion chamber: 7 Gravity flow pipe: Dia 200mm, L=110m Manhole pump: 1 place Pressure pipe: Dia 80mm, L= 250m	No. of diversion chamber: 7 Gravity flow pipe: Dia 200mm, L=180m Pressure feed pipe: ϕ 80mm, L= 110m (Manhole pump that is purchased for the French project is used)
Merit	Feasibility is not affected by the progress of French project	Less facility to be installed	No need to purchase new pump
Demerit	Much facility to be installed	Feasibility is affected by the progress of French project	Purchase time of Manhole type pump is not clear.
Evaluation			Recommended

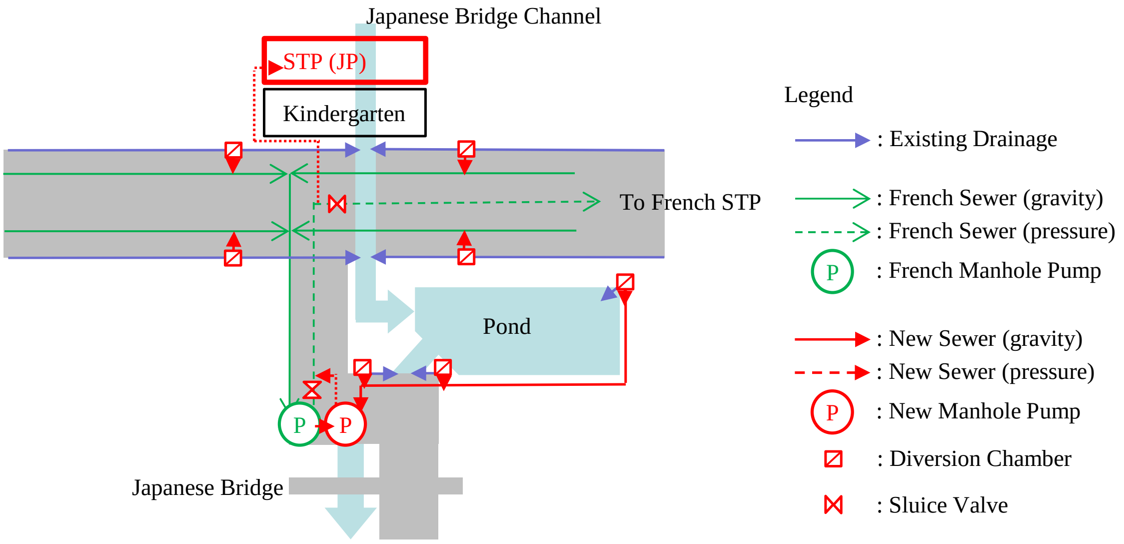


Figure 6.8.3 Outline of plan view at case 3

The pressure pipeline with manhole pump is selected to convey wastewater to the sewage treatment plant of this project, with consideration of the following points.

- Sewer pipeline will be installed underground at a depth of over 3.5 meters around the road west of the kindergarten. If the construction work is carried out using an open cut method, the road is too narrow to operate earth retaining and excavation works. Furthermore, there is not adequate space for shaft installation if the construction work uses a pipe jacking method.
- French sewer pipeline has already been installed under the road, which needs to be removed temporarily.
- There are many other underground utilities along the Phan Chau Trinh Street. The length of the weir in the diversion chamber would be short because of the dimension of the chamber could not be bigger above mentioned situation. The quantity of the actual diverted storm water tends to exceed than the designed quantity, and excessed quantity caused insufficient treatment in sewage treatment plant. In order to avoid the insufficient treatment due to this problem, wastewater is discharged through a manhole pump.

In case of the gravity flow, the sewer depth of earth covering will be about 4.5 meters at the inflow point in sewage treatment plant (the ground level of new sewage treatment facility is 2.9 meters).

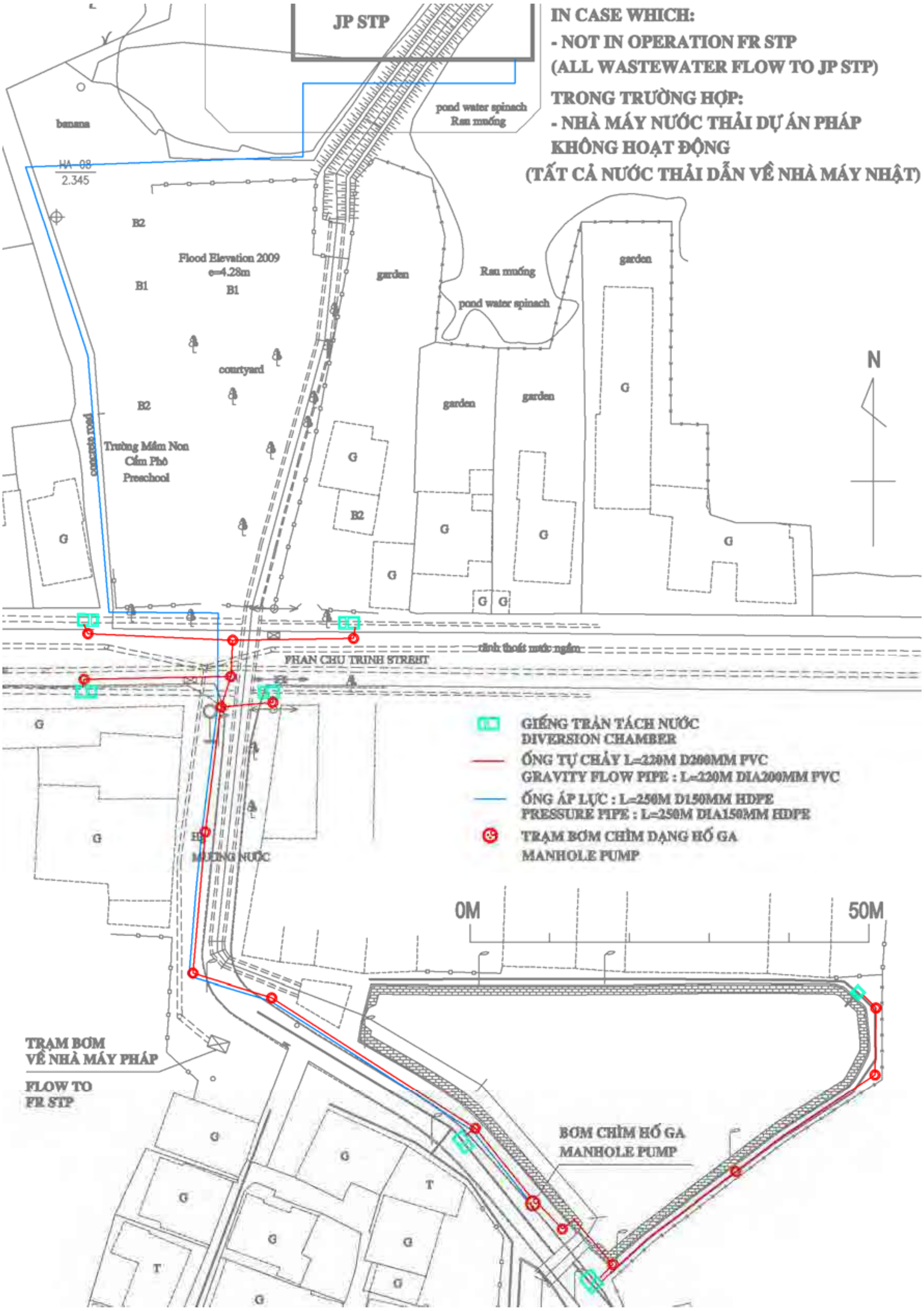


Figure 6.8.4 Plan view at case 1 (wastewater from the AFD project is also pumped into the treatment plant of this project)

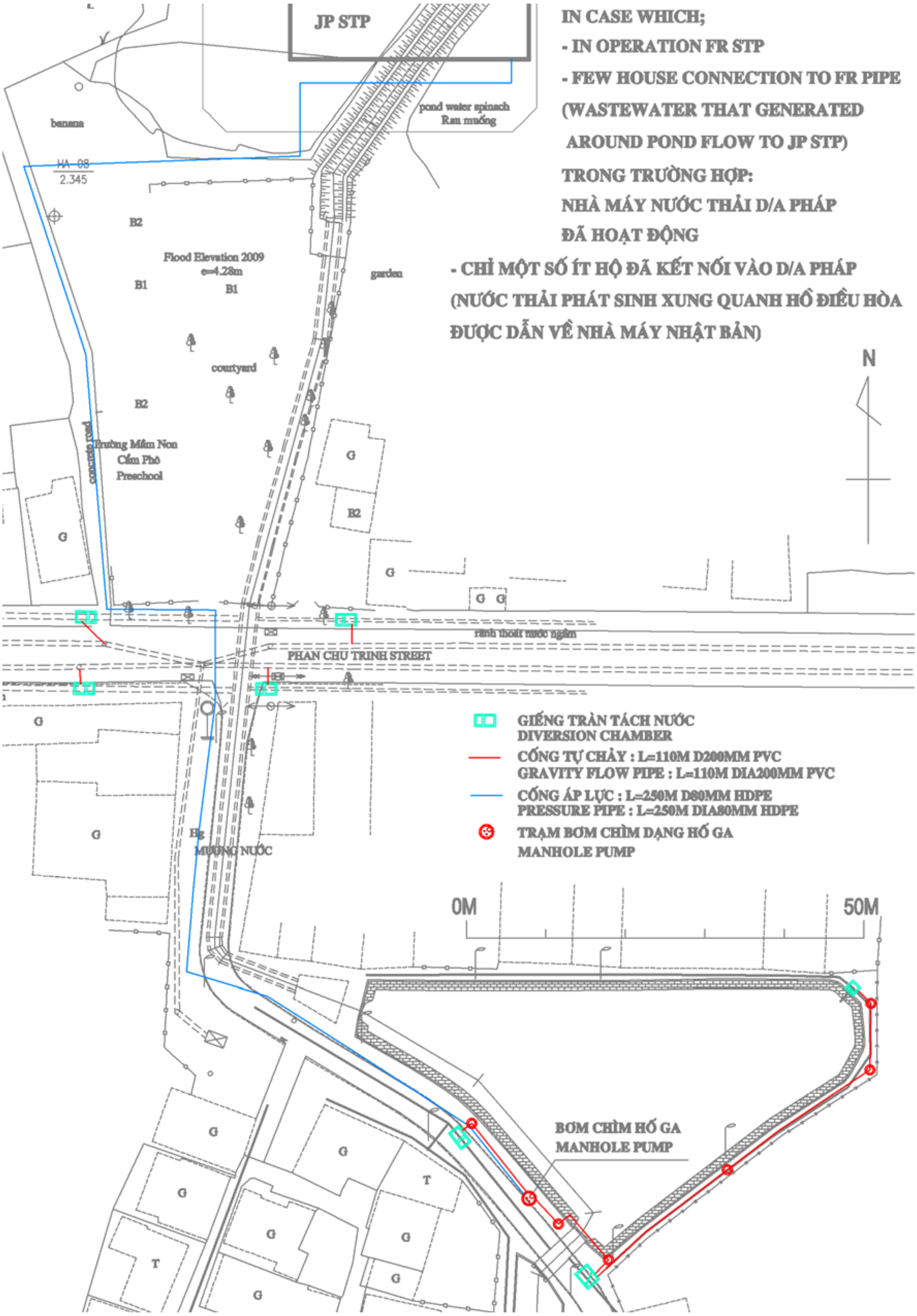


Figure 6.8.5 Plan view at case 2 (wastewater from the AFD project is pumped into the AFD project treatment plant)

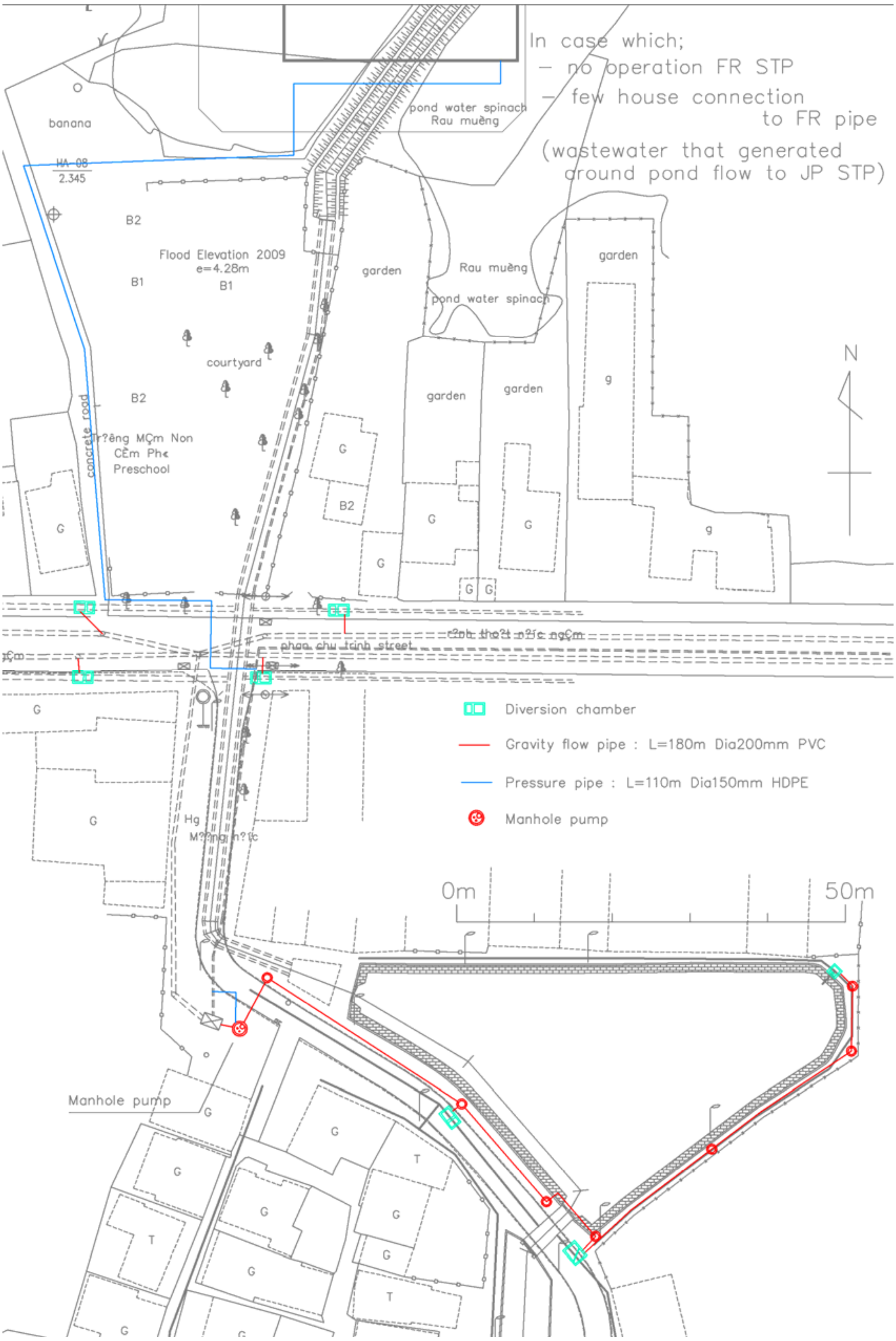


Figure 6.8.6 Plan view at case 3 (The pressure pipe of the AFD project is partially switched to pump into the sewage treatment plant of this project)

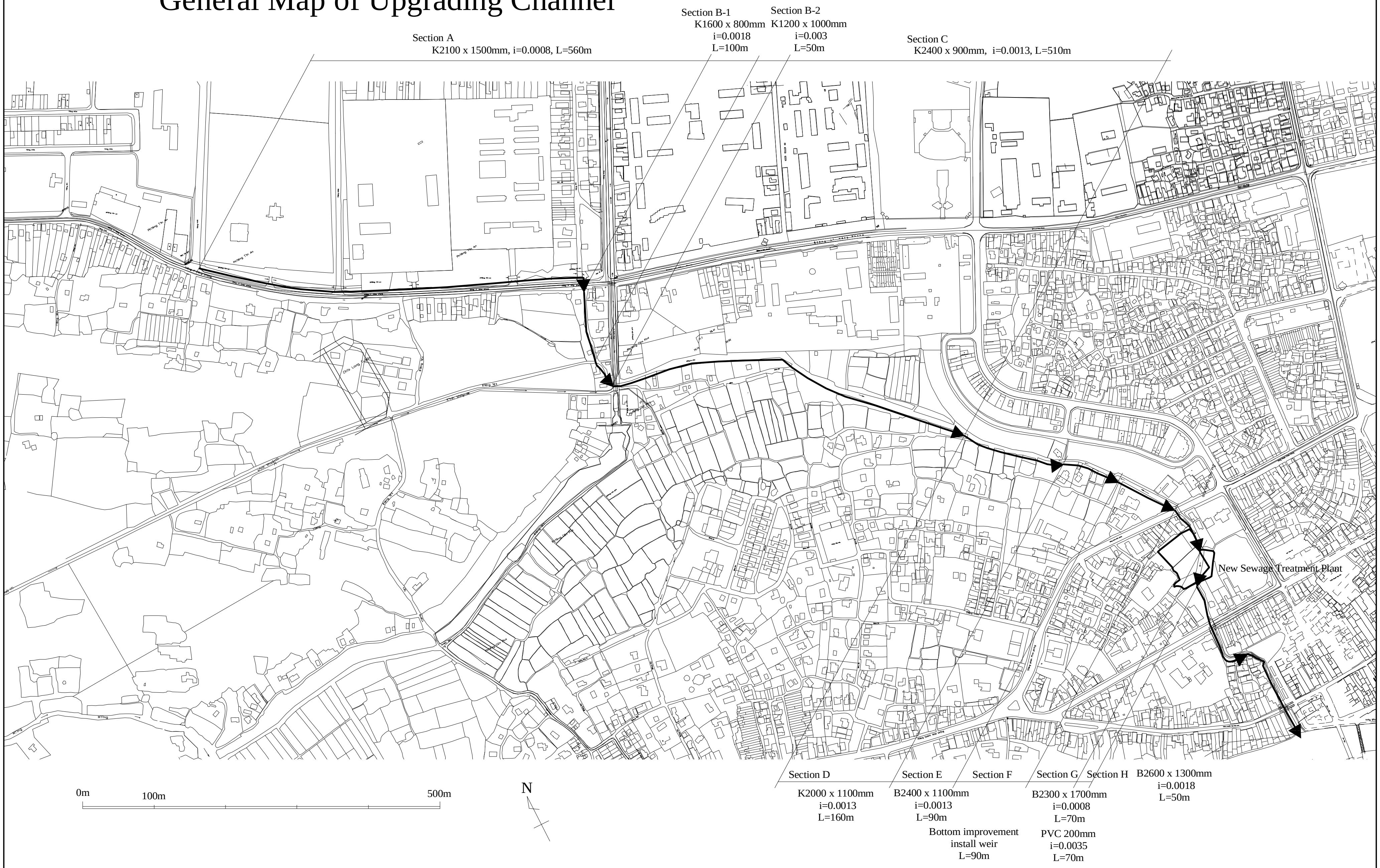
Appendix.6.9

Outline Design Drawings

Appendix 6.9

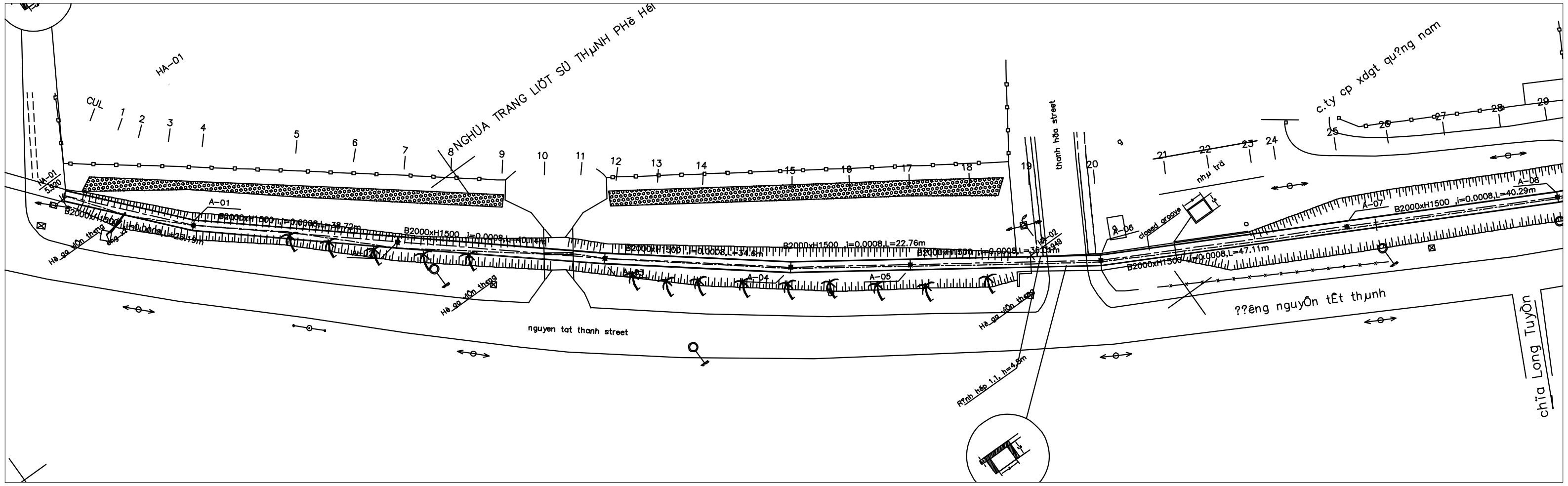
Outline Design Drawings

General Map of Upgrading Channel

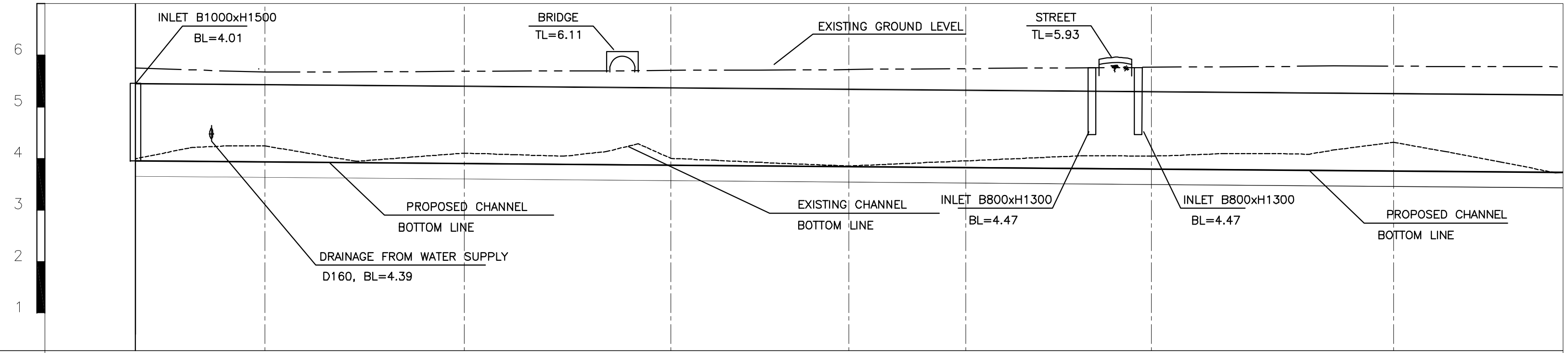


PROJECT	DESCRIPTION		APPROVED BY	DATE	DRAWING No
Preparatory Survey on Water Quality Improvement Project for Japanese Bridge Area, Hoi An in Socialist Republic of Vietnam	General Map of Upgrading Channel				PC-001
		NIHON SUIDO CONSULTANTS CO., LTD.	PREPARED BY	DATE	SCALE 1 : 5000

PLAN

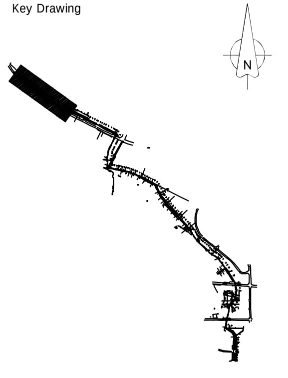


LONGITUDINAL PROFILE



EXISTING SEWER BOTTOM LEVEL	SEWER INVERT LEVEL	INTERNAL DIMENSION / SLOPE (BOX CULVERT)	CUMULATIVE DISTANCE (m)	SINGLE DISTANCE (m)	STATION PLAN ROTATION ANGLE	MANHOLE
4.01	3.96	K2100XH1500 L=25.19m i=0.0008		0.00	CUL	
4.12			5.52	5.52	1	
4.23			5.53	11.05	2	
4.26			7.07	18.12	3	
4.26	3.940	K2100XH1500 L=38.72m i=0.0008	7.07	25.19	C4 172°	A01
3.96			17.70	42.89	5	
4.04			10.51	53.40	6	
4.12	3.909	K2100XH1500 L=40.14m i=0.0008	10.51	63.91	7 180°	A02
4.09			9.68	73.59	8	
4.06			9.67	83.26	9	
4.15			8.29	91.55	10	
4.30			6.14	97.69	11	
4.02	3.877	K2100XH1500 L=34.6m i=0.0008	6.36	104.05	12 178°	A03
3.98			8.56	112.61	13	
3.94			8.57	121.18	C14	
3.87	3.849	K2100XH1500 L=22.76m i=0.0008	17.47	138.65	15 176°	A04
3.92			11.38	150.03	16	
3.97	3.831	K2100XH1500 L=36.01m i=0.0008	11.38	161.41	17 180°	A05
4.02			11.38	172.79	18	
4.07			11.38	184.17	19	
4.06	3.802	K2100XH1500 L=47.11m i=0.0008	13.25	197.42	20 173°	A06
4.11			14.28	211.70	21	
4.11			8.23	219.93	22	
4.10			8.24	228.17	23	
4.18			4.71	232.88	C24	
4.33	3.764	K2100XH1500 L= i=0.0008	11.65	244.53	25 180°	A07
4.15			9.96	254.49	26	
3.95			10.76	265.25	27	
3.74			10.76	276.01	28	

Key Drawing



NOTE

○	Điểm ĐC cấp II	BMs' Traverse grade 2
⊕ A1	Điểm đo vẽ	Urveyed point
↞⊖↠	Cột điện cao thế	High tenion pole
←⊖→	Cột điện	Tenion pole
•—⊙—•	Cột điện thông tinh	Telephone pole
╭	Cột đèn	Lamp-pot
♣	Cây độc lập	Tree
☗	Đình, miếu	Temple
ϟ	Trạm biến thế	Tranformer tation
⧈ ⊠	Cáp quang, hố ga	Power cable, hole
⚲ ↑	Biển báo	Ignboard
☎	Trạm điện thoại	Telephon tation
⊕ + + +	Nghĩa địa, mộ	Cementery, ingle bomb
)(	Cầu, cống	Bridge, culvert
▩	Kè đá	Tone dam
—□—×—	Tường, hàng rào	Wall, Fence
╥╥╥	Bờ mương, sông	River bank, ditch
- - -	Mương , rãnh	Ditch
⊔	Đất màu	Rich oil
G | B1	Nhà gạch, bê tông	Brick, Concrete house
⊕ Bor6	Lỗ khoan	Borehole

PROJECT
Preparatory Survey on
Water Quality Improvement Project for Japanese Bridge Area,
Hoi An in Socialist Republic of Vietnam

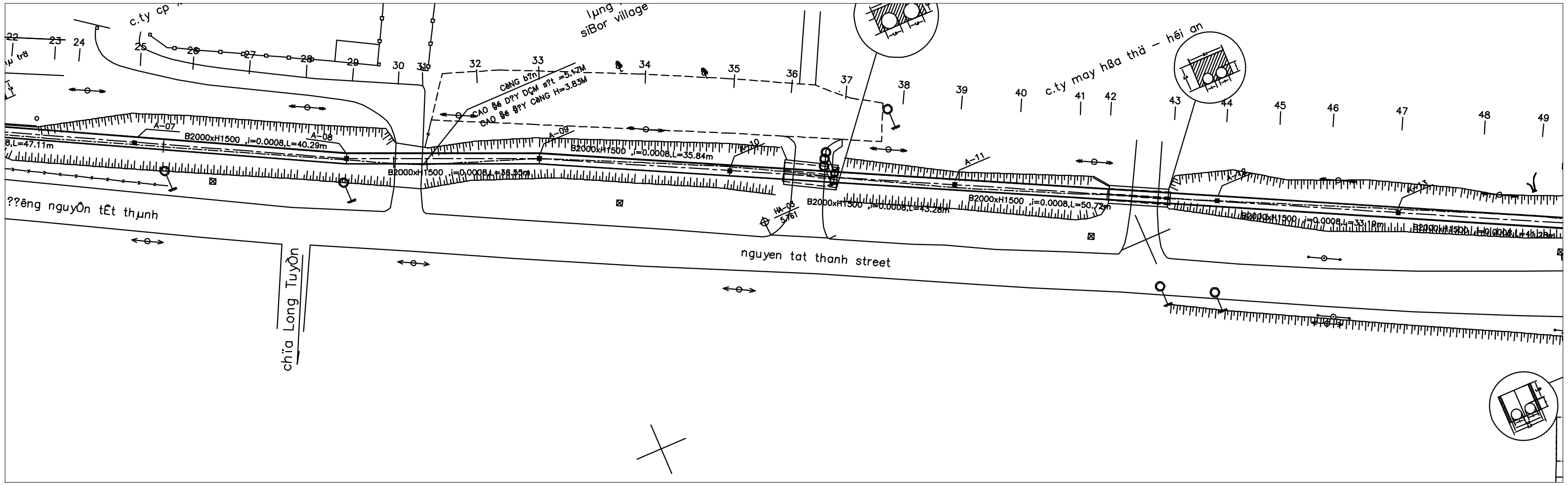
DESCRIPTION
Plan and Profile (section A-1)

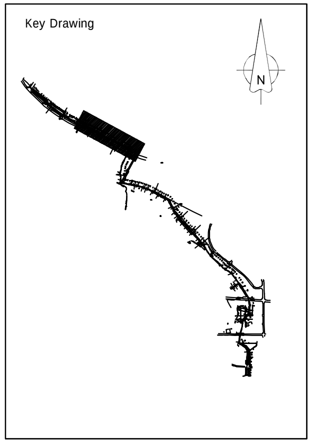
NIHON SUIDO CONSULTANTS CO., LTD.

APPROVED BY
DATE
DRAWING No
PC-002

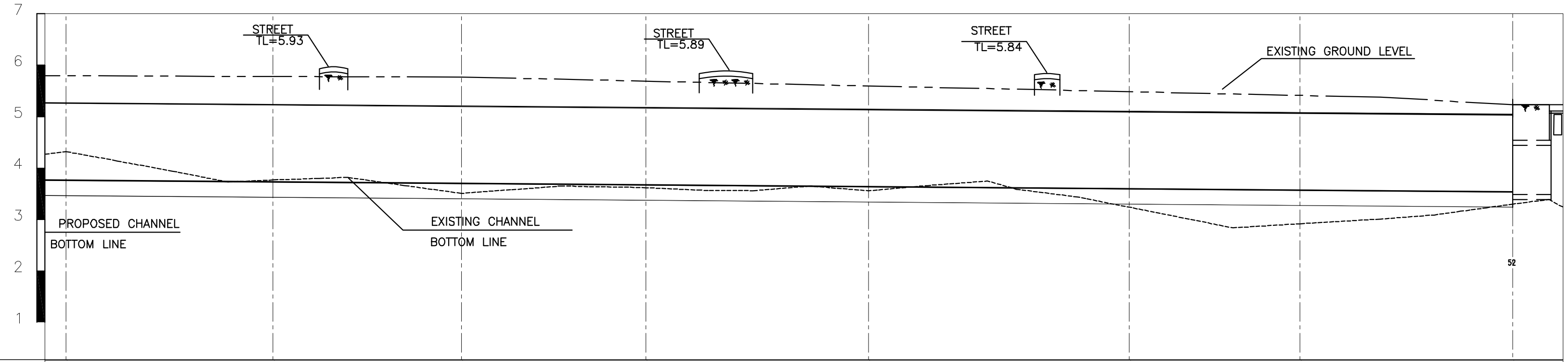
PREPARED BY
DATE
SCALE
H= 1 : 1000
V= 1 : 100

PLAN





LONGITUDINAL PROFILE



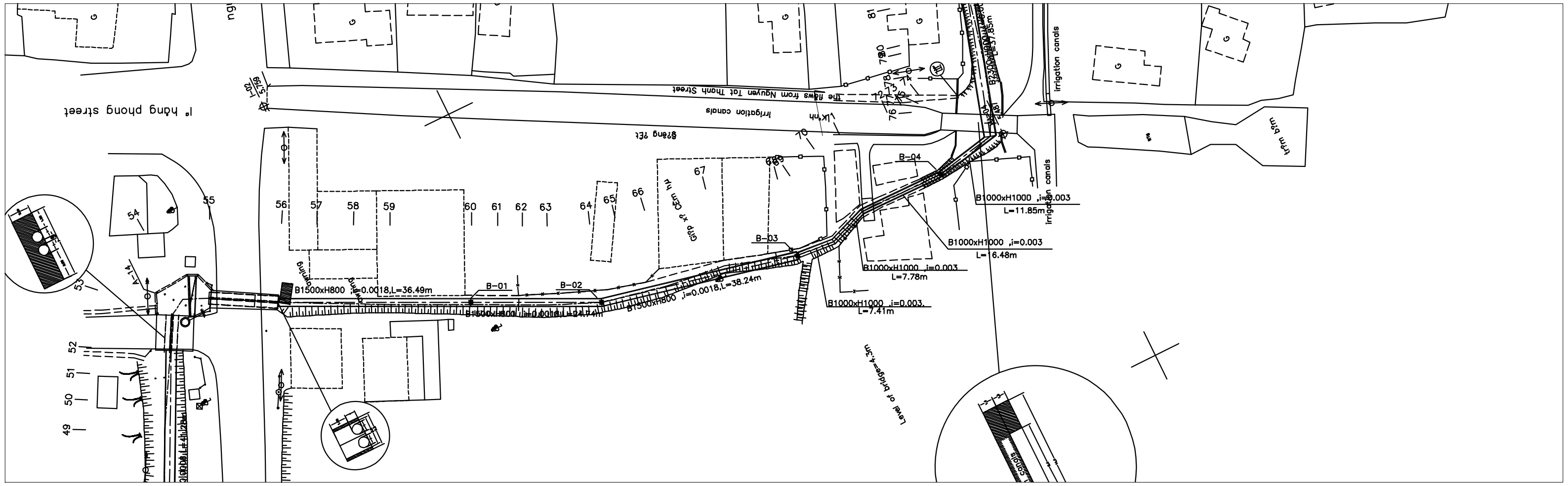
STATION	PLAN ROTATION ANGLE	EXISTING SEWER BOTTOM LEVEL	SEWER INVERT LEVEL	INTERNAL DIMENSION / SLOPE (BOX CULVERT)	CUMULATIVE DISTANCE (m)	SINGLE DISTANCE (m)	MANHOLE
25	180°	4.33	3.764	K2100XH1500 L=40.29m i=0.0008	9.96	244.53	A07
26		4.15			10.76	254.49	
27		3.95			10.76	265.25	
28		3.74			8.81	276.01	
29	176°	3.78	3.732	K2100XH1500 L=36.55m i=0.0008	8.94	284.82	A08
30		3.81			5.57	293.76	
31		3.83			11.02	299.33	
32		3.67			11.02	310.35	
C33	176°	3.52	3.703	K2100XH1500 L=35.84m i=0.0008	19.39	321.37	A09
34		3.66			16.45	340.76	
35	180°	3.63	3.674	K2100XH1500 L=43.28m i=0.0008	10.44	357.21	A10
36		3.58			10.37	367.65	
37		3.57			11.17	378.02	
38		3.66			11.30	389.19	
C39	180°	3.57	3.640	K2100XH1500 L=50.72m i=0.0008	11.57	400.49	A11
40		3.67			11.56	412.06	
41		3.76			5.63	423.62	
42		3.60			11.89	429.25	
43		3.45			10.07	441.14	
44	180°	3.25	3.599	K2100XH1500 L=33.19m i=0.0008	10.08	451.21	A12
45		3.05			10.07	461.29	
46		2.85			13.04	471.36	
47	180°	2.93	3.572	K2100XH1500 L=41.28m i=0.0008	15.60	484.40	A13
C48		3.02			10.49	500.00	
49		3.10			5.06	510.49	
50		3.17			5.07	515.55	
51		3.24			5.06	520.62	
52		3.31	3.539	EXISTING	7.16	525.68	
53		3.40			3.52	532.84	

NOTE

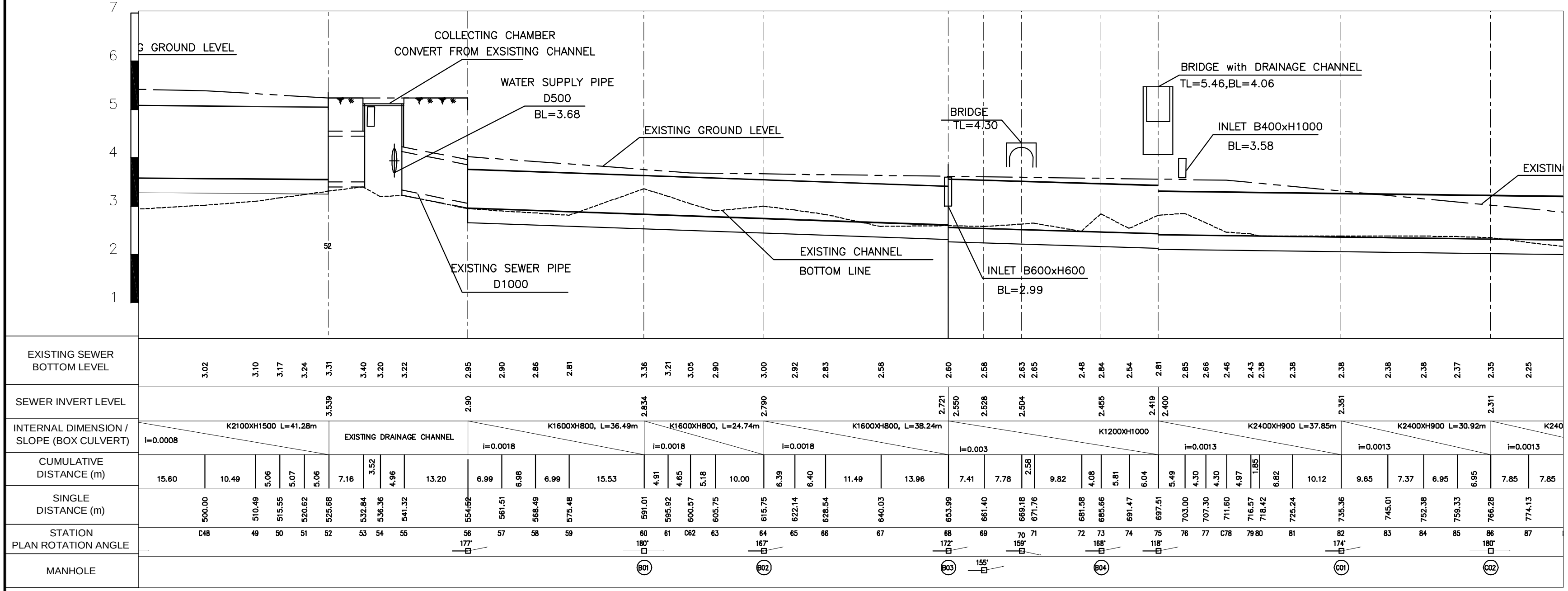
○	Điểm ĐC cấp II	BMs' Traverse grade 2
⌖ A1	Điểm đo vẽ	Urveyed point
↞○↠	Cột điện cao thế	High tenion pole
←○→	Cột điện	Tenion pole
•—⊙—•	Cột điện thông tinh	Telephone pole
⌠	Cột đèn	Lamp-pot
♣	Cây độc lập	Tree
▲	Đình, miếu	Temple
ϟ	Trạm biến thế	Tranformer tation
⧈ ☒	Cáp quang, hố ga	Power cable, hole
⚲ ↑	Biển báo	Ignboard
▲	Trạm điện thoại	Telephon tation
⊕ + + + ◠	Nghĩa địa, mộ	Cementery, ingle bomb
⌣ ⌢	Cầu, cống	Bridge, culvert
▦	Kè đá	Tone dam
—□—×—	Tường, hàng rào	Wall, Fence
╥╥╥	Bờ mương, sông	River bank, ditch
- - -	Mương , rãnh	Ditch
⊔	Đất màu	Rich oil
G B1	Nhà gạch, bê tông	Brick, Concrete house
⊕ Bor6	Lỗ khoan	Borehole

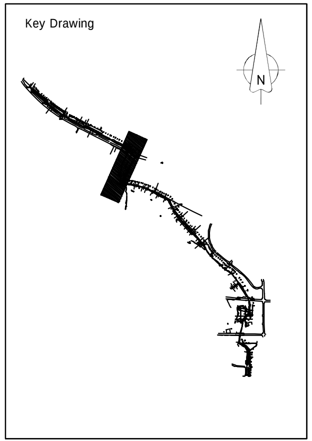
PROJECT	DESCRIPTION		APPROVED BY	DATE	DRAWING No
Preparatory Survey on Water Quality Improvement Project for Japanese Bridge Area, Hoi An in Socialist Republic of Vietnam	Plan and Profile (section A-2)	NIHON SUIDO CONSULTANTS CO., LTD.	PREPARED BY	DATE	PC-003
					SCALE H= 1 : 1000 V= 1 : 100

PLAN



LONGITUDINAL PROFILE





NOTE

○	Điểm ĐC cấp II	BMs' Traverse grade 2
⊕ A1	Điểm đo vẽ	Urveyed point
←○→	Cột điện cao thế	High tenion pole
←○→	Cột điện	Tenion pole
•—⊙—•	Cột điện thông tinh	Telephone pole
	Cột đèn	Lamp-pot
	Cây độc lập	Tree
	Đình, miếu	Temple
	Trạm biến thế	Tranformer tation
◫ ☒	Cáp quang, hố ga	Power cable, hole
	Biển báo	Ignboard
	Trạm điện thoại	Telephon tation
	Nghĩa địa, mộ	Cementery, ingle bomb
	Cầu, cống	Bridge, culvert
	Kè đá	Tone dam
	Tường, hàng rào	Wall, Fence
	Bờ mương, sông	River bank, ditch
	Mương , rãnh	Ditch
⊔	Đất màu	Rich oil
G B1	Nhà gạch, bê tông	Brick, Concrete house
⊕ Bor6	Lỗ khoan	Borehole

PROJECT

Preparatory Survey on
Water Quality Improvement Project for Japanese Bridge Area,
Hoi An in Socialist Republic of Vietnam

DESCRIPTION

Plan and Profile (section B)

NIHON SUIDO CONSULTANTS CO., LTD.

APPROVED BY

DATE

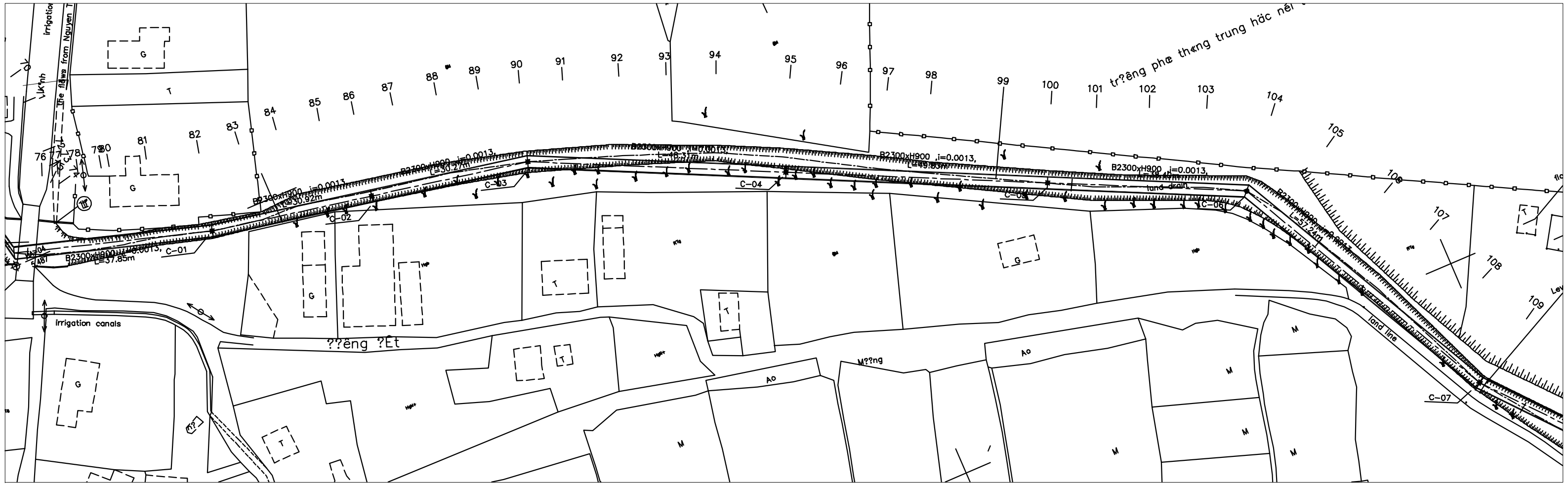
DRAWING No
PC-004

PREPARED BY

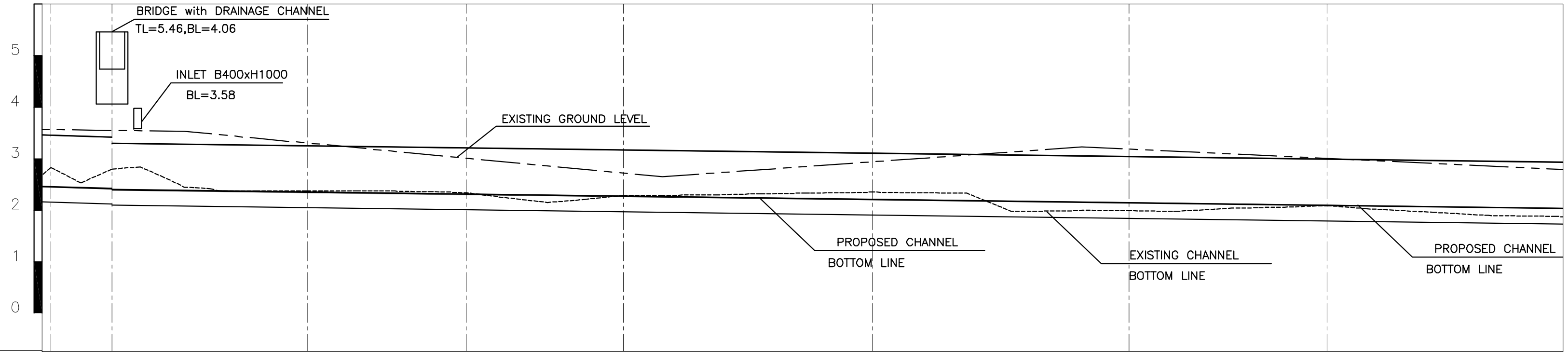
DATE

SCALE
H= 1 : 1000
V= 1 : 100

PLAN

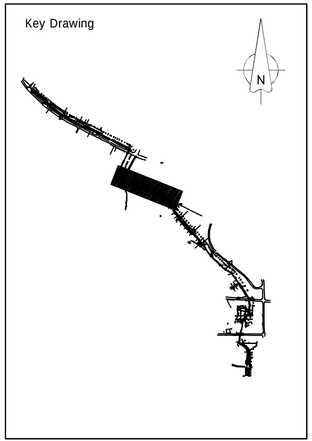


LONGITUDINAL PROFILE



EXISTING SEWER BOTTOM LEVEL	SEWER INVERT LEVEL	INTERNAL DIMENSION / SLOPE (BOX CULVERT)	CUMULATIVE DISTANCE (m)	SINGLE DISTANCE (m)	STATION PLAN ROTATION ANGLE	MANHOLE
2.84	2.455	K1200XH1000	5.81	685.66	73 168°	B04
2.54			6.04	691.47	74	
2.81	2.419 2.400	K2400XH900 L=37.85m i=0.0013	5.49	697.51	75 118°	
2.85			4.30	703.00	76	
2.66			4.30	707.30	77	
2.46			4.97	711.60	C78	
2.43			1.85	716.57	79	
2.38			6.82	718.42	80	
2.38			10.12	725.24	81	
2.38	2.351	K2400XH900 L=30.92m i=0.0013	9.65	735.36	82 174°	C01
2.38			7.37	745.01	83	
2.38			6.95	752.38	84	
2.37			6.95	759.33	85	
2.35	2.311	K2400XH900 L=30.27m i=0.0013	7.85	766.28	86 180°	C02
2.25			7.85	774.13	87	
2.16			7.36	781.98	88	
2.22			7.35	789.34	89	
2.30	2.271	K2400XH900 L=48.31m i=0.0013	7.58	796.69	90 165°	C03
2.30			10.37	804.27	C91	
2.31			8.74	814.64	92	
2.33			8.74	823.38	93	
2.34			12.88	832.12	94	
2.36	2.208	K2400XH900 L=49.83m i=0.0013	9.19	845.00	95 180°	C04
2.35			9.19	854.19	96	
2.34			8.56	863.38	97	
1.99			13.69	871.94	98	
2.00			9.20	885.63	C99	
1.99	2.143	K2400XH900 L=38.40m i=0.0013	9.21	894.83	100 180°	C05
1.98			10.70	904.04	101	
2.04			10.28	914.74	102	
2.06			8.21	925.02	103	
2.09	2.094	K2400XH9 i=0.0013	7.71	933.23	104 143°	C06
2.03			12.97	940.94	105	
1.96			10.56	953.91	106	
1.90			13.00	964.47	107	
1.88				977.47	108	

Key Drawing



NOTE

○	Điểm ĐC cấp II	BMs' Traverse grade 2
⌖ A1	Điểm đo vẽ	Urveyed point
↞○↠	Cột điện cao thế	High tenion pole
←○→	Cột điện	Tenion pole
•⊙•	Cột điện thông tinh	Telephone pole
	Cột đèn	Lamp-pot
	Cây độc lập	Tree
	Đình, miếu	Temple
	Trạm biến thế	Tranformer tation
▣ ⊠	Cáp quang, hố ga	Power cable, hole
	Biển báo	Ignboard
	Trạm điện thoại	Telephon tation
	Nghĩa địa, mộ	Cementery, ingle bomb
	Cầu, cống	Bridge, culvert
▩	Kè đá	Tone dam
	Tường, hàng rào	Wall, Fence
	Bờ mương, sông	River bank, ditch
	Mương , rãnh	Ditch
⊥	Đất màu	Rich oil
G B1	Nhà gạch, bê tông	Brick, Concrete house
⊕ Bor6	Lỗ khoan	Borehole

PROJECT
Preparatory Survey on
Water Quality Improvement Project for Japanese Bridge Area,
Hoi An in Socialist Republic of Vietnam

DESCRIPTION
Plan and Profile (section C-1)

NIHON SUIDO CONSULTANTS CO., LTD.

APPROVED BY

DATE

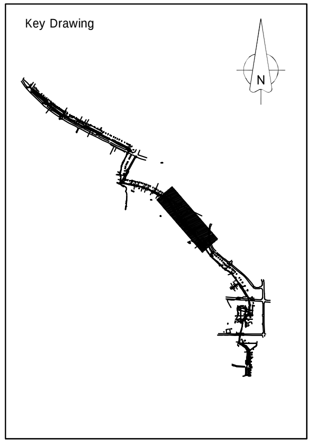
PREPARED BY

DATE

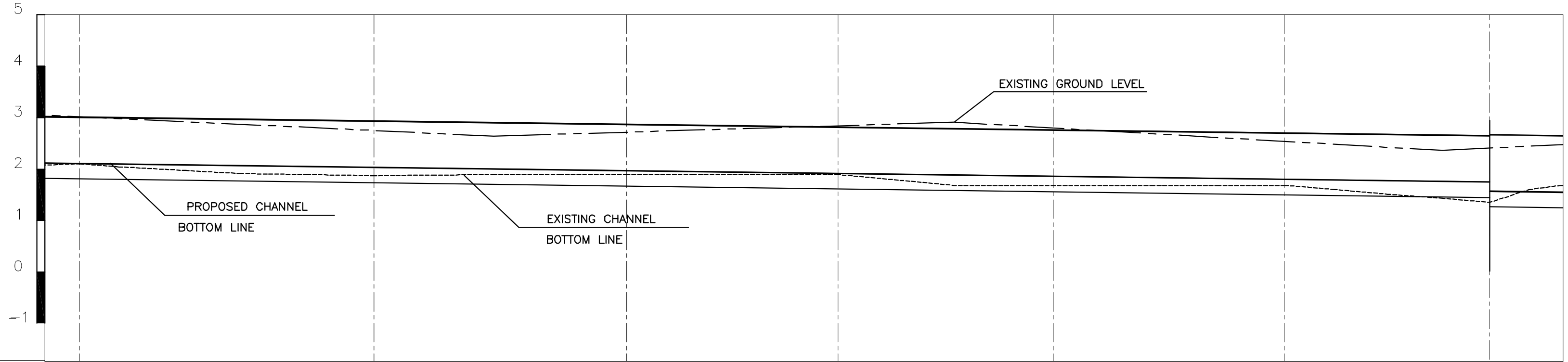
DRAWING No
PC-005

SCALE
H= 1 : 1000
V= 1 : 100

PLAN



LONGITUDINAL PROFILE



		104	105	106	107	108	109	110	C111	112	113	114	115	116	C117	118	119	120	121	122	123	C124	125	126	12
EXISTING SEWER BOTTOM LEVEL		2.09	2.03	1.96	1.90	1.88	1.86	1.87	1.88	1.88	1.88	1.88	1.88	1.88	1.67	1.67	1.67	1.67	1.67	1.59	1.50	1.42	1.34	1.59	1.67
SEWER INVERT LEVEL		2.094					2.019				1.955			1.902		1.848			1.789				1.737 1.550		
INTERNAL DIMENSION / SLOPE (BOX CULVERT)	38.40m	K2400XH900 L=57.24m i=0.0013					K2400XH900 L=49.9m i=0.0013				K2400XH900 L=41.01m i=0.0013			K2400XH900 L=41.82m i=0.0013		K2400XH900 L=44.87m i=0.0013			K2400XH900 L=40.02m i=0.0013				i=0.0013		
CUMULATIVE DISTANCE (m)	8.21	7.71	12.97	10.56	13.00	13.00	11.63	11.63	12.92	12.91	12.92	14.09	14.09	22.60	19.22	19.22	12.82	12.83	9.93	10.13	10.75	9.21	7.63	6.19	
SINGLE DISTANCE (m)		933.23	940.94	953.91	964.47	977.47	990.47	1002.10	1013.73	1026.65	1039.56	1052.48	1066.57	1080.66	1103.26	1122.48	1141.70	1154.52	1167.35	1177.28	1187.41	1198.16	1207.37	1215.00	1221.19
STATION PLAN ROTATION ANGLE		104 143°	105	106	107	108	109 167°	110	C111	112	113 180°	114	115	116 180°	C117	118 180°	119	120	121 180°	122	123	C124	125 171°	126	12
MANHOLE		C06					C07				C08			C09		C10			C11				C12		

NOTE

○	Điểm ĐC cấp II	BMs' Traverse grade 2
⊕ A1	Điểm đo vẽ	Urveyed point
←○→	Cột điện cao thế	High tenion pole
←○→	Cột điện	Tenion pole
•—⊙—•	Cột điện thông tinh	Telephone pole
	Cột đèn	Lamp-pot
	Cây độc lập	Tree
	Đình, miếu	Temple
ϟ	Trạm biến thế	Tranformer tation
◫ ⊠	Cáp quang, hố ga	Power cable, hole
	Biển báo	Ignboard
	Trạm điện thoại	Telephon tation
	Nghĩa địa, mộ	Cementery, ingle bomb
	Cầu, cống	Bridge, culvert
▨	Kè đá	Tone dam
	Tường, hàng rào	Wall, Fence
	Bờ mương, sông	River bank, ditch
	Mương , rãnh	Ditch
	Đất màu	Rich oil
G B1	Nhà gạch, bê tông	Brick, Concrete house
Bor6	Lỗ khoan	Borehole

PROJECT

Preparatory Survey on
Water Quality Improvement Project for Japanese Bridge Area,
Hoi An in Socialist Republic of Vietnam

DESCRIPTION

Plan and Profile (section C-2)

NIHON SUIDO CONSULTANTS CO., LTD.

APPROVED BY

DATE

DRAWING No
PC-006

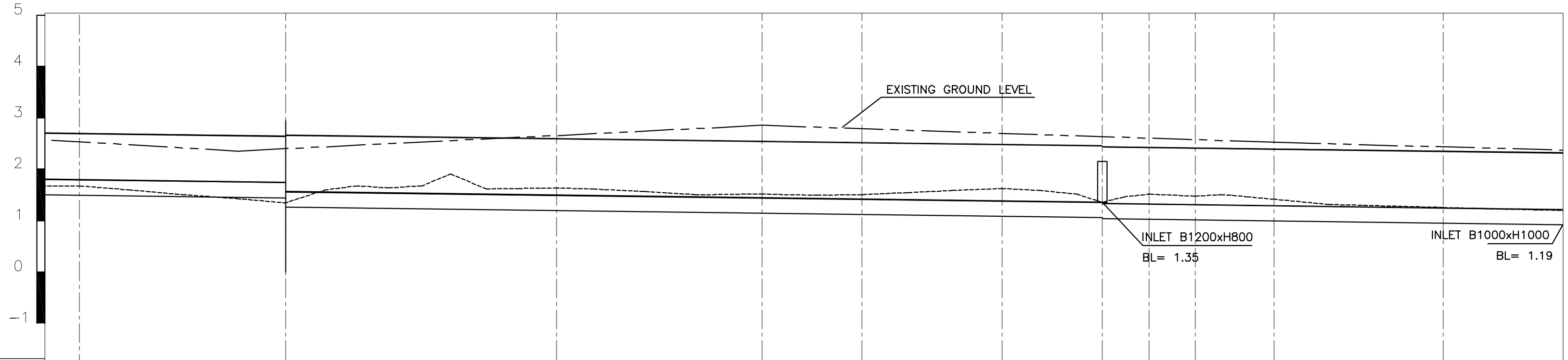
PREPARED BY

DATE

SCALE
H= 1 : 1000
V= 1 : 100

PLAN

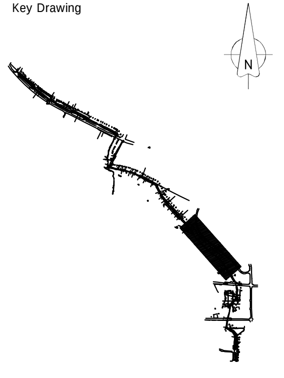
LONGITUDINAL PROFILE



EXISTING SEWER BOTTOM LEVEL		1.67	1.59	1.50	1.42	1.34	1.59	1.67	1.63	1.67	1.90	1.61	1.62	1.63	1.61	1.56
SEWER INVERT LEVEL		1.789				1.737 1.550								1.488		
INTERNAL DIMENSION / SLOPE (BOX CULVERT)	44.87m	K2400XH900 L=40.02m i=0.0013				K2000XH1100 L=52.66m i=0.0013								K2000XH1100 L=39.97m i=0.0013		
CUMULATIVE DISTANCE (m)	.83	9.93	10.13	10.75	9.21	7.63	6.19	6.15	6.53	5.60	6.94	6.33	7.29	7.07	10.03	10.02
SINGLE DISTANCE (m)		1167.35	1177.28	1187.41	1198.16	1207.37	1215.00	1221.19	1227.34	1233.87	1239.47	1246.41	1252.74	1260.03	1267.10	1277.13
STATION PLAN ROTATION ANGLE		121 180°	122	123	C124	125 171°	126	127	128	129	130	131	132	133 168°	134	135
MANHOLE		C11				C12								D01		

EXISTING SEWER BOTTOM LEVEL	1.50	1.51	1.49	1.50	1.54	1.58	1.62	1.58	1.51	1.35	1.46	1.51	1.47	1.50	1.46	1.41	1.31	1.25	1.22
SEWER INVERT LEVEL		1.436		1.410			1.375			1.350 1.330		1.318	1.307			1.287		1.244	
INTERNAL DIMENSION / SLOPE (BOX CULVERT)		K2000XH1100 i=0.0013		K2000XH1100 i=0.0013			K2000XH1100 i=0.0013			K2400 xH1100 i=0.0013		K2400 xH1100 i=0.0013	K2400XH1100 i=0.0013			K2400XH1100 i=0.0013		K2400XH110 i=0.0013	
CUMULATIVE DISTANCE (m)	12.85	10.63	8.77	8.97	8.71	9.55	7.42	7.05	5.03	4.36	4.77	8.93	5.26	4.73	5.32	10.59	22.29	10.99	14.00
SINGLE DISTANCE (m)	1287.15	1300.00	1310.63	1319.40	1328.37	1337.08	1346.63	1354.05	1361.10	1366.13	1370.49	1375.26	1384.19	1389.45	1394.18	1399.50	1410.09	1432.38	1443.37
STATION PLAN ROTATION ANGLE	136	C137 180°	138	139 168°	140	141	142 159°	143	144	145 168°	146	147	148 171°	149	150	C151 169°	152	153 171°	154
MANHOLE		D02		D03			D04						E01					E02	

Key Drawing

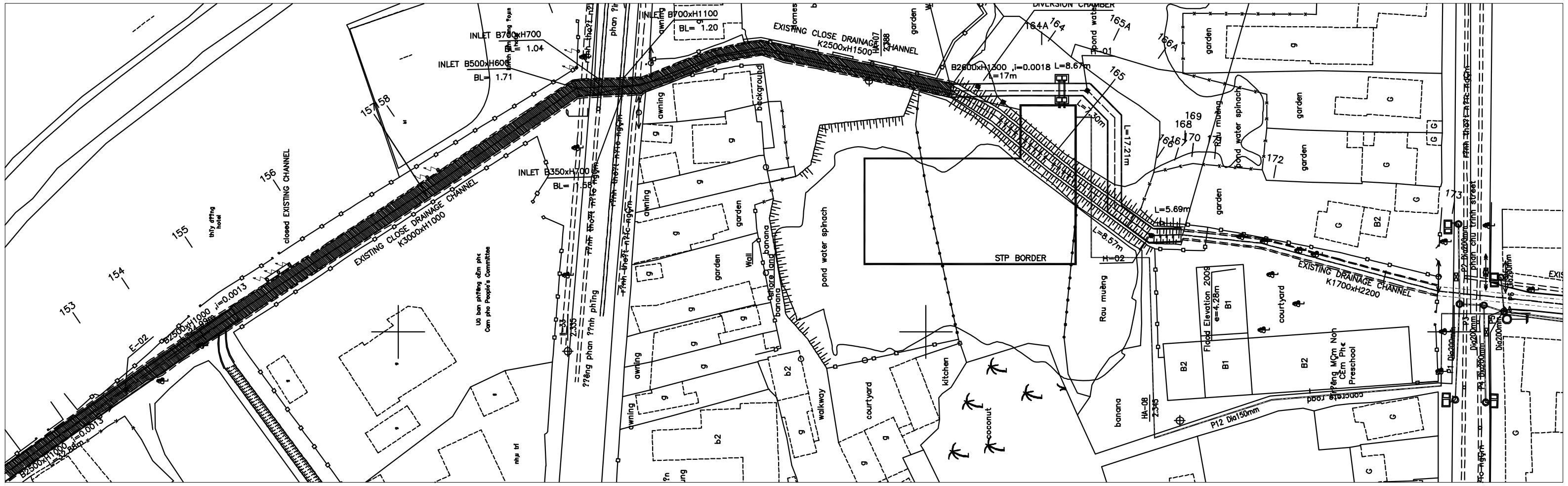


NOTE

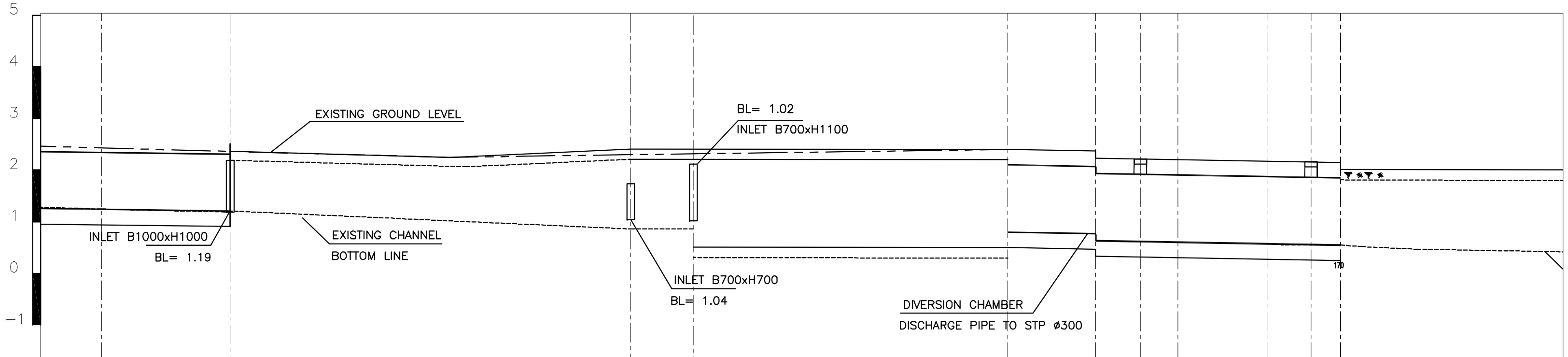
○	Điểm ĐC cấp II	BMs' Traverse grade 2
⊕ A1	Điểm đo vẽ	Urveyed point
←○→	Cột điện cao thế	High tenion pole
←○→	Cột điện	Tenion pole
•⊙•	Cột điện thông tin	Telephone pole
⌠	Cột đèn	Lamp-pot
♣	Cây độc lập	Tree
▲	Đình, miếu	Temple
ϟ	Trạm biến thế	Tranformer tation
◘ ⊠	Cáp quang, hố ga	Power cable, hole
♀ ↑	Biển báo	Ignboard
☎	Trạm điện thoại	Telephon tation
⊕ ⁺⁺⁺ ⌒	Nghĩa địa, mộ	Cementery, ingle bomb
⌒	Cầu, cống	Bridge, culvert
▦	Kè đá	Tone dam
⁓	Tường, hàng rào	Wall, Fence
╥╥╥	Bờ mương, sông	River bank, ditch
┅	Mương , rãnh	Ditch
⊔	Đất màu	Rich oil
G B1	Nhà gạch, bê tông	Brick, Concrete house
⊕ Bor6	Lỗ khoan	Borehole

PROJECT Preparatory Survey on Water Quality Improvement Project for Japanese Bridge Area, Hoi An in Socialist Republic of Vietnam	DESCRIPTION Plan and Profile (section D, E)		APPROVED BY	DATE	DRAWING No PC-007
		NIHON SUIDO CONSULTANTS CO., LTD.	PREPARED BY	DATE	SCALE H= 1 : 1000 V= 1 : 100

PLAN



LONGITUDINAL PROFILE

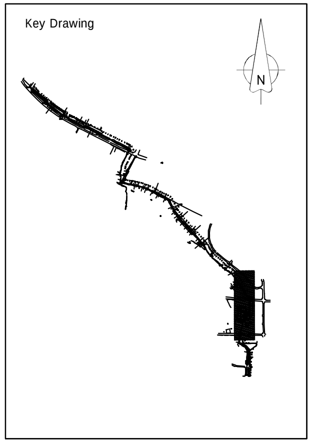


EXISTING SEWER BOTTOM LEVEL	1.25	1.22	1.19	1.13	1.07	1.06	1.00	1.01	0.99	0.97	0.96		0.53				0.55		2.22	2.17
SEWER INVERT LEVEL	1.244		1.210 1.190								0.800	0.769 0.632	0.617	0.604	0.572	0.55	0.55			
SINGLE DISTANCE (m)	1432.38	1443.37	1457.37	1477.23	1500.00	1503.15	1534.98	1547.11	1562.27	1571.02	1608.11	1625.11	1633.78	1641.08	1658.29	1666.86	1672.55	1672.56	1676.86	1687.38
STATION PLAN ROTATION ANGLE	153 171°	154	155 178°	156	C157	158	159	160	161	162	163 167°	164A 180°	165A 135°	166A 135°	167 126°	168 142°	169 171°		171	172
MANHOLE	E02											DIVERSION CHAMBER	H01							

CUMULATIVE DISTANCE (m)	2.29	10.99	14.00	19.86	22.77	3.15	31.83	12.13	15.16	8.75	37.09	17.00	8.67	7.30	17.21	8.57	5.69	4.30	10.52	34.55

INTERNAL DIMENSION / SLOPE (BOX CULVERT)	K2400XH1100	K2400XH1100 i=0.0013	EXISTING CLOSE DRAINAGE CHANNEL K3000xH1400	B2300XH1700 i=0.0018	B2600XH1300 i=0.0018	B2600XH1300 i=0.0018	B2600XH1300 i=0.0018	B2600XH1300 i=0.0018	EXISTING CL

Key Drawing



NOTE

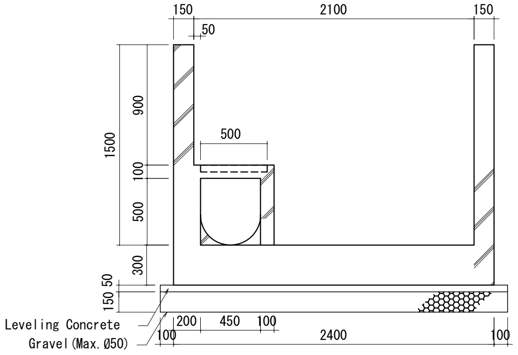
○	Điểm ĐC cấp II	BMs' Traverse grade 2
⊕ A1	Điểm đo vẽ	Urveyed point
↞○↠	Cột điện cao thế	High tenion pole
←○→	Cột điện	Tenion pole
•⊙•	Cột điện thông tinh	Telephone pole
	Cột đèn	Lamp-pot
	Cây độc lập	Tree
	Đình, miếu	Temple
↯	Trạm biến thế	Tranformer tation
▣ ☒	Cáp quang, hố ga	Power cable, hole
	Biển báo	Ignboard
	Trạm điện thoại	Telephon tation
	Nghĩa địa, mộ	Cementery, ingle bomb
	Cầu, cống	Bridge, culvert
▦	Kè đá	Tone dam
	Tường, hàng rào	Wall, Fence
	Bờ mương, sông	River bank, ditch
	Mương , rãnh	Ditch
⊔	Đất màu	Rich oil
G B1	Nhà gạch, bê tông	Brick, Concrete house
⊕ Bor6	Lỗ khoan	Borehole

PROJECT Preparatory Survey on Water Quality Improvement Project for Japanese Bridge Area, Hoi An in Socialist Republic of Vietnam	DESCRIPTION Plan and Profile (section F, G, H)		APPROVED BY	DATE	DRAWING No PC-008
		NIHON SUIDO CONSULTANTS CO., LTD.	PREPARED BY	DATE	SCALE H= 1 : 1000 V= 1 : 100

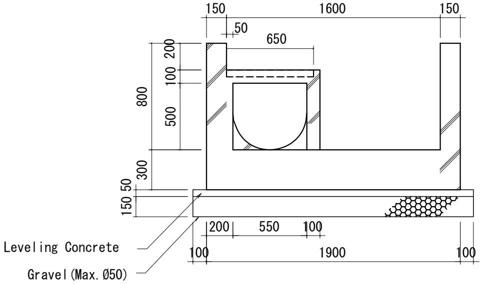
Typical Cross Section

Scale=1/40

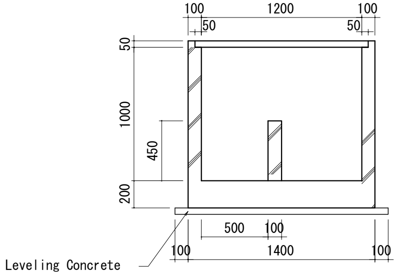
Section a



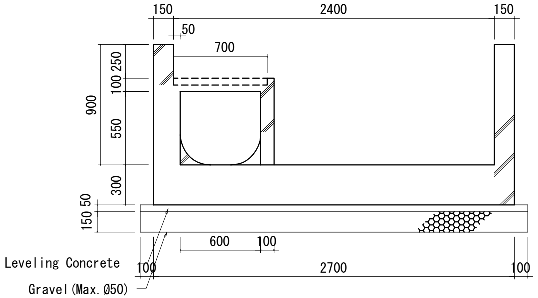
Section b-1



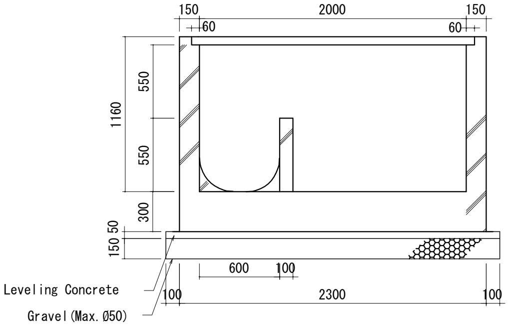
Section b-2



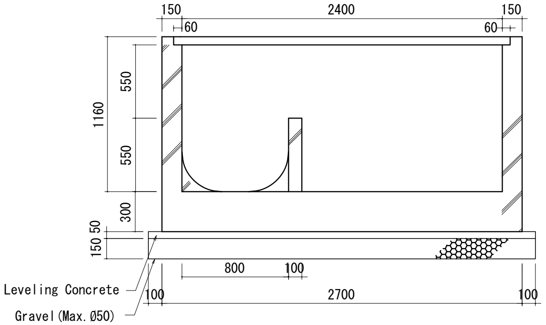
Section c



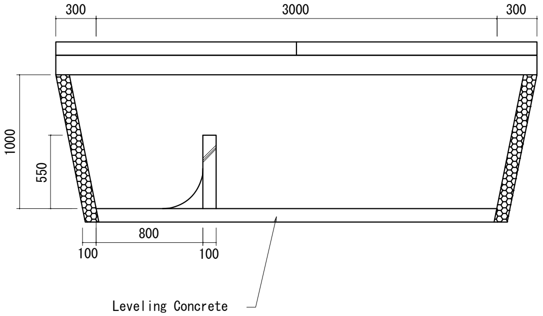
Section d



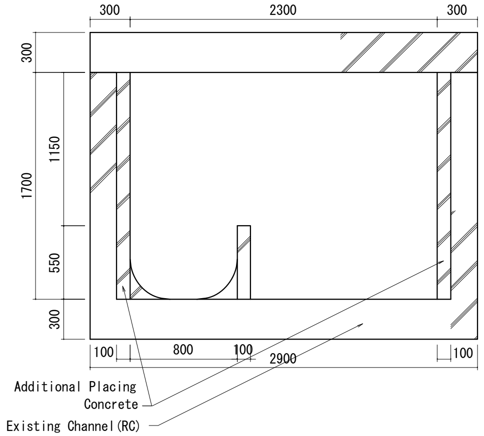
Section e



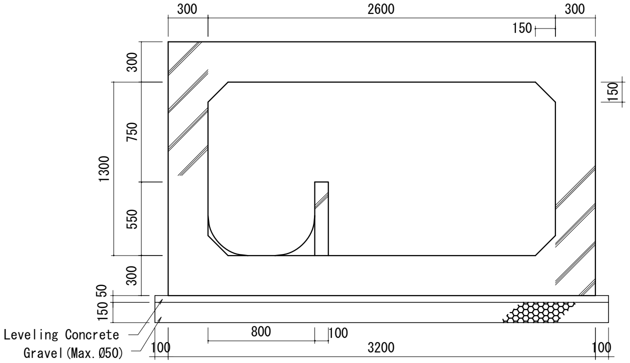
Section f



Section g

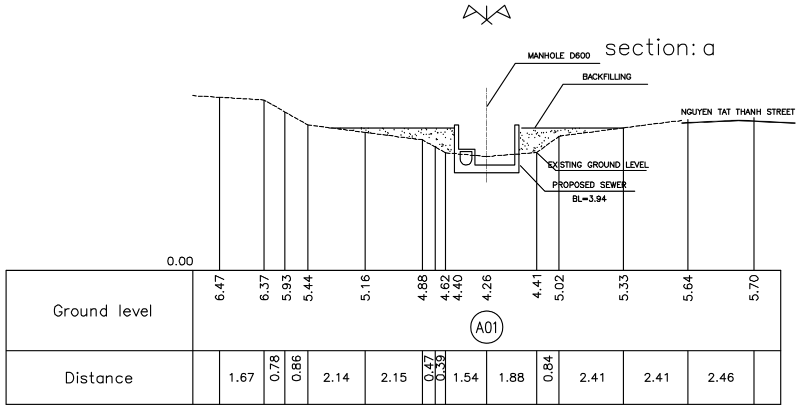


Section h

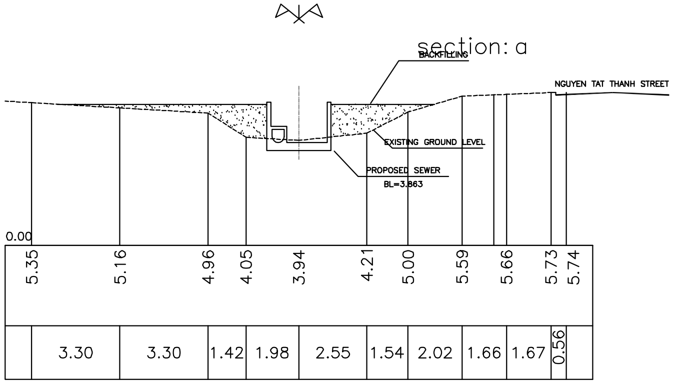


PROJECT	DESCRIPTION		APPROVED BY	DATE	DRAWING No
Preparatory Survey on Water Quality Improvement Project for Japanese Bridge Area, Hoi An in Socialist Republic of Vietnam	Typical Cross Section				PC-009
		NIHON SUIDO CONSULTANTS CO., LTD.	PREPARED BY	DATE	SCALE 1 : 40

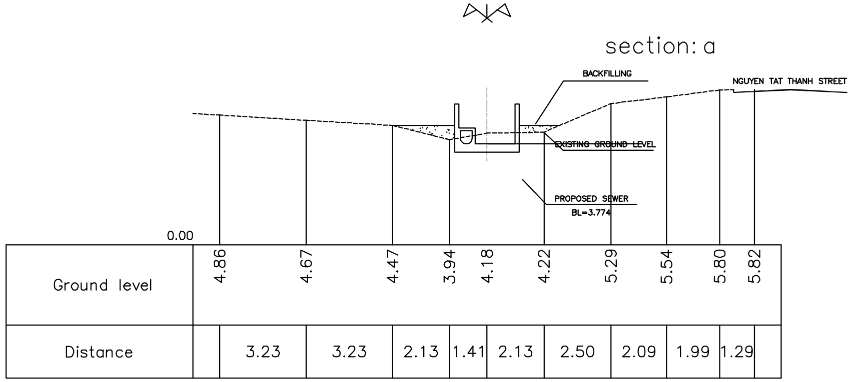
Cross section: C4
Km: 0+25.19



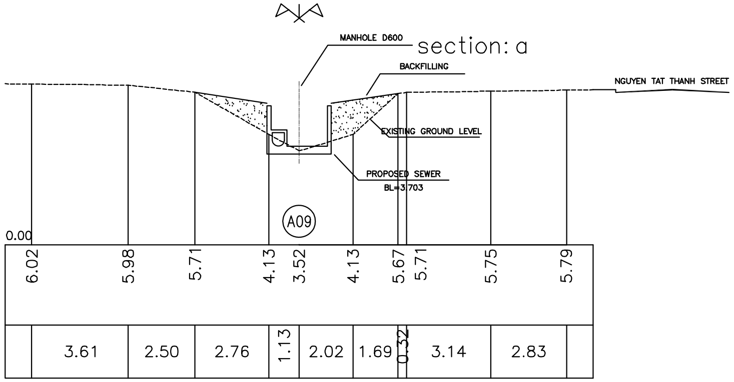
Cross section: C14
Km: 0+121.18



Cross: C24
Km: 0+232.88



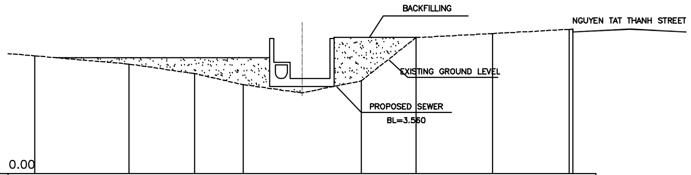
Cross section: C33
Km: 0+321.37



PROJECT	DESCRIPTION		APPROVED BY	DATE	DRAWING No
Preparatory Survey on Water Quality Improvement Project for Japanese Bridge Area, Hoi An in Socialist Republic of Vietnam	Cross Section (1)				PC-010
		NIHON SUIDO CONSULTANTS CO., LTD.	PREPARED BY	DATE	SCALE 1 : 200

Cross section: C48
Km: 0+500

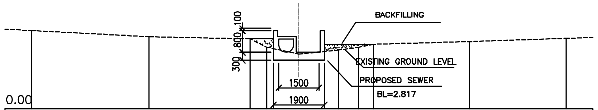
section: a



Ground level	4.41	4.10	3.74	3.33	3.02	3.47	5.09	5.25	5.40	
Distance		3.54	2.44	1.82	2.20	2.23	2.04	2.87	2.87	

Cross section: C62
Km: 0+600.57

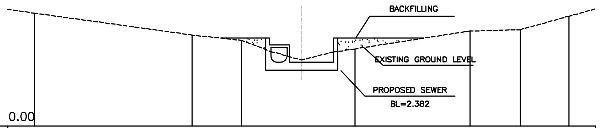
section: b−1



Ground level	3.93	3.70	3.62	3.31	3.05	3.20	3.30	3.42	3.52	3.64	
Distance		4.39	3.79	0.62	1.20	1.49	0.74	0.56	3.60	3.62	

Cross section: C78
Km: 0+711.6

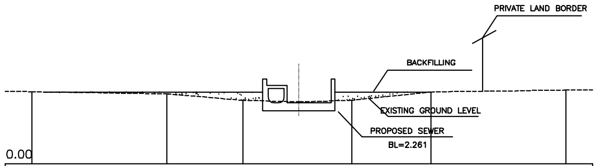
section: c



Ground level	4.22	3.40	3.20	2.77	2.46	2.76	2.88	3.55	3.60	4.10	
Distance		5.90	1.85	1.15	1.10	1.17	0.83	4.30	1.88	1.82	

Cross section: C91
Km: 0+804.27

section: c



Ground level	2.68	2.60	2.36	2.30	2.36	2.67	2.74	
Distance		5.05	2.85	2.10	1.98	2.97	5.05	

PROJECT
Preparatory Survey on
Water Quality Improvement Project for Japanese Bridge Area,
Hoi An in Socialist Republic of Vietnam

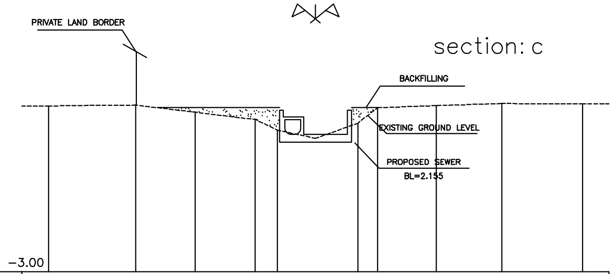
DESCRIPTION
Cross Section (2)

NIHON SUIDO CONSULTANTS CO., LTD.

APPROVED BY
DATE
DRAWING No
PC-011

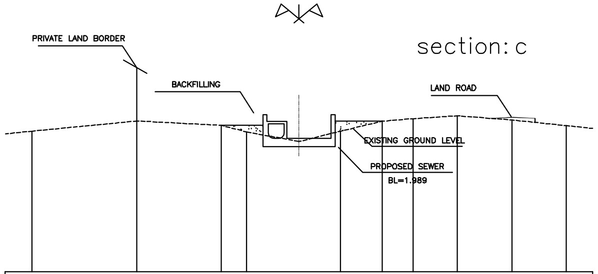
PREPARED BY
DATE
SCALE
1 : 200

Cross section: C99
Km: 0+885.63



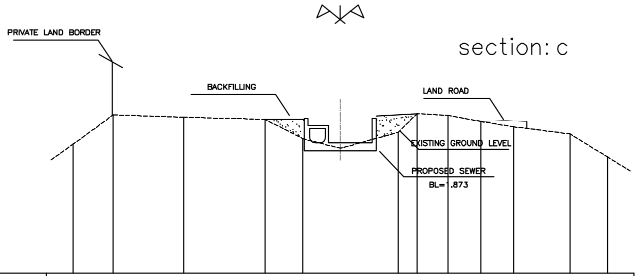
Ground level	3.22	3.22	3.25	2.98	2.71	2.31	2.00	2.57	3.15	3.23	3.31	3.30	
Distance		3.26	2.24	2.24	0.84	1.43	1.59	0.73	2.19	2.46	3.02		

Cross section: C111
Km: 1+13.73



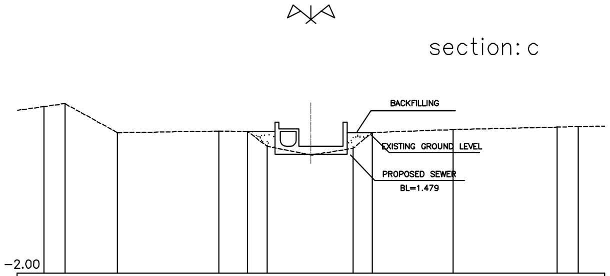
Ground level	2.27	2.65	2.49	2.24	1.88	2.27	2.64	2.74	2.85	2.69	2.48	
Distance		3.92	3.16	0.95	1.97	1.54	1.57	1.15	1.66	2.05	2.03	

Cross section: C117
Km: 1+103.26



Ground level	1.83	2.92	2.84	2.75	2.03	1.67	2.27	2.97	2.90	2.68	2.48	2.21	1.35	
Distance		1.50	2.64	3.04	1.42	1.39	2.17	0.70	1.15	1.23	1.24	2.11	1.40	

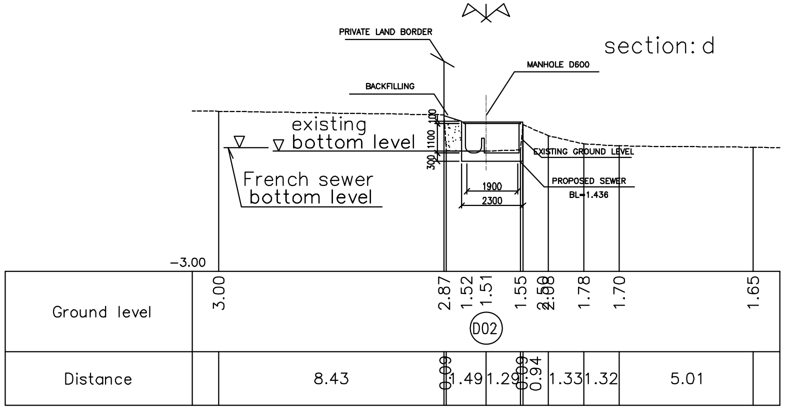
Cross section: C124
Km: 1+198.16



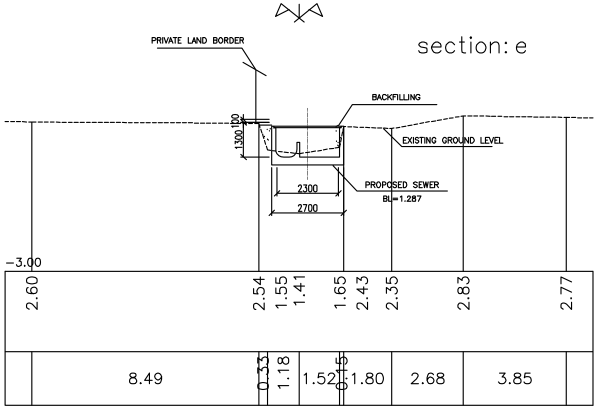
Ground level	3.23	3.34	2.26	2.31	2.30	1.75	1.42	1.67	2.26	2.37	2.47	2.48	
Distance		0.79	1.96	3.80	1.07	0.73	1.64	1.57	0.73	3.02	3.89	0.79	

PROJECT Preparatory Survey on Water Quality Improvement Project for Japanese Bridge Area, Hoi An in Socialist Republic of Vietnam	DESCRIPTION Cross Section (3)		APPROVED BY	DATE	DRAWING No PC-012
		NIHON SUIDO CONSULTANTS CO., LTD.	PREPARED BY	DATE	SCALE 1 : 200

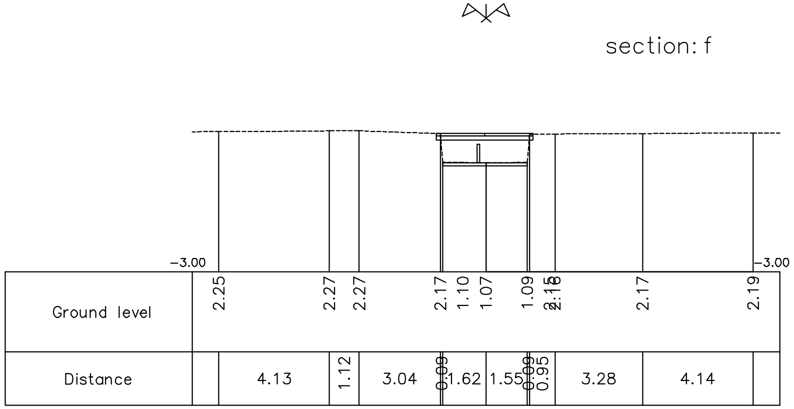
Cross section: C145
Km: 1+300



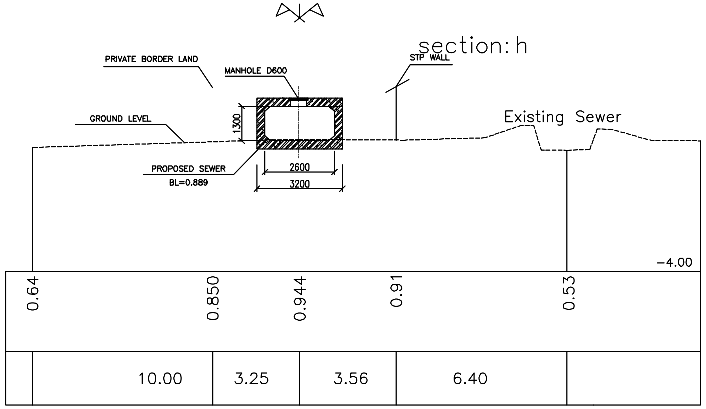
Cross section: C151
Km: 1+399.5



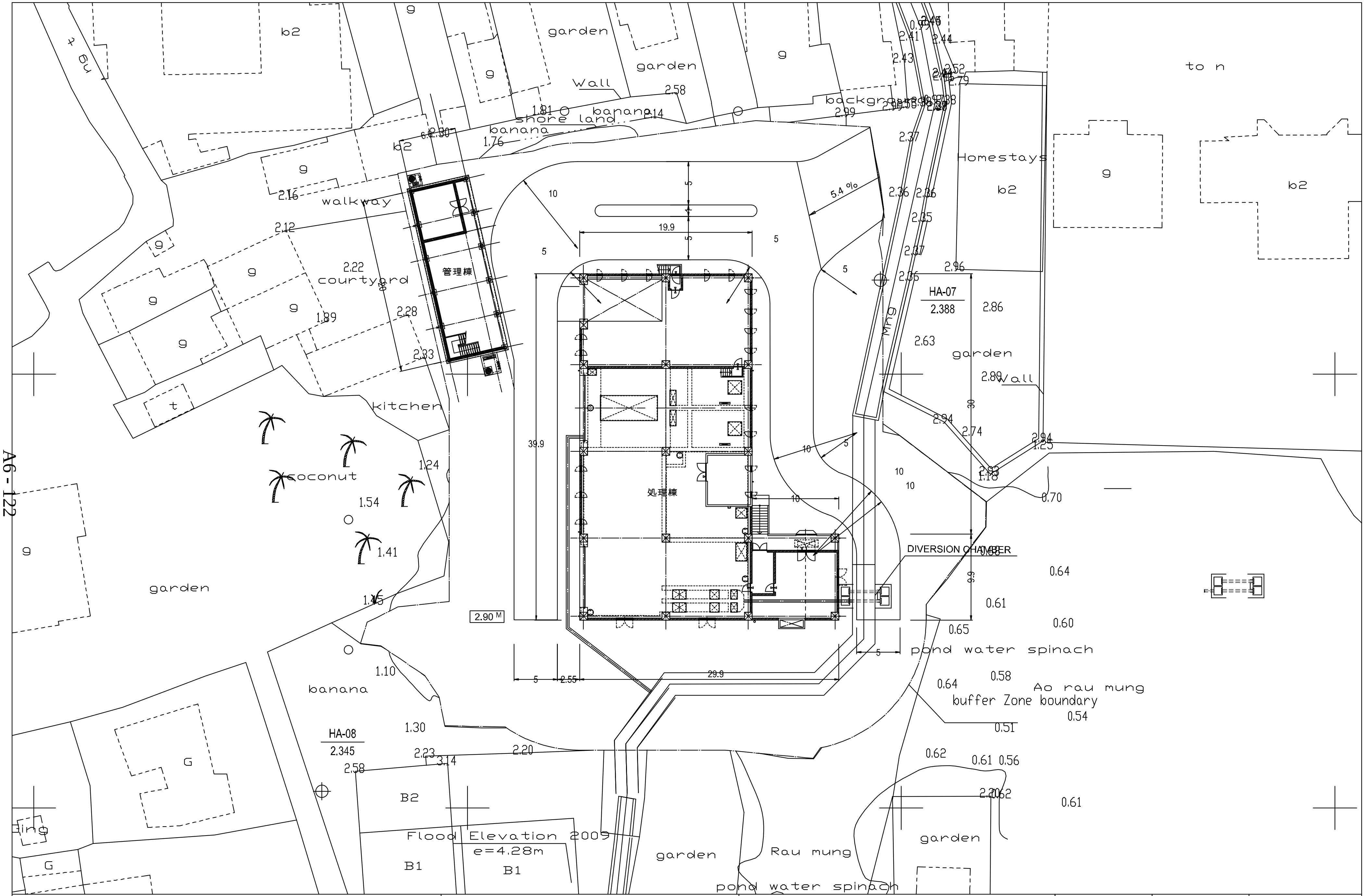
Cross section: C157
Km: 1+500



Cross section: C165a
Km: 1+631.25



PROJECT	DESCRIPTION		APPROVED BY	DATE	DRAWING No
Preparatory Survey on Water Quality Improvement Project for Japanese Bridge Area, Hoi An in Socialist Republic of Vietnam	Cross Section (4)				PC-013
		NIHON SUIDO CONSULTANTS CO., LTD.	PREPARED BY	DATE	SCALE 1 : 200



PROJECT

Preparatory Survey on
Water Quality Improvement Project for Japanese Bridge Area,
Hoi An in Socialist Republic of Vietnam

DESCRIPTION

Sample: STP General Plan

処理棟　一般平面図

NIHON SUIDO CONSULTANTS CO., LTD.

APPROVED BY

DATE

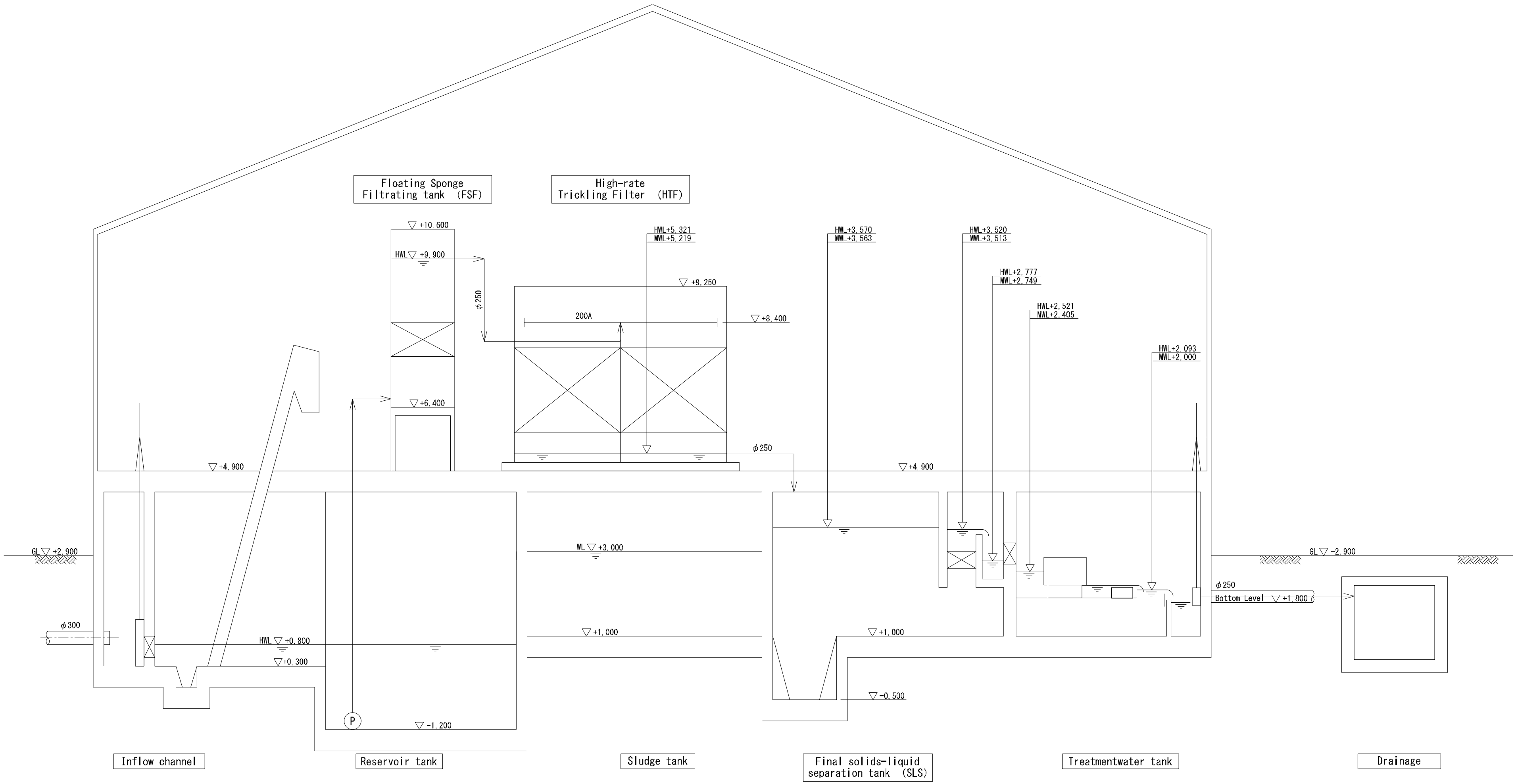
DRAWING No

PREPARED BY

DATE

SCALE

1／200



drawing No

処理場土木:SC-001
処理場建築:SA-001
処理場機械:SM-001
処理場電気:SE-001

管路土木:PC-001

PROJECT
Preparatory Survey on
Water Quality Improvement Project for Japanese Bridge Area,
Hoi An in Socialist Republic of Vietnam

DESCRIPTION
Water Level

NIHON SUIDO CONSULTANTS CO., LTD.

APPROVED BY

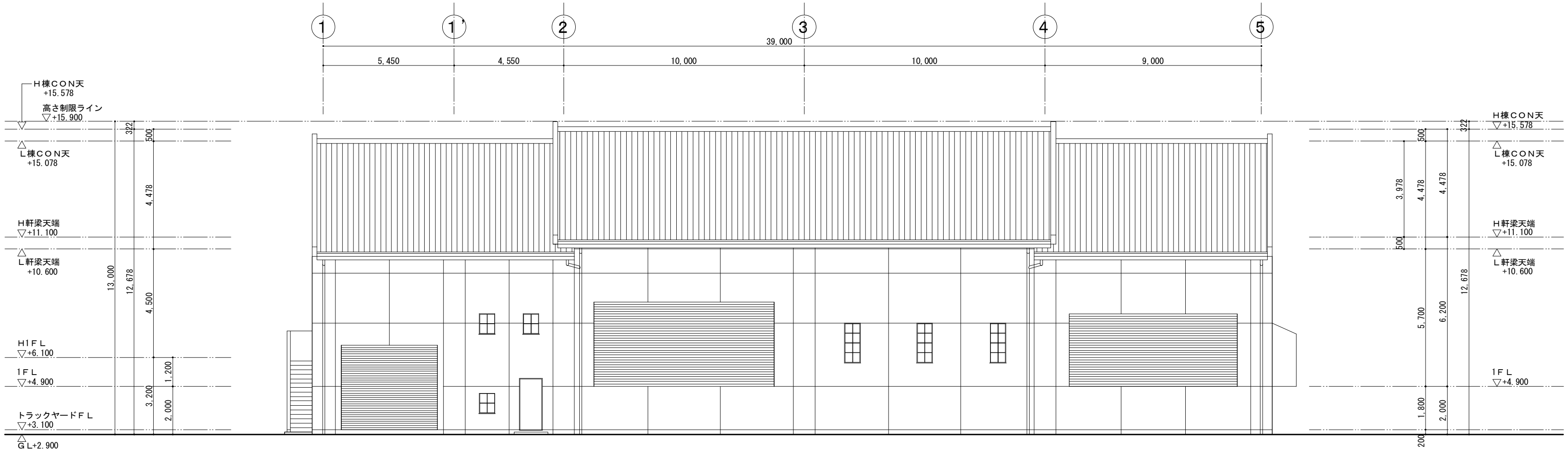
DATE

DRAWING No
SM-xxx

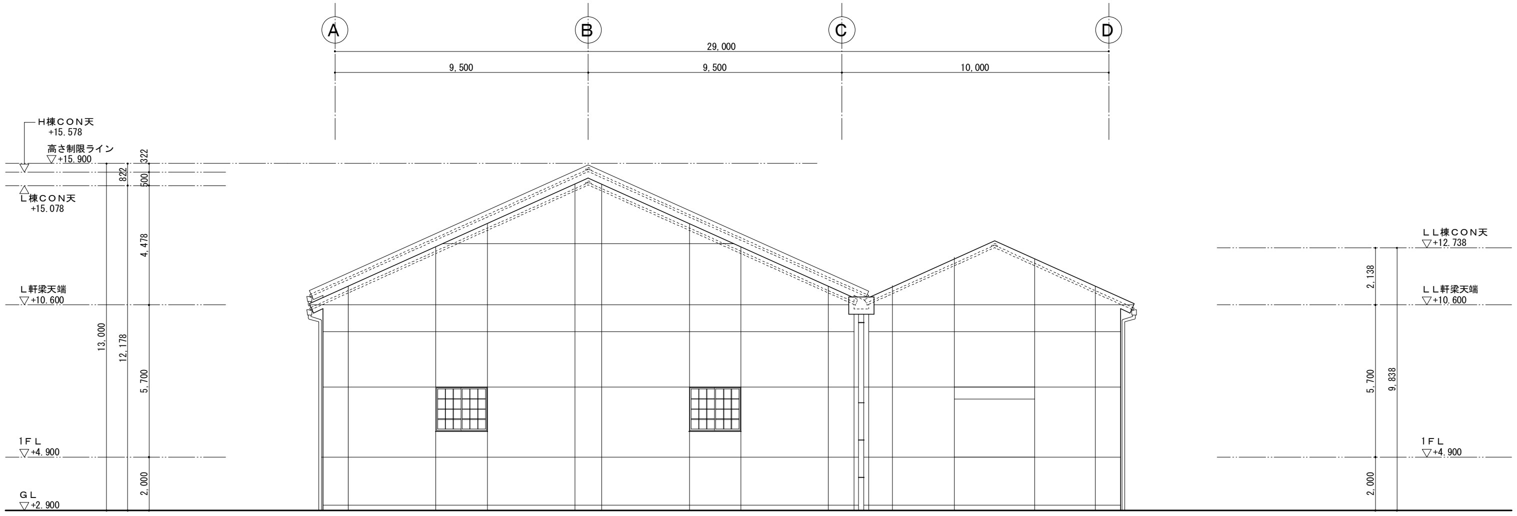
PREPARED BY

DATE

SCALE
NONE



立面図（１）　１／１００



立面図（２）　１／１００

PROJECT
Preparatory Survey on
Water Quality Improvement Project for Japanese Bridge Area,
Hoi An in Socialist Republic of Vietnam

DESCRIPTION
Sample: STP General Plan

処理棟　立面図（１）

NIHON SUIDO CONSULTANTS CO., LTD.

APPROVED BY

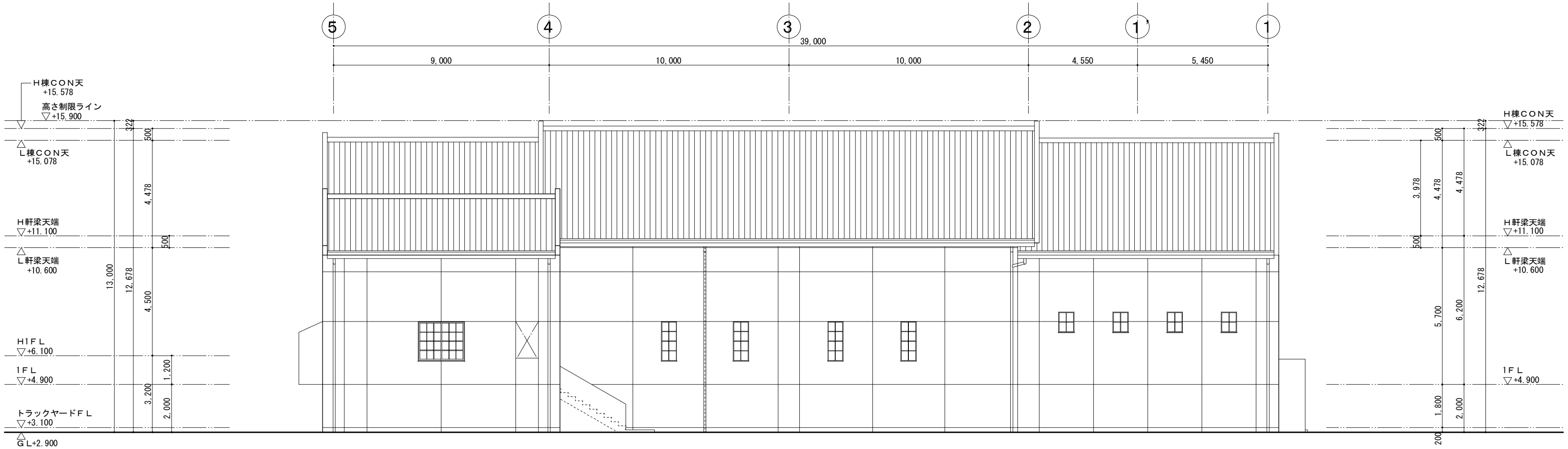
DATE

DRAWING No

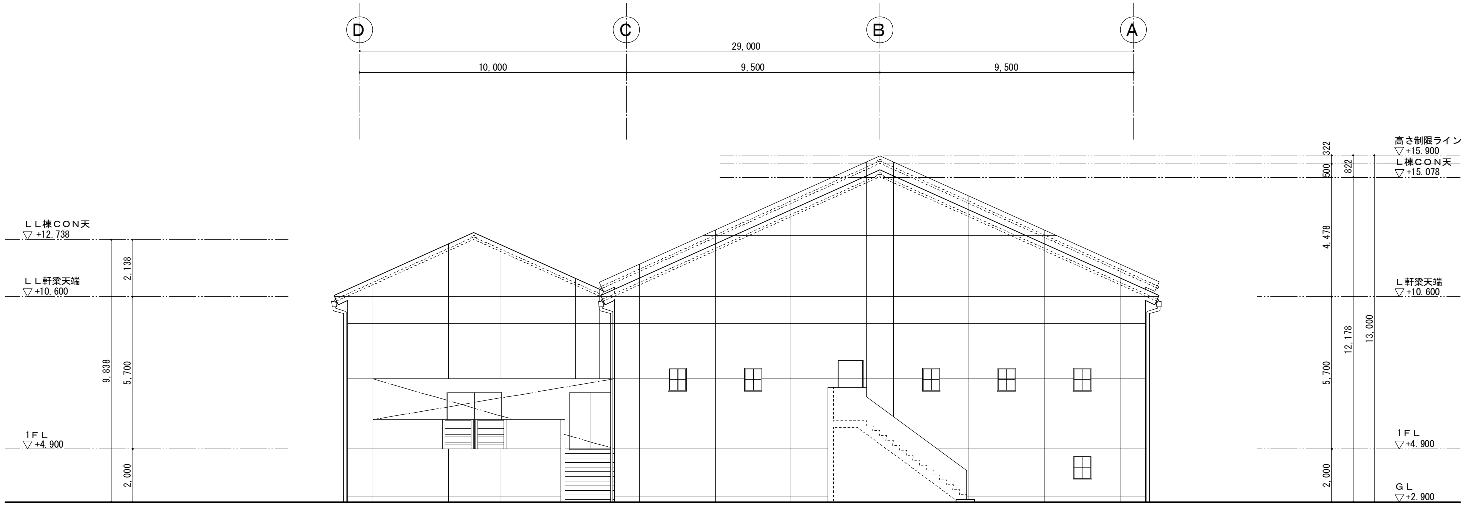
PREPARED BY

DATE

SCALE
1／100



立面図（1）　１／１００



立面図（4）　１／１００

PROJECT

Preparatory Survey on
Water Quality Improvement Project for Japanese Bridge Area,
Hoi An in Socialist Republic of Vietnam

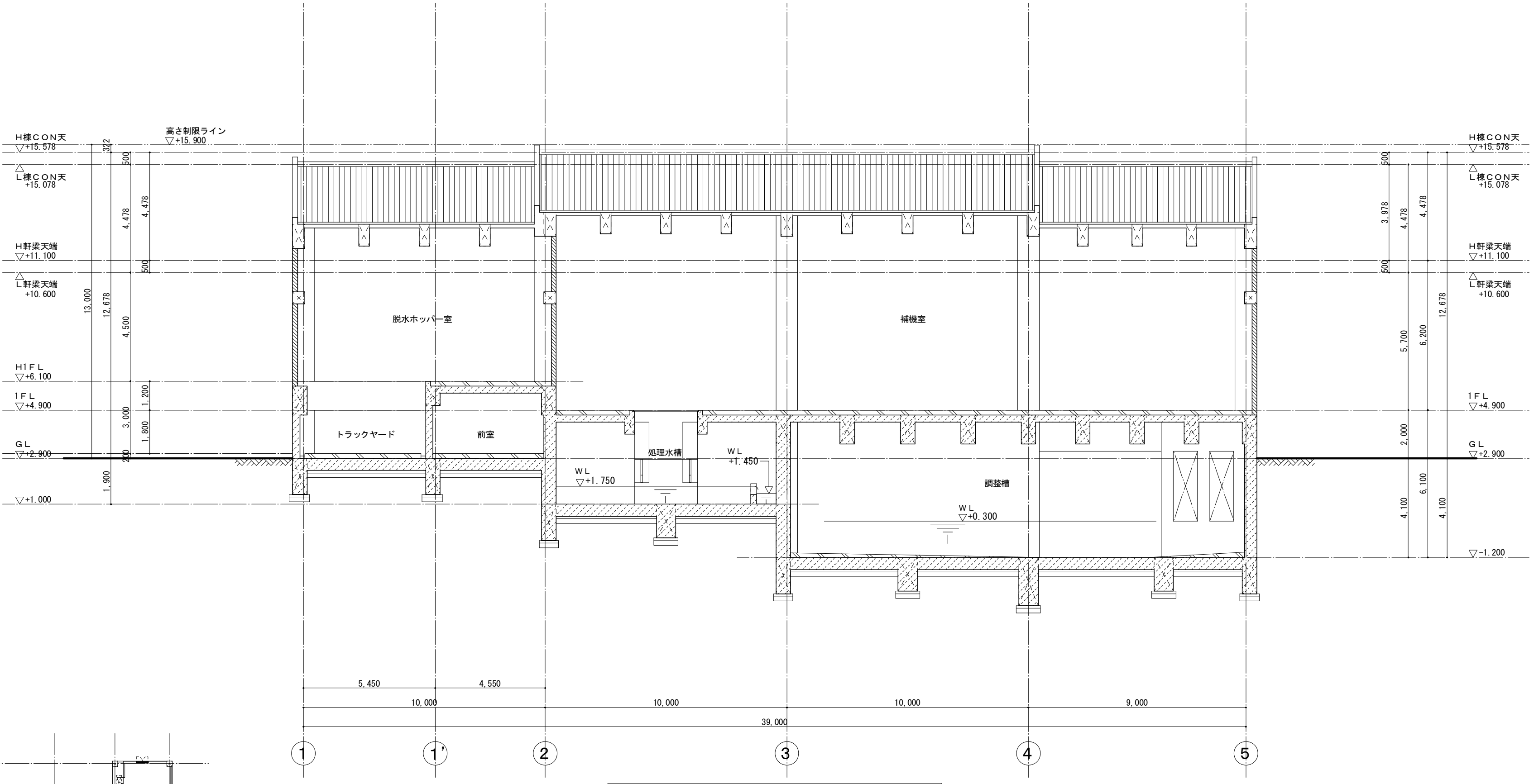
DESCRIPTION

Sample: STP General Plan

処理棟　立面図（２）

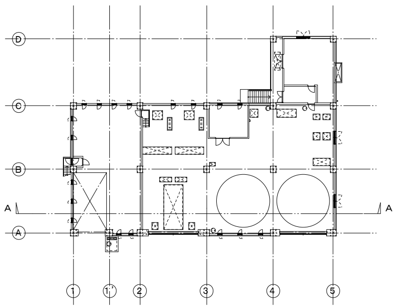
NIHON SUIDO CONSULTANTS CO., LTD.

APPROVED BY	DATE	DRAWING No
PREPARED BY	DATE	SCALE １／１００



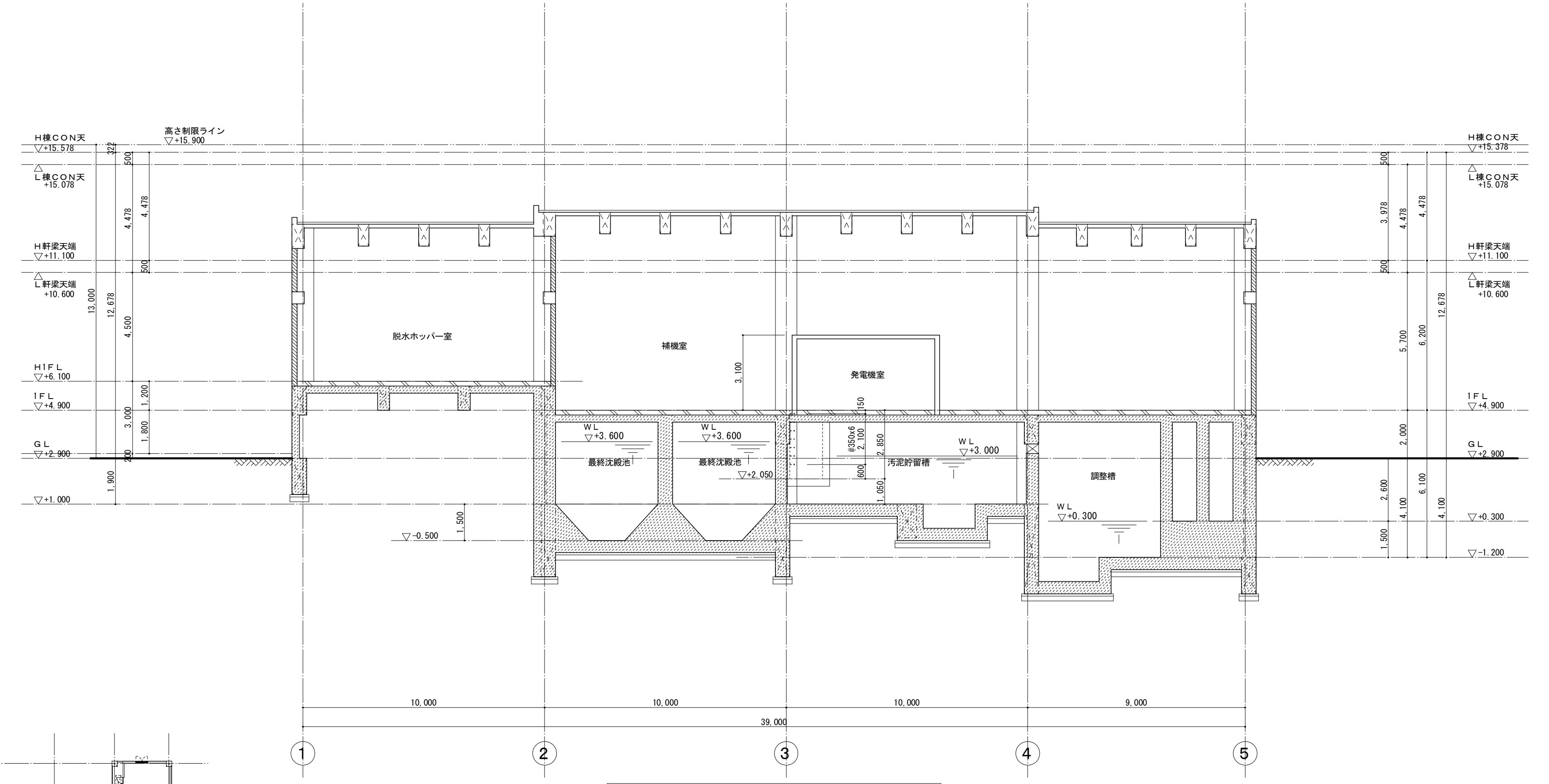
Ａ－Ａ　断面図　１／１００

▨ の部分は土木工事範囲を示す。



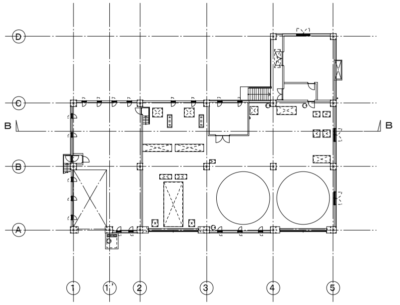
キープラン

PROJECT	DESCRIPTION		APPROVED BY	DATE	DRAWING No
Preparatory Survey on Water Quality Improvement Project for Japanese Bridge Area, Hoi An in Socialist Republic of Vietnam	Sample: STP General Plan	処理棟　断面図（１）			
		NIHON SUIDO CONSULTANTS CO., LTD.	PREPARED BY	DATE	SCALE １／１００



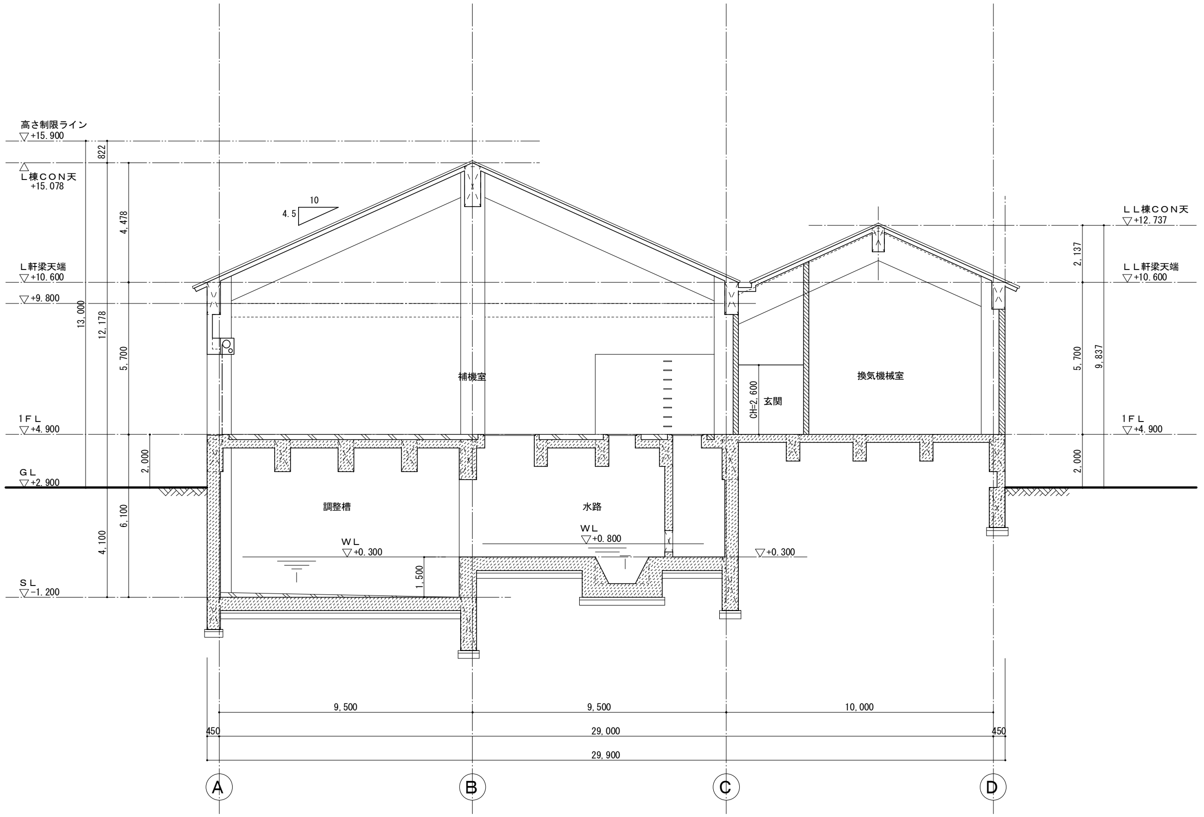
B－B　断面図　１／１００

▨ の部分は土木工事範囲を示す。



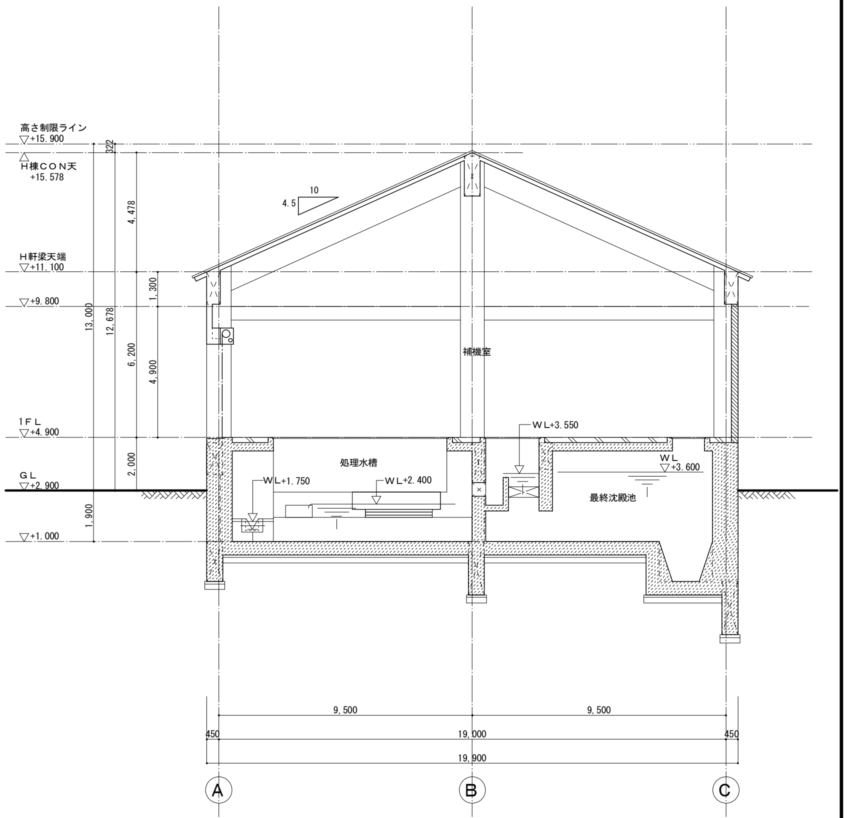
キープラン

PROJECT	DESCRIPTION		APPROVED BY	DATE	DRAWING No
Preparatory Survey on Water Quality Improvement Project for Japanese Bridge Area, Hoi An in Socialist Republic of Vietnam	Sample: STP General Plan	処理棟　断面図（２）			
		NIHON SUIDO CONSULTANTS CO., LTD.	PREPARED BY	DATE	SCALE １／１００



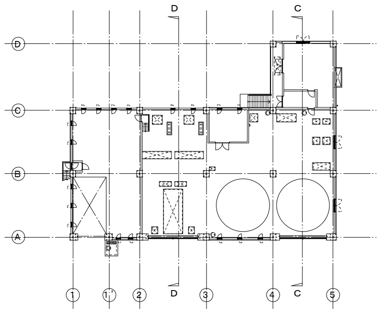
C－ C 断 面 図　　1／100

▨ の部分は土木工事範囲を示す。



D－ D 断 面 図　　1／100

▨ の部分は土木工事範囲を示す。



キープラン

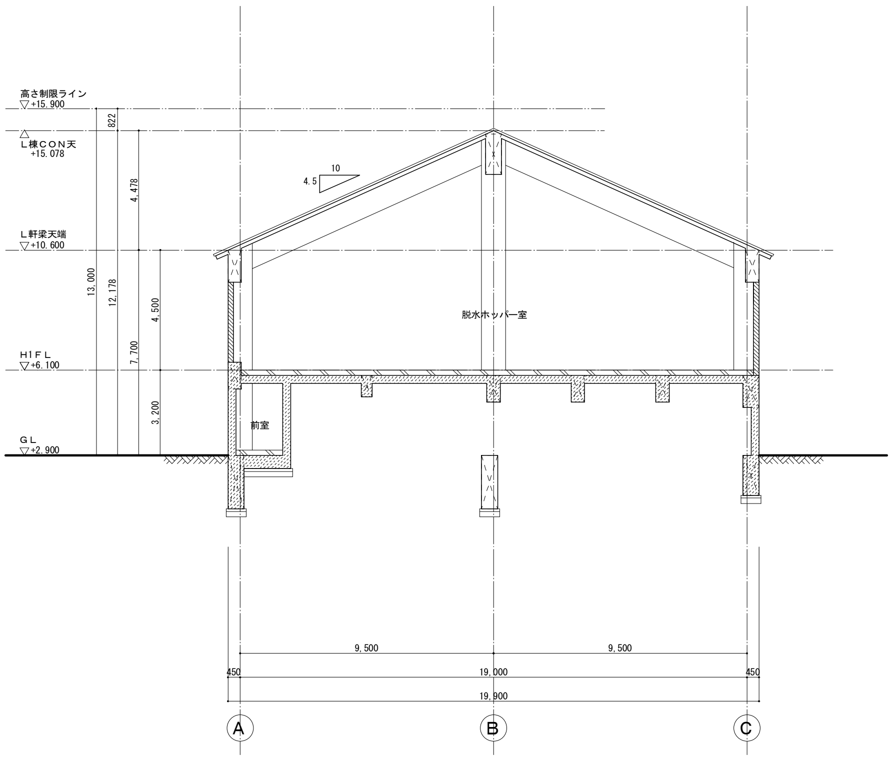
PROJECT
Preparatory Survey on
Water Quality Improvement Project for Japanese Bridge Area,
Hoi An in Socialist Republic of Vietnam

DESCRIPTION
Sample: STP General Plan

処理棟　断面図（３）

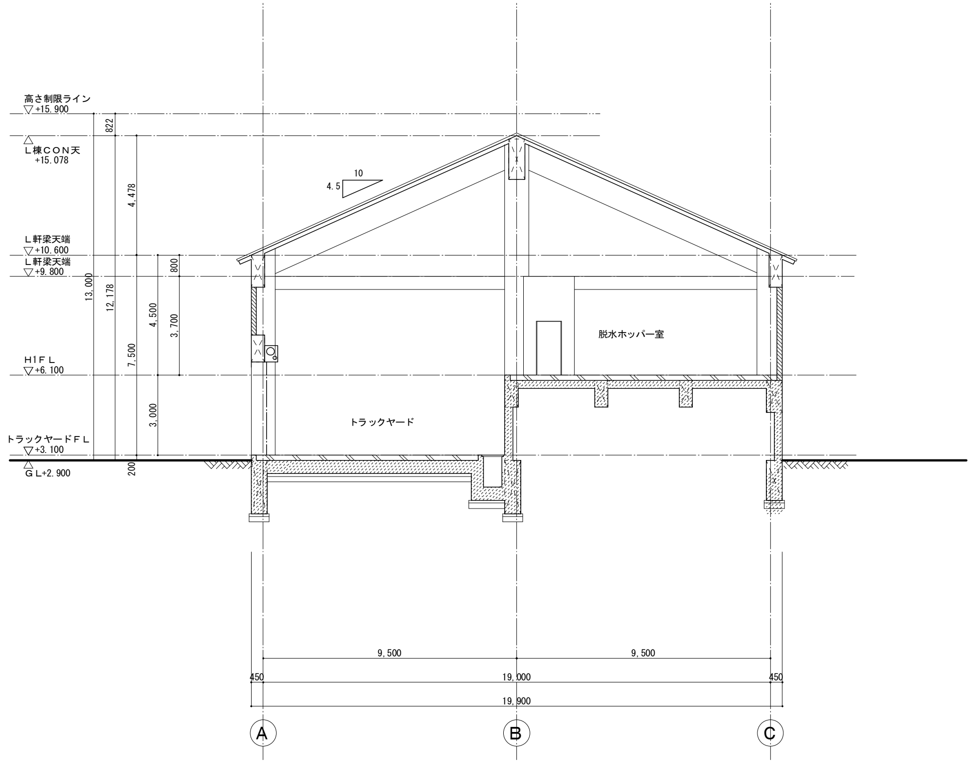
NIHON SUIDO CONSULTANTS CO., LTD.

APPROVED BY
DATE
DRAWING No
PREPARED BY
DATE
SCALE
1／100



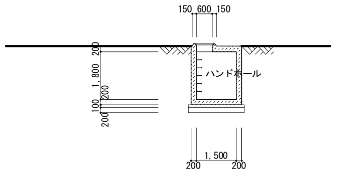
E－E 断面図 1／100

▨ の部分は土木工事範囲を示す。



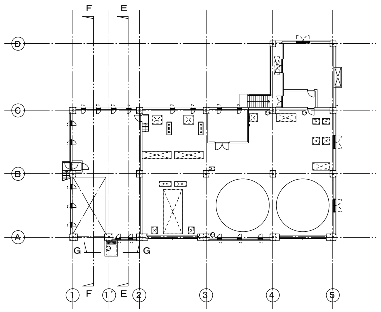
F－F 断面図 1／100

▨ の部分は土木工事範囲を示す。



G－G 断面図 1／100

▨ の部分は土木工事範囲を示す。



キープラン

PROJECT
Preparatory Survey on
Water Quality Improvement Project for Japanese Bridge Area,
Hoi An in Socialist Republic of Vietnam

DESCRIPTION
Sample: STP General Plan

処理棟 断面図（4）

NIHON SUIDO CONSULTANTS CO., LTD.

APPROVED BY

DATE

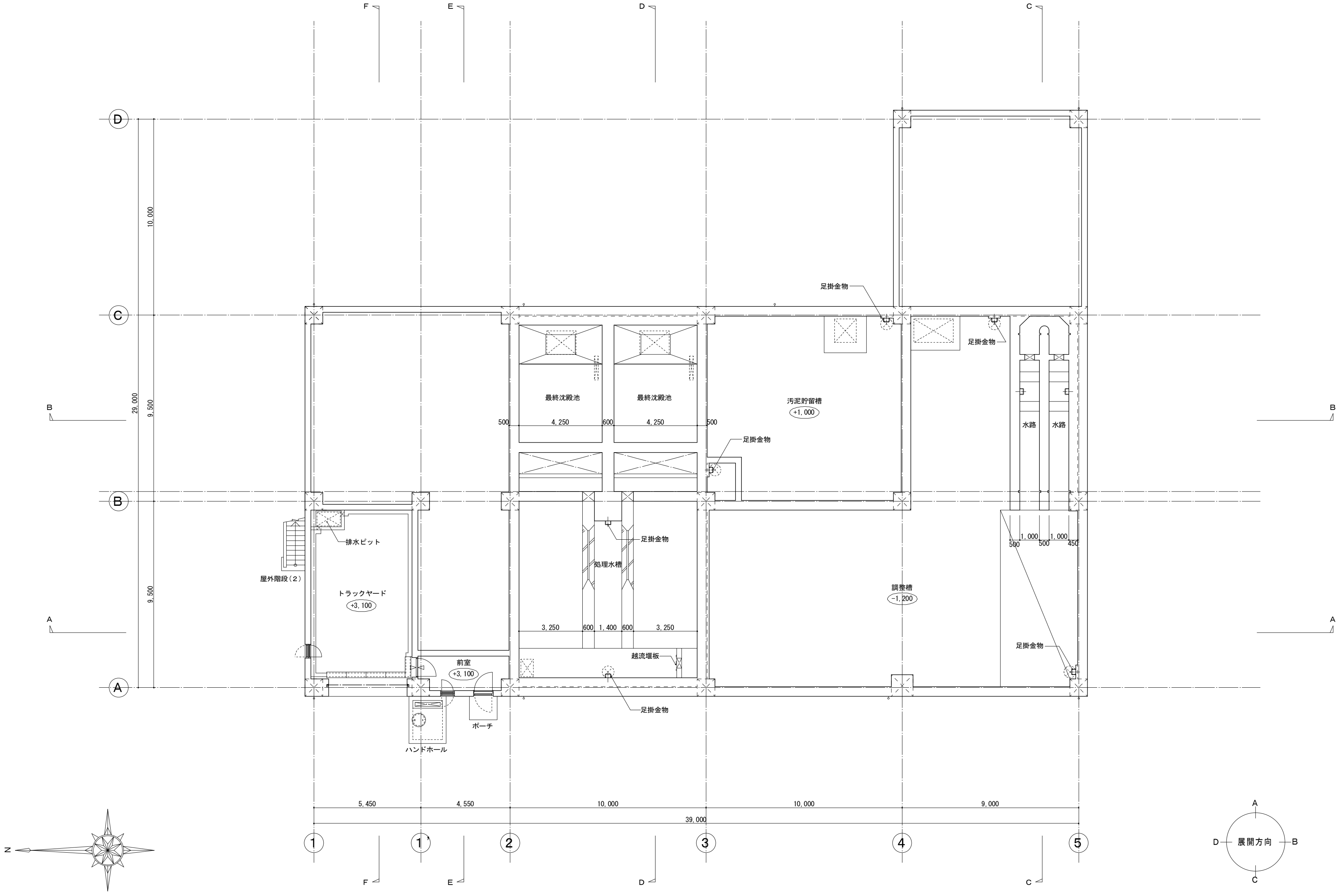
DRAWING No

PREPARED BY

DATE

SCALE
1／100

A6 - 130



下部平面図　　　1／100

凡例　◁ 室名札取付箇所を示す。

PROJECT

Preparatory Survey on
Water Quality Improvement Project for Japanese Bridge Area,
Hoi An in Socialist Republic of Vietnam

DESCRIPTION

Sample: STP General Plan

処理棟　平面図（1）

NIHON SUIDO CONSULTANTS CO., LTD.

APPROVED BY

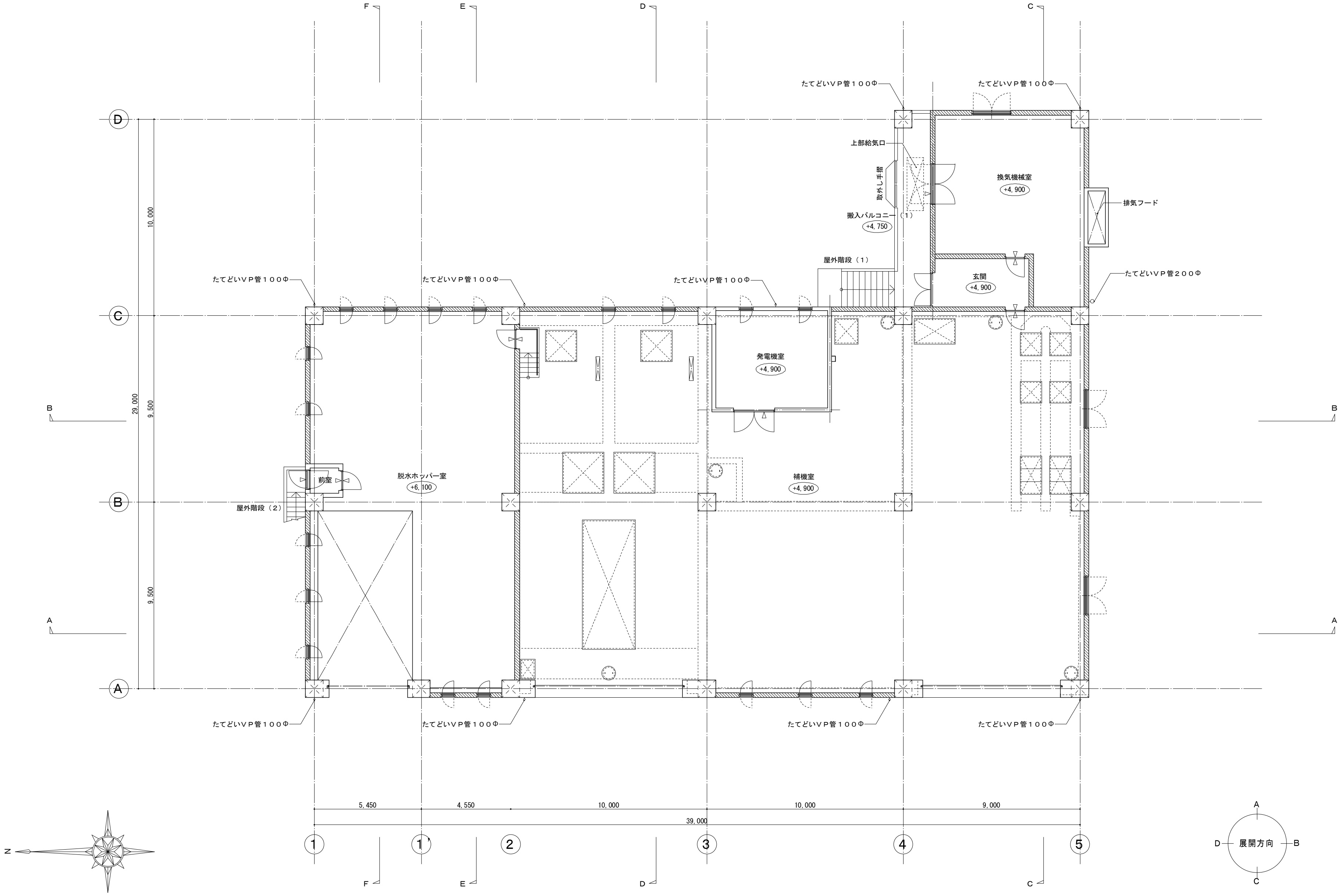
DATE

DRAWING No

PREPARED BY

DATE

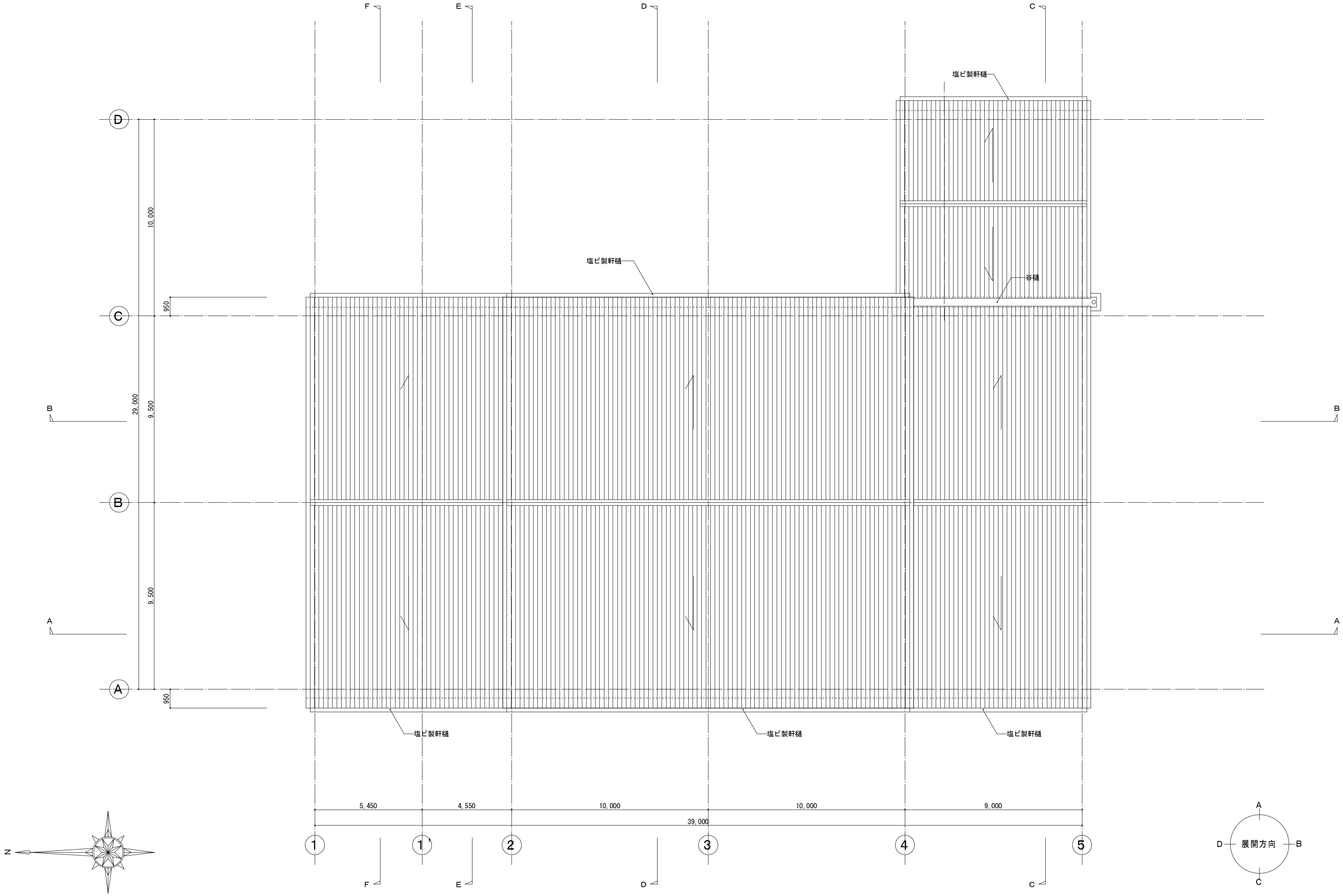
SCALE
1／100



１階　　平面図　　１／１００

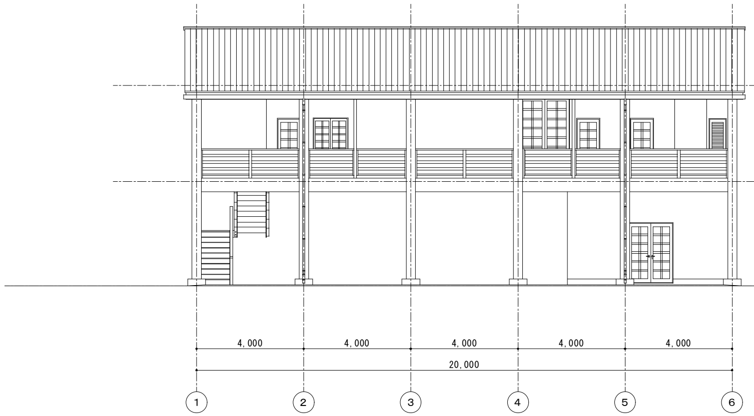
凡例　◁ 室名札取付箇所を示す。

PROJECT	DESCRIPTION		APPROVED BY	DATE	DRAWING No
Preparatory Survey on Water Quality Improvement Project for Japanese Bridge Area, Hoi An in Socialist Republic of Vietnam	Sample: STP General Plan	処理棟　平面図（２）			
		NIHON SUIDO CONSULTANTS CO., LTD.	PREPARED BY	DATE	SCALE １／１００

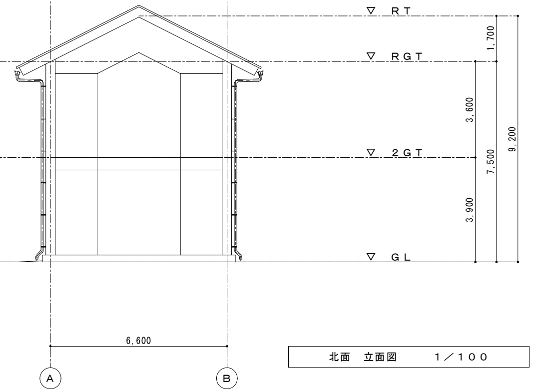


屋根伏図　　1／１００

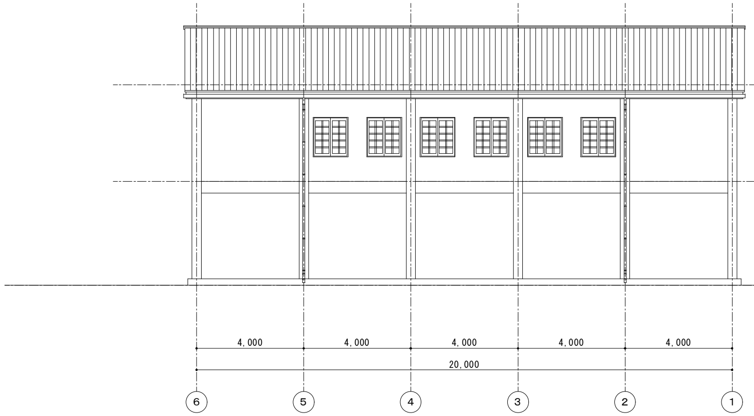
PROJECT Preparatory Survey on Water Quality Improvement Project for Japanese Bridge Area, Hoi An in Socialist Republic of Vietnam	DESCRIPTION Sample: STP General Plan	処理棟　平面図（３） NIHON SUIDO CONSULTANTS CO., LTD.	APPROVED BY PREPARED BY	DATE DATE	DRAWING No SCALE １／１００



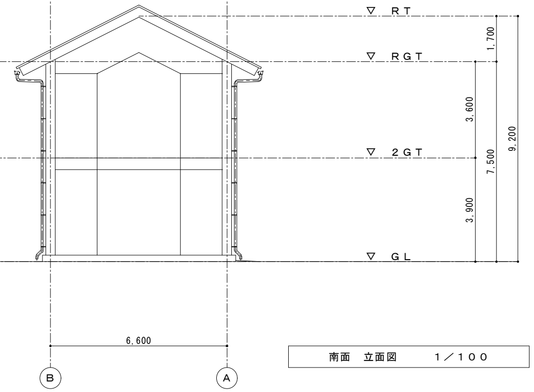
東面　立面図　　1／100



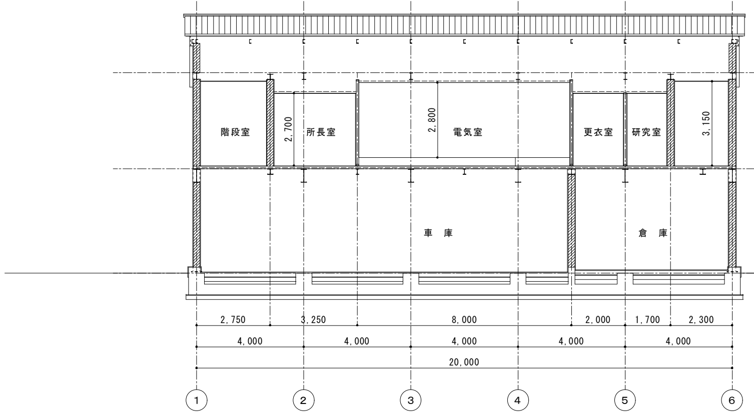
北面　立面図　　1／100



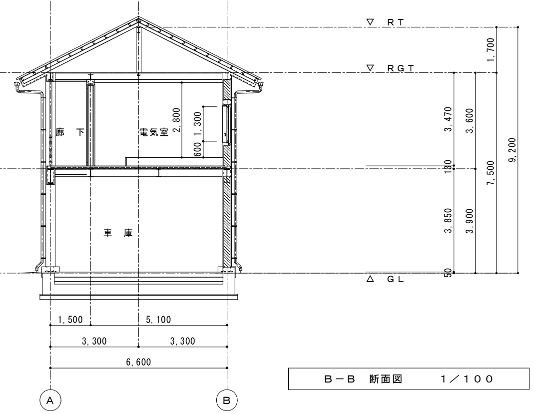
西面　立面図　　1／100



南面　立面図　　1／100



A－A　断面図　　1／100



B－B　断面図　　1／100

PROJECT

Preparatory Survey on
Water Quality Improvement Project for Japanese Bridge Area,
Hoi An in Socialist Republic of Vietnam

DESCRIPTION

Sample: STP General Plan

管理棟　立面図・断面図

NIHON SUIDO CONSULTANTS CO., LTD.

APPROVED BY

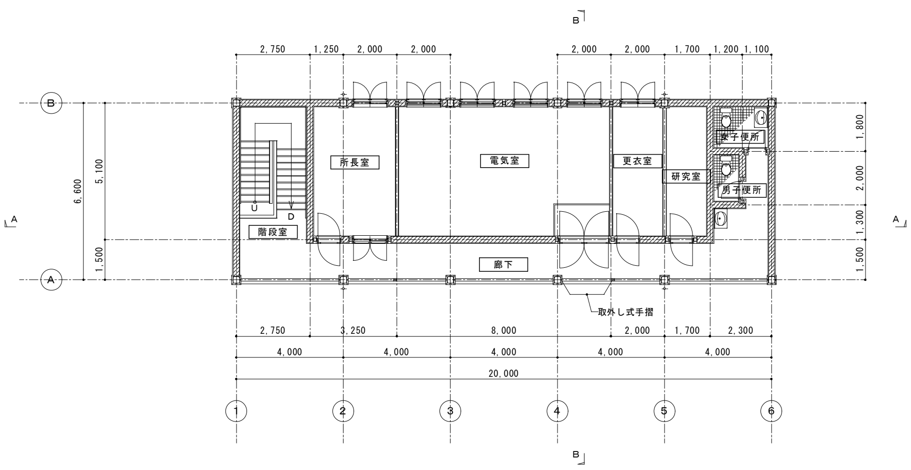
DATE

PREPARED BY

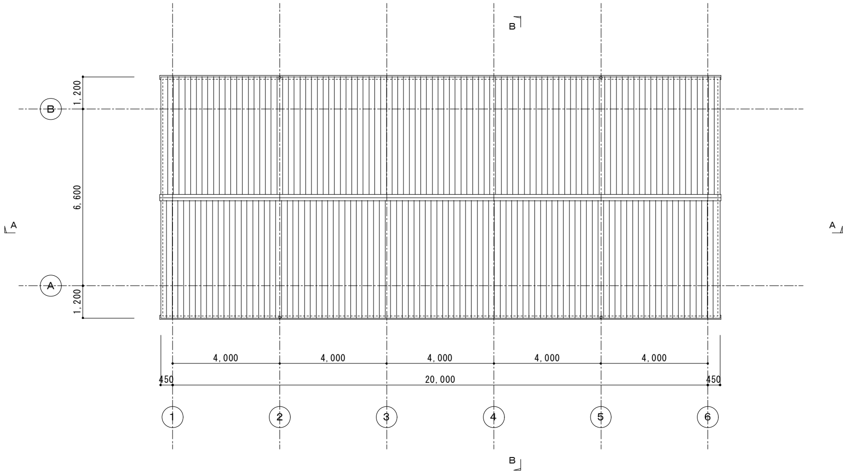
DATE

DRAWING No
SE-001

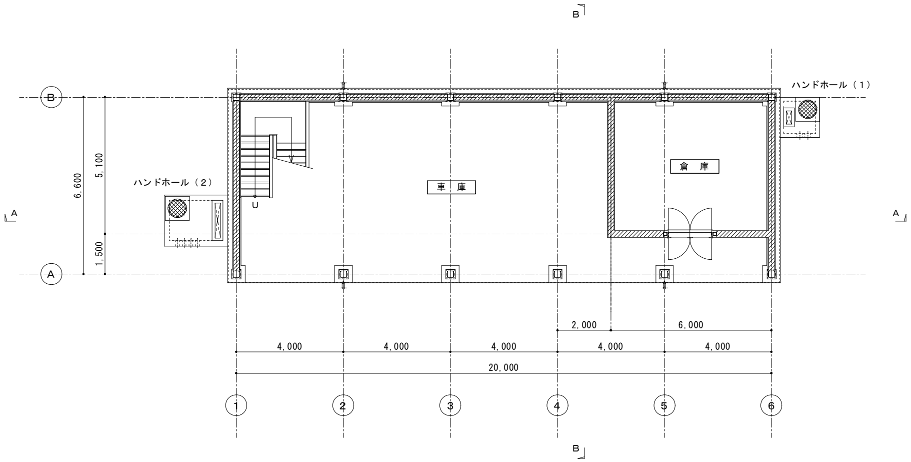
SCALE
1 : XXX
1 : XXX



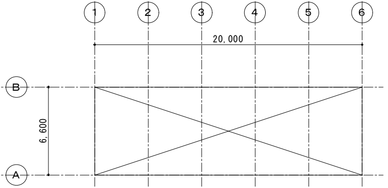
2階　平面図　　1／100



屋根伏図　　1／100

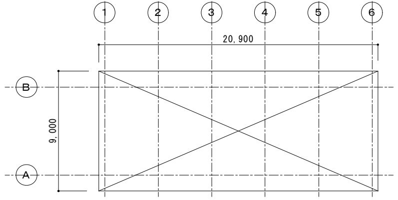


1階　平面図　　1／100



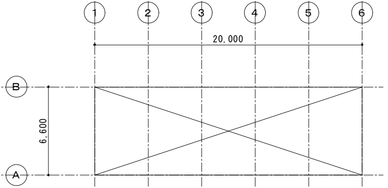
2階床面積　20.000　×　6.600　＝　132.000

2階　求積図　　1／200



建築面積　20.900　×　9.000　＝　188.100

建築面積求積図　　1／200



1階床面積　20.000　×　6.600　＝　132.000

1階　求積図　　1／200

建築面積	188.10　m2
2階床面積	132.00　m2
1階床面積	132.00　m2
延　面　積	264.00　m2

PROJECT

Preparatory Survey on
Water Quality Improvement Project for Japanese Bridge Area,
Hoi An in Socialist Republic of Vietnam

DESCRIPTION

Sample: STP General Plan

管理棟　求積図・平面図

NIHON SUIDO CONSULTANTS CO., LTD.

APPROVED BY

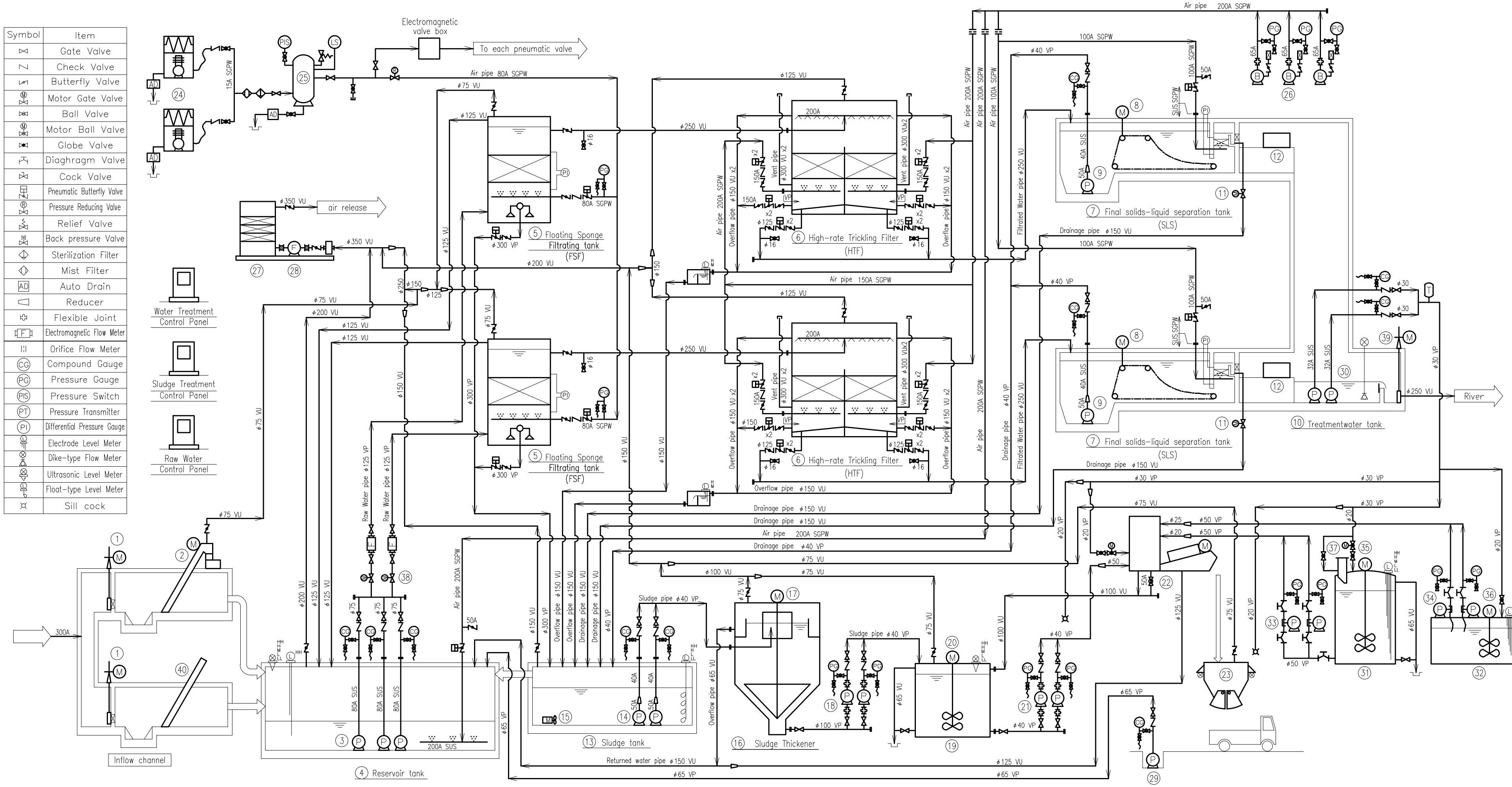
DATE

PREPARED BY

DATE

DRAWING No
SE-001

SCALE
1 : XXX
1 : XXX



Symbol	Item
	Gate Valve
	Check Valve
	Butterfly Valve
	Motor Gate Valve
	Ball Valve
	Motor Ball Valve
	Globe Valve
	Diaghragm Valve
	Cock Valve
	Pneumatic Butterfly Valve
	Pressure Reducing Valve
	Relief Valve
	Back pressure Valve
	Sterilization Filter
	Mist Filter
AD	Auto Drain
	Reducer
	Flexible Joint
F	Electromagnetic Flow Meter
	Orifice Flow Meter
CG	Compound Gauge
PG	Pressure Gauge
PIS	Pressure Switch
PT	Pressure Transmitter
PI	Differential Pressure Gauge
L	Electrode Level Meter
	Dike-type Flow Meter
	Ultrasonic Level Meter
L	Float-type Level Meter
¤	Sill cock

Tag No.	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫	⑬	⑭	⑮
Item	Inflow gate	Auto Screen	Raw water pump	Reservoir tank	Floating Sponge Filtrating tank (FSF)	High-rate Trickling Filter (HTF)	Final solids-liquid separation tank (SLS)	Sludge collector	Sludge transfer pump (1)	Treatmentwater tank	Motorized valve (1)	UV	Sludge tank	Sludge transfer pump (2)	Submersible mixer
Type	Square type	Course type	Submersible pump	RC product	Steel sheet product	Steel sheet product	Filtration system	Chain flight type	Submersible pump	RC cubic tank	–	Open type	RC product	Submersible pump	Agitating submersible mixer
Spec.	W500mm×H500mm	20mm	casing FC,impeller FC	RC	SUS304	–	RC	–	casing FC,impeller FC	RC	–	–	RC	casing FC, impeller FC	casing FC,impeller SUS
	–	W1000mm	0.8m^3/min×12mH	HRT4h×333m^3	4.0m^2x300m^3/m^2/d	38.5m^2x30m^3/m^2/d	25m^2x30m^3/m^2/d	6.0mL×4.25mW	0.13m^3/min×4.0mH	HRT 5min×9m^3	–	1000m^3/d	150m^3	0.13m^3/min×7.0mH	13m^3/min
	400Vx50Hz , 0.75kW	400Vx50Hz , 0.75kW	400Vx50Hz , 3.7kW	–	–	–	–	0.75kW	400V×50Hz , 0.4kW	–	400Vx50Hz , 0.4kW	400V×50Hz , 1.8kW	–	400V×50Hz , 0.4kW	400Vx50Hz , 2.8kW
QTY	2	1	3 (1)	1	2	2	2	2	2	1	2	2	1	2 (1)	1
Remark			Discharge bore:80A						Discharge bore: 50A					Discharge bore:50A	

Tag No.	⑯	⑰	⑱	⑲	⑳	㉑	㉒	㉓	㉔	㉕	㉖	㉗	㉘	㉙	㉚
Item	Sludge Thickener	Sludge collector (for Sludge thickner)	Sludge thickener pump	Sludge service tank	Sludge service tank mixer	Sludge feed pump	Dehydrator	Cake container	Air compressor	Air tank	Blower	Deodorization apparatus	Brower (for Deodorization apparatus)	Drain pump	Water supply system
Type	Steel plate tank	Central drive type	Suction screw pump	Rectangular tank	Vertical type mixer	Suction screw pump	Multi-displate Screw Press type	Steel plate product	Oil free bebicon type	Steel plate cylindrical tank	Root blower	Activated carbon type deodrizing system	Root blower	Submersible pump	Submersible pump
Spec.	SS400	SUS304	casing FC, impeller FC	SS400	–	casing FC, impeller FC	SUS304	SS400	–	SS400	–	–	–	casing FC,impeller FC	–
	φ3600×3000H	–	0.04m^3/min×5.0mH	φ2300×2500H	10m^3	0.05~0.09m^3/min×2.5mH	30kg-DS/h,750W×325L	4m^3	20L/min×0.85MPa	0.2m^3×0.98MPa	3.4m^3/min×30kPa	30m^3/min	30m^3/min	0.1m^3/min×15mH	150L/min
	–	400V×50Hz , 0.4kW	400V×50Hz , 0.4kW	–	400V×50Hz , 3.7kW	400V×50Hz , 0.4kW	1kW	400Vx50Hz , 0.75x2kW	400Vx50Hz , 0.2kW	–	400V×50Hz , 2.7kW	–	400V×50Hz , 3.7kW	400Vx50Hz , 2.2kW	400Vx50Hz , 0.75kW
QTY	1	1	2 (1)	1	1	2 (1)	1	1	2 (1)	1	3 (1)	1	1	1	1
Remark			Discharge bore:40A			Discharge bore:40A					Discharge bore: 65A		Discharge bore: 350A	Discharge bore:65A	

Tag No.	㉛	㉜	㉝	㉞	㉟	㊱	㊲	㊳	㊴	㊵					
Item	Chemical solution tank (A)	Chemical solution tank (B)	Chemical injection pump (A)	Chemical injection pump (B)	Chemical solution tank mixer (A)	Chemical solution tank mixer (B)	Polymer feeder	Motorized valve (2)	Outflow gate	Screen					
Type	PE cylindrical tank	PE rectangular tank	Diaphragm type	Diaphragm type	Vertical type	Vertical type	Tranparent plastic product	–	Round type	Course type					
Spec.	PE	PVC	PVC , PVDF	PVC , PVDF	–	–	–	–	φ250mm	20mm					
	2.0m^3	200L	1.17~2.5L/min×0.2MPa	25~80mL/min×0.2MPa	2.0m^3	150L	10L	–	–	W1000mm					
	–	–	400V×50Hz , 0.75kW	400V×50Hz , 0.4kW	400V×50Hz , 0.75kW	400V×50Hz , 0.1kW	–	400Vx50Hz , 0.2kW	400Vx50Hz , 0.75kW	–					
QTY	1	1	2 (1)	2 (1)	1	1	1	2	1	1					
Remark															

PROJECT

Preparatory Survey on
Water Quality Improvement Project for Japanese Bridge Area,
Hoi An in Socialist Republic of Vietnam

DESCRIPTION

Flow sheet

NIHON SUIDO CONSULTANTS CO., LTD.

APPROVED BY

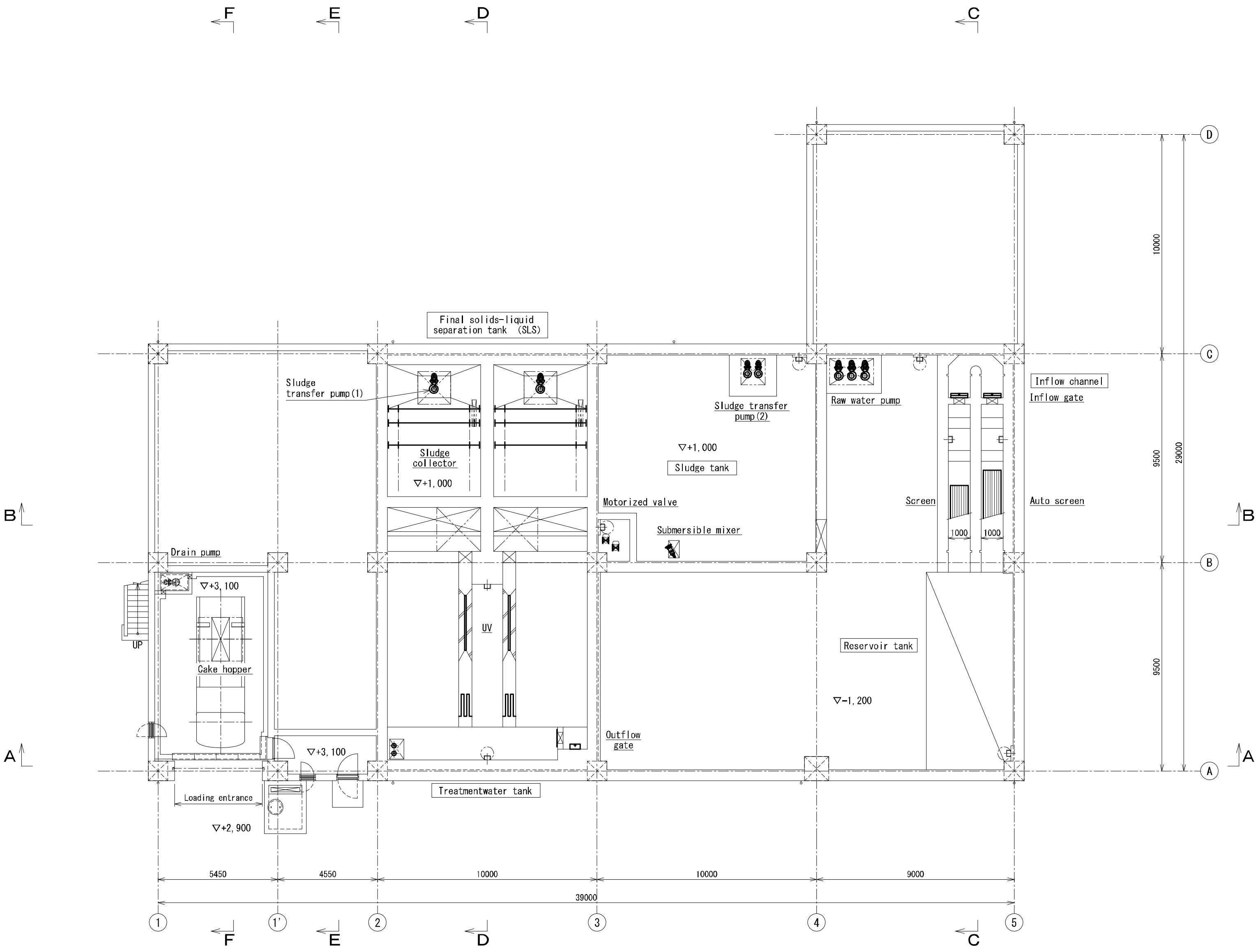
DATE

DRAWING No
SM-001

PREPARED BY

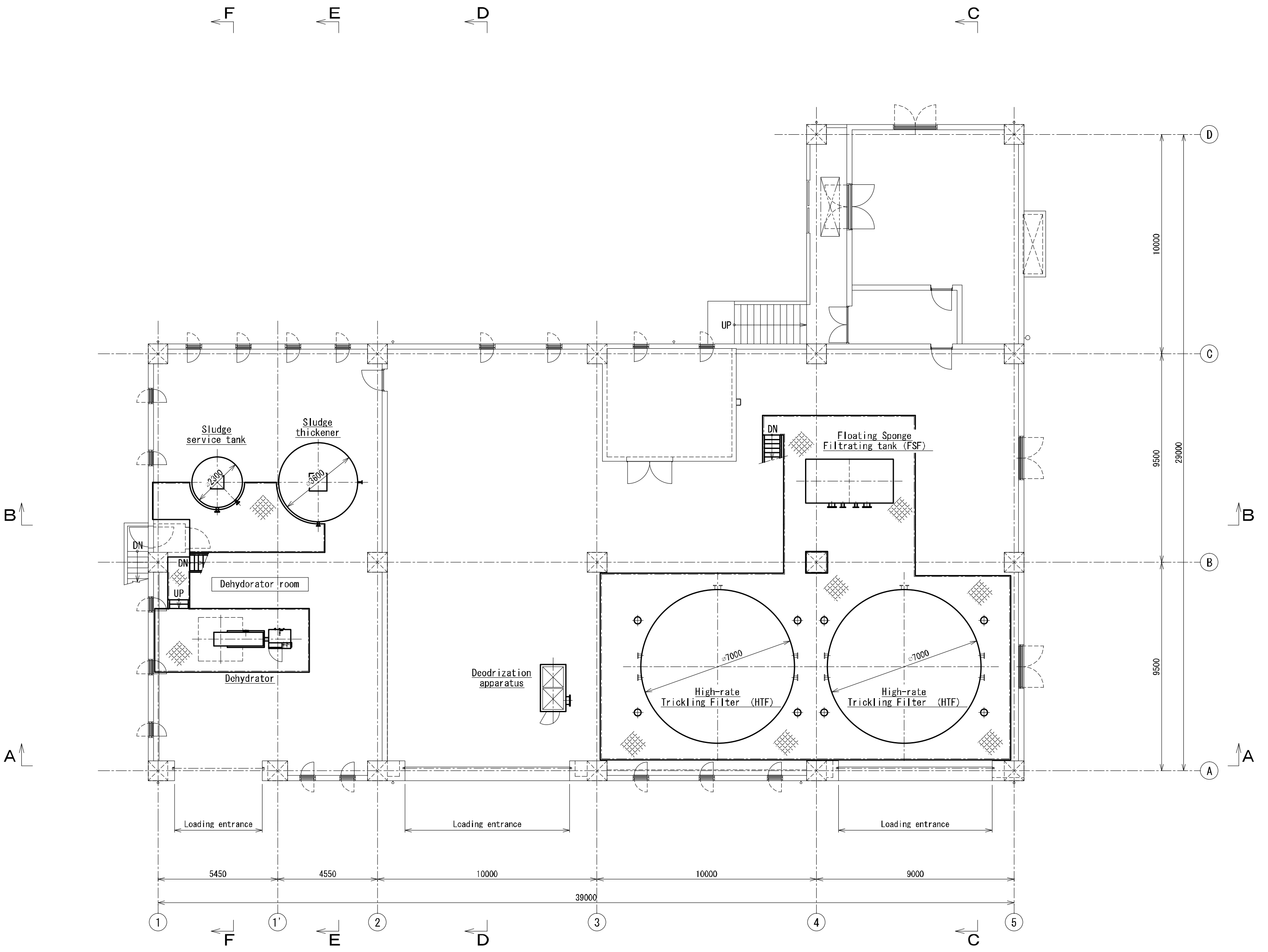
DATE

SCALE
NONE



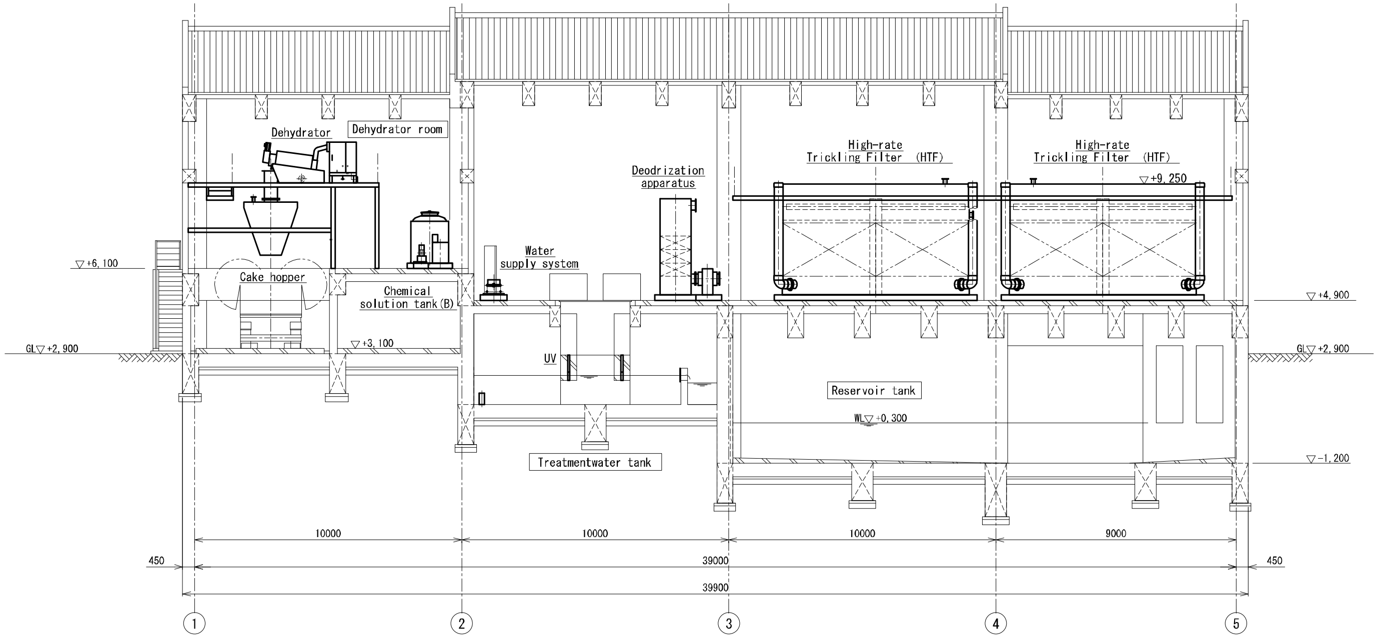
Lower floor

PROJECT	DESCRIPTION		APPROVED BY	DATE	DRAWING No
Preparatory Survey on Water Quality Improvement Project for Japanese Bridge Area, Hoi An in Socialist Republic of Vietnam	Phase floorplan(1/3)				SM-002
		NIHON SUIDO CONSULTANTS CO., LTD.	PREPARED BY	DATE	SCALE S=1:200

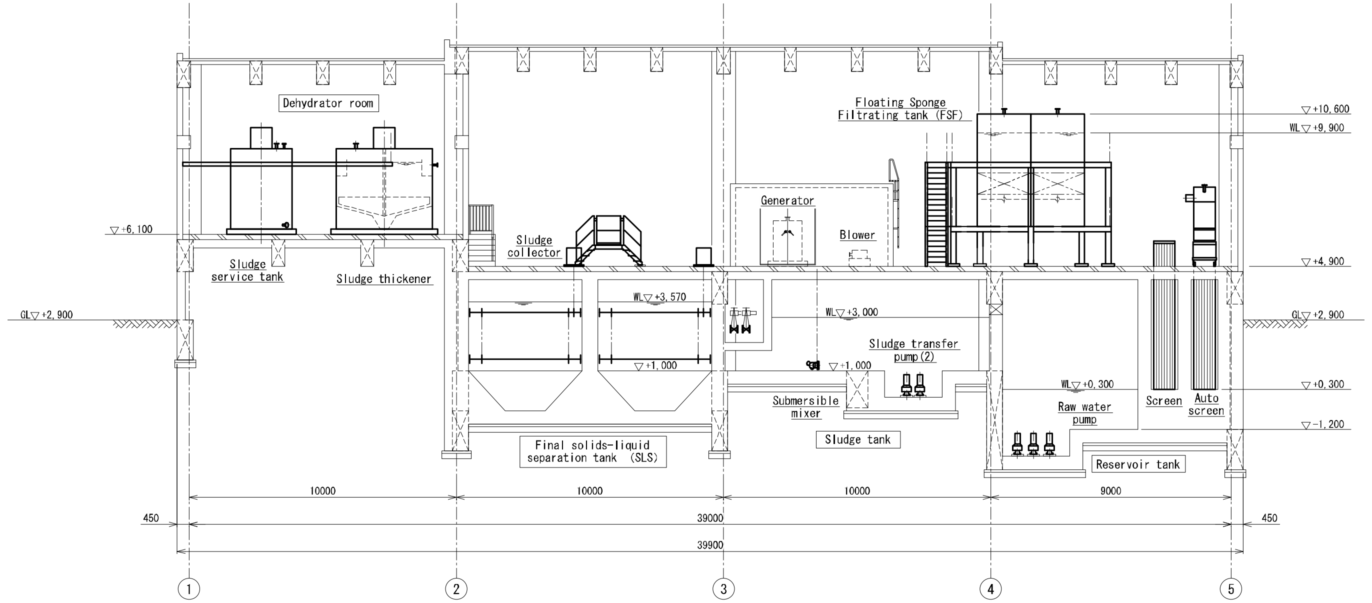


Upper floor

PROJECT Preparatory Survey on Water Quality Improvement Project for Japanese Bridge Area, Hoi An in Socialist Republic of Vietnam	DESCRIPTION Phase floorplan(3/3)		APPROVED BY	DATE	DRAWING No SM-004
		NIHON SUIDO CONSULTANTS CO., LTD.	PREPARED BY	DATE	SCALE S=1:200



A-A



B-B

PROJECT

Preparatory Survey on
Water Quality Improvement Project for Japanese Bridge Area,
Hoi An in Socialist Republic of Vietnam

DESCRIPTION

Cross section(1/2)

NIHON SUIDO CONSULTANTS CO., LTD.

APPROVED BY

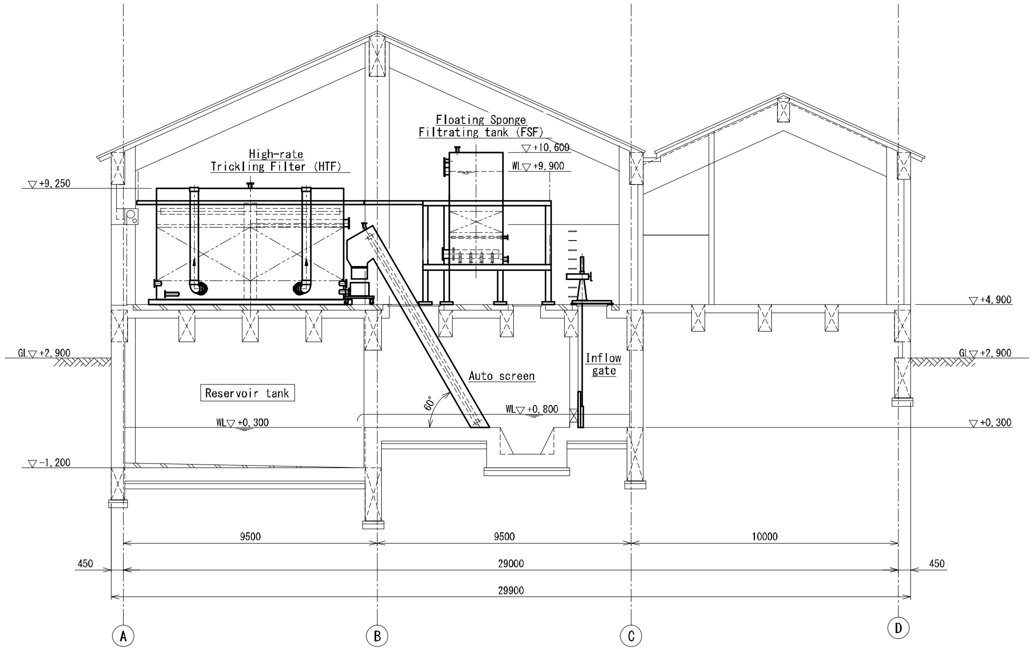
DATE

DRAWING No
SM-005

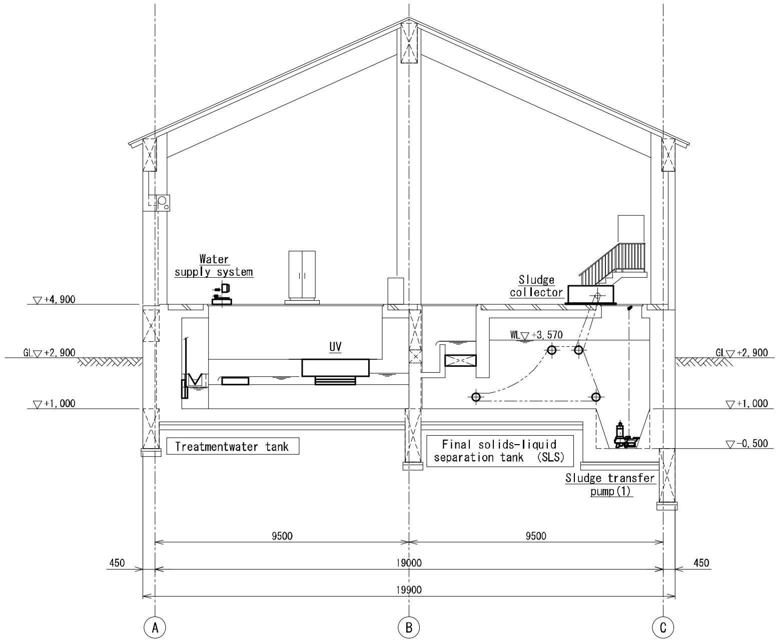
PREPARED BY

DATE

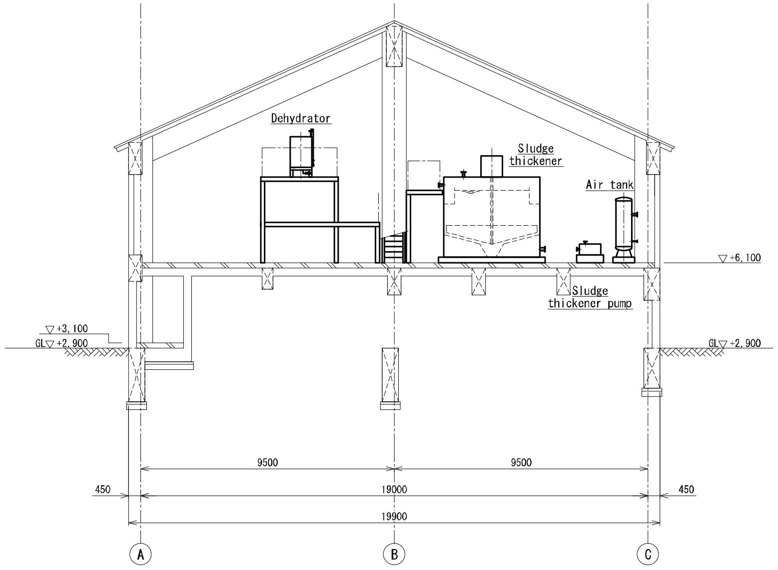
SCALE
S=1:200



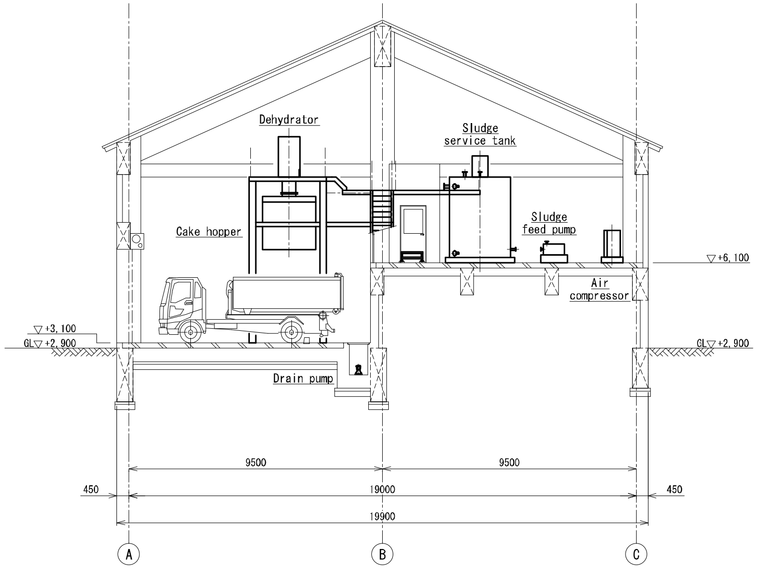
C-C



D-D



E-E



F-F

PROJECT
Preparatory Survey on
Water Quality Improvement Project for Japanese Bridge Area,
Hoi An in Socialist Republic of Vietnam

DESCRIPTION
Cross section(2/2)

NIHON SUIDO CONSULTANTS CO., LTD.

APPROVED BY

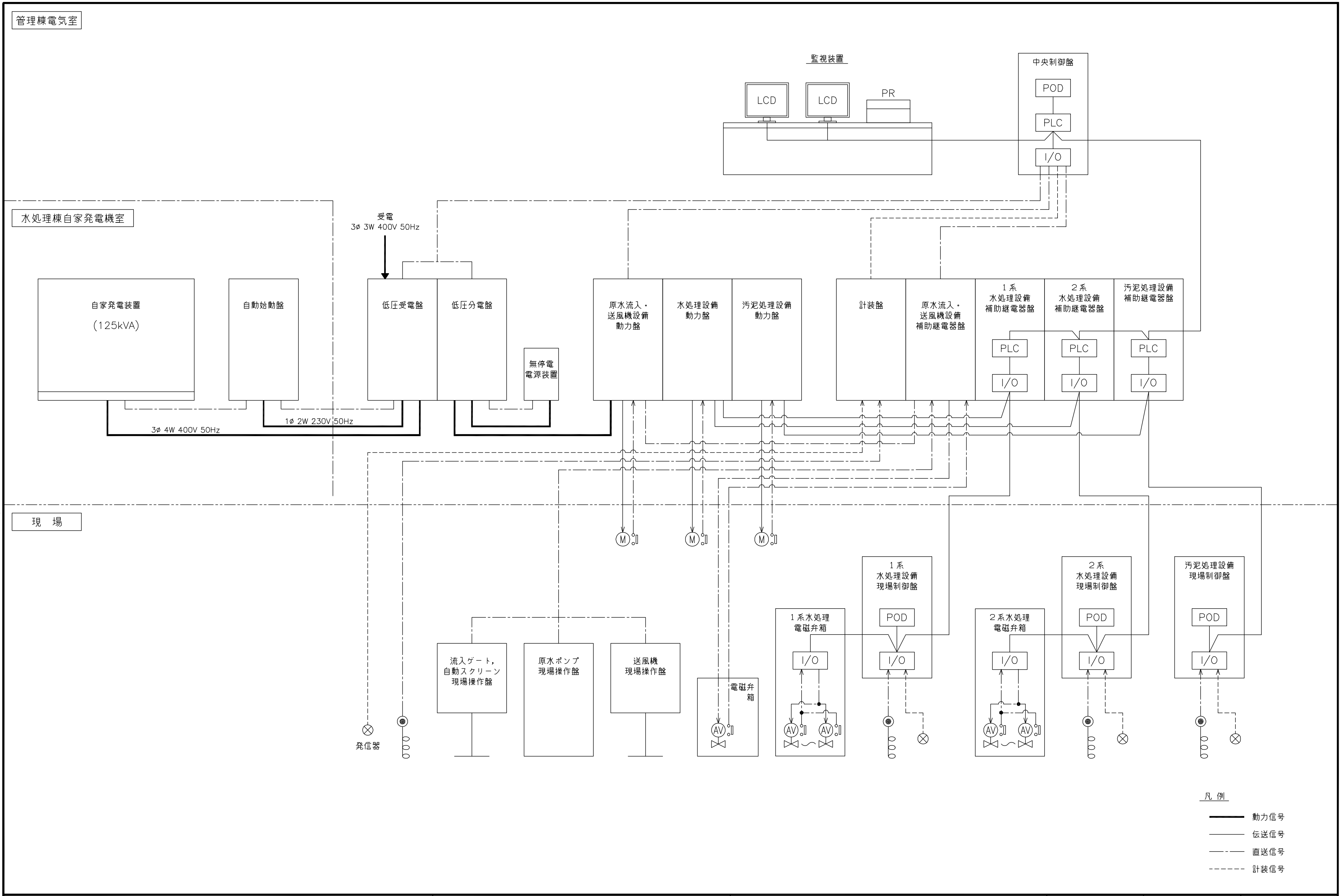
PREPARED BY

DATE

DATE

DRAWING No
SM-006

SCALE
S=1:200



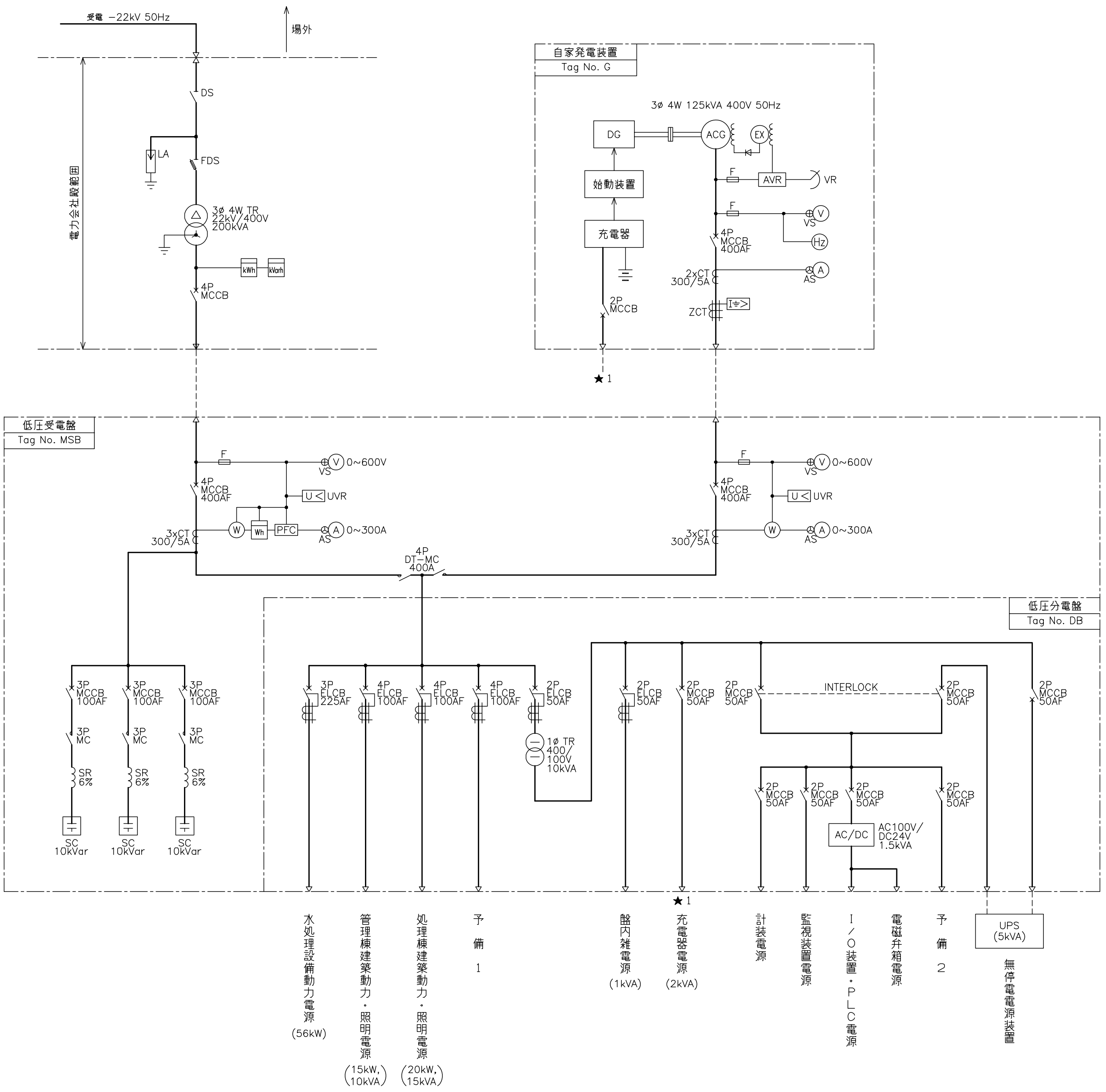
PROJECT
Preparatory Survey on
Water Quality Improvement Project for Japanese Bridge Area,
Hoi An in Socialist Republic of Vietnam

DESCRIPTION
システム系統図

NIHON SUIDO CONSULTANTS CO., LTD.

APPROVED BY
DATE
DRAWING No
001

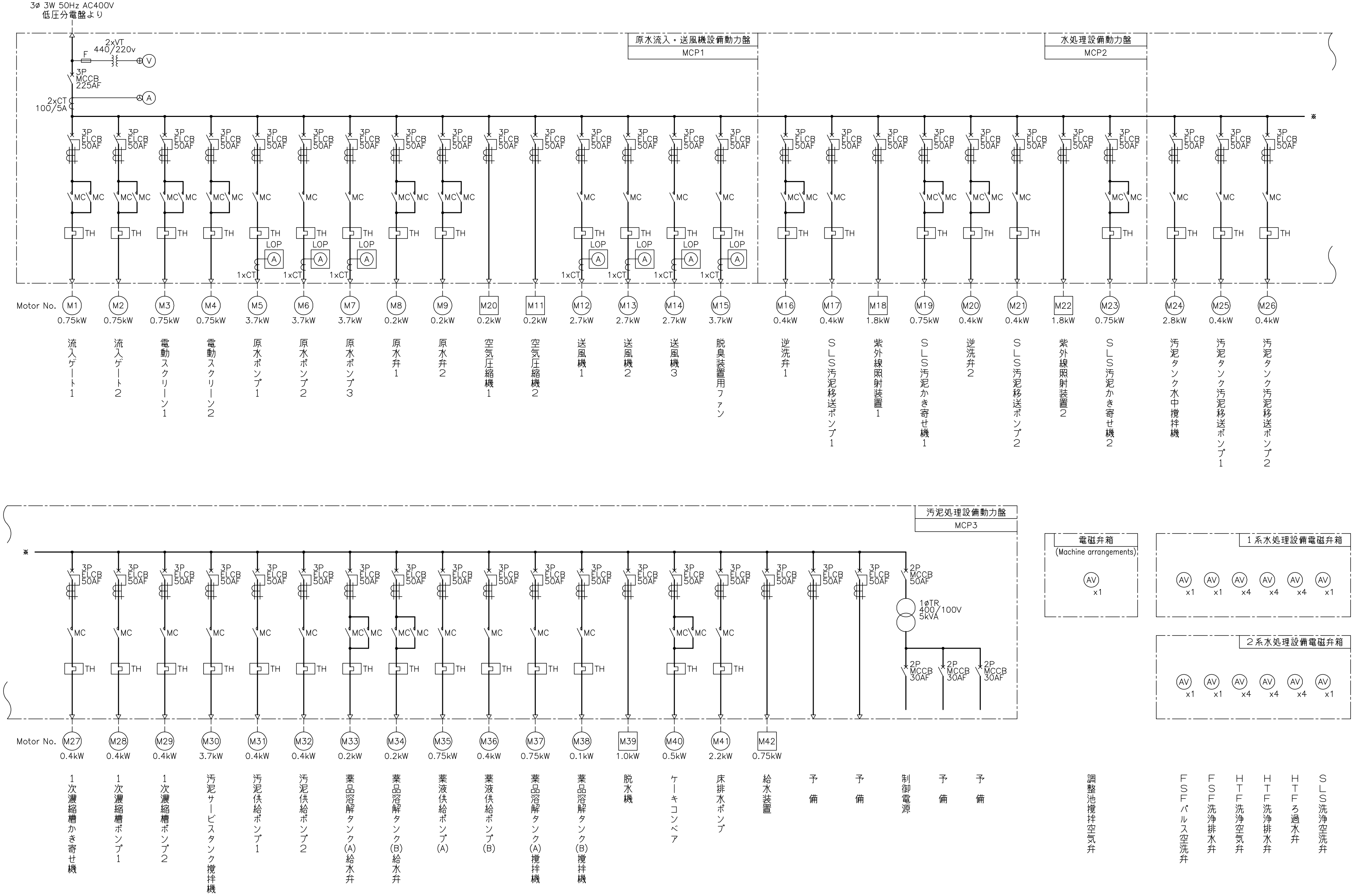
PREPARED BY
DATE
SCALE
NONE



凡例

No.	記　号	名　　称
1	TR	変圧器
2	A	電流計
3	V	電圧計
4	AS	電流計切換スイッチ
5	VS	電圧計切換スイッチ
6	W	電力計
7	Hz	周波数計
8	Wh	電力量計
9	PFC	力率自動調整装置
10	MCCB	配電用遮断器
11	ELCB	漏電遮断器
12	DT−MC	双投電磁接触器
13	MC	電磁接触器
14	SC	コンデンサ
15	SR	直列リアクトル
16	LA	避雷器
17	CT	変流器
18	VT	電圧変換器
19	ZCT	零相変流器
20	F	ヒューズ
21	TH	サーマルリレー
22	DE	ディーゼルエンジン
23	ACG	交流発電機
24	U<	不足電圧継電器
25	I≑>	地絡過電流継電器
25	UPS	無停電電源装置

PROJECT	DESCRIPTION		APPROVED BY	DATE	DRAWING No
Preparatory Survey on Water Quality Improvement Project for Japanese Bridge Area, Hoi An in Socialist Republic of Vietnam	受電単線結線図				002
		NIHON SUIDO CONSULTANTS CO., LTD.	PREPARED BY	DATE	SCALE NONE



PROJECT
Preparatory Survey on
Water Quality Improvement Project for Japanese Bridge Area,
Hoi An in Socialist Republic of Vietnam

DESCRIPTION
動力盤単線結線図

NIHON SUIDO CONSULTANTS CO., LTD.

APPROVED BY

DATE

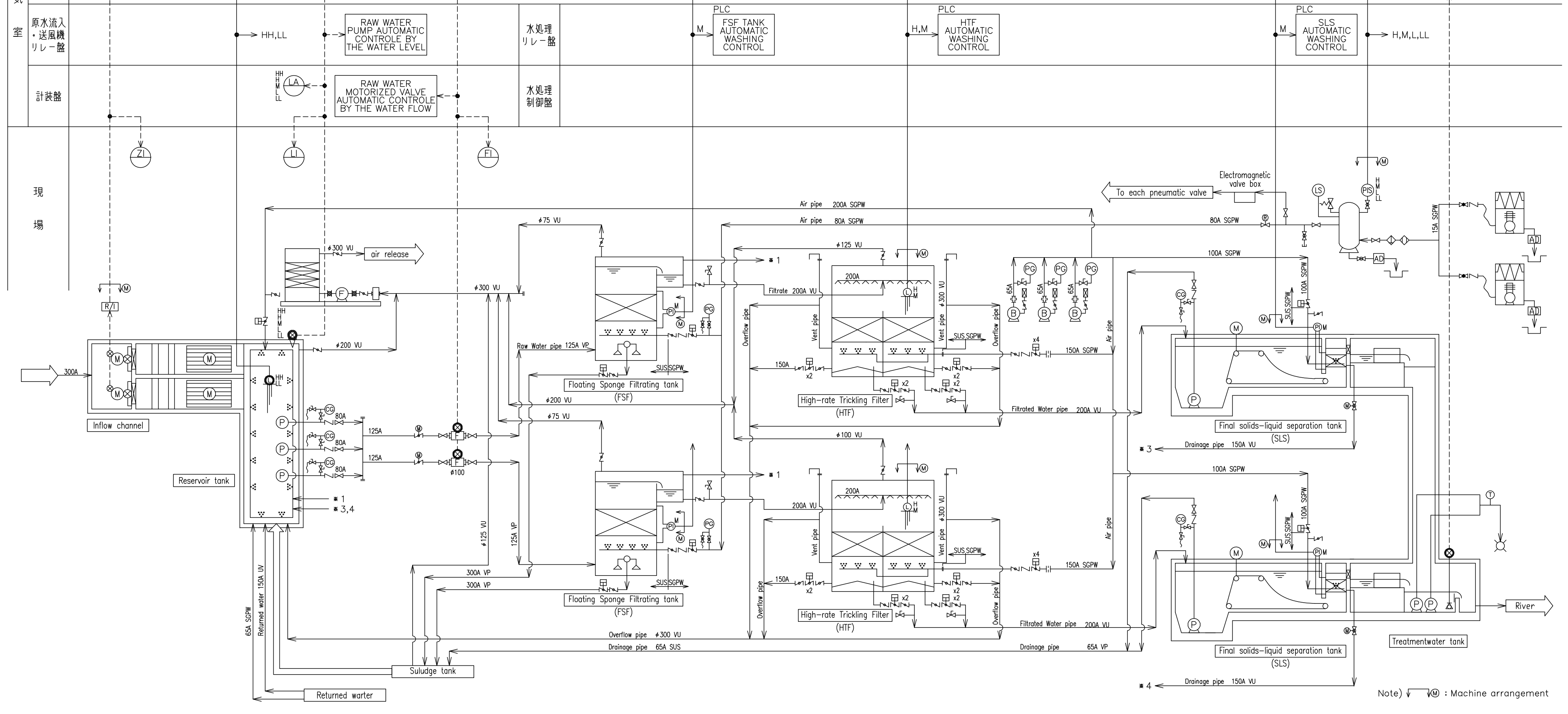
DRAWING No
003

PREPARED BY

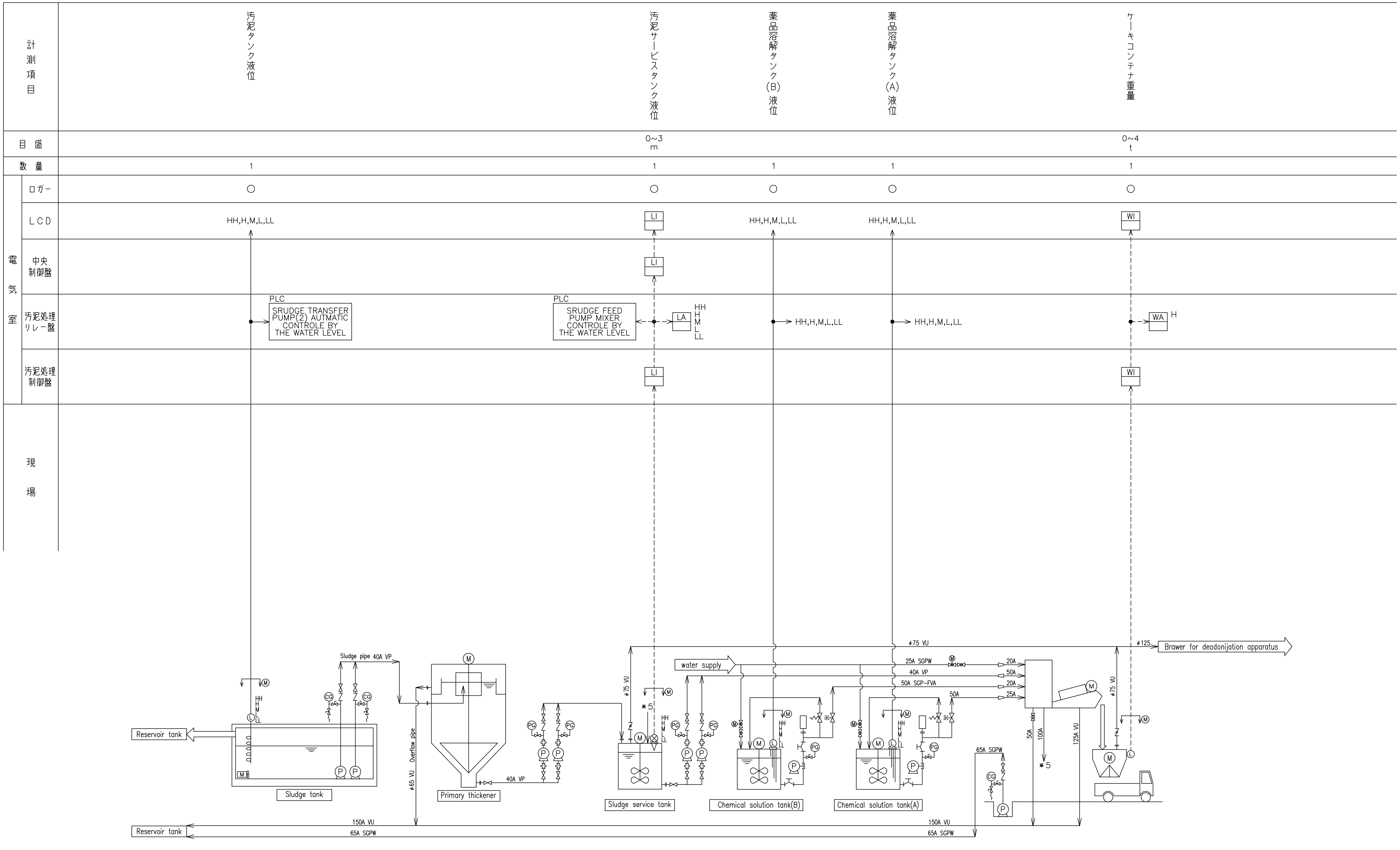
DATE

SCALE
NONE

	計測項目	流入弁開度	原水貯留槽水位	原水貯留槽水位	原水流量	FSFろ抗	HTF水位	SLSろ抗	空気槽圧力	処理水槽流量
	目盛	0~100 %		0~5 m	0~100 m³/h	0~15 kpa		0~15 kpa		0~100 m³/h
	数量	2	1	1	2	2	2	2	1	1
電気室	ロガー	○	○	○	○	○			○	○
	LCD	ZI	HH,LL	LI	FI	PI	H,M	PI	H,M,L,LL	FI
	中央制御盤	ZI		LI	FI	PI		PI		FI



PROJECT	DESCRIPTION		APPROVED BY	DATE	DRAWING No
Preparatory Survey on Water Quality Improvement Project for Japanese Bridge Area, Hoi An in Socialist Republic of Vietnam	計装フローシート 1	NIHON SUIDO CONSULTANTS CO., LTD.			009
			PREPARED BY	DATE	SCALE NONE



Note) ↓ ↓Ⓜ : Machine arrangement

PROJECT	DESCRIPTION		APPROVED BY	DATE	DRAWING No
Preparatory Survey on Water Quality Improvement Project for Japanese Bridge Area, Hoi An in Socialist Republic of Vietnam	計装フローシート 2				010
		NIHON SUIDO CONSULTANTS CO., LTD.	PREPARED BY	DATE	SCALE NONE