

# Initial Environmental Examination

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Project Number: 41456-033  
March 2011

## MFF 0054-VIE: Water Sector Investment Program – Tranche 2

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## **Supplementary Appendix 19-e**

# **Initial Environmental Examination Report of Hung Dao Water Supply Project**

**March 2011**

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## ABBREVIATION

ADB	Asian Development Bank
AP	Affected Person/Party
CPC	Commune People's Committee
DONRE	Department of Natural Resources and Environment, Hai Phong
DPC	District People's Committee
EA	Executing Agency
EMP	Environmental Management Plan
EPC	Environmental Protection Commitment Report
FGD	Focus Group Discussions
GPP	Grievance Point Person
GoV	Government of Vietnam
HH	Households
HPWSCo	Hai Phong Water Supply Company
IEC	information, education and communication
IEE	Initial Environmental Examination
LAR	Land Acquisition and Resettlement
lpcd	liters per capita per day
M&R	Maintenance and Repair
MARD	Ministry of Agriculture and Rural Development
MoH	Ministry of Health
MoNRE	Ministry of Natural Resources and Environment
MPI	Ministry of Planning and Investment
O&M	Operation and Maintenance
OE	Operating Enterprise
PIA	Project Implementation Assistance
PPTA	Project Preparatory Technical Assistance
REA	Rapid Environmental Assessment (ADB Checklist)
RP	Resettlement Plan
TA	Technical Assistance
USD	United States Dollar

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VND	Vietnamese Dong
WTP	Water Treatment Plant

## WEIGHTS AND MEASURES

°C	Celsius/centigrade
dBa	decibel audible
ha	hectare/s
km	kilometres
km <sup>2</sup>	square kilometres
kph	kilometres per hour
m	meters
m <sup>3</sup>	cubic meters
mg/l	milligrams per liter
mm	millimetres

## CURRENCY EQUIVALENTS

As of 3 March 2011  
Currency Unit - Vietnamese Dong (VND)  
USD 1 = VND 20,885.00

## A. INTRODUCTION

### ***A.1 Purpose of the Report and the Project Background***

1. This report is the description of the Initial Environmental Examination (IEE) study of the proposed new Hung Dao water supply project. The IEE study was conducted during the project preparation period to identify the impacts of the proposed project on the environment and to recommend measures to mitigate adverse impacts arising from their implementation. The IEE Report is prepared to meet the environmental requirements of the ADB. The proposed project is located in Hai Phong, the fourth largest city in Vietnam and located about 100 km east of Hanoi, the capital city of Vietnam. Haiphong is one of the cities in Vietnam identified as National Centers.

2. The project executing agency is the Hai Phong Water Supply Company (HPWSCo) owned by the Government of Vietnam (GoV). The new Hung Dao water supply scheme involves constructing a water intake from the Da Do River, a tributary of the Van Uc River, a new Water Treatment Plant with a capacity of 25000 m<sup>3</sup>/d at a place called Hung Dao in the Duong Kinh District and about 24km of new transmission mains in order to supply water for the existing areas and new service areas of:

- a) Do Son District service area;
- b) Hai An service area;
- c) Duong Kinh service area;
- d) Road 401 and Nui Doi service area

3. At present, the existing facilities are unable to provide potable water of standard quality and quantity to the existing and new service areas. In a broader perspective, the need has arisen to (i) expand domestic service coverage, particularly in peri-urban areas; (ii) improve water supply for commercial use to support rapid economic development in the city; (iii) provide continuous water supply 24 hours a day at appropriate quantity and pressure; (iv) further reduce and manage nonrevenue water levels in district meter areas; (v) increase water purification capacity and develop new water sources; (vi) raise customer awareness for water conservation; and (vii) continue capacity development to cope with business growth, further improve financial and operational performance, and prepare for potential private sector participation in the future.

4. The proposed project is a component of the Rehabilitating and Upgrading Project of Haiphong Water Supply System – Stage II planned to meet the Millennium Development Goal of halving sustainable access to safe drinking water and basic sanitation. Hai Phong Water Supply Company seeks to achieve safe drinking water coverage to 90% of the population by 2020 and the country's 5-Year Socio-economic Development Plan, and ADB's Country Partnership and Strategy.

5. The improvement in the water supply system would support the social, economic, and environmental development of the City, supporting trade and commerce, facilitating employment generation, and raising income levels in the project component areas and the

City as a whole. The project will support for women and children as well as it will address the full cost recovery of tariffs to achieve long term financial sustainability of the improvements.

## ***A.2 Extent of the IEE Study***

6. The initial environmental examinations (IEE) study was carried out by the PPTA Consultants attached to AECOM following the requirements of Safeguard Policy Statement (June 2009) and Environmental Assessment Guidelines (2003) of the Asian Development Bank (ADB). Also reference was made to the requirements of the Government of Vietnam (GOV) embodied in Law on Environmental Protection and its implementation guidelines (Decree No. 80/2006/ND-CP of 9 August 2006 and Decree 21/ND-CP of 28 February 2008). Environmental Specialists attached to the PPTA visited the project sites and also carried out public consultations prior to preparation of this report. Moreover, the information provided by other experts carrying out Feasibility Study was also used in this exercise.

7. Thus the IEE Study involved the following activities:

- Gathering of baseline information available on the physical, chemical, biological, and socio-economic environment of the project area and its subcomponent sites; and understanding the technical, social, and institutional aspects of the project; This included public consultation and field visits;
- Screening of potential issues, concerns and impacts relative to siting, design, construction and operation to distinguish those that are likely to be significant for a particular subcomponent and warranting further study;
- Recommending measures to mitigate adverse issues, concerns and impacts, particularly to the project design team;
- Preparing an Environmental Management Plan indicating impact areas, recommended mitigation measures, method of monitoring the impacts, particularly during construction and operation phases and responsible persons; and
- Proposing an environmental monitoring plan (EMP) and the institutional set up for implementation of the above Environmental Management Plan.

8. Findings of site reconnaissance, results of social surveys, results of water quality tests and analyses, technical descriptions based on the engineering designs contained in the Feasibility Reports and outcome of discussions with Officers of the relevant HPWSCo, DONRE, People's Committees and the Communes are integrated into this IEE Report.

9. Public consultation activities were carried out, including on-site consultation with people/communities likely to be affected by the project activities. The consultation workshops allowed the area residents voice their concerns and the TA consultants answered questions they had on the project. These face-to-face meetings allowed the TA consultants fine-tune the environmental management and mitigation plan, particularly to fit the needs of the area residents.



## **B. DESCRIPTION OF THE PROJECT**

### ***B.1 Type and Category of Project***

10. The Project is located in Hai Phong urban area in northern Vietnam, about 100 km east of Hanoi, the capital city of Vietnam (see Figure 1). The objective of the Project is to construct a new water treatment plant (herein referred to as Hung Dao WTP) and transmission mains in order to supply water for the existing areas and new service areas as follows: (i) Do Son District service area; (ii) Hai An service area; (iii) Duong Kinh service area (iv) Road 401 and Nui Doi service area. The project locations are shown in Figure 2, 3 & 4). The Water Supply Project is implemented according to the strategies of the overall urban development scheme up to 2020.

11. Under ADB classification, the Project is a Category “B” undertaking. The adverse impacts that will potentially arise from the implementation of the Project will generally be minor to moderate, and significant only for the land acquisition involved in the proposed WTP site. Measures to mitigate them can be designed, provided and/or instituted without difficulty. For Category “B” projects, the ADB requires an IEE. Regarding the GOV requirements, according to Circular No.05/2008/TT-BTNMT, dated December 8, 2008, water supply projects with design capacity less than 50,000m<sup>3</sup>/day are classified as Category “II” projects. A Category “II” project would require an Environmental Protection Commitment (EPC) for registration with, and certification by, the District People’s Committee through its Natural Resources and Environment Office. The EPC for this Project will be prepared following the completion of this IEE.

### ***B.2 Need for the Project***

12. Hai Phong is the fourth largest city in Viet Nam and serves as the main port for the capital Hanoi. It has been growing rapidly in the last 5-10 years and has made considerable socioeconomic development gains. However, the infrastructure needs couldn’t seem to keep up. The city’s economy is growing at around 11% annually, exceeding Viet Nam’s national economic growth rate of about 8%. This growth rate places serious strain on the city’s infrastructure, including its water supply system.

13. The Hai Phong water supply system constructed in 1905 was seriously degraded by 1980s due to long-term use, damages of war, and aging technologies and didn’t serve its designated function at some parts of the system. Since 1990, the system and water supply facilities have been gradually rehabilitated and improved under the Phase I to rehabilitate and improved the water supply system in the urban centre of the city with the main focus on improvement and rehabilitation of the water supply system in 5 urban districts. Phase I started in 1990s and will be finished in 2009 with the completion of the Kien An Water Supply Project. Phase I was funded by the Government of Finland, World Bank, and HPWSCO itself.

14. The water systems in other urban and peri-urban districts of the City are also in great need of improvement, for the same reasons as in Phase I areas. Therefore, it was necessary to improve the Hai Phong water supply system in both production capacity and service area in the areas not covered by Phase-I, which initiated the drive for Phase II of the Hai Phong Water Supply System Rehabilitating and Upgrading Project. The focus of Phase II would be on the improvement and rehabilitation water supply system in 5 urban districts. The proposed Hung Dao project is only a one component o that Phase II.



Figure 1: General location of Hai Phong city



Figure 2: Location of the proposed WTP

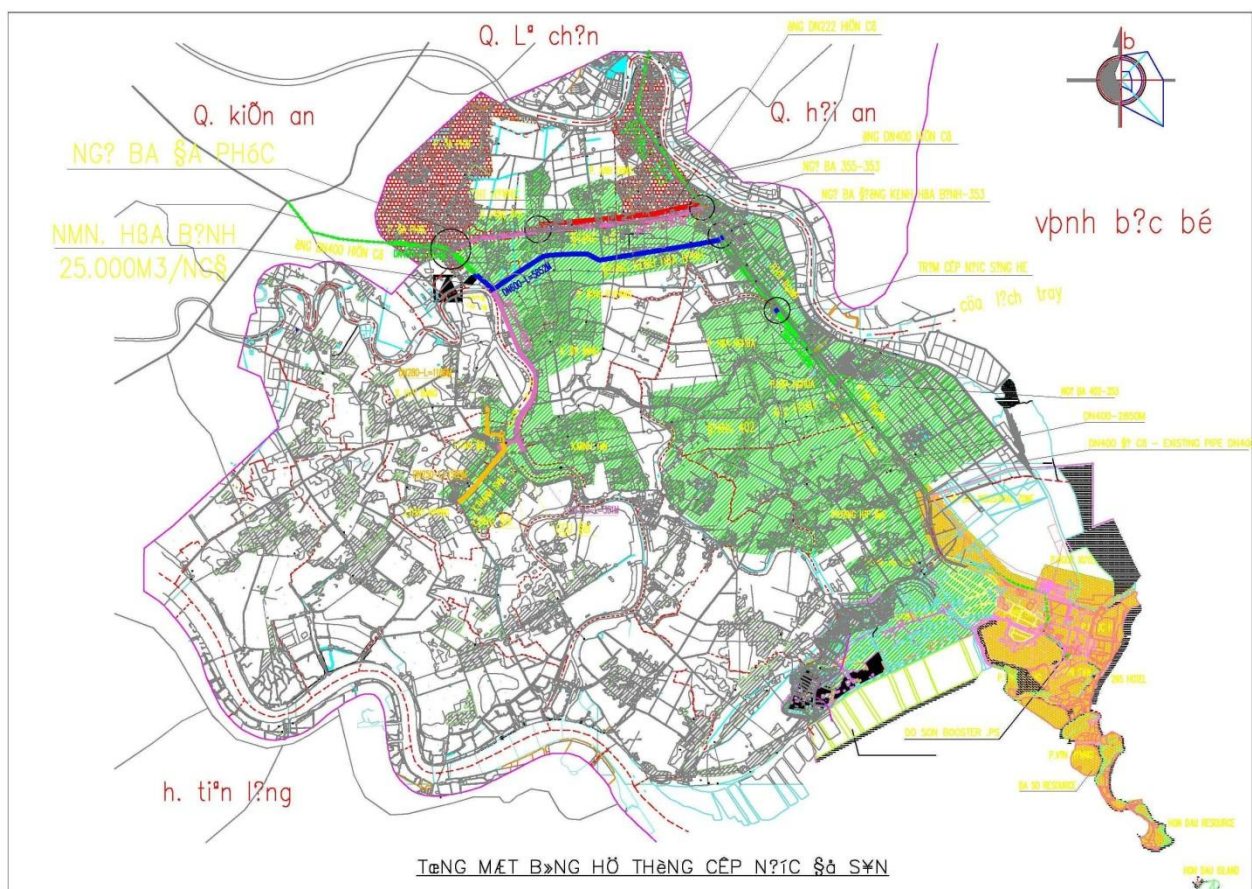


Figure 3: Locations of proposed WTP, Transmission mains and the service areas



### **B.3 Project Facilities and Operations**

15. The project is to expand the scope and raise the quality of urban water supply: 65 percent of the 167,411 urban population will be supplied with clean water with an average of 90 litres per head per day by 2015 and 90 percent of the 175,950 population with an average of 120 litres per capita per day by 2020. Water consumption level for industry is forecast at 140m<sup>3</sup>/day in 2010 and 200m<sup>3</sup> in 2020. It is also an objective to reduce the percentages of water losses and uncollected water revenue to 40% in the existing urban areas and 30% in new areas by the year 2020<sup>1</sup>.

16. The Hung Dao Project will develop a water supply system that will meet total water supply requirements of population, and those of commercial establishments, and institutions of Districts (i.e. Do Son District; Hai An service area; Duong Kinh service area and Road 401 and Nui Doi service area), as well as 100 percent industrial zone, by 2025. The specific sizes and magnitudes of the project component components are:

- (i) Water intake at the Da Do river;
- (ii) Water Treatment Plant (WTP) of 25,000 m<sup>3</sup>/day capacity in Hung Dao ward, Duong Kinh district, Hai Phong city; and
- (iii) About 24 km new transmission mains

#### **Intake and Water Source**

17. The new Hung Dao WTP will be supplied raw water from the Da Do River, a tributary of the Van Uc River. All technical data to be used in design of water supply system are applied in accordance with Vietnam Construction Standard and Water Supply Sector Standards

#### **WTP and Treatment Processes**

18. The treatment system is designed with the following processes to produce water that meets all requirements on food hygiene according to Vietnam Standards of QCVN 01:2009/BYT or the National Technical Regulation on drinking water quality; standards of treated water quality specified by QCVN 01-2009 /BYT and Standards at consumer points stipulated by QCVN-01-2009 BYT and WHO standards.

19. The first process will be pre-chlorination to oxidize organic compounds in water; to limit the growth of algae; and for disinfection, especially as a safeguard against epidemic diseases, if any appears, in the river basin. Pre-chlorination would also increase the effectiveness of coagulation. The second process will be to mix raw water with coagulant of aluminium sulphate Al<sub>2</sub>(SO<sub>4</sub>) or poly-aluminum chloride (AlCl<sub>3</sub>). After dissolving and hydrolysis, it will form positive electrical charged particles. Solid particles in water (including dissolved and undissolved compounds) are negative electrical charged and therefore they will react with the positive coagulants, with the ability to form micro particles for sedimentation.

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<sup>1</sup> "Direction to urban supply development toward 2020" approved by decision 63/1998/QĐ-TTg dated 18 March 1998

20. Alkalization to increase alkalinity will be achieved by addition of chemicals [ $\text{Ca}(\text{OH})_2$  lime milk] to increase stability of the treated water to avoid corrosion of facilities and network. Flocculation process will create suspended particles after mixing. With reasonable mixing, micro suspended particles will be formed and in the mixing tank they will form bigger suspended particles by aggregation, allowing more effective and efficient sedimentation and clarification during the process for sedimentation and clarification. Suspended particles from flocculation tank will be settled in clarification tank. Rapid sand filters will be used for filtration of remaining suspended particles. Quartz sand will be used for filter media. All small suspended particles will be removed together with micro-organisms in filter layers.

21. Post-Chlorination with fluid chlorine for disinfection process is planned as it is a popular process in Vietnam for easy procurement of chlorine and equipment and also the simple operation. Disposal of backwash water from washing filters and sedimentation tanks will be to satisfy standards of TCVN 1329/2002/BYT of Vietnamese Environment Law. All backwash water will be discharged into sludge thickening basins (recovery tanks) and then to sludge drying beds, where sludge and solid particles will settle down and be dried. Clear water from the sludge thickening basins would be returned (i.e. recycled) to the pre-sedimentation basins. Average sludge quantity from backwash water will be approximately 1000 ton per day. Once substantial amount of dried sludge is accumulated, after a period of 3 - 6 months or more, sludge will be disposed at sanitary solid waste landfills.

22. In order to adopt the above processes, the WTP will have the following components (see Figure 4):

- (i) One intake (diameter of gravity is 800 mm) with 2 bar screens to remove floating debris. The intake capacity will be  $1720 \text{ m}^3/\text{h}$  ( $0.48 \text{ m}^3/\text{s}$ ) to supply  $25000 \text{ m}^3/\text{day}$  by the WTP with an abstraction of  $27500 \text{ m}^3/\text{day}$  ( $1146 \text{ m}^3/\text{h}$ ) at hydraulic coefficient of 1.5.
- (ii) Raw water receiving pond of  $4800 \text{ m}^3$  capacity to trap suspended matters (sand and silt) with facilities for weekly de-sludging.
- (iii) Raw water pumping station with 3 pumps (2 in operation while one standby) of capacity  $600 \text{ m}^3/\text{h}$  each and therefore with 3 inlet channels with fine screens.
- (iv) 2 number pre-chlorination tanks located in the raw water pumping station with a hydraulic device to apply pre-chlorination. Also in pushing pipe of raw water pumps, lime milk will be mixed in water for alkalisation before reaching the mixing tank.
- (v) 3 number vertical shaft mechanical rapid mixing tank (two tanks working while one standby) of  $8.1 \text{ m}^3$  volume each.
- (vi) Vertical shaft mechanical rapid flocculation tank with 3 lines, each line comprising 3 serial chambers; volume of each chamber  $54.76 \text{ m}^3$ .
- (vii) Tube sedimentation Tank comprising three lines (32 m long) connecting with three flocculation lines.
- (viii) 4 number rapid sand filters with 2 chambers (each  $3.3\text{m} \times 7.7\text{m}$ ) per filter to be filtrated by water vapour and horizontal sweep current, with a filter media layer of quartz sand; the planned backwash sequence of the filters involve air scouring; air and water back wash; water back wash augmented with surface sweep from filter inlet; The filters of first phase can be converted into dual filter media with anthracite.

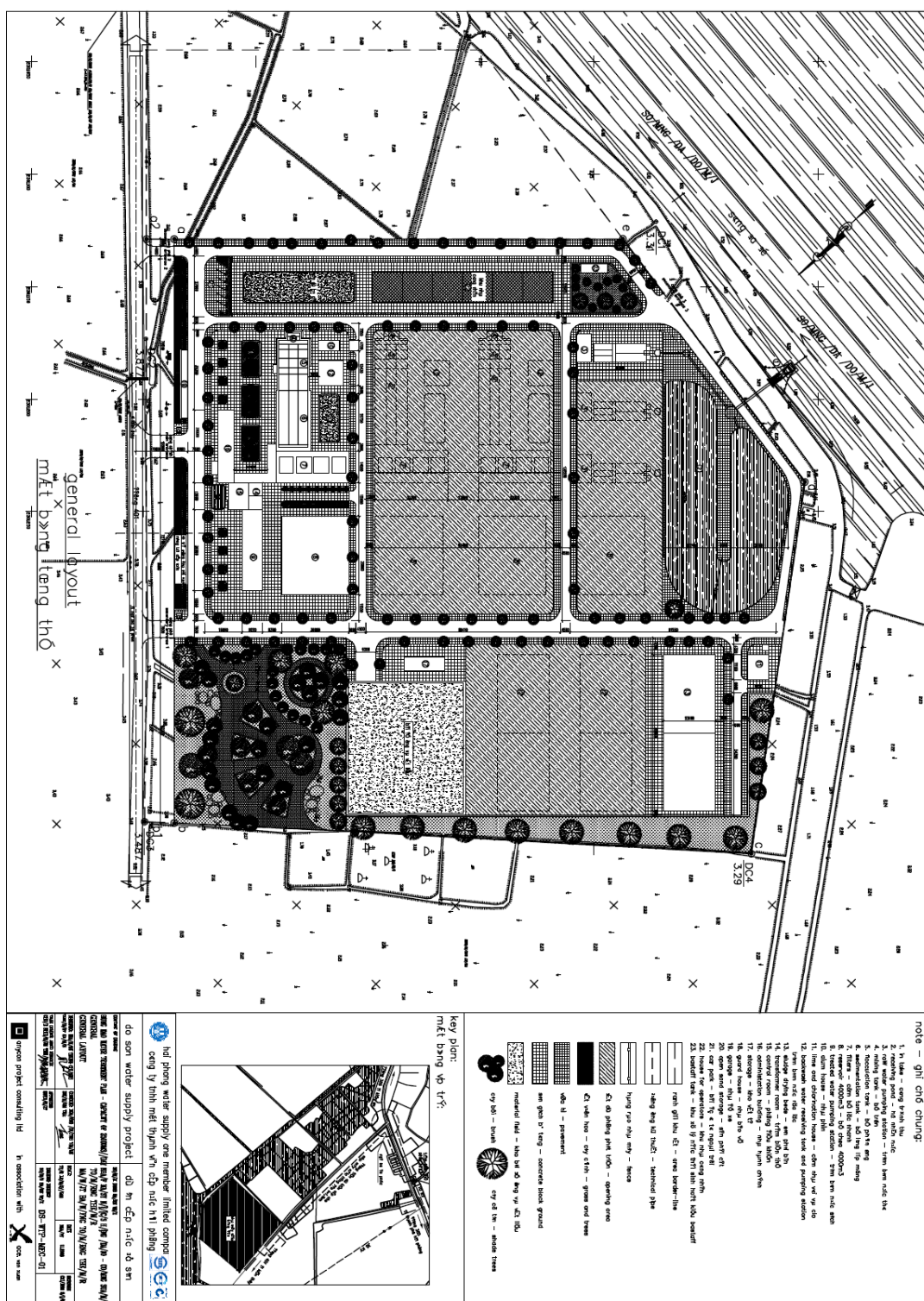
- The operator could increase filtration velocity up to 10 m/h, and even more and the maximum number of filters in one water treatment plant shall not be more than 20;
- (ix) Treated water reservoir of 3750 m<sup>3</sup> capacity to balance flow between raw water pumps and treated water pumps following daily water consumption
  - (x) 4 number of treated water pumps (3 pumps in operation while one standby) with treated water pump capacity of 550 m<sup>3</sup>/h:
  - (xi) Backwash water recovery pumping station tank with a recovery tank of 350 m<sup>3</sup> volume, which is enough for two backwashes. Number of sludge pumps is 2 (1 pump working while one pump is standby) with a pump capacity of 170 m<sup>3</sup>/h to pump backwash water and sludge from the sedimentation tank to sludge drying beds
  - (xii) 3 number sludge drying beds for a retention time of 3 months with 10m x 30m size each.
  - (xiii) Other facilities such as administration building, control room and sub-station, workers house, warehouse, guard house, outdoor lighting system, lightning protection system, fencing walls, etc.

23. High voltage power supplied for the WTP will be taken from the 22kV high voltage line which is managed by Hai Phong Electricity Company. The line will be connected to the 22kV high voltage at Phuc Hai 2 sub-station (there is an agreement with Hai Phong Electricity Company on the connection available).

24. All water containing facilities are constructed with reinforced concrete grade C35A (according to British Standard BS-8007 – Design for waterproof concrete structure). The proposed buildings and pumping station is constructed with reinforced concrete frame grade C25 (according to BS-8110), walls is constructed with bricks grade 75, (made in Vietnam according to relevant Vietnamese standards) and cement mortar grade C10.

### ***Transmission Mains***


25. The project involves construction of about 23,707m of transmission mains along Hoa Binh channel, roads No.353, 355, 401, 402 and 405 in Duong Kinh district, and Kien Thuy district. A continues water supply to meet 2020 demand also in according with Vietnamese standard 20 TCVN-33-85, which specifies the minimum pressure at the tap will be considered in selecting pipe sizes, Pipe materials and fittings will be in accordance with design standards (ISO, BS and other applicable standards). Technical valves, discharging points and air release valves will be installed as required along transmission mains and distribution network for operation and maintenance.



**Figure 4: Lay out of proposed Hung Dao WTP**




26. The location of pipe installation and surrounding environment of each transmission main are described below

Transmissi on main	Location of pipe installation	Site description	Picture
DN600 pipeline from Hung Dao WTP to road No.353.  About 5,852 m length	The pipeline will be installed under edge of asphalt road along the right side of road 401 to Nui Doi town. At Hoa Binh sluice gate, the pipeline will be diverted and installed under earth sidewalk on the right side of the road running along Hoa Binh channel to road No.353	<i>Direction: road 353 to road 401</i> Right site: canal Left site: rice field and scattered residential areas <i>Establishments for attention:</i> -Army camp about 15 m from the road on the left side - T Junction and bridge to the residential area and high school Mac Dinh Chi on other side of canal - Cemetery of Vong Hai residential area on the right site <i>Traffic</i> – The traffic is mainly bicycles and motorcycles, mostly during 6-7.30 AM and 6-7.30 PM. During day time the traffic density is low.	 
DN400 pipeline from Hoa Binh sluice gate (in road No.401) to Nui Doi town 2,771 m length,	The pipeline will be installed under edge of asphalt road on the right of road No.401 to Nui Doi town	Dense residential areas with shops, restaurants, etc., on both sides. <i>Establishments for attention</i> - Cemetery next to the WTP on the right side -T Junction to Lang Con village, Dong Phuong commune - T Junction to Duc Phong village, Dai Dong commune - Viet-Korea Company on the left side - Bridge Doi in Nui Doi town - Martyrs monument is located on the left side about 50 m from crossroad - End of pipeline is on other side of crossroad <i>Traffic</i> The traffic is mainly bicycles, motorcycles, cars and trucks, mostly during 6-7.30AM and 6-7.30PM. During day time the traffic density is moderate.	 
DN400 pipeline from Hung Dao WTP to	The pipeline will be installed on the left side of road No.401 to Da Phuc junction. At the junction, the	Residential area and rice field on the both sides -Water treatment plant for industrial area  The traffic is mainly bicycles,	



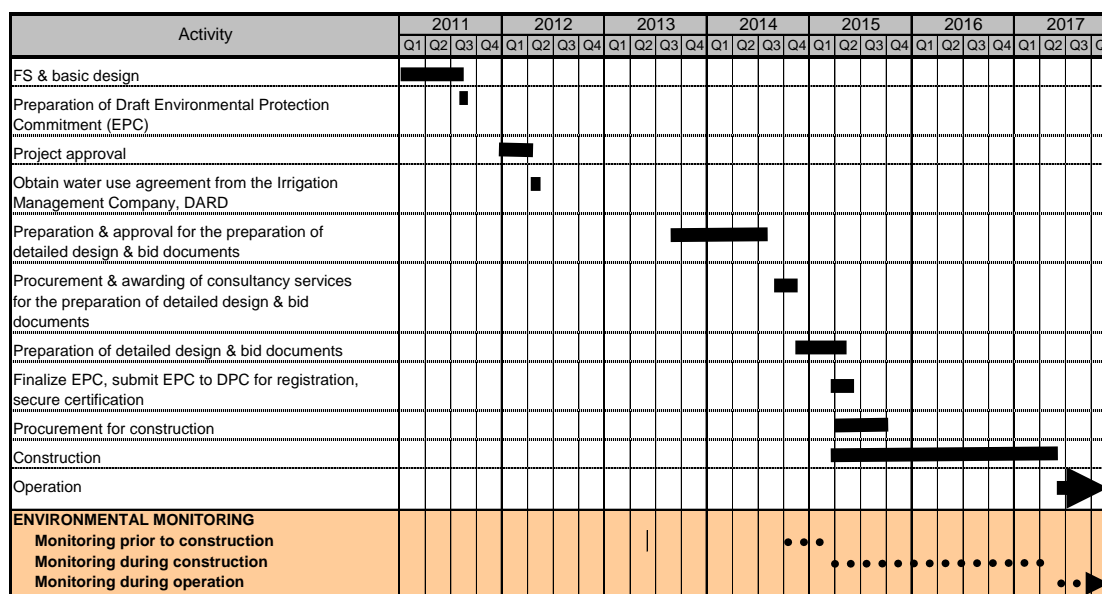
Transmissi on main	Location of pipe installation	Site description	Picture
Da Phuc T Junction 5,311 m length	pipeline will be diverted and installed under asphalt road on the right side of road No.355 to centre of Kien An district	motorcycles, cars and trucks, mostly during 6-7.30AM and 6- 7.30PM. During day time the traffic density is moderate.	
DN300 pipeline from Nui Doi town (in road No.402) to road No.353.  9,773 m length,	Pipe line installed on right side of road No.402 forward to road No.353. At road No.353, the pipeline will be connected to DN400 pipeline from Hoa Binh sluice gate (in road No.353) to Quy Kim junction	Starting from T junction of new bus station of Kien Thuy district Residential area and rice field on the both site. -University area under construction on the right site - Cemetery of Minh Tan commune right site - Garment company Truong Son, very crowded during end of working sessions - Temple Duyen Khang - Primary school Hoa Nghia - New market Hoa Nghia - Martyrs Cemetery of Hòa nghĩa Commune The line ends at Quy Kim T Junction <i>Traffic</i> The traffic is mainly bicycles, motorcycles, cars and trucks transporting construction materials, mostly during 6-7.30AM and 6- 7.30PM. During day time the traffic density is moderate.	 
DN400 pipeline from Hoa Binh sluice gate (in road No.353)	The pipeline will be installed mostly under the green area of the right side of the separating strip (centre island) of road No.353 to Do Son.	Scattering residential areas on tboth side. <i>Establishments for attention</i> - Dinh Vang Shoes Factory on the right site, very crowded during end of working time 6 PM - Tran Nhan Tong Vocational School on the right site - Crossroad with Hai Phong-Hanoi	

Transmissi on main	Location of pipe installation	Site description	Picture
to Quy Kim junction. 5,311 m length.		<p>express way</p> <ul style="list-style-type: none"> <li>- Ward People Committee Office on the left site</li> <li>- School</li> <li>- Tam Hai market on the right site</li> </ul> <p>The traffic is mainly motorcycles, cars and trucks transporting construction materials, mostly during 6-7.30AM and 6-7.30PM. During day time the traffic density is average.</p>	

## B.4 Proposed schedule for implementation

27. it is planned that the Phase II project will be implemented over a total period of 7 years, with June 2011 to June 2012 for the detailed technical design, while bidding for the construction packages would span from June 2012 to April 2016. The implementation of the 5 project components would be from June 2013 to May 2018. The Hung Dao component will be in the first package to be implemented. Implementation of the Hung Dao project components is scheduled as follows:

**Figure 5: Implementation schedule of the Hung Dao water supply project**



\* Operation may start even before repairs are completed.

\*\*EPC to be finalized towards the end of detailed design to incorporate changes. EPC to be submitted for registration right after being finalized. This is to do away with additional requirements of Decision 80/2006/ND-CP and Decree 21/2008/ND-CP if the project is executed only after 24 months from date of certification of registration of its EPC.

## C. DESCRIPTION OF THE ENVIRONMENT

### C.1 Physical Resources

28. Hai Phong, a coastal city in Northeast Viet Nam, lies between 20°30' and 21°10' north latitude and 106°20' and 107°10' east longitude. It is about 100 km east of the country's capital, Hanoi. It borders with the Gulf of Tonkin of the South China Sea in the east, and with the Provinces of Thai Binh in the south, Hai Duong in the west, and Quang Ninh in the north (see Figure 1). The total (non-contiguous) land area is about 1,522 km<sup>2</sup> (or, 0.45 percent of the total land area of Viet Nam)<sup>2</sup>, Haiphong City is administratively subdivided into 15 districts, of which 7 are urban (Hồng Bàng, Lê Chân, Ngô Quyền, Kiến An, Hải An, Đồ Sơn, Dương Kinh), and 8 are rural (An Dương, An Lão, Bạch Long Vĩ, Cát Hải, Kiến Thụy, Tiên Lãng, Thủy Nguyên, Vĩnh Bảo).

29. Do Son District is situated 22 km southeast of the City Centre. It is bounded by the Gulf of Tonkin of the South China Sea in its east and south. On the north, it is bounded by Duong Kinh District and on the south, by Kien Thuy District. Do Son has a total land area of 42.5 km<sup>2</sup>, subdivided into 7 wards.

30. Duong Kinh District borders Do Son District on the north. It lies along the Gulf of Tonkin and immediately adjacent south of Le Chan District. It is administratively composed of 6 wards, occupying a total land area of 45.85 km<sup>2</sup>.

31. Hai An district was established by Decree 106/ND-CP dated December 20<sup>th</sup> 2002 of the Government by merging five split communes of the former An Hai district and Cat Bi ward of Ngo Quyen district into a total area 10.492ha in which 77,600 people (2002) are living. Hai An is located on the southeast part of Hai Phong city, neighbouring Ngo Quyen district and Thuy Nguyen district to the north, Lach Tray River and Kien Thuy district to the south, Cam River with Nam Trieu estuary to the east, Ngo Quyen district and Lach Tray River to the west. It is administratively composed of 8 wards.

32. Kiến Thụy District is located on the southeast part of Hai Phong city, neighbouring Duong Kinh District to the north, Tiên Lãng District to the south, Do Son District to the east, Kien An and An Lao districts to the west. The area of Kien Thuy is 10.735 km<sup>2</sup>; It has 18 communes and 1 town-Núi Đồi.

<sup>2</sup> Natural Conditions – Geographic Position. <http://www.haiphong.gov.vn>; National Statistics Yearbook, 2008

## ***Climate***

33. The climate of Hai Phong has two distinct seasons, winter and summer. It is influenced by tropical monsoons, which affect the entire Southeast Asia. The cold and dry north-eastern monsoon brings in winter that lasts from November to March/April. The south-eastern monsoon ushers in summer from May to October, characterized by heat, heavy rains and occasional typhoons. March and April are the transitional months from winter to summer.

34. Based on the climate data for the period 1957-1997, the annual average temperature is 23°C. In winter, the average temperature is 19°C, in summer, 28°C. January is the coldest month and July is the hottest. Average relative humidity is 85%. It is most humid in February/March to April. Precipitation is high in the months of May to October, with about 83 percent of the annual precipitation occurring in these months. August is the wettest month. The average annual precipitation is about 1,700 mm. Evaporation is almost 700 mm annually on the average, and is about 40 percent of the average annual precipitation.

35. Prevailing wind directions are NE in the winter and SE in the summer. The average maximum wind velocity during SE monsoon period ranges between 20 and 24 m/s; in the NE monsoon period, between 10 and 16 m/s. Storms and tropical low pressures usually occur between July and September. Wind speed during storm events ranges from 40 to 62 kph; during tropical low pressures, it ranges from 63 to 120 kph.

36. Based on more recent climate records of 2007 and 2008, the annual average temperature is approximately 23°C. Precipitation is high in the months of May to September/October. The wettest months are August and September. Annual precipitation was about 1,400 to 1,500 mm. Relative humidity averaged at 85 percent in 2007 and 87 percent 2008.

## ***Air Quality***

37. The Environmental Monitoring Centre of the DONRE conducts monitoring of suspended dust, sulphur dioxide (SO<sub>2</sub>), nitrogen dioxide (NO<sub>2</sub>) and carbon monoxide (CO) at six months interval at 11 locations within Hai Phong City. The 2008 monitoring results reveal that air pollution in Hai Phong is not caused by gas emissions but by suspended dust. Concentrations of SO<sub>2</sub>, NO<sub>2</sub> and CO have remained within the permitted values specified in TCVN 5937-2005. The stations in the City Centre recorded exceeding suspended dust levels in the month of December by 5 to 25 percent. Suspended dust levels are high, especially in areas where industrial activities and/or vehicular traffic are heavy (see [Annex-3](#) for data)

38. Noise level at crowded sections of the City is in the range of 65-92 dBA (the lower level being 10 percent beyond the standard limit set for residential areas, 60 dBA; and the higher level being 26 percent over that for mixed residential-industrial areas, 75 dBA)<sup>3</sup>.

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<sup>3</sup> TCVN 5949-1995: Standards in Public and Residential Areas of Viet Nam.

39. Noise level at crowded sections of the City is in the range of 65-92 dBA (the lower level being 10 percent above the standard limit set for residential areas at 60 dBA; and the higher level being 26 percent over that for mixed residential-industrial areas at 75 dBA.

### ***Topography and Soils***

40. The topography of Hai Phong is very diversified reflecting the long and complicated historical geological process. The northern part of Hai Phong has an appearance of a plain alternated with hills, while the southern part of the city is a low and quite flat terrain of a typical delta inclining to the sea.

41. Although hills and mountains comprise just 15% of the total area of Hai Phong, they are spreading on more than half of the northern part as continuous mount ranges running in the North West - South East direction. Their origination process was closely related to the mountainous system of Quang Ninh in the North-East of Northern. Part of Vietnam Mountainous system of Hai Phong are remaining hills, traces of ancient bent foundation underground where it was once slightly sagged down. The geological composition comprises of sandstone, shale, and limestone of different ages that distributed in separate continuous ranges running in the North West - South East direction from the mainland to the sea<sup>4</sup>.

### ***Surface Water***

42. Hai Phong is located in the Bac Bo plain wherein a dense network of rivers belonging to the Thai Binh and Red River System meanders. The main rivers in Hai Phong are the Da Bach River, Cam River, Lach Tray River, Van Uc River and Thai Binh River. Small rivers/channels also play important role in the overall hydrological system of Hai Phong, e.g. Da Do River and An Kim Hai system (Sai River, Re River and Tam Bac Channel). Rivers are the main sources of water supply in Hai Phong; yet their waters are revealing that pollution levels much higher than allowable. Flowing at low velocities, the rivers in Hai Phong have high silt content. The Re and Da Do Rivers are reported as the heavily polluted among the four sources of water supply.

43. From a hydrological aspect, the rivers are not independent. A large number of canals for irrigation and drainage and new connections between rivers have been built over centuries. Thus, the main rivers have several mutual connections, both natural and man-made, making the whole concept of a drainage basin an ill-defined one. Due to the numerous interconnections between the rivers, it is impossible to define a drainage basin area for most of the rivers.

44. The Da Do River, located in the Kien Thuy District, is the water source for the proposed Hung Dao WTP. The existing Cau Nguyet WTP is supplied raw water by the same source, about 5 km upstream from the planned intake point for the new Hung Dao WTP. Da Do River receives water from the Rang Uc River through the Trung Trang Gate. The river

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<sup>4</sup> <http://haiphong.gov.vn>

flows through Kien Thuy District and flows back to the Rang Uc river through Van Uc Gate. Water from Kinh Thay River flows to Van Uc through an upstream branch called the Rang River, before water from Kinh Thay River flows to the sea. Hoa Binh Channel receives water from Da Do River.

45. Da River is blocked at both ends by gates and serve as a main transmission water canal as well as a reservoir. The major hydraulic parameters of the Daa Do River is as follows

#### Da Do River

River length	48 km
Average width	250 to 300 m
Bottom elevation	-2.3m to -3m msl
Storage to +1m msl height	14,402 x10 <sup>6</sup> m <sup>3</sup>

#### Trung Trang weir

B	4x8m
Q (designed)	111m <sup>3</sup> /s

46. Co Tieu is the main drainage culvert. The average maximum sediment content at the Trung Trang Gate has been about 2,000 g/m<sup>3</sup>, where the mean values for dry months are generally below 100 g/m<sup>3</sup> and those for the rainy months below 1,000 g/m<sup>3</sup>.

47. The nature of tidal fluctuations in the coast may cause salinity of the lower reaches of rivers, especially in the dry season. During high tide, seawater intrudes farther upstream of rivers, depending on the tide level and river discharge. River water is most saline 0 to 2 hours after low tide condition.

48. Many households, sanitation facilities and shops have encroached to the bank of the Da Do River and the river flow is used for washing. According to Da Do Water Exploitation and Management Company, there are over 250 households illegally encroached into the river bank to build houses brick-kiln, plant trees and make aqua cultural ponds, ect<sup>5</sup>. However, the 2008 quality monitoring report revealed that raw water from Da Do River has exceeded limits only for coliform count and NH<sub>4</sub>. In few monitoring occasions, some other parameters, e.g., NO<sub>2</sub> and Fe, have exceeded their respective limits (see Table 1 for the water quality monitoring results).

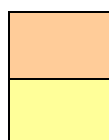
<sup>5</sup> Van Khanh-Tình trạng lấn chiếm đất hai bên bờ hệ thống thủy nông: Mức độ nghiêm trọng (Situation on encroaching two sites of irrigation system) Cập nhật lúc 09:03, Thứ Tư, 23/02/2011 GMT+7) <http://www.baohaiphong.com.vn/>



**Table 1: Da Do River water duality report of 2008 by DONRE**

Month	Temp (°C)	Color (mgPt/l)	Smell	Turbidity (NTU)	pH	Conductivity (µs/cm)	Total Hardness (mg/l)	Cl- (mg/l)	Oxidation degree (mgO2/l)	Coliform		TDS	NH <sub>4</sub> /N (mg/l)	Mn (mg/l)	NO <sub>3</sub> -/N (mg/l)	NO <sub>2</sub> -/N (mg/l)	Fe (mg/l)
										Total (CFU/100ml)	Thermal (CFU/100ml)						
Jan	18.6	23	Not det	39.76	7.79	294	102	15.30	1.70	2329	975	175.0	0.03	0.13	0.14	0.02	0.27
Feb	16.2	16	Not det	27.19	7.82	316	108	19.88	1.70	2130	613	141.0	0.05	0.17	0.11	<0.01	0.36
Mar	22.5	18	Not det	28.25	7.71	289	118	13.93	1.89	2338	1000	184.0	0.09	0.07	0.05	0.01	0.23
Apr	26.2	22	stinking	35.64	7.66	273	110	13.67	2.02	2800	575	179.0	0.06	0.08	0.07	0.01	0.34
May	29.2	23	Not det	41.01	7.69	246	100	11.39	1.94	4008	2400	114.2	0.02	0.16	0.01	<0.01	0.61
Jun	29.1	23	Not det	47.45	7.56	263	86	17.38	2.57	5383	2390	111.3	0.13	0.15	0.09	<0.01	0.81
Jul	30.0	25	Not det	52.57	7.58	276	100	21.18	2.92	1960	900	128.2	0.15	0.16	0.01	<0.01	0.70
Aug	29.6	24	stinking	28.12	7.39	302	88	26.54	3.48	3783	1763	143.9	0.17	0.09	0.07	0.07	0.29
Sep	28.1	22	stinking	19.07	7.29	273	82	25.22	3.18	2915	1750	127.3	0.20	0.15	0.01	0.01	0.38
Oct	27.7	20	Not det	17.10	7.44	244	69	18.75	2.75	2767	500	109.0	0.16	0.13	0.03	0.01	0.15
Nov	23.8	19	Not det	39.76	7.52	245	96	15.16	2.48	2033	1125	106.5	0.24	0.12	0.07	0.02	0.37
Dec	20.9	16	Not det	31.01	7.68	208	92	9.55	1.91	1600	650	108.0	0.18	0.10	0.03	<0.01	0.41
Std 2a	-	-	-	-	6.0-8.5	-	-	250.00	≥ 6.00	2,500	-	-	0.10	-	2.00	0.01	0.50
Std 2b	-	-	-	-	6.0-8.5	-	-	400.00	≥ 5.00	5,000	-	-	0.20	-	5.00	0.02	1.00

- Not mentioned (or not specified limit) in QCVN 08:2008/BTNMT



Value exceeded standard limit (A1)

Value exceeded standard limit (A2)

Std 1a: Maximum limits on surface water quality, according to QCVN 08:2008/BTNMT, for water supply and other purposes (A1)

Std 1b: Maximum limits on surface water quality, according to QCVN 08:2008/BTNMT, for water supply activities requiring appropriate treatment technology. (A2)

Source: Laboratory Unit of An Duong WTP, HPWSCO.

**Groundwater**

49. There are two layers of groundwater aquifers in Hai Phong. The first is in a layer of clay mixed with sand; while the second is in between clay soil and stone. In the first layer, groundwater is reached at 0.5 to 2.0 m below the ground surface. In the second layer, a thickness of 20 to 40 m, groundwater quality is unstable; it can change rapidly from good to bad. The ground water level is not reduced in the dry season (November to April), but increases during the rainy season (May to October). According to the soil investigations in Trang Cat in 1995 and 1998, groundwater level is generally high, i.e., dry season values vary from 0.5 to 3 m from ground surface. Tidal circulation affects the level and quality of groundwater in nearby coastal areas. In the rainy season, salinity in the groundwater decreases. North East Viet Nam, of which Hai Phong City is a part, has an estimated exploitable groundwater resource of 13.6 billion m<sup>3</sup>/year.<sup>6</sup> Despite its abundance, groundwater resource is less exploited. Saline intrusion has caused groundwater in the coastal areas to be salty.

**Geology and Seismology**

50. The soil in the Haiphong area consists of alluvial and marine sediments. According to general geological studies, the total thickness of clay layers is about 25 to 30 meters. Hard stratum of sandstone or siltstone has been found at the depth of 50 to 70 m from the ground surface.

51. Soil conditions are generally not uniform. Top layer has thickness of 0.4 to 2.0 m with load intensity of 1.2 kg/cm<sup>2</sup>. The second layer has thickness of 5 to 20 m with average load intensity of 0.5 kg/cm<sup>2</sup>. The third layer has thickness of 3 to 22 m with load intensity of 0.7 kg/cm<sup>2</sup>.

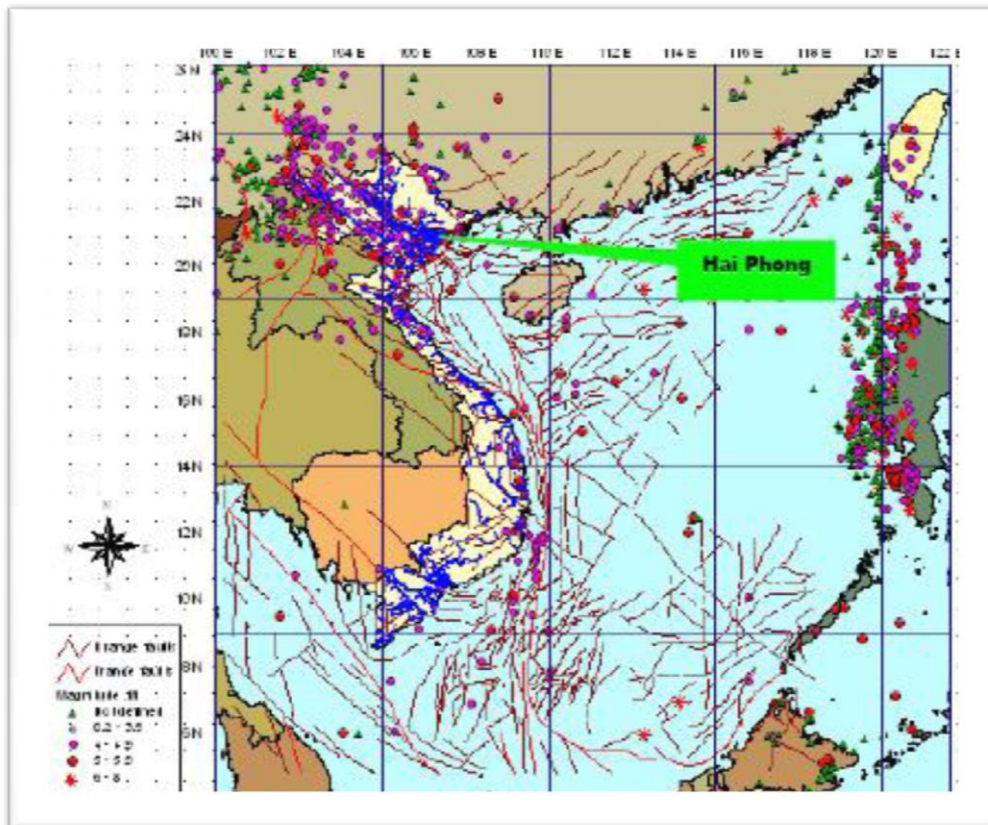
52. The geologic make up of Vietnam consists of five structural blocks namely, the Northeast (NE), Northwest (NW), Truong Son, Kon Tum and Nam Bo. Haiphong is within the NE block, which is part of the South China plate. The NE block extends from Red River fault to the border with China in a NE trending. Strata and igneous rocks dating from the Early Paleozoic to the Quaternary periods have been found in the NE block. The typically formed geological layers in the Hai Phong area are decomposition of sediments on old rock layer (Jurassic period).

53. Vietnam has a complex and numerous systems of faults. The NW-SE trending faults are the biggest and most active ones. The other systems are NE-SW trending, of sub-meridional directions (much smaller and younger faults), and of sub-latitudinal directions (undifferentiated faults, about 10 km thick). Seismicity in Viet Nam is strongly influenced by the two major belts, Circum-Pacific Belt and the Alpide Belt (Mediterranean-Himalayan), between which Viet Nam lies. The country has a high seismic hazard level, but not as great as of those countries that are situated within the so-called "Pacific Ring of Fire", e.g., the Philippines, Indonesia and Japan, among others (see Figure 6 and 7).

<sup>6</sup> The Present State of Water Environment in Vietnam. A presentation in the 2<sup>nd</sup> WEPA Forum, 2007. Nguyen Thi Hue

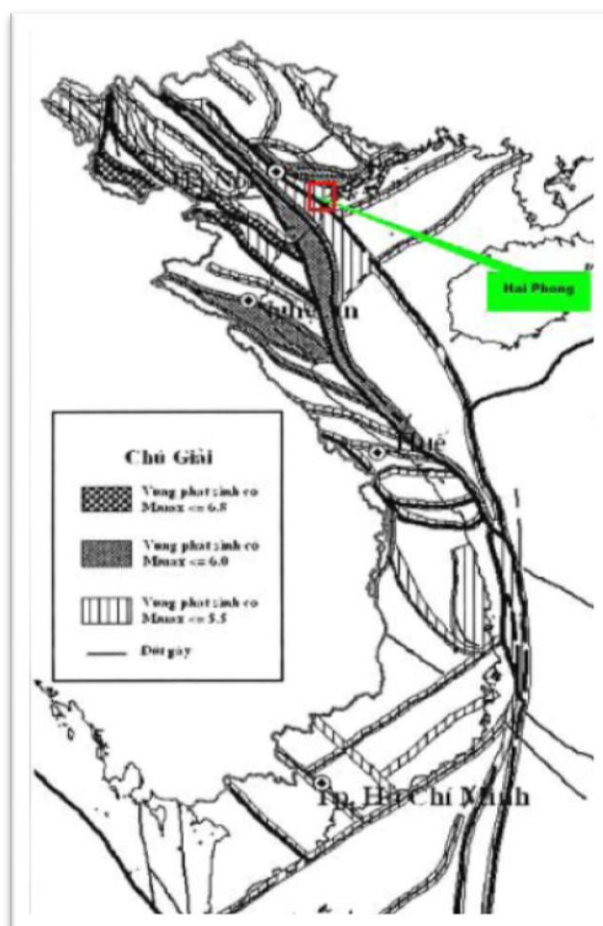


54. Earthquakes in Vietnam are strongly associated with active deep faults, especially the lateral strike ones. Due to the many active tectonic faults in North Vietnam, this region is potentially vulnerable to geo-hazards. Ninety percent of the earthquakes occurred in the north-western part of the country, making the NW more highly vulnerable to geo-hazards. Earthquakes in Vietnam are crustal with depths of less than 3 km. During the 1900 to 2005 period, there have been 450 earthquakes of magnitudes 4 to 7.



**Figure 6: Seismicity of Viet Nam and Adjacent Areas in South East Asia**

Source: Earthquake Hazard and Earthquake Risk Assessment in Vietnam. Seismic Risk Management for Countries of the Asia Pacific Region. December 2003. Bangkok. N.H.Phuong. Hanoi Institute of Oceanography. National Centre for Natural Science and Technology. Vietnam



**Figure 7: Seismogenic Faults in Viet Nam Territory**

Source: Country Report: Seismic Hazard of the Territory of Vietnam. Nguyen Anh Duong. Institute of Geophysics, Vietnamese Academy of Science and Technology

### ***Other Natural Harass***

55. Hai Phong being a low lying coastal city in Asia, it is not spared from various natural hazards, which are now being experienced due to global warming. Hai Phong is lying in the area which is directly influenced by a lot of storms and tropical low pressures in Vietnam, about 31% in total. Storms and tropical low pressures usually occur between July to September period with probability of 78%. The wind of storms is of level 6 – 7 (Beaufort scale: wind speed is 40 to 62 kph) and during tropical low pressures, the wind has level of 8 – 12 (Beaufort scale: wind speed is 63 to 120 kph). Based on the assessment of disaster severity in different geographic areas and in the coastal economic zone of Vietnam, Northeast Vietnm, the region where Hai Phong is situated, is more vulnerable to typhoon, storm surge, flash-flood, whirlwind, drought and landslide<sup>7</sup>.

56.

<sup>7</sup> National Report on Disaster Reduction in Vietnam. For the World Conference on Disaster Reduction. Kobe-Hyogo, Japan. 18-20 January 2005.

## **C.2 Ecological Resources**

### ***Aquatic and Coastal Resources***

57. The sea territories of Hai Phong are part of north-eastern water area of Gulf of Tonkin. The sea bed compositions and oceanographic characteristics of Hai Phong are closely connected to the common characteristics of Gulf of Tonkin and Eastern Sea. The Hai Phong sea is not deep, depth curve of 2m goes around Do Son Cape and then descends down to 5m far from the coast. However, where the rivers discharge into the sea, the depth is greater due to erosion caused by currents. Further offshore, the level of sea bed descends to the depth of the Gulf of Tonkin of about 30 - 40m. The surface of Hai Phong sea bed is formed by fine components with many deep underwater canals which were used to be river beds and are currently used as daily navigation channels for vessels.

58. The length of sea coast of Hai Phong is 125 km including the length of coast surrounding the offshore islands. The coast has a form of a concave curve as the common sea side of the Gulf of Tonkin. It is low and quite flat with the structure created mainly by muddy sand coming from the 5 major estuaries. At the center of the coast, Do Son cape stretches out into the sea like a peninsula. This cape is also the end of the range of mountains of Devonian sandstone running from the mainland. Sea, coast and islands have created special natural landscapes to this coastal city. It is also a special potential advantage of the economy of Hai Phong.

59. Do Son is famous for its 4-km long sandy beaches and emerald transparent sea water. Hai An District, surrounded by the ocean, has a large area of lakes and natural waters. It has beautiful landscape, with Vu Yen Peninsula and Dinh Vu Island having rich tourism potential.

60. Ken Thuy has 19.68 km of coast, 4500 km of tidal flooding making the area unfavourable for rice but aquaculture. As a result 2842 ha has been brought under aquaculture accounting for 28% of the total land area. Tan Thanh and Hai Thanh communes have converted 100% of the cultivated area to aquaculture.<sup>8</sup>

61. Aquatic and coastal resources in Hai Phong are valuable to the local, as well as to the national, economy. In 2007, the fisheries sector contributed VND 858 billion to the economy. Hai Phong has about 1,000 species of shrimp, fish and tens of kinds of sea weeds of high economic value and which are widely popular in the international market, e.g., dragon shrimp, prawn, sea crab, dolphin, sea oyster, sea tortoise, pearl shell, virgin shell, abalone, among others. In Hai Phong seawaters, there are many large fishing grounds and the biggest one is surrounding Bach Long Vi Island with more than 10,000 square miles of abundant and stable yield. The tidal flats of coastal areas, islands and river mouths of more than 12,000 hectares are suitable not only for exploitation but also for salty and brackish water aquaculture of high value products. Do Son is famous for its 4-km long sandy beaches and emerald transparent sea water. In summer, Do Son is alive with tourists. The

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<sup>8 8</sup> Kien Thuy portal website

project component sites are far from the coast, tidal flats and beaches to have any direct impacts.

62. An Hai in Tien Lang District is one of the six sites in the coastal zone of the Red River Delta that have been identified by the Birdlife International as Important Bird Areas (IBAs) under internationally recognized criteria. All project component sites are far from An Hai IBA.

### **Forests and Protected Areas**

63. In 2009, Hai Phong had a total forest area of 17,800 ha of which 10,800 ha was natural forest, 7000 ha were production forest accounting for total forest coverage of 11.2%<sup>9</sup>. Among natural forest, 580 hectares are primeval forest that has many valuable and rare plants classified as special species for protection and many herbs that are of interest to domestic and international medical specialists. Many species of bird, e.g., nightingale, parrots, francolin, eagles, sea-gull, swallow; and many kinds of precious animals, e.g., red face monkey, yellow face monkey, chamois, muntjac, water rat, red-tale squirrel, red-stomach squirrel, lynx, porcupine and white-head langurs, can be found in the primeval forest. The white-head langur/monkey (vooc dau trang, - *trachypithecus francoisi policephalus*) can only be found in the primeval forest in Cat Ba Island, where they live in herds and are classified as a rare species. Cat Ba Island is off Hai Phong City, some 50 km east. The remaining 97 percent of forest area comprise of saline water flood forest, forest for timber exploitation, forest for fruit plantation, bamboo and cane forest.

64. Hai Phong is one of the districts that have potential for mangrove forests. In particular, mangrove forest area is concentrated in the following four coastal districts and three urban coastal Districts: Thuy Nguyen, Kien Thuy, Tien Lang, Cat Hai, Do Son, Duong Kinh and Hai An. Every year, Hai Phong plants hundreds of hectares of mangroves. As a result, the system of coastal protection forest in the area is constantly expanding in size: from only 293 hectares in 1990 to over 4700 hectares in 2011.<sup>10</sup>

65. In Do Son, 13 percent is forest land and Do Son is known for its pine forest. Of the total land area of Duong Kinh, 3.5 percent is forest land. Hai An and Kien Thuy districts has a large area of mangrove forest. However, the project components are not located within any forest or other protected areas but within the city.

### **Biodiversity and Conservation**

66. Vietnam joined many Conventions and Protocols related to biodiversity: i) The Convention on Biological Diversity (CBD adopted in Rio de Janeiro in June 1992); ii) the Ramsar Convention, an international treaty for the conservation and sustainable utilization of wetlands; and iii) CITES (or, The Convention on International Trade in Endangered Species

<sup>9</sup> general statistic office, 2009

<sup>10</sup> Trong rừng ngập mặn ở Hải Phòng <http://www.canhsatmoitruong.gov.vn/default.aspx?tabid=439&ID=5802&CatID=494>)

of Wild Fauna and Flora). The country through its National Assembly has approved in November 2009, the Biodiversity Law which became effective starting 01 July 2009. The Hai Phong People's Committee issued Decision No 2548/QĐ-UBND on 27 November 2006, ratifying a project that is aimed at sustaining the protection of biodiversity and the white-headed langur in Cat Ba Island.

67. The Cat Ba Archipelago and its Cat Ba National Park are regarded as important sites at provincial, regional and international level, due to the diversified species of plants, trees, birds and animals that can be found, some of which are mentioned in the previous section on Forest. In addition, there are about 1,400 vascular plants, including 23 endangered and critically endangered species have so far been recorded in the Red Data Book of Vietnam; IUCN Red List. Large and partly endangered mammals include the Cat Ba langur, the Southern Serow (*Naemorhaedus sumatraensis*), Rhesus macaque (*Macaca mulatta*), Leopard Cat (*Prionailurus bengalensis*), black giant squirrel (*Ratufa bicolor*), and civet cats (*Viverricula indica*, *Paradoxurus hermaphroditus*).

68. In the cave, land snail and butterfly fauna is rich including the most northerly cave-adapted crab species, plus four species of true cave snails. The is considered a hotspot for land snail diversity. It is also conserving a considerable number of bat species, including the rare ones.<sup>48</sup> The Cat Ba Archipelago belongs to the list of the most important regions of diversified biology of the World Bank. It is a World Biosphere Conservation Area. For over ten years now, it has been receiving stable funding, through small-scale international projects on conservation and community development, and projects studies covering the Cat Ba National Park and its surrounding areas. The Project component sites are far from the Cat Ba Archipelago, which is about 50 km off Hai Phong City.

### **C.3 Economic Development**

69. The GDP per capita of Vietnam in 2008 was estimated at \$1,027- 1,030, higher than the levels of some economies with medium incomes. In 2007, the average income per capita was \$835. According to the Ministry of Planning and Investment, Vietnam will see the economic growth rate of 6.5-7% in 2008.

70. About 72% of Vietnam's population lives in the rural areas, and the country is very dependent on its agriculture and natural resources. Vietnam is an agricultural economy in which rice growing is the dominant form of cultivation. Agriculture's share of GDP has fallen from 41% in 1990 to 19% of GDP in 2008. Although agriculture is the backbone of Vietnam, the industrial sector, which initially went through a difficult period, has gradually adjusted to the market environment. Its output and contribution to GDP has been increasing in the last few years. The industrial and construction sector accounted for about 43% of GDP in 2007 compared with 23% in 1990. The major industries in Vietnam include food and foodstuffs, fuel products, textiles and garments, chemicals, fertilizer, rubber, construction materials, machinery and engineering, wood and forest products, paper products and electronics.



71. Much of the heavy industries' products such as coal, steel, chemicals, fertilizer and cement are concentrated in the north with the exception of the oil industry. Vietnam has considerable mineral resources. It is estimated that coal reserves stand at 3 to 3.5 billion tons. There are a number of offshore oil reserves and some large multinational corporations are already involved in major exploration activities.

72. Local construction activities are well developed and there has been substantial house building in rural areas over the past few years. State Enterprises in these sectors have been formed into National Corporations (State General Corporations) to provide greater industry focus and allow for greater expansion and growth.

73. In 2001, the value of goods and services of the domestic sector (in retail prices) in Haiphong was about 12,753 billion VND. The number of shops and other commercial activities has increased rapidly during the past few years. In 2007, the number of persons working in private trade and services was over 60,000.

74. Among the three main sectors of the economy, the service sector leads in contributing to the City's gross domestic product (GDP). In 2005, its GDP contribution was 51 percent. In 2007, it contributed 52 percent. The industry sector contributed 36 percent in 2005 and 38 percent in 2007. Agriculture/forestry/fishing contributed 13 percent in 2000 and 10.5 percent in 2007.

75. Hai Phong is an industrial city. Its industries range from large-scale industries owned by the Central Government, to medium and small-size industries controlled by local authorities, and to small-scale industries of private individuals. The most important industrial sectors include machinery manufacturing, shoes and garment manufacturing, production of construction materials, food processing, and production of chemicals, fertilizers and rubber. Total revenue from exports in the first 5 months of 2008 is estimated at more than USD 534 million, equivalent to some 27 percent increase compared to the same period in 2007. More industrial zones are planned for development outside the urban centre.

76. Commerce and trade is another sector that drives the local economy of Hai Phong. The number of commercial activities has increased rapidly during the past few years. An international tourist destination, Hai Phong attracts people to its naturally beautiful seascapes, unique traditional festivals, ceremonies, and places of historic and cultural interest. In 2005, more than 2.3 million visitors were recorded, of which over 500,000 were foreigners. Despite reduced contributions to the GDP, agriculture and fishery have remained key sectors of Hai Phong's economy.

77. The approved "Planning for Do Son Commune until 2020" specifies, Do Son as a satellite urban area of the City Centre, a destination for local and international tourists and a strategic location for the national security and defence. Marine fishing, fishery farming and

salt producing industries are to be developed. Its economic structure consists of 67 percent tourism and services, 25 percent agriculture and 8 percent industry.

78. In Do Son, in 2008, regarding the GDP tourism and service accounted for 70%, aquaculture and agriculture: 23%; Industry and construction: 7%. GDP per capita in 2005 was estimated at 1,100 USD. In Duong Kinh, economic growth rate reached 12.5% in 2010, shifting the economic structure towards increasing proportion of trade - service; output value of industry - small industry, construction trade – service all exceed expectations increase at a relatively high rate in 2009.

79. In Hai An, The proportion of agricultural production value is expected to decrease from 14.11% in 2004 to a low 0.4% - 0.6% in 2020; The proportion of industrial production value will decrease from 43.93% in 2004 to 36% - 37.6% in 2020; The proportion of service production value will increase from 41.96% in 2004 up to 62% - 63.5% in 2020. Regarding Kien Thu, contribution o GDP is 33% by agriculture, i45% by industry - construction, and 22% by services.

## **Industries**

### **(i) Haiphong Port**

80. The Hai Phong-based port currently handles up to 90 percent of the volume of imports and exports in northern Viet Nam although its length is only one-third of the total of the 24 seaports in the country. Haiphong Port represents one of the major economical activities in Haiphong. It is also the biggest sea port in northern Vietnam. It consists of three separate areas on the southern bank of Cam River: Vat Cach, Hoang Dieu (main port) and Chua Ve - Doan Xa Ports. The capacity and volume of handled goods in Haiphong port was quite stable in the latter half of the 1980's. At the beginning of the 1990's the amount of handled goods decreased, but after 1993 an increase in the volume has been continuous.

81. Every year, the volume of cargo handled through the port increases by an average 10 percent. It reached nearly 24 million tonnes in 2007, far higher than the initially-set target of 18 million tons. The northern port city of Hai Phong alone also plans to boost the sea-born economy, raising its contribution to the city's GDP to 35-40 percent by 2020.

### **(ii) Industry**

82. The industry in Haiphong is diversified from large-size basic industry owned by the Central Government, to medium and small-size industry controlled by local authorities, and to small-scale private enterprises.

83. The most important industrial sectors include machinery manufacturing, shoes and garment manufacturing, production of construction materials, food processing, and production of chemicals, fertilisers and rubber.

84. Total revenue from exports in Haiphong in the first 5 months of 2008 is estimated at more than USD 534 million, equivalent to 27.6% increase compared to the same period last year. Of those, the centrally-owned business contributes USD 77 million (150% increase); the foreign-owned accounts for USD 290 million (39% increase), and; the locally-owned achieves USD 166 million (7.8% increase).

85. The most important industrial sectors include machinery manufacturing, shoes and garment manufacturing, production of construction materials, food processing, and production of chemicals, fertilisers and rubber.

86. According to general planning of Haiphong, new industrial zones have been and will be constructed in areas outside the urban centre. The new industrial zones include the following: a) Vat Cach Industrial Zone, starting with Nomura Industrial Zone; b) Dinh Vu Economic Zone, located in the eastern part of city; During the initial investment period, the project functions as an industrial park; c) Vinh Niem Industrial Area, located along the new Ring Road. It is developed for investment in middle and small industrial enterprises; d) Haiphong – Do Son Road (Road 353) is a potential area for industrial development. At present, there are already many enterprises constructed in this area.

### ***Infrastructure facilities***

87. Established in 1905, the City's piped water supply system has undergone series of upgrading and expansion. It currently services 90 percent of the central urban districts, Hong Bang, Le Chan, Ngo Quyen and residential areas of Hai An. In 2002, its scope of service covers 60 percent of Kien An District and 45 percent of Do Son town. Water is available 24 hours a day in 7 days a week in the central urban areas; while in peri-urban areas, supply can be intermittent at times. Main water source is surface water obtained from the Rivers Da Do, Gia, Vat Cach, Sai and Chanh Duong. The system has 7 water treatment plants, supplying 7 service areas. The HPWSCo, the entity responsible for water supply in Hai Phong, has aimed at achieving a service coverage of 90 percent of the entire City by 2020. Only a small part of Do Son, Duong Kinh, Hai An and Kien Thuy Districts is served by the system supplied by the Do Son WTP. Duong Kinh District has no access to the existing water supply system.

88. Wastewater and storm water management is the responsibility of the Hai Phong Sewerage and Drainage Company. The City is partly served by a sewer system. It has successfully implemented major wastewater management and environmental improvement programs financed by Finnish International Development Assistance and the World Bank in recent years. In 2005, the Japan Bank for International Cooperation approved an additional sanitation project to further enhance wastewater collection and treatment in Hai Phong. This program will provide the city's first wastewater treatment plant, another major step forward in reducing environmental pollution and further enhancing public health and the city's living standards.

89. Hai Phong has no appropriate drainage system. A network of combined sewers serves the urban centre. Some small-scale independent combined sewer systems serve



peri-urban towns like Minh Duc town in Thuy Nguyen District. The combined sewers collect both effluent from septic tanks and storm water, and convey these to natural outfalls without treatment. Currently, only the Quốc Bình residential area is served with a separate drainage and sewer systems, wherein wastewater is collected in a tank and is pumped directly into Lach Tray River. In the Bong Sen village, a small wastewater station exists and is still operational.

90. In Hai Phong, solid waste management services are provided by three entities. The Urban Environment Company (URENCO) services the four inner Districts of Hong Bang, Ngo Quyen, Le Chan, Hai An, and some industrial establishments, hospitals and health centres. The Do Son Public Works and Tourism Service Company services Do Son town, tourist areas and new urban area along Road No. 353. The Hai Phong Construction and Public Works Company services Kien An District. Collected solid wastes are disposed of at the sanitary landfill in Trang Cat, Hai An District.

### ***Transportation***

91. Hai Phong enjoys an excellent and convenient position for transportation when compared to the rest of the country by all means: land (road and railway), air, sea and inland waterway. A railway (Ga Hai Phong) and a good expressway connect the City with Hanoi, the nation's capital, which is about 100 km away. Roads connect the City to Hon Gai-Cam Pha, the foremost coal mining area of the country, and with Ha Long Bay, a famous tourist spot of Viet Nam. The Hai Phong Port, the gateway to North Vietnam is located in the southern bank of the Cam River. It handles some 90 percent of the volume of imports and exports in Northern Viet Nam. The City is connected to foreign countries through its Cat Bi International Airport. It has road connection with Yunnan Province and Guangxi Autonomous Region of Southwest China.

92. Do Son and Duong Kinh Districts are connected to the rest of the City through Provincial Roads 355 and 402. Provincial Road 401 also passes through Do Son District.

93. Hai An District owns fundamental advantages in terms of both transportation by road and waterways. In addition, Hai An is an important traffic hub of Hai Phong city, including roads, waterway (both river and sea), railway and airway. The district is surrounded by the system of Lach Tray river and River Cam river with Nam Trieu estuary leading to the Gulf of Tonkin. Additional traffic advantages, including National Highway 5 connecting Hanoi - Hai Phong; inter-provincial routes; roads linking the district to the city centre such as Tran Hung Dao, Le Hong Phong, Dinh Vu and Cat Ba islands; Chua Ve Port, Cam Port, Military Port and other special ports; a railway from Lac Vien Station to Chua Ve Port; Cat Bi airport with the capacity of 200,000 passengers and nearly 2,000 tons of cargo annually.

94. Kien Thuy District continues to invest in building roads 401, 402, road around the mountain Doi, and the park Ben Thuyen and some other key projects. Rural roads (including asphalt, aggregate, cement, and concrete) have been developed in many communes. Some main roads in the district have been renovated, upgraded in

both the size and quality, contributing to gradually urbanized district downtown. The construction of 353 road and development of south urban area of the city has a strong impact on social- economic life in Kien Thuy District

### **Land Use**

95. Based on 2008 statistics, 35 percent of the City's total land area is devoted to agriculture and 16 percent is forest land. Homesteads account for 6 percent and special uses, e.g., industries, commercial, institutional, etc, 22 percent. The rest is lands that are unused, open and waterways. Decision No 04/2001/QĐ-TTĐ, dated 10 January 2001, modifying the Hai Phong's 2020 Master Plan, directs City expansion towards its outskirts, especially to the northern bank of Cam river, the Northwest, the Southeast, along Road 353 and eastern coastal area of the City. Land for urban construction is divided into main functional areas. Residential areas, totalling to 6,800 ha, includes the under-utilized/under-developed areas and expansion areas in the 7 Districts of Hong Bang, Ngo Quyen, Le Chan, Hai An, Kien An, Do Son and Thuy Nguyen. Some 4,500 ha are for industrial development. Functional (institutional) centres are intended to be in the new urban area in the northern bank of Cam River (Thuy Nguyen) in the long term. Tourism and resort areas will be in the inner urban area, in the outskirts, and in preserved rural natural areas, e.g., Thuy Nguyen northern landscape (Gia River), Do Son tourism resort and Cat Ba Island in connection to Ha Long Bay. Central urban areas will be for special purposes, such as residential areas for foreigners, training schools, scientific institutes, state offices, medical centers, convalescence, medical treatment centers, and sports & recreation centres. Other identified land use zones include the national security and defence area (to be in existing locations), the City's green belt and other construction areas.

96. Do Son District's administrative jurisdiction claims nearly 3 percent of the total land area of Hai Phong. In 2008, about 31 percent of Do Son was special use land; 23 percent agricultural land; 13 percent forest; and 9 percent homestead. The rest was unused/open lands and waterways.

97. Duong Kinh District's administrative jurisdiction claims about 3 percent of the total land area of Hai Phong. In 2008, about 33 percent of Duong Kinh was agricultural land; 24 percent special use land; homestead accounts for 12 percent; and some 4 percent forest. The rest are unused/open lands and waterways.

98. Hai An: The total land is divided into six wards namely Dong Hai, Dang Hai, Dang Lam, Nam Hai, Trang Cat and Cat Bi with certain natural conditions and different developmental potentials. Dong Hai ward has very little agricultural land (about 80ha) scattering among residential areas and businesses, the majority of land has been used for the industrial zones of Dinh Vu and Vu Yen. Dang Hai is the central district mostly with agricultural land (158/307ha) and flower planting tradition. Dang Lam ward has a quite large natural area of 516 ha, including 320ha of specialized land and 106ha of agricultural land. Nam Hai Ward is located on an area of 574ha, but mainly agricultural land, 93 ha land for special use, 76 ha unused area. Cat Bi ward is on an area of 120 ha, of which, water surface is accounted for 32.5 ha. Tra Cat is the largest ward with nearly 3,000 ha of natural land, including 1.045ha of agricultural land and 705 ha of unused area.

99. In Kien Thuy, 50% of the total land area is salty and 20% lowland. At present, Kien Thuy has brought 2483 hectares under aquaculture, accounting for 24% of arable land.

### ***Power Sources and Transmission***

100. Electricity network in Hai Phong stretches from inner city streets to suburban villages, from mainland to remote islands along with a system of large and small transformers. All the residential and industrial areas of Hai Phong are connected to the national electricity network.

### ***Agricultural Development***

101. Agriculture is a portion of economic activity in Haiphong. In 2007, the total gross output of agriculture was about 4,378 billion VND. (see Table 2)

102. In Hai Phong, in 2010, the total planting area was 109,909 ha, equaling to 100.86% of the initial year plan. Average rice yield was estimated at 60.03 quintal / ha, but the actual reached 102.2% of the initial year plan, but production values decreased by 0.6%. Livestock: poultry flock increased by 11.78%, piggery by 0.39%, cattle by 0.26%, buffalo by 1.75% less over the same period. Agricultural production value estimated at 2831.8 billion dong, went up by 4.52% over the same period, meeting the year plan. Fisheries production value estimated at 90.6 thousand tons, went up by 4.7% over the same period, of which livestock increased by 6.2% and mining increased by 3.2%. The value of aquaculture production estimated at 1022.1 billion, went up by 8.01% over the same period meeting year plan.

**Table 2: Statistical data for Agriculture, Forestry and Aquaculture in 2009**

Sector	Unit	2009
<b>Agriculture</b>		
Total paddy area	1000 Ha	82.38
Average yield	Quintal/ha	59.31
Total rice products	1000 ton	488.3
Total food products	"	498.2
Food products/person	Kg	270.5
Buffalos (1/10)	Unit	9,356
Cows (1/10)	Unit	17,378
Pigs (1/10)	1000 unit	533.6
including: sows	"	83.2
Poultry (1/10)	1 mil unit	5.8
Agriculture production values	Billion dong	2,709.5
<b>Forestry</b>		
Forestry production values	Billion dong	24.0
<b>Aquaculture</b>		
Aquaculture production values	Billion dong	946.4
Aquaculture exploitation products	Ton	43,102
Aquaculture breeding products	"	43,442

### **Tourism Facilities**

103. Haiphong is an attractive destination for visitors. In 2005 there were more than 2.3 million visitors of them over 500,000 were foreigners. The most popular destinations are: the Cat Ba Archipelago a World Biosphere Conservation Area, Do Son Beach, Thien van Mountain, Voi Mountain Resort, "Dry Ha Long" Area in Thuy Nguyen District, Ha Lung and Dang Hai Flower Villages, Nguyen Binh Khiem Temple, An Bien Entertainment Park, etc.

104. Visitors to Haiphong are offered a choice of modern and comfortable accommodation with many international standard hotels such as Royal Garden Harbour View, Friendship Hotel, Tray Hotel and luxury apartments at Sunflower Village. Tourists can walk on beautiful white sandy beaches and swim in warm waters under bright sunshine, visit traditional fishing villages such as Cat Ba Resort, Doson Beach.

105. Cat Ba is a diversified resort, consisting of the main island with its National Park and 366 smaller surrounding islands with virgin tropical rain forest, hiking trails, plentiful birds and wildlife with numerous rare species, also a variety of marine species, beautiful natural caves, extraordinary white sandy beaches and clear blue seas.

106. The Do Son Resort is located 20 km away from the city center and on its peninsula stretches out into sea with splendid beaches and beautiful landscape. In Do Son, a huge range of restaurants for a wonderful selection of delicious seafood are encountered. Tourism in Do Son is mostly local and subject to very high seasonal fluctuation, with the high season being from May to September and the peak month being June. In Year 2007, there were 1,500 million visits by tourists to Do Son.

## **C.4 Social and Cultural Resources**

### **Population and Communities**

107. Vietnam is the 12<sup>th</sup> most populous country in the world, with a total population of about 85 million in 2007. The population grew at average annual growth rate of 1.7% between 1989 and 2007, increasing from about 64 million in 1989. This was the lowest growth rate in 45 years, down from 2.1% average annual growth rate of the previous decades. Population growth rates are expected to further decline over the next 25 years due to family planning programs and declining fertility rates.

108. Based on the Hai Phong Statistical Yearbook of 2009, Hai Phong population had reached 1,837,000, of them urban population was more than 847,000 and rural population was more than 990,000 (according to census data, 2009). Population density is 1207 persons/km<sup>2</sup>.

109. Do Son District had a population of 51,417 people in 2008, accounting for nearly 3 percent of the City's population. It has 7 wards that are: Ngọc Hải, Vạn Sơn, Vạn Hương, Ngọc Xuyên, Bằng La, Minh Đức và Hợp Đức.

110. Duong Kinh District, a new district, had a total population of 46,400 in 2008, or 2.5 percent of the City's population. It has 6 wards that are Đa Phúc, Hưng Đạo, Anh Dũng, Hải Thành, Hòa Nghĩa, Tân Thành

111. Hai An: dân số khoảng 77.600 người: population approximate 77,600 people. It has 6 wards. Kien Thuy: population approximate 126,041; It has 18 communes and 1 town-Núi Đồi.

112. The City's urban population in 2009 (847,000 people) was about 46 percent of its total population. The entire population of Do Son and Duong Kinh and Hai An Districts is urban population, representing nearly 20 percent of the City's 2009 urban population

113. No ethnic minorities reside in the Project component wards/communes of Do Son and Duong Kinh, Hai An and Kien Thuy Districts

114. The population projections for the service areas of the proposed Hung Dao water supply project is as follows.

**Table 3: Population forecast in service area of the project**

Service Area	In 2007	In 2010	In 2015	In 2020
Do Son district	51,417	52,975	55,677	58,517
Hai An district	42,773	44,069	46,317	46,680
Duong Kinh district	50,051	51,568	54,198	56,963
Residential areas along road No.401 and Doi mountain	10,360	10,674	11,218	11,791
<b>Total</b>	<b>154,601</b>	<b>159,286</b>	<b>167,411</b>	<b>175,950</b>

**Socio-economic conditions**

115. Vietnam is undergoing one of the fastest urban transitions in the world. At present 28 per cent of them live in urban areas, but this number is expected to increase to 45 per cent or 46 million people by 2020 and it is estimated that in 2030, almost half of the Vietnamese population will live in urban areas. While urbanization is recognised as a driving force behind economic growth, if has left unchecked that its consequences could be disastrous: health problems, social unrest, environmental damage, pollution, and rural/urban tensions are all likely to worsen.

116. In 2009, the average monthly income per capita nationwide was VND 636,000. In Hai Phong, it was VND 653,000, slightly higher than the national average.<sup>11</sup> Based on the initial results of the socio-economic survey in August-September 2009, average monthly income per capita was in the ranges of VND 1.4 to 1.49 Million for the poor and VND 2.87 to 4.97 Million for the non-poor. The average monthly income of the poor respondents is twice the City's average.

117. In 2000, 71 percent of the population aged 15 years and over in Hai Phong were economically active. About 4.5 percent were unemployed. In 2008, of the 70 percent economically active population aged 15 years and over, 3.5 percent had no job. In the urban area, the rates of economically active population (aged 15 years and over) that were without job in 2008 was 4.2 percent, much smaller than that in 2000, 6.3 percent. The rural area experienced only a slight reduction from 3.7 percent in 2000 to 3 percent in 2008. Based on the initial results of the socio-economic survey, the major sources of income were employment in the public and private sectors and running own businesses. Less than 10 percent were in the agriculture/fishing sector. No one was working outside their ward/district of residence.

118. Number of employees in 2010 increased to 47,353, up by 4.7% compared to 2009, reaching 100.75% of the year plan. Also, the poverty rate (according to old standards) decreased by 3.86 %.

<sup>11</sup> Meet the Savings Demand: Mobilizing Micro-Savings Among the Poor in Vietnam. Report to the Vietnam Bank for Social Policy. March 2009. Tu Chi Nguyen.



119. In 2004, the nationwide poverty rate in Viet Nam was 23.2 percent, decreasing an average annual rate of a little over 10% since 2002 (28.9 percent). In 2009, national poverty rate was 16 percent; in Hai Phong, 8.8 percent.<sup>12</sup> Of the 100 respondent households in the socio-economic survey of August-September 2009, about 9 percent are poor.

### **Health Facilities**

120. At a national level, Vietnam's health indicators are very favourable. The overall quality of healthcare is regarded good, as reflected by 2005 estimates of life expectancy (70.61 years) and infant mortality (25.95 per 100,000 live births). However, malnutrition is still common in the provinces, and the life expectancy and infant mortality rates are stagnating. In 2001 government spending on health care was just 0.9 percent of gross domestic product (GDP). Government subsidies covered only about 20 percent of healthcare expenses, with the remaining 80 percent coming out of individuals' own pockets.

121. These favourable health indicators are much better than other countries with a comparable level of income and are a result of an historical emphasis on primary health care. Haiphong is an exceptional example, where there are about 22 hospitals (2007), with a total of about 4,050 patient beds, and another 1,100 patient beds in small clinics.

122. In 2008, Hai Phong had 1,349 doctors and 2,354 nurses, accounting for a ratios of 7.3 doctors and 12.75 nurses per 10,000 inhabitants. In 2003 the corresponding ratios were 5.88 and 5.95, showing the increase in doctors and nurses between 2003 and 2008. The country's vision is for the health system to reach the grass root level, aiming for each commune health worker to serve 1,400 to 1,600 inhabitants.

123. In 2010 Hai Phong actively implemented measures to prevent epidemics, controlling outbreaks such as influenza A (H1N1), cholera ... occurring in the area. Medical examination and treatment for the poor, children under 6 years old and the sick with health insurance was implemented in communes and wards, successfully maintaining 100% of communes to the national standards of health. Organized 11 inspections in the fields of medical examination and treatment, private medical clinics, hygiene and food safety; discovering and punishing 126 violators . Prevention of HIV / AIDS was emphasized: in 2010 the number of new HIV infections fell by 5% compared to 2009. Effective implementation of methadone therapy: now treating 1,000 cases of addiction, continuing to expand 4 more methadone treatment clinics in Hai An, Duong Kinh, Hong Bang and An Duong districts.

124. Reliable health statistics on the incidence of water borne diseases are problematic to obtain in Haiphong and elsewhere, because of inaccuracies in recording health statistics, and unreported cases which are either treated at home, treated privately, or go untreated. Regardless, diseases relating to water and hygiene are very common and affect large numbers of people. Poor nutritional intake and food shortages, and diarrhoea disease from unsafe water and poor sanitation, combine to keep malnutrition at high levels.

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<sup>12</sup> Haiphong Statistical Yearbook. 2008

**Education Facilities**

125. Vietnam's education system can be divided into 5 categories: pre-primary, primary, intermediate, secondary, and higher education. Most students manage to pass the IGE. High school, which consists of grades 10, 11 and 12 is standardized in all major urban regions, though it is not uniform in rural provinces. University Entrance Examination (UEE) is very important in Vietnamese students' lives. High school graduates have to take it after the SGE and get high results to be admitted to universities. In the year 2004, it was estimated that nearly 1 million Vietnamese students took the UEE, but on average only 1 out of 5 candidates succeeded.

126. Most of Vietnam's universities also offer Master (2 years) and Doctor (4 years) degrees. In addition to universities, there are community colleges, art and technology institutes, professional secondary schools, and vocational schools which offer degrees/certificates from a-few-month to 2-year courses.

127. Foreign educational institutions are increasingly open in Vietnam. Most of their fields are English language and information technology. As the second country after China with sustained economic growth during the first years of the 21<sup>st</sup> century, Vietnam is currently revisiting its education system. It recognized the increasing role of English as the language of business and the importance of international cooperation to help adapt the education system, notoriously slow in change management, to the rapid pace of its economy.

128. In Haiphong, there were 1736 kindergarten classes in the year 2007-2008. Number of primary school pupils in the middle of academic year 2007-2008 was 114 308, lower secondary school pupils 113 162 and upper secondary school pupils 77 522. Again, Haiphong is an exceptional example, where there were 480 grade schools (2007) including 218 primary schools, 192 lower secondary schools and 58 high schools. In urban districts, there were 140 schools, or 29% of the total amount. In addition, there are 12 universities, colleges and training schools in Hai Phong.

129. In the school year 2009 – 2010, the percentage of students passing high school graduation of the city reached 98.96% (including 18 high schools with graduation rate of 100%); successfully equipping more than 1,200 classrooms with standard lighting. By now, the city has 217/733 national standard schools, a rate of 29.6% Finalizing the project specifying tuition rates for preschool and public schools of the city in the 2010-2011 school year. The statistical data in 2010 for education is presented in Table 4.

**Table 4: statistical data in 2010 for education**

	Unit	Year 2009	Estimated 2010



<b>Preschool education</b>			
Number of children attending nursery	Pupils	13,801	13,813
Number of nursery teachers	"	1,199	1,263
Number of kindergarten pupils	"	56,852	60,638
Number of kindergarten teachers	"	3,004	3,228
<b>Education</b>			
- Number of schools	schools	479	478
Elementary	"	218	219
Secondary school	"	204	203
High school	"	57	56
- Number of classes	Classes	8,311	8,093
Elementary	"	3,812	3,938
Secondary school	"	2,910	2,574
High school	"	1,589	1,581
- Number of school teacher	Teachers	16,345	16,312
Elementary	"	6,052	6,213
Secondary school	"	6,425	6,201
High school	"	3,868	3,898
- Number of pupils	pupils	284,885	283,075
Elementary	"	115,295	121,183
Secondary school	"	96,576	91,072
High school	"	73,014	70,820
- Total number of pupils recruited			
	Pupils	73,662	70,439
Elementary	"	26,709	25,701
Secondary school	"	22,793	21,694
High school	"	24,160	23,044

### ***Physical / Cultural Heritage***

130. Do Son District: Ba De Temple, a cultural and religious destination in Do Son, featuring a small temple at the foot of the Doc Mountain and facing the sea. This temple draws attention from thousands of pilgrims every spring to worship and pray for luck and happiness. The Tuong Long Tower, built on top of the Ngoc Son Mountain, along with Ngoc Communal House, Rhong Stream, is a well-known ecological, historical and cultural tourism community in Do Son. These special sites are not in close proximity to the Hung Dao WTP site or transmission mains.

131. Tuong Long (Do Son) Tower, This Buddhist architectural work was built under the Ly Thanh Tong Dynasty on 2,000 sq.m of land. It was located in Van Son Ward, Do Son town. The four angles of the tower are leaning by 1999 toward the centre. Inside it was a Buddha statue. However, the tower was destroyed for its bricks when Hai Duong citadel was built in 1804. The current Tuong Long Pagoda is located on the location where Tuong Long Tower once stood. All the relics are located far from the project component area.

132. Duong Kinh District: No historical or cultural site has been found in Duong Kinh District

133. **Hai An District:** Shrine Lung Ha is located in Dong Hai ward, Temple and Pagoda Trung Hanh is located in suburban areas Dang Lam ward. Ve Hai An Pagoda is the Buddhists temples located in Dong Hai ward. Tu Luong Xam is located in the northeast of the Nam Hai ward. Tu Luong Xam is a monument of the national hero Ngo Quyen – who brought the country's independence. Tu Luong Xam has been certified as a national historical relic. All these are located far from the project component areas.

134. Kien Thuy District: Kien Thuy is also home to many cultural relics as the Temple Mo (Ngu Phuc commune) Pagoda Hoa Lieu (Thuan Thien Commune), Thien Phuc (Thuy Huong Commune) .... It is also home to many unique festivals such as materials for the festival in Kim Son - New Movement, boat racing on the Da Do River. Tra Phuong Pagoda is the name of the locality where the temple is located, the village of Tra Phuong, Huong Thuycommune, Kien Thuy suburban districts of Hai Phong. Other name is Thien Phuc Tu.

135. Kim Son Temple. Kim Son relics was built in the 19th century on the campus belonged to Tan Trao Commune, KienThuy district. House was built for the villagers faith, worship Royal village Temple – Hoa Lieu. This temple is the place where worshiped Royal Queen Vu Thi Ngoc Toan, the woman credited with the expansion of the village, building villages, helping people do good deeds, help others. According to the Mac pedigree, Vu Hoang Thai Hau was the wife of King Mac Dang Dung. In 1993, remains of temples and pagodas of Hoa Lieu at Thuan Thien commune had been classified as National Monument level.

136. Mo Temple. Mo temple belongs Ngu Phuc -Kien Thuy district, located about 4km from the district center adjacent the highway. Mo Temple worships the Quynh Tran princess who has publicized the ground. The worship hall of the Macs (family name) is situated at Co Trai commune, Kien Thuy district, 15 km south from Haiphong center, where was a native of Mac Dang Dung, the first King of Mac dynasty (1527-1592). When the Le's reign was

replaced by the Mac's, the second capital was built by Mac Dang Dung at his native land Co Trai village, Ngu Doan commune, Kien Thuy district.

137. Royal dynasty of the Mac in Duong Kinh. In Duong Kinh village, Ngu Doan commune, Kien Thuy district there was time when royal dynasty of the Mac was prosperous. Rings of old capital walls, inscriptions and temples are still exist. 'The trails of the old palace can be found at Temples and Communal houses' are now waiting tourists to come and visit and for archaeologists to discover.

138. Kim Son Ball Playing Festival. Kim Son village located in Tan Trao commune was once famous in the Japanese resistance war period. There is a kind of sport game called 'Ball Playing' which was invented by Pham Ngu Lao (a General of the army in Tran's Dynasty time) for the purpose of training his soldiers. Annually, the game is held on the 6th of New Lunar Year at the communal house's yard.

139. Phu Xa Temple. Located in Dong Hai ward, Hai An District, the Phu Xa Temple is dedicated to the worship of the hero Hung Dao Vuong Tran Quoc Tuan, who dedicated his life to the nation and the people. The temple also worships a woman named Bui Thi Tu Nhien who was responsible for managing the food warehouses during the Tran Dynasty. Every lunar March and August, Phu Xa Temple holds its high days. The State has recognized it as historical site of national level.

140. Linh Son Vien Giac Pagoda. Linh Son Vien Giac Pagoda is a new temple is situated on a mountain Doi of Nui Doi town, where stores a long cultural history. This pagoda is sponsored by UNESCO. The Vietnam GiacVien Linh Son Pagoda in the town of Mount For Free. Inaccordance with the contents of the sponsor, Linh Son Vien Giac Pagoda is considered the relics of historical and culturalvalue of Kien Thuy district. Project component area is about 4 km from Temple – Hoa Lieu and 3 km from Linh Son Vien Giac Pagoda.

## **D. SCREENING OF POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES**

### ***D.1 Potential Environmental Impacts***

#### **D 1.1 Issues / Concerns Relative to Siting**

141. Land area for construction of water treatment facilities, intake works and water treatment plant will be permanently acquired. There are land areas which will be used temporarily for construction of temporary works, such as camps, warehouses and for construction of transmission mains. Temporarily required land areas will be given back to their owners after the works have been completed and the laying of transmission mains will be within the right-of-way of the roads.

142. Locations of facilities are selected to limit negative impacts on local land uses and houses. The major impacts due to location of the project are owing to the present land use in the proposed WTP and intake site. However, land area specified for intake works, the water treatment plant are public land areas under management of local authorities of Kien Thuy District. These land areas are now used for cultivation of rice, vegetables, cut flowers, coconut, fruit trees and also as fish ponds. Also a one household is among these lands. These lands have been identified and people have been informed.

143. The affected households due to acquisition of 27,096 m<sup>2</sup> or 2.71 ha of lands in the proposed WTP and intake sites is 51 in number. For them a total sum of 19,090,057,380 VND have been allocated as compensation. However, legal right to acquire 20 ha for WTP has also been approved by the GoV and the actual acquisition is much less than this.

144. Laying of transmission mains will be within the right-of-way of the existing roads. The impacts will be mainly due to the intensity of urban development, population density, and traffic volume in some portions of the roads proposed for laying transmission mains. In some sections of the transmission mains, facilities such as schools/training institutes, public markets, public offices/factories, residential areas, temples, cemeteries, etc., are located close to proposed transmission mains. As such, during construction problems of noise, vibration, disturbance to access, etc., may result although installation will be within the right-of-way of the roads. In some sections road surface and sidewalk may be destroyed. Also in some sections irrigation canals and roads have to be crossed by the transmission mains. In such locations disturbances to normal operation of such facilities and damages may result. The project activities will be carried out in a short time (within a day in each segment) at small scale and the public will be informed in advance. Therefore, the impacts will vary from mild to moderate depending on the location and construction supervision.

145. Structural stability of the facilities may be impacted by the weak soil in the area identified for WTP unless adequate structural stability is incorporated into the design. If adequate safety precautions are not considered in case of new high voltage lines to be installed, risks may arise to nearby entities.

146. Water user conflict may result due to irrigation farmers using water downstream of the intake from the same river. However, the Master Plan prepared for the Hai Phong city by the District Committee for the period 2020 to 2050 periods, the Da Do River has been identified as the source of water for Hung Dao WTP to extract without any impacts on the other sectors. The rate of abstraction for proposed WTP will be very small compared to river flow/storage in this Da do river, which serve also as a reservoir. The daily abstraction at 27,000 m<sup>3</sup> per day is less than 3% of the water that can be released at 11 m<sup>3</sup>/s from the Rang Uc River through the Trung Trang Gate. When compared to the total storage of the Da Do river, daily abstraction for WTP is negligible. Moreover, the flow in Rang Uc river is augmented from Kinh Thay River through an upstream branch called the Rang River. As such any impacts on downstream water users due to water abstraction for the WTP are unlikely.

147. There is a national level water resources management plan approved by the Prime Minister and that has identified the source of water for water supply and clearly shown the possibility of harnessing the source without any impacts on irrigation uses. Again at local level there had been consultations among irrigation and water supply agencies at the time of project identification and basically all have agreed for the project. However, legal agreement will be signed between the Water Supply Company and relevant irrigation Management Company once the project is approved by the government.

148. There are no sensitive ecosystems, protected areas, endemic or threatened species to be impacted due to the project sites. As well, none of the historic, cultural and architectural sites will be impacted. Similarly, none of the sites used for different customs, traditional practices and rituals are within the sites.

### ***Raw Water Quality***

149. The new Hung Dao WTP will be supplied raw water from the Da Do River, a tributary of the Van Uc River. The existing Cau Nguyet WTP is supplied raw water by the same source; about 5 km upstream from the proposed intake point and no problem associated with water quality is reported there. Water quality of the Da Do river vary depending on changes of climate, as well as operational and management regulations of irrigation gates in the system. Generally, water quality changes according to the location on the length of river. Water quality is better in the upstream areas.

150. Raw water quality at the intake of Cau Nguyet WTP has been continuously measured from Year 2005 to 2008. The measurements are comprehensive, and are typical raw water quality from this data is presented in able 5.

**Table 5: Typical Raw Water Quality of Da Do River at Cau Nguyet WTP from 2005 to 2008**

Parameter	Unit	Analysed Result	
		Lowest	Highest
Temperature	°C	15	33
Turbidity	NTU	5.7	91.8
pH	---	6.65	7.84
Conductivity	μS/cm	189	973
Chloride (Cl <sup>-</sup> )	mg/l	8.52	211.6
Total Alkalinity	mg/l	73	94
Total hardness	mg/l CaCO <sub>3</sub>	64	176
KMnO <sub>4</sub>	mg/l O <sub>2</sub>	1.28	4.56
Total Fe	mg/l	0.04	0.50
NH <sub>4</sub> <sup>+</sup>	mg/l	0.04	0.8
NO <sub>2</sub> <sup>-</sup>	mg/l	0.00	0.50
NO <sub>3</sub> <sup>-</sup>	mg/l	0.02	0.24
PO <sub>4</sub> <sup>---</sup>	mg/l	0.2	0.1
Suspended Solids	mg/l	104	574
Feecal Coliform	MPN/100ml	100	6200
Total Coliform	MPN/100ml	300	11200

151. From Table 5, the chloride amounts are very low, indicating no salinity problems. Turbidity was high in the summer month, probably as a result of rainy weather or high flow conditions in the river. Turbidity was much lower for the spring month. Values for coliform bacteria were higher in the summer, again probably as a result of high flow conditions in the river. Generally, all parameters would achieve most water quality standards without treatment, except for turbidity and coliform bacteria. Based on this representative data, the raw water quality in Da Do River is very acceptable.

152. Preliminary assessments regarding expected raw water quality were confirmed by obtaining raw water samples at the proposed intake for the new Hung Dao WTP. Samples were taken daily from February 24 to 28, 2003, and from March 3 to 7, 2003. All samples were obtained at the depth of 0.5 meters. One sample was obtained from a distance of 1.0 m from one bank of the river. A second sample was obtained from a distance of 1.0 m from one bank of the river. A third sample was obtained from the middle of the river.



153. Water quality was analysed by HPWSCO in their water laboratory. Water quality of the samples from all sampling locations was about the same. Results from the analyses are presented in Appendix A2 and summarized in Table 6.

**Table 6: Raw Water Quality of Da Do River at Proposed Intake**

Parameter	Unit	Analysed Result	
		River Banks	Middle of River
Temperature	°C	22 – 27	22 – 27
Turbidity	NTU	11.5 – 48.2	11.7 – 46.5
pH	---	7.42 – 7.90	7.40 – 7.81
Colour	TCU	30 – 80	20 – 100
Conductivity	μS/cm	264 – 292	263 – 285
Salinity	mg/l	12.1 – 18.5	11,4 – 18.5
Total hardness	mg/l CaCO <sub>3</sub>	102 – 145	95 – 125
KMnO <sub>4</sub> –consumption	mg/l O <sub>2</sub>	1.4 – 2.2	1.1 – 2.6
Total Fe	mg/l	0.10 – 0,28	0.10 – 0.22
NO <sub>2</sub> <sup>-</sup>	mg/l	0.13 – 0.27	0.17 – 0.27
NO <sub>3</sub> <sup>-</sup>	mg/l	0.22 – 0.53	0.26 – 0.44
SO <sub>4</sub> <sup>++</sup>	mg/l	7 – 24	6 – 24
Feacal Coliform	MPN/100ml	20 – 260	40 – 300
Total Coliform	MPN/100ml	100 - 1,850	100 – 1,100

154. From Table 6, the chloride amounts are very low, indicating no salinity problems. Turbidity was also low. Values for coliform bacteria were again high. Generally, all parameters would achieve most water quality standards without treatment, except for turbidity and coliform bacteria.

155. As a conclusion, raw water quality data indicates that Da Do River represents a viable raw water source for the new Hung Dao WTP. The treatment plant can be designed using feasible and economical technology with previous application in Vietnam.

### D.1.2 Issues / Concerns Relative to Design

156. Unsatisfactory raw water quality may result from the WTP if design of the facilities and processes are unable to cope with raw water quality to produce safe drinking water. Similarly, deficiencies in the system design may result in delivery of unsafe water due to poor material, leaks, etc. Moreover, the whole system may become vulnerable to contamination due to laying of pipes within sewerage manholes, inadequate consideration of geology, soil characteristics, etc., into design parameters to ensure safety, etc.

157. The facilities may be exposed to outside attack and contamination unless adequate buffer zones, fencing, coverings for water storages, etc., are provided in the WTP. Also impacts may arise during operation phase unless adequate attention is paid for required sanitation facilities and safeguards are incorporated into the design of the WTP.

158. Inadequate consideration of utilities and infrastructure facilities in deciding alignments for transmission mains may result in damages to them, which could have been avoided with proper planning. Inadequate attention and standards at design stage for all the repair and renovation of damaged utilities and infrastructure facilities may result in low quality renovation or neglect due to inadequate funds in the budget.

159. Incomplete settlement and compensation planning may not reflect actual impacts on housing facilities, agricultural lands, crops, loss of corresponding income, community social infrastructure facilities as well as the due compensation for mitigation of livelihood impacts.

### **D.1.3 Project Alternatives**

160. The project is directly linked to the agenda of assisting and supporting infrastructure development in the Vietnam country strategy and program (2007–2010) and no-project alternative will deny the Millennium Development goal to achieve safe drinking water coverage to 90% of the population by 2020s.

161. Lessons learnt from the experience of ADB and other uni-and-multi-lateral donor agencies on urban water supply improvement projects, as well as from HPWSCO's use of foreign loans in other similar projects have been reviewed during and the relevant lessons incorporated to optimize the project design and to avoid the same mistakes twice.

162. Where appropriate, conventional engineering designs with proven records of reliable performance were adopted for the system improvements, for which there would not be any unexpected difficulties or problems. The major engineering risks were related to geotechnical and subsurface issues but they were overcome with adequate safeguards provided in the design. The consultant during detailed design project implementation will support the EA to ensure that engineering risks will be handled properly.

163. Technical alternatives considered for the project components have been reviewed and the least cost options were determined. The least-cost analysis ensures that each project component is optimally designed both to meet the goals of the project component and does not involve unnecessary extra costs. The project will apply technologies that are

deemed feasible and sustainable in developing countries. More importantly, these are technologies that the HPWSCo is highly familiar with. The proposed water treatment process is a traditional, simple, easy to managed and easy to construct type. The data and operation experience has proved that it is suitable for actual condition and highly effective. Haiphong One Member Limited Water Supply Company (HPWSCo) operates An Duong WTP, Vat Cach WTP and Cau Nguyet WTP which are designed according to the proposed water treatment process and met the objective of satisfying all requirements for drinking water standards.

164. The water source is the source identified by the District People's Committee in the Water Resources Development Master Plan developed to meet all sectorial development requirements in different sectors during 2025 – 2050 periods. Moreover, there is also an existing WTP at Cau Nguyet which is supplied raw water by the same source, about 5 km upstream from the proposed intake point for the new Hung Dao WTP. This WTP has operated without any serious issues regarding water quality.

165. The geological specification of the WTP area is generally of low load intensity due to alluvial and marine sediments. Therefore in these weak soils, 32m concrete piles shall be castled. Such specifications were adhered to while selecting options for water treatment facilities satisfying technical requirements. As such, the facilities requiring lower surface area were selected.

166. There were 2 options for mixing tank: namely mechanical rapid mixing tank and hydraulic mixing tank. Vertical shaft, mechanical, rapid mixing tank was selected because surface area is lesser than that of hydraulic mixing tank. Also involved construction cost is less as well foundation construction cost is decreased as 32m concrete piles shall be castled due to weak soil.

167. There were 2 options for flocculation tank: mechanical flocculation tank and hydraulic flocculation tank. Other flocculation tanks are not popular. Vertical shaft, mechanical, rapid flocculation tank was selected with converter in order to change the mixing intensity. The basis for this selection is that it can control the mixing intensity, decrease flocculation time, thus the surface area is lesser than that of hydraulic flocculation tank. Construction cost is less; foundation construction cost is decreased as 32 meter long concrete piles shall be casted due to weak soil.

168. There were 2 options for sedimentation tank: Horizontal and tube sedimentation tank. Other sedimentation tanks are not suitable with the capacity or are not popular. Tube sedimentation tank is selected due to its technical advantage of compactness; reliability; and easiness to operate & maintain. It also adapt to local geological conditions; involve simple and less concrete work. It also facilitate higher surface loading and the surface area is only 35% in comparison with horizontal sedimentation tank. Within the boundary of 8.1 ha, tube sedimentation provide space for future expansion of the capacity of Hung Dao Water Treatment Plant up to 150,000 m<sup>3</sup>/day in compliance with the General Planning of Hai Phong.

169. Rapid Sand Filters with 2 chambers per filter are selected. Filter media layer is quartz sand filtrated by water vapour and horizontal sweep current. The basis for this selection is that the filtration process uses less water than other filters, thus save power cost.

170. Considering above criteria used for selection of processes, technologies and facilities, it is clear that any other alternatives will not arise to optimize the safety, efficiency and the costs involved.

#### **D.1.4 Issues / Concerns / Impacts during Construction**

171. The main construction activities involved in the project are: (i) excavating and building intake works and the water treatment plant; (ii) excavating road right-of-way to install transmission mains; (iii) transporting equipment/materials to the site; (iv) transporting spoil and other waste for disposal; and (v) temporarily storing (stockpiling) excavated materials and construction materials on the site.

172. The potential adverse impacts of construction on the socio-economic environment may arise from: i) traffic; ii) accidents and safety hazard; iii) local flooding caused by siltation and clogging of urban drains due to poor management of fine aggregates, excavated materials and solid wastes; iv) water, telecommunication and power supply interruptions due to accidental damage/s v) public inconvenience by access blocking, etc.; vi) health hazard from dust, fumes, hazardous materials, noise and vibration; and Vii) public nuisance caused by construction workers. All these will adversely impact unless they are mitigated.

##### ***Excavating and building intake works and the WTP***

173. During the construction stage, such activities as site clearance, levelling, clearing green areas for construction of the intake facilities, WTP and entrance to the project site will be carried out. All these activities will be carried out in a remote area within the acquired lands. Any substantial impacts are likely only if soil erosion and sediment transport into the river system occurs. However, the WTP is way from the river and only the intake facilities may impact if adequate precautions are not taken.

174. The intake structure in the river will be built within dikes (coffer dams with sand bags) after pumping out of water in the enclosed area adjacent to the river bank. As such, impacts on river water are likely only by sediments caused by the dikes during building of them and removal. However, the natural level of turbidity of this river is high and very short periods of high sediment limited to localized area in this slow moving river will not adversely impact on the river water.

175. The construction activities within the acquired premises for intake and the WTP are unlikely to impact on any sensitive ecosystem or cause public nuisance due to its remote location. However, transport of material and equipment as well as disposal of spoil may impact on the traffic in the roads.

##### ***Laying of Transmission Mains***

176. For installation of transmission mains, it's expected that there will be about 27km of road sidewalk/surface to be excavated, which would generate about 11,520m<sup>3</sup> of excavated materials. Most of excavated materials will be sand, soil and stones. The materials will be reused on site for backfilling after pipelines have been installed. Expected duration of construction works is about one to two weeks in each road. Excavated materials will be piled along trenches, which may cause dust (if the excavation is carried out during dry season) and traffic congestion if there is no proper management at site. If road excavation activities are carried out during rainy season from November to January, soil may leak into installed pipelines, excavated materials will cause dirt on road surface and also rain water will flood trenches.

177. **Air Quality:** Means of transport will cause dust and air pollution on site along trenches where transmission mains are installed. These means of transport will carry excavated materials out of the site and construction materials to the site (pipes, sand, stones, etc.) Total quantity of excavated materials is expected at about 11,520m<sup>3</sup>. The excavated materials will be used for backfilling after the pipelines have been installed. It's expected that 30% of excavated materials will be redundant and removed from the site. Dust will be generated from traffic and backfilling activities; CO, SO<sub>2</sub>, etc. will be exhausted from means of transport and construction plants.

178. Construction plants of the project would include the following

Works	Construction plants of the project
Excavation and backfilling	Bull dozers, excavators, trucks for soil and sand transportation
Construction	Concrete mixing plant, trucks for construction materials transportation

179. Exhaust gas emanating from automobiles can be estimated as follows:

Gases	Exhaust gas quantity (kg/day of running)
HCHO	0,6698 x 10 <sup>-3</sup>
CO	58 x 10 <sup>3</sup>
CO <sub>2</sub>	5 x 10 <sup>-3</sup>
NO <sub>2</sub>	2,9 x 10 <sup>-3</sup>
SO <sub>2</sub>	0,2 x 10 <sup>-3</sup>

180. At these levels, emissions into the open air, where air quality is good (as shown by DONRE 2008 report in Annex 3), it is not likely to impact on the human health when compared to WHO guidelines given in table 7 below.

181. Exhaust gases and dust during construction stage may cause negative impacts on surrounding areas causing public nuisance in nearby residential areas or commercial establishments and other institutions. However, the construction activities will not be carried out at a large scale during a long period and they will not be significant and can be mitigated by proper construction management. Moreover, excavation and construction activities carried out in existing rice field /remote areas apart from residential/commercial areas are unlikely to impact adversely.

Table 7: WHO Ambient Air Quality Guidelines <sup>13</sup>		
	Averaging Period	Guideline value in mg/m <sup>3</sup>
Sulfur dioxide (SO <sub>2</sub> )	24-hour	125 (Interim target-1) 50 (Interim target-2) 20 (guideline)
	10 minute	500 (guideline)
Nitrogen dioxide (NO <sub>2</sub> )	1-year	40 (guideline)
	1-hour	200 (guideline)
Particulate Matter PM <sub>10</sub>	1-year	70 (Interim target-1) 50 (Interim target-2) 30 (Interim target-3) 20 (guideline)
	24-hour	150 (Interim target-1) 100 (Interim target-2) 75 (Interim target-3) 50 (guideline)
	1-year	35 (Interim target-1) 25 (Interim target-2) 15 (Interim target-3) 10 (guideline)
	24-hour	75 (Interim target-1) 50 (Interim target-2) 37.5 (Interim target-3) 25 (guideline)
Ozone	8-hour daily maximum	160 (Interim target-1) 100 (guideline)

182. **Noise** during construction stage is mainly generated from construction plants and trucks transporting construction materials to the sites and excavated materials for disposal. The sources of the noise will be more than 10-20m apart from residential areas in the WTP premises and in agricultural fields through which transmission mains will be laid. However, in the case of residential areas/ commercial areas, the building may be very close to the source of noise.

183. However, the noise at locations which are 10-20m apart from the source will be reduced. In some cases when all plants and equipment working at the same time, particularly during rush hours (noise from trucks is from 82 to 92 dBA) rate of noise at locations which are 10m apart will be higher than that regulated in national standard (see Table 8).

184. According to the 2008 air quality monitoring by DONRE, noise level at crowded sections of the Hai Phong City is in the range of 65-92 dBA (i.e. the lower level being 10

<sup>13</sup> World Health Organization (WHO). Air Quality Guidelines Global Update, 2005. PM 24-hour value is the 99th percentile;; 2 Interim targets are provided in recognition of the need for a staged approach to achieving the recommended guidelines.



percent beyond the standard limit set for residential areas at 60 dBA; and the higher level being 26 percent over that for mixed residential-industrial areas at 75 dBA). AS such, the construction activities may not be unusual in the city. However, It can be expected that some local households, shops and various institutions along narrow streets will be negatively impacted during construction stage unless mitigation measures are followed (about 1-2 weeks in each road/street and complete in a day within a segment).

**Table 8: Expected rate of noise generated from traffic vehicles and plants used for construction (dBA) is as follows:**

Types of vehicles and plants	Noise rate at locations which are 1m apart from the source (dBA)		Expected rate of noise at locations which are 10m apart from the source (dBA)	Expected rate of noise at locations which are 20m apart from the source (dBA)
	approximate	Average		
Bull dozer		93,0	73,0	67,0
Grader	72,0	74,0	54,0	47,9
Excavator	72,0 – 84,0	78,0	58,0	52,0
Truck	82,0 – 94,0	88,0	68,0	62,0
Concrete mixer	75,0 – 88,0	81,5	61,5	55,4
National standard (TCVN 5949-1998) 50 - 75 dBA (from 6:00 – 18:00) in residential areas				
National standard for working environment issued by Ministry of Health 85 dBA (8 hours/working day)				
General EHS guidelines by World Bank indicate the allowable limit in residential, institutional and educational areas at 55 dBA at day time (7.00 – 22.00 hr) 45 dBA at night (22.00 - 7.00 hr); in commercial and industrial areas 70 dBA for day and night <sup>14</sup>				

185. Vibration from the operation of construction equipment may impact, particularly on facilities located close to the transmission mains, but that will not be significant due to type of equipment used for pipe laying.

186. **Impacts on aquatic environment:** During construction stage, local aquatic environment will be shortly impacted and water quality may be reduced at water sources receiving water or sediments from the construction site. If construction is during rainy season, polluted storm water will overflow into construction areas. There will be suspended matters in overflowing water which sweeps over sand and clay. Flow of water will depend on area of the site, rain intensity and construction site where there is no roofing/ cover system.

<sup>14</sup> IFC WB 2009. Environmental, Health, and Safety (EHS) Guidelines

Surface water sources, such as local canals and rivers will be impacted due to overflow rain water, discharged water from the works and waste water generated by workers. Also, groundwater quality will be reduced due to construction activities if adequate precautions are not taken. In general, most of negative impacts due to construction activities are temporary and will be ended shortly after the construction activities are finished. However, there is no any sensitive ecosystem or other water uses, which are likely to impacted.

187. The Project component is unlikely to impact on biological resources.

188. **Impacts by domestic wastes:** Quantity of domestic waste generated by construction workers can be estimated based on maximum number of workers during construction stage (about 100 workers). Estimated quantity of solid waste generated is about 50kg/day on the basis of 0.5kg/capita/day and with the assumption that workers are allowed to have meals on site. This quantity of solid waste is not much and could be collected and treated by the Contractor. Poorly managed sewage, wastewater, and solid (particularly organic) and hazardous wastes may generate odor that will be unpleasant and may pollute water bodies, if not properly disposed.

189. **Oil leakage:** During construction stage, oil may leak from maintenance of machines and vehicles. According to Technical specifications, quantity of oil disposed from construction machines is about 10 liters in each time of maintenance and this new oil will be replaced after 3-6 months. If there are 5 machines for construction, the quantity of disposed oil may be from 10-15 liter/month. Disposed machine oil is considered as a toxic waste (code: A3020, Basel: Y8). If there is not a proper management regarding collection of used oil and its disposal, leaking oil may cause serious pollution to soil and groundwater in the construction site.

190. **Impacts on local traffic:** Piles of excavated materials along trenches may cause traffic congestion and safety problems to local people. It's estimated that the maximum excavated material quantity is about 3 - 4m<sup>3</sup> for one meter of road. A pile height of about 1.0m in 10m wide roads, piles of excavated materials will occupy about 30-40% of the road area. In narrow roads, the proportion of occupied area will be increased correspondingly. However, most of the roads do not have high traffic loads during the day time and traffic is mainly by motorbikes and bikes. Unless the traffic flow and pile sizes are well managed, impacts on traffic will be an issue.

191. If poorly managed, solid wastes/construction debris, excavated materials and fine aggregates will lead to clogged urban drains in the vicinities of project sites. Deposited wastes in urban drains will potentially find their way to natural outfalls.

192. Estimated duration of negative impacts during construction stage:

Works	Wastes	Duration
Construction of the water treatment plant	Dust, exhausted gas, domestic wastes	10 months
Construction of	Dust, exhausted gas, noise	4 months

transmission mains

(in each road about  
2 weeks)

193. **Impacts on utilities/services:** During the excavation for transmission mains, impacts may arise if any utilities, such as underground power supply, telecommunication or water supply connections are damaged. Also there may be unavoidable damages to some physical infrastructure facilities like canals and roads when transmission mains run across them. Moreover, access into households, buildings and other roads may be temporarily impacted during construction. These will be temporary and could be mitigated only if constructions activities are well coordinated and immediate attendance to damages are ensured. Further, the roads and bridges used for hauling material may be damaged and impacts will be significant unless they are repaired after completion of work.

194. **Impacts of resources extraction:** Most of materials needed for water treatment plant will be cement, sand and gravel, crushed rocks, brick, configured steel and reinforcement steel, ready mix concrete, etc., which are available in the local market and can be purchased from local suppliers. There will be no direct impacts due to resources extraction, particularly quarrying, if purchase from the licenced dealers because they operate with permits from relevant authorities.

195. **Labour Camps:** If outside labour is brought to the site, there will be a need for labour camps and they may impact the environment if there is no proper disposal of waste and allow conflicts to develop with local communities. Also health hazards are likely if they are not provided with adequate health facilities and awareness on communicable diseases are neglected.

### D.1.5 Issues / Concerns / Impacts during Operation

196. Noise will be generated from pumping stations; however, since electric motors are used in pumping stations, dust and smoke will not be generated. Regarding noise, all pumps are manufactured under new technology with soundproofing design to limit noise. In addition, since these proposed pumping stations are constructed apart from residential areas, sound pollution will not arise.

197. During operation stage, only chlorine, lime milk and aluminum will be used as chemicals and due to unsafe storage and handling they may be exposed to the local environment. During water treatment process, there will be some sludge generated and sludge will be treated and dried at sludge drying beds. When dry sludge is transported from the water treatment plant to disposal site, there will be a possible risk of pollution unless it is properly transported and disposed in sanitary landfills.

198. The potential adverse impacts during operation may also arise from inadequate design and or inefficient operation and maintenance of the facilities, algal growth in storage of treated water, contamination of treated water, etc., which in turn will produce/supply low

quality water compared to required standards. Similarly inadequate funds for operation and maintenance, failure to identify leaks and act promptly, will have a series of impacts.

199. Sewage, wastewater and solid waste generated within the WTP premises may impact unless proper disposal is practiced.

200. With new WTP and augmented supply, more water consumption will result in the generation of more wastewater. Without adequate management of sewage and wastewater (critically, industrial wastewaters) in the service area, the quality of life in the service area may pose a risk on health and impair aesthetics while deteriorating adjacent ecosystems.

### ***Positive Impacts and Benefits***

201. In general, overall impacts of the project are positive since it will help to improve the sustainability and stability of water supply services in Hai Phong city. Areas to be supplied with piped water will also be expanded. The project will also ensure adequate water supply in the future and the possibility to further expansion and improve the water supply system.

202. There will be opportunities for local employment and increased earnings of local enterprises during construction. Based on experience in Vietnam, an average 40-50 percent of the construction employment is sourced from the local labour force. The opportunity for short-term employment, however, is citywide in scope, not necessarily limited to the labour force available in the wards of Project sites. The operation of the Project component will bring about any combination of the following benefits that will offset the aforementioned minimal to moderate (and temporary) adverse impacts: i) improved quality of life in the service areas; ii) induced socio-economic growth, which will open up new or higher income and employment opportunities; and iii) improved local economy brought about by higher public revenues from intensifying economic activities and increased land values. Overall, the operation of the Project component will support sustainable urban development.

## ***D.2 Mitigation of Environmental Impacts***

### **D.2.1 Mitigation Measures during Designs**

203. The water treatment technology should be selected such that treatment process could produce water that will comply with the relevant drinking water standards of the country specified by QCVN 01-2009 /BYT from the raw water of identified quality. The capacity and stability of the WTP to ensure reliability of the service and both quality and the volume of treated water supplied for consumers must be ensured by design. Safe storage facilities for chemicals, sanitation facilities for workers, safety features for control room, particularly to avoid electrocution, protection from lightening, etc., are among the features to be incorporated into the design. Also exposure of treated water to contaminants should be

minimized by designing covered storages for treated water, incorporation of leak detection devices and control valves into the transmission mains, etc.

204. A green buffer zone around WTP and peripheral fencing walls at least 30m apart from facilities must be incorporated into the design. Houses or other structures must not be allowed within fencing walls.

205. In the design of alignments for transmission mains special attention must be paid for protection of clean water, particularly from contamination by sewage if installed through sewerage manholes or culverts. Similarly, soil conditions, geology, pipe material, etc., must be considered to prevent impacts of weather and other external elements on pipes causing damages thereby exposing to contamination. In principle, pipelines must be designed considering facilities of other projects in the same area to ensure the compatibility among the projects and master plans.

206. Potential areas to be impacted by damages to utilities must be identified during the design period to minimize such impacts by adjusting the alignments. Also standards for rebuilding damaged facilities such as resurfacing must be provided in bidding documents.

207. Routes for transportation and disposal of excavated materials must be reasonably designated. Suitable areas should be selected as disposal site with the agreement of DONRE and DPC.

208. Adequate safety precautions considering no approach zone should be applied in case of new high voltage lines to be installed and the following EHS Guidelines of the WB (2009) can be used.

Table 9: No Approach Zones for High Voltage Power Lines	
Nominal phase to phase voltage rating	Minimum distance
750 or more volts, but no more than 150,000 volts	3 meters
More than 150,000 volts, but no more than 250,000 volts	4.5 meters
More than 250,000 volts	6 meters

Source: EHS Guidelines of the WB,2009

209. In order to overcome the weak soils of the WTP, site the vegetable blanket must be removed before levelling the site. The site shall be filled layer by layer (of 30cm thick) and compacted to ensure the compaction of  $k=0.95$ . Material for filling must be mountainous soil which is not mixed with organic matters and mud, etc. Also concrete piles shall be castled to ensure structural stability of the WTP.

210. An updated and environmentally responsible O&M Manual or Procedural Guidelines will be prepared during the design stage to facilitate physical mitigation measures applicable during the operation phase.

211. All construction works must be planned to be carried out during the dry season to minimize the potential impacts much easily.

212. Resettlement plans should be formulated through participatory process with fair compensation schemes. Compensation payments should be scheduled to pay at least 30 days before awarding of contracts. Also interim replacement of access roads and other utilities must be contemplated in the design prior to permanent repairs on completion of pipe laying.

213. The Environmental Management Plan, which will be finalized during detailed design, shall form part of the bid document to ensure its implementation. Bidders shall prepare a Contractor's EMP following the Project component EMP. Bid evaluation shall include evaluation of the Contractor's EMP and their previous experience with EMPs. The contract/s for civil works shall explicitly stipulate the obligation of parties involved to institute the mitigation measures properly and carry out environmental monitoring according to the EMP and submitted Contractor's EMP.

## D.2.2 Mitigation Measures during Construction

214. All work items of the project must be carried out according to the technical specifications, relevant standards and the Contract/Bidding documents. A summary of mitigation methods, which were proved effective in management of possible risks to environment during construction process, is presented in the following table 10.

**Table 10: Measures of environmental impacts mitigation during construction**

Impacts	Mitigation Measures Recommended
Noise, bad odour, wastes and dust	<ul style="list-style-type: none"> <li>Noise shall be controlled by proper construction management to agree with minimum acceptable rate of noise regulated in Vietnamese standards TCVN 5949:1998 and TCVN 5949:1999 applied for roads and residential areas.</li> <li>Air pollution and dust shall be mitigated by methods of minimizing dust and emissions to Vietnamese standard TCVN 5937-2005 applied for air quality.</li> <li>Meet standards by prompt maintenance &amp; repair of construction equipment/vehicles; scheduling of noisy &amp; vibration-causing activities during daytime and in sensitive areas; use of construction technologies/procedures and equipment that emit least noise and vibrations; watering to minimize dust in residential/commercial areas.</li> <li>Suitable equipment shall be used to prevent overload on trucks. In cases of oil, lubricant leakage, and dirt dropping, etc., from machinery and equipment, these pollutants will be taken out from traffic and cleaned immediately.</li> <li>Dust, wastes and inconvenience to local people on site shall be mitigated by implementation of good site supervision and management.</li> <li>Local roads shall be regularly washed out to clean dirt, mud, oil and excavated materials generated during construction process.</li> </ul>
	<ul style="list-style-type: none"> <li>Excavated materials shall be transported from construction site to disposal site where these materials will not cause pollution. Pollutants shall be disposed at central areas specified and</li> </ul>



Impacts	Mitigation Measures Recommended
Disposal of wastes	<p>permitted by the People's Committee of the city and DONRE.</p> <ul style="list-style-type: none"> <li>Wastes shall not be left laying on site for longer period than 24 hours.</li> <li>Water generated during excavation process or due to flow rectification shall be discharged into drain ditches or existing streams. This water must not be pumped into public areas or left infiltrating into soil layers.</li> </ul>
Public and private properties	<ul style="list-style-type: none"> <li>The Contractor shall minimize damages to public and private properties during construction stage. The Contractor shall investigate utilities prior to excavation activities to avoid displacement of properties or damages to attached properties/utilities. The Contractor shall compensate the property owners or attend to repair to damaged utilities.</li> <li>The Contractor shall not cut off or block utility structures unless there is a suitable agreement with the Utility Owners.</li> <li>The Contractor shall, after finishing construction, reinstate all damages at construction sites.</li> </ul>
Health and safety	<ul style="list-style-type: none"> <li>The Contractor shall provide enough safety equipment, tools and protective clothes for workers and apply safety methods during construction stage.</li> <li>Facilities shall be provided for the workers so that they can do washing with clean water during and after working.</li> <li>Clean water and necessary medicines for first aid shall be available on site to clean and to treat bleeding injuries.</li> <li>The Contractor shall follow national regulations on safety and health when using supporting methods during excavation process.</li> <li>Masks shall be provided for workers to prevent dust.</li> <li>The Contractor shall construct and maintain safe access during construction if affected and repair after laying of pipes.</li> <li>For all temporary camps where workers will live overnight, the Contractor shall co-ordinate with local health workers to give suitable instructions and information of HIV/AIDS prevention.</li> </ul>
Arrangement of vehicles and traffic maintenance	<ul style="list-style-type: none"> <li>In residential and commercial areas and where traffic is moderate to high, excavations along roads shall not exceed 50m in any segment and that shall be backfilled within the day after pipe laying in the section before proceeding to other segment. The length of segment shall be 100 – 200m in remote areas with low traffic.</li> <li>Contractor employ adequate personals and the Contractor shall install and maintain, with allocated amounts, lighting and protection systems, barriers, warning signs when and at necessary places to protect the site or to provide comfort and safety for the public.</li> <li>Construction activities shall not cause any congestion to local traffic flow and block to public roads or walkway and entrance of local houses. The area occupied by the Contractor's vehicles shall not be wider than half of local roads, walkways or lanes.</li> <li>The Contractor shall select routes for their trucks based on the truck load and divide the load to prevent damages to local roads and bridges.</li> <li>Bull dozers are not allowed to enter pavement.</li> <li>The Contractor shall be responsible for damages to local roads and bridges.</li> </ul>
Working session and cleaning site	<ul style="list-style-type: none"> <li>The working session shall not exceed the session from 7 a.m. to 6 p.m. in residential areas.</li> <li>Work shall be avoided in places where employees and pupils travel in and out of institutions, factories, etc..</li> <li>Noisy equipments shall be avoided close to schools, universities and other sensitive places during sessions and while rituals are in progress in temples, cemeteries, etc.</li> <li>The Contractor shall supervise their works on site, clean the site, set up barriers, warning signs</li> </ul>

Impacts	Mitigation Measures Recommended
	and lighting system according to Contract documents.
Public relations	<ul style="list-style-type: none"> <li>Each method statement shall be agreed with by the Contractor, DONRE and the Construction Management Consultant. In addition, the Contractor shall submit and present Method statement (CEMP) to the Construction Management Consultant, PMU. Each method statement shall be agreed by representatives of the Contractor. If requested by the PMU, a meeting shall be held to explain and discuss on method statements with participation of local people or their representatives.</li> <li>The PMU shall release notices of construction works and schedule which will impact on local people during construction stage. The notices shall be broadcasted in newspapers or other media. The notices shall also be released by representatives of local residential areas. Amplifiers shall be used to update news related to areas relevant to construction activities.</li> <li>Sign boards indicating names of the project, the EA and the Contractor must be installed at easy-to-see places on site.</li> </ul>

215. HPWSCo shall ensure that the contractors (i) comply with the applicable labour laws and regulations, including stipulations related to employment, e.g. health, safety, welfare and the workers' rights; (ii) do not force the labour to work; (iii) employ women and local people, including disadvantaged people, living in the vicinity of the relevant works; (iv) provide equal pay to men and women for work of equal type; (v) do not employ child labour; (vi) maintain records of labour employment, which shall include the name, age, gender, working time, and payment of wages; and submit a copy of such records to the PMU.

### D.2.3 Mitigation Measures during Operation

216. The environmental considerations made from the conceptualisation of the project through to construction and operation will translate to impacts encountered during operation. Hence, some mitigation measures for impacts relative to siting and design and during construction are actually mitigating potential impacts during the operation phase.

217. Before commencing operations, it is important for the HPWSCo to secure permits to operate and agreements reach with water supply company responsible for irrigation water from the Da Do river in order to ensure safe operation and no-conflicts with downstream water users. It is also important for the HPWSCo to make sufficient provision of O&M budget while hiring of competent staff particularly in critical aspects of O&M, adequate and appropriate equipment, tools, supplies and vehicles.

218. During operations, the conscientious environmental monitoring, particularly water quality at various time intervals; reporting, and prompt action to arising issues/concerns/grievances are important to deliver a safe and satisfactory service.

219. The Management must also institute the necessary coordination with the concerned CPCs and DPC; and vigilance on the water supply and demand situation to allow timely planning and programming of system upgrading and mitigate the risk of the system becoming inefficient to meet increasing demand. Some specific measures include: Information- Education- Communication on water conservation, quick response to system leaks, and regular inspection of the system's components.

220. Arrangements must be made to transport sludge by suitable vehicles and these vehicles must be completely covered to prevent materials from dropping and causing bad door. It should be ensured that the sludge is only disposed at recommended sanitary disposal site.

221. In general, proper housekeeping of the premises, storage and disposal of waste generated; safe storage of chemicals are important.

222. In order to avoid deterioration of raw water quality, human activities around the intake of WTP must be regulated. The water source protection zone is identified as follows according to Vietnamese standards

Protection zone for surface water	Protection zone	Restrictions within protection zone
At the upstream	200 - 500 m	Construction' Discharging waste water ; Fish farming;
At the downstream	100 - 200 m	Bathing

223. Human activities within the water source protection zone must be regulated in order to minimize potential pollution of river water. In the protection zone, there must be improved sanitary conditions, limitations in agricultural activities, particularly in using fertilizer and pesticide, fishing and fish farming. In addition, there should be limitations to business activities, particularly to the industries within and near the protection zone. The land uses have been defined in the Master Plan for such Protection Zones. However, HPWSCo must coordinate with DONRE and other relevant authorities involved in planning as well as industries, and DPC to ensure proper implementation of the regulations and protect the entire Da Do river from pollution that may impact the river water substantially. In this regard, activities may include educating local community and manufacturing establishments on environmental protection and industrial, agricultural sanitation, particularly in areas near raw water source.

224. In addition to source protection, use of chemical fertilizer and pesticide, cattle raising, etc., should be forbidden within the premises of the WTP to prevent impacts on water quality. Country regulations on labour safety, sanitation and environmental protection shall be applied for all staff and workers working in the water supply project, particularly within the WTP.

225. In order to minimize adverse impacts due to more wastewater generation after augmented supply local authorities must establish regulations on environmental protection and waste water treatment and strictly punish violations. The DPC should initiate action to

ensure operation of manufacturing establishments which use water to discharge wastewater in accordance with the Law on Environment Protection and Environmental Degrading Prevention.

226. In order to ensure delivery of safe drinking water in agreement with the GoV standard, given in **Annex 4**, the following regular water quality tests should be carried out by the HPWSCo:

- Prior to start operation of distributing from the WTP, test the water quality for parameters specified in QCVN 01- 2009 BYT required to obtain permit for operation of the WTP;
- During operations weekly water quality test for colour, smell, turbidity, pH Cl, Hardness, Fe, Mn, NO<sub>3</sub>, NO<sub>2</sub>, SO<sub>4</sub>, residual Chlorine, DO, coliform, e-coli, (QCVN 01-2009 /BYT);
- During operations, monthly water quality after operation for parameters of: pH, smell, colour, temperature, TSS, conductivity, DO, BOD, COD, Cl, Po<sub>4</sub>, Fe, Mn, NH<sub>4</sub>, NO<sub>3</sub>, NO<sub>2</sub>, Coliform, faecal coliform (QCVN 01-2009 /BYT)
- During operation, once every 6 month water quality test for TDS, Al, As, NH<sub>4</sub>, H<sub>2</sub>S, Fl, Pb, Hg, Na, Phenol, Benzene, Benzophyrene, Monoeloroobenene, monochloramine, gross alpha activity, gross beta activity (QCVN 01-2009 /BYT),
- Once every 2 years the remaining 78 parameters of the 109 parameters tested prior to operations (QCVN 01-2009 /BYT)
- Treated water quality regularly monitored in different locations along pipelines for primary parameters of faecal, pH, conductivity, salinity, alkalinity, hardness, KMNO<sub>4</sub>, Fe, Coliform, NO<sub>2</sub>, NO<sub>3</sub>, microquantity; elements, such as As, Cu, Zn, Mn, Mg, Cr, Phenol, Hg, CN, be analysed twice per year. Residual Chlorine shall be measured on site. In average, five (5) samples per day. Sampling locations shall be changed and additional samples shall be collected in the same day if there is any complaint from consumers.
- In addition, raw water quality must be monitored at locations 2km apart in the upstream for pH turbidity and conductivity. Microquantity, As, Cu, Zn, Mn, Mg, Cr, Phenol, Hg, Cn and residual quantity of pesticide.

227. Also irregular (extraordinary) monitoring is recommended in case of:

- When the test results of water source or epidemiological investigation showed that water is subjected to pollution risk;
- When the environmental incident may affects the quality of water resources; and
- When there are other special requirements.
- Vietnamese Standards 1329/2002/BYT and WHO Standards

228. In the following table 11, water quality parameters used for drinking water by the GoV and other international agencies are shown.

**Table 11: Comparison of Drinking water standards**

	Indicators	Unit	Vietnam Limits	WHO Limits
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	Indicators	Unit	Vietnam Limits	WHO Limits
1	Turbidity	NTU	2	5
2	Colour	TCU	15	15
3	pH	--	6,5 - 8,5	6,5 - 8,5
4	Hardness	mg/l CaCO <sub>3</sub>	300	500
5	Oxygenation	mg/l O <sub>2</sub>	2	---
6	Chloride Cl <sup>-</sup>	mg/l	250	250
7	Free chlorine	mg/l	0,3	---
8	Nitrite NO <sub>2</sub> <sup>-</sup>	mg/l	3	0,1
9	Nitrate NO <sub>3</sub> <sup>-</sup>	mg/l	50	10
10	Ammonia NH <sub>4</sub> <sup>+</sup>	mg/l	1,5	1,5
11	Sulphate SO <sub>4</sub> <sup>--</sup>	mg/l	250	400
12	Phosphate PO <sub>4</sub> <sup>---</sup>	mg/l	2,5	---
13	Flouride F	mg/l	0,7-1,5	1,5
14	Iron Fe	mg/l	0,5	0,3
15	Manganese Mn	mg/l	0,5	0,1
16	Arsenic As	mg/l	0,01	0,05
17	Chromium Cr	mg/l	0,05	0,05
18	Lead Pb	mg/l	0,01	0,05
19	Copper Cu	mg/l	2	1
20	Nickel Ni	mg/l	0,02	0,05
21	Selenium Se	mg/l	0,01	0,01
22	Mercury Hg	mg/l	0,001	0,001
23	Cyanide CN	mg/l	0,07	0,1
24	Dihydro Sulfua	mg/l	0,05	---
25	Fecal Coliform	MPN/100ml	0	0
26	Total Coliform	MPN/100ml	0	0

229. From the table it is clear that in general, GOV standards are even more stringent than WHO for most of the parameters and proposed water quality monitoring is acceptable.

#### **D.2.4 Additional considerations**

230. Due consideration must be paid to the policy and legal frameworks, standards and multilateral agreements signed by the GoV during all three stages of the project, viz. design, construction and operation. Such relevant policies, standards and conventions, to be adhered by the pertinent EA, Contractor, DONRE, DPC, etc., are listed below.

231. The basic GOV laws/policies that provide general framework and procedures/guidelines on environmental assessment:

- (i) Law on Environmental Protection of 29 November 2005, (No 52/2005/QH1), providing for environmental protection; for policies, measures and resources for environmental protection; and for the rights and obligations of organizations, household and individuals for environmental protection. Its Section 2, which includes Articles 18 to 23, discusses environmental impact assessment.
- (ii) Decree 80/ND-CP of 09 August 2006, detailing and guiding the implementation of a number of articles of the Law on Environmental Protection regarding environmental standards; strategic environmental assessment; EIA and environmental protection commitments; and disclosure of environmental information and data, among others.
- (iii) Decree 21/ND-CP of 28 February 2008, amending and supplementing some articles of Decree 80/2006/ND-CP, such as the list of projects for which a report on assessment of environmental impact must be prepared; the appraisal and approval process of EIA reports; and the requirement for projects that have not commenced after 24 months from the date of approval of the EIA reports, among others.
- (iv) Circular 05/2008/TT-BTNMT of 08 December 2008, providing detailed instructions on the implementation of some contents relating to evaluation of strategic environment, of impact on environment and commitment to environment protection prescribed by Law on Environment Protection,
- (v) Decree 80/2006/ND-CP and Decree 21/2008/ND-CP. The instructed contents include the preparation and assessment of reports on evaluation of strategic environment; the preparation, assessment and approval of reports and additional reports on evaluation of impacts on environment; the checking and certifying of the contents of reports; the examining regime, reporting on the assessment and approval of reports on evaluation of impacts on environments, certifying the commitment to environment protection. This Circular replaced Circular No. 08/2006/TT-BTNMT.

232. Law on Water Resource (No. 8/1998/QH10 of 20 May 1998, provides for the management, protection, exploitation and use of water resource; the protection and combat against, and overcome of, the harmful effects of water.

- (i) QCVN 01:2009/BYT, or the National Technical Regulation on (treated) drinking water quality;
- (ii) QCVN 08:2008/BTNMT; column A1 and A2, containing the national technical specifications surface (raw) water quality
- (iii) Standards at consumer points stipulated by QCVN-01-2009 BYT



233. Other issuances relevant to the conduct of environmental assessment of water supply projects are, but not limited to, the following:

- (i) TCVN 5937-2005, specifying the ambient air quality standards.
- (ii) TCVN 5938-2005, specifying the allowable maximum concentration of hazardous substances in ambient air.
- (iii) TCVN 5949-1998 – specifying the permitted maximum levels of noise in public places and populated areas.
- (iv) TCVN 6962:2001: specifying the permitted levels of vibration from construction and industrial activities in residential and public areas.,
- (v) Law on Biodiversity, which took effect on 1 July 2009
- (vi) Law on Aquatic Resource Protection, 1989.

234. Environmental conventions and protocols that the country is party of includes:

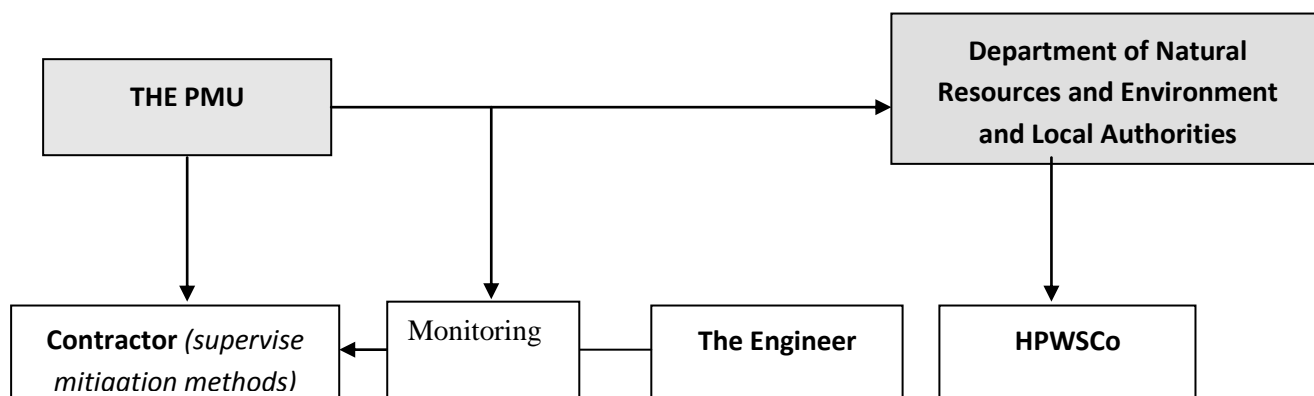
- (i) UNESCO World Heritage Convention,
- (ii) Ramsar Convention on Protection of Wetlands,
- (iii) Basel Convention on the Control of Transboundary Movements of Hazardous
- (iv) Wastes and their Disposal,
- (v) Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES, also known as the Washington Convention),
- (vi) Convention on Biological Diversity (known informally as the Biodiversity Convention), Cartagena Protocol on Biosafety,
- (vii) Kyoto Protocol (on climate change).
- (viii) Decision No 2548/Q $\square$ -UBND was issued by the Haiphong People's Committee on 27 November 2006, ratifying the project that promoted the sustainability of the protection of biodiversity and the white-headed langur in Cat Ba Island, funded by the Regional Natural Heritage Programme (RNHP)

## E. INSTITUTIONAL REQUIREMENTS AND ENVIRONMENTAL MONITORING PLAN

235. The impacts to be mitigated and activities to implement the mitigation measures, including how, when, and where they will be implemented together with responsible agency are shown in the Environmental Management Plan (EMP) given in Annex -1. The environmental management costs are also described

236. In this Chapter, the institutional arrangements for implementation are described.

237. Organization of the project environmental management system



### ***Project Management Unit (PMU)***

238. The Hai Phong Water Supply Company (HPWSCO) will be the executing agency for the Project. A Project Leading Group (PLG), chaired by a Vice Director of HPWSCO, has been established to provide overall guidance and support to project preparation and implementation. Officials and staff from the various department of the HPWSCO sit as members of the PLG. A PMU has also been established to undertake and manage the day-to-day activities of the Project.

239. PMU is responsible for implementation and monitoring Environmental Management Plan. With the support from the Construction Management Consultant (Environmental Engineer), The PMU will monitor the Contractor's implementation of mitigation methods during construction stage. The PMU will co-ordinate with local authorities to inform local communities of the project preparation, implementation and operation. The PMU is also responsible for reporting the implementation of Environmental Management Plan to Department of Natural Resources and Environment (DONRE) based on their observation on site, conclusions of meetings and monthly progress reports prepared by the Construction Management Consultant.

240. Regarding Environmental Monitoring, the PMU is responsible for:

- (i) Ensuring that terms and conditions related to Environmental Management Plan are specified and described in the Contract of Construction.

- (ii) Following the implementation of Environment Monitoring Plan and Mitigation methods during the Contract implementation as specified in relevant terms of reference.
- (iii) Reviewing the Contractor's mobilization and working plan to find out possible negative impacts and carry out random and regular checking of the Contractor's implementation of Environment Mitigation Methods.
- (iv) Ensuring that the selected Environment Monitoring Consultant fulfils their responsibility described in terms of reference.

241. The PMU shall make sure that the following are fulfilled:

- (i) A qualified environmental engineer, who will be responsible for monitoring the EMP implementation be hired/seconded to PMU prior to start of the detailed design phase,;
- (ii) Prior to construction, a grievance point person, who has background in liaising/communicating with social/community group ne hired/ seconded to the PMU;
- (iii) The Environmental Protection Commitment shall have been registered with, and certified by, the DPCs and building permit secured, prior to the start of construction.
- (iv) Sufficient prior public information and signboards about the Project component will have to be conducted in concerned communes and posted in strategic places, respectively, prior to construction (PMU shall release notices of construction works and schedule which will impact on local people during construction stage. The notices shall be broadcasted in newspapers or other media. The notices shall also be released by representatives of local residential areas. Amplifiers shall be used to update news related to areas relevant to construction activities).

### ***Hai Phong Department of Natural Resources and Environment (DONRE)***

242. Hai Phong DONRE is responsible for ensuring the compliance with regulations on Environmental Management and Protection specified in the Law on Environmental protection No. 52/2005/QH1 dated 29/11/2005, Decree No. 80/2006/ND-CP dated 09/08/2006 issued by the Government and circular No. 08/2006/TT-BTNMT dated 08/09/2006 issued by Ministry of Natural Resources and Environment.

243. Monitoring reports and implementation of Environmental Management Plan will be appraised and approved by DONRE in accordance with legal framework for environmental management and protection.

### ***The Construction Management Consultant***

244. The primary tasks of the Construction Management Consultant are to supervise order and administrative procedures for civil works, standard operation procedures to mitigate environmental impacts as described in IEE Report and EMP. These tasks will be specified in terms of reference for The Construction Management Consultant and the Contract agreement between the Construction Management Consultant and the Client. Following instructions of the PMU, the primary tasks of The Construction Management Consultant to

ensure application of mitigation measures and construction management consists of (but not limited to) the followings:

- (i) To assist and co-ordinate with the PMU to establish, collect and provide information of environmental parameters on site and information of the project implementation;
- (ii) To ensure that construction works are implemented in accordance with the approved Environmental Management Plan, relevant specifications and standard operation procedures specified in Contract documents for Environment Impacts Mitigation and Environment Monitoring Plan.
- (iii) To supervise the Contractor's implementation of Mitigation methods, to provide timely proposal and to carry out additional intervention to develop Mitigation methods to meet requirements of the project environmental management.
- (iv) To prepare emergency action plan/alternatives to treat environmental problems in emergency cases and possible damages during construction stage.
- (v) To recommend to the PMU suspending parts or the entire construction works if the Contractor does not meet requirements of labour safety and environmental protection agreed or specified in Contract documents.
- (vi) To hold meetings with relevant parties, to collect and to provide required information about the project, to carry out working time schedule to enhance public awareness and to identify possible problems that may happen in the local community to seek for solutions for problems before carry out construction works.

### ***Grievance Point Person (GPP)***

245. Under the Construction Supervision Engineer the GPP shall manage the grievances raised during construction. He/she shall be responsible for ensuring the observance of the grievance redress mechanism and for preparing the monthly and annual grievance redress reports.

246. Informally, a complainant can approach or call the PMU, the Contractor or the Operator to raise his/her complaints/concerns. If complaint is not acted on promptly, or if complainant is not satisfied with the resolution undertaken, he/she can call or approach the HPWSCo's Customer Relations Office.

247. The Grievance Point Person (GPP) and the Operating Enterprise (OE) will be responsible for documenting and registering complaints received during construction and operation, respectively. Other potential complaint recipients shall make sure that the received complaints are documented by, and registered with, the GPP/OE as soon as possible. The GPP/OE shall make sure that documented/registered complaints are acknowledged, duly referenced and complainants informed of the expected action timelines as set forth in the established mechanism. The GPP/OE shall inform the Affected Party/person (affected party/person) immediately if the grievance is within, or outside, the purview of the mechanism. If it is outside the scope, AP shall be directed to the proper institution and/or proper mechanism for the complaint.

248. If it is covered by the mechanism, the complaint will be immediately reviewed, investigated and discussed together with Contractor's/OE's duly designated grievance officer, if conditions allow, that is, both AP and Contractor's/OE's grievance officer are

available for discussion. If not, the review, investigation and discussion should take place immediately the next day. The discussion will cover the measures to implement based on the review and investigation.

249. If impact/issue is minor, the Contractor/OE shall immediately act on the complaint. Minor impacts/issues are generally those that would not require thorough review and investigation and are easy to resolve. If impact/issue will need thorough review and investigation, more work to be done, and/or supplies/parts to be procured, to resolve, the Contractor/OE shall immediately provide the most suitable interim measure to reduce impact; and to start working on the final measure not later than 5 days from the day discussion meeting is held.

250. The GPP/OE shall keep track of, and document, the progress of each step for record purposes, future reference and for monitoring and evaluation of the effectiveness of the mechanism. If, according to the AP, the impact has been resolved satisfactorily, GPP/OE shall obtain a written confirmation of satisfaction from the complainant, which will form part of the grievance documentation.

251. For at least a week after closure of grievance (that is, when action implemented has been satisfactorily confirmed in writing by the complainant), the GPP/OE shall monitor the effectiveness of the resolution. Monitoring shall be properly documented. The GPP/OE shall make sure that the status of grievance management is reported monthly to the PMU/HPWSCO's Customer Relations Office. The report shall provide comprehensive information on number of grievance received, timeframe of actions made, number of action backlogs, efficiency rate, and remarks particularly on the constraints and lessons learned. Reports shall serve as basis for evaluating the effectiveness of the mechanism and shall help in determining improvements to strengthen the mechanism and improve the environmental management of the Project component. It is also advisable to use the monitoring reports to report back to the concerned villages & communes on the implementation of the grievance redress mechanism. It will be an effective tool to gain the appreciation and respect of the villages and communes on the sincerity of the goal of the Project component and the services of the HPWSCO.

252. In the event the issue persists, AP can lodge an appeal to his/her CPC. The CPC shall immediately: i) record the appeal; ii) contact the GPP, Contractor or OE, provide them with copy of the appeal; and iii) call for a meeting to review the history of the grievance and discuss the appeal and quick resolution of the issue. If the proposed action/measure has not started within 5 days from the time of formal lodging of the appeal, AP can seek assistance from CPC to raise the grievance to the most relevant institution, i.e., District or City Court. It is highly unlikely that grievance redress process for the Project component will reach the level wherein Complainants need to go through the "appeal" stage.

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**Contractor/s**

253. The Contractor is responsible for fully and effectively implementing mitigation methods and terms related to Environment specified in Contract documents and following the CEMP submitted to PMU and approved by them.

254. The Contractor shall submit and present Method statement (EMP) to the Construction Management Consultant, PMU and DONRE. This CEMP or the method statements shall be agreed by representatives of the Contractor, DONRE and the PMU in meetings. When requested by DONRE or the PMU, a meeting shall be held to explain and discuss on method statements with participation of local people or their representative.

**Environmental Monitoring Program**

255. The environmental monitoring plan will describe the impacts to be monitored, and when and where monitoring activities will be carried out, and who will carry them out. The Environmental Monitoring Plan is given in the **Annex-2**.

256. The environmental monitoring is applied to ensure or at least manage impacts, to fully record effectiveness of impacts mitigation methods for later reference and complaints or questions for the public which are solved reasonably. Environment monitoring activities will create basis for collecting, filing and reporting information related to environment. These reports will be directly submitted to the PMU after each monitoring trip. Final report will also be submitted to the PMU. The report will be prepared based on results of monitoring trips during construction stage.



## **F. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE**

### ***F.1 Public Consultation***

257. Consultation and participation during project preparation were carried out in the form of on-site informal discussions during field visit, key informant interviews, socio-economic surveys and focus group discussions.

258. The field visit conducted by the Environmental Specialists and a PMU officers in March 2011 was a joint preliminary assessment of the environmental/cultural sensitiveness of the Project sites. Few informal interviews with residents were made to find out the level of awareness of the residents of the Project component. Those interviewed confirmed their awareness of the proposed Project component and potential impacts as well as desire to have access to potable water supply.

259. Key staffs of HPWSCo were consulted on environmental management measures being implemented by HPWSCo enterprises, as well as on their experiences with other existing water supply projects. Also they were consulted about the land acquisition for the WTP, mitigation of impacts during construction as well as O&M after completion including sludge disposal. They were made aware of the questions raised by people in the consultation meetings and need to address such issues.

260. HPWSCo officers were consulted about the problems encountered during recent upgrading of the water supply schemes and they informed that the more common complaints received during construction were on dust, noise and accidents. Complainants were directly raising their concerns to the Contractor, who normally resolved the complaints on its own. With respect to use of the right of way for transmission mains, local residents were willing to face little difficulties in exchange for safe water supply.

261. Focus Group Discussions were held on 6<sup>th</sup> March 2011 at the cultural house of Quyet Thang Village, Hung Dao Ward- Duong Kinh District. The participants include householders affected by resettlement and householders living around the proposed Hung Dao WTP area, who would be affected by activities during construction/operation of Hung Dao WTP. The participants were divided into three groups for discussion.

262. People were concerned about impact on downstream irrigation water supply due to abstraction of water for the new project. They were explained that the abstraction is very little or negligible compared to the river flow/ storage in Da Do river and most of the water is discharged into the sea at a distance (10 – 20 Km) downstream of the proposed intake point.

263. People highlighted that during the period of construction labor camps will create problems unless well planned and supervised. Their major concern was that sewage from labor camps may be discharged into surface water bodies and that must be totally stopped. It was made clear that the contractors will be required to have adequate temporary toilets with septic tanks for workers and the pits be filled with soil after completion of work. None of

the participant was concerned about noise, dust and other constructional impacts of the WTP site because of its remoteness.

264. People also raised issue of high tension power lines and to take adequate precautions if they run close to high rising buildings

265. They were also keen to know about impacts of sludge from WTP because they believed it contains hazardous material and had heard of bad impacts in some other existing WTPs. It was explained to them that only Aluminums like metals are the contaminants in sludge and that will be disposed to safe landfill sites approved by the authorities to ensure that no adverse impacts would take place. The disposal contractor would also be required to produce certificate from the landfill operators to prevent potential violation of the contract. People were not concerned about other operational impacts of the WTP such as noise.

266. Participants highlighted the need to adopt preventive measures to control any leakage of Chlorine used for water disinfection in the WTP. Also they recommended not discharging any wastewater from the WTP to the surrounding environmental without treatment. Further they highlighted that the domestic wastewater from workers quarters and toilet need a dedicated sewerage system and should not be discharged into the river.

267. The general opinion of participants about the project operation was expressed as follows:

- The water intake of WTP will not affect water quantity of Da Do river because the river is always full during dry and rainy season. The water level rise and low down due to tidal regimes only.
- The irrigation water as a source for agricultural production will not be affected because Hung Dao WTP use only Da Da water river as raw water but it does not affect groundwater or cause soil pollution.
- iver

### The list of participants

	Name	Female/Male
Group 1		
1	Trần Thị Găng	F
2	Đỗ Thị Loan	F
3	Trần Thị Loan	F
4	Trần Thị Dần	F
5	Bùi Thị Ngân	F

	<b>Name</b>	<b>Female/Male</b>
6	Trần Thị Mỗi	F
7	Đỗ Thị Quý	F
8	Nguyễn Thị Hát	F
9	Trịnh Thị Nức	F
Group 2		
10	Đỗ Thị Dinh	F
11	Đỗ Thị Thuyết	F
12	Đỗ Thị Hời	F
13	Nguyễn Thị Ngãi	F
14	Đỗ Thị Yến	F
15	Đồng Thị Thắm	F
16	Bùi Thị Ngã	F
17	Vũ Thị Chinh	F
Group 3		
18	Do Quang Vien	M Household head
19	Do Van Anh	M
20	Do van An	M Household head
21	Do Van Dia	M
22	Tran Quang Dam	M
23	Do van Kha	M Household head
24	Do Van Khang	M
25	Bui Thi Nga	F
26	Dong Thi Tham	F
27	Bui Van Dang	M Household head

	<b>Name</b>	<b>Female/Male</b>
28	Bui Van Dang	M
29	Pham Van Thang	M
30	Bui Van Tuyen	M
31	Hoang Thi Hanh	F

## ***F.2 Information Disclosure***

268. To date, the following have been disclosed: i) Project component description and components; ii) locations; and iii) expected period of implementation, in the planned joint social, resettlement and environmental public consultation events held in March 2010. The findings of the draft IEE, including the draft EMP, will be disclosed to the relevant people after completion of the IEE in April 2011. In this public consultation, (i) All stakeholders will be invited and encouraged to participate in the consultation workshops; (ii) Suggestions from the general public will be sought about potential impacts in their view and any proposed alternate mitigation measures; (iii) The responsible officers will be available at the meeting to answer any matter concerning the project design and operation as well as contract management and environmental monitoring.

269. The SIEE report will be required to be circulated worldwide, through the depository library system and on the ADB web site. The Vietnam version of EPC report will be disclosed at commune level as a country requirement.

## G. FINDINGS AND RECOMMENDATIONS

270. Based on the environmental screening carried out for the IEE study, the proposed project is unlikely to cause significant, irreversible adverse impacts on the environment. More importantly, the proposed subproject is intended to improve the quality of the living environment, living standards and income generation of the communities in the project areas.

271. The benefits will include availability of house connected safe and reliable supply of water for already connected and new households as well as for industrial establishments for drinking, sanitation and industrial use. Improved personal sanitation resulting from hygiene and sanitation coupled with better health and environmental sanitation will result in marked improvement in community health in addition to enhanced productivity and employment generation from industrial and economic growth.

272. The potential adverse impacts that are associated with design, construction and operation of the proposed project will be mostly of low, with very few of moderate, magnitude, and localized, and which can be mitigated to acceptable levels without difficulty through proper engineering design and incorporation or application of recommended mitigation measures and procedures in all stages. The impacts due to resettlement in the WTP site will be relatively more important but could be mitigated by proper resettlement plans with adequate compensation as people have no objection. Impacts during constructions will be temporary and could be minimized by following the construction management and supervision proposed in the Environmental Management Plan.

273. All project activities prior to construction, during construction and during operation will be monitored and a monitoring mechanism for which is provided in this IEE Report. Moreover, the members of the communes and DPC have an important role in project construction and operation so that they can intervene when necessary or when complaints arise.

274. For the project, no further special study or detailed EIA is warranted. Therefore the IEE itself, becomes the completed environmental assessment for the project and no follow-up EIA will be needed.

## H. CONCLUSIONS

275. Based on the findings of the IEEs for the Hung Dao project, the classification of the Project as Category “B” is confirmed under the ADB Guidelines. The adverse impacts that will arise from the implementation of all project components will generally be minor or moderate and measures to mitigate them are provided and they could be instituted without difficulty through proper engineering design and environment-friendly management of construction activities and operation.

276. The operation of the proposed project, will bring about numerous socio-economic benefits that will far outweigh all aforementioned adverse impacts, for instance improved, convenient access by residents to reliable supply of safe, potable water in both the urban centre and peri-urban areas; enhanced environmental sanitation and public health; induced urban development and socio-economic growth in the suburban areas leading to the opening up of income and employment opportunities and improvement of the local economy of Hai Phong.

277. Based on the findings of the IEEs for the Hung Dao project, the classification of the Project as Category “B” is confirmed. No further special study or detailed EIA needs to be undertaken to comply with ADB’s Safeguard Policy. Under GOV regulations, the project component is classified as Category “II”, which would require only “Environmental Protection Commitments” for registration with, and certification by Hai Phong District People’s Committees through their Natural Resources and Environment Office.



## ***Annex - I : Environmental Management Plan***

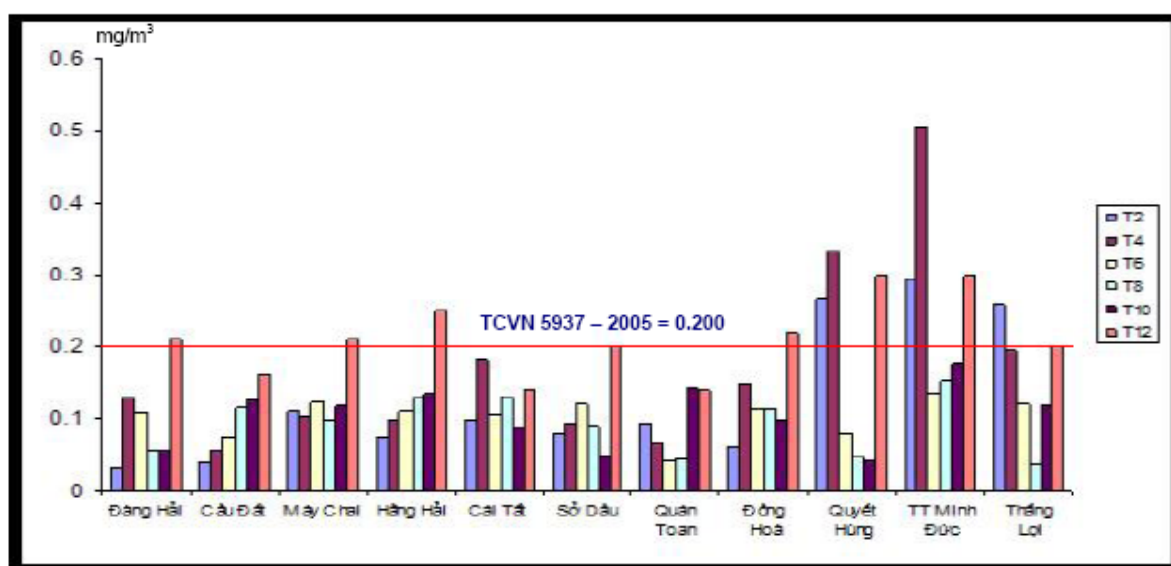
## ***ANNEX - 2: Environmental Monitoring Plan***

## Annex – 3: Air Quality Monitoring Results for Hai Phong City (2008 by DONRE)

### Suspended Dust

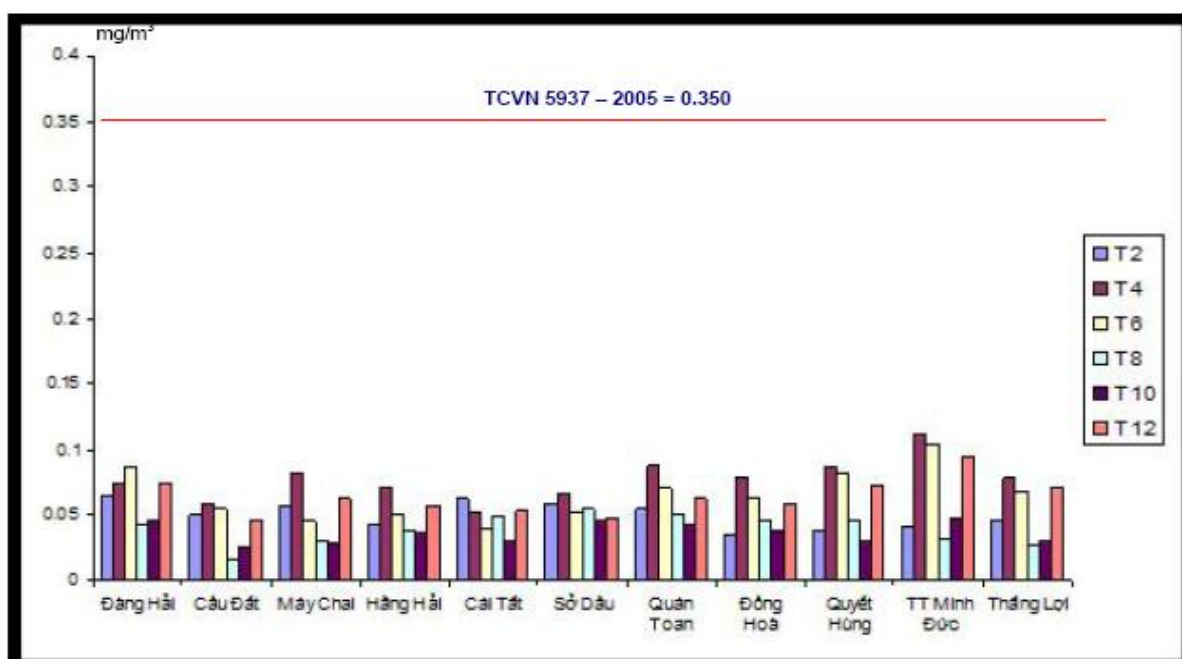
Monitoring Point				2008 Results (mg/m <sup>3</sup> )					
No.	Site	Coordinates		Feb	Apr	Jun	Aug	Oct	Dec
		Latitude	Longitude						
1	Dong Hai Ward	20°50,639' N	106°43,380' E	0.033	0.129	0.108	0.056	0.056	0.210
2	DOST	20°51,160' N	106°41,197' E	0.040	0.058	0.074	0.116	0.125	0.160
3	May Chai Ward	20°52,326' N	106°42,175' E	0.110	0.103	0.124	0.098	0.119	0.210
4	Marine University	20°50,271' N	106°41,703' E	0.075	0.098	0.110	0.129	0.135	0.250
5	Cai Tat Dam	20°49,757' N	106°39,058' E	0.100	0.182	0.105	0.130	0.089	0.140
6	So Dau Ward	20°52,288' N	106°39,521' E	0.080	0.095	0.120	0.091	0.049	0.200
7	Quan Toan Ward	20°53,479' N	106°36,424' E	0.094	0.066	0.043	0.044	0.144	0.140
8	Dong Hoa Ward (Kien An)	20°49,761' N	106°39,988' E	0.061	0.148	0.114	0.114	0.100	0.220
9	Quyet Hong residential, Thuy Nguyen.	20°58,008' N	106°43,465' E	0.266	0.334	0.079	0.046	0.042	0.300
10	Minh Duc town- Thuy Nguyen.	20°57,233' N	106°41,630' E	0.293	0.506	0.135	0.152	0.178	0.300
11	Thang Loi residential, Thuy Nguyen.	20°57,713' N	106°44,759' E	0.260	0.196	0.121	0.036	0.119	0.200
TCVN 5937 - 2005				0.200					

0.196 Results that have almost reached, reached or exceeded standard limit.



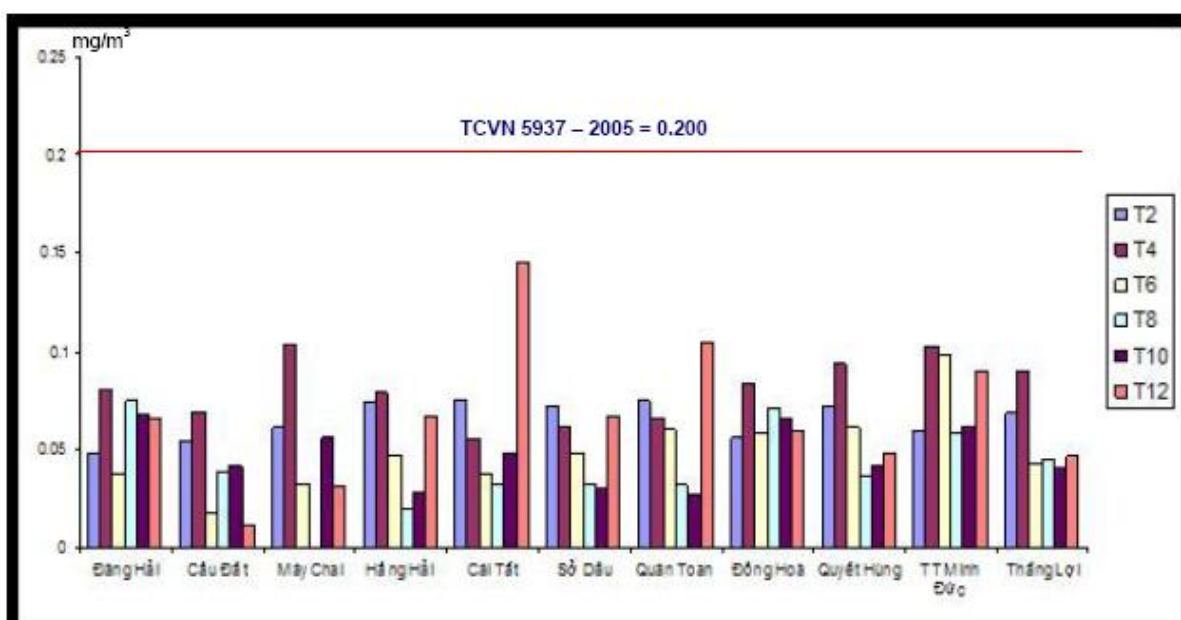
## Sulfur Dioxide (SO<sub>2</sub>)

Monitoring Point				2008 Results (mg/m <sup>3</sup> )					
No.	Site	Coordinates		Feb	Apr	Jun	Aug	Oct	Dec
		Latitude	Longitude						
1	Dong Hai Ward	20°50.639' N	106°43.380' E	0.065	0.074	0.086	0.043	0.047	0.075
2	DOST	20°51.160' N	106°41.197' E	0.051	0.059	0.054	0.016	0.025	0.046
3	May Chai Ward	20°52.326' N	106°42.175' E	0.057	0.082	0.045	0.031	0.029	0.062
4	Marine University	20°50.271' N	106°41.703' E	0.043	0.071	0.051	0.038	0.037	0.057
5	Cai Tat Dam	20°49.757' N	106°39.058' E	0.062	0.052	0.040	0.049	0.030	0.053
6	So Dau Ward	20°52.288' N	106°39.521' E	0.059	0.067	0.052	0.054	0.045	0.048
7	Quan Toan Ward	20°53.479' N	106°36.424' E	0.054	0.088	0.071	0.050	0.042	0.062
8	Dong Hoa Ward (Kien An)	20°49.761' N	106°39.988' E	0.035	0.079	0.063	0.046	0.039	0.059
9	Quyet Hong residential, Thuy Nguyen.	20°58.008' N	106°43.465' E	0.039	0.086	0.083	0.045	0.031	0.073
10	Minh Duc town- Thuy Nguyen.	20°57.233' N	106°41.630' E	0.041	0.112	0.104	0.032	0.048	0.095
11	Thang Loi residential, Thuy Nguyen.	20°57.713' N	106°44.759' E	0.046	0.079	0.068	0.026	0.031	0.071
TCVN 5937 - 2005				0.350					



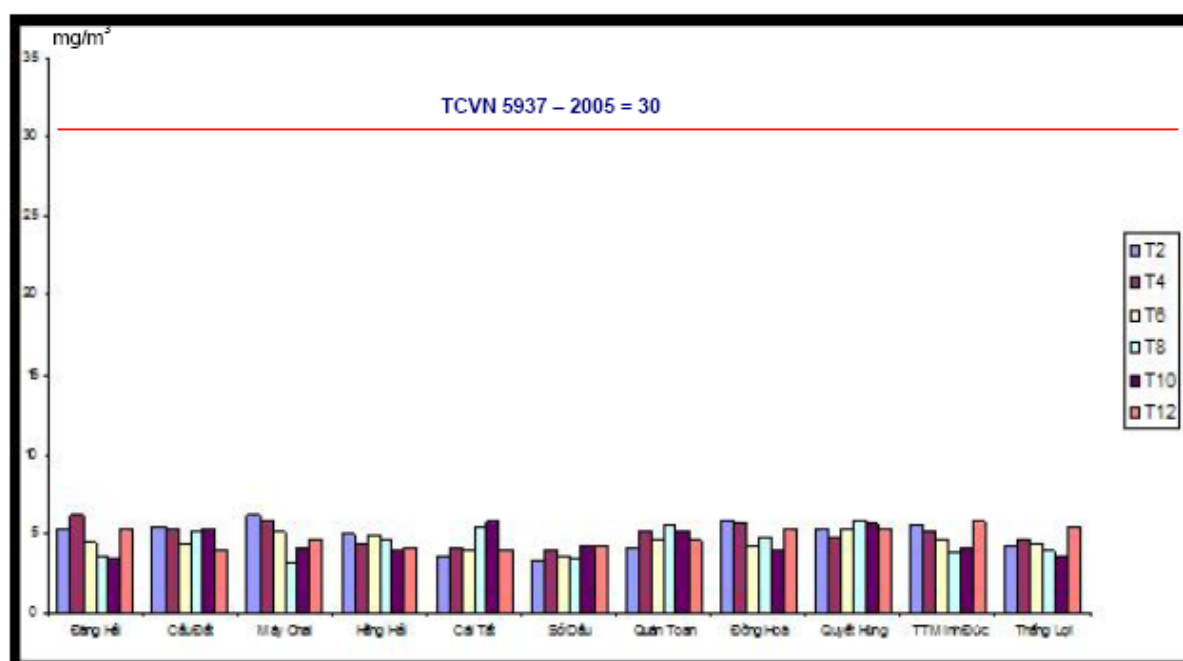
## Nitrogen Dioxide (NO<sub>2</sub>)

Monitoring Point				2008 Results (mg/m <sup>3</sup> )					
No.	Site	Coordinates		Feb	Apr	Jun	Aug	Oct	Dec
		Latitude	Longitude						
1	Dong Hai Ward	20°50.639' N	106°43.380' E	0.048	0.081	0.038	0.075	0.068	0.066
2	DOST	20°51.160' N	106°41.197' E	0.054	0.069	0.018	0.039	0.041	0.011
3	May Chai Ward	20°52.328' N	106°42.175' E	0.061	0.103	0.032	0.063	0.056	0.031
4	Marine University	20°50.271' N	106°41.703' E	0.074	0.079	0.047	0.020	0.028	0.067
5	Cai Tat Dam	20°49.757' N	106°39.058' E	0.075	0.055	0.037	0.033	0.048	0.145
6	So Dau Ward	20°52.288' N	106°39.521' E	0.072	0.062	0.048	0.032	0.030	0.067
7	Quan Toan Ward	20°53.479' N	106°36.424' E	0.075	0.066	0.060	0.032	0.027	0.105
8	Dong Hoa Ward (Kien An)	20°49.761' N	106°39.988' E	0.056	0.083	0.058	0.071	0.066	0.059
9	Quyét Hong residential, Thuy Nguyen.	20°58.008' N	106°43.465' E	0.072	0.094	0.061	0.036	0.042	0.048
10	Minh Duc town- Thuy Nguyen.	20°57.233' N	106°41.630' E	0.059	0.102	0.098	0.058	0.061	0.089
11	Thang Loi residential, Thuy Nguyen.	20°57.713' N	106°44.759' E	0.069	0.090	0.043	0.045	0.040	0.046
TCVN 5937 - 2005				0.200					



## Carbon Monoxide (CO)

Monitoring Point				2008 Results (mg/m <sup>3</sup> )					
No.	Site	Coordinates		Feb	Apr	Jun	Aug	Oct	Dec
		Latitude	Longitude						
1	Dong Hai Ward	20°50.639' N	106°43.380' E	5.32	6.21	4.45	3.59	3.45	5.35
2	DOST	20°51.160' N	106°41.197' E	5.45	5.36	4.36	5.12	5.29	3.86
3	May Chai Ward	20°52.326' N	106°42.175' E	6.21	5.89	5.12	3.11	4.12	4.63
4	Marine University	20°50.271' N	106°41.703' E	4.95	4.32	4.87	4.52	3.98	4.14
5	Cai Tat Dam	20°49.757' N	106°39.058' E	3.63	4.17	3.89	5.43	5.75	4.02
6	So Dau Ward	20°52.288' N	106°39.521' E	3.24	3.98	3.62	3.47	4.26	4.22
7	Quan Toan Ward	20°53.479' N	106°36.424' E	4.12	5.11	4.57	5.51	5.16	4.55
8	Dong Hoa Ward (Kien An)	20°49.761' N	106°39.988' E	5.71	5.62	4.26	4.81	3.90	5.26
9	Quyet Hong residential, Thuy Nguyen.	20°58.008' N	106°43.465' E	5.35	4.78	5.27	5.84	5.62	5.34
10	Minh Duc town- Thuy Nguyen.	20°57.233' N	106°41.630' E	5.48	5.24	4.6	3.75	4.1	5.76
11	Thang Loi residential, Thuy Nguyen.	20°57.713' N	106°44.759' E	4.18	4.69	4.32	3.94	3.55	5.43
TCVN 5937 - 2005				30.00					



Source: Hai Phong Environmental Monitoring Center



**Annex – 4: Water Quality Standards of the GOV**

**CỘNG HÒA XÃ HỘI CHỦ NGHĨA VIỆT NAM**

**QCVN 01:2009/BYT**

**QUY CHUẨN KỸ THUẬT QUỐC GIA  
VỀ CHẤT LƯỢNG NƯỚC ĂN UỐNG**

***(National technical regulation on drinking water quality)***

**HÀ NỘI – 2009**

Lời nói đầu:

QCVN 01:2009/BYT do Cục Y tế dự phòng và Môi trường biên soạn và được Bộ trưởng Bộ Y tế ban hành theo Thông tư số: 04/2009/TT - BYT ngày 17 tháng 6 năm 2009.

QUY CHUẨN KỸ THUẬT QUỐC GIA

VỀ CHẤT LƯỢNG NƯỚC ĂN UỐNG

(National technical regulation on drinking water quality)

PHẦN I.

QUY ĐỊNH CHUNG

Application Targets

This regulation applies to all agencies, organizations, individuals and households to exploit, or making business of drinking water facilities including water supply for daily use with a capacity of 1,000 m<sup>3</sup>/day or more (hereinafter referred to as the water supply establishment).

## II.

## QUY ĐỊNH VỀ KỸ THUẬT

Bảng giới hạn các chỉ tiêu chất lượng:

Table: the quality criteria limits

STT	Parameters	Unit	Permitted limit	Testing method	Monitoring level
<b>I. Chỉ tiêu cảm quan và thành phần vô cơ</b>					
1.	Color <sup>(*)</sup>	TCU	15	TCVN 6185 - 1996 (ISO 7887 - 1985) hoặc SMEWW 2120	A
2.	Smell <sup>(*)</sup>	-	Không có mùi, vị lạ	Cảm quan, hoặc SMEWW 2150 B và 2160 B	A
3.	Turbidity <sup>(*)</sup>	NTU	2	TCVN 6184 - 1996 (ISO 7027 - 1990) hoặc SMEWW 2130 B	A
4.	pH <sup>(*)</sup>	-	Trong khoảng 6,5-8,5	TCVN 6492:1999 hoặc SMEWW 4500 - H <sup>+</sup>	A
5.	Hardness, CaCO <sub>3</sub> <sup>(*)</sup>	mg/l	300	TCVN 6224 - 1996 hoặc SMEWW 2340 C	A
6.	Tổng chất rắn hoà tan (TDS) <sup>(*)</sup>	mg/l	1000	SMEWW 2540 C	B
7.	Aluminum <sup>(*)</sup>	mg/l	0,2	TCVN 6657 : 2000 (ISO 12020 :1997)	B
8.	Amonia <sup>(*)</sup>	mg/l	3	SMEWW 4500 - NH <sub>3</sub> C hoặc SMEWW 4500 - NH <sub>3</sub> D	B
9.	Antimon	mg/l	0,005	US EPA 200.7	C
10.	Total Arsenics	mg/l	0,01	TCVN 6626:2000 hoặc SMEWW 3500 - As B	B
11.	Bari	mg/l	0,7	US EPA 200.7	C
12.	Bo consisting of Borat and Axit	mg/l	0,3	TCVN 6635: 2000 (ISO 9390:	C

	boric			1990) hoặc SMEWW 3500 B	
13.	Cadimi	mg/l	0,003	TCVN6197 - 1996 (ISO 5961 - 1994) hoặc SMEWW 3500 Cd	C
14.	Clorua <sup>(*)</sup>	mg/l	250 300 <sup>(**)</sup>	TCVN6194 - 1996 (ISO 9297 - 1989) hoặc SMEWW 4500 - Cl <sup>-</sup> D	A
15.	Total Crom	mg/l	0,05	TCVN 6222 - 1996 (ISO 9174 - 1990) hoặc SMEWW 3500 - Cr <sup>-</sup>	C
16.	Total Cu <sup>(*)</sup>	mg/l	1	TCVN 6193 - 1996 (ISO 8288 - 1986) hoặc SMEWW 3500 - Cu	C
17.	Xianua CN	mg/l	0,07	TCVN 6181 - 1996 (ISO 6703/1 - 1984) hoặc SMEWW 4500 - CN <sup>-</sup>	C
18.	Hàm lượng Florua F <sup>-</sup>	mg/l	1,5	TCVN 6195 - 1996 (ISO10359 - 1 - 1992) hoặc SMEWW 4500 - F <sup>-</sup>	B
19.	Hydro sunfur <sup>(*)</sup>	mg/l	0,05	SMEWW 4500 - S <sup>2-</sup>	B
20.	Total Fe (Fe <sup>2+</sup> + Fe <sup>3+</sup> ) <sup>(*)</sup>	mg/l	0,3	TCVN 6177 - 1996 (ISO 6332 - 1988) hoặc SMEWW 3500 - Fe	A
21.	Pb	mg/l	0,01	TCVN 6193 - 1996 (ISO 8286 - 1986) SMEWW 3500 - Pb A	B
22.	Total Mn	mg/l	0,3	TCVN 6002 - 1995 (ISO 6333 - 1986)	A
23.	Total Hg	mg/l	0,001	TCVN 5991 - 1995 (ISO 5666/1-1983 - ISO 5666/3 - 1983)	B
24.	Molybden	mg/l	0,07	US EPA 200.7	C
25.	Niken	mg/l	0,02	TCVN 6180 -1996 (ISO8288 - 1986) SMEWW 3500 - Ni	C
26.	Nitrat	mg/l	50	TCVN 6180 - 1996 (ISO 7890 -1988)	A
27.	Nitrit	mg/l	3	TCVN 6178 - 1996 (ISO 6777- 1984)	A
28.	Selen	mg/l	0,01	TCVN 6183-1996 (ISO 9964-	C

				1-1993)	
29.	Natri	mg/l	200	TCVN 6196 - 1996 (ISO 9964/1 - 1993)	B
30.	Sunphát <sup>(*)</sup> SO <sub>4</sub>	mg/l	250	TCVN 6200 - 1996 (ISO9280 - 1990)	A
31.	Zn	mg/l	3	TCVN 6193 - 1996 (ISO8288 - 1989)	C
32.	Pecmanganat	mg/l	2	TCVN 6186:1996 hoặc ISO 8467:1993 (E)	A
<b>II. Organic matter Content</b>					
<b>a. Group of chlorinated alkanes</b>					
33.	Cacbonetetraclorea	µg/l	2	US EPA 524.2	C
34.	Diclorometan	µg/l	20	US EPA 524.2	C
35.	1,2 Dicloroetan	µg/l	30	US EPA 524.2	C
36.	1,1,1 - Tricloroetan	µg/l	2000	US EPA 524.2	C
37.	Vinyl clorua	µg/l	5	US EPA 524.2	C
38.	1,2 Dicloroeten	µg/l	50	US EPA 524.2	C
39.	Tricloroeten	µg/l	70	US EPA 524.2	C
40.	Tetracloroeten	µg/l	40	US EPA 524.2	C
<b>b. Aromatic Hydrocacbua</b>					
41.	Phenol and phenol derivativ es	µg/l	1	SMEWW 6420 B	B
42.	Benzen	µg/l	10	US EPA 524.2	B
43.	Toluen	µg/l	700	US EPA 524.2	C
44.	Xylen	µg/l	500	US EPA 524.2	C
45.	Etylbenzen	µg/l	300	US EPA 524.2	C
46.	Styren	µg/l	20	US EPA 524.2	C
47.	Benzo(a)pyren	µg/l	0,7	US EPA 524.2	B
<b>c. Group of chlorinated Benzen</b>					
48.	Monoclorobenzen	µg/l	300	US EPA 524.2	B
49.	1,2 - Diclorobenzen	µg/l	1000	US EPA 524.2	C
50.	1,4 - Diclorobenzen	µg/l	300	US EPA 524.2	C
51.	Triclorobenzen	µg/l	20	US EPA 524.2	C

**d. Group of complex organic matter**

52.	Di (2 - ethylhexyl) adipate	µg/l	80	US EPA 525.2	C
53.	Di (2 - ethylhexyl) phthalat	µg/l	8	US EPA 525.2	C
54.	Acrylamide	µg/l	0,5	US EPA 8032A	C
55.	Epichlorhydrin	µg/l	0,4	US EPA 8260A	C
56.	Hexachloro butadien	µg/l	0,6	US EPA 524.2	C

**III. Pesticide residues**

57.	Alachlor	µg/l	20	US EPA 525.2	C
58.	Aldicarb	µg/l	10	US EPA 531.2	C
59.	Aldrin/Dieldrin	µg/l	0,03	US EPA 525.2	C
60.	Atrazine	µg/l	2	US EPA 525.2	C
61.	Bentazone	µg/l	30	US EPA 515.4	C
62.	Carbofuran	µg/l	5	US EPA 531.2	C
63.	Clodane	µg/l	0,2	US EPA 525.2	C
64.	Clorotoluron	µg/l	30	US EPA 525.2	C
65.	DDT	µg/l	2	SMEWW 6410B, hoặc SMEWW 6630 C	C
66.	1,2 - Dibromo - 3 Cloropropan	µg/l	1	US EPA 524.2	C
67.	2,4 - D	µg/l	30	US EPA 515.4	C
68.	1,2 - Dicloropropan	µg/l	20	US EPA 524.2	C
69.	1,3 - Dichloropropen	µg/l	20	US EPA 524.2	C
70.	Heptaclo và heptaclo epoxit	µg/l	0,03	SMEWW 6440C	C
71.	Hexachlorobenzen	µg/l	1	US EPA 8270 - D	C
72.	Isoproturon	µg/l	9	US EPA 525.2	C
73.	Lindane	µg/l	2	US EPA 8270 - D	C
74.	MCPA	µg/l	2	US EPA 555	C
75.	Methoxychlor	µg/l	20	US EPA 525.2	C
76.	Methachlor	µg/l	10	US EPA 524.2	C
77.	Molinate	µg/l	6	US EPA 525.2	C
78.	Pendimetalin	µg/l	20	US EPA 507, US EPA 8091	C
79.	Pentachlorophenol	µg/l	9	US EPA 525.2	C
80.	Permethrin	µg/l	20	US EPA 1699	C
81.	Propanil	µg/l	20	US EPA 532	C



82.	Simazine	µg/l	20	US EPA 525.2	C
83.	Trifuralin	µg/l	20	US EPA 525.2	C
84.	2,4 DB	µg/l	90	US EPA 515.4	C
85.	Dichloprop	µg/l	100	US EPA 515.4	C
86.	Fenoprop	µg/l	9	US EPA 515.4	C
87.	Mecoprop	µg/l	10	US EPA 555	C
88.	2,4,5 - T	µg/l	9	US EPA 555	C
<b>IV. Chemical disinfection and byproducts</b>					
89.	Monocloramin	µg/l	3	SMEWW 4500 - Cl G	B
90.	Clo residuals	mg/l	Trong khoảng 0,3 - 0,5	SMEWW 4500Cl hoặc US EPA 300.1	A
91.	Bromat	µg/l	25	US EPA 300.1	C
92.	Clorit	µg/l	200	SMEWW 4500 Cl hoặc US EPA 300.1	C
93.	2,4,6 Triclorophenol	µg/l	200	SMEWW 6200 hoặc US EPA 8270 - D	C
94.	Focmaldehyt	µg/l	900	SMEWW 6252 hoặc US EPA 556	C
95.	Bromofoc	µg/l	100	SMEWW 6200 hoặc US EPA 524.2	C
96.	Dibromoclorometan	µg/l	100	SMEWW 6200 hoặc US EPA 524.2	C
97.	Bromodiclorometan	µg/l	60	SMEWW 6200 hoặc US EPA 524.2	C
98.	Clorofoc	µg/l	200	SMEWW 6200	C
99.	Axit dicloroaxetic	µg/l	50	SMEWW 6251 hoặc US EPA 552.2	C
100.	Axit tricloroaxetic	µg/l	100	SMEWW 6251 hoặc US EPA 552.2	C
101.	Cloral hydrat (tricloroaxetaldehyt)	µg/l	10	SMEWW 6252 hoặc US EPA 8260 - B	C
102.	Dicloroaxetonitril	µg/l	90	SMEWW 6251 hoặc US EPA 551.1	C
103.	Dibromoaxetonitril	µg/l	100	SMEWW 6251 hoặc US EPA 551.1	C

104.	Tricloroaxetonitril	µg/l	1	SMEWW 6251 hoặc US EPA 551.1	C
105.	Xyano clorit (tính theo CN <sup>-</sup> )	µg/l	70	SMEWW 4500J	C
<b>V. Levels of radioactive contamination</b>					
106.	Total activity α	pCi/l	3	SMEWW 7110 B	B
107.	Total activity β	pCi/l	30	SMEWW 7110 B	B
<b>VI. Microbiological parameters</b>					
108.	Total Coliform	Vi khuẩn/ 100ml	0	TCVN 6187 - 1,2 :1996 (ISO 9308 - 1,2 - 1990) hoặc SMEWW 9222	A
109.	E.coli or thermal Coliform	Vi khuẩn/ 100ml	0	TCVN6187 - 1,2 : 1996 (ISO 9308 - 1,2 - 1990) hoặc SMEWW 9222	A

### SECTION III.

#### QUALITY MONITORING REGIME

##### I. Monitoring of water before using the water source

- Test all parameters under level A, B, C by the establishment of water supply

##### II. Periodic monitoring

###### 1. For the parameters under level A:

- Test at least 01 time/01 week by the WTP;
- Inspect, supervise, test at least 01 time/ month by a competent agency

###### 2. For parameters of the level B:

- Test at least 01 time/6 months by the WTP;
- Inspect, supervise, test at least 01 time/6 months by a competent agency

###### 3. For parameters of the level C:

- Test at least 01 time/2 years by the WTP;
- Inspect, supervise, test at least 01 time/ 2 years by a competent agency

##### III. Irregular monitoring

1. The cases that have made extraordinary monitoring:

- a) When the test results of water source or epidemiological investigation showed that water is subjected to pollution risk;
- b) When the environmental incident may affects the quality of water resources;
- c) When there are other special requirements.

## Annex – 5: Photos

Picture of public consultation meetings

	
Group 1	Group 1 discussion
	
Group 2	Group 2 discussion

	
<p>Group 3</p>	<p>Discussion of group 3</p>