

Environmental Monitoring Report

Semestral Report from January to June, 2011
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VIE: Phuoc Hoa Water Resources Project

Prepared by Institute of Coastal and Offshore Engineering for the Hydraulic
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CURRENCY EQUIVALENTS

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ABBREVIATIONS AND ACRONYMS

ADB	Asian Development Bank
AFD	Agence Francais de Developpement
DARD	Department of Agriculture and Rural Development
DTPW	Department of Transport and Public Works
DOC	Department of Construction
DOF	Department of Finance-Pricing
DONRE	Department of Natural Resources and Environment
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
GIS	Geographical Information System
HCMC	Ho Chi Minh City
ICOE	Institute of Coastal and Offshore Engineering
ICMB9	Investment and Construction Management Board No.9
IDA	International Development Association (of the World Bank)
JBIC	Japan Bank for International Cooperation
MARD	Ministry of Agriculture and Rural Development
MONRE	Ministry of Natural Resources and Environment
PAF	Project Affected Families
PHWRP	Phuoc Hoa Water Resources Project
RAP	Resettlement Action Plan
RFP	Request for Proposals
RPF	Resettlement Policy Framework
TOR	Terms of Reference
WB	World Bank

NOTES

- The fiscal year (FY) of the Government of Vietnam and Ministry of Agriculture and Rural Development ends on 31 December. FY before a calendar year denotes the year in which the fiscal year ends, e.g., FY2011 ends on 31 December 2011.
- In this report, "\$" refers to US dollars.

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FOREWORD

Phuoc Hoa Water Resources Project (Project) consists of two parts: Part A – Support for Institutional and Integrated Development, and Part B – Construction of Water Resources Infrastructure. Currently, the project has implemented series of components including construction activities of the Headworks, Phuoc Hoa – Dau Tieng transfer canal, Tan Bien irrigation canal ... that has caused different negative and positive impacts to the environment. The task for Environmental Packages (Packages) is to collect environmental indicators regularly and other related issues, record, detect and respond different impacts of the Project to environment in order to adjust, overcome and mitigate the environmental impacts.

For the purpose of coordination, monitoring, and implementation of EMP packages, the six monthly progress report will summarize all activities and implementation status of environmental packages. The report also orientate and guide in implementing tasks of EMP packages as well as monitor and speed up the implementation progress of the tasks as proposed schedule. In addition, the report also monitors current situation in the project area and its vicinity, and develop the database for environmental management programmes of project as well as to ensure that the implementation can be done in compliance with environmental management plan and Environmental Protection Law of Vietnam.

The six monthly progress report as a basis for ICMB9 to upgrade their tasks of management and coordination and it also helps ADB to monitor the implementation status of the project as well as the concerned environmental changes.

1. Introduction

1.1. Phuoc Hoa Project Introduction

- (i) Phuoc Hoa Water Resources Project funded by Asian Development Bank (ADB) with the Loan No. 2025 (SF) according to Special Draw Out Rights (SDR) equivalent to 90 million USD and 2 loans of Agency Française de Developement (AFD) with a total amount of 34 million USD. The ADB loan was approved on 27 November 2003, signed on 8 April 2004 and took efforts from 23 August 2004. The AFD loans were approved on 20 November 2003. The project objective is to provide additional water to Sai Gon River and Vai Co East River for agriculture development with irrigation and enhance current water sources supply in order to control salinity, domestic, municipal industrial water supply (DMI) Ho Chi Minh City and neighbouring provinces. This project will use the approach of integrated development to increase agricultural production by enhancing effective and sustainable water resources management.
- (ii) The Project consists of two parts: Part A – Support for Institutional and Integrated Development, and Part B – Construction of Water Resources Infrastructure.
- (iii) The Project will support construction of the Phuoc Hoa barrage and transfer canal to convey water from the Be river to the existing Dau Tieng reservoir on the Saigon river. Two new irrigation areas will be constructed as: Tan Bien irrigation system in Tay Ninh province; and Duc Hoa irrigation system in Long An province. The ADB loan is financing to construct Phuoc Hoa barrage, transfer canal and main canals of three irrigation systems, as well as project management costs. The AFD loans are financing infrastructure development of tertiary canals for the irrigation systems and support for the on-farm and social development program (OSDP).
- (iv) The executing agency (EA) is the Ministry of Agriculture and Rural Development (MARD), which originally provided overall management and coordination through its Central Project Office (CPO) based in Hanoi. In order to improve project management and coordination, from June 2006, MARD assigned the overall responsibility for project implementation to Investment and Construction Management Board No.9 (ICMB9) in Ho Chi Minh City (HCMC), and Departments of Agriculture and Rural Development (DARDs) of four provinces (Binh Duong, Binh Phuoc, Tay Ninh and Long An). ICMB9 provides an interface with the ADB and AFD, and is directly responsible for management and construction of the Phuoc Hoa Barrage, Phuoc Hoa – Dau Tieng transfer canal, and main canals for the two irrigation systems and transfer to Dau Tieng Irrigation management company (IMC) for

management. The role of ICMB9 is to provide overall management assistance and coordination, and to provide instruction to the DARDs and PPMBs with assistance of Black & Veatch International (BVI) Consultant.

- (v) Project environmental management and environmental Impact assessment (EIA) study was prepared by Black & Veatch International (BVI) in September, 2001 (BVI 2001a and approved by the Asian Development Bank (ADB) in March 2003 (ADB 2003a). In accordance with Vietnamese environmental law, a third EIA report (ENTEC 2007) was carried out in April 2005 by the Environmental Technology Centre (ENTEC), under contract (A41) to ICMB9 from 2005 - 2007. This EIA was revised and submitted to Ministry of Natural Resources and Environment (MONRE) for approval in September 2007. MONRE approved the project EIA in early 2008.

As required by ADB, a follow-up Environmental Management Plan (EMP) for the Project was prepared by BVI from late 2006 – 2007 period (BVI 2007c). The EMP was approved by MARD and ADB in January 2008. The EMP documents provide details of the environmental management, monitoring and protection programmes.

1.2. Package OP4 Introduction

1.2.1. Scope of Works

- Overall management, co-ordination, supervision and monitoring of the Phuoc Hoa Water Resource Project environmental and EMP implementation programmes;
- Supervision and monitoring of environmental programmes and EMP implementation consultants and contracts;
- Collection, storage and distribution of EMP monitoring data, technical reports and civil contracts or EMP techniques for the project extension. Providing the information of progress and budgets from EMP consultants and other Provincial sources, and presenting these data in accordance with an appropriate form;
- Carry out field surveys and contact with provincial governments and communities to inspect the environmental conditions in the project area and its vicinity as well as downstream areas in order to ensure that construction contractors, EMP and project activities are implemented in accordance with environmental laws, safeguards and signed agreements;
- Provide main information of the report and comments to ICMB9 regarding problems and solutions relating to the EMP implementation, EMP consultant performance, environmental trends in the project area or within river basin of the project and environmental impacts from the project;

- Acting as a spokesman for the environmental aspect of the project and representing ICMB9 in general scope and official forums relating to ministerial, provincial levels and communities as well as media liaison;
- Provide six monthly report to ICMB9, MARD, ADB, AfD, MONRE and organizations, PPCs who participating in environmental condition of the project as well as relating to above duties. Responsibilities of the environmental staffs, ICMB9 environmental division, consultants and contractors must comply with environmental requirements and trends of the project based on the river basin.

1.2.2. Specific Tasks

- Understanding the existing and proposed Phuoc Hoa water resources project environmental management programme;
- Management, supervision and monitoring of EMP implementation contractors and contracts;
- Supervision and monitoring of EMP implementation programmes and environmental compliance;
- Supervision and monitoring of environmental outputs, environmental trends and project environmental impacts;
- Ministerial, provincial and public liaison;
- Reporting and data distribution.

2. Activities of OP4, BVI and ICMB9 in the first six months 2011

2.1. Activities of OP4

Based on TOR and in order to implement the tasks of coordination, supervision of EMP packages. OP4 consultant has carried out activities including the meetings with EMP consultants, employer, donors, local authorities and others relating to relevant issues of the project as follows:

- On 11 April 2011, a meeting was held with participation of representatives of ICMB9, ADB, ADB, and BVI to review the progress of EMP packages and plan a site visit.
- On 20 June 2011, had a meeting with representatives of ICMB9, BVI and EMP consultants to discuss on progress of packages, outstanding issues and solution.

In addition to aforementioned meetings, the OP4 consultant has also cooperated with relevant agencies to involve in field surveys in the project area and worked with local authorities. These activities are summarized in Table 1.

In accordance with each package's TOR, the review and assessment activities of implementation results of EMP packages through progress reports have also been carried out frequently.

2.2. Activities of ICMB9

In the first six months of 2011, ICMB9 cooperated with BVI and OP4 consultants to carry out some main contents as follows:

- Overall management on the progress and implementation of EMP packages;
- Organized meetings with the relevant authorities in order to monitor, supervise and speed up the progress as well as to solve outstanding issues of EMP packages.
- Worked with local authorities regarding the implementation of packages MT2 and MT8.
- Inspected, evaluated and requested contractors to implement the Environmental Management Plan of the project seriously.

2.3. Activities of BVI

The main activities of BVI consultant in the first six months of 2011 included:

- Supported ICMB9 in carrying out the management and implementation of EMP packages.
- Cooperated with OP4 Consultant to comment and assess the implementation

results of EMP packages through their progress reports of consultants.

- Attended and organized meetings between the EMP consultants and local authorities during the implementation.
- Supported ICMB9 in preparing the proposed documents for packages which are going to open the bidding such as MT1, MT9, etc.

Table 1: Summary of contents and implementation results

No.	Date	Cooperative units	Supervision contents	Supervision results
1	11/4/2011	ICMB9, package MT5 and representative of ADB mission,	<ul style="list-style-type: none"> - Inspected gauging stations on Sai Gon river. - Inspected the implementation status of package MT5. 	<ul style="list-style-type: none"> - The ADB's inspection site was not carried out as the same time with the monitoring time. However, the mission stated that selected gauging stations are logical and the monitoring data is typical and trustable. - The inspection was done at the time that the tide was ebbing; flow velocity was average and light traffic of navigation. - Base on the inspection results, the monitoring activities were done in accordance with current norms and regulations.
2	11/4/2011	ICMB9, package MT2 and representative of ADB mission,	<ul style="list-style-type: none"> - Inspected the implementation status of package MT2. - Inspected the selected forestation pilot, 6 ha (19 households). 	<ul style="list-style-type: none"> - Through the inspection and contacting with local people, it was found that the local people wanted to forest on their owned land and they committed to comply as the guides and forestation process of the Consultant. - Inspected some sections of the future Phuoc Hoa reservoir banks, it was found that the erosion appeared at many locations in which the most concern is that the local people encroached compensated land cultivated causing collapse. - The erosion mostly appeared at the area with low adhesive soil and the soil surface was not cover by vegetation.
3	12/4/2011	ICMB9, representative of ADB mission and construction packages	<ul style="list-style-type: none"> - Inspected construction site of package 1C - Inspected EMP implementation status at packages 	<ul style="list-style-type: none"> - At the time of inspection, the construction activities at package 1C were very busy with many equipment and workers. - Due to the most of excavated materials at this canal section was Kaolin, dust was easy to disperse into the air because of loose soil. Therefore, at the time of inspection, the dust density in the air was observed very high. The construction contractor watered but the dust was not subsided. Fortunately, the construction site located far from the resident area, the dust did not affect the resident population area. - Due to most of excavated materials was not treated such as transferring to the disposal area or the material was not covered, chance of dust dispersed into the air is very high.
4	13/4/2011	ICMB9, BVI and representative of ADB mission	<ul style="list-style-type: none"> - Work with the Management Board of Lo Go – Xa Mat National Park. - Inspected the buffer 	<ul style="list-style-type: none"> - Representative of Lo Go – Xa Mat National Park (Mr. Nguyen Truong Xuan) expressed his reservation on unwanted impacts could be occurred during constructing works in the area such as: <ul style="list-style-type: none"> ✓ It could make the groundwater level subside, this could affect the existing animal and plant of the National Park;

			zone and core zone of the National Park	<ul style="list-style-type: none"> ✓ When the project finished, the cultivation areas increase that means fertilizers and pesticides would also increase, causing pollution for the environment; ✓ The works could limit the drainage capacity in the area. <p>Through the inspection of the buffer zone and the core zone, it was found that the National Park has a diver ecosystem and a rich and strongly developed plants.</p>
5	23/4/2011	Package MT6	<ul style="list-style-type: none"> - Inspected the Duc Hoa irrigation sub-project. - Supervised the acid sulphate soils monitoring at Duc Hoa irrigation system area, Long An. 	<ul style="list-style-type: none"> - As observed, soil in inspected area was highly contaminated acid sulphate. - Due to the inspection was carried out in the dry season, farms and canals were dried. - The monitoring activities were carried out in accordance with current regulations and norms.

3. Implementation of EMP packages in the first six months of 2011

3.1. Package MT2

The contract agreement of Package MT2 was signed in April 2010. The consultant has carried out office works and field surveys. In the first six months of 2011, the consultant submitted the Quarterly report I and II.

Base on the contents and requirements of the consulting contract, the consultant selected and recovered related documents as well as proposed specific working plans for each quarter and implemented contents of Task I and II in accordance with TOR of the package. The consultant organised site visits to the project area in order to evaluate, determine potential eroded locations and find out causes. In addition, the consultant also worked with local authorities and local people regarding the pilot forestation implementation.

During the implementation, the consultant actively operated with ICMB9 and local authorities, especially departments and divisions of Binh Duong and Binh Phuoc provinces. Based on the implementation results and compared to the TOR of the consulting contract, up to now, the consultant has implemented in accordance with the proposed schedule and required quantities.

3.2. Package MT4

The contract agreement of Package MT4 was signed in January 2010. At present, the MT4 consultant completed the Inception report, the first six monthly report of 2010, the implementation report of 2011 (draft report) and is implementing other activities.

For the site inspection, the consultant carried out site surveys and site inspections to the project area in March, April and May. The site inspections were done at headworks, Be river basin, fish path and other locations that may affect the Phuoc Hoa fishery activities in order to reassess the status and changes may occur during the construction as well as monitored fish path construction. In addition, for the establishment of Be river and Phuoc Hoa forest and fisheries association, the consultant carried out the site surveys, interviewed the local people and met with the management agencies and local governments on the exploration and fishery status at the local area. For the office works, the consultant carried out the selection of documents relating to implementation contents of the package, developed the specific programs and contents for the Phuoc Hoa fisheries management programmes, Be River and lower Dong Nai fishery management strategy ... and some other relevant contents.

In general, the consultant implemented significantly and kept abreast of

contents of TOR and the consulting contract. The implementation results met the requirements. However, the preparation of the progress reports has not done well.

3.3. Package MT5:

The contract agreement of Package MT5 was signed in September 2009, January 2010. Up to now, the MT5 consultant has implemented four site survey stages, hydrographic and topographic monitorings (*Stage 1 was carried out in October 2009, Stage 2 in April 2010, Stage 3 in October 2010 and Stage 4 in April 2011*), finished the inception report, monitoring reports of Survey 1, 2, 3 and 4.

In general, the consultant actively implemented the contents according to the consulting contract, organised four site survey stages, 1 stage in 2009, 2 stages in 2010, and 1 stage in April of this year, and selected necessary documents. The measurement and field surveys were implemented seriously with sufficient contents in accordance with current norms and regulations to ensure the quality and meet TOR requirements. Therefore, it is recommended that the consultant continue to implement next tasks timely, and ensure the quality and quantity. The diagram of monitoring network is showed in annexes.

3.4. Package MT6:

The contract agreement of package MT6 was signed in November 2009, up to now, the MT6 consultant completed the Inception Report, monitoring reports in April, June, and August and October 2010 and submitted the monitoring report in April 2011. The monitoring results in April (dry season) 2011 was carried out timely, and ensure the quality and quantity as required in the consulting contract

The consultant completely implemented all EMP requirements and provisions in the contract. The implementation results met the requirements, presented a good capacity of the consultant during the implementation. The consultant finished their tasks timely as scheduled.

However, there were some shortcomings during the preparation of the report, the consultant was requested to revise and resubmit to ICMB9. It is requested that the consultant continue next tasks as scheduled.

The monitoring results of the package will be presented in detail in the environmental status of this report. The diagram of monitoring network is showed in annexes.

3.5. Package MT7:

The contract agreement of package MT7 was signed in October 2008. Up to now, MT7 consultant completed quarterly their reports such as Quarterly report IV/2008, Quarterly report IV in 2009, Quarterly report IV in 2010, and Quarterly report II in 2011. In the first six months of 2011, the consultant carried out some contents as

follow:

- (i) Supervising the EMP implementation status of construction contractors.
- (ii) Supervising the sites of construction packages, including:
 - Monitoring the abiotic environment;
 - Monitoring the biotic environment and vegetation;
 - Monitoring the social environment;
- (iii) Supervising the environment of the construction activities, including:
 - Air environment;
 - Water environment: domestic water, wastewater;
 - Excavated materials, solid waste and construction waste;
 - Toxic waste;
 - Health and working safety;
 - Other issues that affect to the Economic - Social aspect and biological resources;

In general, the consultant completely implemented in accordance with the signed contract agreement with ICMB9. The consultant also presented basic contents: site survey, results of environmental sample analysis, finding the reason and assessing status of each environmental object. And the progress of the implementation of the package in the Quarter I&II/2011 met requirement.

3.6. Package MT8:

The contract agreement of package MT8 was signed contract June 30th 2011. Base on the technical proposals of the consultant, all implementation contents of the package MT8 are done according to following stages:

Stage 1: During 4 weeks from the date started the assignment, the consultant carries out the site survey for understanding of the existing monitoring system in order to relocate monitoring stations. Checking and finishing the procedures of land allocation, construction drawings for the construction of the salinity and pollution monitoring stations on the Dong Nai river.

Stage 2: In the next 10 weeks, constructing the salinity and pollution monitoring stations on Dong Nai river with the area of 50 m². Procuring the permanent salinity monitoring and environment equipment, and other necessary chemicals as required in the TOR.

Stage 3: In the Within next 4 weeks, installing devices for 2 salinity monitoring stations on Sai Gon and Vam Co Dong rivers, and 1 combined salinity and pollution monitoring station on Dong Nai river.

Stage 4: In the next 2 weeks, testing constructed monitoring stations and having some proper technical adjustment for the accuracy.

Stage 5: Within next 2 weeks, training for representatives of ICMB9, DONRE, technicians who will be in charge of equipment adjustment, , operation, maintenance, data selection and recording before and after the equipment is installed at the site.

The summary of implementation results of the package MT8 includes: conclusion of the MT8's implementation status, additional issues, outstanding issues and resolved issues. All above contents will be presented in the final report.

Stage 6: In the last 2 weeks, handing over the whole package to ICMB9 and relevant agencies.

After signing the contract, the consultant established an implementation team to implement sequent contents of the package. As required in the technical proposal, the consultant must submit the inception report to the employer after 4 weeks since the contract has been signed. However, until now, the consultant has not finished and submitted this report.

3.7. Package MT10

The contract agreement of package MT10 was signed in November 2009, up to now, the MT10 consultant completed the Inception report. In 2010, the consultant organized four workshops consisting of 2 workshops in Binh Phuoc Province in March 2011 (1 community level workshop and 1 provincial level workshop), 2 workshops in Binh Duong Province in August 2011 (1 community level workshop and 1 provincial level workshop).

In the first six months of 2011, the consultant also carried out 2 workshops consisting of 1 workshop at Ho Chi Minh city in February; 1 workshop at Dong Nai province in April. The workshops were held as scheduled

Workshops were held at provinces in the project area in the first six months of 2011 that considered satisfactory as required in the consulting contract. All workshops contained 4 special subjects and presented by experienced specialists. The contents of implementation were properly organized and in accordance with requirements of the project (TOR), and workshops had a significant effect. The progress of the implementation met requirements as scheduled.

4. Environmental management program at construction sites

4.1. Main construction activities at the sites

Up to the reporting period, the construction activities of packages 1A, 1B, 1C, 1D, PH3 and 1E, 1F were completed. The construction packages of Duc Hoa main canal and Duc Hoa irrigation area are going to implement.

Table 2: List of construction packages are under construction

No.	Name of packages		Name of contractor	Duration	
				Start	Finish
1	1A	Head works	Sinohydro Co., Ltd (SCL)	09/03/2008	08/03/2011
2	1B	Phuoc Hoa – Dau Tieng transfer canal (K0-K12+092)	Licogi9 and Lam Dong hydraulic construction joint stock company (LHC)	14/12/2008	31/03/2011
3	1C	Phuoc Hoa – Dau Tieng transfer canal (K12+092-K26+550)	TICCO, DRECO, SCC, ICCO 40	15/12/2008	15/03/2011
4	1D	Phuoc Hoa – Dau Tieng transfer canal (K26+550-K40+760)	Construction Corporation No. 47	13/12/2008	31/03/2011
5	PH3	Tan Bien Main Canal	Joint Venture of CC24, NA1, NA3	05/02/2009	05/01/2011

Sources: ICMB9

4.2. Impacts to be caused by construction activities

Unexploded Ordinance, Land Mines and Toxic Waste: According to the results reported from the contractor, up to now, the unexploded ordinance, land mines or toxic waste have not been found during excavation or site clearance.

Reinstatement of Temporary Working Areas: The contractors have proper location of borrow pits and disposal areas to minimize the area of the site in accordance with operation process standard of the management of soil, filling materials and reinstatement of borrow pit, disposal areas and stone quarries as indicated in the Technical Specifications and SEMP.

Work in public highway, inside and outside the sites: The contractors have complied with the National Standards in transporting materials on the public highway, avoid moving the construction equipment through residential areas and managing temporary and permanent transportation.

Site drainage: in the beginning stage of the project construction, there were heavy rainfall causing local flood in some locations (foundation pits), however, all problems have been solved. Up to now, the flooding problems are no longer occurred.

Sanitation and site facilities: The contractors comply with the arrangement of worker camps, offices as indicated in drawings. Water supply systems were done and domestic water is enough for requirements of living. However, domestic wastewater and sewerage at the sites have not been treated and discharged directly into the environment. Waste at the packages are collected and disposed to the opening pits for the natural decomposition and these pits close to the offices or worker camps. Most of waste collected pits were not covered by fence

The protection of the surrounding landscape: During the implementation, the contractors have complied with the approved construction layout. The project is not located in the National Parks or Nature Reserves. The contractors also avoid the influence of historical relics during the implementation.

4.3. Environmental monitoring results at the sites

4.3.1. Air quality

❖ At the Headwork (Package 1A):

In comparison with the same period in 2010, dust pollution problem at the Package 1A in the first 6 months of 2011 was trending decrease [Table 3]. In all quarters, the dust concentration was in the range of allowable limit (QCVN 05:2009/BTNMT is $300 \mu\text{g}/\text{m}^3$). The treatment for the reduction of dust concentration is using water spraying to increase the moisture of the soil surface.

This means the dust pollution at the package 1A was paid attention and resolved. However, out of the contractor's effort, the solution also laid on other conditions such as weather, quantities and type of construction. Therefore, it is requested that the package 1A should pay more attention to the solution to minimize the dust pollution in the coming time.

Table 3: Dust concentration at Package 1A

No.	Monitoring locations	Units	2010	2011	Rate (2)/(1)	2010	2011	Rate (4)/(3)
			Q.1 (1)	Q.1 (2)		Q.2 (3)	Q.2 (4)	
1	Offices, worker's campus areas	$\mu\text{g}/\text{m}^3$	390	230	59%	155	200	129%
2	The intersection of roads in construction sites	$\mu\text{g}/\text{m}^3$	1.22 0	110	9%	187	150	80%
3	The construction sites	$\mu\text{g}/\text{m}^3$	770	210	27%	132	140	106%
	QCVN 05:2009/BTNMT	$\mu\text{g}/\text{m}^3$	300	300		300	300	

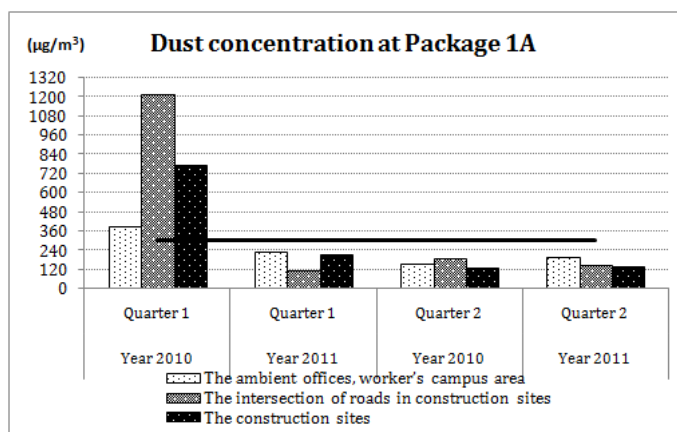


Figure 1: Graph of dust concentration at Package 1A

❖ At the transfer canal construction sites (Packages 1B, 1C, 1D):

Table 4: Dust concentration of Packages 1B, 1C and 1D

No.	Monitoring positions	Units	2010	2011	Rate (2)/(1)	2010	2011	Rate (4)/(3)
			Q.1 (1)	Q.1 (2)		Q.1 (3)	Q.1 (4)	
1	Offices, worker's campus areas	µg/m ³	760	223	29%	216	137	63%
2	The intersection of roads in construction sites	µg/m ³	717	343	48%	272	143	53%
3	The construction sites	µg/m ³	1723	380	22%	268	173	65%
	QCVN 05:2009/BTNMT	µg/m ³	300	300		300	300	

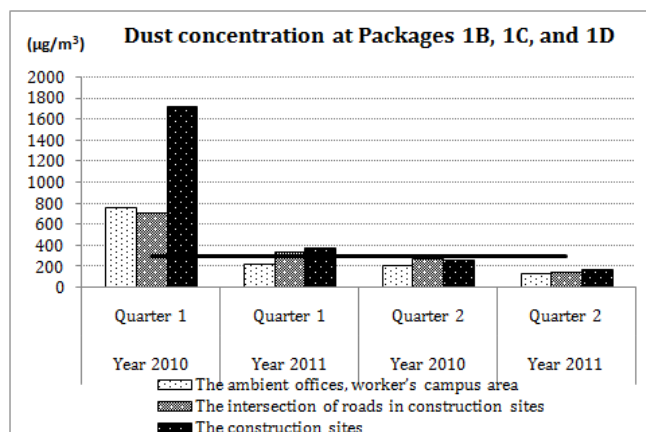


Figure 2: Graph of dust concentration at Packages 1B, 1C, 1D

❖ At the Tan Bien irrigation area (Package PH3):

Table 5: Dust concentration at Packages PH3

No.	Monitoring positions	Units	2010	2011	Rate (2)/(1)	2010	2011	Rate (4)/(3)
			Q.1 (1)	Q.1 (2)		Q.2 (3)	Q.2 (4)	
1	Offices, worker's campus areas	µg/m ³	290	230	79%	267	100	37%
2	The intersection of roads in construction sites	µg/m ³	330	110	33%	245	240	98%
3	The construction sites	µg/m ³	355	210	59%	289	160	55%
	QCVN 05:2009/BTNMT	µg/m ³	300	300		300	300	

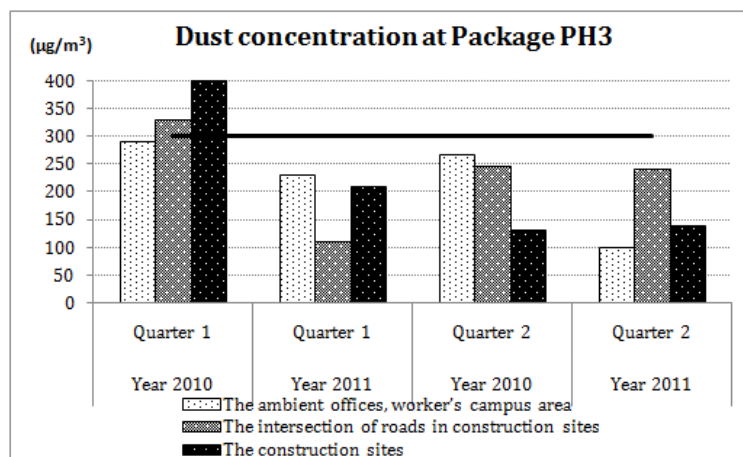


Figure 3: Graph of dust concentration of Packages PH3

As same as the case of the head works, at the transfer canals and main canal packages, the average dust concentration in Quarter I was still higher than Quarter II. The intersection of roads in construction sites is always appearing the highest dust concentration.

The treatment for the reduction of dust concentration at these packages is also using water spraying. However, the survey results show that the contractors did not control the dust in the dry season, typically, the dust concentration in Quarter I at the area C (the construction area), the dust concentration exceeded the permitted norm. In summary, in comparison with 2010, the dust pollution problem was decreased significantly.

4.3.2. Noise

The monitoring results show that all monitored locations have the noise in the range of permitted limit of QCVN 26:2010/BTNMT. The constructor did not make the noise pollution exceed the standard value at construction sites.

4.3.3. Domestic water

Domestic water plays an important role for the health of staffs and workers in construction sites. In the construction packages, the domestic water is taken from underground water, the depth of well is from 25 to 50 m.

❖ At the headwork package (Package 1A):

Table 6: Monitoring parameters of domestic water of Package 1A in Quarter I & II of the year 2011

No.	Monitoring locations	Units	2010	2011	Rate (2)/(1)	2010	2011	Rate (4)/(3)
			Q.1 (1)	Q.1 (2)		Q.2 (3)	Q.2 (4)	
1	Fe ^{Total}	mg/l	0.03	0.08	267%	0.21	0.13	62%
	QCVN 02:2009/BYT	mg/l	0.5	0.5		0.5	0.5	
2	E. Coli	MPN/100ml	4	0	0%	0	4	0%
	QCVN 02:2009/BYT	MPN/100ml	20	20		20	20	

3	Total Coliform	MPN/100ml	22	0	0%	0	1	0%
	QCVN 02:2009/BYT	MPN/100ml	150	150		150	150	

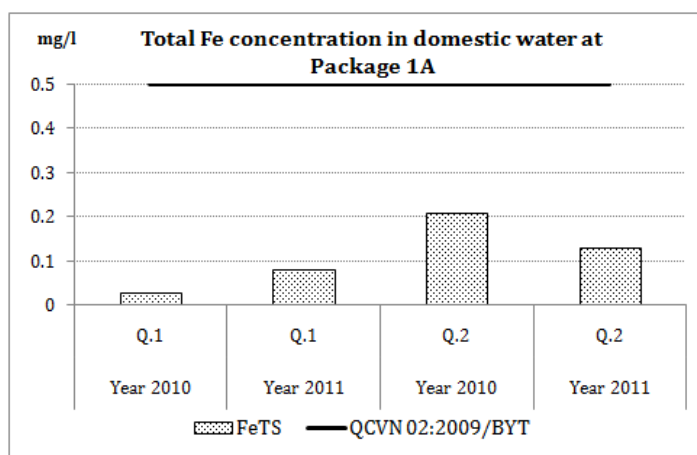


Figure 4: Graph of total Fe concentration in domestic water of Package 1A

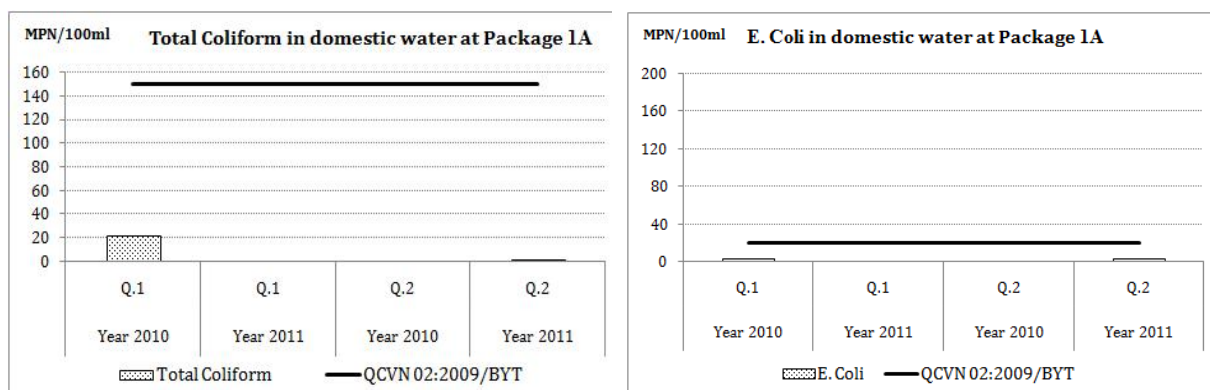


Figure 5: Value of microorganism pollution in domestic water at package 1A

The monitoring and analysed results of domestic water at construction packages show that most of analysed factors met the standard for domestic water quality of the Ministry of Public Health QCVN 02:2009/BYT. However, in the first two quarters of 2011, the micro-organism infection and low pH still appeared. These are the causes affecting to the domestic water resources. The contractors need to pay attention and apply the solution to improve the water quality as advised by environmental consultants.

❖ At the transfer canal sites (Packages 1B, 1C, 1D):

In comparison with the same period in 2010 and the situation of pollution at Package 1A, the drinking water pollution status at the transfer canal (packages 1B, 1C, 1D) was improved remarkably, and most of them met the permitted limit of QCVN 02:2009/BYT standard for the domestic water quality.

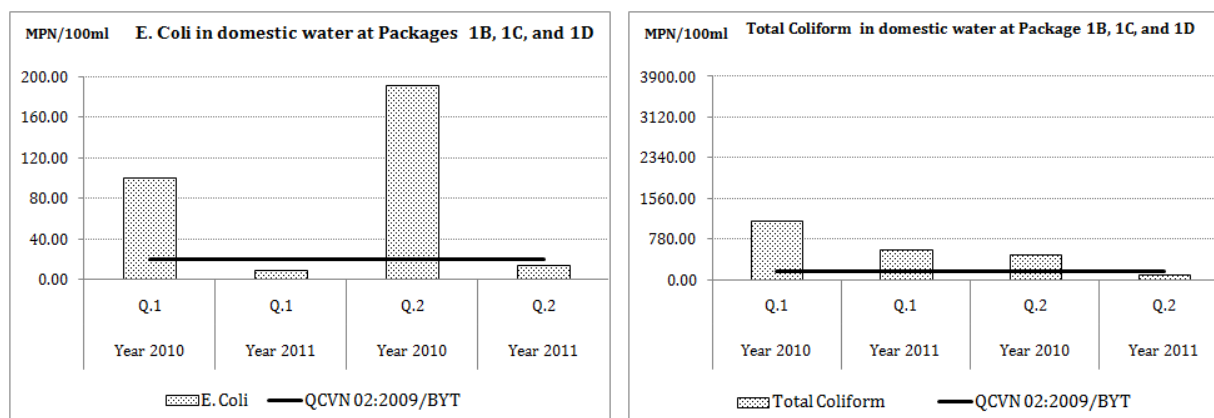


Figure 6: Average value of microorganism pollution in domestic water at packages 1B, 1C, and 1D

❖ At the Tan Bien irrigation area (Package PH3):

As the same case as the transfer canal construction packages, the condition of domestic water quality at Tan Bien irrigation area have been improved considerably, and most of them met the permitted limit of QCVN 02:2009/BYT standard for the domestic water quality.

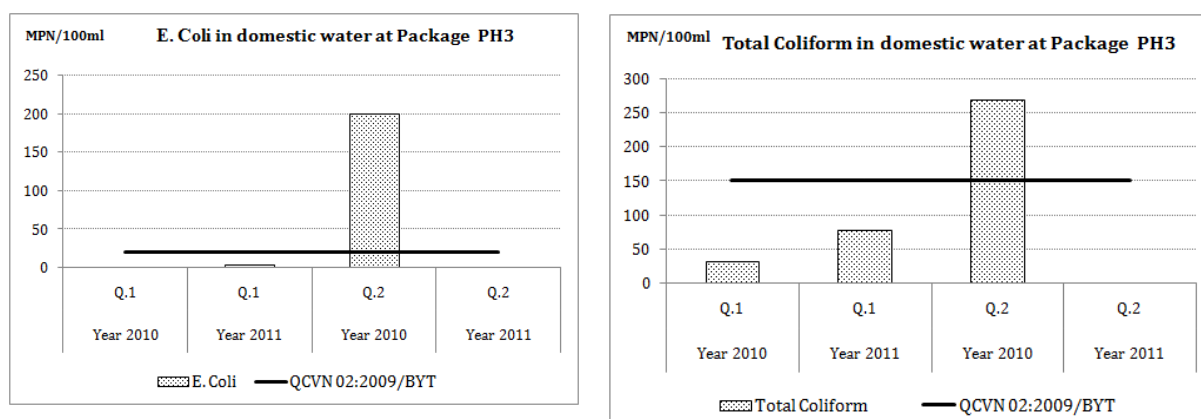


Figure 7: Value of microorganism pollution in domestic water of package PH3

4.3.4. Drinking water

During the survey period, boiled and filtered water was used for drinking at construction packages.

The water quality monitoring results of packages in the first 2 quarters of 2011 show that the domestic water quality in quarter II was remarkably improved in comparison with quarter I. However, the micro-organism infection still appeared, it could affect the health of the water user:

Table 7: Monitoring parameters of drinking water at packages in Quarter I/2011

No.	Parameters	Units	1A	1B	1C	1D	PH3	QCVN 01:2009/BYT
1	pH	-	6,28	8,33	6,08	7,87	7,55	6,5-8,5

2	Colour	Pt - Co	0	3	0	0	0	15
3	Total hardness	mgCaCO ₃ /l	0,44	110	0,5	14	42	300
4	Temporary hardness	mgCaCO ₃ /l	KPH	102	KPH	2	23	-
5	Clorua (Cl ⁻)	mg/l	6	4	2	13	15	250
6	Total Fe	mg/l	0,12	KPH	KPH	0,07	KPH	0,3
7	Asen (As)	mg/l	KPH	KPH	KPH	KPH	KPH	0,01
8	Total Coliform	CFU/100ml	6,7x10 ³	2,1x10 ³	KPH	6	13x10 ³	0

(Source: environmental monitoring report of construction packages – Package MT7)

Table 8: Monitoring parameters of drinking water at packages in Quarter II/2011

No.	Parameters	Units	1A	1B	1C	1D	PH3	QCVN 01:2009/BYT
1	pH	-	6,82	8,04	6,71	5,77	6,02	6,5-8,5
2	Colour	Pt - Co	KPH	4	2	KPH	2	15
3	Total hardness	mgCaCO ₃ /l	16	123	10	2	7	300
4	Temporary hardness	mgCaCO ₃ /l	3	123	1	0,3	KPH	-
5	Clorua (Cl ⁻)	mg/l	3	3	11	2	13	250
6	Total Fe	mg/l	KPH	0,07	KPH	KPH	KPH	0,3
7	Asen (As)	mg/l	KPH	KPH	KPH	KPH	KPH	0,01
8	Total Coliform	CFU/100ml	KPH	140	3	KPH	KPH	0

(Source: environmental monitoring report of construction packages – Package MT7)

Although the MT7 consultant had warnings and advised the mitigation solution, the contractors have not paid attention properly. Therefore, the pollution still occurs, especially the micro-organism infection. Although the micro-organism infection in the quarter II was decreased in comparison with quarter I, the risk of re-pollution is very high. Contractors should pay attention on this matter in order to ensure the best living condition for their workers at sites.

4.3.5. Surface water

Most of packages (except PH3 package), physical and chemical factors (pH, COD, total Suspended Substances (SS), Oil, and Total Fe) met the QCVN 08:2008/BTNMT standard. Particularly, at Tan Bien irrigation area (package PH3), the value of COD, total Fe, and E.Coli exceeded the requirement of the QCVN 08:2008/BTNMT standard. Constructors and the employer need to pay more attention to the surface water quality for this area.

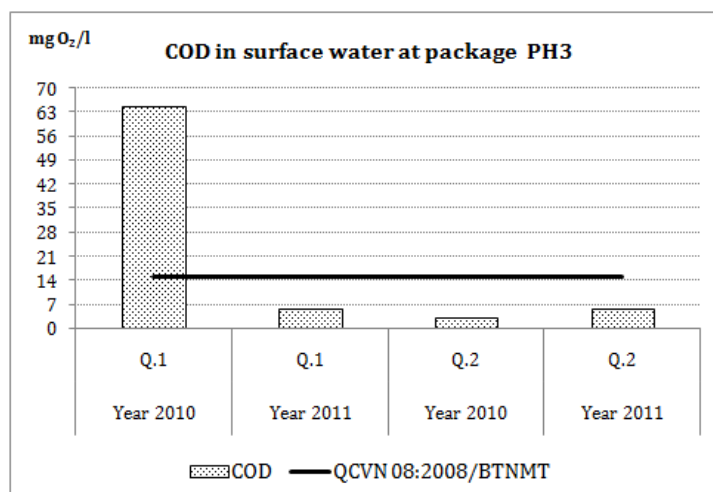


Figure 8: Graph of COD in surface water of package PH3

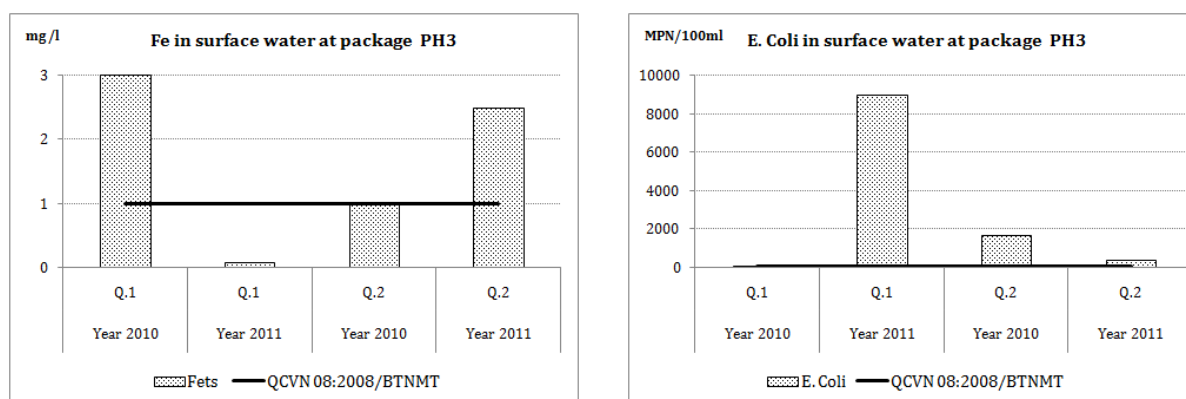


Figure 9: Graph of Total Fe and E.Coli in surface water of package PH3

4.3.6. Wastewater (domestic and worksites)

As same as previous monitoring stages, in the first 2 quarters of 2011, the oil pollution and micro-organism infection was at serious level. The main cause is that wastewater was not treated and directly discharged into the environment. The existing wastewater is not so big but the above pollution level could highly affect to the environmental water quality and people's health. TSS at packages 1A and 1B is very high from 2-2,5 times compared to the permitted standard and there is a sign of micro-organism infection to the wastewater, the COD higher 2-3 times than permitted limit.

Most of construction site wastewater at packages was infected by oil, micro-organism, and TSS. As same case as the domestic water, the wastewater was not treated by any treatment or selection system before discharging into the environment. However, wastewater quality at sites is going better than before.

Table 9: Domestic wastewater quality of packages in Quarter II/2011

No.	Indicators	Units	Results					Column B, QCVN 14:2008/BTNMT
			1A	1B	1C	1D	PH3	
1	pH	-	6,18	6,8	6,01	4,79	5,54	5-9

			Results					
2	COD	mgO ₂ /l	159	271	4	2	4	80
3	TSS	mg/l	131	83	33	36	4	100
4	Total Oil	mg/l	4,4	10,7	KPH	0	KPH	-
5	Total Coliforms	MPN/100ml	43 x10 ³	240 x10 ³	4,6 x10 ³	430 x10 ³	930 x10 ³	5x10 ³

Source: Environmental monitoring report of construction packages – Package MT7

Table 10: Construction sites wastewater quality of packages in Quarter II/2011

No.	Indicator s	Units	Results					Column B QCVN 24:2009/BTNMT
			1A	1B	1C	1D	PH3	
1	pH	-	6,88	8,45	6,1	7,6	6,37	5,5-9
2	COD	mgO ₂ /l	10	4	4	25	6	80
3	TSS	mg/l	76	48	109	1534	169	100
4	Total Oil	mg/l	KPH	0,6	KPH	KPH	KPH	5-20
5	Total Coliforms	MPN/100ml	0,4x10 ³	0,93x10 ³	0,93x10 ³	11x10 ³	2,110 ³	5x10 ³

Source: environmental monitoring report of construction packages – Package MT7

4.3.7. Conclusion of the monitoring results at construction sites:

❖ The air quality and noise:

In the first six months of 2011, the monitoring results of noise level at all packages met regulations. Dust concentration at most of monitoring sites met the allowable regulation except the cases at construction areas and intersection of roads in construction sites. However, this case is not so serious.

This means that dust is the main cause of the air pollution,. Dust generated by construction activities. The contractors have applied many mitigation treatment for the dust reduction, and the most effective treatment is watering. Although dust concentration in the air fluctuates constantly, sometimes it exceeds the regulation, but is not too serious. This has not affected to the local people living around the project. It is recommended that contractor use proper treatment so that the dust concentration at construction packages can meet stipulated environmental norms.

❖ The drinking water quality:

The drinking water at the packages is provided by local companies with a manual and unclosed production process. Therefore, the water quality is unstable, especially the hygienic stage and water is usually infected with bacteria. On the other hand, the water tank is not cleaned, thus the water is infected with bacteria.

It is recommended that contractor apply two solutions: (i) boiling the drinking water; (ii) if using the filter water, contractor should purchase good quality water for their workers.

❖ The surface water:

In general, the hauling of materials is not affected to water quality. Some causes that affect to water quality such as dust, soil sand, cement, and asphalt ... falling down the road or to be swept to streams causing polluted water. Except the package PH3, other packages have a good surface water quality.

❖ The wastewater (domestic and worksites):

Domestic wastewater was discharged from the kitchens, the bathrooms. It usually has the high content of organic, micro-organism, total oil pollutant at the places where gathering a large number of employees, workers, untreated wastewater is higher than the other packages. Therefore, proposals are appreciated such as filtering sediment tanks and the disinfected tank by chlorine for domestic wastewater before discharging into the environment. MT7 consultant need to consider carefully and cooperate with constructors to choose effective and feasible treatments.

5. Water Environment

5.1. The changes of the water flow and erosion status at riverbanks

5.1.1. The changes of water flow

The monitoring results in April 2011 show that except the station Q4 on the Be river, most of other stations was affected by tide, the influence at each station is very different. But the highest affected level was occurred at the Vam Co Dong river where the station Q1 with the distance 218 km to the Sea and water flow is clearly two-way flow. The next affected level is station Q2 on the Dong Nai River. Because there is a small water capacity from the upstream, the water flow at all stations was monitored smaller than the same period of 2010, this had been predicted by specialist before.

At the moment, the Phuoc Hoa reservoir has not been impounded, the construction of Phuoc Hoa – Dau Tieng transfer canal has not been completed. Therefore, it means that up to April, all changes of water flows in 4 main rivers and other rivers of its vicinity have not been affected by Phuoc Hoa project. It is observed that water in all rivers is being dried up, the main reason is water flow from the upstream is smaller than previous years. The changes of water flow in the project area will be continuously monitored and updated in next monitoring stages, especially the monitoring in the flood season (October 2011), by this time, according to the schedule, the Phuoc Hoa reservoir could be impounded and the transfer canal could be operated.

5.1.2. The situation of the erosion

Most of the surface soil erosion in the project occurred at rubber tree areas, the erosion occurred lightly and partly at areas without vegetation. Recently, the local people excavated soil in the project area nearby streams to fill their gardens. This causes minimizing the area for forestation, and the newly backfilled areas were eroded seriously and a part of eroded soil entered into the adjacent streams.

Out of the erosion caused by human activities, there are some natural eroded locations occurred along 2 banks of Suoi Dong stream of hamlet 4, Minh Thang commune. The erosion and collapse partially occurred in an area of the length 100m, this stream located between 2 rubber tree gardens of local people. The stream collects big water flows but the bottom of stream is small, creating a high velocity of flow and causing erosion and collapse at some bends where there is no vegetation or very little vegetation at both sides of the stream.



Erosion caused by rainfall



Erosion caused by human activities

Figure 10: Erosion status in the project area

5.2. The changes of water quality

5.2.1. Surface water quality

❖ Be River basin:

Monitoring results of 2011:

- The value of pH is stable and within permitted limit (QCVN-08/BTNMT, Column A). However, at the Suoi Thon stream (WQ02), the pH value is higher than standard (pH=10), this is a high alkali environment and could negatively affect to the development of fishes. The micro-organism pollution at station WQ02 due to the Suoi Thon stream received untreated wastewater from the township and Chon Thanh industrial park.
- The DO at the inspection time was quite low, it was lower than the value at the same period of April 2010, it did not meet the minimum limit of water surface quality of (QCVN 08:2008/BTNMT, Column A1). Especially at downstream of Be river (WQ10), the DO value reached the lowest level (DO=1.2 mg/l), this DO level could made fishes die.
- TSS was much lower than standard of surface water Column A (QCVN:08:2008/BTNMT, Column A1=20mg/l) and much lower than the same period of 2010.

In Comparison with QCVN-08/BTNMT:

The water quality in Be river was fairly good, equivalent to **A1 and A2 Column of the standard QCVN-08** (*it is good for domestic water supply, aquatic conservation and other demand which need a lower water quality*). The impact of Phuoc Hoa dam construction to TSS content only occurred at the construction sites.

Comparison of monitoring results through the years:

Comparison between monitoring results in April 2011 and March 2003 at WQ10 in lower Be River close to the confluence with Dong Nai River shows that there was no significant difference in the absolute value of most measuring indicators in those two periods. The values of TSS and PO_4^{3-} in April 2011 were 2-3 times higher than those in March 2010. Except TSS value was higher than water resource standard, Comlumn A2 of QCVN:08 norm. Other parameters were all lower than this norm.

Table 11: Comparison of monitoring data in April 2011 against the data before project implementation

No.	Monitoring indicators	3/2003	4/2010	4/2011	QCVN - 08 A2
1	TSS (mg/l)	44	55	78	30
2	PO_4^{3-} (mg/l)	0,018	0,04	0.054	0.2
3	NO_3^- (mg/l)	0.4	0.04	0.36	5
4	DO (mg/l)	6	6.2	6.25	5
5	COD (mg/l)	7	2.5	1.95	15

Source: EIA report, Southern Institute for Water Resources research, 9/2007.

Levels, trends and causes of pollution:

The water quality of Be River was quite good, most of monitoring indicators (pH, NO_3^- , COD, BOD, and heavy metals) reached the column A1, A2 of QCVN08:2008/BTNMT, due to the population of this region is sparse, and production activities have not yet increase. In 2010 and early months of 2011, construction activities of Phuoc Hoa project did not significantly affect to the Be River's water quality. Only TSS content at construction site was increasing.

According to monitoring results report in April 2011 of package MT6, it showsthat the surface water quality in Be river was trending worse in comparison with the same period of last year (April 2010). Due to streams which flow to Be river directly received the domestic and industrial wastewater with bad water quality. For example, at the Suoi Thon stream, during the inspection period, water flow was very small, with brownish color water. The reason of pollution problem at WQ02 was that the Suoi Thon stream received untreated wastewater from the township and a part wastewater from Chon Thanh industrial park. The low water quality of streams will significantly affect to water quality of Phuoc Hoa reservoir, especially in the begining of impoundment.

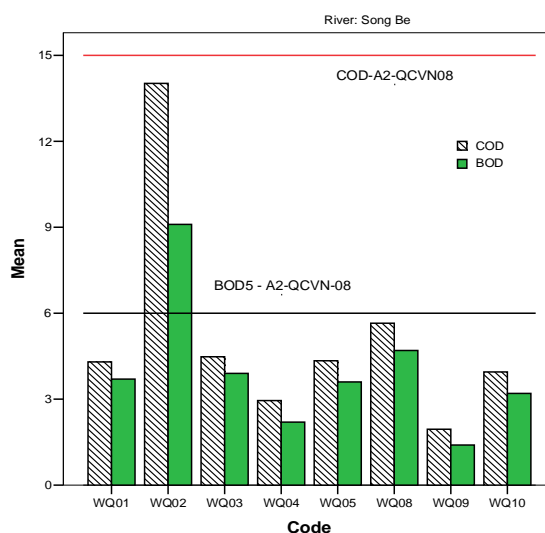


Figure 11: Variables of COD and BOD in Be River

❖ **Dong Nai River:**

Monitoring results of 2011:

- The pH values fluctuated 6 to 7, was not different from April 2010, and met permitted limit for surface water quality (QCVN 08:2008/BTNMT, Column A1).
- The DO content was smaller than 6 mg/l show that water pollution appeared in the basin. There was a light change of DO content but stable through the years.
- TSS content was in the range of permitted limit, Column A of surface water quality (QCVN: 08:2008/BTNMT, Column A1=20), and this DO content was much lower than the same period of previous years.
- The heavy metal contents and Fecal coliform quantities in April 2011 in the Dong Nai river were very low, equivalent to usual value of natural rivers.

In comparison with QCVN 08:2008/BTNMT:

In general, the water quality of upper Dong Nai River is good at monitoring stations, equivalent to A1 and A2 column of QCVN-08. The water quality in the dry season infected by salinity at the downstream area of Dong Nai river, it is not suitable for domestic and agricultural water use. At monitoring periods in 2011, there was not any significant change in the Dong Nai River's water quality that affected by the Phuoc Hoa construction activities.

Comparison of monitoring results through the years:

Comparison between monitoring results in April 2011 and March 2003 at WQ14 at Ben Than of Cu Chi district in the Sai Gon river shows that there was no significant difference in the absolute value of most measuring indicators among these two monitoring periods, except PO_4^{3-} value was 10 times higher than that in March 2003.

Although there was a significant change of PO_4^{3-} content, but this content is

lower than QCVN:08 standard, and this comparison is only used for reference.

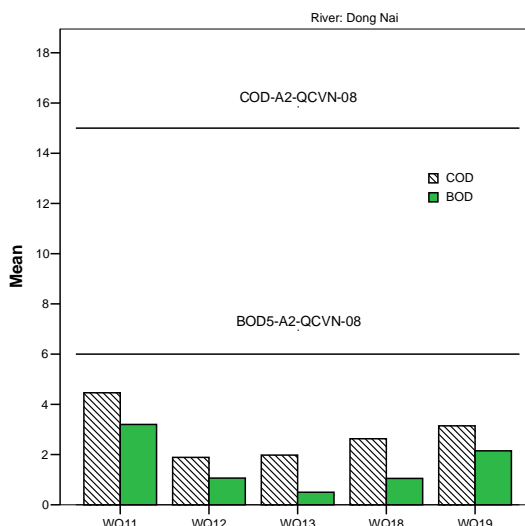


Figure 12: Variables of COD and BOD contents in Dong Nai river

Table 12: Comparison of monitoring data in April 2010, 2011 and the data before project implementation in March 2003

TT	Chỉ tiêu quan trắc	3/2003	4/2010	4/2011	QCVN-08 A2
1	TSS (mg/l)	61	56	69	30
2	PO ₄ ³⁻ (mg/l)	0.016	0.03	0.032	0.2
3	NO ₃ ⁻ (mg/l)	0.01	0.09	0.593	5
4	DO (mg/l)	5	5.2	5.46	5
5	COD (mg/l)	12	3	2	15

Source: EIA report, Southern Institute for Water Resources research, 9/2007

Levels, trends and causes of pollution:

Similar to the monitoring stages in 2010 and 2011, all monitoring parameters (pH, NO₃⁻, COD, BOD, heavy metal) conformed to columns A2 and B1 of QCVN 08:2008 Standard (for domestic water supply, aquatic organism protection and irrigation). Exceptional cases are in Tan Mai, Ong Keo areas where were polluted by bacteria because these locations were affected by untreated domestic wastewater. At downstream locations of station WQ12 in Bien Hoa city, stations WQ18-WQ19 at Nhon Trach and Phu Xuan of Nha Be district where received the domestic and industrial wastewater from these areas, therefore, the Dong Nai water resources appeared micro-organism infection.

The monitoring results of package MT6 found that construction activities of the Phuoc Hoa project did not affect to the changes of water quality in Dong Nai River in 2010 and 2011.

❖ Sai Gon River basin:

Results of 2011:

The water quality in Sai Gon river was trending downward from upstream to downstream, the section from WQ14 to WQ17 appeared serious pollution,

specifically:

- The pH value changed from 6–7.5, at Ben Than station (WQ14) the pH value was lower than the other stations. However, the pH value met requirement of surface water standard, Column A1 (QCVN: 08:2008/BTNMT, Column A1: 6-8.5).
- The EC value at monitoring stations such as Ben Than, Ben Cui, Tan Thuan (WQ14-WQ16) had a low electrical conductivity from 10 – 20 mS/m. While at Nha Be station (WQ17) appeared salinity intrusion due to the tide, the electrical conductivity in the water resources at this area was over 900 mS/m, equivalent with the salinity from 4-5 mg/l.
- The organic contents at stations such as Ben Than, Ben Cui, Tan Thuan (WQ14-WQ16) had a low value, and the values of BOD₅ and COD were much lower than the standard for water resources, Column A2 of QCVN standard.
- The monitoring results of DO content at all stations were quite low, and it were lower than the requirement of surface water standard, Column A1 (QCVN: 08:2008/BTNMT, Column A1: ≥ 6).
- The heavy metal contents at monitoring stations in Sai Gon river were very low, equivalent to usual values of natural rivers.
- Fecal Coliform quantities was highest value at the Tan Thuan WQ17, 4.000 MPN/100ml.

In comparison with QCVN 08:2008/BTNMT:

According to the results from national monitoring networks and the General Water Resources Department monitoring networks found that the water quality in Sai Gon River in the periods of 2001 and 2011 were trending downward. The water resources at stations WQ15 and WQ16 is equivalent to the rank B1 under the QCVN-2008, meet requirements for irrigation. Water sources at WQ14 and WQ17 is equivalent to the rank B2 under the QCVN-2008, meet requirements for navigation.

Comparison of monitoring results through the years:

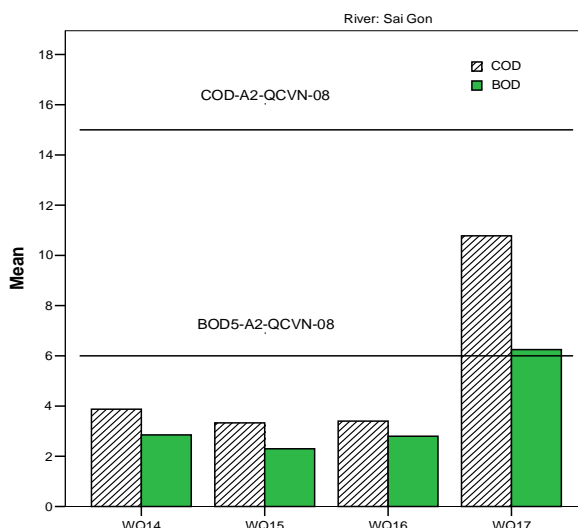
The infected acid sulphate status in Sai Gon River in 2011 was significantly improved in comparison with 2010.

Comparison between monitoring results in April 2011 and March 2003, at WQ14 at Ben Than of Cu Chi district in the Sai Gon river shows that there was no significant difference in the absolute value of most measuring indicators at those two monitoring periods, except PO₄³⁻ content in April 2011 was 10 times higher than that in March 2003. Although there was an aforementioned significant change, the PO₄³⁻ content is lower than the standard QCVN:08.

Table 13: Comparison of monitoring data in April 2010, 2011 against the data before project implementation

No.	Monitoring indicators	3/2003	4/2010	4/2011	QCVN - 08 A2
1	TSS (mg/l)	72	51	62	30
2	PO ₄ ³⁻ (mg/l)	0.003	0.05	0.04	0.2
3	NO ₃ ⁻ (mg/l)	0.6	0.9	0.825	5
4	DO (mg/l)	5	4.5	5.12	5
5	COD (mg/l)	5	6.15	4.6	15

Source: EIA report, Southern Institute for Water Resources research, 9/2007

**Figure 13: Variables of COD and BOD contents in Sai Gon river****Levels, trends and causes of pollution:**

The monitoring results in Sai Gon River in 2011 show that the water quality was affected by the urban, industrial, agricultural waste resources, especially the lower areas were affected by Ho Chi Minh City, Binh Duong Province that caused organic and microorganism pollutions.

Sai Gon River was being seriously affected by natural phenomenon (acid sulphate, salinity intrusion) as well as human activities (domestic, industrial, and productive wastewater) of a largest city of Viet Nam. Recent years, with effort of the government and people in Ho Chi Minh city, many big scope environmental improvement projects have been carried out. When these projects finished, the surface water quality could be improved positively.

The monitoring results of MT6 show that the Phuoc Hoa Reservoir construction activities have not affected to the degradation of the water quality in Sai Gon River.

❖ Vam Co Dong River basin:**Results of 2011:**

In general, the water quality in Vam Co Dong river at the monitoring period was quite good. However, the water quality was trending downward from upstream to

downstream:

- In comparison with other river basins, the Vam Co Dong basin appeared acid sulphate infection. However, the acid sulphate infection in April 2011 was lower than previous years.
- The organic contents were quite low, only the COD contents at Ben Da station (WQ21) were higher than the QCVN Standard, Column A2.
- The heavy metal contents at monitoring stations in Vam Co Dong river were very low, equivalent to usual values of natural rivers, and lower than the Standard QCVN:08, Column A2.

In comparison with QCVN 08:2008/BTNMT:

The water quality in Vam Co Dong River is quite good, equivalent to rank **A1 – A2 under the QCVN-08**, the pH indicator in the nature ranges from 5.6-6.5, it almost met the surface water standard, Column A1.

Nutrient contents from phosphorous origin had a low value, the PO₄ concentration was lower than the Standard QCVN:08, Column A2. Nutrient contents from nitrogen origin had a higher value the Standard. At stations such as Tra Cu and Xang Lon canal (WQ22-23), the nitrogen content was higher 0,2 mg/l and seriously exceeded the Standard QCVN-08, Column A2.

Comparison of monitoring results through the years:

The comparison between monitoring results in April 2011 against March 2003, at WQ23 station of Vam Co Dong River at the beginning of Xang Lon canal shows that there was no significant difference on absolute values of most monitoring parameters between these two periods. However, the indicators of PO₄³⁻, NO₃⁻, and COD had higher values than those in March 2003.

Table 14: Comparison of monitoring data between April 2010, 2011 against the data before project implementation

No.	Monitoring indicators	3/2003	4/2010	4/2011	QCVN – 08, A2
1	TSS (mg/l)	164	70	72	30
2	PO ₄ ³⁻ (mg/l)	0.002	0.03	0.012	0.2
3	NO ₃ ⁻ (mg/l)	0.4	0.7	0.78	5
4	DO (mg/l)	6	4.5	4.2	5
5	COD (mg/l)	8	6	6.7	15

Source: EIA report, Southern Institute for Water Resources research, 9/2007

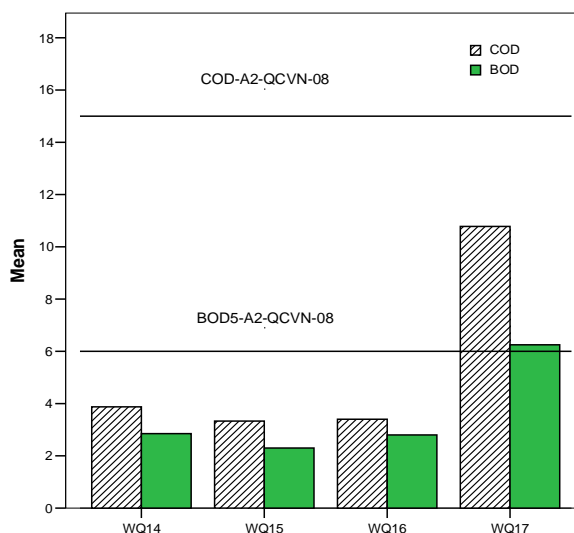


Figure 14: Variables of COD and BOD contents in Vam Co Dong river Levels, trends and causes of pollution:

In early months of rainy season, the water sources were affected by acid sulphate soils. This caused difficulties in using domestic and agricultural water.

In the dry season, the downstream areas affected by salinity intrusion, and the area from Go Dau to Ben Luc affected by wastes discharged from Go Dau and Ben Luc industrial parks of Long An province which increase the polluted organic risk. Aforementioned issues indicate that the water quality of Cam Co Dong river is not only affected by natural impacts such as acid sulphate soils and salinity intrusion but also affected by waste sources discharge from industrial zones which were strongly increasing in recent years.

For Phuoc Hoa project, it found that the Phuoc Hoa Reservoir construction activities have not affected to the degradation of the water quality in Vam Co Dong River in the periods of 2010-2011.

5.2.2. Groundwater quality:

Monitoring results in April 2011:

Results at monitoring wells in April 2011 contained a low contents of chemical and physical composition.

- The pH value at monitoring wells GW2,3 in Binh Phuoc province, GW4,7,9 in Binh Duong province, GW5 in Dong Nai province, GW12 in Long An province and GW14 in Tay Ninh province ranged from 3.5–5.2, these value were lower the permitted limit of the Standard QCVN:09.
- The Total Fe content in ground water ranged from 0.06–3.0 mg/l, it was lower than the Standard QCVN:09. Except, the monitoring well GW08 in Dau Tieng district, Binh Duong province has its Total Fe content was 6 times (31.5 mg/l) higher than the Standard QCVN:09.

- The heavy metal content was lower and smaller many times compared to the Standard QCVN-09.
- Most of monitoring well appeared Fecal Coliform with quantities from 5-100 MPN/100ml, these results did not meet requirements of the Standard QCVN:09, especially the monitoring well GW08 contained quantities of Fecal Coliform reached 24.000 MPN/100ml.

In comparison with QCVN 08:2008/BTNMT:

Most of physical and chemical compositions of ground water meet the QCVN-09 Standard, except, some wells were infected by Faecal Coliform and Fe content. These results were familiar with the monitoring evaluation report on changes of ground water in Binh Phuoc province.

Comparison of monitoring results through the years:

In comparison with ground water data between April 2011 against September 2005 at Nha Bich commune, Chon Thanh district, Binh Phuoc province shows that there were no significant difference of physical and chemical compositions, many indicators such as Fe, Mn, Nitrate have its value lower than those in 2005. Only the quantities of Fecal Coliform were higher than the quantities in 2005 at the most of monitoring wells.

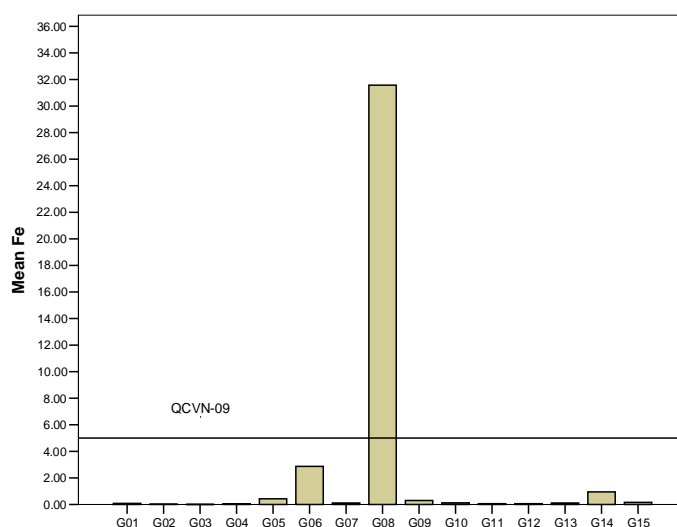


Figure 15: Total Fe content in ground water of the project area

Table 15: Comparison of monitoring data in April 2011 with previous years

No.	Monitoring indicators	9/2005	4/2011	QCVN-09
1	pH	6.33	6.07	5.5 – 8.5
2	NO ₃ ⁻ (mg/l)	10	0.08	15
3	T-Fe	1.00	0.08	5
4	Mn	0.21	0.03	0.5
5	Fecal Coliform	0	78	0

Source: EIA report, Southern Institute for Water Resources Science, 9/2007.

Levels, trends and causes of pollution:

The construction of Phuoc Hoa dam is going to complete and the reservoir has not been impounded. Therefore, there was no basis to assess the impact of the project to the changes of ground water. The ground water quality was at medium level, the risk of impact of construction activities to ground water is very low.

5.2.3. Water quality of Duc Hoa irrigation area:

Monitoring results in 2011 and the comparisons with QCVN 08:2008/BTNMT and 09:2008/BTNMT:

Monitoring results of **surface water** parameters in Duc Hoa irrigation sub-project – Long An compared to the range B1 of QCVN 08:2008/BTNMT as follow:

- The pH values of monitored water samples ranged from 2.78 to 6.10, the lowest value was found in W4 sample and highest value was at W11 sample
- The NO_3^- content in samples fluctuated from 0 to 16.47 mg/l. Among 12 monitored samples, there were 4 samples containing NO_3^- content higher from 0.7 to 1.5 times in comparison with Standard QCVN:08, Column B1. These show that the surface water at these locations appeared NO_3^- pollution.
- Total nitrogen content in monitored samples varied from 6.30 to 31.13 ppm. Total phosphorus content in monitored samples changed from 0.02 to 3.06 ppm.
- Total Fe content at monitoring location fluctuated from 0.37 to 6.57 mg/l. There were 11/12 analysed water samples resulting a value of Fe content exceeded 1.0 to 4.0 times in comparison with the norm.
- Al^{3+} content at locations varied from 0.06 to 5.13 mg/l. Some locations has its Al^{3+} content seriously higher than other locations. Because the pH value at these locations was lower than other locations, the pH value varied from 2.69 to 2.78, it means the acid sulphate infection appeared clearly.

Monitoring results of **groundwater** quality parameters in Duc Hoa Irrigation area, Long An province in 2011 was compared to the QCVN 09:2008/BTNMT as follows:

- pH value in groundwater samples varied from 5.51 to 7.8; all six groundwater samples meet the Standard QCVN 09:2008/BTNMT. Some samples were slightly contaminated by acid sulphate.
- NO_3^- content varied from 5.51 to 7.80 mg/l; all samples are met the groundwater quality standard QCVN 09:2008/BTNMT.
- Total Nitrogen content varied from 1.80 to 11.56 mg/l; total phosphorus content varied from 0 to 2.16 mg/l;
- Fe content varied from 0.03 to 5.62 mg/l; this met the Standard of the ground

water QCVN 09:2008/BTNMT.

- SO_4^{2-} content varied from 0 to 61.23 mg/l, all samples met the standard for ground water quality.

Comparison of monitoring results through the years:

In comparison with 2010, monitoring results of surface water in April 2011 had no significant changes:

- Total Fe content at some locations was twice higher than the same period of 2010 (3.12 mg/l in 2010 against 6.57 mg/l in 2011).
- Al_3^+ content in 2011 was declined in comparison with 2010 (5.13 mg/l in 2011).

In comparison with 2010, monitoring results of groundwater in the same period of 2011 had no significant changes. There are only some small changes in the contents of Al^{3+} and SO_4^{2-} in comparison with 2010.

- Al_3^+ content did not appear at some monitored locations in 2011. While it appeared over all monitored locations in 2010.
- SO_4^{2+} content did not appear at some monitored locations in 2011, or appeared with a small content compared to the year 2010 (from 0 to 61.23 mg/l in 2011 compared to the range from 39.5 to 88.1 mg/l 2010).

Level, trends and causes of pollution:

It is difficult to predict how the project affect to the acid sulphate infected irrigation area in Long An Province because there are only monitoring data in 2010 and 2011, and the construction activities have not been implemented.

6. Biodiversity

6.1. Aquatic biodiversity

6.1.1. Fishes and shrimps

Monitoring results found 116 species of fish and 1 *Macrobrachium rosenbergii* belong to 11 orders, 31 families and 81 genera. The dominant orders such as *Cypriniformes* with 56 species (47,86%), *Perciformes* with 24 species (20,51%), *Siluriformes* with 20 species (17,1%). Some orders have a few species such as *Anguiliformes* (1 species), *Beloniformes* (3 species), *Osteoglossiformes* (2 species).

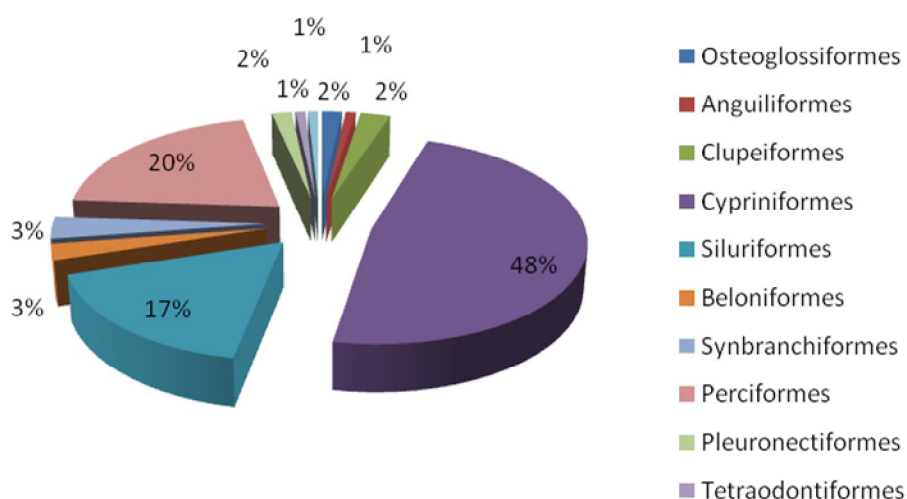


Figure 16: The composition of fishes and shrimps species

Among 116 monitored species of fish, there were 7 rare fish species appeared in the Red book of Viet Nam, in range VU (Vulnerable) and needed to protect such as *Chitala ornata*, *Anguilla marmorata*, *Cirrhinus microlepis*, *Probarbus jullieni*, *Bagarius bagarius*, *Hemibagrus filamentus*, *Wallago micropogon* (Red book of Vietnam-2007).

6.1.2. Phytoplankton

Analysed results received from 11 monitoring stations showed that the species composition of phytoplankton is the presence of 5 phyla with a total of 117 species. Dominant species of the algae species is classified according to the following order:

- The phylum *Bacillariophyta*: 43 species; 36.75% in total;
- The phylum *Chlorophyta*: 41 species; 35.04% in total;
- The phylum *Cyanophyta*: 23 species; 19.66% in total;
- The phylum *Euglenophyta*: 7 species; 5.98% in total;
- The phylum *Dinnophyta*: 3 species; 2.56% in total;

Through the analysed results, the density of algae as in the water sample, it was found that the heavy organic pollution was not appeared at all monitoring

stations. However, there were 4 stations appearing a moderate organic pollution such as stations TS2, TS3, TS4 and TS9. The remaining stations did not appear any pollution through the Palmer index, 1969.

6.1.3. Zooplankton

Through the analysed results from 11 monitoring stations, it was found 40 zooplankton species of 5 phylum. *Arthropoda* phyla contained the biggest number of species with 28 species (70%). Due to the samples were taken in dry season, samples at some monitoring stations were infected by salinity. Therefore, out of the freshwater species as previous surveys, at the station TS7 also appeared brackish water species such as *Acartia*, *Oithona*.

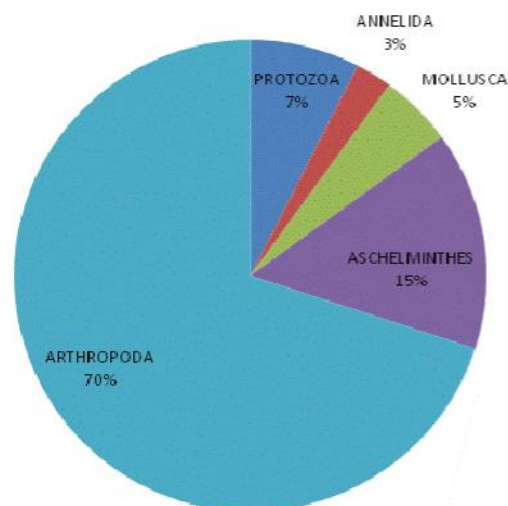


Figure 17: The composition of zooplankton species

Zooplankton density distribution was high, varying from 1,000 - 21,500 individuals/ m³. Except stations TS10 and TS5 containing a low density (1.000 -1.500 individuals/m³), the TS2 stations containing the most plentiful density distribution with 21,000 individuals/m³, the next density distribution level is station TS7 containing 14,500 individuals/m³.

6.1.4. Zoobenthos

The zoobenthos was found in all monitoring stations, including 11 species belong to 6 classes of 3 phylum. The species density composition at each monitoring station was very low varying from 1 to 7 species. The zoobenthos density composition was not spreaded at all monitoring stations. The highest species density composition appeared at station TS4 with 850 individuals/m², the next density distribution level is station TS8 containing 550 individuals/m².

6.1.5. Fishery productivity in Be River

❖ Binh Duong province:

Based on the data of DARD of Binh Duong province in 2010, the fishery productivity was twice increased than that in 2003 (235 tons) and 4 times increased than that in 1996 (152 tons). In Tan Uyen district fish was caught on Dong Nai River and Da Ban Reservoir (55%); In Thuan An district fishery productivity was caught on Sai Gon river (14%). In Phu Giao and Ben Cat districts fishery productivity was caught in Be and Thi Tinh rivers (11%), in Dau Tieng district, fishery productivity was

caught in Dau Tieng and Can Don reservoirs (4-5%).

Table 16: Fisheries development situation in Binh Duong province

No.	Indicators	Units	2007	2008	2009
1	Aquaculture				
	- Area	Ha	469	495	517
	- Production	Ton	4059	4559	4906
2	Fishing	Ton	518	468	536
3	Total production	Ton	4577	5027	5442

Source: Binh Duong DARD

Currently, the Economic Division of DARD is managing fisheries activities in Binh Duong province. At district level, the management unit is the district Economic Division and the Commune People's Committee manages households.

❖ Binh Phuoc province:

According to data of fishery surveys of Binh Phuoc Statistics Department, there were 586 households with 772 labours (2009) fishing in Thac Mo reservoir and upstream Be River of Phuoc Long District.

Base on the assessment of governmental agencies, it is shown that during the period from 2006 to 2010, aquaculture areas increased of 12%, aquaculture productivities increased of 16%; fishing productivities increased of 15%.

Table 17: Fisheries development situation in Binh Phuoc province

No.	Indicators	Units	2007	2008	2009
1	Aquaculture				
	- Area	Ha	2118	2229	2496
	- Production	Ton	5269	6102	7078
2	Fishing	Ton	488	559	643
3	Total production	Ton	5757	6661	7721

Source: Binh Phuoc DARD

It is not similar to Binh Duong Province, the Fisheries Division – Binh Phuoc DARD takes the responsibility to manage fisheries activities, support technologies to fisherman and plays a role as an advisory unit for the DARD on the fishery aspect in the whole provincial are. The management of household activities is Commune People's Committees.

6.2. Terrestrial biodiversity

At the moment, packages MT1 and MT2 have their contents relating to the terrestrial biodiversity. However, package MT1 has not implemented this content. As required in the TOR, the package MT2 only concentrates on investigating the vegetation in Phuoc Hoa Reservoir catchment, the monitoring data used in designing forestation protection program in the catchment.

The monitoring results of package MT2 were presented in the previous report as well as in the progress report of MT2. Based on the monitoring results of this package, there have not been any significant changes of the vegetation in the Phuoc

Hoa reservoir catchment.

Information on fauna will be updated based on the implementation results of package MT1 in the coming time.

7. Soil condition

7.1. Assessment of monitoring results of Duc Hoa irrigation are in 2011:

7.1.1. Soil

Similar to previous years, in April 2011, soil condition at monitored areas contained a high acid content because this is an acid sulphate soils area. $\text{pH}_{\text{H}_2\text{O}}$ values at monitoring sites varied from 3.13 to 4.47; pH_{KCl} value varied from 2.55 to 3.95.

Most of soil samples appeared a high or quite high organic content. The total organic carbon content of soils varied from 0.25% to 7.45%. Most of soil samples contained low protein content that varied from 0% to 0.519%. Total P content is low.

Total Fe content in the soil at the monitored locations varied from 846 to 2469 ppm. Al^{3+} content in soil ranged from 146 to 863 ppm. SO_4^{2-} content in the soil at monitored locations ranged from 0 to 0.56%.

7.1.2. Soil solution

In 2011, soil solution in monitored areas contains a high acidic content, pH varied from 2.5 to 3.12. Total N content in the soil solution varied from 10.23 to 89.60 ppm. Total P content in soil solution varied from 0.35 ppm to 9.65 ppm.

Total Fe content varied from 6.34 to 9.86 ppm. Value Al^{3+} in soil solution varied from 24 to 221 ppm. And SO_4^{2-} content in the soil solution varied from 156 to 342 ppm at monitored locations.

Total Al^{3+} content in soil solution varied from 24 ppm to 165 ppm. At each monitoring location, the Al^{3+} content was gradually decreasing according to the depth of the monitoring area. This may be resulted by the pH was gradually increasing according to the depth, and aluming evaporated to the upper layers so that the Al^{3+} content in the upper layers was higher than below layers.

7.2. Comparison of monitoring results through the years:

In comparison with 2010, the monitoring results of acidic soil in April 2011 negligibly changed with some minor changes: (i) Total P content in soil was appeared in most of samples; and (ii) SO_4^{2-} content was not appeared at some monitored locations,

In comparison with the same period of 2010, the monitoring results of moisture in soil had some changes: (i) Total N content at some locations was increased suddenly compared to 2010 (23.82 ppm in 2010 against 89.6 ppm in 2011); (ii) total P content appeared in all samples. In 2010, total P content only appeared in deep layers at both two monitored locations in November 2010. The remaining monitoring indicators were not significantly changed.

7.3. Levels, trends and causes of pollution:

At present, it seems that the impact of the Phuoc Hoa project to this area has not been occurred and the construction packages in this area have not been implemented. Therefore, it can not be made any comments about the environmental changes in this area related to the project. The changes of the environmental qualities (soil, water) can be considered the natural changes of the environment.

8. Environment Awareness

8.1. Environment Awareness of contractors

It can be considered that the environment awareness of most contractors have been improved significantly during the implementation. The environmental protection activities are being implemented fully and comprehensively. Specifically contractors actively monitor, supervise and implement in accordance with the forms in the frame report for the construction and SEMP. However, for various reasons such as lack of engineer who has a good environmental educated background, so far, the contractors have not measured chemical, physical, microbiological indicators in order to evaluate the pollution level of air, domestic water, wastewater, surface water caused by their construction activities. These outstanding issues were reminded several times by the Employer and MT7 consultant.

8.2. Environment Awareness of resident's community

As reported in previous reporting stages, it can be considered that the environment awareness of local communities in the project area and its vicinity is very different.

Most local communities have begun to aware well about the environment after receiving the sufficient information of project and the relevant environment information through some workshops held by packages MT2, MT4, especially package MT10. However, only a few local people and authorities had opportunity to acknowledge the official information of the project through the environmental training courses, so that the propagation on environmental awareness is still limited and the effective results in the community have not been obtained. Therefore, currently package MT2 informed the land encroachment of the local people that the land was acquired for the forestation to protect the Phuoc Hoa Reservoir catchments. This issue will cause obstructing and affecting to the forestation implementation in the coming time and increasing the erosion in the basin. This is one of insufficient environment awareness.

In order to be aware from local people to the project as well as environmental issues adequately, it is important to provide information of the project regularly, it can inform the implementation process of project through meetings in each hamlet or ward. In addition, leaflets can be made to propagate the contents to public. By such way, the necessary contents could come to the individual citizens.

9. Conclusions and Recommendations

9.1. Conclusions

9.1.1. The natural and social environment

The natural environment has not been negatively affected by the project, except some local impacts occurred at construction sites. Since Phuoc Hoa Reservoir has been impounded and the Phuoc Hoa – Dau Tieng transfer canal has not been operated as well. However, in comparison with prior project implementation (according to the EIA detail Report), the water quality of the river catchments in the project area has become worse, the organic polluted level was increasing, particularly in some large urban areas of Bien Hoa and Ho Chi Minh City. The quality of the water environment was significantly changed and gradually decreased from upstream to downstream in the river basins.

The hydrological condition in the first six months showed that there was a large fluctuation over the same period of last year, it can be clearly found that the water flow was dried up, the flow capacity from the upstream was less than last year. This problem affected the production and activity of the people living in the area seriously, especially salinity intrusion problem in Saigon and Dong Nai rivers.

Through field survey results, EMP package reports and ICMB9 showed that social issues have not been occurred in the project area. Contractors have not caused any incidents affecting communities surrounding area, and the project has also created more jobs for the local people. Public activities, land compensation and land acquisition have been implemented satisfactory by the Employer, local authorities and consultants. Especially, the reforestation land allocation to farmers whose land was acquired that received the enthusiastic support from the people and local government.

9.1.2. EMP packages

Package MT2: outstanding issues of package MT2 that did not give a specific calculation method of erosion and sediment hauling from upstream of be river to Phuoc Hoa reservoir. Therefore, it cannot predict potential eroded and collapsed locations logically and reliably. Due to lack of specific calculations, the proposed solutions were not practical.

Package MT4: the implementation has been carried out for 18 months. Base on the implemented activities, it can be included that the MT4 consultant implemented satisfactory with a good progress. However, the implemented contents were not clearly presented in the regular reports.

Package MT5: Up to now, the MT5 consultant has implemented four site surveys, hydrographic and topographic surveys (*Stage 1 was carried out in October*

2009, Stage 2 in April 2010, Stage 3 in October 2010 and Stage 4 in April 2011). In general, contents in the TOR have been implemented timely and adequately.

Package MT6: the consultant completely implemented all EMP requirements and provisions in the consulting contract and its proposals. The implementation progress met the requirements. The monitoring result report in April 2011 (dry season) was done by the consultant timely and adequately as indicated in the consulting contract.

Package MT7: the consultant has done its duties well, especially the consultant has monitored and reminded contractors in implementing the SEMP. However, the preparation of the quarterly reports has been done inadequately even has been reminded by BVI and OP4 several times.

Package MT10: according to the schedule, package MT10 held 5 workshops at Dong Nai Province, Ho Chi Minh City and Tay Ninh Province (provincial and community levels). The consultant has implemented contents in accordance with its proposed contents. Contents presented at workshops were satisfactory.

9.1.3. Advantages, disadvantages and outstanding issues:

Advantages:

The implementation of all EMP packages has met the requirements of proposed schedule and contents. Serious environmental incidents have not been occurred. These results have been achieved by following certain advantages:

- Selected consultants are capable and have experiences in implementing contents of package.
- Enthusiatic support from local authorities, agencies, and local people.
- Cooperation, share, and support among EMP consultants.
- Coordination and supports timely from ICMB9 in all cases to assist consultant in implementing their works.

Disadvantages:

As mentioned in the previous reports, in the first half of 2011, besides the above advantages, the EMP tasks were faced to some certain difficulties as follows:

- Contractors do not have any staffs who have an environmental educated background, only pluralities. Therefore, the compliance with commitments and the implementation of contents related to environmental protection have not really been done well. Some outstanding issues have not been resolved
- At present, there are only 8/14 packages are under the implementation but the workloads are still quite big. In addition, each package implements

different missions in different times. Therefore, the coordination among these packages is also very difficult.

- The project is implemented in a large area and located in different provinces. Therefore, the implementation of supervision activities and especially the site activities will take a lot of time.

Outstanding issues:

Out of the aforementioned difficulties, in the first six months of 2011, some environmental issues of the EMP implementation have not been completely solved that mainly concerned to construction packages even have been reminded by the Employer and relevant EMP consultants. These difficulties can be listed as follows:

❖ At construction sites:

- Sampling, analysis and evaluation has not been done by the construction contractor (samples of air, surface water, drinking water, domestic water and waste water).
- Large amount of dust appeared in the dry months, using water truck was quite effective but has not been done seriously by contractors, especially in packages 1C.
- Drinking water, domestic water used for engineers and workers at some packages has been infected by microbiology. However, this infection level is not serious than the same period of last year.
- Wastewater and sewage at sites were not treated and discharged directly to environment, causing the local pollution.
- Contractors were not interested in restricting solid waste and construction materials spilled into rivers and streams in the construction area.
- There were no necessary signs at some locations in the construction sites
- Some dump trucks were not covered during hauling materials

❖ For EMP packages

As mentioned, EMP packages are implementing their duties quite well. Outstanding issues of some packages do not affect the quality and progress of the project implementation. However, it is needed to improve the quality and effect of each package:

- After having comments from OP4 and BVI consultants, the revision and resubmission of reports to the Employer have been done slowly.
- At present, consultants are using maps with different sources, formatting and

coordinates are not utilized. This problem will cause difficulties in synthesizing and managing documents.

9.2. Recommendations

9.2.1. General recommendations for EMP packages

- The EMP package consultants must comply with the commitment of the submission of inception report with three full sets (hard copy and CD Rom).
- Relevant agencies should immediately resolve outstanding issues as mentioned in this report.
- The EMP package consultants should be initiative in delivering and sharing the data with other packages.
- The deadline for the submission of reports must be complied within the TOR, summarise the EMP packages implementation results in the middle and the end of the year.
- The preparation and submission of reports must be done timely as required for some packages (MT5, MT6...).

9.2.2. Recommendation for each EMP packages

- ✓ For package MT2: the forestation pilot has been implemented, the consultant should strengthen the supervision activities, support the technologies to farmers. Especially pay attention to mentioned outstanding issues. Report to the Employer the working plans of remaining works in detail and soon so that the coordination and supervision of the Employer can be done properly.
- ✓ For package MT4: the next implementation contents will be very important. The establishment of fisheries association as proposed is not feasible. Therefore, the consultant needs to discuss with the employer to carry out next contents. Continue to supervise the fish pass construction, always play a role as a technical consultant during the implementation process, and report the specific situation to the Employer, BVI and OP4. Actively carry out the community support program as assigned.
- ✓ For packages MT5: To prepare necessary contents for the next surveys in October 2011. Continue to collect data and documents as package's requirements, and pay more attention to the submission of implementation result reports. Continuously update the information of the impoundment of Phuoc Hoa Reservoir, conveying water activities through the Phuoc Hoa – Dau Tieng transfer canal and this information

should be provided in next report.

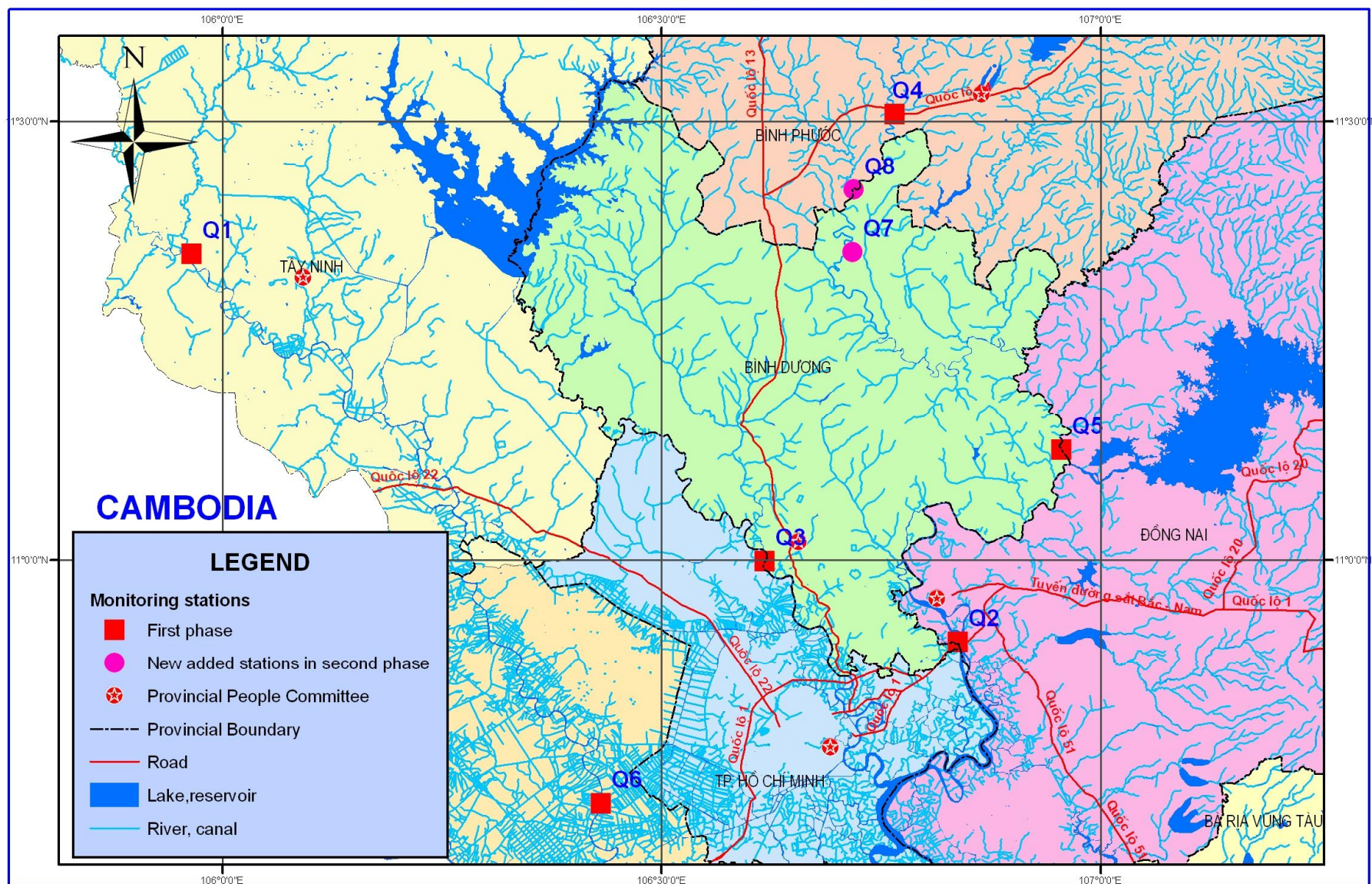
- ✓ For package MT6: the consultant needs to implement timely and in accordance with its proposals. In the last six months of 2011, some items of the project will be put into the operation and affect some certain affects to the environment in the area. It is recommended that the consultant continuously update and provide the necessary monitoring data in order to report promptly the trend of environmental changes in the project area.
- ✓ For package MT7: in the coming time, some items of the project will be put into the operation. It is recommended that the consultant continuously update the information, strengthen monitoring and supervision activities, restore working areas, collect sewages at sites...And prepare a working plan in assisting the implementation of contractors in the coming time.
- ✓ For package MT8: prepare a detailed work plan, implement closely to consulting contract's requirements. Closely cooperate with the Employer, BVI and OP4 consultants during the implementation.
- ✓ For package MT10: scheduling a specific program for remaining workshops and informing to the Employer, BVI and OP4 consultants as soon as possible.

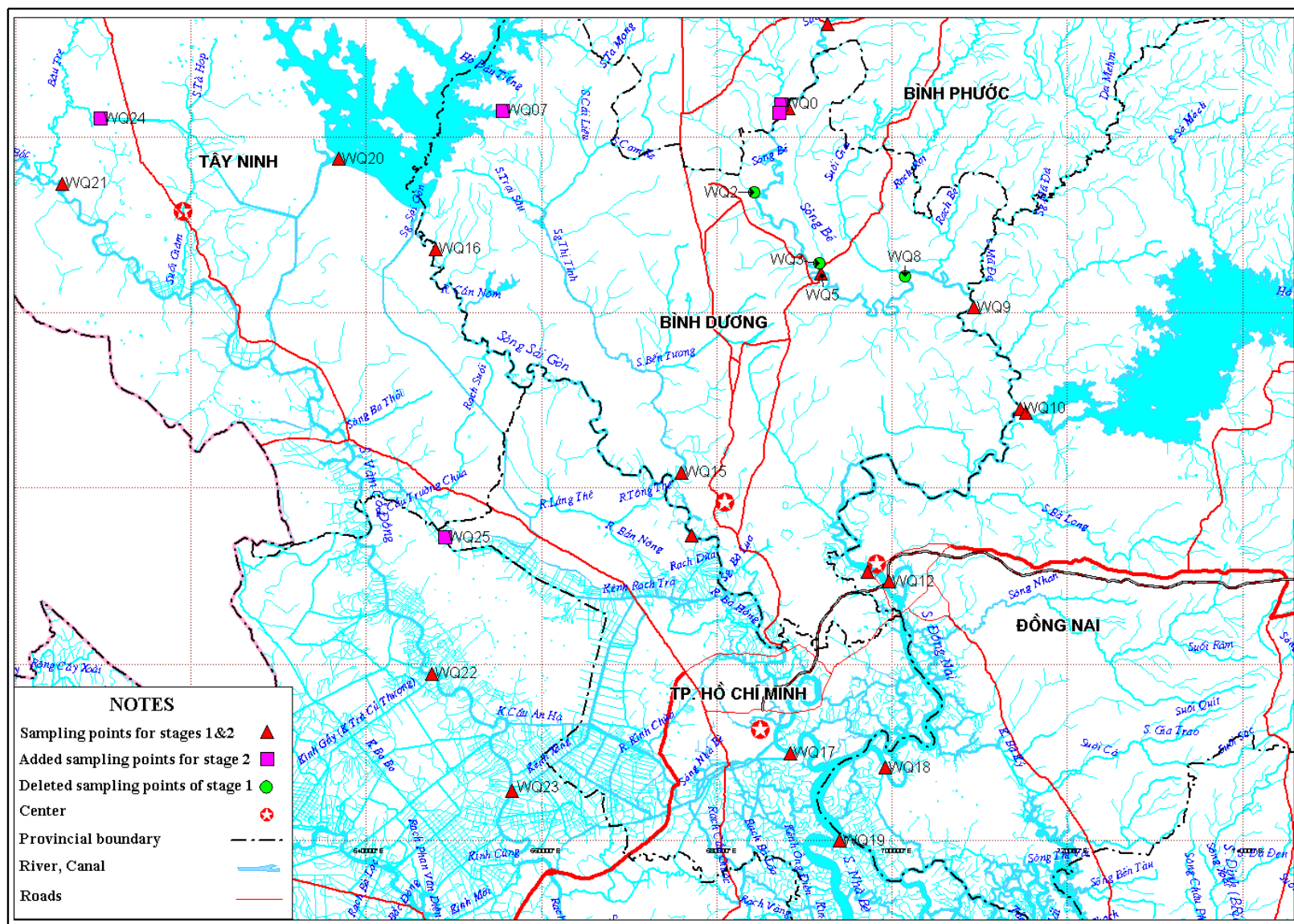
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10. Annexes: Maps

PHUOC HOA WATER RESOURCES PROJECT MAP OF FLOW MONITORING STATIONS







PHUOC HOA WATER RESOURCES PROJECT SAMPLING MAP FOR ACID SULPHATE SOIL MONITORING

