

Initial Environmental Examination

September 2010

Multitranche Financing Facility VIE: Water Sector Investment Program (Project 1)

Prepared by the borrower for the Asian Development Bank.

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**WATER SECTOR INVESTMENT PROGRAM –
MULTITRANCHE FINANCING FACILITY (MFF)**

HO CHI MINH CITY WATER SUPPLY PROJECT – PFR1

INITIAL ENVIRONMENTAL EXAMINATION

I. EXECUTIVE SUMMARY

1. During the Country Review Programming Mission of 2007 the Government of Viet Nam requested the Asian Development Bank for assistance to prepare the Ho Chi Minh City Water Supply Project. The project addresses the urgent need for increased water supply and sanitation required to cope with the high economic growth rate of Ho Chi Minh City (HCMC).

2. The initial environmental evaluation (IEE) of the HCM City Water Supply Project (PPTA 7091-VIE) is reported herein. This category B project is at the feasibility design phase and is defined by the following four interrelated project components:

- (i) Construction of a new 10 km, 2400 mm treated water main;
- (ii) Analysis of non revenue water (NRM), and distribution pipe renewal program.

3. The collective goal of the project components is to increase and expand the supply of potable water to HCMC in order to improve the quality of life for the residents of the city. The project will be implemented by the Sai Gon Water Corporation (SAWACO), and is located in HCMC, southern Binh Duong province, and western Dong Nai province.

4. The systematic evaluation of the pre-construction, construction, and operational phases of the four project components which included input from two formal public consultation meetings with the affected community indicates that the direct environmental impacts of the project are short-term civil construction-related, and can be mitigated. The civil construction impacts of elevated dust, noise, traffic disruptions, erosion and sedimentation, and public and worker safety can be mitigated and managed effectively with well described municipal-provincial, national, and international construction management directives and guidelines.

5. The absence of critical wildlife habitat, rare or endangered species, biodiversity values, ecological protected areas, and affected cultural or heritage structures in the urban-suburban project environment focuses the short-term impacts of the project on the community and workers that will be directly affected by the construction and rehabilitation activities. Worker safety is a particular issue of the planned in-pipe rehabilitation of 1800 mm pipeline of Component 1 that must be managed carefully.

6. The public meetings in Binh Thanh district and Thu Duc district underscored the need for effective management of noise, dust, traffic disruptions, and safety during the construction of the 2400 mm pipeline followed by the need for complete cleanup and restoration of all construction sites. The public meetings requested that a HOTLINE telephone number to a responsive SAWACO office be clearly posted at all construction areas, and that regular meetings between SAWACO and the Ward offices of affected community be convened to review issues of construction activities.

7. The crossings of the 2400 mm pipeline at the Sai Gon river and three tributary canals will not cause significant impacts to water quality or aquatic habitat due to the plan to tunnel the pipeline underneath these watercourses. Alternatively, if the pipeline traverses the watercourses along dedicated elevated bridge structures the associated impacts of erosion & sedimentation on water quality, and lost aquatic habitat will be short-term, and minor.

8. The IEE concludes that the project description of the feasibility design stage combined with available information on the affected environment are sufficient to understand the scope of potential construction-related environmental impacts of the project. Providing that major

changes in the design of one or more of the project components do not occur at the detailed design phase, a further more detailed environmental impact assessment (EIA) is not required.

9. An environmental management plan (EMP) has been prepared for the project. The EMP provides an impacts mitigation plan, an environmental monitoring plan, and specifies the institutional responsibilities and capacity development needs for implementing the EMP. SAWACO will be responsible for the implementation of the EMP.

10. Two long-term issues outside the immediate scope of the project are the increasing demand of HCMC for potable water, and the increased downstream production of wastewater that will result from the increased water supply. The planned extraction of raw water from the Dong Nai river at Hoa An by 2025 represents 5% of the present mean daily flow of the river. Interprovincial and provincial water resource planning underway for the Dong Nai-Sai Gon river basins needs to consider future water needs of HCMC in view of all other demands of the resource to ensure a sustainable supply of potable water for HCMC.

11. The predicted increase in the use of domestic water supply of approximately 67,900 and 306,900 m³/day by 2013 and 2017 translates to a significant increase in domestic wastewater production. It is important that the increased production of wastewater is consistent with the 2000 JBIC Wastewater Master Plan for HCMC, and within the capacity of two ongoing JICA and World Bank wastewater projects. The effects of the increased discharge of untreated wastewater on the receiving environment of the Sai Gon river - Nha Be river ecosystem and resources should be examined.

12. The IEE recommends that the EMP be reviewed when detailed project designs are completed to ensure that the EMP fully addresses the final project design. The longer term issues of basin-wide surface water resource allocation, and management of wastewater while outside the immediate scope of the project should be jointly clarified by SAWACO, provincial DoNREs, and the Flood Control Program Centre of HCMC.

CURRENCY EQUIVALENTS

(14 September 2010)

Currency Unit	–	dong (D)
D 1.00	=	\$ 0.00005181
\$1.00	=	D19,300

ABBREVIATIONS

ADB	–	Asian Development Bank
AP	–	Affected Person
BOD	–	Biological Oxygen Demand
COD	–	Chemical Oxygen Demand
CPO	–	Central Project Office
DO	–	Dissolved Oxygen
DoH	–	Department of Health
DONRE	–	Department of Natural Resources and Environment
DoT	–	Department of Transportation
EIA	–	Environmental Impact Assessment
EMD	–	Environmental Management Division
EMP	–	Environmental Management Plan
EPC	–	Environmental Protection Commitment
FDI	–	Foreign Direct Investment
FS	–	Feasibility Study
GDP	–	Gross Domestic Product
GoV	–	Government of Viet Nam
HCMC	–	Ho Chi Minh City
ICEM	–	International Centre for Environmental
IEE	–	Initial Environmental Examination
JBIC	–	Japan Bank for International Cooperation
JICA	–	Japan International Cooperation Agency
JSC	–	Joint Stock Company
LEP	–	Law on Environmental Protection
MARD	–	Ministry of Agricultural Development
MoH	–	Ministry of Health
MoLISA	–	Ministry of Labour, Invalids, and Social Affairs
MONRE	–	Ministry of Natural Resources and Environment
MTR	–	Mass Transit Rapid Line
NRW	–	Non Revenue Water
PC	–	People Committee
PM	–	Particulate Matter
PMU	–	Project Management Unit
PPTA	–	Project Preparatory Technical Assistance
REA	–	Rapid Environmental Assessment
RoW	–	Right-of-way
RP	–	Resettlement Plan
SAWACO	–	Sai Gon Water Corporation
TA	–	Technical Assistance
TD	–	Treasury Department
TOC	–	Table of Contents

TSS	–	Total Suspended Solids
VIWASE	–	Viet Nam Water, Sanitation and Environment JSC
VWRAP	–	Viet Nam Water Resources Assistance Project
WPC	–	Weakly Performing Country
WTP	–	Water Treatment Plan

NOTE

In this report, "\$" refers to US dollars.

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III. INTRODUCTION

A. Background to Project

13. In 2007 during the Country Review Programming Mission the Government of Viet Nam requested the Asian Development Bank (ADB) for assistance to prepare the Ho Chi Minh City Water Supply Project. The project addresses the urgent need for increased water supply and sanitation required to cope with the high economic growth rate of HCMC of approximately 12% per annum.

14. The HCMC People's Committee is preparing a master plan for the HCMC water system up to 2025. The plan prescribes an increase in urban water supply coverage from the present 76% of the city's population to 100% which corresponds to an estimated increase in capacity from 1.2 to 3.2 million m³/day of treated water. A parallel feasibility study on non revenue water (NRM) in six pre-defined hydraulic zones is being conducted by the World Bank.

15. The water supply operations of HCMC are managed by the Saigon Water Corporation (SAWACO). SAWACO is under growing pressure to: (i) improve and modernize its service and sustainably supply all HCMC residents (i.e., achieve 100% coverage) with potable water by 2025; (ii) increase public-private partnerships and private sector participation; and (iii) provide and deliver water to the city in a sustainable manner.

16. The future impact of the Project will be to improve urban livability and competitiveness in HCMC through development of water supply infrastructure. The outcome of PPTA 7091-VIE will be the design of a project to increase the level of water service by: (i) extending and rehabilitating a portion of the water distribution network of HCMC including booster pumping stations and reservoirs to increase the coverage and provide potable water to all city residents by 2025; (ii) improving the level of service and SAWACO's financial performance by reducing NRW in four of the city's six hydraulic zones; and (iii) overall strengthening of water operations in the city.

17. An integral component of the feasibility study of the HCMC Water Supply Project is an examination of the potential environmental impacts of the project. Provided herein as part of PPTA 7091-VIE is an initial environmental evaluation (IEE) of the proposed water supply project.

B. Assessment Context

18. The HCMC Water Supply Project is in the feasibility design phase. The project is situated in a mature urban and developed suburban environment extending from the centre of HCMC north to southern and western Binh Duong and Dong Nai provinces. Project activities will be implemented along an existing water pipeline and/or a major highway corridor, and in high density urban streets.

1. Screening

19. The HCMC Water Supply Project was initially screened and classified as an Environmental Category B project which requires an initial environmental evaluation (IEE). For completeness the rapid environmental assessment (REA, ADB 2003) checklist for Water Supply projects was re-applied. (Appendix A). Using the project description and information on the

affected environment available at the beginning of the IEE the potential impacts of the project were screened as minor and mitigable, and justified the level of assessment of an IEE.

IV. POLICY, LEGAL, AND ADMINISTRATIVE FRAMEWORK

20. All ADB financed projects must undergo environmental impact assessment. The Safeguards Policy Statement (ADB 2009) clarifies the rationale, scope and content of an environmental assessment as supported by technical guidelines (Environmental Assessment Guidelines 2003). Projects are initially screened to determine the level of assessment that is required according to the following three project categories: category A such as hydroelectric dams that normally cause major environmental or social impacts; category B for which minor impacts are expected and can be mitigated; and category C projects that do not pose environmental or social impacts.

21. The Viet Nam Law on Environmental Protection (LEP 2005) prescribes the requirement for environmental impact assessment (EIA) for development and domestic project interventions that affect the natural and social environments. Decree 80/2006/ND-CP in conjunction with Decree 21/2008/ND-CP elaborate the LEP (2005) and distinguish projects that require an EIA from projects requiring a simpler environmental protection commitment (EPC). The difference between the two processes reflects the level of assessment, and review and appraisal required. Circular 05/TT-BTNMT supports Decrees 80 and 21 with technical guidance for preparing and reporting both levels of assessments.

22. Management and development of potable water supply in HCMC is the responsibility of the Sai Gon Water Corporation (SAWACO). Management of wastewater and drainage in HCMC is the responsibility of the newly created Flood Control Program Centre (Decision 4576/2008/QD-UBND).

23. The HCMC Department of Natural Resources and Environment (DoNRE) is responsible for management and protection of the environment in HCMC. The Department of Transportation (DoT) is responsible for management of the public roadways. As part of its mandate for managing the water supply, SAWACO is also responsible for the environmental assessment and management of their water supply development projects.

24. An environmental assessment of the HCMC Water Supply Project pursuant to the LEP (2005) and Decree 21 will be prepared by SAWACO. Because the HCMC Water Supply project is trans-boundary with Binh Duong and Dong Nai provinces the EIA prepared by SAWACO will be reviewed by an appraisal committee lead by Ministry of Natural Resources and Environment (MoNRE) in conjunction with the HCMC DoNRE.

25. Emanating from the EIA prepared by SAWACO will be an environmental management plan (EMP) that must meet the requirements of the ADB. The contractor(s) who will implement the project will be responsible to implement the EMP under SAWACO direction and responsibility. It is expected that SAWACO will recruit the assistance of a consultant to assist with the preparation of the EIA, and implementation of the EMP.

V. DESCRIPTION OF THE PROJECT

26. The project is in the feasibility stage, thus the detailed designs and activities have not been completed. However, effort has been taken to articulate as much of the detail of the final project activities as possible from consultations with project engineers, and from existing

engineering reports. The project consists of the following four interrelated components (Figure 1).

Component 1: New 2400 mm Treated Water Main

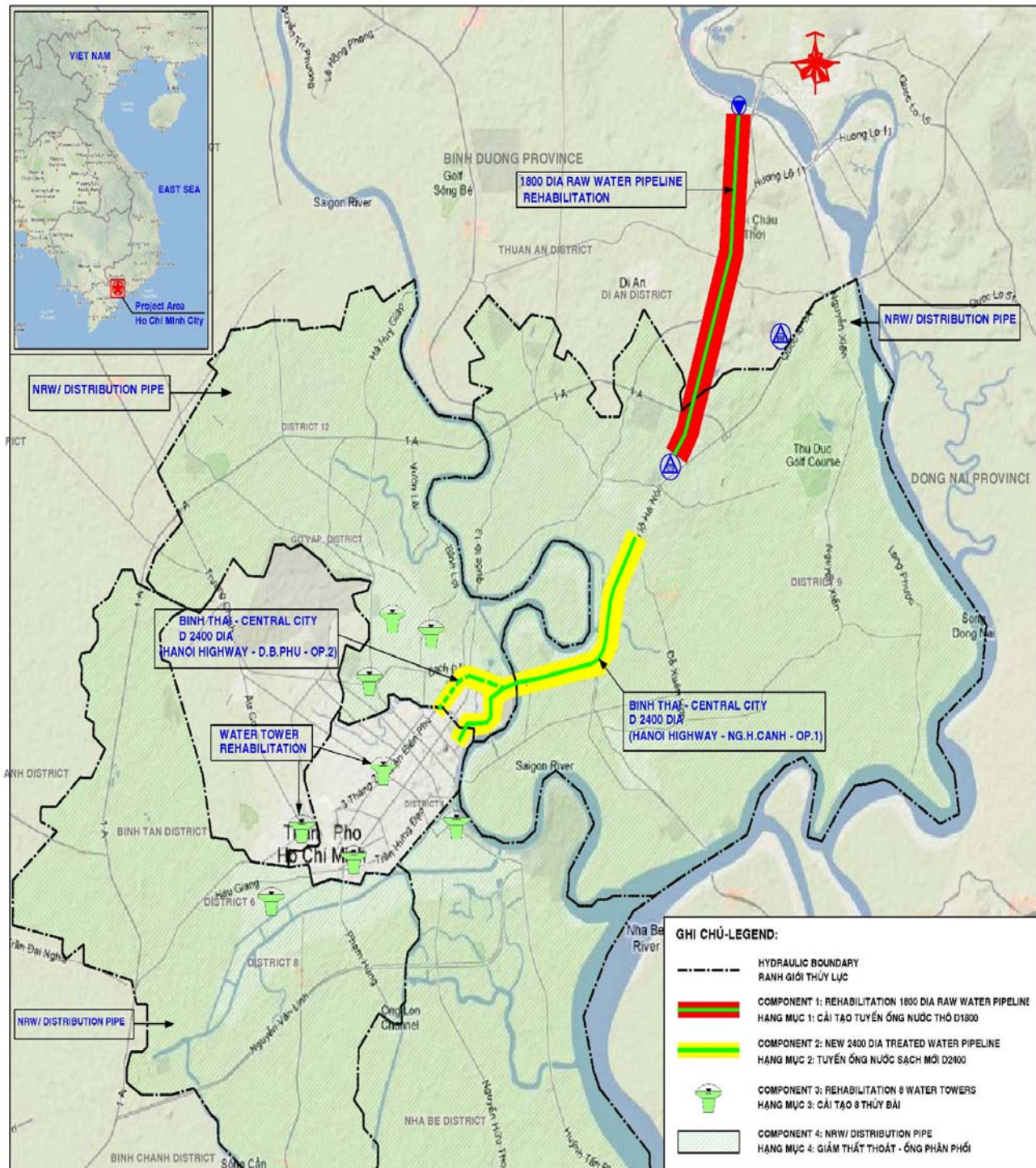
Component 2: Distribution Pipeline Renewals

27. The description of the HCMC Water Supply project provided herein focuses on construction and operational activities of the project that could potentially affect natural and social environments. The full description of the engineering and economics of the project can be found in the feasibility report on the project (MWN 2009).

28. The description of the project, and the organization of the IEE are structured by the following three generic project phases:

- 1) pre-construction;
- 2) construction; and
- 3) post-construction operational.

Figure 1: Location of Components of the HCMC Water Supply Project



A. Component 1: New 2400 mm Treated Water Main

1. Overview of Component

29. A new 2400 mm treated water pipeline will be constructed from Binh Thai south to the existing distribution network in HCMC (Figure 1). The pipeline is one of the key transmission pipelines recommended in the VIWASE 2008 Master Plan which has been assigned a high priority by SAWACO. The purpose of the pipeline is to strengthen the supply of treated water to central HCMC area in Districts 3, Binh Thanh and Phu Nhuan.

30. Construction of a short section of the pipeline is already underway by SAWACO from Thu Duc WTP to the Binh Thai (Figure 1) where it will link to the start of Component 2. This section of the pipeline is not included in Component 2. Construction activities for Component 2 have been derived from the ongoing section under construction. Component 2 of the project has been divided into the following three sections:

a. Section 1: Binh Thai south to the Ha Tien cement factory

31. In this section the 2400 mm pipeline currently being constructed by SAWACO will be continued south through the cleared right-of-way (RoW) along the west side of the Ha Noi highway.

b. Section 2: Ha Tien cement factory to the Sai Gon river

32. This RoW for this section along the west shoulder of the Ha Noi highway has not been completed. The land allocated to the RoW narrows continuously from the Ha Tien cement plant south to the Sai Gon River at which point available space between the Ha Noi highway and adjacent land use is limited to non-existent. The placement of the pipeline along this section will form part of the future expansion of the Ha Noi highway, and development of the elevated metro rail line (MTR). The pipeline crosses a canal off the Sai Gon river.

c. Section 3: Sai Gon river to city centre transmission network

33. The VIWASE master plan identifies a route to the transmission centre from the Sai Gon river along Nguyen Huu Canh street. The project has proposed an alternate route along Dien Bien Phu street which provides much more unobstructed area for pipeline construction. The VIWASE apparently is preparing feasibility study for Nguyen Huu Canh option.

34. Construction of the 2400 mm pipeline will be most difficult in this section in part because of obstacles (e.g., buildings, roads & overpasses) and lack of space, and in part because of planned tunneling under the Sai Gon river and 3 canals. Both street options provide the same obstacles, however, Dien Bien Phu provides significantly more space to avoid the obstacles. The plan is to tunnel the pipeline under the Sai Gon River and associated canals using “pipe jacking” or micro tunneling techniques.

2. Pre-construction Phase

35. After the design for the 2400 mm pipeline is completed the initial land use surveys along the pipeline corridor will be reviewed. The feasibility study concluded that resettlement or temporary relocation of secondary structures were not expected, but that future resettlement

needs determined from the detailed designs of pipeline will be identified in a separate resettlement plan developed as part of the expansion of the Ha Noi highway.

3. Construction Phase

a. Land-based

36. The construction of the 2400 mm pipeline will employ standard civil construction practices. The major construction activities for land-based works in the order of execution are: 1) land clearing; 2) concrete pad construction; 3) site excavation & spoil disposal; 4) pipe placement and jointing; 5) back filling & grading; and 6) re-surfacing and restoration with combinations of grass/shrubs, trees, or concrete & asphalt depending on land use.

37. The concrete pads that will underlay and provide a stable foundation for the buried pipe will be cast on site. The excavations and placement of the temporary sheet piling will be conducted with large backhoes, and the pipeline lowered into position with two large cranes. Excavated soil (spoil) will be transported out of area by standard dump trucks after being filled with the backhoes.

38. It is not clear at the time of writing the exact alignment of the pipeline in the high density sections 2 and 3.

b. Water crossings

39. The current plan is apply pipe jacking techniques to bury ("push") the pipe underneath the Sai Gon River and canals. The technique requires the excavation and construction of a large reinforced vertical shore-based cavity from which pipe sections are sequentially pushed horizontally under the watercourse with hydraulic jacks. The opposing wall of the cavity will be reinforced with concrete to provide the required foundation for the hydraulic jacks.

40. Individual sections of pipe will be lowered into the cavity, placed in front of the hydraulic jack, and then slowly pushed into the sandy soil underlying the water courses. Subsequent sections of pipe are placed in line, joints sealed, and then pushed under the water course. This continues until the pipeline emerges into the receiving vertical cavity on the opposite side of the water course.

41. The alternate, less expensive plan is to suspend the pipeline above the Sai Gon River and canals on constructed bridge supports that are placed on shore and in the water. The bridge pilings and pipeline will need to be spaced and elevated to not obstruct boat traffic. This means that for the Sai Gon River crossing the pipeline may need to be at the height of the Sai Gon Bridge, or conversely, attached to the Sai Gon Bridge without the need for separate bridge pilings.

4. Post-Construction Operation Phase

42. The pipeline will convey treated water from the Thu Duc WTP to the transmission centre in HCMC. Periodic maintenance of the operational pipeline and associated conduits, and flow & pressure valves will occur by SAWACO employees. Table 1 summarizes major activities of Component 2.

Table 1: Summary of Activities of Component 2

Pipeline Construction Phase:	Summary of Expected Major Activities
Pre-construction	1) As part of Ha Noi highway expansion project, re-survey pipeline corridor and finalize required resettlement or temporary relocations.
Construction	<p><u>Land-based</u></p> <p>2) Complete RoW and temporary relocation of structures. 3) Inform public along RoW of schedule of construction works. 4) Secure and demarcate work site with fencing and signage. 5) Cast concrete pipeline bases on site. 6) Excavate trench with backhoe and truck spoil away for disposal. 7) Place support sheet piling long walls of trench. 8) Place section(s) of pipe on concrete bases in trench with two cranes, seal pipe joints, backfill & tamp, and restore with original vegetation or road/side walk surface.</p> <p><u>Water crossings – tunneling</u> (pipe jacking or micro tunneling)</p> <p>9) Site clearing and excavation of vertical work cavities on either side of watercourse. 10) Placement of sheet piling reinforcement and concrete pads for jacking or drilling equipment. 11) Hydraulically jack “push”, or drill and place series of jointed pipe sections underneath watercourse to opposing work cavity. 12) Connect tunneled section to incoming/outgoing pipeline, backfill and tamp, and restore original land surface.</p>
Construction	<p><u>Water crossings – elevated bridging</u></p> <p>13) Placement of vertical bridge pile supports on shore and in watercourse, and installation of cross support members. 14) Placement of pipe sections, seal joints, and secure pipe.</p>
Post-construction Operation	<p>15) Commission pipeline to transport treated raw water from Thu Duc WTP to distribution centre. 16) Routine maintenance of pipeline and support hardware.</p>

B. Component 2: Distribution Pipeline Renewals

1. Overview of Component

43. A non revenue water analysis (NRW), followed by a distribution pipeline renewal program will be implemented in hydraulic zones 3–6¹. Estimates of the current number of different sizes of pipe that need to be replaced by the different Joint Stock Companies (JSC) for their respective operating areas in HCMC are provided in Table 2.

¹ World Bank project is addressing NRW in hydraulic zones 1 and 2.

Table 2: Estimated Number of Distribution Pipe Renewals

	Pipe Diameter (mm)											Total
Water Supply Company	250	300	350	400	450	500	700	800	900	1200	1500	
Thu Duc Water Supply JSC	0	29	33	18	9	30	47	1	1	1	1	170
Trung An Water Supply Enterprise	0	1	9	6	3	6	20	1	0	2	1	49
Ben Thanh Water Supply JSC	0	10	11	5	4	7	1	0	0	0	0	38
Cho Lon Water Supply JSC	0	10	13	15	10	2	7	6	1	0	0	64
P.H. Tan Water Supply JSC	0	1	1	2	3	1	3	0	0	0	0	11
Tan Hoa Water Supply Branch	0	0	33	34	13	12	10	1	0	0	0	103
Nha Be Water Supply JSC	0	7	20	5	10	15	24	2	0	6	0	89
Gia Dinh Water Supply JSC	0	20	25	38	19	15	38	16	2	15	0	188
Total	0	78	145	123	71	88	150	27	4	24	2	712

Modified from MWH, 2009

2. Pre-pipe Renewal Phase

44. The NRW assessments to identify pipe renewal locations will be completed in zones 3 & 4, and then in zones 5 & 6 using sound and observation techniques at night. Land use affected by replacement areas will be surveyed to determine extent of required temporary relocation or loss of secondary structures.

3. Pipe Renewal Phase

45. Pipe renewal will require a few workers and light equipment to be on site, may involve temporary site clearing of personal property, or small excavations to expose broken pipes. Broken pipe will be replaced, and the affected area re-graded and surfaced to original state.

4. Post-pipe Renewal Operation Phase

46. After the faulty-leaky pipes have been replaced the water supply will resume with more pressure reliability.

Table 3: Summary of Activities of Component 4

Distribution Pipe Renewal Phase:	Summary of Expected Major Activities
Pre-renewal	1) Acoustic surveys to locate faulty-leaky pipes 2) Notify affected families that pipe renewal activity will occur.
Pipe Renewal	3) Clear site to expose work area. 4) Excavate where necessary to expose faulty pipe. 5) Turn off water supply through pipe. 6) Replace broken pipe. 7) Backfill, tamp, grade, and restore site to original surface condition. 8) Return relocated property.
Post-renewal Operation	9) Resume water supply through repaired pipe.

VI. DESCRIPTION OF AFFECTED ENVIRONMENT

47. The description of the affected environment was assembled with information from different sources. Information for HCMC was extracted from recent reports on the environmental status of HCMC provided by HCMC DoNRE, and the HCMC Environment Protection Sub-department. Information for southern Binh Duong province was provided by Binh Duong DoNRE. Environmental inventories assembled for recent environmental studies in the area were also consulted. Supplementing documented information were direct observations made during site visits of the project component areas, and from interviews with DoNRE staff.

A. Physical Resources

1. Climate

48. The project area is located in HCM City, which spans 10°10' - 10°38' North and 106°2' - 106°54' East. The City borders with Binh Duong Province in the north, Tay Ninh Province in the northwest, Dong Nai Province in the east and northeast, Ba Ria- Vung Tau Province in the southeast. Long An and Tien Giang provinces are located west and southwest of the city. HCMC's climate is subequatorial, strongly influenced by monsoon, with two distinctive seasons: the dry season from November to April and the rainy season from May to October.

49. The highest and lowest recorded air temperatures were 40°C and 13.8°C. April is the hottest month with an average temperature of 29.5°C. December is the coolest month with an average temperature of 26.9°C. The mean temperature in 2008 was 27.9°C. Average monthly air temperatures in project area is shown in Table 4.

Table 4: Average Monthly Temperature (Tan Son Hoa Station - °C)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Year Average
27.2	27.3	28.2	29.5	28.2	28.6	28.3	27.7	27.7	28.0	27.2	26.9	27.9

Source: HCMC Statistical Office 2009

50. Average rainfall in project in 2008 was 1,813.1 mm. The total number of rainy days approximates 159 days/year. The rainy season is responsible for 80-85% of annual rainfall, with the average volume between 250-350 mm/month. July and August have the highest rainfall, while January and February receive are comparatively dry. Rainfall is not distributed evenly among the city districts and tends to increase along a southwest to northeast axis. Thus, most districts in the northern reaches of the project area experience higher rainfall than the southern project areas. Average monthly rainfall is shown in Table 5.

Table 5: Average Monthly Rainfall (Tan Son Hoa Station -mm)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Year Total
9.5	1.5	58.9	127.0	246.9	147.2	331.2	297.8	202.6	165.6	167.1	57.8	1,813.1

Source: HCMC Statistical Office 2009

51. Average annual relative humidity in project area is 77%. Average humidity during rainy season is about 80% with the recorded maximum registered at close to 100%. Conversely, average relative humidity during the dry season is 74.5% with the lowest level recorded at 20%. Monthly mean humidity is showed in Table 6.

Table 6: Monthly Mean Humidity (Tan Hoa Station - %)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Year Average
71	69	71	73	81	78	79	83	83	81	79	73	77

Source: HCMC Statistical Office 2009

52. There are two main wind directions in the city: east-southeast during the dry season and west-southwest in the rainy season, with an average velocity of 3-4 m/s. The west - southwest wind comes from Indian Ocean with average velocity 3.6 m/s and peak velocity 4.5 m/s recorded in August. The north – northeast wind comes from South China Sea with average velocity 2,4 m/s. In addition, there is also south – southwest wind (from March to May) with average velocity of 3.7 m/s. There have been virtually no storms observed in many years.

53. HCMC is in a low lying area at sea level that will be sensitive to predicted sea level rise from greenhouse gas induced global climate change (e.g., ICEM 2009). The loss of land area of HCMC based on modeled sea level rise will be dramatic. Future development of the urban infrastructure of HCMC, and land development will need to consider the possibilities of the loss of present urban area due to effects of global climate change.

2. Air Quality

54. Air quality in urban centers throughout Vietnam has been deteriorating in recent years in line with increasing construction and transportation activities. The main public health issue is particulate matter (PM), particularly PM₁₀ and finer particulate matters finer particulates of PM_{2.5}. Current TCVN and QVCN environmental standards including TCVN 5937:2005 for air quality are listed in Appendix D.

55. Sulfur dioxide (SO₂) levels are usually below the relevant TCVN criteria in urban areas, although levels exceeding TCVN criteria by two to three times can occur near major intersections. Diesel powered vehicles are the major source of SO₂ in urban areas, together with coal burning for domestic use. Nitrogen oxides (NO_x) result from fuel combustion and are

usually found at levels below TCVN criteria in urban areas. Elevated levels, however, are observed at major urban intersections. Carbon monoxide (CO) levels commonly exceed TCVN standards at major intersections in urban areas and along major roads, but are generally within standards in other areas. Mobile emission sources such as vehicles are the main generators of CO.

56. HCMC Environmental Protection Sub-department conducts environmental monitoring for air quality and publishes reports annually. Tables 7 and 8 show measured air quality at major road sides and intersections in the project area. Table 9 shows air quality at urban residential areas in the project area.

Table 7: Air Quality at Major Roadsides in the Project Area

Parameter	Station	Max hourly average	Annual Average 2007	Annual Average 2008
CO (mg/m ³)	Office of Binh Chanh Education Division	17.53	9.47	3.31
	DOSTE Office	33.05	8.92	5.09
	Hong Bang Secondary School, Dist 5	18.54	5.25	4.09
NO ₂ (µg/m ³)	Office of Binh Chanh Education Division	76.37	27.46	14.21
O ₃ (µg/m ³)	DOSTE Office	195.56	20.84	16.32
PM ₁₀ (µg/m ³)	Office of Binh Chanh Education Division	383.22	78.19	77.70

Source: HCMC Environment Protection Sub-Department, 2009.

Table 8: Air Quality at Major Intersections in the Project Area

Parameter		Station			
		Hang Xanh Roundabout	Dinh Tien Hoang - Dien Bien Phu	Go Vap Intersection	Nguyen Van Linh - Huyh Tan Phat
CO (µg/m ³)	Annual Average 2008	10.55	14.19	16.55	9.24
	Max value	32.30	25.20	48.50	15.67
	% exceeding standards	1%	0%	4%	0%
Total Suspended Particulate (mg/m ³)	Annual Average 2008	0.44	0.58	0.45	0.53
	Max value	0.73	0.95	0.71	1.27
	% exceeding standards	83%	97%	82%	95%
Pb (µg/m ³)	Annual Average 2008	0.28	0.39	0.31	0.25
	Max value	0.61	0.66	0.92	0.50
NO ₂ (mg/m ³)	Annual Average 2008	0.91	0.24	0.20	0.15
	Max value	0.34	0.34	0.32	0.35
	% exceeding standards	21%	62%	51%	47%

Source: HCMC Environment Protection Sub-Department, 2009.

Table 9: Air Quality at Residential Areas in the Project Area

Parameter	Station	Max hourly average	Annual Average 2007	Annual Average 2008
NO ₂ (µg/m ³)	District 2 PC Office	76.16	18.19	20.08
	Quang Trung Software Park	95.72	-	19.02
	City Zoo Thao Cam Vien	83.11	18.00	23.88
O ₃ (µg/m ³)	District 2 PC Office	213.96	39.42	29.46
	Tan Son Hoa	183.88	33.16	31.06
	City Zoo Thao Cam Vien	248.95	35.47	31.08
PM ₁₀ (µg/m ³)	City Zoo Thao Cam Vien	495.44	-	73.80
SO ₂ (µg/m ³)	District 2 PC Office	198.16	17.78	15.76
	Quang Trung Software Park	149.05	-	30.11

Source: HCMC Environment Protection Sub-Department, 2009.

57. The following observations are made regarding the air quality in the project area:

- Airborne particulate matter, in particular PM₁₀ exceeded permitted levels (TCVN 5937-2005) in 87% of measurements.
- Levels of NO₂ in 2008 exceeded TVCN standards in 42% of measurements.
- Other parameters such as CO and SO₂ generally were within TVCN permitted levels.

58. The HCMC Technical Infrastructure Investment Joint Stock Company conducted recent air quality monitoring along Hanoi Highway as part of its environmental assessment for the upgrading of Hanoi Highway². Because the section of the 2400 mm treated water main will follow Hanoi highway, the results of air quality monitoring for that EIA are useful for the present IEE (Table 10).

Table 10: Air Quality at Hanoi Highway from Binh Thai to Sai Gon River

Unit: µg/Nm³

No	Parameters	Under Sai gon Bridge		Cat Lai Section		Binh Thai Section	
		1h average	24 h average	1h average	24 h average	1h average	24 h average
1	Total Suspended Particulate (TSP)	1.326	0.871	0.683	0.715	0.457	0.424
2	Particulate matter PM ₁₀	0.867	0.571	0.268	0.286	0.186	0.159
3	CO	29.415	17.667	27.347	20.353	12.851	15.207
4	NO ₂	0.119	0.068	0.117	0.106	0.064	0.065
5	SO ₂	0.128	0.088	0.126	0.123	0.081	0.087
6	HC	4.864	3.081	4.597	3.965	2.355	2.398

Source: HCMC Technical Infrastructure Investment Joint Stock Company, 2009

² HCMC Technical Infrastructure Investment Joint Stock Company, 2009. Environmental Impact Assessment Report for Upgrading Hai Noi Highway from Sai Gon Bridge to Tan Van Intersection.

3. Noise Levels

59. Noise levels monitored by HCMC Environment Protection Sub-department during 2008 at semi-automatic monitoring points in the project area show that noise levels exceed applicable TCVN standards for public and residential areas in 87% measurements (TCVN 5949:1998; Appendix D).

60. Noise levels recorded along Hanoi Highway by HCMC Technical Infrastructure Investment Joint Stock Company for Hanoi Highway upgrading project are shown in Table 11. These data are directly relevant to the for 2400 mm water main pipeline of component 2.

Table 11: Noise Levels at Hanoi Highway from Binh Thai to Sai Gon river

Parameters	Under Sai gon Bridge			Cat Lai Section			Binh Thai Section		
	Average 6 - 18h	Average 18h-22h	Average 22 – 6 h	Average 6 - 18h	Average 18 -22h	Average 22 – 6 h	Average 6 - 18h	Average 18 -22h	Average 22 – 6 h
Leq	81.9	80.0	76.0	74.2	72.2	69.6	76.2	74.3	71.9
L10	90.9	88.6	84.2	82.8	80.4	77.7	84.8	83.0	80.2
L90	77.5	75.5	72.0	71.3	69.5	66.9	73.3	71.6	69.1

Source: HCMC Technical Infrastructure Investment Joint Stock Company, 2009

4. Topography and Geology

a. Topography

61. HCM City is located in a transitional region between the northeastern and Mekong Delta regions. The terrain generally gets lower from north to south and from east to west. There are three main types of the terrain:

- (i) The higher terrain is in the north-northeastern area and forms part of the northwestern area encompassing northern Cu Chi, northeastern Thu Duc and District 9. The average elevation is 10-25 meters.
- (ii) The low-lying region is in the south-southwestern and southeastern part encompassing districts 9, 8, 7, Binh Chanh, Nha Be and Can Gio. The elevation ranges from 0.5 to 2 meters.
- (iii) The medium terrain is in the central part of the city, encompassing old built-up areas, part of districts 2 and Thu Duc, Districts 12 and Hoc Mon. The elevation is 5-10 meters³.

62. In general, the topography of HCM City is fairly homogeneous and favorable for multi-faceted development.

b. Geology

63. The soil of HCM City was formed on the following two sediment classes (footnote 3):

Pleistocene sediment:

³ ADB, 2009. Ho Chi Minh City Metro Rail System Project, Line 2 and 3: Environmental Impact Assessment Draft Report.

- (i) This ancient alluvial sediment covers most of the northern, northwestern and northeastern parts of the city, encompassing Cu Chi, Hoc Mon, northern Binh Chanh and Thu Duc districts, north and northeastern District 9, and old inner-city areas. Main characteristics of the sediment class are hilly terrain, with a depth range from 3 to 25 meters, and oscillation in the southeastern direction. Due to the combined effects of natural factors, the sediment class has developed into grey soil. Grey soil makes up 45,000 hectares or 23.4% of the city's total soil area.

Holocene sediment:

- (i) This new alluvial sediment of HCM City has its origin in coastal areas, bays, riverbeds and alluvial plains and consequently formed different types of soil. Specifically, alluvial soil makes up 15,100 hectares or 7.8% of the total area; aluminum soil is 40,800 hectares or 21.2%; and alkaline soil is 45,500 hectares or 23.6%. The remaining area, 400 hectares or 0.2% is made of sandy soil near the ocean and yellow-brown fealties soil on hills that have eroded.

5. Flooding

64. Ho Chi Minh City is located 50 km from the South China sea and northeast of the Mekong river delta in an estuarine area of Dong Nai river system with high flow volume. The city is surrounded by marshes on the lower reaches of the Sai Gon river. The Sai Gon and Dong Nai rivers flow through the city and together with canals form a complex network that is affected by the tide. Most of urbanized land is only 2 to 3 meters above sea level. The low land elevation combined with heavy rainfall makes the city susceptible to flooding induced by tidal fluctuations.

65. Each year HCMC suffers many serious floods, not only in rainy season from May to November, when monthly average rainfall is 250 mm, but also during the season with high tides from September to January. Flooding is exacerbated by poor drainage and stormwater infrastructure which become overloaded during heavy rain events, and from the changing land use patterns which have resulted in many low-lying underdeveloped areas⁴.

66. Flooding is particularly severe in newly developed parts of district 6, 11, and Tan Binh. Streets can remain flooded for several hours after heavy rain events. Heavy rain in June 2003, for example, resulted in the flooding (up to 50 cm in depth at places) of the roads between Cho Lon and An Lac (footnote 3).

6. Surface Water

a. River system

67. Ho Chi Minh City is situated next to the Sai Gon river, which together with Dong Nai river form the northern and eastern boundaries of the city. These waterways act both as potential water supplies, and as drainage for wastewater.

68. Dong Nai river has an average daily flow approximately 450 m³/s (Sogreah et al. 1997). It originates from the Central Highland and flows through Dong Nai and Ho Chi Minh City with

⁴ Ho Long Phi, 2007. Climate change and urban flooding in Ho Chi Minh City, Proceedings of the Third International Conference on Climate and Water 3-6 September 2007, Helsinki, Finland.

water received from other provinces. The total catchment area is 42,665 km². The Dong Nai river joins the Sai Gon river at the Nha Be river in southern part of the city. The lowest and highest water levels of Sai Gon River (measured at Phu An station) are shown in Table 12.

Table 12: Low and High Water Levels in Saigon River in 2008 (cm).

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Low											
-183	-170	-180	-192	-208	-227	-233	-206	-220	-164	-172	-172
High											
141	143	137	128	125	123	116	127	132	148	154	155

Source: HCMC Statistical Office, 2009

69. Surface water resources are abundant within the project area. The total volume of water for domestic and industrial uses in HCMC was approximately 1,890,000 m³/day in 2006, which included 1,270,000 m³/day taken from Sai Gon and Dong Nai Rivers. At the same time these surface water resources provide aesthetic and recreational values, and provide major functions of conveying storm water flows to control flooding, and receiving city wastewater.

b. Water quality

70. The HCMC Environment Protection Sub-department of the HCMC DoNRE conducts monitoring for surface water quality in Sai Gon - Dong Nai river system. Table 13 shows water quality at locations where water is extracted for city use.

Table 13: Surface Water Quality in Sai Gon - Dong Nai River System (2008)

Station	Ph	Salinity (%)	DO (mg/l)	COD (mg/l)	BOD ₅ (mg/l)	Oil (mg/l)	Coliforms (MPN/100ml)	Mn (mg/l)
Ben Cui	6.05	0.018	5.48	3.98	2.82	0.02	11,716	0.001
Ben Suc	5.7	0.015	4.76	4.71	2.6	0.037	12,007	<0.001
Thi Tinh	5.53	0.027	4.16	6.71	3.56	0.034	5,523	0.019
Phu Cuong	5.63	0.046	3.82	5.85	3.23	0.034	21,785	0.031
Hoa An	6.39	0.021	6.14	3.63	2.34	0.321	20,392	0.004
Canal N46	5.91	0.019	6.00	3.98	2.79	0.021	26,082	0.005

Source: HCMC Environmental Protection Sub-Department, 2009

71. The surface water in Sai Gon - Dong Nai rivers does not meet all current water quality standards (Appendix D). In particular coliform levels exceed the QCVN standard. COD BOD₅ are closer to allowable levels.

72. Monitoring results at other stations in Sai Gon - Dong Nai river system show that the water quality meets QCVN standards for Type A1 and A2, i.e., water that can be used for domestic purpose (A1), or water that can be used for domestic purpose with appropriate treatment technology for pH, COD, BOD₅ and oil (A2). Water quality monitoring at stations in Dong Nai river including Hoa An intake station for the Thu Duc WTP showed that DO levels met QCVN standards for type A1. However, the Sai Gon river at all stations did not meet QCVN standards for type A2 water quality. Coliform levels at most stations exceed QCVN standards (type A1) from 1.1 to 5.2 times.

73. Within HCM City, a hydrological network of 5 canals acts as the natural water drainage: Nhieu Loc – Thi Nghe (9km), Tau Hu – Kinh Doi – Kinh Te (19.5km), Ben Nghe (5.9km), Tan

Hoa – Ong Buong – Lo Gom (7.2km), and Tham Luong – Ben Cat – Vam Thuat (14km). Water quality in the canals is exemplified in Table 14.

Table 14: Water Quality in Nhieu Loc - Thi Nghe Canal (2008)

Station	pH		COD (mg/l)		BOD (mg/l)		Coliforms (MPN/100ml)	
	High water	Low water	High water	Low water	High water	Low water	High water	Low water
Le Van Sy	6.71	6.58	92.6	193.9	38.88	75.43	2,360,000	19,000,000
Dien Bien Phu	6.52	6.7	36.13	149.85	10.85	74.78	140,000	4,200,000

Source: HCMC Environmental Protection Sub-Department, 2009

74. The monitoring data for Nhieu Loc - Thi Nghe canal show that, with the exception of BOD during high water, water quality does not meet QCVN 08:2008 for Type B2 uses in terms of COD, BOD and coliforms (Appendix D). In particular, coliform levels exceed the standards from 14 times during high water to 1,900 times during low water.

c. Saltwater intrusion

75. Saltwater intrusion depends on tidal flow regimes, location, and terrain. Saltwater intrusion from the sea into Sai Gon river usually is strongest 2-3 hours after maximum tide. During the dry season saltwater intrusion extends inland the farthest due to low river flows and to the strong northeast wind of 2 m/s to 5 m/s or even 10 m/s.

7. Ground Water

76. The groundwater resources in HCMC are defined by three aquifers (footnote 3):

1) The **holocene aquifer** found over a small area defined by Le Minh Xuan- Binh Chanh and Can Gio with average thickness of 0-8m. Water extracted from this zone is rarely used for daily purposes.

(2) The **pleistocene aquifer** extends broadly throughout the city. The depth of the water table varies from 3.2 m at Linh Xuan, & Thu Duc to 63 m at Tan Tao and Binh Chanh. In Hoc Mon and Cu Chi areas the water table is less than 20 m deep, and in downtown areas 20-30 m.

3) The **pliocene aquifer** is commonly found at the depth 40-80m, and the thickness varies from 36m (Cu Chi) to 82m (Hoc Mon). The lower Pliocene aquifer is found at depth from 125m.

77. Currently, groundwater is extracted mainly from the pleistocene and pliocene aquifers to supply for the city needs. HCMC Environment Protection Sub-department maintains monitoring program for ground water quality. The groundwater quality for the pleistocene and upper pliocene aquifers in the project area in 2008 are shown in Tables 15 and 16.

78. The monitoring data suggest that ground water in pleistocene is contaminated with fecal coliform bacteria at 5 stations (Linh Xuan, Truong Tho, Dong Hung Xuan, Tan Son Nhat and Thanh My Loi). Iron (Fe) and NO₃ concentrations appear to exceed QCVN 09:2008 standards for groundwater (Appendix D).

Table 15: Ground Water Quality of Pleistocene Aquifer

Station	Zone/ WS plant	pH	Total Dissolved Solids (mg/l)	Hardness (mgCaCO ₃ /l)	NO ₃ ⁻ (mg/l)	Total Organic Carbons (mg/l)	Fe (mg/l)	Total Coliform (MPN/100ml)	Fecal Coliforms (MPH/100ml)
Linh Xuan	Zone 4/ Thu Duc	7.43	245.0	85.2	3.4	5.0	11.4	700	2,300
Truong Tho	Zone 4/ Thu Duc	5.32	129.5	53.1	2.7	3.4	8.4	230	32
Dong Hung Thuan	Zone 3/ Trung An	5.29	277.2	102.7	0.2	20.1	10.9	320,000	100,000
Go Vap	Zone 3/ Trung An	5.08	168.3	52.6	0.1	4.9	8.0	3.8	0
Tan Son Nhat	Zone 3/ Gia Dinh	5.06	227.3	14.9	53.7	1.6	0.6	23	10
Phu Tho	Zone 2/ Phu Hoa Tan	4.84	262.5	36.5	71.9	5.3	0.5	0	0
Tan Tao	Zone 6/ Cho Lon	5.12	1,533.1	619.0	0.1	5.0	11.8	0	0
Tan Chanh Hiep	Zone 3/ Trung An	4.59	181.6	14.2	13.0	10.2	1.1	0	0
Thanh My Loi	Zone 4/ Thu Duc	4.33	63.0	9.0	0	19.8	2.7	29	5
Long Thanh My	Zone 4/ Thu Duc	6.4	207.2	5.5	3.8	2.5	3.9	0	0

Source: HCMC Environment Protection Sub-Department 2009

Table 16: Ground Water Quality of Upper Pliocene Aquifer

Station	Zone	pH	Total Dissolved Solids (mg/l)	Hardness (mgCaCO ₃ /l)	NO ₃ ⁻ (mg/l)	Total Organic Carbons (mg/l)	Fe (mg/l)	Total Coliform (MPN/100ml)	Fecal Coliforms (MPH/100ml)
Tan Chanh Hiep	Zone 3/ Trung An	5.2	149.15	11.15	2.44	42.46	1.67	375	175
Tan Son Nhat	Zone 3/ Gia Dinh	5.0	250.90	28.44	28.33	5.79	1.46	1	0
Linh Xuan	Zone 4/ Thu Duc	7.0	136.23	12.73	1.96	2.25	2.77	22	3
Thanh My Loi	Zone 4/ Thu Duc	4.1	25.30	3.01	7.76	1.13	0.57	165	80
Long Thanh My	Zone 4/ Thu Duc	5.3	101.1	14.56	0.05	1.95	0.45	0	0
Phu Tho	Zone 2/ Phu Hoa Tan	4.8	158.8	13.55	19.77	3.45	0.53	2	0
Tan Tao	Zone 6/ Cho Lon	3.8	3,716.67	1,350.33	0.11	4.46	11.59	13	2

Source: HCMC Environment Protection Sub-Department 2009

79. For other parameters such as TDS, hardness most stations recorded levels within TCVN standards except for Tan Tao station which showed levels far exceeding the standards. The monitoring results show that most parameters do not meet TCVN standards. In particular, Tan Tao station recorded very low pH and very high TDS, hardness and Fe levels. Water quality at Tan Chanh Hiep is most contaminated with TOC, total and fecal coliform exceeding TCVN.

B. Ecological Resources

1. Terrestrial Ecology

80. Terrestrial ecology values in the project area are low due to the highly developed urban-suburban project environment. Similarly, flora in the project area is limited to scattered roadside and garden trees of various domestic endemic species and agricultural land use.

a. Flora

81. In general vegetation in the project area is limited to scattered and planted garden trees of various domestic endemic species. Trees exist in open areas, along roadsides, and on private property. Trees are natural or planted for timber or shade purposes. Species include *Eucalyptus teriticornis*, *Sonnertia caeseolari*, *Ceiba pentandra*, *Ficus microcarpa*, *Eugenia oblata*.

82. Shrubs are scattered throughout agricultural land, alongside roadways or on private property normally in poor soil. Common species include: *Annona glabra*, *Malpighi glabra*, *Melaleuca cajeputi* and *Hibiscus tiliaceus*. Common plant species along river banks and canals include *Nipa fruticans*, *Sonneratia caeseolaris*, *Polygonum hydropiper*, *Stenochlaena palustris* (HCMC Technical Infrastructure Investment Joint Stock Company, 2009). Common plants in residential areas include fruit trees⁵.

b. Fauna

83. In general fauna in the project area is limited to domestic animals, several species of reptiles, amphibians, insects, birds, and vermin such as rats and mice that have become adapted to the HCMC urban environment.

84. Animal species of the following major taxa are found in the project area (footnote 5):

Amphibia: *Bufo melanostictus*, *Ranalinnocharis*, *R. macrodactyla*, *R. tigrina*, *Kaloula pulchra*

Reptilia: *Xeochothis piscator*, *Elapheradiata*, *Xenopeltis*, *Hemidactylus ferrenatus*, *Mabuya multifasciata*.

Aves: *Dicacum concolor*, *Picnonotus jocosus*, *Phalacrocorax niger*.

Mamalia: *Bandicota indica*, *Rattus argentiventer*, *Suncus murinus*.

85. There are captive animals kept in Thao Cam Vien City Zoo. No non-captive, rare or endangered species listed in Vietnam Red book are not found in the project area.

2. Aquatic Ecology

86. Aquatic ecology values in the project are low due to the poor water quality and habitat in the rivers, lakes and canals. Aquatic flora comprises algae, protozoa and other exotic species.

⁵ HCMC Department of Transport and Public Works. 2006. Environmental Impacts Assessment for Urban Metro Railway Ben Thanh – Cho Nho – Suoi Tien Bus Station.

87. Aquatic fauna species are limited to benthic organisms, symbiotic species, and marine species such as insects, crustacean, worms, and molluscs (footnote 3).

88. There are approximately 151 alga species belonging to 6 groups in Sai Gon river and the canal systems in HCM City. Typical group is *Bacillariophyta* (72 species or 47.7% total). Other popular groups include: *Euglenophyta* (21.2%), *Chrysophyta* (18.5%) and *Cyanophyta* (11.2%).

89. There are approximately 220 species of protozoa belonging to 2 classes in which the majority are freshwater species (64%). Blackish water species are comprised of 56 species (25%) and alum water only accommodates a few species (11%). Protozoa play an important role in the material cycle are useful indicators of environmental quality.

90. Due to high level of pollution zoo benthos are missing in many inner city canals where most species of molluscs do not survive. There are only 8 species of 4 classes of zoo benthos are found in Sai Gon river and inner city canals with the most common being *Corbicula leviuscula*, *Corbicula castanea* and *Limnoperna siamensis* found way from pollution sources. Most popular groups of zoo planktons are *Rotatoria*, *Copepoda*, *Cladocera*.

91. One hundred and eight seven fish species have been identified in Ho Chi Minh City of which 30 species have high economical value. In the Sai Gon river 34 fish species belonging to 19 families, of these 25 species have high economic value. Thirteen shrimp species belonging to 4 families have also established in Sai Gon river. No rare or endangered aquatic species are known in the project area (HCMC Technical Infrastructure Investment Joint Stock Company, 2009).

3. Protected Area

92. There are no protected areas in the vicinity of the project area.

4. Fisheries and Forestry

93. There are 7,953 ha of water surface for aquaculture purposes in HCMC. However the aquaculture areas are located almost exclusively in the south of the city along the Nha Be estuary into which the Dong Nai and Sai Gon rivers flow. Most fisheries activities take place in Sai Gon -Dong Nai river system and small number of inland ponds.

94. Forestry is not significant economic sector for HCM City The area of forest land reduced sharply from 875.5 ha in 2005 to only 138 ha in 2008 due to rapid urbanization and industrialization in the city⁶. There are no concentrated forestation lands in the city with existing forested areas being dispersed. The economic value of the forest is considered to be low.

C. Overview of Economic Development

1. Economic Growth

95. Ho Chi Minh city is at the center of the burgeoning national economy and the country's industrial heart. In 2008 in spite of the high inflation and many difficulties, the city continued maintaining its growth rate GDP was achieved at 11%, 1.6 times higher than that of the whole

⁶ HCMC Statistical Office, 2009, HCMC Statistical Yearbook 2008.

country. The total export turnover was increased to 24.3% and the foreign direct investment (FDI) was reached 8.38 billion USD, 4.22 times upper than the same period last year (footnote 6).

96. Ho Chi Minh city has been played an important role to the country's development, accounting for 21% of total GDP, 30% of the industrial output, 29% of the total retail sales and services, 40% of the export turnover, and 33% of the State budget. In particular, its GDP per capita is highest in Vietnam, 3 times higher than the country's average figure. Together with Ho Chi Minh City, Dong Nai and Binh Duong provinces are at a core of southern economic hub, with dynamic economic activities.

2. Land Use

97. With an area of 2,095.01 km², Ho Chi Minh City comprises 24 districts in which there are 19 urban districts and 5 rural districts. Land use along alignment of project components is mix of residential and commercial areas. Number of private commercial establishments in the project area is shown in Table 17.

Table 17: Private and Commercial Establishments in Project Area.

District	Number of establishments (2007)
Urban districts	
District 1	14,296
District 2	6,223
District 4	4,315
District 5	11,649
District 6	10,210
District 7	11,796
District 8	14,981
District 9	10,997
District 12	14,064
Go Vap	23,923
Binh Thanh	12,767
Phu Nhuan	6,706
Thu Duc	20,144
Binh Tan	18,439
Rural districts	
Binh Chanh	16,439
Nha Be	4,219
Can Gio	3,079

Source: HCMC Statistical Office, 2009

3. Infrastructure

98. HCMC provides a network of roads ranging from small residential streets and alleys to large elevated multi-lane expressways. Electricity is provided to residents and businesses mostly in above ground power lines. Wastewater is collected and discharged to a network of major canals that discharge ultimately into the Nha Be river and south China Sea south of HCMC. The first wastewater treatment plants are currently under development. The city provides domestic and international air travel at Ton Son Nhat airport in the northwest of the

city, and domestic and international port facilities along the Sai Gon-Dong Nai river systems and in Nha Be river.

D. Social and Cultural Resources

1. Population

99. HCMC is the largest city in Viet Nam with an area of 2,095 km² and a population that has grown at an average of 2.4% over the last 15 years, to over 6.8 million in 2008, or approximately 8% of Viet Nam's total population.

Table 18: Population in Project Area in 2008.

District	No of communes/wards	Area (sq.km)	Population (persons)	Population density (persons/sq.km)
City	322	2,095.01	6,810,461	3,251
Urban districts				
District 1	10	7.73	206,098	26,662
District 2	11	49.74	138,194	2,778
District 4	15	4.18	191,925	45,915
District 5	15	4.27	195,643	45,818
District 6	14	7.19	258,444	35,945
District 7	10	35.69	211,141	5,916
District 8	16	19.18	381,721	19,902
District 9	13	114.00	227,816	1,998
District 12	11	52.78	346,638	6,568
Go Vap	16	19.74	520,928	26,389
Binh Thanh	20	20.76	474,206	22,842
Phu Nhuan	15	4.88	180,272	36,941
Thu Duc	12	47.76	373,278	7,816
Binh Tan	10	51.89	500,493	9,645
Rural districts				
Binh Chanh	16	252.69	373,441	1,478
Nha Be	7	100.41	82,816	825
Can Gio	7	704.22	69,545	99

Source: HCMC Statistical Office, 2009

2. Community Facilities

100. There are a large number of university, colleges and schools, as well as health and other community facilities located in the project area.

3. Livelihood and Incomes

101. Results of survey on incomes in HCMC from 2002 to 2008 revealed that average income per capita increased 2.6 times from 2002 to 2008.

Table 19: Monthly Average Income per Capita in HCM City (VNDx1,000)

	2002	2004	2006	2008
City average	904.1	1,164.8	1,465.0	2,426.0
- Urban	987.0	1,266.9	1,552.7	2,632.1
- Rural	549.0	726.0	988.3	1,248.9

Source: HCMC Statistical Office, 2009

Table 20: Kindergartens and Schools in Project Area

District	Kindergartens	Schools
City	638	843
Urban districts		
District 1	24	38
District 2	16	18
District 4	15	23
District 5	28	40
District 6	29	30
District 7	38	25
District 8	23	36
District 9	22	32
District 12	25	30
Go Vap	41	38
Binh Thanh	36	52
Phu Nhuan	23	23
Thu Duc	48	36
Binh Tan	19	26
Rural districts		
Binh Chanh	21	45
Nha Be	16	19
Can Gio	8	25

Source: HCMC Statistical Office, 2009

VII. PUBLIC CONSULTATION

102. The equipment rehabilitation and civil construction activities will potentially affect the local community at different magnitudes and frequency. The civil construction works for the new 2400 mm pipeline of Component 2 represent by far the largest physical interventions compared to the rehabilitation works of the other project components. Thus, the formal public consultations with the affected community focused on the new 2400 mm pipeline.

A. New 2400 mm Water Main

1. Public Meetings in Thu Duc District and Binh Thanh District

103. The local community of Component 2 was consulted in two separate public meetings representing the following two sections of the new 2400 mm pipeline (Figure 1):

- (i) northern section from Binh Thai south to approximately Ha Tien cement factory; and,
- (ii) southern section from Sai Gon river to distribution centre via two optional routes:
 - a) Nguyen Huu Canh Street
 - b) Dien Bien Phu Street.

104. Public consultations along the intermediary section of the 2400 mm pipeline between the Ha Tien cement factory and the Sai Gon river were excluded because the specific alignment of that section of the pipeline is uncertain, and the assessment of community impacts will be subsumed by the imminent expansion of the Ha Noi highway and development of the metro line (MTR) at the same site.

105. The public meetings were designed to accomplish the following:
- a) provide formal introduction to HCM City Water Supply Project;
 - b) introduce details of new 2400 mm pipeline including construction activities, schedule, site maps, and photographs;
 - c) orient APs to typical impacts of pipeline construction if necessary;
 - d) facilitate subgroup discussions on environmental concerns or issues; and
 - e) introduce environmental management of pipeline construction.
106. The minutes and agenda of the two public meetings are found in Appendix B and C.

2. Interviews of APs of Ongoing Construction of 2400 mm Water Main.

107. During the site visits of Component 2 some local residents and construction workers that are currently exposed to the ongoing construction of the 2400 mm pipeline by SAWACO were interviewed to determine environmental issues or concerns. While this section of the pipeline is outside the project the opportunity was taken to obtain insight into how well community – based impacts of the pipeline are being managed. A household owner, small restaurant owner, and a construction worker were interviewed

B. Summary of Public Concerns

1. New 2400 mm Pipeline of Component 1

a. Truong Tho Ward, Thu Duc District

108. Issues raised by the participants of the public meeting in Truong Tho Ward (Appendix B) are summarized as follows:

- 1) noise, dust, and traffic disruption;
- 2) the request for short pipeline sections to be started and finished completely instead of long excavations lying open for extend periods;
- 3) localized flooding; and
- 4) and incomplete clean up after construction

b. Ward N^o 19, Binh Thanh District

109. Issues and recommendations raised by the participants of the public meeting in Ward No 19 (Appendix C) are summarized as follows:

- 1) too many projects in streets that are poorly coordinated;
- 2) option of using Dien Bien Phu is good;
- 3) creation of noise, dust, and traffic disruption including bad road surface & potholes;
- 4) the construction schedules need to be shortened;
- 5) localized flooding;
- 6) need for complete site restoration;
- 7) need for HOTLINE for easy contact of SAWACO; and
- 8) need for regular meetings between Wards and contractor/SAWACO during construction to review project issues starting with a follow-up meeting to this meeting.

c. Ongoing construction of 2400 mm pipeline

109. The owner of a small restaurant (Sai Gon Garden) identified noise, dust, and traffic as ongoing issues with the construction of the pipeline. Mr. Lap Trung Anh a home owner next to the construction area identified noise, dust and traffic ongoing problems with the pipeline construction activities. The construction worker (Mr. Nguyen Vu) identified noise, dust, traffic, and personal safety as the environmental issues of concern during construction. All three APs identified increased noise as a problem during the operation phase of the pipeline.

VIII. POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

A. Approach to Impacts Assessment

110. The impact assessment of the four project components was structured with the three phases of the project description as follows: 1) pre-construction (or rehabilitation) phase; 2) construction (or rehabilitation) phase; and 3) post construction (rehabilitation) operation phase. In this way specific project activities as they are currently defined in feasibility design stage are assessed systematically as they ultimately will be implemented.

111. By acknowledging the commonality of the pre-construction-rehabilitation phases of all four project components, a single assessment of the “pre-intervention phase” is provided for all four project components. Conversely, separate assessments of the construction-rehabilitation phase of each project Components are provided. Finally, a joint assessment of the operational phase of the integrated four project components is provided.

B. Pre-construction & Rehabilitation Phase of all Components

112. The future consultations of affected persons prior to the start of construction or rehabilitation phases of all components will not negatively influence or affect the natural or social environments. Moreover, the continued interaction with the public will act to minimize or prevent negative impacts on the natural and social environment by raising awareness of valued natural resources and assets of affected properties.

C. Component 1: New 2400 mm treated Water Main

1. Construction Phase

a. Natural environment

113. The series of construction activities starting with heavy equipment arrival, trench excavation, sheet piling placement, construction of concrete bases, the placement and sealing of sections of new pipe in the excavated trench, and finishing with complete site restoration will potentially elevate dust levels, and increase noise from equipment operation. The magnitude of potential impacts will differ depending on the location. For example, elevated dust levels would be expected highest along the open and wind-exposed RoW of section 1 just south of the Binh Thai, while exceedances of ambient noise levels would be lowest along the high density optional routes of Nguyen Huu Canh street and Dien Bien Phu street, and along the Ha Noi highway.

114. The potential impact of pipeline construction on the natural environment will vary depending on location. No impact to vegetation will occur along the cleared RoW of section 1 below the Binh Thai. The greatest potential impact on vegetation is in section 3 where highly valued mature shade trees line the streets of Dien Bien Phu and part of Nguyen Huu Canh. Some or many of these trees could potentially be removed or damaged if the pipeline is aligned along the shoulder of the streets. However, the potential impact on the mature shade trees is much lower on Dien Bien Phu street because that street is much wider and provides more unobstructed space for the pipeline.

115. The pipeline will cross 3 canals and the Sai Gon river. The water quality, and aquatic habitat of those water courses should not be directly affected if the pipeline is buried - tunneled - under the water courses using planned pipe jacking techniques. Some soil erosion and sedimentation of the water courses could occur during the excavation of the shore-based cavities needed for the jack and micro-tunneling equipment.

116. The alternate method to tunneling is to traverse the water courses along new elevated bridge supports, or attach the pipeline to the existing road bridges. The decision to construct new bridge supports or use existing road bridges will be determined in part by obstruction to boat traffic. Overhead pipeline construction activities will potentially expose boat operators to risk of injury from falling debris and equipment.

117. The construction of the foundations for bridge supports that must be placed in the watercourses will cause a short-term significant increase in turbidity and suspended sediment, and the destruction of aquatic habitat at the location of the bridge pile foundations.

b. Excavated spoil

118. The construction of the 2400 mm pipeline will generate large volumes of excavated spoil which will have been exposed to different ongoing and past land uses. Site visits along Component 2 did not identify high-contaminant industries such petrochemical factories. Large industrial complexes along Component 2 include the Ha Tien cement factory, and a container port adjacent to a canal to the Sai Gon river. However, potential contaminated soils from undocumented past land uses could create a contaminants issue for selected disposal locations, or uses of the excavated spoil after it is removed from the site.

(i) Mitigation measures

- 1) Regular use of wetting agents should be employed at construction sites to minimize dust
- 2) All equipment should be maintained in proper working order, and not operated at night if possible to minimize noise
- 3) The protection of mature shade trees and other vegetation must follow directives of Decision 20 on protection of urban vegetation and green spaces.
- 4) Present and past land use should be reviewed and the quality of soil excavated examined to determine if excavation will produce contaminated spoil. Contaminated spoil should be disposed at a landfill or a location agreed upon with HCMC DoNRE.
- 5) Berms and/or sheet fencing should be constructed around excavation sites beside Sai Gon river and canals to prevent soil erosion and sedimentation of water courses.

- 6) In-water pipeline bridge supports should be pile driven as opposed to being built on concrete footings to minimize habitat loss.
- 7) All work in Sai Gon river and canals should be well marked and scheduled to avoid boat traffic.

c. Affected public and urban environment

119. The construction of the pipeline will disrupt normal traffic patterns, expose residents to increased noise and dust (from above), and potentially expose the public to risk of injury or accidents. No resettlement is currently planned, and public and worker safety issues apply equally along Component 2.

(i) Mitigation measures

120. To protect the urban environment and minimize the impact of construction on the public existing directives of the DoT and MoLISA that govern the safe and orderly operation of road works in HCMC should be consulted.

d. Worker safety

121. The civil construction works of the pipeline can expose workers to risk of injury. Accidents and injury can arise from use of heavy equipment, work in excavated cavities, and while joining multi-ton pipe sections together.

(i) Mitigation measures

122. The construction site safety guidelines provided by Ministry of Labour, Invalid and Social Affairs (MoLISA) and the World Bank (2007) should be applied to all construction areas (Table 21). At a minimum, workers should wear safety approved construction helmets, and proper footwear.

2. Post-construction Operation Phase

a. Natural environment

123. The single greatest positive impact of the completed water main is the increased supply of drinking water to the residents of HCMC. An additional positive effect is the expected reduction in groundwater consumption for domestic uses, and the indirect effect of reduced salt water intrusion from the Nha Be – Soi Rap estuary that normally accompanies groundwater consumption.

Table 21: Summary of Potential Impacts and Mitigations of Component 2

Component Phase	Potential Impact	Mitigation Measure
Construction of pipeline	<ol style="list-style-type: none"> 1. Damage or loss of original vegetation, and mature shade trees in HCMC. 2. Sedimentation & loss of aquatic habitat in Sai Gon river and canals 	<ol style="list-style-type: none"> 1. Mature trees, and vegetation should be protected. Sites restored and re-vegetated after construction is finished. 1.1 Construction must follow Circular 20/2005/TT-BXD issued by MoC for the protection of trees and vegetation. 2. Barrier berms or plastic sheet fencing should be used to contain loose soil of excavation sites near water courses.

Component Phase	Potential Impact	Mitigation Measure
	3. Contaminated excavated spoil. 3. Public safety 4. Noise & dust 5. Disrupted traffic 6. Worker safety	Pipeline bridge supports located in Sai Gon river and canals should be pile driven where possible to minimize footprint of pipeline bridge foundations. 3. Present and past land use along pipeline corridor must be reviewed to determine if contaminated soil could exist. All excavated soil should be examined to determine if contaminated, and disposed in designated sites. 3. Work sites must be completely fenced and signed to protect and inform public that work is in progress. Excavations must be fenced when workers not present. Public must be kept away from operation of heavy equipment by fulltime site, and construction truck traffic guards. Boat traffic must diverted away from all pipeline construction works. 4. Wetting agents regularly applied to exposed soil and roads. All equipment maintained in good working order. Work performed between 07:00 – 17:00. 5. Construction truck movement to/from sites should be scheduled as much as possible during low traffic periods. 6. Workers should wear certified construction helmets and protective footwear. Worker conditions should adhere to: 6.1 E.g., Decree No. 16/2005/ND-CP on labour safety; and 6.2 World Bank (2007) Environmental, Health, and Safety Guidelines, Wash. DC.
Post-construction operation	7. Increased drinking water to residents of HCMC	7. No mitigation required

D. Component 2: Distribution Pipeline Renewals

1. Pipe Renewal Phase

a. Potential Impacts and Mitigation Measures

124. The location of pipeline renewals for the NRM reduction program have not been identified other than being located in hydraulic zones 3 – 6. The expected focus of the renewal program will be in zones 3 and 4 due to the relatively high water pressure in the northern areas of the city.

125. The pipeline renewal activities will involve the replacement of faulty or leaking sections of water supply pipe. This will involve small excavations to expose the leaky pipes, replacement, and then site restoration. The disturbances will be small and will not significantly affect the natural environment.

126. The local home owners and small businesses will be inconvenienced on a short-term basis with the presence of workers, equipment, and pipe, along with possible interference with normal movement caused by the small excavations. The potential for short-term relocation of secondary structures if pipe to be replaced is located under property is unclear at the feasibility

stage. Standard construction methods to minimize disturbance and disruption of normal routine of homeowners and small business shall be implemented.

E. Guidelines and Environmental Standards

127. The construction and operation phase activities of the HCMC water supply project must meet existing environmental protection standards, and follow existing directives and guidelines for conducting civil construction works in HCMC. The list of pertinent construction management directives for HCMC, and applicable environmental standards are listed in Table 23.

Table 22: Summary of Potential Impacts and Mitigations of Components 3 and 4.

Components Phase	Potential Impact	Mitigation Measure
Rehabilitation of water tanks Renewal of distribution pipes	1. Removal of small trees and plants 3. Public safety 4. Noise & dust 5. Worker safety	1. Site should be re-vegetated after rehabilitation completed. 3. A sufficient buffer zone around base of water towers must be fenced to keep the public away from rehabilitation works. Similarly, pipeline renewal areas must be fenced and clearly marked. Dangerous equipment must be kept away from the public. 4. Wetting agents regularly applied to exposed soil and roads. All equipment maintained in good working order. Work should be performed between 07:00 – 17:00. 5. Proper scaffolding should be used on water towers. Workers should wear certified construction helmets and protective footwear. Worker conditions should adhere to: 5.1 E.g., Decree No. 16/2005/ND-CP on labour safety must be followed. 5.2 World Bank (2007) Environmental, Health, and Safety Guidelines, Wash. DC.
Operation of water tanks and new pipes	1. No negative impacts	

Table 23: Construction Management Directives and Environmental Standards.

HCMC Construction Directives & Guidelines
<ul style="list-style-type: none"> • Dept. of Transport Notification No.99/2008/TB-SGTVT concerning traffic safety during road construction. • Dept. of Transport Decision 292/2009/QD-SGTVT, and Decision 1080/2009/QD-SGTVT regarding the use of safety fences around construction in HCMC. • Dept. of Transport Notification 173/2009/TB-SGTVT regarding information disclosure for construction projects and the requirement of signage providing project information. • Dept. of Transport and Public Works (DTPW) Decision 2616/2005/QD-GT regarding

<p>construction schedules, traffic safety, safety for related structures, environment and sanitation during construction projects.</p> <ul style="list-style-type: none"> • Peoples Committee Decision 1456/2002/QD-UB, Decision 60/2004/QD-UB, and Decision 47/2005/QD-UB concerning restrictions for excavation of roadways • Dept. of Construction Circular 20/2005/TT-BXD, on requirements for protection of trees in HCMC during, construction and permit requirements for moving or cutting trees • Dept. Planning & Investment Decree 16/2005/ND-CP, on labour safety and environmental protection for construction of investment projects.
Ministry of Labour, Invalids and Social Affairs
<ul style="list-style-type: none"> • Decree 110/2002/ND-CP, supplementing some articles of Decree 06/1995 on labour code of occupational safety and health • Decree 06/1995, Elaborating provisions of labour code on occupational safety and health
International Guidelines
<ul style="list-style-type: none"> • World Bank Group, 2007. Environmental Health and Safety Guidelines, Wash. DC.
Vietnamese Environmental Protection Standards (see Appendix D)
<ul style="list-style-type: none"> • TCVN 5937:2005 - ambient air quality standards • TCVN 5945:2005 – industrial waste discharge standards • TCVN 5942:1995 – allowable pollutant level in surface waters • TCVN 6962:2001 – allowable vibration and shock from construction activities • TCVN 5949:1998 - allowable noise levels in residential and public areas • QCVN 08:2008/BTNMT: national (MoNRE) regulation on surface water quality • QCVN 09:2008: national (MoNRE) groundwater quality standards

F. Operation of Integrated Components

128. There are two long-term project-related issues that are outside the immediate scope of the project. They concern the sustainability of potable water supply for HCMC, and the effects and management of the increased wastewater that will be produced from the increased supply of potable water.

1. Sustainable Water Supply

129. The planned increases in consumption of the Dong Nai river for domestic water supply to HCMC should be reviewed in view of future water resource demands in the Dong Nai-Sai Gon river basins. The estimated consumption of the Dong Nai river at the Hoi An PS in the VIWASE master plan for 2025 is approximately 2.1 million m³/day, which is approximately 5% of the mean daily flow of 39 million m³/day the river (Sogreah et al. 1997).

130. Water resource planning for the Dong Nai-Sai Gon river basins has just begun by the HCMC DoNRE (DoNRE pers comm., 2009). However, because both rivers are interprovincial MoNRE and the northern provinces of both basins will need to be involved. The key issue with water resource planning for the two basins is to insure that the Dong Nai-Sai Gon river systems can provide a sustainable supply of treatable water to HCMC amongst other future users of the resource.

131. There is a potential future need to relocate the extraction of domestic water supply for HCMC to higher areas in the basin - for example from the Dau Tien reservoir - to avoid the increasing pollution of the downstream reaches of the rivers (S. Jarigisma, UPS-SAWACO project, pers. comm., 2009). By moving higher in the basin there is less basin yield available which could cause conflicts among other uses such as irrigation.

132. By example, the World Bank-funded Viet Nam Water Resources Assistance Project (VWRAP) is currently rehabilitating the Dau Tien reservoir and canal system to provide more irrigation water to downstream irrigation and aquaculture command areas. Drawing water from the reservoir for HCMC should be considered in an upper basin water resource planning context.

2. Increased Wastewater Production

133. The downstream environmental issue that will arise after the four project components are completed and HCMC begins to receive the increased supply of treated water is the resultant increase in wastewater that will be produced. The project-predicted increase in domestic water supply use in HCMC of approximately 67,900 and 306,900 m³/day by 2013 and 2017 translates to a significant increase in domestic wastewater.

134. At the detailed design phase the expected increase in wastewater produced by the increased water supply should be compared to the standing JBIC Master Plan for Wastewater Management for HCMC (2000) to ensure that realized increases in wastewater are consistent with planned volumes and pollutant loads. Specifically, the increase in wastewater needs to be compared to the planned capacities of the two ongoing wastewater projects⁷ in HCMC which are based on the JBIC Master Plan. The wastewater projects are upgrading collection systems, developing a treatment plant for the southwest of the city, and developing and rehabilitating existing wastewater collection canals.

135. SAWACO needs to review their projections for increased domestic water supply with the Flood Control Program Center of HCMC which is responsible for management of wastewater and drainage to ensure that that domestic wastewater production is consistent with management expectations.

⁷ JICA Second Environmental Improvement Project of HCMC, and World Bank Ho Chi Minh City Environmental Sanitation Project.

136. The increased flow-through of the untreated wastewater component will directly affect the downstream receiving environment. The water quality, aquatic ecosystem, and human uses of the Nha Be river system will be affected. SAWACO and the Flood Control Program Centre need to coordinate with the HCMC DoNRE to provide DoNRE with the knowledge base to be able to begin to monitor and estimate the likely impacts of the increased wastewater load to the Nha Be river system.

IX. ANALYSIS OF ALTERNATIVES

137. The range of feasible project alternatives to further minimize potential environmental impacts are delimited by the following project design recommendations:

- 1) Option #2 (Dien Bien Phu street) for placement of the 2400 mm pipeline of Component 1 in the city centre;
- 2) Plan to tunnel the 2400 mm pipeline under the Sai Gon river and canal watercourses in Component 1; and

138. Relocating one or more of the project components to other locales that might pose lesser disturbance to the environment is not feasible.

139. The identification of the much wider street of Dien Bien Phu as the alternative to the original choice of the VIWASE master plan of placing the new 2400 mm pipeline along Nguyen Huu Canh street will make pipe construction much easier. Both streets have the same obstacles, however, Dien Bien Phu street provides much more room to avoid the obstacles.

X. INFORMATION DISCLOSURE AND PUBLIC GRIEVANCE MECHANISMS

A. Project Information

140. Information on the four project components was provided to the public in three formats. For the public consultation meetings in Thu Duc and Binh Thanh districts a written summary of the description of the construction of the 2400 mm pipeline of Component 2 was sent to the participants with the meeting invitation and agenda. Later at both meetings a MWH engineer delivered a formal presentation of the entire project which included schematic maps, satellite photographs, and site photographs of ongoing pipeline work in Thu Duc District. The third method of informing the public of the project was during the face to face interviews of APs. The APs were given a verbal description of the project to provide the context for the subsequent questionnaire.

B. Public Communication Mechanisms

141. The formal disclosure of information to affected persons and stakeholders during the IEE is meant to provide the template for continued information disclosure as the project is implemented. Moreover, as requested at the second public meeting, the affected people of Binh Thanh district want regular information exchange meetings with SAWACO at the Ward offices of affected community to occur during the construction phase of the pipeline. Thus, the mitigation plan of the EMP (see below) indicates SAWACO's responsibility to ensure that the public receives regular information about the project, and that regular contact with the affected Ward offices is maintained.

142. In addition to regular meetings between SAWACO and affected community at Ward offices the public meetings in Thu Duc and Binh Thanh districts identified the need to establish a telephone HOTLINE to provide easy and instant contact with SAWACO. The specific request was made for a clearly marked phone number for a responsive SAWACO office be placed at all construction sites of all four project components.

143. The purpose of the HOTLINE is to enable affected persons to convey to SAWACO at any time their concerns or issues of the project during the construction and operation phases. However, the construction phase was identified as being the most important project phase for communicating with SAWACO.

XI. ENVIRONMENTAL MANAGEMENT PLAN

A. Institutional Arrangements & Responsibilities

144. The Environmental Management Division (EMD) the HCMC DoNRE is regulatory agency which regulates and provides guidance for the environmental management of HCMC. The DoNRE, *inter alia*, provides direction to project proponents on the requirements for conducting EIA according to the LEP (2005), and guidance on use of the environmental quality standards that are in place protect the environment (Appendix D). The MoNRE in Ha Noi provides policy and guideline support for environmental management to the HCMC DoNRE and all other DoNREs in Viet Nam.

145. The EMD/DoNRE is responsible to review and appraise EIAs that are prepared by proponents for all development projects that occur within the geographic boundaries of HCMC. However, for the HCMC Water Supply Project the MoNRE will be responsible for organizing the review and appraisal committee for the EIA because the project is transboundary with Binh Duong and Dong Nai provinces.

146. The Department of Transport is responsible for the management of the roads in HCMC, and provides guidelines and directives for all above and below ground construction activities involving excavation and placement of utility conduits. The newly created Flood Control Program Centre (Decision 4576/2008/QD-UBND) is responsible for the management of the wastewater side of the water supply-wastewater management continuum.

147. In addition to managing water supply to HCMC SAWACO is also responsible for conducting all EIAs for water supply development. Moreover, SAWACO is responsible for implementing the environmental management plan (EMP) that is produced by an EIA. For the HCMC water supply project it is expected that SAWACO will implement the EIA and the EMP with the assistance of an environmental consultant and construction contractor. SAWACO's responsibility with the EMP includes an active communication plan with the affected community as defined above.

B. Mitigation Plan

148. The mitigation measures are formulated into the comprehensive mitigation plan for the project which is summarized in Table 24. The plan includes the environmental issues and concerns raised at the public meetings in Thu Duc and Binh Thanh districts, and during the individual interviews of APs of Component 1 and 3. The plan identifies responsible parties, location, and indicative costs, and timing.

149. The mitigation plan combines the construction phase activities common to the four project components while highlighting the activities specific to each component. The construction activities of the new 2400 mm pipeline dominate because of the comparatively large magnitude of the activities compared to the smaller rehabilitation and distribution pipe renewal activities.

150. Published municipal-provincial, national, and international guidelines and directives to prevent, minimize, and manage civil construction-related environmental and social impacts listed in Table 25 should be applied to the project.

Table 24: Environmental Impact Mitigation Plan

Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Mitigation Activity Ward Meetings & Reporting	Estimated Marginal Cost for Project (USD)	Responsibility: Supervision / Implementation
<i>Construction of new 2400 mm Pipeline, and Physical Facilities Rehabilitation of Components 1 – 2</i>							
Site clearing and preparation	Damage or loss of trees and vegetation	1. Buffer zone around trees, restoration and re-vegetation of site.	Primarily component 2 and component 1.	Beginning and end of project	Monthly	No marginal cost	SAWACO / contractor
Excavation, and equipment operation	Dust Noise	2. Regularly apply wetting agents to exposed soil and construction roads. 3. Maintain equipment in proper working order. As much as possible restrict working time between 07:00 and 17:00	All excavation sites	Fulltime	Monthly	No marginal cost	SAWACO / contractor
Excavation, and equipment operation	Public and worker safety Traffic disruption	4. Proper fencing, protective barriers, and buffer zones. Sufficient signage and information disclosure, and site supervisors and night guards 5. Schedule construction vehicle activity during light traffic periods. Adequate traffic detours, and sufficient signage & warning lights	All excavation sites	Fulltime	Monthly	No marginal cost	SAWACO / contractor
Excavation, and equipment operation	Soil erosion & sedimentation of water courses. Loss of aquatic habitat	6. Protective berms or plastic sheet fencing should be placed between all shore-based excavations and the Sai Gon river and canals. 7. Pipeline bridge supports located in the Sai Gon river and canals should be pile driven if possible instead of secured with concrete footings/pads.	Sai Gon river and associated canals	At the start , and throughout construction phase	Monthly	No marginal cost	SAWACO / contractor

Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Mitigation Activity Ward Meetings & Reporting	Estimated Marginal Cost for Project (USD)	Responsibility: Supervision / Implementation
Excavated soil (spoil) disposal	Disposal of potentially contaminated soil	<p>8. Potentially contaminated soil from petrol stations & other contaminant sources should be inventoried before excavation.</p> <p>9. Suspected contaminated soil should be tested, and disposed of in designated sites identified by DoNRE.</p>	Component 1, and all other sites of excavation.	At beginning and throughout repair works	Monthly	\$5000.00	SAWACO / consultant

C. Monitoring Plan

151. The environmental monitoring plan for the EMP is provided in Table 29. The monitoring plan focuses on the construction/rehabilitation phase of the project and consists of environmental indicators, the sampling locations & frequency, method of data collection, responsible parties, and the estimated costs. The purpose of the monitoring plan is to determine the effectiveness of the impact mitigations, and to document any unexpected positive or negative environmental impacts of the project. SAWACO will be required to oversee the implementation of environmental monitoring plan.

152. After the construction-rehabilitation phase is completed and all project components are in operation the benefits of increased and expanded potable water supply to the general health of the affected residents of HCMC should be closely monitored by the Department of Health (DoH) in conjunction with SAWACO. The data and information on improved community health can be obtained at local hospitals and clinics.

153. The potential effects of increased domestic wastewater production also should be monitored. This includes the ability of individual households and small industries to manage the increased waste stream they produce, as well as the impact of the collective increased wastewater discharge on the downstream receiving environment of the Nha Be - Sai Gon river system. The Flood Control Program Centre should monitor how well the increased wastewater is managed, while the HCMC DoNRE should monitor the effects of the discharged untreated wastewater stream on the Nha Be – Sai Gon river system.

154. Monitoring the success of the resettlement the few households that have to be moved, and the temporary relocation of secondary structures will be undertaken as part of the separate resettlement plan prepared for the project.

1. Reporting

155. Regular reporting on the implementation of mitigation measures, and on monitoring activities during construction and rehabilitation phases of the project are required. Reporting is the responsibility of SAWACO and should be conducted in conjunction with the regular meetings with the Wards as requested by the public meetings. The mitigation and monitoring plans (Tables 28 & 29) summarize the timing of required reporting.

2. Estimated Cost of Mitigation and Monitoring Plans

156. The marginal costs for implementing the mitigation measures during the construction phase of the project (Table 23) are estimated to be USD \$7,000.00. Estimated costs for field sampling and laboratory analyses for the monitoring plan are \$29,800.00 during the first year, and \$26,200.00 annually to the end of construction phase. The estimated costs are based on the national cost norms for environmental sampling and analyses (Circular 83/2002/TT-BTC).

157. As prescribed in Table 25 the MoH should monitor the effect of increased and expanded water supply on human health, and the DoNRE should monitor the effects of increased wastewater discharge to the Sai Gon and Nha Be rivers. The estimated annual costs for MoH and DoNRE are \$500.00 and \$6,000.00, respectively.

D. Institutional Capacity Review and Needs

158. Utility companies do not need fulltime staff dedicated to environmental assessment of their operations and development initiatives. Normally utility companies outsource specialized environmental management support when needed. In project meetings the project PMU and SAWACO staff confirmed that necessary fulltime environmental expertise is required only for management of water treatment plant processes, monitoring raw and

treated water quality, and management of treatment process waste such as used alum and sludge. This work is performed by environmental engineers of the utility.

159. However, in order to protect the natural environment, and their investments SAWACO should be independently knowledgeable of their responsibilities for protecting the environment pursuant to the LEP (2005) including understanding the GoV EIA process and their responsibilities for implementing the EIA process. Moreover, SAWACO will be responsible for the preparation of an EIA, and to implement the resultant EMP for the HCM City Water Supply Study to satisfy the LEP (2005).

160. As part of the institutional capacity development plan for the project two environmental engineers of SAWACO should be identified and trained on the LEP (2005) and how it is applied to SAWACO activities. The training should include the implementation of EIA and an EMP, and use of TCVN and QCVN environmental standards. SAWACO will continue to outsource the preparation of EIAs and the implementation of EMPs for their development projects, however, the training will position SAWACO to be able to better manage consultant activities and inputs. The trained staffers would become responsible for managing external consultants.

161. Two courses would sufficient. A first course should be given on the LEP (2005) and all supporting Decrees and Circulars that are directly relevant to SAWACO business activities. Other policy on construction management from for example the DoT should be included. A second course on EIA and EMP should follow. The key requirement is to have the courses focus on the context and needs of SAWACO for environmental management.

Table 25: Environmental Monitoring Plan

ENVIRONMENTAL EFFECTS MONITORING						
Environmental Indicators	Location	Means of Monitoring	Frequency	Reporting	Responsibility Management / Compliance Monitoring	Estimated Cost (USD)
Pre-construction & Rehabilitation Baseline Supplementary						
A) Air quality: dust, noise and vibration levels B) Water quality: TSS, heavy metals (As, Cd, Pb, Hg, Mn) oil and grease, coliforms, DO, BOD, and nutrients (N&P) C) Inventory of present and past land uses that could cause contaminated soil. D) Analysis of soil quality (heavy metals (As, Cd, Pb, Hg, Mn), hydrocarbons.	A) - Near APs of component 1. - Along component 2 including optional Nguyen Huu Canh, and Dien Bien Phu streets. - At three water tower requiring most repair work B) - Sai Gon river and 4 canals at pipeline site. C) - Along Components 1 and 2 D) - At petrol station located above 1800 mm pipeline and at other petrol stations along Component 1.	Using field and analytical methods described in TCVN standards for ambient air and surface water quality monitoring.	(A – C): One day and one night measurement of each parameter. D): Once	One baseline supplement report before construction/ rehabilitation phase starts	SAWACO / Monitoring Consultant	A) \$600.00 B) \$1,000.00 C) \$1,000.00 D) \$1,000.00
Construction of new 2400 mm Pipeline, and Physical Facilities Rehabilitation of Components 1 – 4						

ENVIRONMENTAL EFFECTS MONITORING						
Environmental Indicators	Location	Means of Monitoring	Frequency	Reporting	Responsibility Management / Compliance Monitoring	Estimated Cost (USD)
<p>A) Air quality: dust, noise and vibration levels</p> <p>B) Water quality: TSS, heavy metals (As, Cd, Pb, Hg, Mn) oil and grease, coliforms, DO, BOD, and nutrients (N&P)</p> <p>C) Analysis of soil quality (heavy metals (As, Cd, Pb, Hg, Mn), hydrocarbons.</p> <p>D) Public comments and complaints</p>	<p>A) – At baseline AP sites of component 1. - At baseline sites along component 2 including optional Nguyen Huu Canh, and Dien Bien Phu streets. - At three water tower requiring most repair work</p> <p>B) - Sai Gon river and 4 canals at pipeline site.</p> <p>C) - At sites where contaminated soil is suspected.</p> <p>D) Using hotline number placed at construction areas</p>	<p>A – C : Using field and analytical methods described in TCVN standards for ambient air and surface water quality monitoring.</p> <p>Include visual observations of dust and noise from contractor & public reports .</p> <p>D) Information transferred by telephone hotline number</p>	<p>(A – B): Monthly during construction periods</p> <p>Daily visual records</p> <p>C) Once at start of excavations</p> <p>D) Continuous public input</p>	Monthly	<p>(A - C): SAWACO / Monitoring Consultant</p> <p>D) & daily observations : SAWACO / contractor</p>	<p>A) \$7,200.00 /yr</p> <p>B) \$12,000.00 /yr</p> <p>C) \$6,000.00 /yr</p> <p>D) \$1,000.00 / yr</p>
Operation of Completed Components						
Incidence of water-borne disease or illness	In new and upgraded service areas	Number of sick persons at local hospitals	Continuous	Yearly	DoH	\$500.00 / yr
Coliform bacteria, nutrients (N&P), BOD , DO	Area of Nha Be river receiving domestic wastewater discharge of HCMC	Using field and analytical methods described in TCVN standards for surface water quality monitoring	Bi-annual	Yearly	DoNRE	\$6,000.00 /yr

XII. CONCLUSIONS AND RECOMMENDATION

162. The systematic evaluation of the three phases of the two project components which included input from two public meetings with the affected community indicates that the potential direct environmental impacts of the project are minor, short-term civil construction related impacts that can be mitigated. The civil construction impacts of elevated dust, noise, traffic disruptions, erosion and sedimentation, and public and worker safety can be managed effectively with existing municipal-provincial, national, and international construction management directives and guidelines.

163. The public meetings in Binh Thanh district and Thu Duc district underscored the need for effective management of noise, dust, traffic disruptions, and safety during the construction of the 2400 mm pipeline followed by the need for complete cleanup and restoration of all construction sites. The public meetings requested that a HOTLINE telephone number to a responsive SAWACO office be clearly posted at all construction areas, and that regular meetings between SAWACO and the Ward offices of affected community be convened to review issues of construction activities.

164. The absence of critical habitats, rare or endangered species, biodiversity values, ecological protected areas, or affected cultural or heritage structures focuses the short-term impacts of the project on communities and construction workers that will be directly affected by the construction and facilities rehabilitation activities. The published guidelines and regulations of MoLISA and the DoT that govern workplace and public safety should be applied to the project.

165. The crossings of the new 2400 mm pipeline at the Sai Gon river and 3 canals will not cause significant impacts to water quality or aquatic habitat due to the plan of tunneling the pipeline across these watercourses. Should the pipeline traverse the watercourses along elevated bridges supports impacts to water quality from suspended sediment, and lost aquatic habitat will be minor and short-term.

166. The IEE concludes that the description of the feasibility design of the project combined with available information on the affected environment is sufficient to identify the scope of potential environmental impacts of the project. Providing that no significant changes occur to the design of one or more of the project components, further detailed environmental impact assessment (EIA) of the project is not required.

167. The EMP developed for the project provides an impacts mitigation plan, an environmental monitoring plan, and specifies the institutional responsibilities and capacity needs for the environmental management of the project. The SAWACO will be responsible for implementing the EMP with the assistance of external consultants.

168. The IEE recommends that the EMP should be reviewed at the detailed design phase to ensure that it addresses fully the final project designs. The issue of basin-wide water resource planning for sustainable water supply for HCMC, and the issue of the increased wastewater production are outside the immediate scope of the project but nonetheless are important issues for consideration at the detailed design phase.

XIII. REFERENCES AND INFORMATION SOURCES

- ADB, 2009. Safeguard Policy Statement, ADB Policy Paper.
- ADB, 2009. Ho Chi Minh City Metro Rail System Project, Line 2 and 3: Environmental Impact Assessment, Draft Report.
- ADB, 2003, Environmental Assessment Guidelines of the Asian Development Bank.
- Dong Nai Department of Natural Resources and Environment, 2005. Environmental Status of Dong Nai Province 2001-2005: Summary Report.
- HCMC Environment Protection Sub-department, 2009. Report of Results of Environmental Quality Monitoring in HCMC in 2008.
- HCMC Department of Transport and Public Works. 2006. Environmental Impacts Assessment for Urban Metro Railway Ben Thanh – Cho Nho – Suoi Tien Bus Station
- HCMC Statistical Office, 2009, HCMC Statistical Yearbook 2008.
- HCMC Technical Infrastructure Investment Joint Stock Company, 2009. Environmental Impact Assessment Report for Upgrading Hai Noi Highway from Sai Gon Bridge to Tan Van Intersection.
- Ho Long Phi, 2007. Climate change and urban flooding in Ho Chi Minh City, Proceedings of the Third International Conference on Climate and Water 3-6 September 2007, Helsinki, Finland.
- ICEM, 2009. Ho Chi Minh City Adaption to Climate Change, report prepared for ADB.
- MWH, 2009. HCMC Water Supply Project: Draft Feasibility Report, Prepared for ADB/SAWACO.
- SAWACO, 1998. HCMC Water Supply and Sanitation Rehabilitation Project ADB Loan No.1273-VIE (SF): Part C - Rehabilitation of the Distribution Network: HCMC Water Towers and Reservoir: Final Design Report. Prepared by SOGREAH Ingenierie in association with Parsons Engineering Science and WASE for the Project Management Unit.
- SAWACO, 2004. HCMC Water Supply and Sanitation Rehabilitation Project ADB Loan No.1273-VIE (SF): Rehabilitation of the 1,800 mm Raw Pipe between Hoa An PS and Thu Duc WTP: Feasibility Study Report. Prepared by SOGREAH Consultants in association with Parsons Engineering Science and WASE for the Project Management Unit.
- SAWACO, 2005. Feasibility Study Report of D2400mm Treated Water Pipe from Binh Thai to Urban Area of HCMC. Prepared by WASE for the Project Management Unit.
- SAWACO, 2009. Feasibility Study Report of D2400mm Treated Water Pipe from Binh Thai to Urban Area of HCMC. Prepared by WASE for the Project Management Unit.
- Sogreah et al. 1997. Initial Environmental Evaluation of Ho Chi Minh Water Supply and Sanitation Rehabilitation Project, Loan Agreement No. 1273 VIE (SF).
- Sogreah et al. 2004. Report on the Rehabilitation Requirements of the 1800 mm Pipeline from Hoa An Pumping Station to Thu Duc Water Treatment Plant

XIV. APPENDIX A: SCREENING OF PROJECT

WATER SUPPLY SECTOR

HCMC Water Supply Project (PPTA 7091-VIE)
Energy and Water Division
SE Asia Department

SCREENING QUESTIONS	Yes	No	REMARKS
▪ Pollution of raw water supply from upstream wastewater discharge from communities, industries, agriculture, and soil erosion?	X		Project is concerned about future use of lower Dong Nai river due to increasing pollution
▪ Impairment of historical/cultural monuments, areas and loss/damage to these sites?		X	
▪ hazard of land subsidence caused by excessive ground water pumping?		X	
▪ social conflicts arising from displacement of communities ?	X		Minor conflicts addressed by resettlement plan
▪ conflicts in abstraction of raw water for water supply with other beneficial water uses for surface and ground waters?		X	Increase in consumption of Dong Nai river should be evaluated as part of basin-wide water resource planning
▪ unsatisfactory raw water supply (e.g. excessive pathogens or mineral constituents)?	X		As above
▪ delivery of unsafe water to distribution system?		X	
▪ inadequate protection of intake works or wells, leading to pollution of water supply?		X	
▪ over pumping of ground water, leading to salination and ground subsidence?		X	
▪ excessive algal growth in storage reservoir?		X	
▪ increase in production of sewage beyond capabilities of community facilities?	X		The increased wastewater that will be produced needs to be rationalized with the 2000 JBIC Wastewater Plan for HCMC
▪ inadequate disposal of sludge from water treatment plants?		X	Planned upgrades to WTPs include treatment of process waste.
▪ inadequate buffer zone around pumping and treatment plants to alleviate noise and other possible nuisances and protect facilities?		X	
▪ impairments associated with transmission lines and access roads?		X	

SCREENING QUESTIONS	Yes	No	REMARKS
▪ health hazards arising from inadequate design of facilities for receiving, storing, and handling of chlorine and other hazardous chemicals.		X	Planned upgrades to WTPs include management of treatment chemicals
▪ health and safety hazards to workers from the management of chlorine used for disinfection and other contaminants?		X	As above
▪ dislocation or involuntary resettlement of people	X		Yes, only a few households. See resettlement plans
▪ social conflicts between construction workers from other areas and community workers?		X	
▪ noise and dust from construction activities?	X		Short-term civil construction impact can be mitigated
▪ increased road traffic due to interference of construction activities?	X		Short-term road construction impact can be mitigated
▪ continuing soil erosion/silt runoff from construction operations?	X		Short-term civil construction impact can be mitigated
▪ delivery of unsafe water due to poor O&M treatment processes (especially mud accumulations in filters) and inadequate chlorination due to lack of adequate monitoring of chlorine residuals in distribution systems?		X	
▪ delivery of water to distribution system, which is corrosive due to inadequate attention to feeding of corrective chemicals?		X	
▪ accidental leakage of chlorine gas?		X	
▪ excessive abstraction of water affecting downstream water users?		X	
▪ competing uses of water?		X	
▪ increased sewage flow due to increased water supply	X		The increased wastewater that will be produced needs to be rationalized with the 2000 JBIC Wastewater Plan for HCMC
▪ increased volume of sullage (wastewater from cooking and washing) and sludge from wastewater treatment plant		X	

XV. APPENDIX B: MINUTES OF PUBLIC MEETING IN THU DUC DISTRICT

**Socialist Republic of Vietnam
Independence - Freedom - Happiness**

Minutes of Public Consultation Meeting

Truong Tho Ward PC office
Thu Duc District
HCMC

September 29, 2009
2:00 pm

Participants

- Mr. Tran Van Binh, Vice Chairman of Truong Tho Commune PC
- Mr. Phan Ba Tha, Officer, Land and Construction, Truong Tho Commune PC
- Mr. Bui Nguyen Xuan Huy, Officer, Land and Construction, Truong Tho PC
- Mr. Bui Xuan Huy, Truong Tho PC
- Ms. Nguyen Thi Thanh Loan, Environmental Officer, Thu Duc District PC
- Mr. Ngo Quang Tien, SAWACO
- Mr. Don Meisner, Environment specialist, MWH
- Ms. Penny Dutton, Social impact specialist, MWH
- Ms. Pierre Arnoux, Resettlement specialist, MWH
- Ms Vu Hoang Hoa, Environment specialist, MWH
- Mr. Trinh Van Nam, Design specialist, MWH
- Ms. Thu Nhung Mlo, Social impact specialist, MWH
- Mr. Dang Huu Luu, Resettlement specialist, MWH
- Eighteen representatives of father-front committee, woman union, affected households
(see Table B1 below for affected individuals)

Organization

Truong Tho Ward PC received official request (2028/UBND-VP, 18/9/2009) from Thu Duc District PC requesting assistance to SAWACO and MWH's specialists to convene a public meeting to discuss environmental concerns and issues of Component 1 of HCMC Water Supply Project (new D2400 pipeline from Binh Thai to Ha Tien Cement Factory).

Proceedings

- Mr. Tran Van Binh; commune PC Chairman opened meeting by stating meeting objectives, and invited representatives of MWH to brief participants on the project.
- Don Meisner introduced the environmental evaluation of the project, the purpose and objectives of the meeting, and reviewed meeting agenda.
- Mr. Nam, MWH engineer introduced project, construction activities, and expected project schedule.
- Ms. Hoa provided instructions to the participants on the information needed for the environmental evaluation. Participants were split into two subgroups and given the following three questions to guide their discussions:

- 1) Identify environmental concerns or issue of project;
- 2) Propose ways to prevent or manage issue of concern; and
- 3) Identify best way for public or stakeholders to be able to contact and inform SAWACO of any future concern or issue of project.

All participants were divided in two subgroups (all affected persons in one group versus representative/stakeholders in another group)

Comments and Concerns of Project Identified by Participants:

- The construction period is very long, and will cause localized flooding, environmental deterioration, and disruption of traffic flow.
- Request that pipeline be fully completed in small sections at a time with complete site restoration in order to minimize inconvenience to the residents.
- Experience with other construction is that contractor usually did not clean up site after construction that has caused many difficulties for local traffic and household access. For example, a contractor of another distribution pipeline project left cement blocks in front of house a year after construction completed.
- Participants claimed that compensation is usually at low price, and requested that compensation for land acquisition must be at the real current price.
- In the ward area a similar project caused damage to houses but after 2 years people still had not received any compensation because as the agreement was that compensation would be happen only after all construction activities are finished.
- Representatives of each group raised concerns of the following specific environmental quality issues during construction:
 - a) dust and noise emissions during construction;
 - b) localized flooding due to poor drainage of wastewater and storm water;
 - c) land depression (subsidence) during the construction phase and operation phase; and
 - d) prolonged construction period and delay of completion
- Mitigation measures proposed by participants:
 - a) watering construction site to reduce dust generation;
 - b) appropriate construction daily schedule, and equipment operation to minimize noise generation;
 - c) complete site clean up and restoration to original state upon completion of the construction;
 - d) using adequate pumping system and appropriate construction methodology to minimize local flooding;
 - e) reduce construction time by mobilizing more equipment/machinery;
 - f) establish a program to supervise construction activities
- Future communication with SAWACO:

The participants identified the need to establish a HOTLINE that would enable the public to contact SAWACO easily during the construction phase of the project. A large sign should be placed at each construction area with telephones numbers of SAWACO officers that would be most responsive to public input.

Summary of Next Steps of Evaluation

- Don Meisner concluded the meeting with: a) summary of the IEE and content and purpose of resultant environmental management plan (EMP) being prepared for project; b) that concerns raised by participants of the construction phase will be

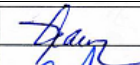
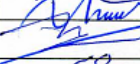

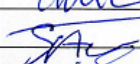
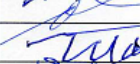




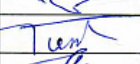
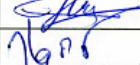







addressed by the mitigation measures of the EMP that SAWACO is responsible to implement; and c) that it is important that the hotline be established to enable continued involvement of the public and stakeholders in the project.

Meeting adjourned 4:00 pm.

Minute taker (edited)
(signed)

Bui Nguyen Xuan Huy

Table B1. Individual Affected Persons Attending Thu Duc Public Meeting

N	Name	Address	Title / Affiliation	Signature
1	Phan Ba' Tho		(CB)Đ chính phường	
2	Trần Văn Bình		P. CTich phường	
3	Bùi Xuân Thiệp		C. Tích Mat Tân	
4	Nguyễn Văn Sơn	46A, Tổ 10, kp6	Hầu Tru'	
5	Đào Văn Thiệu	Tổ 12, kp6	Hầu Tru'	
6	Nguyễn Văn Sáu	9/14 Tổ 10, kp6	hàm ruộng	
7	Nguyễn Huy Phùng	9/29/10 Tổ 10, kp6	C. Bè	
8	Nguyễn Văn Mai	155 Tổ 13, kp6	ở nhà	
9	Nguyễn Văn Kha'	469 Tổ 13, kp6	Hầu Tru'	
10	Vương Bình	kp6	C. Bè	
11	Nguyễn Thị Thanh Loan	86	Đại diện UBND Quận PTH-K'	
12	Nguyễn Thị Dê	13/2 Tổ 12, kp6	ở nhà	
13	Hùng Văn Long	13/11 Tổ 12, kp6	//	
14	Nguyễn Thị Cam	13/9 Tổ 12, kp6	//	
15	Nguyễn Văn Nghĩa	Đường kp6	//	
16	Phạm Thị Hoa	9/29 Tổ 10, kp6	//	
17	Bùi Nguyễn Xuân Huy		Đ chính phường	
18	Đường Thị Tâm Thanh	7/5A Tổ 12 kp6	ở nhà	

**HCMC Water Supply Project
1 Cong Truong Quoc Te, Ward 6, District 3, HCM City**

Ref: ADB TA 7091-VIE

Initial Environmental Evaluation IEE

**Public Consultation Meeting
Thu Duc District**

**Draft Agenda
Attached to Invitation Letter**

MWH Participants:

Mr. Don Meisner, MWH
Ms. Vu Hoang Hoa, MWH
Mr. Trinh Van Nam, MWH

	<u>Person</u>	<u>Estimated Time</u>
1) Introduction to Meeting: <ul style="list-style-type: none">• purpose• objectives	Meisner	15 min
2) Review of agenda:	Meisner	5 min
3) Description of Project: <ul style="list-style-type: none">• overview of HCMC Water Supply Project - 4 project components• detailed description of construction & operation phase activities in/near Thu Duc District	Nam	30 min
4) Identification of Environmental Concerns & Issues of Participants <ul style="list-style-type: none">• common environmental issues of pipeline projects• identification of issues and concerns of all participants	Hoa	10 min
	Participants	90 min
5) Environmental management of impacts & issues <ul style="list-style-type: none">- e.g., mitigations, monitoring- further involvement of affected persons	JDM	20 min
6) Further questions/comments	Participants	10 min
7) End		

XVI. APPENDIX C: MINUTES OF PUBLIC MEETING IN BINH THANH DISTRICT

**Socialist Republic of Vietnam
Independence - Freedom - Happiness**

Minutes of Public Consultation Meeting

Binh Thanh District
HCMC

October 15, 2009
9:00 am

Location: Cultural House of Ward N^o 19

Participants

- Mr. Bui Hai Thien Vu, Natural Resources and Environment Division of Binh Thanh District's PC
- Mrs. Bui Thi Thu Ha, Vice-Chairman of Ward N^o 19 PC, Binh Thanh District
- Mr. Do Quy, Vice- Chairman of Father Front Land of Ward N^o 19, Binh Thanh District
- Mrs. Lam Thi Hai, Chairman of Woman Union of Ward N^o 19, Binh Thanh District
- Mr. Nguyen Khac Trung, representative of Ward N^o 25 PC, Binh Thanh
- Mr. Nguyen Vo Hoang Lam, environmental officer of Ward N^o 25 PC, Binh Thanh
- Ms. Tran Thi Lan, representative of Ward N^o 22 PC, Binh Thanh District
- Ms. Duong Thi Thuy, Chairman of Father Front Land of Ward N^o 22, Binh Thanh District
- Mrs. Nguyen Thi Thanh Loan, Environmental Officer of Natural Resources and Environment Division, Thu Duc district - Facilitator
- Mr. Ngo Quang Tien, SAWACO
- Mr. Don Meisner, Environment specialist, MWH
- Ms Vu Hoang Hoa, Environment specialist, MWH
- Mr. Trinh Van Nam, Design specialist, MWH
- Don Meisner, Environment specialist, MWH
- Vu Hoang Hoa, Environment specialist, MWH
- Trinh Van Nam, technical specialist, MWH
- Ngo Quang Tien, engineering, SAWACO
- Twenty four affected households of Wards N^o 19, 22, 25
(see Table C1 below for affected individuals)

Organization

PC Wards N^o 19, 22, 25 received official request (225/VP-TH, 2/10/2009) from Binh Thanh District PC requesting assistance to SAWACO and MWH's specialists to convene a public meeting to discuss environmental concerns and issues of Component 2 of HCMC Water Supply Project (new D2400 pipeline from Sai Gon Bridge to central of Ho Chi Minh city along Nguyen Huu Canh street (option 1) and Dien Bien Phu street (option 2)).

Proceedings

- Mrs. Vu Hoang Hoa, environmental specialist of MWH opened meeting by stating meeting objectives, and briefly introducing MWH's and SAWACO's representatives.
- Don Meisner introduced the environmental evaluation of the project, the purpose and objectives of the meeting, and reviewed meeting agenda.

- Mr. Nam, MWH engineer introduced project, construction activities, and expected project schedule.
- Ms. Hoa provided instructions to the participants on the information needed for the environmental evaluation. Participants were split into two subgroups and given the following three questions to guide their discussions:
 - 1) Identify environmental concerns or issue of project;
 - 2) Propose ways to prevent or manage issue of concern; and
 - 3) Identify best way for public or stakeholders to be able to contact and inform SAWACO of any future concern or issue of project.
- All participants were divided in two subgroups (all affected persons and representatives of ward N019 and 25 in one group and all affected persons, representatives of ward N022 and representative of Binh Thanh District in another group)

General Comments and Concerns Raised During Plenary Discussion (translated):

- The adopted construction methods and construction option must have least impacts on local residents as many existing projects are affecting living along Nguyen Huu Canh residents with regards to the business, income, local traffic, and construction waste.
- When considering proposed options, the preferred option should be more economically but also less impacts on residents.
- As per explanation from MWH's engineering officer on construction activities and from our experiences, we think the option 2 that passes Dien Bien Phu would cause less impacts on the residents.
- At the next stage, SAWACO must invite more people to the meeting and inform on the decision adopted.
- Construction period is rather long, and will cause localized environmental deterioration, and disruption of traffic flow.
- Regular meeting and 2 ways communication between investor-construction contactors-residents-wards' representatives should be in place. Information on implementation plan must be regularly updated for District and Wards PC. Contractors must follow commitment written in the Environmental protection Certificate and local residents could be a part of monitoring team.
- Representatives of each group raised concerns on the following specific environmental quality issues during the construction:
 - a) Dust and noise emissions impacts due to open digging, local traffic jam due to potholes and road block;
 - b) localized flooding due to siltation, poor drainage of wastewater and stormwater,
 - c) Site restoration after the construction and
 - d) Possible prolonging of construction period and delay in the completion
- Mitigation measures proposed by participants:
 - a) Watering construction site to reduce dust generation;
 - b) Appropriate scheduling of daily construction works and equipment

- operation to minimize noise generation;
 - c) Complete site clean up and restoration to original state upon completion of the construction;
 - d) Using appropriate construction methods to minimize dust, air and vibration impacts on residents and local premises;
 - e) Reduce construction time by mobilizing more equipment/machinery;
 - f) Establish a program to supervise construction activities with participation of local residents.
 - g) Future communication with SAWACO:
- The participants identified the need to establish a HOTLINE that would enable the community to contact SAWACO and contractors easily during the construction phase of the project. SAWACO need to have a working group to response to all residents complains/concerns.

Summary of Specific Responses to Three Questions Asked of Subgroups (translated)

Question 1: *What are your environmental concerns & issues of project?*

- Project construction start date, construction duration, daily hours;
- Air and acoustic environment: noise, dust, exhaust gas, vibration;
- Waste water discharge affecting surrounding areas;
- Blocking of drainage canals by construction materials/spoil;
- Flooding of adjacent properties;
- Spillage of construction materials during the transportation;
- Disruption to the local traffic;
- Damages to streets due to transportation activities;
- Disruption to normal street business of nearby households;
- Poor environmental amenity surrounding construction sites; and
- Safety hazards for local residents

Question 2: *Propose ways to prevent or manage the concerns or issues.*

- Contractors to conduct consultations with affected households to understand their needs;
- Conducting survey of existing conditions of households;
- Pipeline should go through Dien Bien Phu street to reduce negative impacts;
- Construction schedule should be adhered to; construction period should be shorten as much as possible;
- Resident's complaints should be promptly and satisfactorily responded to;
- Appropriate traffic diversion/coordination to reduce impacts on the traffic;
- Quality restoration of street surface immediately after construction;
- Local people should be allowed to supervise the construction;
- Investor/contractor to keep commitments to mitigate impacts. There should be sanction policies in place for contractors failing to fulfill the commitments;
- Having appropriate fencing of the construction sites;
- Assistance/compensation should be considered for affected trading households;
- Having appropriate areas for spoil disposal;
- Covering transportation vehicles to minimize dust generation;
- Watering streets to reduce dust;
- Limiting noisy construction activities to daytime; and
- Any accidents must be promptly dealt with.

Question 3: *Identify best way for the public or stakeholders to contact and inform SAWACO of any future concerns or issues of project.*

- Establish designated hotline to receive residents' concerns;
- Having posters at construction sites with contact details of contractors/investor;
- SAWACO, contractors and local PCs should designate representatives to deal with environmental problems;
- A taskforce with representatives of the investor, contractors, local WPCs and representatives of local residents would be useful to deal with any emerging issues; and
- The investor to regularly coordinate with local authorities in supervising the contractors

Summary of Next Steps of Evaluation

- Don Meisner concluded the meeting with:
 - a) summary of the IEE and content and purpose of resultant environmental management plan (EMP) being prepared for project;
 - b) that concerns raised by participants of the construction phase will be addressed by the mitigation measures of the EMP that SAWACO is responsible to implement; and
 - c) that it is important that the hotline be established to enable continued involvement of the public and stakeholders in the project.

Meeting adjourned 12:15 pm.

Minute taker (edited)
(signed)
Nguyen Thi Thanh Loan

Table C1. Individual Affected Persons Attending Binh Thanh Public Meeting

N	Name	Address	Title / Affiliation	Signature
STT	Tên	Địa chỉ	Thành phần tham gia	Chữ ký
31	Nguyễn Minh Trung	10/11/10 F.1		
32	Nguyễn Văn Hùng	1/1		
3	Lê Văn Tào	10/15/11 F.1	Tập 44 (P19)	
4	Nguyễn Văn Hùng	13/1/11 F.1	Tập 44 (P19)	
5	Hồng T. Hải	252 NHC		
6	Phan Hải Hòa	1/1/11 F.1	CV	
7	Bùi Văn Hùng	115 P19		
8	Ngô Văn Hùng	P19		
9	Lâm Thị Hải	Hà PN		
10	Hoàng Văn Hùng	12/15/11 NHC	H3 D.1	
11	Nguyễn Văn Hùng	15/1/11 NHC	H3 D.1	
12	Nguyễn Văn Hùng	15/1/11 NHC	H3 D.1	
13	Nguyễn Văn Hùng	15/1/11 NHC	H3 D.1	
14	Nguyễn Văn Hùng	15/1/11 NHC	H3 D.1	
15	Nguyễn Văn Hùng	15/1/11 NHC	H3 D.1	
16	Nguyễn Văn Hùng	15/1/11 NHC	H3 D.1	
17	Nguyễn Văn Hùng	15/1/11 NHC	H3 D.1	
18	Nguyễn Văn Hùng	15/1/11 NHC	H3 D.1	
19	Nguyễn Văn Hùng	15/1/11 NHC	H3 D.1	
20	Nguyễn Văn Hùng	15/1/11 NHC	H3 D.1	
21	Nguyễn Văn Hùng	15/1/11 NHC	H3 D.1	
22	Nguyễn Văn Hùng	15/1/11 NHC	H3 D.1	
23	Nguyễn Văn Hùng	15/1/11 NHC	H3 D.1	
24	Nguyễn Văn Hùng	15/1/11 NHC	H3 D.1	

**HCMC Water Supply Project
1 Cong Truong Quoc Te, Ward 6, District 3, HCM City**

Ref: ADB TA 7091-VIE

Initial Environmental Evaluation IEE

**Public Consultation Meeting
Binh Thanh District**

**Draft Agenda
Attached to Invitation Letter**

(see Thu Duc District Agenda)

XVII. APPENDIX D: TCVN AND QCVN ENVIRONMENTAL STANDARDS

TCVN 5937:2005: Air quality – ambient air quality standards.

Table C1: Ambient Air Quality Standards (µg/Nm³)

Parameter	Average				
	Average over 1 hour	Average over 8 hours	Average over 24 hours	Average over 1 year	Equivalent to
SO ₂	-	-	125	50	WHO guidelines
CO	30,000	10,000	-	-	WHO guidelines
NO ₂	200	-	-	40	WHO guidelines
O ₃	120	-	80	-	US EPA guidelines
TSP	300	-	200	140	as previous TCVN
Particulate matters ≤ 10µm (PM ₁₀)	-	-	150	50	Singaporean standards
Pb	-	-	1.5	0.5	ASEAN countries standards

TCVN 5945:2005: Industrial waste - Discharge standards

Table C2. TCVN 5945:2005: Industrial waste discharge standards

Parameter	Unit	Limited value		
		A	B	C
Temperature	°C	40	40	45
PH value		6 đến 9	5,5 đến 9	5 đến 9
Odor		Not unpleasant	Not unplesant	-
Color, Co-Pt at pH=7		20	50	-
BOD ₅ (20 ⁰ c)	mg/l	30	50	100
COD	mg/l	50	80	400
suspended solids	mg/l	50	100	200
Arsenic	mg/l	0,05	0,1	0,5
Cadmium	mg/l	0,005	0,01	0,5

Lead	mg/l	0.1	0.5	1
Chlorine	mg/l	500	600	1000
Cr (VI)	mg/l	0.05	0.1	0.5
Cr (III)	mg/l	0.2	1	2
mineral oil and fat	mg/l	5	5	10
animal or vegetable fat and oil	mg/l	10	20	30
Cu	mg/l	2	2	5
Zn	mg/l	3	3	5
Mn	mg/l	0.5	1	5
Ni	mg/l	0.2	0.5	2
PCBs	mg/l	0.003	0.01	0.05
total phosphorus	mg/l	4	6	8
Fe	mg/l	1	5	10
residual chlorine	Mg/l	1	2	-
Tn	mg/l	0.2	1	5
Hg	mg/l	0.005	0.01	0.01
total N	mg/l	15	30	60
ammonia (as N)	mg/l	5	10	15
Fluoride	mg/l	5	10	15
Phenol	mg/l	0.1	0.5	1
Sulphide	mg/l	0.2	0.5	1
Cyanide	mg/l	0.07	0.1	0.2
Coliform	MPN/100 ml	3000	5 000	-
herbicide: organo phosphorous	mg/l	0.3	1	

herbicide: organic chlorine	mg/l	0.1	0.1	
LC10 bioassay toxicity		90% of fish survived after 96h in 100% of wastewater		

A: Waste water being discharged into water bodies intended for domestic uses

B: Waste water being discharged into water bodies other than for domestic uses and those listed in column A

C: the discharge is only permitted to designated bodies such as dedicated ponds or drainage system leading to concentrated waste water treatment plants

TCVN 5949:1998 - Noise in public and residential areas; maximum permitted noise levels.

Table C3. Maximum Ambient Noise Criteria in TCVN 5949:1998

Land Use	Day Time (6h - 18h)	Evening (18 h – 22h)	Night Time (22h – 6h)
Quiet areas – hospitals, libraries, schools	50	45	40
Residential areas	60	55	45
Commercial and services areas	70	70	50
Small industrial factories mixed with residential	75	70	50

TCVN 6962-2001: Vibration emitted by construction works – Maximum permitted levels in the environment of public and residential areas (dBA)

Table C4. Maximum permitted levels vibration in the environment of public and residential areas (dBA)

No.	Areas	Time	Permissible value, dB	Remarks
1	Special Areas	7h - 19h	75	Continuous working time not more than 10 hours/day
		19h - 7h	Background level	

2	Residential areas. hotels. restaurants. office buildings and others	7h - 19h	75	Continuous working time not more than 10 hours/day
		19h - 7h	Background level	
3	Mixed areas: Residential within commercial	6h - 22h	75	Continuous working time not more than 14 hours/day
		22h - 6h	Background level	

Note: Background level is ambient vibration level.

QCVN 09:2009: groundwater quality standards

Table C5: Limit levels of ground water quality parameters

N	Parameter	Unit	Limit level
1	pH	-	5,5-8,5
2	Hardness(CaCO ₃)	mg/l	500
3	Total solid	mg/l	1500
4	COD (KMnO ₄)	mg/l	4
5	Amoni (tính theo N)	mg/l	0,1
6	Clorua (Cl ⁻)	mg/l	250
7	Florua (F ⁻)	mg/l	1,0
8	Nitrit (NO ₂ ⁻)(based on N)	mg/l	1,0
9	Nitrat(NO ₃ ⁻)(based on N)	mg/l	15
10	Sulfat(SO ₄ ²⁻)	mg/l	400
11	Xianua (CN ⁻)	mg/l	0,01
12	Phenol	mg/l	0,001
13	As	mg/l	0,05
14	Cd	mg/l	0,005
15	Pb	mg/l	0,01
16	Cr ⁶⁺	mg/l	0,05
17	Cu	mg/l	1,0
18	Zn	mg/l	3,0
19	Mn	mg/l	0,5
20	Hg	mg/l	0,001
21	Fe	mg/l	5
22	Se	mg/l	0,01
23	Total radio actives anfa	Bq/l	0,1
24	Total radioactive beta	Bq/l	1,0
25	E-Coli	MNP/100ml	Không phát hiện thấy
26	Coliform	MNP/100ml	3

QCVN 08:2009: surface water quality standards

Table C5: Limit levels of surface water quality parameter

N	Parameter	Unit	Limit level			
			A		B	
			A1	A2	B1	B2
1	pH		6-8,5	6-8,5	5,5-9	5,5-9
2	DO	mg/l	> 6	> 5	> 4	> 2
3	TSS	mg/l	20	30	50	100
4	COD	mg/l	10	15	30	50
5	BOD ₅ (20°C)	mg/l	4	6	15	25
6	Amoni (NH ₄ ⁺) (based on N)	mg/l	0,1	0,2	0,5	1
7	Clorua (Cl ⁻)	mg/l	250	400	600	-
8	Florua	mg/l	1	1,5	1,5	2
9	Nitrit (NO ₂ ⁻) (based on N)	mg/l	0,01	0,02	0,04	0,05
10	Nitrat (NO ₃ ⁻) (based on N)	mg/l	2	5	10	15
11	Phosphat (PO ₄ ³⁻) (based on P)	mg/l	0,1	0,2	0,3	0,5
12	Xianua (CN ⁻)	mg/l	0,005	0,01	0,02	0,02
13	As	mg/l	0,01	0,02	0,05	0,1
14	Cd	mg/l	0,005	0,005	0,01	0,01
15	Pb	mg/l	0,02	0,02	0,05	0,05
16	Cr ³⁺	mg/l	0,05	0,1	0,5	1
17	Cr ⁶⁺	mg/l	0,01	0,02	0,04	0,05
18	Cu	mg/l	0,1	0,2	0,5	1
19	Zn	mg/l	0,5	1,0	1,5	2,0
20	Mn	mg/l	0,1	0,1	0,1	0,1
21	Fe	mg/l	0,5	1,0	1,5	2,0
22	Hg	mg/l	0,001	0,001	0,001	0,002
23	Surface actives	mg/l	0,1	0,2	0,4	0,5
24	oils & grease	mg/l	0,01	0,02	0,1	0,3
25	Phenol (total)	mg/l	0,005	0,005	0,01	0,02
26	Herbicide Organic Clor Aldrin+Dieldrin Endrin BHC DDT Endosunfan (Thiodan) Lindan Chlordane Heptachlor	microg/l microg/l microg/l microg/l microg/l microg/l microg/l microg/l microg/l	0,002 0,01 0,05 0,001 0,005 0,3 0,01 0,01	0,004 0,012 0,1 0,002 0,01 0,35 0,02 0,02	0,008 0,014 0,13 0,004 0,01 0,38 0,02 0,02	0,01 0,02 0,015 0,005 0,02 0,4 0,03 0,05
27	Pesticides Organic phosphor Paration Malation	microg/l microg/l	0,1 0,1	0,2 0,32	0,4 0,32	0,5 0,4
28	Herbicides 2,4D 2,4,5T Paraquat	microg/l microg/l microg/l	100 80 900	200 100 1200	450 160 1800	500 200 2000
29	Total radioactive Anfa	Bq/l	0,1	0,1	0,1	0,1
30	Total radioactive Beta	Bq/l	1,0	1,0	1,0	1,0
31	E.Coli	MPN/10 0ml	20	50	100	200
32	Coliform	MPN/10 0ml	2500	5000	7500	10000