SOCIALIST REPUBLIC OF VIETNAM
MINISTRY OF CONSTRUCTION

LOCAL WATER SUPPLY AND WASTEWATER SECTOR SURVEY

TECHNICAL REPORT ON WATER SUPPLY AND WASTEWATER PROJECTS IN BINH DUONG

FINAL REPORT

January 2015

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

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

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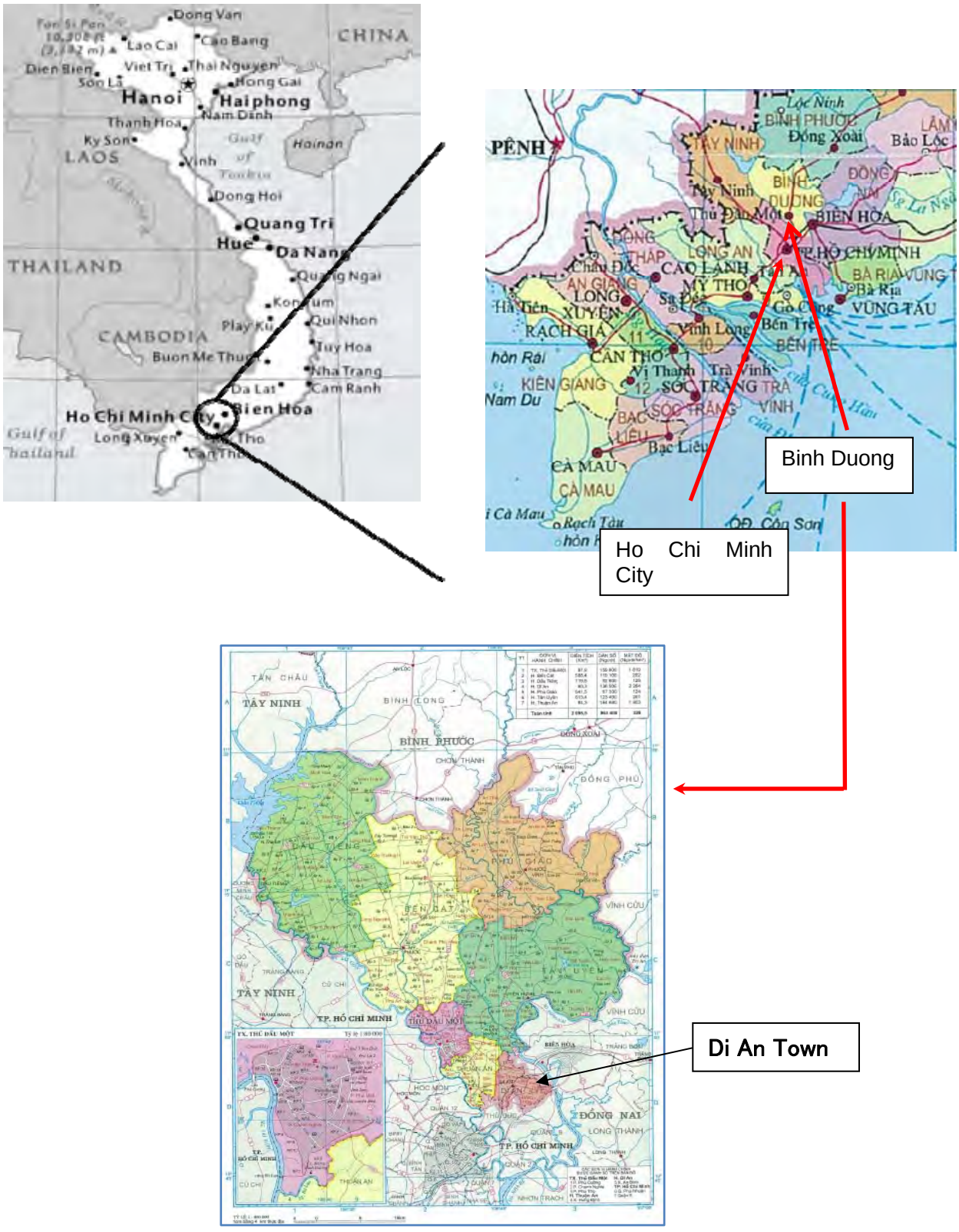
SOUTHERN BINH DUONG PROVINCE WATER ENVIRONMENT IMPROVEMENT PROJECT PHASE III, AREA OF DI AN TOWN IN THE SOCIALIST REPUBLIC OF VIETNAM

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

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



Location Map of Project Area

LOCAL WATER SUPPLY AND WASTEWATER SECTOR SURVEY
TECHNICAL REPORT ON
SOUTHERN BINH DUONG PROVINCE WATER ENVIRONMENT IMPROVEMENT PROJECT PHASE III, AREA OF DI AN TOWN

FINAL REPORT

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ABBREVIATIONS

ASBR	Advanced Squent Biological Reactor
DIP	Ductile Iron Pipe
DN	Nominal Diameter
F/S	Feasibility Study
HDPE	High Density Polyethylene Pipe
JICA	Japan International Cooperation Agency
JPY	Japanese Yen
M/M	Man Month
USD	United State Dollar
VAT	Value Added Tax
VND	Vietnamese Dong
WWTP	Wastewater Treatment Plant

1. Introduction

This Technical Report is prepared to facilitate the formation of a Japanese Loan project for implementation of the Southern Binh Duong Province Water Environment Improvement Project Phase III, Area of Di An Town (the Project III). The contents of this Technical Report are summary of the Investment Report (Feasibility Study Report) of the Project III prepared by Binh Duong Water Supply – Sewerage - Environment Co., Ltd.

2. Present Status of Wastewater Treatment in Di An Town

2.1. Present Status of Wastewater Treatment in Industrial Parks, Industrial Zones, and Individual Production Facilities

- Wastewater collection sewer and treatment plant are planned to meet the standards type in the planning of industrial development projects, and then treated water is discharged to public water courses. Song Than 1 and 2 industrial parks have sewer network of wastewater collection and treatment plants.
- Some individual factories only have internal treatment plan by which wastewater is treated partially. Wastewater is drained to pit of self-absorbed or rainwater drainage system. Some industrial facilities do not have a good treatment caused pollution for many canals and the surrounding residential areas.

2.2. Present Situation of Wastewater Treatment in Residential Area

The residential areas in Di An town including residential Di An ward do not have wastewater collection and treatment facilities. Wastewater from toilets is processed by self-absorbed or drained to rainwater drainage system. Typically, Mu U stream in Tan Binh commune is seriously polluted.

3. Candidate Components of ODA Loan Project

3.1. Scope of Work of the Project

According to Resolution No. 04/NQ-CP dated 13/01/2011 about the establish of Di An town and Thuan An town, Di An town with an natural area of 6,010 hectares with 7 wards which are Di An, An Binh, Tan Dong Hiep, Dong Hoa, Tan Binh, Binh An and Binh Thang.

With consideration of the current development situation (2013) as well as in accordance with geographical and transport development, the scope of the Project III was proposed including Di An ward, Tan Dong Hiep ward and a part of Binh An ward, Dong Hoa ward and Tan Binh ward with a total area of 1,600 ha with served population of 89.000 people in 2020. The service area of wastewater collection and location of wastewater treatment plant (WWTP) of the Project III are shown in **Figure 3.1.1**.

The candidate of ODA loan project, the Project III consists of WWTP, sewers, and pumping stations as summarized in **Table 3.1.1.**

Table 3.1.1 Main Facilities of the Project III

Facility	Description	Quantity	Remarks
Main Sewers	HDPE pipe DN300 - 400 PU-coated DIP DN500 - 1000 HDPE pipe DN1086/1200 HDPE pipe DN150 - 500	41,916 m 11,028 m 1,499 m 5,300 m	
Pumping Station		9 stations	
Wastewater Treatment Plant (WWTP)	ASBR	15.000 m^3/day	1)

1) Treatment plant of 2020 period of 15,000 m^3/day, the land to build the treatment plant planned for a total capacity for all phases of 60.000 m^3/day

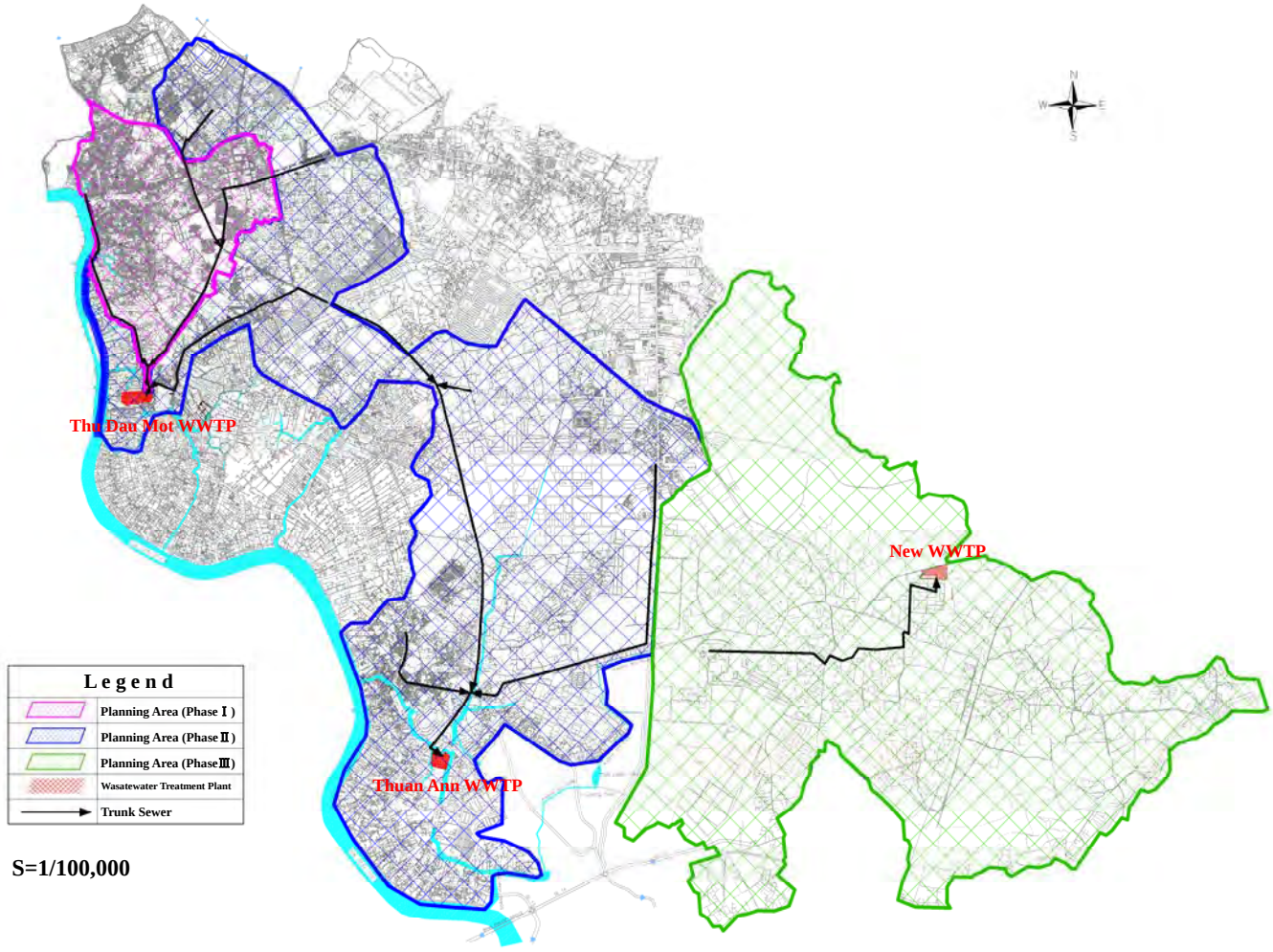


Figure 3.1.1 General Plan of the Southern Binh Duong Province Water Environment Improvement Project Phase III, Area of Di An Town

Total population in 12/2012 at Di An town is 365,120 people (source Di An Department statistics). Expected population growth of the next period as follows:

- Period 2013 - 2020: 3.5%

- Period 2020 - 2025: 2.5%
- Period 2025 - 2030: 2.0%
- Period 2030 - 2035: 1.0% (population gradually grow to saturation)

Results of population projection and capacity of WWTP are shown in **Table 3.1.2** and **Table 3.1.3.**

Table 3.1.2 Population Projection for the Project III

Area Ward	Population 12/ 2012	Population forecast 2030	Percentage of population with wastewater collection in 2020	Number of people with wastewater collection in 2020	Population Forecast 2035	Percentage of population with wastewater collection in 2035	Number of people with wastewater collection in 2035
Di An	86,606	110,187	30%	33,056	144,663	72%	104,157
An Binh	67,133	85,412	15%	12,812	112,136	50%	56,068
Tan Dong Hiep	93,785	119,321	27%	32,217	156,655	60%	93,993
Dong Hoa	51,326	65,301	15%	9,795	85,733	45%	38,580
Tan Binh	29,737	37,834	3%	1,135	49,671	30%	14,901
Binh An	22,963	29,215			38,356	30%	11,507
Binh Thang	13,570	17,265			22,667	30%	6,800
Total	**365,120**	**464,535**		**89,000**	**609,881**		**326,000**

Table 3.1.3 Wastewater for Treatment in the Project III

Area Ward	2020			2025		
	Population of service area in 2020	Drainage standard 2020 (l/people. day)	Wastewater capacity in 2020 m^3/day	Population of service area in 2035	Drainage standard 2035 (l/people. day)	Wastewater capacity in 2035 m^3/day
Di An	33,056	165	5,454	104,157	185	19,269
An Binh	12,812	165	2,114	56,068	185	10,373
Tan Dong Hiep	32,217	165	5,316	93,993	185	17,389
Dong Hoa	9,795	165	1,616	38,580	185	7,137
Tan Binh	1,135	165	187	14,901	185	2,757
Binh An	-			11,507	185	2,129
Binh Thanh	-			6,800	185	1,258
Total	**89,000**		**14,687**	**326,006**		**60,311**
Capacity of treatment plant			**15,000**			**60,000**

3.2. Implementation Schedule

Implementation program for the Project III is prepared for 84 months from preparation and approval of Feasibility Study Report to the end on commissioning test as shown in **Table 3.2.1**.

Table 3.2.1 Implementation Prgram

Description	2013		2014		2015		2016		2017		2018		2019		2020		Period
	H1	H2	H1	H2	H1	H2	H1	H2	H1	H2	H1	H2	H1	H2	H1	H2	(Months)
F/S preparation																	12
F/S Approval			☆	03/2014													
Selection of Consultant					03/2015												6
Land Acquisition and Clearance						06/2015											9
Detailed Design							06/2016										12
Selection of Contractor																	3
Construction															12/2019		42
Commissioning Test, training															03/2020		3

Note: This schedule is planned in Investment Report and actual schedule will be revised.

3.3. Project Cost

Project cost is estimated as VND 2,959 billion or JPY 13.6 billion based on the following conditions and summarized in **Table 3.3.1**.

- Exchange Rate
  - USD 1 = 21,000 VND
  - VND 1 = 0.0046 JPY
- Escalation Rate
  - For foreign currency : 1.6 % / year.
  - For local currency : 12.6 % / year.
- Physical Contingency
  Basically 5% (being determined according to the accuracy of project planning, design and cost estimate of the project).
- Remuneration for consulting services
  - Expert of group A: 2,591,000 JPY ／M/M ±10%
  - Expert of group B: 49,000,000VND ／M/M ±10%
  - Expert of group C: 25,000,000VND ／M/M ±10%
- Tax and VAT
  - Import tax 3% and VAT 10% of cost in foreign currency of purchase/construction
  - VAT 10% of cost in local currency of purchase / construction
  - Tax of consulting services : 15% of cost in consulting services
- Time base: 06/2013

- Sequence of estimation for the project
  - (1) Basic cost
  - (2) Basic cost x Escalation rate
  - (3) = ((1)+(2)) x Physical contingency
  - Project Cost = (1) + (2) + (3)

Table 3.3.1 Project Costs

No.	Item	Project Cost	
		VND	Equivalent JPY
1	Levelling and Fenc for WWTP	23.000.000.000	106.029.873
2	Construction costs for WWTP, 15,000 m3/day	400.285.000.000	1.845.311.636
3	Construction costs for pipeline network	1.179.647.300.000	5.438.167.527
4	Price Contingency	320.586.460.000	1.477.901.807
5	Physical Conitingency	192.351.876.000	886.741.084
6	Consulting Services	224.410.522.000	1.034.531.265
7	Land aquisition	118.600.000.000	546.745.344
8	Administration cost	160.293.230.000	738.950.904
9	VAT	160.293.230.000	738.950.904
10	Import tax	8.014.662.000	36.947.547
11	Tax for consulting services	28.852.781.000	133.011.161
12	Interests during construction	84.955.412.000	391.643.979
13	Commitment fee	32.058.646.000	147.790.181
14	Connection cost (capital turnover)	26.000.000.000	119.859.856
15	**Total**	**2.959.349.000.000**	**13.642.583.000**

Total project investment is VND 2.959.349.000.000 or JPY 13.642.583.000.
The sources of capital used include:

- Japan capital (JICA): JPY 11.596.195.550, appropriate to 85% of the total investment of the project.
- Corresponding capital: VND 443.902.000.000, appropriate to 15% of total investment by the provincial budgets to implement the preparatory investment work, compensation, land clearance, and other expenses according to Vietnam Law.

3.4. Land Acquisition and Compensation

As the design of the project, approximately 10 hectares of land are affected by the Project III. Period to land acquisition has began in 2013. The affected households will be compensated and supported according to policy of the Project III.

Total compensation costs, clearance support is estimated VND 118.6 billion.

The budget for the implementation of the resettlement plan is counterpart capital (budget is taken from

People's Committee of Binh Duong province).

3.5. Operation and Maintenance

Establishment of a management unit is proposed to manage the entire drainage system of the town including the new wastewater collection and treatment system invested in the Project III. Functions and tasks of management unit of drainage system are:

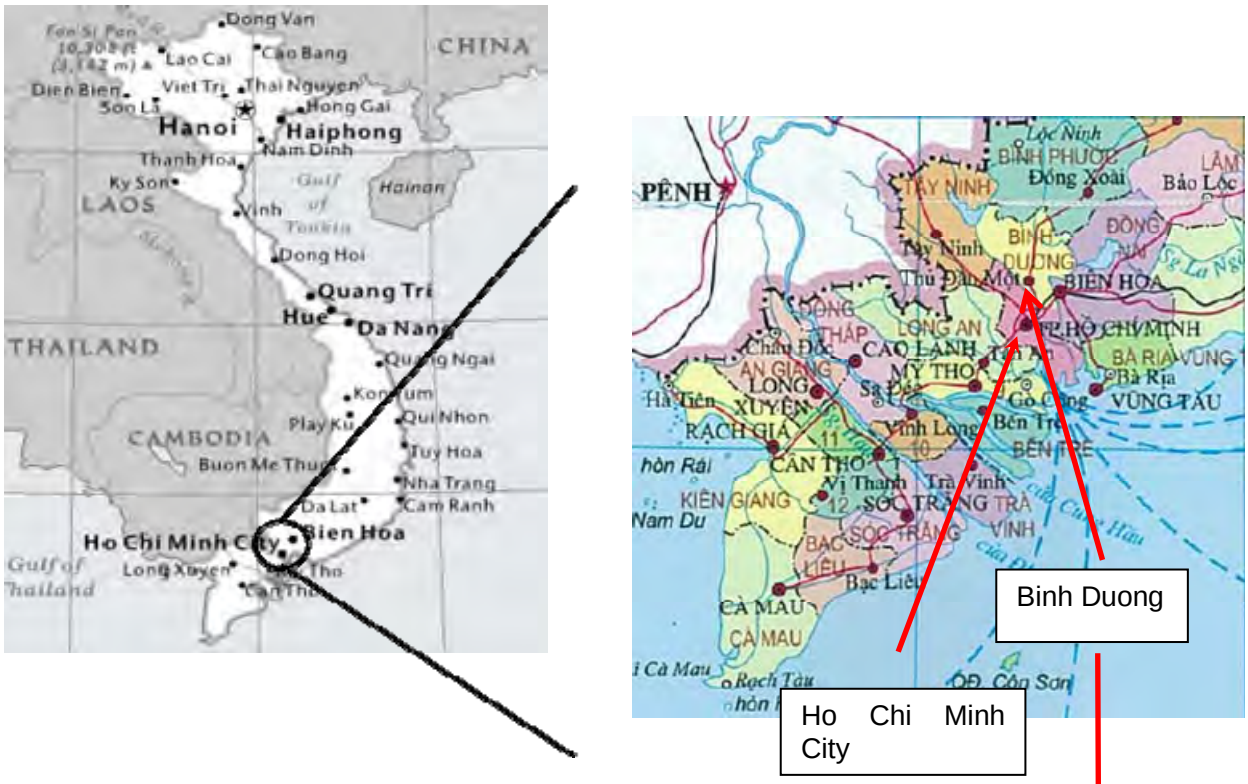
- Maintenance and management of drainage and sewerage system in the city, the suburban drainage channel, rainwater lake, and tide sluices. Periodic dredging and repair.
- Managing WWTP, testing, control of industrial wastewater in the handled area by the discharge standards into drainage system of the city and and rivers. For wastewater from households and offices will also been checked by this unit and allow to be discharged into the drainage system
- Construction and management of parks, trees, ponds, planting flowers to create a landscape for towns and climate control.
- Organization of charge fee for environment using wastewater treatment system.

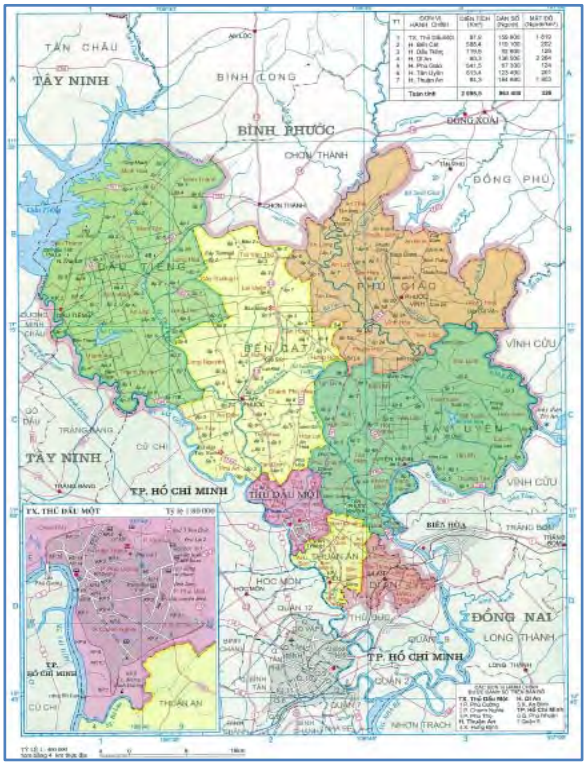
Expected personnel of the management unit are 15 persons of technical management staff and 30 persons of workers.

WATER SUPPLY PROJECT IN NEW CITY AND INDUSTRIAL PARKS IN NORTHERN PART OF BINH DUONG PROVINCE IN THE SOCIALIST REPUBLIC OF VIETNAM

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

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





Location Map of Project Area

LOCAL WATER SUPPLY AND WASTEWATER SECTOR SURVEY
TECHNICAL REPORT ON
WATER SUPPLY PROJECT IN NEW CITY AND INDUSTRIAL PARKS
IN NORTHERN PART OF BINH DUONG PROVINCE

FINAL REPORT

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ABBREVIATIONS

BDPPC	People's Committee of Binh Duong Province
BECAMEX IDC	Industrial Investment & Development One Member Inc. Ltd.
BIWASE	Binh Duong Water Supply – Sewerage - Environment Co., Ltd. Binh Duong Water Supply & Drainage Environment One-Member Company Ltd.
BOT	build, own and transfer
DIP	Ductile Iron Pipe
DN	Nominal Diameter
FRP	Fiberglass Reinforced Plastic Mortar Pipe
F/S	Feasibility Study
HDPE	High Density Polyethylene Pipe
JICA	Japan International Cooperation Agency
JPY	Japanese Yen
LFDC	Land Fund Development Center
NBDWTP	North Binh Duong Water Treatment Plant
NRW	Non-revenue water
O&M	Operation and Maintenance
ODA	Official Development Assistance
PAC	Polyaluminum Chloride
PMU	Project Management Unit
PPC	Provincial People's Committee

PPP	Public-Private Partnership
Pre-FS	Pre-feasibility Study
PVC	Polyvinyl Chloride Pipe
SP	Steel Pipe
SPC	Special Purpose Company
TOR	Terms of Reference
USD	United State Dollar
VND	Vietnamese Dong
WB	World Bank
WTP	Water Treatment Plant

1. Background of the Project

Binh Duong Province, which is the north of Ho Chi Minh City, has an important hub-function in the south of Vietnam. Having a geographical advantage, over 2,000 foreign companies and 150 Japanese companies have already started their business in 28 industrial parks. On the other hand, recent rapid urbanization has been creating a danger of fresh water shortage and impact to the water environment of the Province. The capacity of the treated water production will be outstripped by the rapidly increasing demand from the population and industry.

In Circular 7023/TB-BNN-XD (2007/12/24), it was decided that Binh Duong Water Supply Sewerage Environment Co., Ltd. (BIWASE) has water rights to intake raw water from the existing canal located in the north of the Binh Duong Province. In Decision, the Prime Minister permitted to start water treatment project in this area, and Pre-feasibility was prepared in April, 2011 funded by World Bank for the Water Supply System for Northern Binh Duong Province named "Options Study for Rehabilitation and Expansion of Water Services in Urban Areas HCMC and Binh Duong Province" (Options Study).

Based on the above pre-feasibility study, feasibility study was conducted by JICA to formulate a private sector participated project namely "The Preparatory Survey on Water Supply Project in New City and Industrial Parks in Northern Part of Binh Duong Province" (JICA Preparatory Survey), which aimed to clarify the necessity, viability and sustainability of the project in view of technical, financial, and environmental aspects, and to propose optimum implementation of water supply infrastructure on a PPP/BOT etc. basis or as a private project and operation and maintenance (O&M) schemes utilizing private funds, international funds, and public fund.

To provide an economically feasible water supply infrastructure for the water supply area.During the preparation of the above Preparatory Survey, general agreement on introducing BOT structure with an optimum demarcation between the public and the private sector was made as follow.

- Public Sector : Construction and O&M of Regulating Reservoir, Raw Water Transmission Pipeline, and Distribution Pipeline
- Private Sector : Construction and O&M of Raw Water Pumping Station and Water Treatment Plant (WTP)

2. Objective of the Technical Note

This technical note is prepared to facilitate the formation of a Japanese Loan project for implementation of the public sector portion of the Water Supply Project in New City and Industrial Parks in Northern Part of Binh Duong Province.

3. Development Need as PPP Infrastructure Project

The Vietnamese government declared policies in 2009 which include the expansion of water supply area and reduction of leakage ratio as stated in the Decision 1929/2009/QD-TTg. The targets of water supply coverage ratio in envisioned are 90% by 2015 and 100% by 2025, for urban areas of cities with a population of 50,000 or more. Binh Duong Province aims at increasing the water supply coverage ratio of the urban areas to 97% by 2015, as stipulated in Binh Duong Province Social Economy Development Plan (2011 to 2015). The water supply project in the new city and industrial park in the northern part of Binh Duong Province (the Project) will contribute to the above national target and development plan of Binh Duong Province.

Recent rapid urbanization and development of new industrial parks, and construction of main roads are underway. Some of the construction projects are delayed due to the shortage of government budget to cover the sharp increase the infrastructure developments across the country. Therefore, the government is shifting its policy to utilize private capital.

It is well-established that the water supply business can be financially independent, and the introduction of private funds in BOT and BOO schemes are encouraged.

4. Present Status of Water Supply in Binh Duong Province

4.1 Present Status of Water Supply in Binh Duong Province

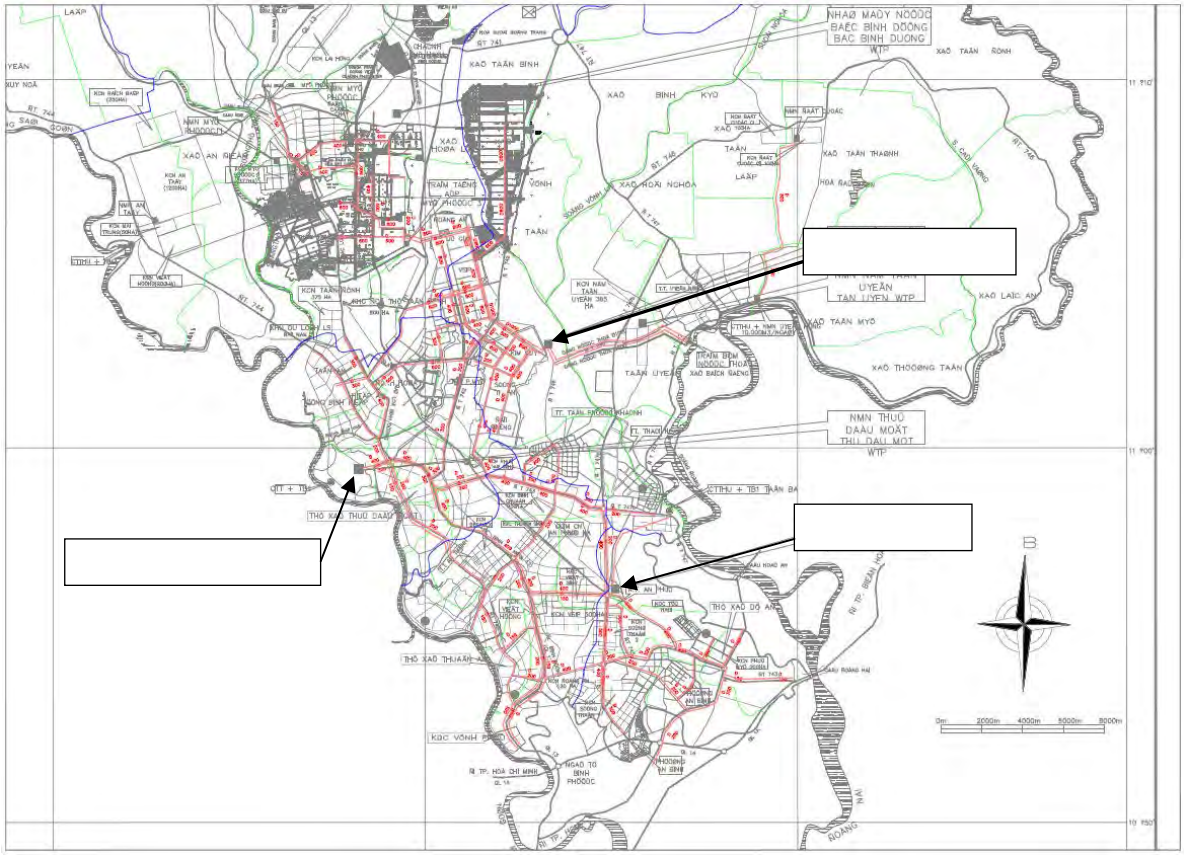
BIWASE is the service provider in the province having six water supply enterprises in the field of drinking water. The company deals consultancy, construction, and management services in the fields of environment, irrigation, water supply, solid waste, sewerage, civil and industrial construction, and other infrastructures.

There are 3 major and several small-scale Water Treatment Plants (WTP) in Binh Duong Province. The Production capacities and production records of the WTPs in 2012 are summarized in **Table 4.1**. The location of the WTPs and present distribution networks are shown in **Figure 4.1**.

Table 4.1 Capacity and Production of WTPs in 2012

No.	WTP	Capacity	Production	
		Daily Average	Daily Max.	Daily Average
1	Thu Dau Mot	21,600	21,906	18,868
2	Di An	90,000	117,000	105,000
3	Tan Hiep	60,000	18,124	14,155
4	My Phuoc I, II, III	29,000	35,230	31,600
5	Bau Bang	1,200	671	581
6	Uyen Hung	5,000	2,100	1,550
7	South Tan Uyen	3,000	3,900	3,500
8	Phuoc Vinh	1,200	1,900	1,000
9	Dau Tieng	1,000	2,600	1,800
Total		**211,000**	**203,431**	**178,054**

Source: BIWASE



Source: BIWASE

Figure 4.1 Existing Major Three WYPs and Distribution Mains

4.2 Present Situation of Water Supply Project in New City and Industrial Parks of Northern Part of Binh Duong Province

Final report on "Options Study for Rehabilitation and Expansion of Water Services in Urban Areas HCMC and Binh Duong Province" (Options Study) dated 14th April, 2011 funded by World Bank provides Pre-Feasibility Study for the Water Supply System for Northern Binh Duong Province.

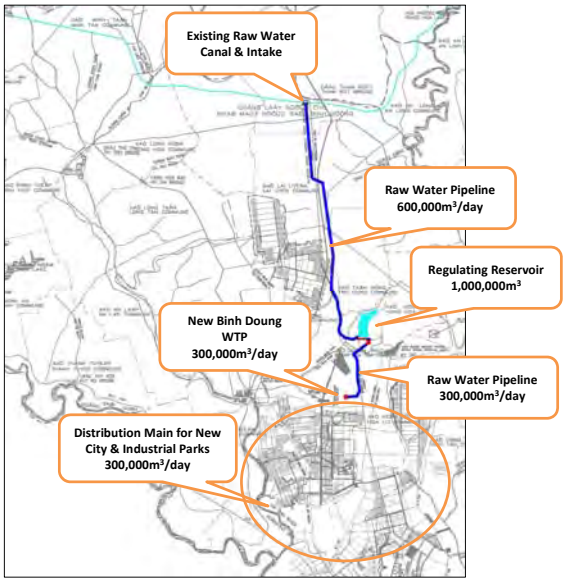
This is newly formulating system to take raw water from main canal of Phuoc Hoa lake to regulating reservoir at My Phuoc area and to construct pumping station to transmit raw water from regulating reservoir to new North Binh Duong WTP to supply water for mew city, industrial parks and existing urban areas of North of Binh Duong Province, creating conditions for enhancing economic and social development of the Province.

According to the Options Study, North Binh Duong WTP is planned to have capacity of 1,200,000 m³/day in final stage and phasing construction is planned. Assuming the first stage capacity of North Binh Duong WTP as 300,000 m³/day, required facilities are extracted and summarized in **Table 4.2** and **Figure 4.2** from the Options Study.

Table 4.2 Facilities Proposed in Options Study for Water Supply Project of Northern Binh Duong Province

Facility	Required Capacity of the Facilities	
	Final Stage with 1,200,000 m^3/d WTP	Stage with 300,000 m^3/d WTP
Raw Water Pipeline	1,200,000 m^3/d (DN 2,600 mm and DN 2,400 mm : 2 lines)	600,000 m^3/d (DN 2,600 mm and DN 2,400 mm : 1 line)
Regulating Reservoir	About 3,100,000 m^3	About 900,000 m^3
Intake Pump	1,200,000 m^3/d	300,000 m^3/d
WTP	1,200,000 m^3/d	300,000 m^3/d
Distribution Main	Distribution for 1,200,000 m^3/d	Distribution for 300,000 m^3/d

Source: JICA Preparatory Survey



Source: JICA Preparatory Survey

Figure 4.2 Facilities Proposed in Options Study for Water Supply Project of Northern Binh Duong Province

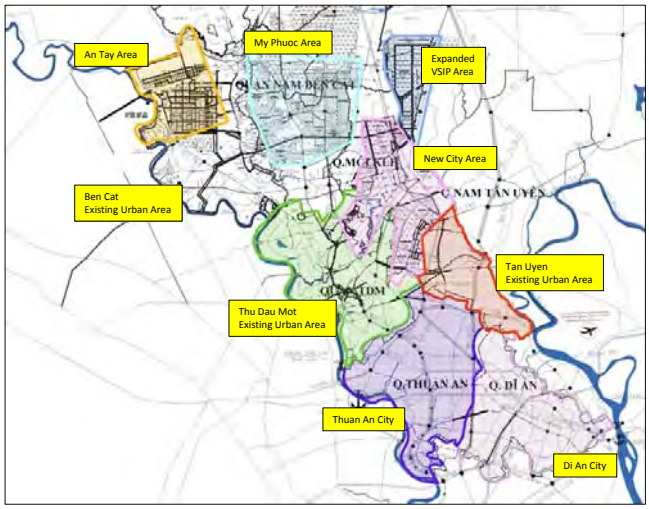
Binh Duong Province People's Committee has approved the policy allowing BIWASE to be investor of the project of Raw Water Pipeline from the main canal of Phuoc Hoa lake to the area in My Phuoc, Ben Cat and the districts and towns in the North of Binh Duong Province, and directed BIWASE to prepare report to looking for the investment capital in 20th February, 2008 by No. 399/UBND-SX. Development of Raw Water Pipeline from Phuoc Hoa reservoir to Binh Duong urban area was further approved in principle by the Prime Minister by No. 1797/TTg-KTN dated 28th September, 2009.

5. Water Supply Planning

5.1 Water Demand

New North Binh Duong WTP will supply water to the area of southern part of the WTP and the following areas are the target areas to project future water demand. The locations of the areas are indicated in **Figure 5.1**.

- Existing Supply areas of Thu Dau Mot, Ben Cat, Tan Uyen, Thuan An and Di An
- New Housing areas and Industrial Parks in following areas
  An Tay, My Phuoc, Expanded VSIP, and New City



Source: JICA Preparatory Survey

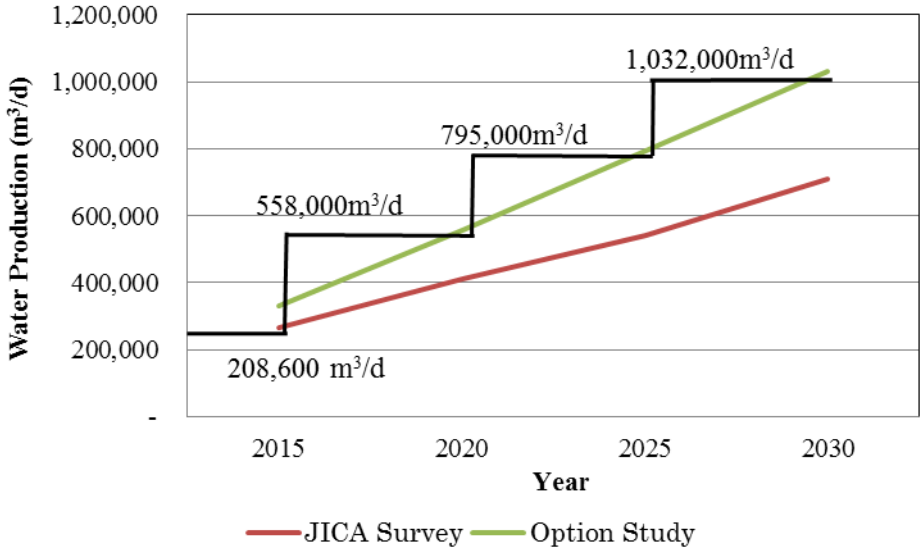
Figure 5.1 Water Supply Area

Water demand projection is reviewed based on the present situation of development of industrial parks and new residential areas as well as population growth of the present water supply area. The review results are shown in **Table 5.1** and **Figure 5.2.**

Table 5.1 Water Use Projection in the Study Area (m^3/d)

Study	2020	2025	2030
JICA Survey	412,566	540,135	708,526
Option Study	557,648	-	1,032,267

Source: JICA Preparatory Survey



Source: JICA Preparatory Survey

Figure 5.2 Water Use Projection vs. Planned Production Capacity

The total production capacity of existing Water Treatment Plants (WTPs) in the study area is 208,600 m^3/d at present and expected to be 238,600 m^3/d in 2015 as shown in **Table 5.2**.

Table 5.2 Expected Production Capacity (m^3/d)

WTP	2012	2015
Thu Dau Mot	21,600	21,600
Di An	90,000	90,000
Tan Hiep	60,000	90,000
My Phuoc I, II, III	29,000	29,000
Uyen Hung	5,000	5,000
South Tan Uyen	3,000	3,000
Total	**208,600**	**238,600**

Source: JICA Preparatory Survey

According to the construction schedule in "Option Study", priority has given to expansion of Tan Hiep WTP to 120,000 m^3/d and Di An WTP to 150,000m^3/d. The schedule is reasonable based on the above consideration and is recommended to forward accordingly. However, it will be still production shortage in 2020, when the expansion of the two WTPs is completed by 2020, as total production capacity will reach 328,600 m^3/d. Since the shortage of production capacity would be approximately 84,000m^3/d for the JICA prediction and 229,000m^3/d for the prediction of "Option Study", NBDWTP is required to be operated at least partly by 2020.

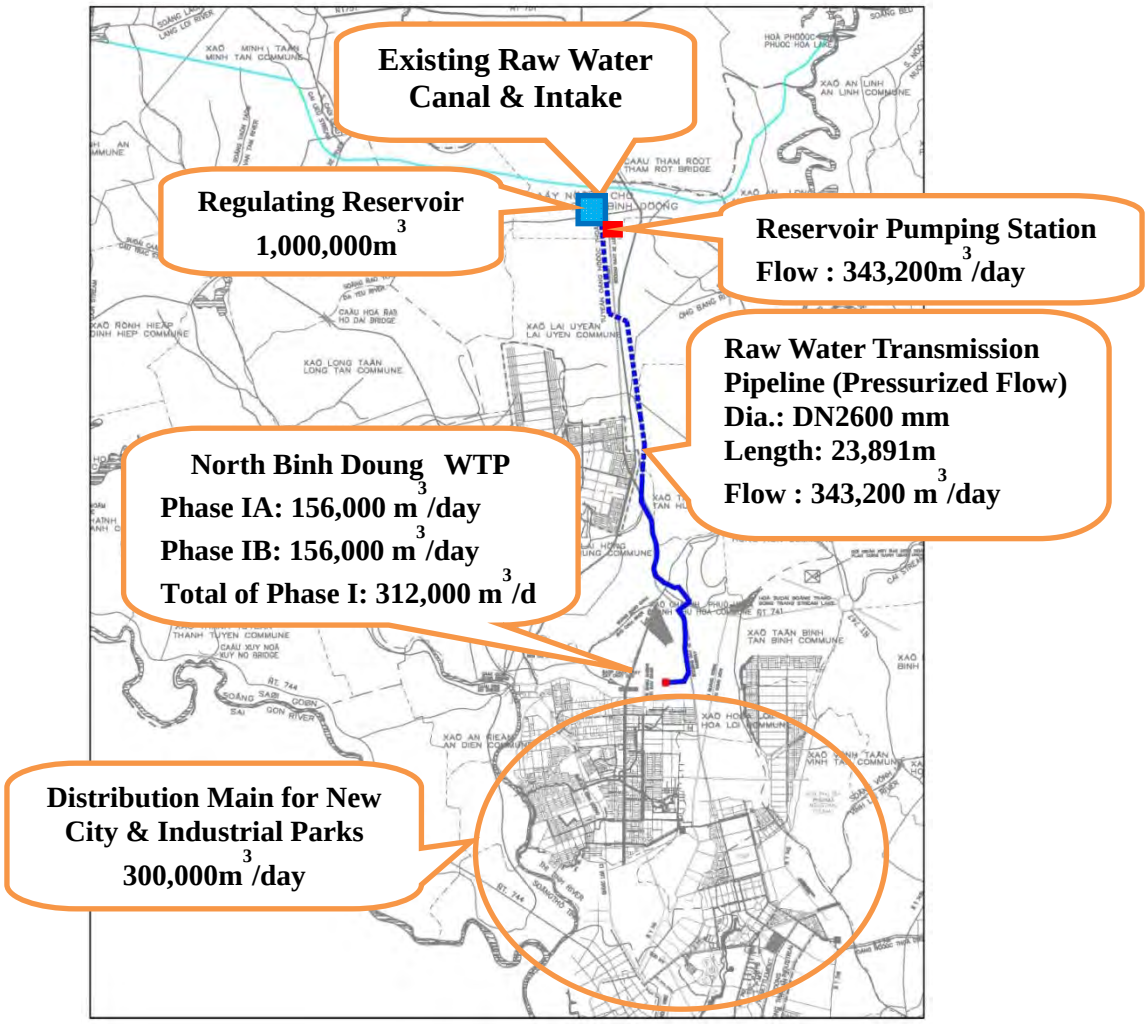
On the other hand, the growth of water demand in this area mainly depends on construction and occupation progress of new city and industrial parks as well as the population growth in piped area and BIWASE's effort to expand distribution network and connection activities. Therefore, the project would be prepared according to the occupation progress of new city and industrial parks

5.2 Water Supply Facilities of New City and Industrial Parks of Northern Part of Binh Duong Province Phase I

The following amendments from "Option Study" were made by "JICA Preparatory Survey" in which technical review of the project was taken place.

- Supply of raw water to Bau Bang area is not included in the Project.
- Raw water transmission system, such as regulating reservoir, intake pumping station, and raw water transmission pipeline was re-located by alternative study for economic system.
- Area of NBWTP is limited to 31.1 ha, and final production capacity is decided as 1,000,000m^3/d.
- Phase I is divided into Phase IA and IB with each capacity of 150,000 m^3/d based on the slow growth of water demand than expected previously and expansion schedule of the existing WTPs decided.

Overall arrangement of revised system of New City and Industrial Parks of Northern Part of Binh Duong Province (NBDWSP) Phase I is shown in **Figure 5.3**.



Source: JICA Preparatory Survey

Figure 5.3 Revised Layout of Proposed Facilities of NBDWSP

5.2.1 Raw Water Transmission System

Raw Water Transmission System consists of;

- Raw water intake facility (Existing)
- Regulating Reservoir
- Intake Pumping Station
- Raw Water Transmission Pipeline

(1) Raw Water Intake Facility

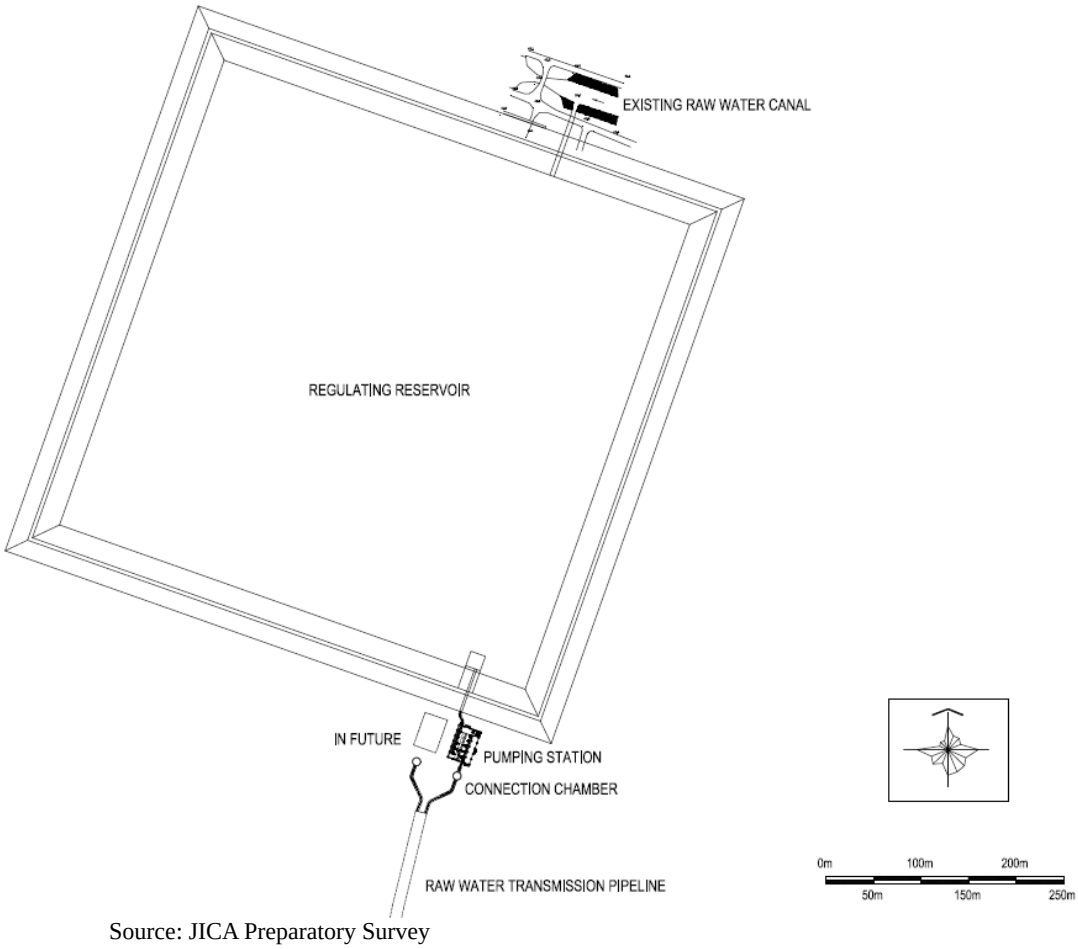
Raw water for NBDWTP will be taken from the existing intake of the Phuoc Hoa - Dau Tieng Canal as shown in **Photo 5.1**. Dimensions of the existing intake gate are H3.40m x W4.00m. The intake is located in Tru Van Tho commune of Ben Cat district.

Source: JICA Preparatory Survey

Photo 5.1 Existing Intake for New North Binh Duong WTP on Phuoc Hoa - Dau Tieng Canal

(2) Regulating Reservoir and Intake Pumping Station

Layout of regulating reservoir and intake pumping station is illustrated in **Figure 5.4**



Source: JICA Preparatory Survey

Figure 5.4 Layout of Regulating Reservoir and Intake Pumping Station

1) Regulating Reservoir

The functions of the regulating reservoir is to ensure the stable and continuous water supply for Northern Part of Binh Duong Province when water resource is stopped supplying from Phuoc Hoa - Dau Tieng Canal due to inspection and maintenance.

Based on the approval by Hydraulic Project Investment & Construction Management Board No. 9, Ministry of Agriculture and Rural Development with Decision No. 307 QD-BQL9 signed on May 23, 2012, 2 to 3 days capacity of NBDWTP is employed for planning of regulating reservoir. The construction process and the reservoir volume are determined as shown in **Table 5.3**.

- Phase I : Construct the regulating reservoir with 1,000,000 m^3 of useful volume. NBDWTP capacity is 312,000 m^3/day.
- In the future : When NBDWTP capacity increases to 1,000,000 m^3/day, the reservoir area will be expanded to increase the reservoir volume to 2,000,000 m^3.

Table 5.3 WTP Capacity and Reservoir Volume

Phase	WTP Capacity	Reservoir Volume
Phase I	312,000 m^3/day	1,000,000 m^3
In the future	1,000,000 m^3/day	2,000,000 m^3

Source: JICA Preparatory Survey

On the basis of the dead volume and the useful volume, the normal water level is defined as the **Table 5.4**.

Table 5.4 Capacity of the Reservoir

No.	Parameter	Unit	Value	
			Phase I	In the future
1	Normal water level	m	40.5	40.5
2	Dead water level	m	37.0	37.0
3	Total volume (normal water level)	m^3	1,200,000	2,200,000
4	Dead volume	m^3	200,000	200,000
5	Useful volume	m^3	1,000,000	2,000,000

Source: JICA Preparatory Survey

There are two material alternatives for the levee body, such as stone masonry wall with slope and concrete retaining wall. The dimension of levee body is defined as **Table 5.5**.

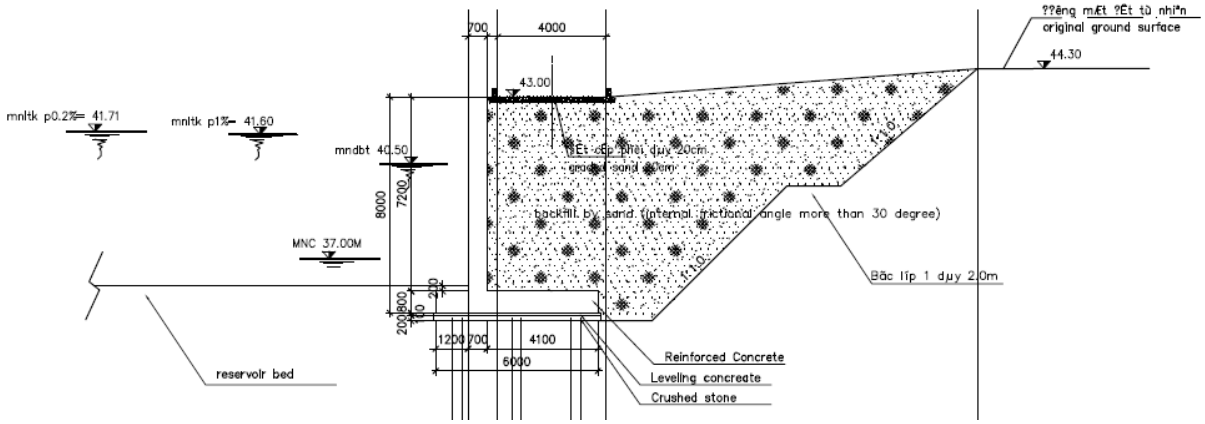
Table 5.5 Dimension of Levee Body

No.	Parameter	Unit	Phase I	
			Concrete retaining wall	Stone masonry wall with slope
1	Levee crest level	M	43.0	43.0
2	Levee bed level at lowest place	M	35.0	35.0
3	Highest levee height	M	8.0	8.0
4	Length of one side of wall	M	572	606
5	Area	M	32.7	36.7
6	Levee crest width	M	4.0	4.0

Source: JICA Preparatory Survey

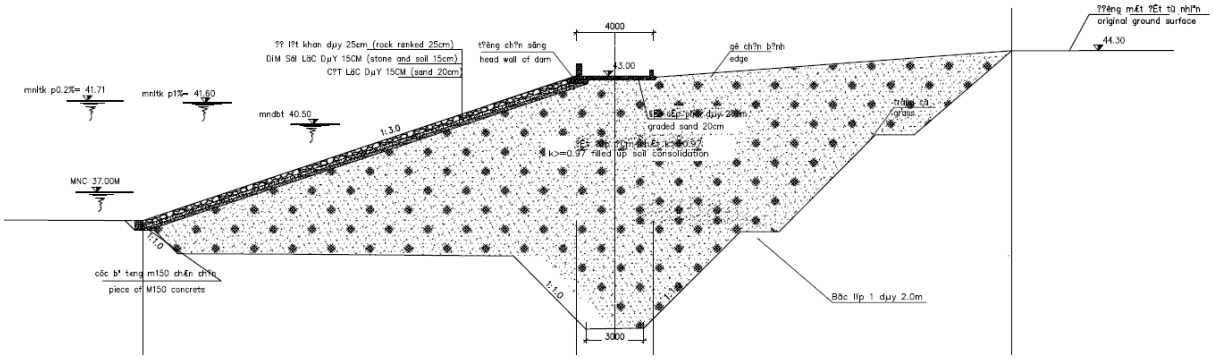
Two alternatives of the levee material as shown in **Figure 5.5** and **Figure 5.6** are compared. Both levees have the structural stability as a result of water proof, erosion protection for levee body and

ground load bearing capacity. The stone masonry wall with slope was proposed mainly because of low cost as USD 5.5 million compared to USD 14.0 million of concrete



Source: JICA Preparatory Survey

Figure 5.5 Cross Section of Concrete Retaining Wall



Source: JICA Preparatory Survey

Figure 5.6 Cross Section of Stone Masonry Wall with Slope

2) Intake Pumping Station

Intake Pumping Station in Phase I with transmission flow rate of 343,200 m^3/d for production capacity of 300,000 m^3/d at NBDWTP was designed with required capacity and Pump head as shown in **Table 5.6**.

Power substation and emergency generator will be provided.

Table 5.6 Description of Intake Pumping Station

Flow rate:	3.97m^3/sec = 343,200m^3/day
Number of pumps:	- 3 pumps including 1 standby in Phase I - 2 pumps in future
Total pump head	- 13.3 m
Dimensions:	W24.0m x L36.0m

Source: JICA Preparatory Survey

3) Raw Water Transmission Pipeline

Pipeline to be constructed in Phase I caters for the next Phase with NBDWTP capacity of 600,000 m^3/d. Total length of raw water transmission pipeline by diameter is summarized in **Table 5.7**.

Table 5.7 Raw Water Transmission Pipeline

Item/Section	Diameter and/or length	Remarks
Intake to Regulating Reservoir	DN 2600 mm: 32 m, FRP	
Intake Pumping Station to WTP	DN 2600 mm: 23,759 m, FRP DN 2600 mm: 100 m, SP	

Source: JICA Preparatory Survey

5.2.2 North Binh Duong Water Treatment Plant (NBDWTP)

The planned production capacity of the proposed (NBDWTP) in Phase I will be 300,000m^3/day. Four percent (4%) loss in the treatment processes will be added to the production capacity.

Table 5.8 Production Capacity and Treatment Capacity

Production capacity (m^3/day)	Treatment capacity (m^3/day)
300,000	312,000

Source: JICA Preparatory Survey

The water treatment facilities of Phase I will be constructed in two phases, namely 156,000 m^3/day in Phase IA and156,000 m^3/day in Phase IB.

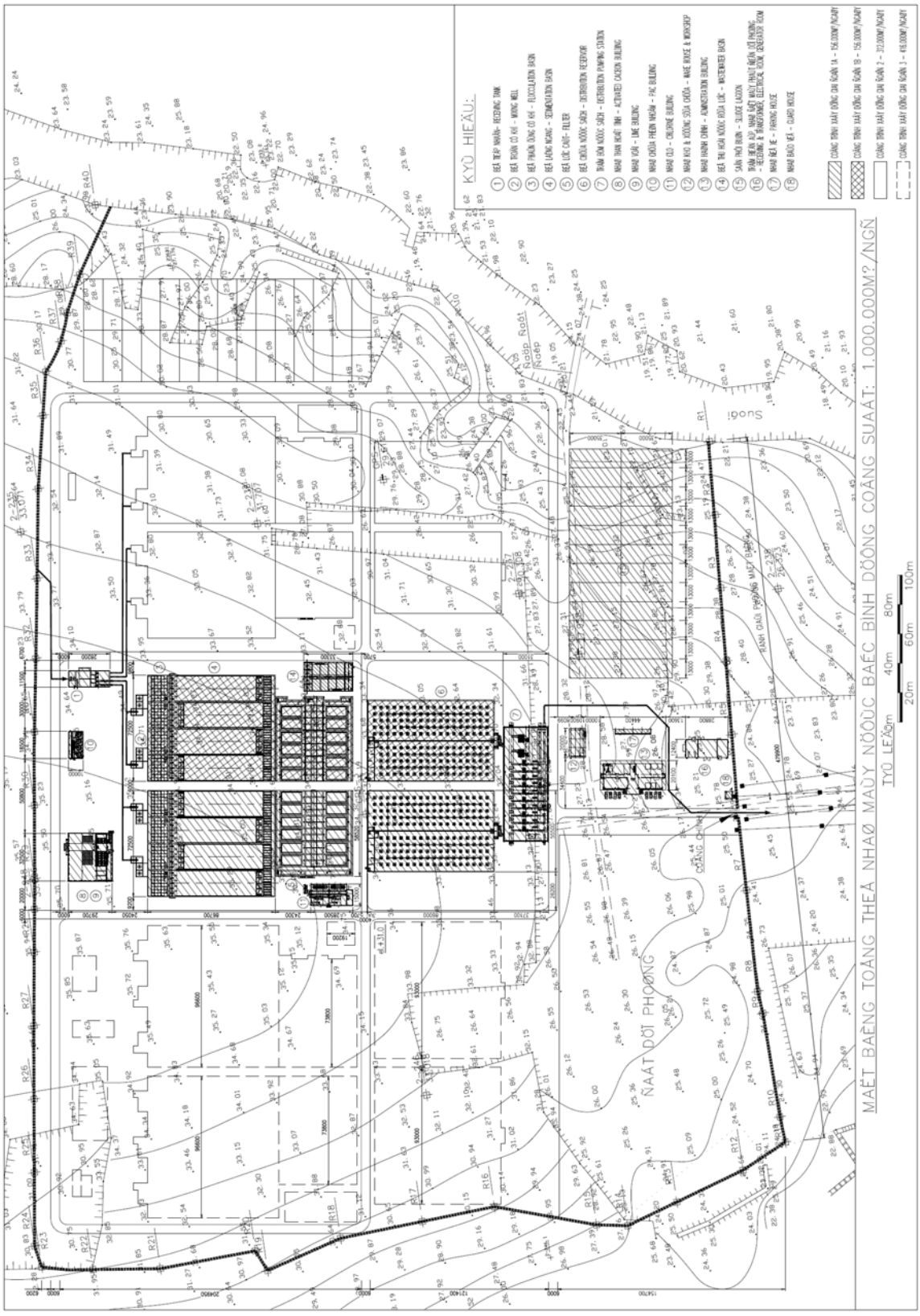
Some of the water treatment facilities will be constructed in Phase IA in consideration of the efficiency of operation and ease of expansion as shown in **Table 5.9**.

Table 5.9 Designed Capacities of Water Treatment Facilities in Phase I

Name of facility	Designed Treatment Capacity	
	Phase IA	Phase IB
a) Receiving & distribution tank	: 624,000 m^3/day	: Not Applicable
b) Rapid mixing well	: 156,000 m^3/day	: 156,000 m^3/day
c) Flocculation basin	: 156,000 m^3/day	: 156,000 m^3/day
d) Sedimentation basin	: 156,000 m^3/day	: 156,000 m^3/day
e) Rapid sand filter	: 156,000 m^3/day	: 156,000 m^3/day
f) Wastewater basin	: 312,000 m^3/day	: Not Applicable
g) Sludge drying bed	: 312,000 m^3/day	: Not Applicable
h) Chemical dosing facility	: 156,000 m^3/day	: 156,000 m^3/day
i) Buildings (administration, chemical, etc.)	: 312,000 m^3/day	: Not Applicable
j) Distribution reservoir	: 156,000 m^3/day	: 156,000 m^3/day
k) Distribution pump station	: 624,000 m^3/day	: Not Applicable
l) Distribution pump	: 156,000 m^3/day	: 156,000 m^3/day

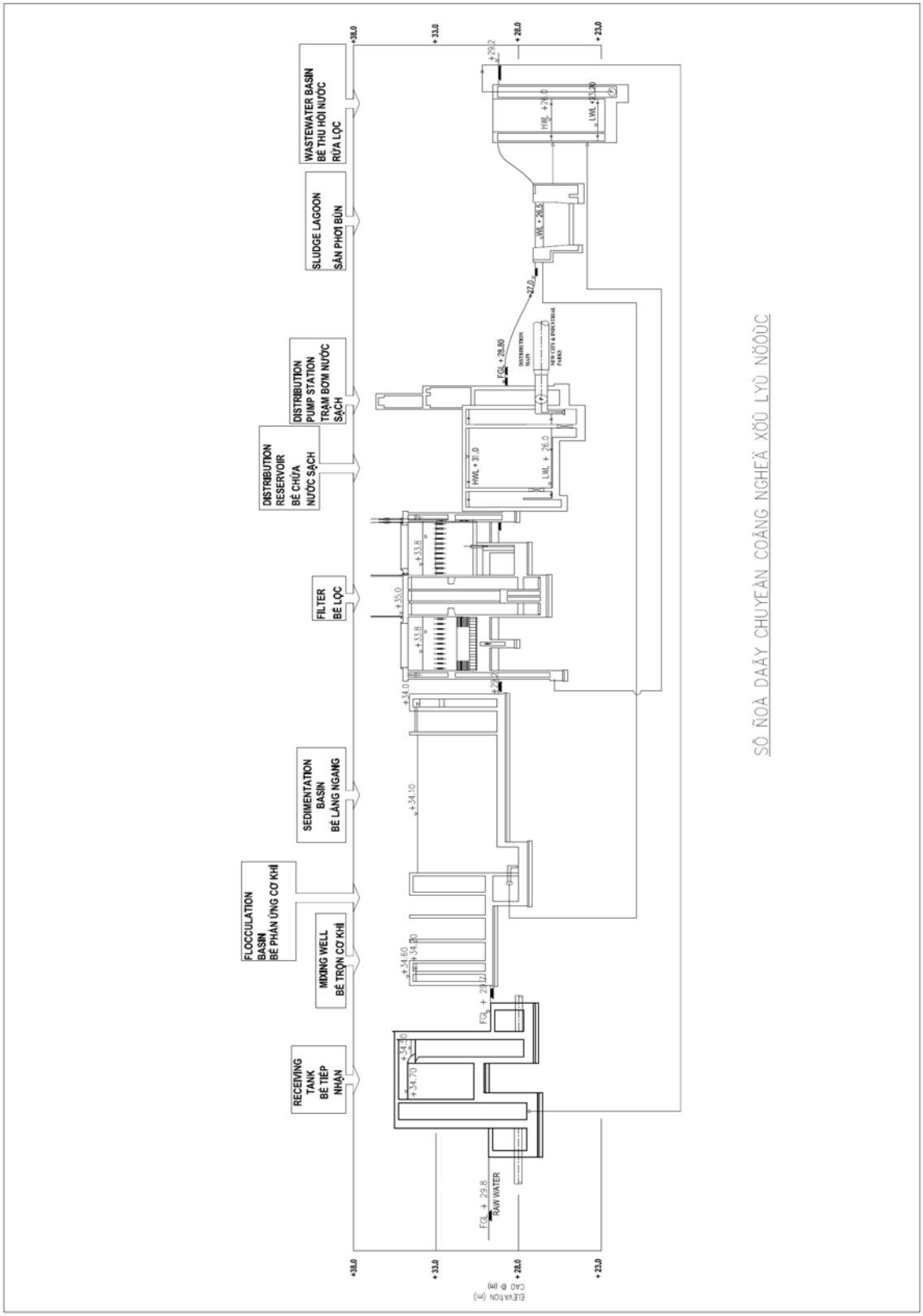
Source: JICA Preparatory Survey

NBDWTP land area of 31.3 ha will be acquired by BIWASE. The area is for water production capacity of 1,000,000 m^3/day. The planned ground elevations of NBDWTP will be varied from +29.80 to +27.00 m. NBDWTP layout and hydraulic profile are shown in **Figure 5.7** and **Figure 5.8** respectively.



Source: JICA Preparatory Survey

Figure 5.7 NBDWTP Layout



Source: JICA Preparatory Survey

Figure 5.8 Hydraulic Profile of NBDWTP

Table 5.10 shows the descriptions of water treatment facilities of NBDWTP.

Table 5.10 Descriptions of Water Treatment Facilities of NBDWTP

Name of facility	Description		Remarks
	Phase 1A	Phase 1B	
Receiving & distribution tank	- Flow rate: 624,000m^3/day = 433.3m^3/min - Retention time: 1.5min - No. of tanks: 1 - Effective depth: 5.0m - Dimensions: W10.7m x L12.4m x D5.0m = 663.4m^3	Not Applicable	Powdered activated carbon will be dosed in the tank in emergency case.
Rapid mixing well	- Flow rate: 156,000m^3/day = 108.3m^3/min - Type of mixing: Mechanical type - Retention time: 2.5min - No. of wells: 2 - Effective depth: 4.0m - Dimensions: W4.2m x L4.2m x D4.0m x 2 stages = 141.1m^3/well	- Flow rate: 156,000m^3/day = 108.3m^3/min - Type of mixing: Mechanical type - Retention time: 2.5min - No. of wells: 2 - Effective depth: 4.0m - Dimensions: W4.2m x L4.2m x D4.0m x 2 stages = 141.1m^3/well	Pre-alkali, pre-chlorine and coagulant will be dosed in the well.
Flocculation basin	- Flow rate: 156,000m^3/day = 108.3m^3/min - Type of flocculation: Hydraulic type - Retention time: 20min - No. of basins: 4 - Effective depth: 3.5m - No. of stages: 5 - Dimensions: W2.0m x L17.4m x D3.5m x 5stages = 609m^3/basin	- Flow rate: 156,000m^3/day = 108.3m^3/min - Type of flocculation: Hydraulic type - Retention time: 20min - No. of basins: 4 - Effective depth: 3.5m - No. of stages: 5 - Dimensions: W2.0m x L17.4m x D3.5m x 5stages = 609m^3/basin	
Sedimentation basin	- Flow rate: 156,000m^3/day - Type: Horizontal flow type - Overflow rate: 25mm/min = 36m/day - Mean velocity: 0.4m/min - No. of basins: 4 - Effective depth: 4.5m - Required area: 156,000/36/4 = 1,083m^2/basin - Desludging: Submerged sludge collector - Dimensions: W17.5m x L62.0m x D4.5m = 4,882.5m^3/basin	- Flow rate: 156,000m^3/day - Type: Horizontal flow type - Overflow rate: 25mm/min = 36m/day - Mean velocity: 0.4m/min - No. of basins: 4 - Effective depth: 4.5m - Required area: 156,000/36/4 = 1,083m^2/basin - Desludging: Submerged sludge collector - Dimensions: W17.5m x L62.0m x D4.5m = 4,882.5m^3/basin	
Rapid sand filter	- Flow rate: 156,000m^3/day - Type: Gravity type, out flow control - Filtration rate: 135m/day - No. of filters: 12 - Required area in total: 156,000/135 = 1,156m^2 - Required area per filter: 1,156/12 = 96.3m^2/filter - Dimensions per filter: W16.3m x L6.0m = 97.8m^2/filter - Water backwashing and air scouring	- Flow rate: 156,000m^3/day - Type: Gravity type, out flow control - Filtration rate: 135m/day - No. of filters: 12 - Required area in total: 156,000/135 = 1,156m^2 - Required area per filter: 1,156/12 = 96.3m^2/filter - Dimensions per filter: W16.3m x L6.0m = 97.8m^2/filter - Water backwashing and air scouring	
Distribution reservoir	- Total volume: 150,000 m^3/day x 15% = 22,500 m^3 - No. of reservoirs: 2	- Total volume: 150,000 m^3/day x 15% = 22,500 m^3 - No. of reservoirs: 2	Post-chlorine will be dosed at the influent channel for

Name of	Description		Remarks
	- Effective depth: 5.0m - Dimensions per reservoir: W27.0m x L85.0m x D5.0m = 11,475m^3/reservoir	- Effective depth: 5.0m - Dimensions per reservoir: W27.0m x L85.0m x D5.0m = 11,475m^3/reservoir	disinfection.
Distribution pump station	- For the production capacity of 600,000m^3/day - Basement floor and 1st floor - Dimension: W30.0m x L77.0m	Not Applicable	
Distribution pump	- Type: Horizontal shaft double suction volute pump - Production capacity: 150,000 m^3/day - Hourly peak factor: 1.25 - No. of pumps: 3 including 1standby - Rated capacity: 65.2m^3/min - Rated head: 50m - Motor output: 710kW	- Type: Horizontal shaft double suction volute pump - Production capacity: 150,000 m^3/day - Hourly peak factor: 1.25 - No. of pumps: 2 - Rated capacity: 65.2m^3/min - Rated head: 50m - Motor output: 710kW	
Backwash pump	- Type: Horizontal shaft double suction volute pump - No. of pumps: 2 including 1 standby - Rated capacity: 58.7m^3/min - Rated head: 20m - Motor output: 280kW	Not Applicable	
Plant water pump	- No. of pumps: 1 - Rated capacity: 1.0m^3/min - Rated head: 40m - Motor output: 18.5kW	No. of pumps: 1 - Rated capacity: 1.0m^3/min - Rated head: 40m - Motor output: 18.5kW	
Sludge lagoon	- For the treatment capacity of 312,000m^3/day - Average raw water turbidity: 20NTU - Average PAC dosage rate: 20mg/liter - Dry solid: 8.9 tons/day = 3,250 tons/year - Sludge loading rate: 50kg/m^2 - Filling cycle: 6 times/year - Required area: 3,250/(6*50) = 10,830m^2 - No. of lagoons: 24 - Dimensions per lagoon: W13m x L35m = 455m^2/lagoon	Not Applicable	
Wastewater basin	- Backwashed wastewater from filter: 921m^3 per 1 filter washing - No. of basins: 2 - Effective depth: 3.5m - Dimensions: W9.0m x L32.1m x D3.5m = 1,011m^3/basin	Not Applicable	Return pump - Type: Submersible sand pump - No. of pumps: 6 including 2 standby - Rated capacity: 5.2m^3/min - Rated head: 20m - Motor output: 37kW
Administration building	- Second-story - Total area: 1,568m^2 - Dimension: W19.6m x L40.0m x 2-story	Not Applicable	

Name of	Description		Remarks
Activated carbon & Lime building	- For the treatment capacity of 624,000m^3/day - One-story - Total area: 965m^2 - Dimension: W32.5m x L29.7m x H10.0m - Chemical feeding system: for 156,000m^3/day	- Chemical feeding system: for 156,000m^3/day	
PAC building	- For the treatment capacity of 312,000m^3/day - One-story - Total area: 162m^2 - Dimension: W9.0m x L18.0m x H12.0m - Chemical feeding system: for 156,000m^3/day	- Chemical feeding system: for 156,000m^3/day	
Chlorine building	- For the treatment capacity of 312,000m^3/day - One-story - Total area: 406m^2 - Dimension: W14.5m x L28.0m x H6.0m - Chemical feeding system: for 156,000m^3/day	- Chemical feeding system: for 156,000m^3/day	
Power receiving, transformer, electrical & generator rooms	- For the treatment capacity of 312,000m^3/day - One-story - Total area: 426m^2 - Dimension: W13.4m x L31.8.m	Not Applicable	
Workshop & ware house	- One-story - Total area: 162m^2 - Dimension: W 9.0m x L18.0m	Not Applicable	
Garage	- One-story - Total area: 41m^2 - Dimension: W3.4m x L12.0m	Not Applicable	
Guard house	- One-story - Total area: 18m^2 - Dimension: W 4.0m x L4.5m	Not Applicable	

Source: JICA Preparatory Survey

5.2.3 Distribution Mains

BIWASE uses three types of pipes of HDPE, Cast Iron (Ductile Cast Iron), and PVC at the present depending on the diameter as shown in **Table 5.11**.

Table 5.11 Pipe Material Used for Distribution Pipe by Diameter

Pipe Type	Diameter Applied	Remarks
PVC	200 mm and below	
HDPE	300 mm - 600 mm	Depend on soil conditions
Cast Iron (Ductile Cast Iron)	300 mm and above	

Source: BIWASE

The above practice of BIWASE is followed in this Project. HDPE is applied for 300 mm - 600mm in diameter and DCI is used for the diameter of more than 600 mm.

Hydraulic calculation to estimate pipe sizes of distribution mains is conducted in following conditions.

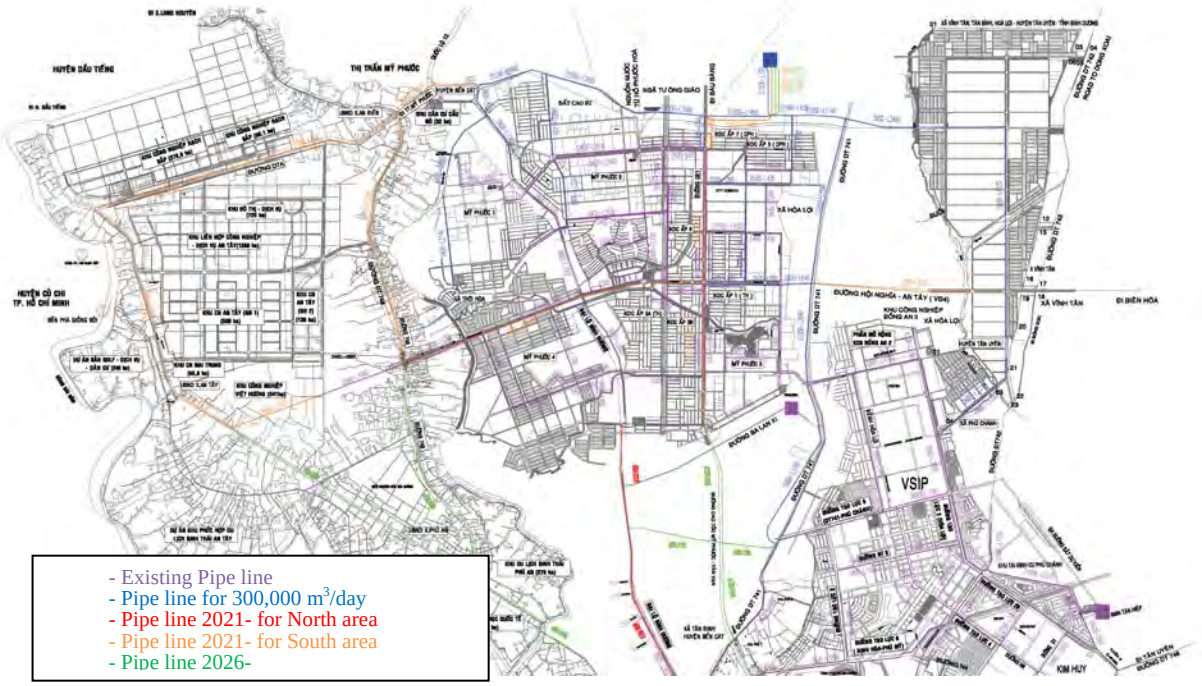
Hydraulic calculation formula	:	Hazen-Williams equation
Flow coefficient	:	130
Daily maximum factor	:	1.2
Hourly maximum factor	:	1.25
Applied software	:	EPANET ver2.0
Objective distribution main	:	300 mm in diameter and above
Effective pressure	:	30 m -50m

The Hydraulic calculation results are shown in **Figure 5.9** and **Table 5.12** shows distribution mains required in initial stage with distribution capacity from NBDWTP of 300,000m3/d.

Table 5.12 Distribution Mains Required in Initial Stage

Diameter (mm)	Length (m)				Total
	Type 1	Type 2	Type 3	Pipe Bridge	
DN 400	4,220	2,126	0	0	6,348
DN 500	2,497	0	0	0	2,497
DN 600	3,400	11,581	1,743	0	16,724
DN 800	3,496	3,137	0	0	6,633
DN 1000	0	6,426	0	0	6,426
DN 1200	0	1,478	0	0	1,478
DN 1500	6,170	2,254	0	50	8,474
DN 1800	0	0	0	0	0
DN 2500	0	0	0	0	0
Total	19,785	27,002	1,743	50	48,580

Note: Asphalt reinstatement type; Type3: National Road, Type2: Main Road, Type1: Other road
Source: JICA Preparatory Survey



Source: JICA Preparatory Survey

Figure 5.9 Existing and Proposed Distribution Mains

6. Candidate Components of ODA Loan Project

6.1 Scope of Work of the Project

Phase 1 of Water Supply Project in New City and Industrial Parks in Northern Part of Binh Duong Province consists of Regulating Reservoir, Raw Water Transmission Pipeline, and distribution mains as shown in **Table 6.1**, as Intake Pumping Station and North Binh Duong Water Treatment Plant (NBDWTP) Phase I will be constructed by private company as mentioned above.

Table 6.1 Proposed Scope of Work for Water Supply Project in Binh Duong Province

Facility	Description	Amount	Remarks
Regulating Reservoir	606m x 606m	1,000,000 m^3	Near intake facility
Raw Water Pipeline	DN 2,600 mm	23,891m	Pressurized main
Distribution Main	DN 400 mm : DN 500 mm : DN 600 mm : DN 800 mm : DN 1,000 mm : DN 1,200 mm : DN 1,500 mm : Total	6,348 m 2,497 m 16,724 m 6,633 m 6,426 m 1,478 m 8,474 m 48,580m	

Source: JICA Survey Team

6.2 Implementation Schedule and Base Cost

6.2.1 Implementation Program

Phase I of Water Supply Project in Binh Duong Province comprises three components: A. Construction Work B. Engineering Services, and C. Preparations by project owner. These components and their related activities are summarized below.

A. Construction Work

A1: Construction of Regulating Reservoir

A2: Construction of Raw Water Transmission Pipeline

A3: Construction of Distribution Mains

B. Engineering Services

B1: Detailed design (D/D, including surveys), tender assistance and supervision (SV)

C. Preparatory Works by Project Owner

C1: Preparation of EIA and F/S reports and obtaining implementation permit

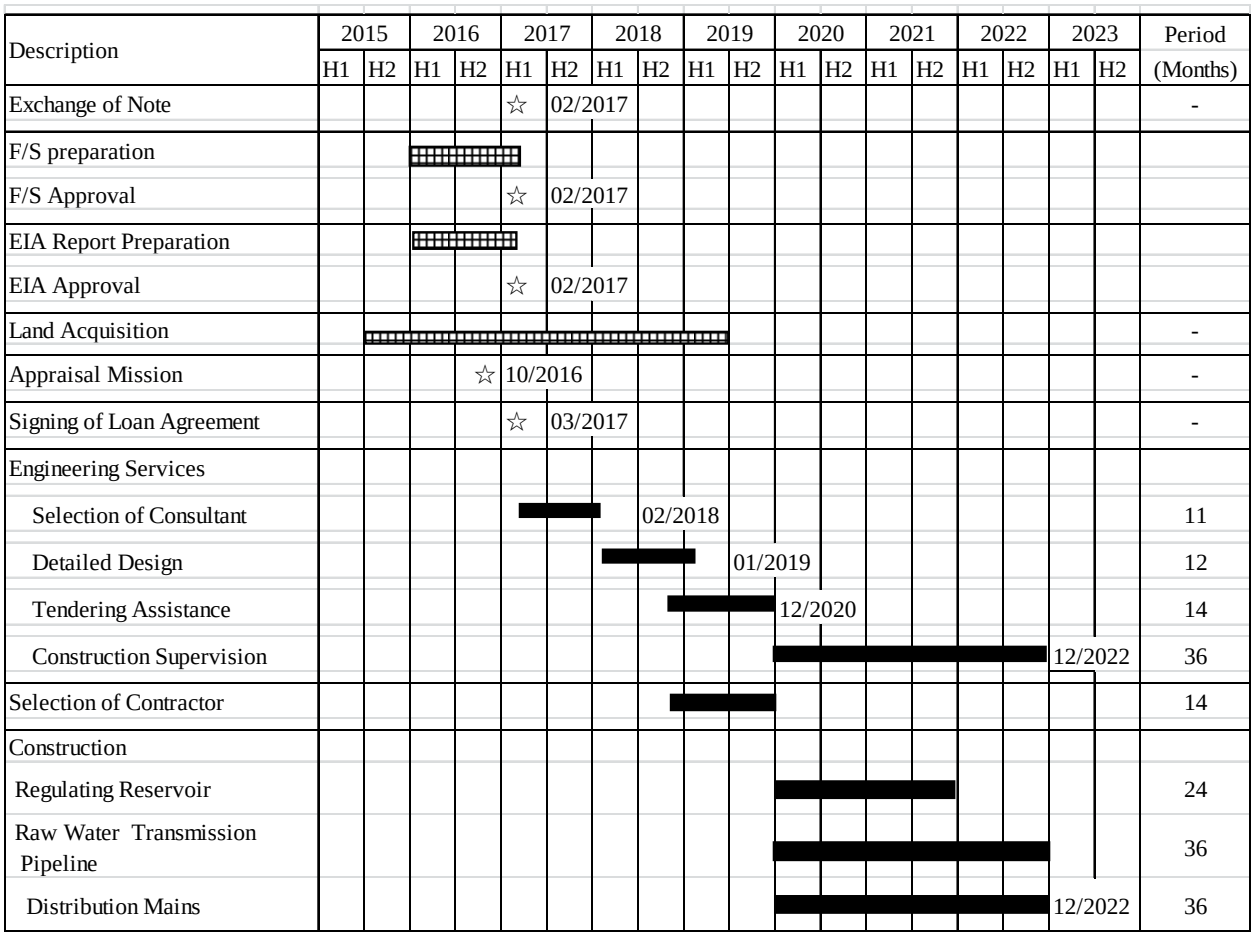
C2: Establishment of PMU as implementation agency

C3: Land acquisition for Regulating Reservoir and Raw Water Pipeline

The proposed schedule for the above activities is presented in **Figure 6.1** The schedule is based on the following timeframes for completion:

(1)	Selection of consultants	:	11	Months
(2)	Detailed Design including surveys	:	12	Months
(3)	Tender Assistance for Local Competitive Bidding (LCB)	:	14	Months
	Preparation of tender document and JICA concurrence	:	4	Months
	Tender period	:	3	Months
	Evaluation of bids	:	2	Months
	JICA approval of bid evaluation	:	1	Months
	Contract negotiation	:	2	Months
	JICA Approval of contract		1	Months
	Opening of Letter of credit and issuance of letter of commitment		1	Months

Source : JICA



Source: JICA Survey Team

Figure 6.1 Implementation Schedule for the Project

6.3.2 Engineering Services

(1) Detailed Design

The engineering services for detailed design include the following:

- Review all documents relating to the project including F/S and Preparatory Study reports
- Discuss and clarify the requirements of the project with PMU and PPC
- Prepare base maps in digital, GIS compatible format, covering Phase I project area
- Carry out topographic and geological survey for detailed design in Phase I project area
- Carry out detailed design and preparation of tender documents for Phase I project

(2) Tender Assistance

Under this component the engineers would assist with the following:

- Pre-qualification tasks
- Clarification and modification of tender document
- Evaluation of bid
- Contract negotiation.

(3) Construction Supervision

The engineering services for construction supervision include the following:

- Review the construction schedule proposed by the contractor
- Monitor the progress of work and instruct the contractor to update the schedule when required
- Assist PMU with progress meetings
- Review construction shop drawings submitted by the contractor
- Process contractor's progress and final payment requisitions and issue progress certificates for PMU/JICA approval
- Monitor and advise PMU of the financial progress of the work
- Advise PMU on contract variations and claims issues
- Provide quality assurance during construction phase through supervision of civil and geotechnical engineering works
- Check and approve contractor's O&M manual and as-built drawings
- Prepare engineering, progress, and project completion reports

6.3.3 Cost Estimate

(1) Construction Cost

Construction base cost of Regulating Reservoir, Raw Water Transmission Pipeline, and Distribution Mains excluding WTP and Pumping Station estimated in Phase I of Water Supply Project in New City and Industrial Parks in Northern Part of Binh Duong Province (Preparatory Survey) is shown in **Table 6.2**.

Table 6.2 Construction Base Cost Estimated in Preparatory Survey (March 2013 Price Level)

Item		FC (JPY)	LC (VND)	Total (JPY)
1.	Procurement and Construction			
(1)	Regulating Reservoir	0	131,654,829,007	579,281,248
(2)	Raw Water Transmission Pipeline	0	1,297,485,434,792	5,708,935,913
(3)	Distribution Mains	0	1,024,650,920,958	4,508,464,052
	Base Cost of Construction	0	2,453,791,184,757	10,796,681,213
2.	Land Acquisition and Compensation	0	354,594,175,000	1,560,214,370
Total Cost base Cost		0	2,808,385,359,757	12,356,895,583

US$ 1.0 = 91.84 Japanese Yen, VND 1.0 = JPY 0.0044
Source: JICA Preparatory Survey

Construction base cost was estimated with the price level of March 2013 and cost adjustment is made to cater for the price level of June 2014. Consumer Price Indexes available in Binh Duong Province, South East, and whole country of Viet Nam are collected and analyzed to adjust the local currency portion and 105 % of escalation rate from March 2013 to June 2014 as discussed in **Annex 6-A**. While foreign currency portion is reminded as that of March 2013 level, as foreign currency, especially Japanese yen has not escalated remarkably since the year 2013. Adjusted construction base cost is show in **Table 6.3**. For the adjustment, the following exchange rates are applied in the cost estimate in accordance with ODA loan in 2014 for Viet Nam:

- US$ 1.0 = JPY 102.6
- US$ 1.0 = VND 21,036

- VND 1.0 = JPY 0.0048774

Table 6.3 Construction Base Cost Adjusted (June 2014 Price Level)

Item	FC (JPY)	LC (VND)	Total (JPY)
1. Procurement and Construction			
(1) Regulating Reservoir	0	138,237,570,457	674,239,926
(2) Raw Water Transmission Pipeline	0	1,362,359,706,532	6,644,773,233
(3) Distribution Mains	0	1,075,883,467,006	5,247,514,022
Base Cost of Construction	0	2,576,480,743,994	12,566,527,181
2. Land Acquisition and Compensation	0	372,323,883,750	1,815,972,511
Total Cost base Cost	0	2,948,804,627,744	14,382,499,691

Source: JST

(1) Engineering Service Cost

Base cost of engineering service is estimated separating in two stages, such as detailed design and tender assistance stage and construction supervision stage, with price level of June 2014 as shown in **Table 6.4**. Detailed estimate and background information are presented in **Annex BD6-B**.

Table 6.4 Base Cost of Engineering Service (June 2014 Price Level)

Stage	Cost		
	Foreign Portion (JPY)	Local Portion (VND)	Total (JPY)
Detailed Design and Tender Assistance	321,600,000	26,783,260,000	452,232,672
Construction Supervision	498,140,000	32,319,200,000	655,773,666
Total	819,740,000	59,102,460,000	1,108,006,338

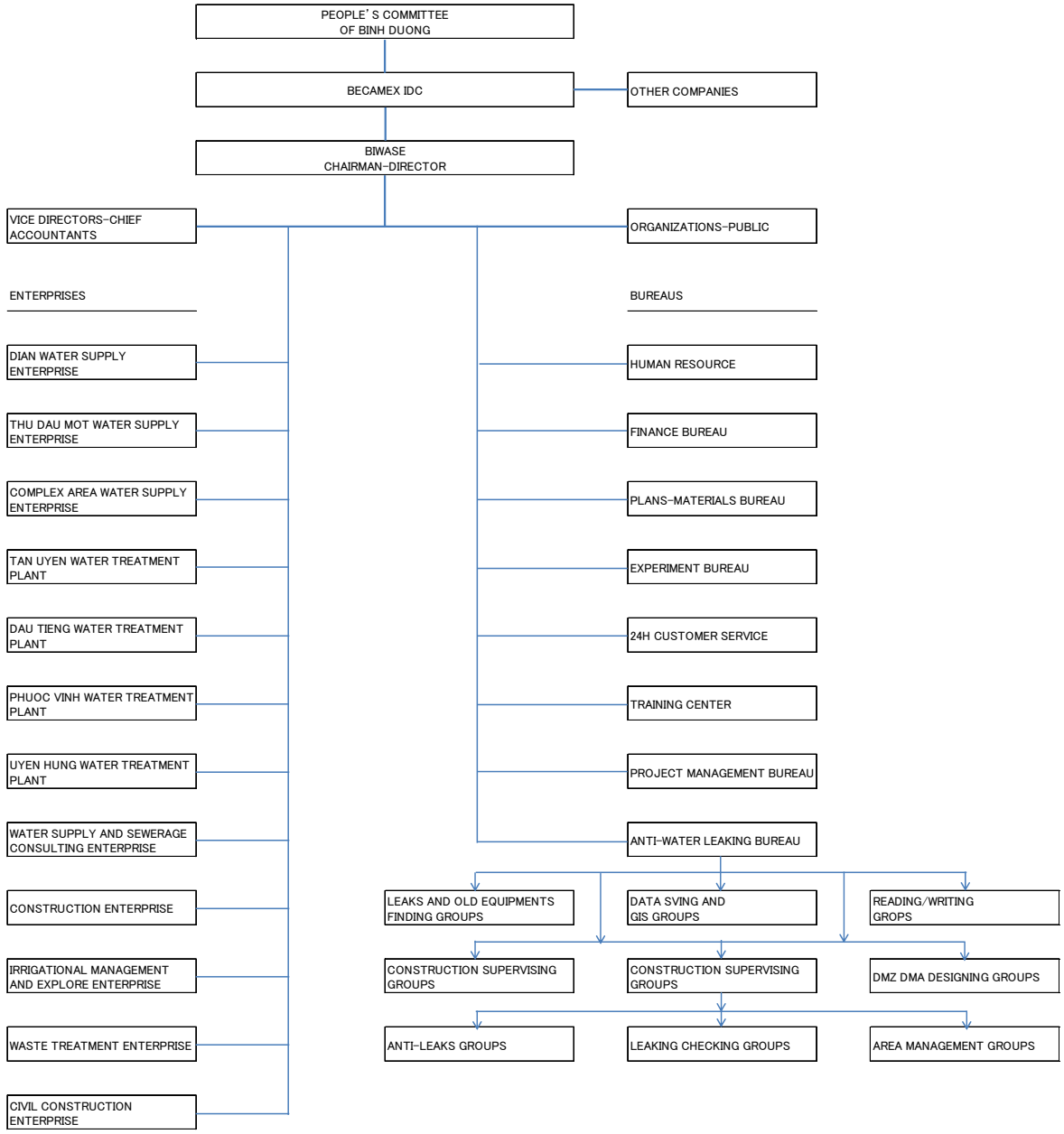
Source: JST

6.3 Operation and Maintenance

(1) Present Status of Operation and Maintenance

BIWASE is the service provider in the province having six water supply enterprises in the field of drinking water supply as of March 2013. The company deals consultancy, construction, and management services in the fields of environment, irrigation, water supply, solid waste, sewerage, civil and industrial construction, and other infrastructures with the organization structure presented in **Figure 6.2**.

BIWASE provides drinking water more than 79,000 connections in 2012 serving anywhere between 25% and 50% of urban population and is actively increasing connections around 10,000 to 15,000 per year. The company is efficiently managed and derivers high quality water with relatively law NRW rate (less than 10%),and is operating 3 major and several small-scale Water Treatment Plants (WTP) in Binh Duong Province. The maximum capacity of the existing WTP of Di An is 90,000m^3/d.



Source: BIWASE

Figure 6.2 Organization Structure of BIWASE

(2) Operation and Maintenance for the Project

In this project, Dau Tieng - Phuoc Hoa Irrigation Mining Limited Liability Company would supply raw water from Phuoc Hoa - Dau Tieng Canal to the SPC under a raw water bulk supply agreement. The SPC would supply the treated water to BIWASE under a bulk water supply agreement.

Regulating reservoir would be operated and maintained by BIWASE. The existing water resources are revers and ground water, and then BIWASE has no experience on operation and maintenance of relatively large regulating reservoir. O&M of the regulating reservoir is necessary for the purpose of sustainable abstraction of raw water for water supply and to secure the safety of the reservoir.

BIWASE is managed based on the self-supporting financial system. BIWASE's costs including operation and maintenance costs, loan repayment, and depreciation costs, are basically covered by water tariff revenue. Facility construction is funded mainly by foreign ODA loan.

Water tariff in Viet Nam is basically calculated to cover all of the necessary cost of water supply; such as, electricity, chemicals, staff salary and allowances, depreciation, materials & equipment, repairs, management costs, sales cost.

The same conditions apply to BIWASE. Periodical tariff revision is one of the essential factors for sustainable operation of the company.

Annex 6-A Escalation Ratio

(1) Objective to apply CPI

Construction cost of Phu Quoc Island water supply project was calculated with the price level at February 2012 and Binh Duong water supply project was calculated with the price level at March 2013. Since the price level of FY 2014 Japanese ODA loan projects is indicated with the price level at June 2014,, it requires to adjust the estimated construction costs of the projects by considering escalation ratio during the designated periods. Cost adjustment is made for only local currency portion (VND). While foreign currency portion of JPY is not adjusted, as JPY has not escalated significantly since 2012.Exchange rates are also replaced from the estimated times of the projects to the rate applied for FY 2014 Japanese ODA loan projects

The escalation ratios are calculated by Consumer Price Index (CPI) available in Vietnam in July 2014..

(2) Collection data

CPIs in Vietnam are available for whole country, major cities, and each area such of Red River Delta, North East, South East, Mekong River Delta, and province. Collected data of CPIs are shown in **Table 1**. Escalation ratio to be applied for the projects are estiamted bythese data.

Table 1 Collected data on CPI

District/Province	Data Source	Remarks
Whole country	Homepage of GENERAL STATISTICS OFFICE OF VIETNAM	http://www.gso.gov.vn
South East	Same with above	Including Binh Duong
Mekong Delta	Same with above	Including Kien Giang
Binh Duong	Statistical Year Book 2013 (Binh Duong)	Only 2013 data
Kien Giang	Statistical Year Book 2012 (Kien Giang)	Only 2012 data

(3) Inflation rate

CPIs in Vietnam cover representative value of whole items and specific items such as food, beverage and cigarette, and housing and construction materials. The collected CPIs of representative value and housing and construction materials related to Phu Quoc Island and Binh Duong province are shown in **Table 2**.

Table 2 Collected CPIs

Year	Month	All items					housing and construction materials				
		Whole country	South East	Mekong Delta	Binh Duong	Kien Giang	Whole country	South East	Mekong Delta	Binh Duong	Kien Giang
2012	Jan	101	101.06	100.58	100.77	100.76	101.71	101.81	101.86		103.39
	Feb	101.37	101.39	101.41	101.66	101.17	102.47	102.73	102.39		103.17
	Mar	100.16	100.26	99.77	100.59	100.36	102.31	102.88	102.2		102.99
	Apr	100.05	100.09	99.84	100.2	99.99	99.56	99.77	99.16		97.90
	May	100.18	100.15	100.35	100.48	99.91	99.03	98.41	98.82		97.18
	Jun	99.74	99.65	99.89	99.75	100.11	98.79	98.27	98.41		97.57
	Jul	99.71	99.51	99.43	99.54	99.2	99.07	98.18	98.99		98.50
	Aug	100.63	100.54	100.69	100.4	100.53	102.03	102.25	101.69		103.80
	Sep	102.2	101.67	102.46	101.81	102.56	102.18	102.55	102.62		102.48
	Oct	100.85	100.9	100.89	100.51	101.58	101.09	101.45	101.46		102.58
	Nov	100.47	100.11	100.47	100.11	100.02	100.53	100.51	100.66		102.03
	Dec	100.27	100.19	100.4	100.49	100.46	100.15	100.06	100.27		100.31
2013	Jan	101.25	100.93	100.96	107.29		100.36	100.06	100.37	99.28	
	Feb	101.32	101.09	101.31	101.18		100.45	100.29	100.4	101.69	
	Mar	99.81	99.82	99.8	100.05		100.09	99.96	100.16	98.17	
	Apr	100.02	99.9	99.76	99.99		99.56	99.28	99.71	100.48	
	May	99.94	99.82	100.05	99.97		99.47	98.95	99.39	100.45	
	Jun	100.05	100.15	99.99	100.19		100.02	99.65	99.97	100.15	
	Jul	100.27	100.27	100.35	100.38		100.43	100.22	100.3	100.47	
	Aug	100.83	100.46	100.74	100.69		100.88	100.93	100.8	101.84	
	Sep	101.06	102.14	100.72	100.67		100.91	100.98	101.05	100.89	
	Oct	100.49	100.34	100.43	100.2		100.5	100.28	100.37	99.53	
	Nov	100.34	100.28	100.38	100.22		100.41	100.47	100.59	99.16	
	Dec	100.51	100.51	100.55	100.57		102.31	103.03	102.2	103.39	
2014	Jan	100.69	100.56	100.7			101.02	101.35	100.9		
	Feb	100.55	100.41	100.62			99.36	98.72	99.38		
	Mar	99.56	99.51	99.25			99.26	99.07	99.26		
	Apr	100.08	100	100.12			99.44	98.97	99.36		
	May	100.2	100.26	100.28			100.03	99.68	99.96		
	Jun	100.3	100.52	100.43			100.61	100.39	100.55		

The escalation ratios to be applied for adjustment are estimated based on and the above related data for Phu Quoc Island and Binh Duong province for each specified period and shown in **Table 3** and **Table 4**.

Table 3 Escalation Ratio for Phu Quoc Island (from February 2012)

Year	Month	All items			housing and construction materials		
		Whole country	Mekong Delta	Kien Giang[1)]	Whole country	Mekong Delta	Kien Giang[1)]
2012	Jan						
	Feb	1.00	1.00	1.00	1.00	1.00	1.00
	Mar	1.00	1.00	1.00	1.02	1.02	1.03
	Apr	1.00	1.00	1.00	1.02	1.01	1.01
	May	1.00	1.00	1.00	1.01	1.00	0.98
	Jun	1.00	1.00	1.00	1.00	0.99	0.96
	Jul	1.00	0.99	1.00	0.99	0.98	0.94
	Aug	1.00	1.00	1.00	1.01	0.99	0.98
	Sep	1.03	1.02	1.03	1.03	1.02	1.00
	Oct	1.04	1.03	1.04	1.04	1.03	1.03
	Nov	1.04	1.04	1.04	1.05	1.04	1.05
	Dec	1.04	1.04	1.05	1.05	1.04	1.05
2013	Jan	1.06	1.05	1.06	1.05	1.05	1.06
	Feb	1.07	1.07	1.07	1.06	1.05	1.06
	Mar	1.07	1.06	1.07	1.06	1.05	1.06
	Apr	1.07	1.06	1.07	1.05	1.05	1.06
	May	1.07	1.06	1.07	1.05	1.04	1.05
	Jun	1.07	1.06	1.07	1.05	1.04	1.05
	Jul	1.07	1.07	1.07	1.05	1.05	1.05
	Aug	1.08	1.07	1.08	1.06	1.05	1.06
	Sep	1.09	1.08	1.09	1.07	1.07	1.07
	Oct	1.10	1.09	1.09	1.08	1.07	1.08
	Nov	1.10	1.09	1.10	1.08	1.08	1.08
	Dec	1.11	1.10	1.10	1.11	1.10	1.11
2014	Jan	1.11	1.10	1.11	1.12	1.11	1.12
	Feb	1.12	1.11	1.12	1.11	1.10	1.11
	Mar	1.11	1.10	1.11	1.10	1.09	1.10
	Apr	1.12	1.10	1.11	1.09	1.09	1.10
	May	1.12	1.11	1.11	1.10	1.09	1.10
	Jun	1.12	1.11	1.12	1.10	1.09	1.10

1) CPI of Mekong Delta was applied after January 2013

Table 4 Escalation Ratio for Binh Duong Province (from March 2013)

Year	Month	All items			housing and construction materials		
		Whole country	South East	Binh Duong[1)]	Whole country	South East	Binh Duong[1)]
2013	Jan						
	Feb						
	Mar	1.00	1.00	1.00	1.00	1.00	1.00
	Apr	1.00	1.00	1.00	1.00	0.99	1.00
	May	1.00	1.00	1.00	0.99	0.98	1.01
	Jun	1.00	1.00	1.00	0.99	0.98	1.01
	Jul	1.00	1.00	1.01	0.99	0.98	1.02
	Aug	1.01	0.99	1.01	1.00	0.99	1.03
	Sep	1.02	1.00	1.02	1.01	1.00	1.04
	Oct	1.03	1.02	1.02	1.02	1.00	1.04
	Nov	1.03	1.03	1.02	1.02	1.01	1.03
	Dec	1.04	1.04	1.03	1.05	1.04	1.06
2014	Jan	1.04	1.04	1.03	1.06	1.05	1.08
	Feb	1.05	1.05	1.04	1.05	1.04	1.07
	Mar	1.04	1.07	1.03	1.04	1.03	1.06
	Apr	1.04	1.06	1.03	1.04	1.02	1.04
	May	1.05	1.06	1.04	1.04	1.01	1.04
	Jun	1.05	1.06	1.04	1.04	1.02	1.05

1) CPI of South East was applied after January 2014

There are not significant differences in each estimated escalation ratio in both Phu Quoc Island and Binh Duong province. Therefore, the ratios of "housing and construction materials", which is thought to be suitable item for the object, are applied to calculate the base cost of June 2014 level for the projects as shown in **Table 5**.

Table 5 Inflation ratio to apply

Target project area	Base Price Level	Escalation ratio from the base Level to June 2014
Phu Quoc Isrand	February 2012	110%
Binh Duong Province	March 2013	105%

Annex 6-B Cost Estimate for Engineering Service

(1) Detailed Design and Tender Assistance

Summary of Cost (DD/TA)

I	**Foreign Portions**					**JPY**		**321,600,000**
II	**Local Portions**					**VND**		**26,783,260,000**
	Total					**JPY**		**452,232,672**
		US$ 1.0 =	102.6	Japanese Yen				
		US$ 1.0 =	21,036	VND				
		VND =	0.004877	Japanese Yen				

I. Foreign Portion (DD/TA)

Summary of Foreign Portions

1	Remunerations	260,550,000
2	Expenses	45,610,000
3	Others	15,440,000
	Total	321,600,000

Remunerations

	International Experts		Employment Status	Currency	Man-month		Home/Field Rate/month	Sub-Total
No.	Full Name	Position			Home	Field		
					MM		Yen	Yen
Total	**All**			Yen	**0**	90	2,895,000	260,550,000

Expenses

No.	Description		Unit	Quantity		Unit Price		Total Amount
1	International Flights (Fixed Rate)							
	Home Country - HCM round trip		R Trip	32	Yen	300,000	Yen	9,600,000
2	Miscellaneous travel expenses (Fixed Rate)							
	Excess baggage from HCM (10kg)		Person	11	Yen	30,000	Yen	330,000
	Incidental Travel Cost in home country.		Trip	32	Yen	30,000	Yen	960,000
	Establishment Allowances, Visa		Trip	32	Yen	15,000	Yen	480,000
		Sub-total					Yen	1,770,000
3	Subsistence Allowance for Foreign Expe							
		Subsistence Allowance for foreign personnel	Day	2,700	Yen	12,000	Yen	32,400,000
4	Communication (Fixed Rate)							
		Communication and air-courier from Head Offices	Month	23	Yen	80,000	Yen	1,840,000
		Total of Expenses						45,610,000

Others

No.	Description		Unit	Quantity		Unit Price		Total Amount
1	Training Cost (Fixed Rate)							
		Overseas Training Costs	Ls	1	Yen	10,000,000	Yen	10,000,000
		Sub-total					Yen	10,000,000
2	Others (Fixed Rate)							
		Mobilization / Demobilization for foreign Experts	Person	11	Yen	40,000	Yen	440,000
		Insurances	Ls	1	Yen	5,000,000	Yen	5,000,000
		Sub-total					Yen	5,440,000
		Total of Others						15,440,000

II. Local Portion (DD/TA)

Summary of Local Portions		
1	Remunerations	13,668,000,000
2	Surveys	5,824,000,000
3	Expenses	7,291,260,000
	Total	26,783,260,000

Remunerations

	Local Experts		Employment Status	Currency	Man-month		Home/Field Rate/Month	Sub-Total
No.	Full Name	Position			Home	Field		
Local Engineer & Experts							VND	VND
	B1	Expert		VND	0	156	54,000,000	8,424,000,000
	B2	Sub Expert		VND	0	126	40,000,000	5,040,000,000
	C	Support staff		VND	0	12	17,000,000	204,000,000
		Total				294		13,668,000,000

Surveys

No.	Description	Unit	Quantity		Unit Price		Total Amount
1	Detailed Investigation (Lump Sum)						
	Topographic Survey	Ls	1	VND	3,120,000,000	VND	3,120,000,000
	Geological Investigation	Ls	1	VND	2,080,000,000	VND	2,080,000,000
	Hydrographic Survey & Data Collection	Ls	1	VND	624,000,000	VND	624,000,000
	Sub-total						5,824,000,000

Expenses

1	Subsistence Allowance for Local Experts (Fixed Rate)						
	Subsistence Allowances for Local (Assume Half staff comes from HCM)	Month	147.0	VND	4,000,000	VND	588,000,000
2	Local Transportation Costs (Fixed Rate)						
	Incidental Travel Cost in VN	RT	30	VND	1,600,000	VND	48,000,000
	Domestic Airfare (Hanoi)	RT	30	VND	6,500,000	VND	195,000,000
	Sub-total					VND	243,000,000
3	Communication (Fixed Rate)						
	Communication & Air Courier from BD	Month	23	VND	2,000,000	VND	46,000,000
4	Office Supply (Fixed Rate)						
	Office Supplies, stationary and consumal	Month	23	VND	15,000,000	VND	345,000,000
	Utilities (electricity, water and cleaning)	Month	23	VND	10,000,000	VND	230,000,000
	Internet charges	Month	23	VND	5,000,000	VND	115,000,000
	Telephone charges (Including Mobiles)	Month	23	VND	5,000,000	VND	115,000,000
	Office Setting/De-setting	Ls	1	VND	208,000,000		208,000,000
	Sub-total					VND	1,013,000,000
5	Local Transportation Rental Costs (Lump Sum)						
	4-W drive Car	Month	45	VND	50,000,000	VND	2,250,000,000
6	Office Space (Fixed Rate)						
	Office Space for the area of 150 m2 US$20/m2	Month	23	VND	63,000,000	VND	1,449,000,000
7	Reporting'	Ls	1				
	Sub-total					VND	1,000,000,000
8	Office Equipment (Lump Sum)	Ls	1				
	Sub-total					VND	232,880,000
9	Computer System (Lump Sum)	Ls	1				
	Sub-total					VND	1,425,880,000
	Total of Expenses					**VND**	**7,291,260,000**

III. Staff Assignment Schedule (DD/TA)

GRP	Position	Scope of Works	2018												2019												Total
			1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	
Group A					DD								TA														
A-1	**Project Manager**	**Overall Project/Technical Management**		1	1	1	1		1	1	1	1	1	1	1			1	1	1	1	1	1			1	18
A-2	**Water Supply Engineer (1)**	**Distribution Pipeline design, tendering**		1	1	1	1		1	1	1	1	1	1	1			1				1	1				14
A-3	**Water Supply Engineer (2)**	**Transmission pipe design, tendering**		1	1	1			1	1	1	1	1	1				1				1					11
A-4	**Civil Engineer**	**Reservoir design, tendering**		1	1	1			1	1	1	1	1					1				1					10
A-5	**Mechanical Engineer**	**Mechanical requirement for pump station**				1						1															2
A-6	**Structural Engineer**	**Structural design of reservoir**							1	1	1	1	1	1													6
A-7	**Topographic/Geographic Engineer**	**Topographic/geographic surveys instruction**		1	1	1	1	1																			5
A-8	**Contract Specialist/ Document Specialist**	**Reports, Tender Documents, tendering**									1	1	1	1	1			1				1					7
A-9	**Environmental Specialist**	**Environmental Study**			1	1					1		1	1													5
A-10	**Social Management Specialist**	**Social Impact Study/RAP**			1						1		1	1													4
A-11	**Cost Estimate/Construction Planner**	**Cost estimation, construction scheduling**			1	1					1	1	1	1	1							1					8
A	**Total of the Group A**		**68**												**22**												90
Group B																											
B-1	**Deputy Project Manager**	**Overall Project/Local Management**		1	1	1	1	1	1	1	1	1	1	1	1			1	1	1	1	1	1			1	19
B-2	**Water Supply Engineer 1**	**Distribution Pipeline design, tendering,**		1	1	1	1	1	1	1	1	1	1	1	1			1	1	1	1	1	1				18
B-3	**Water Supply Engineer 2**	**Distribution Pipeline design,**		1	1	1	1	1	1	1	1	1	1	1	1												12
B-4	**Water Supply Engineer 3**	**Transmission Pipeline design, tendering**		1	1	1	1	1	1	1	1	1	1	1	1			1				1					14
B-5	**Water Supply Engineer 4**	**Transmission Pipeline design**		1	1	1	1	1	1	1	1	1	1	1	1												12
B-6	**Water Resources Engineer**	**Reservoir design, tendering**		1	1	1	1	1	1	1	1	1	1	1	1			1				1					14
B-7	**Civil Engineer 1**	**Reservoir design**		1	1	1	1	1	1	1	1	1	1	1	1												12
B-8	**Mechanical Engineer**	**Sewer Design,**			1	1					1	1	1														5
B-9	**Structural Engineer**	**Electrical design of pump station**			1	1	1	1	1	1	1	1	1	1	1												11
B-10	**Topographic/Geographic Engineer**	**Topographic/geographic surveys instruction**		1	1	1	1	1																			5
B-11	**Contract Specialist/ Document Specialist**	**Reports, Tender Documents, Tendering**			1	1					1	1	1	1	1			1				1				1	10
B-12	**Environmental Specialist**	**Environmental Study**			1	1				1	1	1															5
B-13	**Social Management Specialist**	**Social Impact Study/RAP**			1	1					1	1															4
B-14	**Cost Estimate/Construction Planner 1**	**Cost estimation, construction scheduling**			1	1					1	1	1	1	1							1					8
B-15	**Cost Estimate/Construction Planner 2**	**Cost estimation, construction scheduling**			1	1					1	1	1	1	1												7
B	**Total of the Group B**		**124.0**												**32.0**												156
Supporting Staff																											
C-1	**AutoCAD draftsman/Technician 1**	**Drawings, Engineering support**		1	1	1	1	1	1	1	1	1	1	1	1												12
C-2	**AutoCAD draftsman/Technician 2**	**Drawings, Engineering support**		1	1	1	1	1	1	1	1	1	1	1	1												12
C-3	**AutoCAD draftsman/Technician 3**	**Drawings, Engineering support**							1	1	1	1	1	1	1												7
C-4	**AutoCAD draftsman/Technician 4**	**Drawings, Engineering support**							1	1	1	1	1	1	1												7
C-5	**AutoCAD draftsman/Technician 5**	**Drawings, Engineering support**							1	1	1	1	1	1	1												7
C-21	**Office Manager**	**Management of Administration Staff**		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	23
C-22	**Secretary**	**Secretarial Management**		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	23
C-23	**Accountant**	**Accounting/invoicing**		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	23
C-24	**Interpreter/Secretary**	**Interpretation/report typing/secretarial work**		1	1	1	1	1	1	1	1	1	1	1	1												12
C-25	**Administration Staff**	**General office work/typing/Misc work**		1	1	1	1	1	1	1	1	1	1	1	1												12
	Total of the Group C		**95**												**43**												138
	Total of the Group B&C		**219.0**												**75.0**												
	Total of Groups A, B & C		**287.0**												**97.0**												

(2) Construction Supervision

Summary of Cost (SV)

I	**Foreign Portions**					**JPY**		**498,140,000**
II	**Local Portions**					**VND**		**32,319,200,000**
	Total					**JPY**		**655,773,666**
		US$ 1.0 =	102.6	Japanese Yen				
		US$ 1.0 =	21,036	VND				
		VND =	0.004877	Japanese Yen				

II. Foreign Portion (SV)

1	Remunerations							413,985,000
2	Expenses							68,875,000
3	Others							15,280,000
		Total						498,140,000

Remunerations

	International Experts		Employment Status	Currency	Man-month		Home/Field Rate/month	Sub-Total
No.	Full Name	Position			Home	Field		
					MM		Yen	Yen
Total	**All**			Yen	**0**	143	2,895,000	413,985,000

Expenses

No.	Description		Unit	Quantity		Unit Price		Total Amount
1	International Flights (Fixed Rate)							
	Home Country - HCM round trip		R Trip	41	Yen	300,000	Yen	12,300,000
2	Miscellaneous travel expenses (Fixed Rate)							
	Excess baggage from HCM (10kg)		Person	7	Yen	30,000	Yen	210,000
	Incidental Travel Cost in home country.		Trip	41	Yen	30,000	Yen	1,230,000
	Establishment Allowances, Visa		Trip	41	Yen	15,000	Yen	615,000
		Sub-total					Yen	2,055,000
3	Subsistence Allowance for Foreign Expe							
		Subsistence Allowance for foreign personnel	Day	4,290	Yen	12,000	Yen	51,480,000
4	Communication (Fixed Rate)							
		Communication and air-courier from Head Offices	Month	38	Yen	80,000	Yen	3,040,000
		Total of Expenses						68,875,000

Others

No.	Description		Unit	Quantity		Unit Price		Total Amount
1	Training Cost (Fixed Rate)							
		Overseas Training Costs	Ls	1	Yen	10,000,000	Yen	10,000,000
		Sub-total					Yen	10,000,000
2	Others (Fixed Rate)							
		Mobilization / Demobilization for foreign Experts	Person	7	Yen	40,000	Yen	280,000
		Insurances	Ls	1	Yen	5,000,000	Yen	5,000,000
		Sub-total					Yen	5,280,000
		Total of Others						15,280,000

II. Local Portion (SV)

Summary of Local Portions			
1	Remunerations		22,316,000,000
2	Surveys		656,000,000
3	Expenses		9,347,200,000
	Total		32,319,200,000

Remunerations

	Local Experts		Employment Status	Currency	Man-month		Home/Field	Sub-Total
No.	Full Name	Position			Home	Field	Rate/Month	
Local Engineer & Experts							VND	VND
	B1	Expert		VND	0	218	54,000,000	11,772,000,000
	B2	Sub Expert		VND	0	233	40,000,000	9,320,000,000
	C	Support staff		VND	0	72	17,000,000	1,224,000,000
		Total				523		22,316,000,000

Surveys

No.	Description	Unit	Quantity		Unit Price		Total Amount
1	Survey & PR						
	Environment Analysis		1	VND	246,000,000	VND	246,000,000
	Others		2	VND	205,000,000	VND	410,000,000
	Sub-total						656,000,000

Expenses

1	Subsistence Allowance for Local Experts (Fixed Rate)						
	Subsistence Allowances for Local (Assume 1/2 staff comes from HCM/Hanoi)	Month	261.5	VND	4,000,000	VND	1,046,000,000
2	Local Transportation Costs (Fixed Rate)						
	Incidental Travel Cost in VN	RT	72	VND	1,600,000	VND	115,200,000
	Domestic Airfare (HCM/Hanoi)	RT	72	VND	6,500,000	VND	468,000,000
	Sub-total					VND	583,200,000
3	Communication (Fixed Rate)						
	Communication & Air Courier from BD	Month	36	VND	2,000,000	VND	72,000,000
4	Office Supply (Fixed Rate)						
	Office Supplies, stationary and consumal	Month	36	VND	15,000,000	VND	540,000,000
	Utilities (electricity, water and cleaning)	Month	36	VND	10,000,000	VND	360,000,000
	Internet charges	Month	36	VND	5,000,000	VND	180,000,000
	Telephone charges (Including Mobiles)	Month	36	VND	5,000,000	VND	180,000,000
	Office Setting/De-setting	Ls	1	VND	208,000,000	VND	208,000,000
	Sub-total					VND	1,468,000,000
5	Local Transportation Rental Costs (Lump Sum)						
	4-W drive Car	Month	70	VND	50,000,000	VND	3,500,000,000
6	Office Space (Fixed Rate)						
	Office Space for the area of 150 m2 US$20/m2	Month	36	VND	63,000,000	VND	2,268,000,000
7	Reporting'	Ls	1				
	Sub-total					VND	410,000,000
8	Office Equipment (Lump Sum)	Ls	1				
	Sub-total				Provided	VND	0
9	Computer System (Lump Sum)	Ls	1				
	Sub-total				Provided	VND	0
10	Cafeteria Equipment (Lump Sum)	Ls	1				
	Sub-total				Provided	VND	0
	Total of Expenses					**VND**	**9,347,200,000**

III. Staff Assignment Schedule (SV)

GRP	Position	Scope of Works	2020												2021												2022												2023			Total
			1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	-	12	
Group A																																									
A-1	**Project Manager**	**Overall Project/Technical Management**	1	1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1		1	1	1	1		2		35.0
A-2	**Water Supply Engineer (1)**	**Distribution Pipeline**	1	1	1	1	1	1		1	1	1	1	1	1		1	1	1	1	1	1	1		1	1	1	1	1	1		1	1	1	1	1	1				32.0
A-3	**Water Supply Engineer (2)**	**Transmission pipe**	1	1	1	1	1	1	1	1		1	1	1	1	1		1	1	1	1	1	1		1	1	1	1			1	1									25.0
A-4	**Civil Engineer**	**Reservoir,**	1	1	1	1	1		1	1	1	1	1	1	1	1	1		1	1	1	1	1		1																20.0
A-5	**Structural Engineer**	**Structural of reservoir and pipeline**			1	1	1					1	1	1			1			1	1						1	1													11.0
A-6	**Environmental Specialist**	**Environmental Study**		1	1			1			1				1						1						1				1					1	1				10.0
A-7	**Social Management Specialist**	**Social Impact Study/RAP**		1	1			1			1				1						1						1				1					1	1				10.0
A	**Total of the Group A**		**59.0**												**46.0**												**36.0**												**2.0**			143.0
Group B																																									
B-1	**Deputy Project Manager**	**Overall Project/Local Management**	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1		2		36.0
B-2	**Water Supply Engineer 1**	**Distribution Pipeline**	1	1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1				34.0
B-3	**Water Supply Engineer 2**	**Distribution Pipeline**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1													26.0
B-4	**Water Supply Engineer 3**	**Transmission Pipeline**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1									30.0
B-5	**Water Supply Engineer 4**	**Transmission Pipeline**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1															24.0
B-6	**Water Resources Engineer**	**Reservoir**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1															24.0
B-7	**Structural Engineer**	**Structural of reservoir and pipeline**			1	1	1					1	1	1			1	1		1	1						1	1													12.0
B-8	**Environmental Specialist**	**Environmental Study**	1	1	1	1	1	1		1	1				1	1				1	1				1	1											1	1				16.0
B-9	**Social Management Specialist**	**Social Impact Study/RAP**	1	1	1	1	1	1		1	1				1	1				1	1				1	1											1	1				16.0
B	**Total of the Group B**		**93.0**												**84.0**												**39.0**												**2.0**			218.0
Supporting Staff																																									
C-1	**Site Supervisor 1**	**Site Supervise-Distribution Pipes**			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1				33.0
C-2	**Site Supervisor 2**	**Site Supervise-Distribution Pipes**			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1													24.0
C-3	**Site Supervisor 3**	**Site Supervise-Intake/Reservoir**			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																			17.0
C-4	**Site Supervisor 4**	**Site Supervise-Transmission pipe**			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1									28.0
C-5	**Site Supervisor 5**	**Site Supervise-Transmission pipe**			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																			19.0
C-6	**Office Manager**	**Management of Administration Staff**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2			38.0
C-7	**Secretary**	**Secretarial Management**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1				36.0
C-8	**Accountant**	**Accounting/invoicing**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2			38.0
C-9	**Interpreter/Secretary**	**Interpretation/report typing/secretarial work**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1				36.0
C-10	**Administration Staff**	**General office work/typing/Misc work**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1				36.0
C	**Total of the Group C**		**110.0**												**112.0**												**79.0**												**4.0**			305.0
B/C	**Total of the Group B&C**		**203.0**												**196.0**												**118.0**												**6.0**			523.0
	Total of Groups A, B & C		**262.0**												**242.0**												**154.0**												**263**			921.0