

Environmental Monitoring Report

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VIE: Phuoc Hoa Water Resources Project

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CURRENCY EQUIVALENTS

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ABREVIATIONS AND ACRONYMS

ADB	Asian Development Bank
AFD	Agence Française de Développement
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 “the 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 a series of components including construction of the Headwork's of Phuoc Hoa reservoir, Phuoc Hoa – Dau Tieng transfer canal, and Tan Bien irrigation Main Canal. These construction activities and their effect on the natural and hydrological conditions in the area have caused different negative and positive impacts to the environment. The aim of the Environmental Packages (Packages) is to collect environmental indicators regularly and other related issues, record and detect different impacts of the Project to the environment in order to adjust, overcome and mitigate any negative environmental impacts.

For the purpose of coordination, monitoring, and implementation of the EMP packages, this six-monthly progress report will summarize all activities and the implementation status of these Packages. The report will also orientate and guide in implementing the tasks of EMP packages as well as monitor and speed up the implementation progress of the tasks as in proposed schedules. In addition, the report also monitors the current situation in the project area and its vicinity, and develops the database for the environmental management programs of the Project. Meanwhile the report aims to ensure that project implementation can be made in compliance with the EMP and the Environmental Protection Law of Vietnam.

The six-monthly progress report is a basis for ICMB9 to upgrade their tasks of management and coordination and it also helps ADB and others 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 is funded jointly by the Asian Development Bank (ADB) and Agence Française de Développement (AFD) with a total amount in loans and Special Drawing Rights (SDR) equivalent to 217.27 million USD. The loans were agreed in 2 phases, for the 1st phase in 2003 and for the 2nd phase in 2011/2012. The closure dates are in 2014 and 2017 for ADB and AFD loans respectively.

All loans are summarized in the table below.

Loans	Amount (US\$ million)	Date		
		Approval	Signed	Effective
ADB loan	SDR 63.042 million equivalent to US\$ 90 million	27 November 2003	08 April 2004	23 August 2004
Two AFD loans	EUR 29.6 million equivalent to US\$ 2.270 million	20 November 2003	20 August 2004	20 August 2004
ADB loan supplemental	SDR 38.594 million equivalent to US\$ 60 million	27 May 2011	27 May 2011	30 September 2011
AFD loan supplemental	EUR 20 million equivalent to US\$ 25 million	25 May 2012	7 September 2012	7 September 2012
Total	217.27			

- (ii) 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) to 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.
- (iii) The Project consists of two parts: Part A – Support for Institutional and Integrated Development, and Part B – Construction of Water Resources Infrastructure.
- (iv) 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. Under Phase 2, two new irrigation areas will be constructed: Tan Bien irrigation system in Tay Ninh Province; and Duc Hoa irrigation system in Long An Province. The ADB loans are financing the main infrastructure: Phuoc Hoa barrage, Phuoc Hoa – Dau Tieng transfer canal and the 2 main irrigation canals 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).

- (v) 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 November 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 for transfer of infrastructure to Dau Tieng Irrigation management company (IMC) for management and operation. 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) Consultants.
- (vi) 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 the 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 in 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. The Scope of Works of OP4 Package comprises:

- 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 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 format;

- Carry out field surveys and keep 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 contracts, 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 consultants' 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 reports to ICMB9, MARD, ADB, AFD, MONRE, and local governments, PPCs in the project areas as well as organisations and individuals that are in charge of the above mentioned tasks. Environmental staffs, the environmental division of ICMB9, consultants and contractors must comply with environmental requirements of the Project.

1.2.2. Specific Tasks of OP4 Package

- Understanding the existing and proposed Phuoc Hoa water resources project environmental management programme;
- Management, supervision and monitoring the work 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 distributing.

2. Activities of OP4, BVI and ICMB9 in the firth six months 2013

2.1. Activities of OP4

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

The list of meetings held by OP4

No.	Time	Participants	Contents
1	04/01/2013	Representatives of MARD, ADB, ICMB9, BVI, Phuoc Hoa – Dau Tieng IMC, MT2, MT4 packages, and local authorities	The semi-flooded areas management, catchment and aquiculture protection of Phuoc Hoa Reservoir Conference.
2	20/03/2013	Representatives of ICMB9, BVI, OP4, and EMP packages.	A briefings meeting
3	10/04/2013	Representatives of ICMB9, OP4, and EMP packages	Checking up on the outstanding issues of each packages that were mentioned on the Aide Memoire of ADB, and setting up the implementation plan for solving there issues mentioned.
4	14/05/2013	Representatives of ICMB9, BVI, and MT2.	the implementation of Task II of MT2 package.
5	28/05/2013	Representatives of ICMB9, BVI, OP4, Ben Cat District people's committe, Cay Truong Commune people's committe, and relevant local agencies.	Determining the placement of the 200 m ³ pumping station belong to MT3 package.

In addition, to aforementioned meetings, the OP4 consultant has also cooperated with relevant agencies to be involved in field surveys in project area, and worked with local authorities as follows:

- On 25th April 2013 cooperated with MT5 working group carried out surveying, assessing the execution of field monitoring;
- On 25th and 28th June 2013 cooperated with representatives of ICMB9 and MT8 to work with Long An Hydrometeorology Centre, and Binh Duong, Dong Nai Environmental Monitoring Centre about the operation and management scheme for the salinity monitoring stations.

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

2.2. Activities of ICMB9

In the first six months of 2013, 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;
- Organization 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 MT1, MT2, MT8, MT7, MT4;
- Inspected, speeded up the EMP packages to implement the aide memoir of ADB on 2nd May 2012.
- Cooperated with BVI to prepare the request proposal for MT9, OP3 packages; extending the implementation time of MT7 consulting contract.
- Inspected, evaluated and requested construction 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 2013 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.
- Cooperated with ICMB9 and relevant consultant units such as MT2, MT4, MT7, MT8, OP4, and others to implement works as indicated in the Aide-Memoir of ADB dated 2nd May 2012.
- Supported ICMB9 in preparing the request documents for some EMP packages such as MT1, MT9, and OP3.

3. Implementation of EMP packages in the first six months of 2013

Up to this time, there is 10/14 packages were signed contract, these packages are implementing as follows:

3.1. Package MT1

The contract agreement of Package MT1 was signed in September 2012. Consultant has carried out Inception Conference in the Lo Go – Xa Mat National Park. As the same time, the Inception Report was completed according proposal schedule. They also have submitted the Quarter I/2013 report, the report of Buffer Zone Economic Development Programme of Lo Go – Xa Mat National Park, and the report of Implementation of 50,000 fruit tree plantation programme in buffer zone of Lo Go – Xa Mat National Part. At present, the Consultant is implementing their coming tasks as follows:

- Forest status assessing, monitoring the residence, bioversity of National Park and Production forest;
- Demarcation of National Forest and Production forest;
- Resettlement guidance;
- Capacity building and raising awareness program;
- Buffer zone economic development programme;
- Awareness enhancing workshop (held on 28th May 2013).

The Consultant is simultaneously implementing tasks following the proposed working plan. The implementation results are presented through the progress reports and suitable implementation approaches.

3.2. Package MT2

The contract agreement of Package MT2 was signed in April 2010, and will be finished in November 2013. Up to now, Task I is considered finishing. With Task II, there are some developments as follows:

- The conference on 4th January 2013 analysed and concluded that the project semi – flooded areas have been compensated and revoked to serve the reservoir protection purposes. Therefore, these areas need to be managed by the government agencies, and obey the decree No.112/2008/NĐ-CP and the circular No.03/2012/TT-BTNMT, at the same time, in order to satisfy the project objectives, the semi – flooded areas need to be cover with vegetation cover to reduce erosion as follows: (i) Dam Owner coordinates with communes in project areas to conduct setting up landmarks for the semi –

flooded areas, after that hand over to Commune People's Committees for management; (ii) Commune People's Committees coordinates with District People's Committees conduct landuse planning for the semi – flooded areas obey Vietnamese law and satisfy the project objectives; (iii) MT2 consultant has stopped conducting the reforestation task, and this task will be replaced with supporting the Dam Owner, District and Commune People's committees carry out landuse planning for the semi – flooded areas.

- On 9th May 2013, Binh Phuoc Province People's Committee issued the Document No.1456/UBND-KTN about the agreement of forestation planning alternatives for the reservoir areas belong to Phuoc Hoa Project that were compensated.
- On 6th May 2013, DARD of Binh Phuoc also issued the Document No.655/SNN-PH about supporting local government on implementing the forestation planning for the reservoir areas belong to Phuoc Hoa Project that were compensated.
- On 27th May 2013, BVI has sent the draft version of TOR (soft copy) to ADB Environmental Expert.

3.3. Package MT3

The contract agreement of Package MT3 was signed on 21 September 2011 and the consultant has carried out his tasks as required in the consulting contract. The implementation status can be evaluated as follows:

Construction drawings of Duc Hoa and Lower Be River area water supply scheme have been finished. Particularly for the cost estimate, Consultant is adjusting due to the change of workforce cost.

The package is on the process of completing the procedure for handing over land use for construction. However, the current implementation progress is too low due to lack of initiative in implementation process of Consulting Unit.

ICMB9 is preceding the selection of contractor for construction. Construction works are expected in the quarter III/2013.

3.4. Package MT4

The contract agreement of Package MT4 was signed in January 2010. At present, the MT4 consultant completed the Inception report, and the annual reports of 2010, 2011, 2012, and the first interim report.

In the first six months of 2013, the consultant continued to implement the tasks as required in TOR but the progress of preparation and submission of reports was still slow. According to the TOR, package MT4 consists of 09 specific tasks. We, OP4 consultant assessed the implementation status up to now as follows:

Task I “**Understanding the proposed Be River and Phuoc Hoa fishery, Reservoir and Fish pass management program**”: this task has been implemented early, the basic information was collected and analysed. Recently, the consultant has continued to update the statistic data of the fishery sector of Binh Duong and Binh Phuoc provinces in 2011 and 2012.

Task II “**Monitoring hydrology and environmental flows management**”: This task has been done regularly and continuously. The main data was collected from the data of packages MT5 and MT6.

Task III “**Monitoring the fish pass construction**”: During the reporting phase, the MT4 consultant supervised and monitored the construction of the fish pass. Up to now, the construction of the fish pass was finished. In the first six months of 2013, the consultant conducted two field surveys respectively.

Task IV “**Establishment of Be River and Phuoc Hoa forest and fisheries association**”: This is one of the key tasks of the package. On 9 December 2012, the consultant held a meeting with representatives of ICMB9, BVI, MT4, and Binh Phuoc Aquiculture Centre to discuss the establishment of Phuoc Hoa Fishery Resources Exploitation and Protection Association. On 15th May 2013, a meeting between Binh Phuoc Aquiculture Centre and MT4 Consultant was held. On 28th 2013 a meeting among representatives of ICMB9, MT4 and Binh Phuoc, Binh Duong DARD was conducted at Binh Phuoc Province People’s Committees office. According to report, these departments have worked with each commune and prepared personnel scheme, operational regulation, and these associations are expected to be established in early of July 2013. In order to operate effectively these associations after established, these departments required that the dam owner have to define clearly the terms of reservoir water level and aquaculture management in order to discuss the suitable operation regulations.

Task V “**Operation and Protection of Fish Pass**”: Recently, the Consultant conducted two stages of surveying and monitoring the components of migratory fish species through the fish pass, the samples are testing (Stage I: from 10 to 15 May; Stage II: from 28 to 30 May 2013).

Task VI “**Phuoc Hoa Reservoir fishery management plan**”: in the first six months of 2013, the Consultant conducted several field surveys together with fish pass surveys.

Task VII “**Social support and compensation for affected fishermen**”: According to the MT4’s report, land acquisition and compensation were implemented quite well.

Task VIII “**Management of Be River and lower Dong Nai fishery**”: The main contents of this task are to prepare fishery management plans and action plans

for Be - Dong Nai Rivers basin. Recently, main activities are defined as the collection of relevant documents/data and investigation.

Task IX ***“Monitoring and evaluation of Be River fishery management program”***: Consultant aimed to understand the fisheries management models of other provinces with a similar program so that the consultant will be able to apply these similar programs for the Be River basin in future.

According to plan, MT4 package is going to end in 2013, however, there are three important tasks have been implementing with specific results, namely: (i) Establishment of Aquatic Resources Protection and Management Association; (ii) Training in exploiting and protecting aquatic resources; (iii) Monitoring, assessing the fish pass. Therefore, with these remaining tasks, the Consultant should build an implementation plan promptly, especially the establishment of fishery management teams, training for the members of these teams and local fishermen. Because of the dependence of these tasks on local agencies are so much, hence the Consultant should be more active in the coming time.

3.5. Package MT5:

Up to the end of June 2013, the consultant has monitored the water flow at 8 stages. The details of these measurements are presented in Table 1. The monitoring activities have been made seriously and sufficiently. These monitoring activities were consistent with current governmental norms and regulations and complied with the requirements of the TOR.

Table 1: Monitoring stages of water flow of package MT5

No.	Date		No. monitoring stations	Monitoring stations	Notes
	From	To			
1	17/10/2009	22/10/2009	6	From Q1 to Q6	
2	20/04/2010	25/04/2010	6	From Q1 to Q6	
3	7/10/2010	12/10/2010	6	From Q1 to Q6	
4	20/04/2011	25/04/2011	6	From Q1 to Q6	
5	13/10/2011	18/10/2011	6	From Q1 to Q6	Monitoring station Q5 was moved to upstream with a distance of 1.0 km as proposed by BVI.
6	23/04/2012	28/04/2012	8	From Q1 to Q8	Provided 2 additional monitoring stations at the fish pass and downstream of the dam.
7	02/10/2012	07/10/2012	8	From Q1 to Q7	Q8 had not been monitored due to the water level in fish pass was too low.

8	22/04/2013	27/04/2013	10	From Q1 to Q10	Q9 is placed at the beginning (K0) and the end (K36+316) of PH-DT canal. Q11 and Q12 have not been monitored yet, because construction has been not completed.
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At present, the field surveys have been made as scheduled. The monitoring activities have been implemented in accordance with current governmental norms and regulations on the hydraulic monitoring and measurement.

3.6. Package MT6:

The contract agreement of package MT6 was signed in November 2009. Up to now, the consultant completed their Inception Reports and monitoring result reports in 2010, 2011 and 2012 (February 2013). The measurement and sampling activities at sites have been made as scheduled.

In comparison with the TOR, most of the tasks have been implemented quite well such as providing additional monitoring locations for the operation stage, taking water samples at field sites, and analysing the quality of surface water, groundwater, and industrial wastewater. According to the TOR, in the third year of operation stage, the monitoring network will have some changes. For example, the consultant will not take water samples at streams of Be River such as Chon Thanh stream, Nuoc Trong stream and Giai stream (WQ2, WQ3, and WQ8), the details of these changes have been shown in the first six months report of 2012.

In the first six months of 2013, Consultant carried out one monitoring stage in April 2013 consisting of surface water, groundwater, industrial wastewater, irrigation area, aquatic life, and the Operation and Management House.

The outstanding issues of this package have been mentioned in the previous reports, which are happening such as consultant was not active in contacting and cooperating with local authorities. Therefore, the information of monitoring systems as well as monitoring data from local agencies was not mentioned in the reports of this package.

3.7. Package MT7

The contract agreement of package MT7 was signed in October 2008, and was finished in October 2012. By the end of the contract, consultant has finished entire field works as well as submitting the final report of 1A, 1B, 1C, 1D, PH3, 1E, 1F packages according to the TOR. They are submitting the cost estimate of monitoring the PH4 construction bid package to ADB.

In general, most of tasks that were indicated in the TOR have been implemented by the MT7 consultant. At present, the construction activities of the first Phase of the project were finished but serious environmental incidences have not occurred. This achievement is a joint effort of relevant stakeholders.

3.8. Package MT8:

The contract agreement of package MT8 was signed on 30 June 2011. Up to now, the execution time of contract is overed, the MT8 package finished. At present, the Consultant continues to support the monitoring stations, particularly support the OP3 package.

3.9. Package MT9

BVI consultant has drafted the TOR and cost estimate of package MT9, and submitted to the investor. The investor has submitted to the donor (ADB) to review. Revision was made on the implementation schedule and resubmitted to ADB for approval .

3.10. Package MT10

Up to now, the tasks of package MT10 were finished. The effects of this package have been recorded and evaluated through the process of EMP packages implementation. These evaluations have been combined and performed more details in Section 9 “Environment Awareness” of this report.

4. Environmental management program at construction sites

4.1. Main construction activities at the sites

Up to the end of June 2013, all construction packages (1A, 1B, 1C, 1D, PH3) were completed. At present, only PH4 package is under processing. This package consists of one main contractor and five subcontractors.

Main contractor: Joint Venture Taeyoung E&C and WASECO Company.

Subcontractors:

- K0+000 - K2+550: CC5 (Construction Company No.5);
- K2+550 - K10+200: BIDECO (Binh Thuan Infrastructure Development Joint Stock Company);
- K10+200 - K12+770: CCI9 (Construction Company No.9);
- K12+770 - K14+020: Joint Venture TW and LILAMA 45.1 (LILAMA 45.1 is in charge of producing the siphon steel pipes);
- K14+020 - K17+680: BIDECO.

Table 2: Total volume construction of PH4 package

No.	Categories	Unit	Total
1	Excavated soil	m ³	700.350
2	Filling soil	m ³	1.142.361
3	Filling sand	m ³	180.450
4	PVC connection (channel reinforcement only)	m	111.985
5	Geotextile Fabric	m ²	120.309
6	Concretes	m ³	43.462
7	Steel and reinforcing steel	kg	4.552.472
	Where, Thay Cai siphon steel:	kg	2.949.915
	- Steel pile D 2,6 m, thickness 18 mm	kg	2.181.725
	- Steel pile D 2,6 m, thickness 22 mm	kg	768.190

Sources: ICMB9

Table 3: Total volume construction of PH4 package until 30/06/2013

No.	Categories	Unit	Total	30/06/2013
1	Excavated soil	m ³	700.350	201.360
2	Filling soil	m ³	1.142.361	101.200
3	Filling sand	m ³	180.450	30.000
4	PVC connection (channel reinforcement only)	m	111.985	
5	Geotextile Fabric	m ²	120.309	49.100

No.	Categories	Unit	Total	30/06/2013
6	Concretes	m ³	43.462	1900
7	Steel and reinforcing steel	kg	4.552.472	70.000
	Where, Thay Cai siphon steel:	kg	2.949.915	0
	- Steel pile D 2,6 m, thickness 18 mm	kg	2.181.725	
	- Steel pile D 2,6 m, thickness 22 mm	kg	768.190	

Sources: ICMB9

4.2. Impacts to be caused by construction activities

The impacts of construction activities at work sites must be monitored, considered frequently during construction time as follows:

- Unexploded Ordinance, Land Mines and Toxic Waste;
- Reinstatement of Temporary Working Areas;
- Work in public highway, inside and outside the sites;
- Site drainage;
- Sanitation and site facilities;
- The protection of the surrounding landscape.

Up to now, the attentive issues as were mentioned above have not yet been occurred. However, MT7 should conduct these activities as soon as possible to prevent the potential risks from construction activities to surrounding environment and worker health.

4.3. Environmental monitoring results at the sites

According to the agreement contract, this package was finished in October 2012. In addition, most of construction activities in 1A, 1B, 1C, 1D, PH3 packages were finished up to 30/06/2013. PH4 package has conducted construction activities. Up to now, MT7 package Consultant is still negotiating contract to extent the implementation time, hence we do not have any environmental monitoring results.

5. Water Environment

5.1. Changes of the water flow and erosion status at riverbanks

5.1.1. Changes of the water flow

See the map of flow monitoring stations in attached appendix A.

General changes of the water flow:

Through 4 monitoring stages in the dry seasons (April) of the years 2010, 2011, 2012 and 2013 show that the monitoring results did not follow any particular rules. The average water flow in the dry season of 2011 was less than that in 2010 at all monitoring stations. The monitoring results in April 2012 show that the water flow from Q1 to Q6 were higher than in the same period of 2011 even higher than the monitoring results in 2009. In this dry season (April 2013), the average flow at stations was less than that in the same period in 2012. Particularly the average flow was less than that in the dry season of the year 2011 at Q3 station (on Sai Gon River), Q5 (on Be River).

Changes of the water flow upstream and downstream Phuoc Hoa dam

- **Upstream:**

The monitoring results of the station Q4 (Nha Bich bridge) in the upstream area of the Phuoc Hoa dam in 2010, 2011, 2012, and 2013 show that:

- Before the impoundment time for Phuoc Hoa Dam (July 2010), if the water flow is decreased in comparison with the same period of the previous year, hence the water level is decreased (the measured results in 10/2009 and 10/2010, 4/2010 and 4/2011).
- Since the monitoring stage in the dry season of 2011, although the discharge in April 2012 was 142.6 m³/s that was too much less than that in October 2011, was 501.7 m³/s. However, at Q4 station, the water level in April 2012 was still higher than that in October 2011 of 2.1 m (+42.8 m in comparison with +40.7 m).
- The mean water level at Q4 station in October 2012 and April 2013 were higher than the top of Labyrinth spillway +42.5 m (the top of Labyrinth spillway of Phuoc Hoa Dam).

The monitored results show that Phuoc Hoa Dam has made the water level in the upstream areas raise.

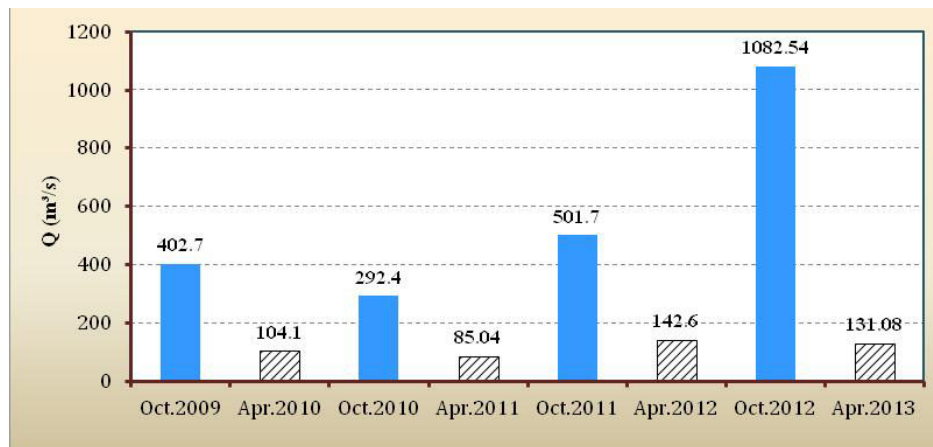


Figure 1: Water discharge at Q4 station – in the upstream of Phuoc Hoa Dam



Figure 2: Water level at Q4 station – in the upstream of Phuoc Hoa Dam

• **Downstream:**

Since 17th February 2013, Dau Tieng – Phuoc Hoa IMC has begun transferring water from Phuoc Hoa Reservoir to Dau Tieng Reservoir with the maximum discharge of 50 m³/s. The average discharge at the head of transfer canal is 43.7m³/s (from 22 to 27 April 2013). Since the beginning of February 2013, Dau Tieng Reservoir has to release water three times to push salinity to ensure the water quality for Tan Hiep Water supply Company. For this reason, the salinity intrusion on the Sai Gon River and Vam Co Dong River is negligible, thanks to the regression discharge from Dau Tieng.

At Dong Nai River basin, the monitored results show that the discharge was decreased compared to the same period of 2012 at stations namely Q7 (in the downstream of the Phuoc Hoa Dam), Q5 (in the downstream of the Be River), and Q2 (Dong Nai Bridge). Hence the transfer of water may impact certainly on the flow regime and salinity intrusion in the Dong Nai River. In order to have a precise conclusion about the impact of water transfer, we should have a sequence of continuous monitoring data of water quality and salinity.

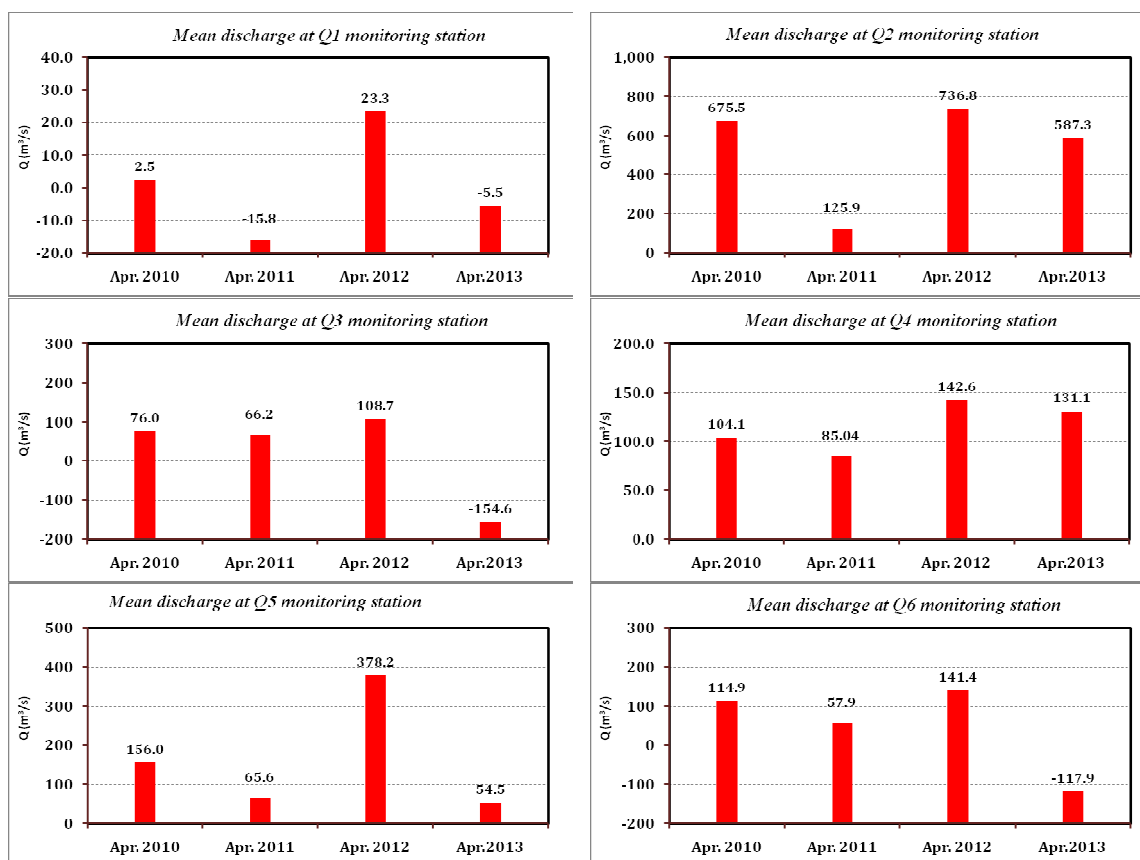


Figure 3: Changes of discharge at monitoring stations in the rainy season of years 2010, 2011, 2012 and 2013

Preliminary forecast on the salinity intrusion possibility in the Sai Gon and Dong Nai Rivers:

The monitoring results of 8 measured stages from October 2009 to April 2013 show that there is a close interrelationship between the volume and time of rainfall in the rainy season in the previous year and the dry season in the next year.

- In the dry season of 2011, the water flow from the upstream to the downstream areas was less than that in 2010, the level of salinity intrusion was therefore more serious in 2011.
- Up to the rainy season of 2011, the water flow was higher than in the years 2010, 2009. Therefore, the level of salinity intrusion in 2012 is less serious than in the previous 2 years.
- In 2012, the rainy season came and ended soon, it's mean that the dry season also ends soon. In addition, the flood season of 2012 was smaller than forecast, the water discharge came to the upstream reservoirs was small. In coordination with prolonged drought that will make salinity intrusion raises in the Sai Gon, Dong Nai, Vam Co Dong Rivers in the dry season of 2013. Salinity of Sai Gon River in the early of March 2013 was higher than the same period of the previous year 3 – 5 ‰. The salinity peak fell at the end

of March, up to April several seasonal rains was appeared then the average salt content reduced slightly.

5.1.2. *The status of riverbanks erosion*

As mentioned in the previous reports, there were 09 minor eroded locations. Up to now, these old erosions are stable and new erosion locations have not been found. The natural vegetation along both sides of the river was overgrown and stable. For downstream areas, there were 66 eroded locations noticed 4 days after the dam had been impounded due to slides caused by groundwater pressure. So far, these erosions have been stable and new erosions did not occur. Vegetation on both sides of the river is growing stably.

For the transfer canal, in the monitoring stage of April 2013, working team found serious collapsed location at Km36+800, the collapsed location extended over 50 meters length, and 2 – 3 meters deep into the riverbank that made the TSS content and organic matter in water, which discharged into Dau Tieng Reservoir, significantly increased and obstructed the flow.

5.1.3. *Variables of the vegetation along the Be riverbanks.*

Regarding the surveying results of the MT2 package, along both sides of Be River consists of 2 kinds of vegetation: natural vegetation and artificial vegetation.

The natural vegetation mainly distributes on the left bank of Be River (viewed upstream to downstream), including 04 main types: Type 1: *Pure thorny bamboo forest*; Type 2: *Thorny bamboo forest mixed with broad-leaved species*; Type 3: *Sparse broad-leaved forest and shoot regenerating forest*; and Type 4: *Grass and shrubs*. The artificial vegetation includes rubber forest, cashews, orchards and short-term crops, which are mainly grow both sides of Be River (not on vacant land). All artificial vegetation as mentioned above were grown one species with one-layer, which is relatively uniform in size and coverage. The current coverage ranges 50 - 60%. Most types of planted vegetation typically distribute from the river inclined edges about 5 -10 m.

5.2. **Changes of the water quality**

See the sampling map for water quality in attached appendix A.

5.2.1. *Surface water quality*

❖ **Be River basin:**

There are 5 monitoring locations: Nha Bich (WQ01), Phuoc Hoa dam (WQ04), Phuoc Hoa bridge (WQ05), Ma Da (WQ09), downstream of Be river (WQ10).

Monitoring results in the first six months of 2013:

- Value of pH was stable in the range from 6.7 – 7.1, and in the range of level A2 of the standard QCVN 08:2008/BTNMT.
- Value of TSS fluctuated in the range from 44 – 64 mg/l. It tended to be high in the upstream and downstream areas, and decreased inside of the Phuoc Hoa Reservoir.
- The nutrient content was rather low, total nitrogen (T-N) in the range from 0.55 - 1.09 mg/l, the highest value at the lower areas of Phuoc Hoa Bridge. The other nutrient contents such as NO₂, NO₃, PO₄, and total phosphorous (T-P) had the same variable.
- Dissolved oxygen values (DO) at monitoring locations in Be River in April were greater than 5 mg/l. The organic content was rather low. The COD value is in the range from 2.0 – 3.5 mgO/l, BOD₅ is in the range from 2.0 – 2.5 mgO/l.
- The Fecal Coliform value was less than 1.000 MPN/100 ml.

Comparison with the standard QCVN 08:2008/BTNMT

- The water quality in Be River was quite good, equivalent to the water resource range **A1 – A2 under the standard QCVN 08:2008/BTNMT** (*it is good for domestic water supply, aquatic conservation and other demands which need a lower water quality*).
- The impacts of Phuoc Hoa Dam construction to TSS content only occurred clearly at the downstream area.
- DO values was suitable for protection of aquatic life according to the standard QCVN 38:2008/BTNMT and meet the level A2 of the standard QCVN 08:2008/BTNMT.
- COD values and BOD₅ values are equivalent to the level A1 and A2 of the standard QCVN 08:2008/BTNMT.
- Total oil and heavy metal contents are equivalent to normal values of metal that naturally occur in surface water.

Comparison of monitoring results through the years:

Assessments of yearly trend of Be River water quality in this report do not include springs such as Thon Spring (WQ02), Nuoc Trong (WQ03) and Giai Spring (WQ08), because these stations was not monitored continuously from 2012.

- The TSS content in 2013 was decreased in comparison with the average values of many years at stations WQ09 and WQ10. In April 2012, TSS was

138 mg/l at WQ09, up to April 2013 it dropped to 44 mg/l. Particularly at WQ05 in the upstream area of Phuoc Hoa Reservoir, TSS in April 2013 was higher than that in April 2012, however, still less than that in the same period of the years 2010 and 2011 [Figure 4].

- COD and BOD values in April 2012 were lower than the average of many years at the most monitoring locations, but not significant differences.
- In 2010 – 2013 period, T-N tends to increase from the upper areas of Be River to Phuoc Hoa Dam (WQ01 – WQ05), however, T-N in April decreased compared with the same period of years towards the downstream.

Therefore, by comparison with the same period of years from 2010 to 2012 and the pre-project phase, the monitoring results in April 2013 show that [Table 4] the contents of TSS, PO_4 , NO_3 , DO, COD were equivalent or smaller.

(See the results of the monitoring stage in April of years in the First Six-Monthly Report 2010, 2011, 2012 – Package OP4).

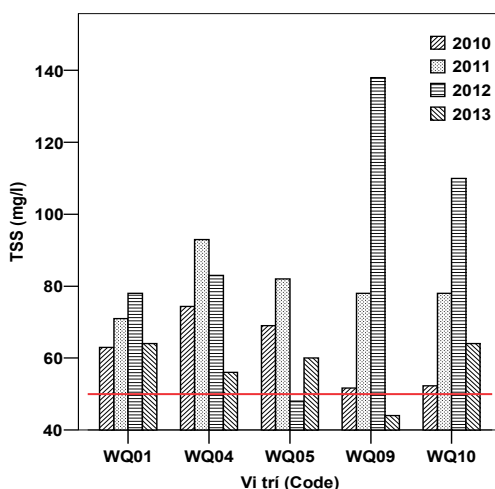


Figure 4: TSS of Be River in the dry season, 2010 - 2013

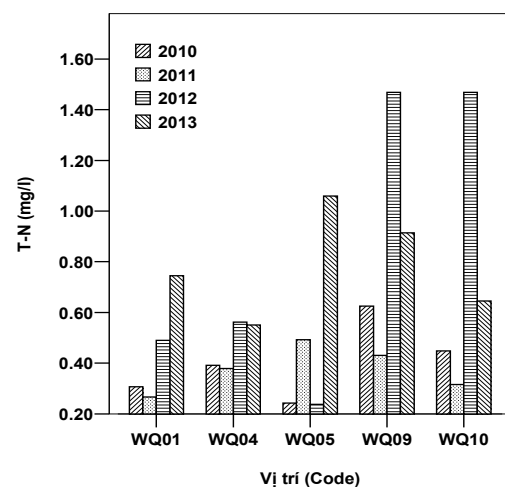


Figure 5: T-N of Be River in the dry season, 2010 - 2013

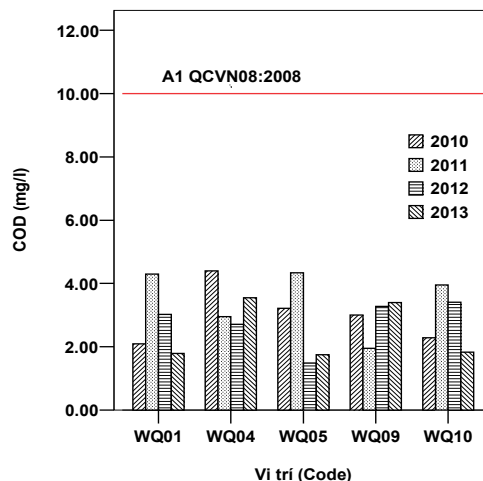


Figure 6: COD of Be River in the dry season, 2010 - 2013

Table 4: Comparison of monitoring data in April 2013 with the data before project implementation, Be River

No.	Monitoring indicators	3/2003	4/2010	4/2011	4/2012	4/2013	A2 - QCVN 08:2008
1	TSS (mg/l)	44	55	78	138	44	30
2	PO ₄ ³⁻ (mg/l)	0.02	0.04	0.05	0.05	0.02	0.2
3	NO ₃ ⁻ (mg/l)	0.40	0.04	0.36	0.80	0.19	5
4	DO (mg/l)	6.0	6.2	6.3	5.8	5.5	5
5	COD (mg/l)	7.0	2.5	2.0	3.3	3.4	15

Source: Southern Institute of Water Resources Research, Phuoc Hoa EIA report, 2007

❖ **Dong Nai River:**

The monitoring stations in Dong Nai River are located in the downstream area of Tri An reservoir (WQ11), Bien Hoa City (WQ12), downstream area of Hoa An Bridge (WQ13), Nhon Trach area (WQ18) and before the junction with Sai Gon River at Nha Be district (WQ19).

Monitoring results in the first six months of 2013:

- pH value was stable and fluctuated in range of 6.1 - 7. 8, and they had no significant differences among monitoring stations.
- In the monitoring stage of April 2013, highest salinity value at Nha Be was 7.5 m/l. The upstream areas from Tri An to Hoa An Bridge, the salinity was too low and less than 0.5 g/l. The salinity was increased from Nhon Trach to the confluence of Sai Gon River.
- TSS values fluctuated in range of 41 – 152 mg/l, highest value was measured at the confluence of Sai Gon River.
- Contents of nutrient, organic matters were low generally, but most of them had the decreased trend of contents, highest value was measured in the lower area of Tri An Reservoir, and increased gradually towards the lower area of Nha Be.
- Oxygen demand contents of Dong Nai River fluctuated in range of 3.8 – 6.2 mg/l, lowest content was measured in Bien Hoa and Nha Be.
- The amount of Fecal Coliform in the upstream area of the Dong Nai River was low, less than 3 MPN/100ml.
- The content of heavy metal measured at monitoring stations was low in compared with the level A2 of the standard QCVN 08:2008/BTNMT.

Comparison with the standard QCVN 08:2008/BTNMT

In general, the water quality of upper Dong Nai River (from Tri An to Hoa An) is good at monitoring stations equivalent to the rank **A1 and A2 of the standard QCVN 08:2008/BTNMT**. The water resource in lower areas were influenced by salinity intrusion in the dry season, which could not be used for domestic and irrigational purposes. The level of pollution tends to increase from Nhon Trach to the confluence with the Sai Gon River.

Comparison of monitoring results through the years:

- pH value tends to decrease in comparison with the same period of years 2010 – 2012 at most of monitoring stations.
- The stations are impacted by salinity and tidal regime (Nhon Trach, Nha Be), in the dry season of 2013, the salinity increased slightly in comparison with the same period of year 2012, but it was less than that in the dry season of years 2010 and 2011. There had no significant difference in the areas from Tri An to Hoa An.
- TSS and COD contents tend to increase slightly in the stage of April 2013 in comparison with 2012, particularly in the lower areas of Dong Nai River to Bien Hoa. These results are equivalent to the monitoring results of the Environmental Technology and Monitoring Centre of Dong Nai Province.
- In comparison with the water quality while implementing the project shows that TSS and pH had no significant differences, however, the contents of nutrient such as NO₃, PO₄ tend to increase whereas the DO contents tend to decrease (station WQ12, Tan Mai).
- The change of water quality monitoring parameters of Dong Nai River in the 2010 – 2012 period are suitable to the monitoring results of national monitoring networks and also water resources sector. The changes of water quality are caused by development activities in lower areas such as navigation, sand exploitation; and the impact of weather changes such as rainfall increase, and tide regime. The monitoring results of MT6 package have not discovered any relationship between activities of Phuoc Hoa project (preparation, construction, and testing operation) with those changes of water quality in Dong Nai River in the 2010-2012 period.

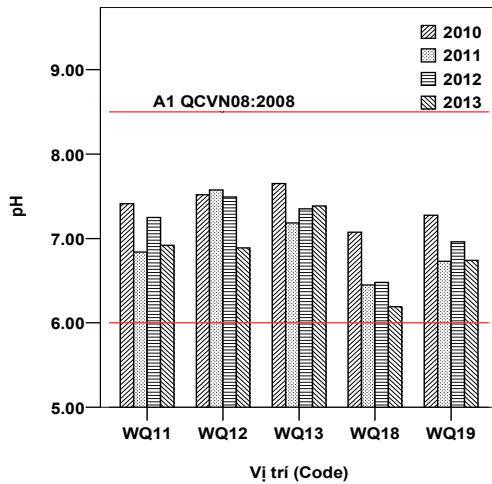


Figure 7: pH of Dong Nai River in the dry season, 2010 - 2013

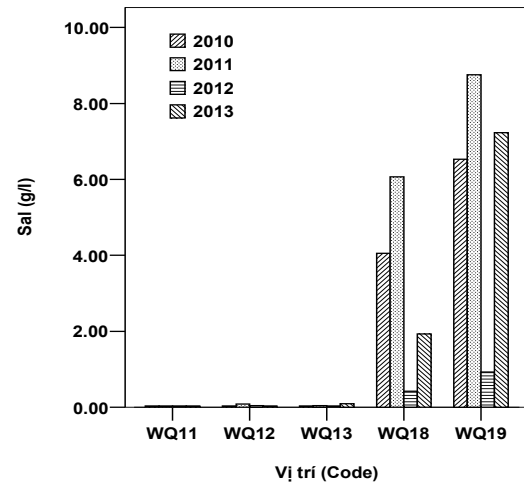


Figure 8: Salinity of Dong Nai River in the dry season, 2010 - 2013

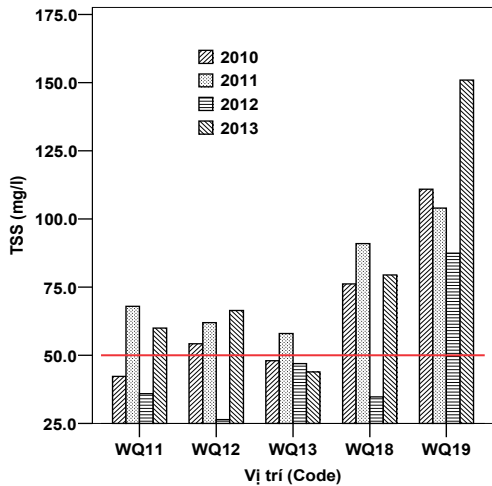


Figure 9: TSS of Dong Nai River in the dry season, 2010 - 2013

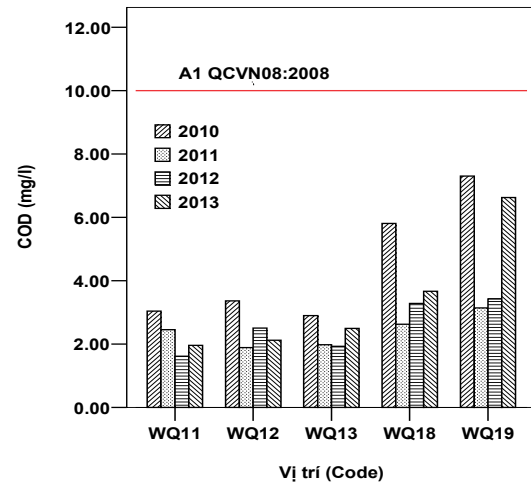


Figure 10: COD of Dong Nai River in the dry season, 2010 - 2013

Table 5: Comparison of monitoring data in April 2013 with the data before project implementation, Dong Nai River

No.	Monitoring indicators	3/2003	4/2010	4/2011	4/2012	4/2013	A2 - QCVN 08:2008
1	TSS (mg/l)	61	56	69	22	64	30
2	PO ₄ ³⁻ (mg/l)	0.02	0.03	0.03	0.02	0.02	0.2
3	NO ₃ ⁻ (mg/l)	0.01	0.09	0.59	0.8	0.22	5
4	DO (mg/l)	5.0	5.2	5.5	5.6	3.8	5
5	COD (mg/l)	12.0	3.0	2.0	1.8	2.0	15

Source: Southern Institute of Water Resources Research, Phuoc Hoa EIA report, 2007

❖ Sai Gon River:

Monitoring stations in Sai Gon River located at the Ben Than water treatment plant in Cu Chi district (WQ14), the confluence with Thi Tinh River (WQ15), Dau Tieng Township in Binh Duong Province (WQ16) and downstream of Sai Gon River

in Tan Thuan (WQ17).

Monitoring results in the first six months of 2013:

- In the monitoring stages of April 2013, pH value was stable and fluctuated between 6.1 and 6.8 at all monitoring location, the impact of alkaline cleaning activities on Sai Gon River was not significant. pH value at Tan Thuan (6.56) was higher than other upper locations due to tidal impact.
- From Ben Than to Binh Duong (WQ14), the salinity was low and lower than 0.1 g/l, the highest value measured at Tan Thuan was 3.0 g/l.
- TSS content fluctuated from 49 – 87 mg/l in Sai Gon River. In Ben Than region, the turbidity was highest causing by sand exploitation, construction material transportation along the river from An Nhon Tay to Ben Than.
- DO content fluctuated from 3.3 – 6.3 mg/l, the lowest value was measured in the areas, where the water in Sai Gon River runs into Thu Dau Mot area.
- Although contents of nutrient and organic matters were low compared to the level A2 of the standard. However, the same as Dong Nai River, the contents of these matters tend to increase towards the downstream after flowing through the urban areas and industrial zones of Binh Duong and Ho Chi Minh City.
- Amount of Fecal Coliform in Sai Gon River was fluctuated so much, from 0 to 9.300 MPN/100ml, highest at the areas where the river flows through Tan Thuan area, and much higher than Be River and Dong Nai River.
- The heavy metal concentration of three stations that receive waste sources such as WQ14, WQ15 and WQ17 were very low in the first six months of 2013.

Comparison with the standard QCVN 08:2008/BTNMT

- In general, the water quality in Sai Gon River that from Cu Chi area to the confluence with Thi Tinh River in the dry season of 2013 was quite good, equivalent to the class A2 of the standard QCVN 08:2008/BTNMT, it was suitable to domestic water supply, aquatic conservation, and the other demands which need a lower water quality. The water quality of the reach, which flows from Binh Duong to the confluence with Dong Nai River, tends to increase the level of pollution.
- The monitoring values show that the water quality was impacted by waste sources from towns, industrial parks, agricultural zones, especially in the lower areas. The results from monitoring networks of Nation and the General Department of Water Resources also find the degradation of water quality of

Sai Gon River in period 2001-2012.

Comparison of monitoring results through the years

- pH value was stable and not significantly different to the years 2010 and 2012.
- In the lower area of Sai Gon River (Tan Thuan), the salinity in April 2013 was 3.0 g/l that higher than 2012, but still less than the same period of years 2010 – 2011.
- Similar to nutrients, the content of organic matters at monitoring stations in the downstream of Sai Gon River (from Dau Tieng to Thu Dau Mot) in April 2012 were less than the same periods of years 2010 - 2011.
- In comparison some water quality parameters at Ben Than with the data in the pre-project phase show that the level of organic pollution tends to increase over time.

Due to the limits of monitoring data in the dry season, hence it is not enough for us to assess the impacts of water transfer on pushing salinity in Sai Gon River. However, according to **DARD** of Tay Ninh and Long An Province, confronted with situation of serious drought that occur at most of areas in whole country in the dry season of 2013, the water supplement to Dau Tieng Reservoir from Phuoc Hoa has improved the drought condition for thousand hectares of paddy field and vegetable garden.

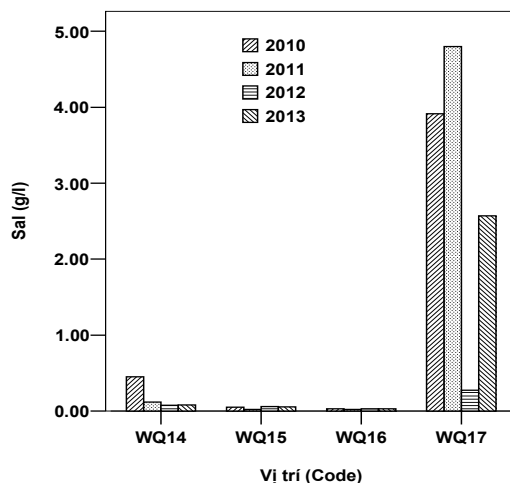


Figure 11: Salinity of Sai Gon River in the dry season, 2010 - 2013

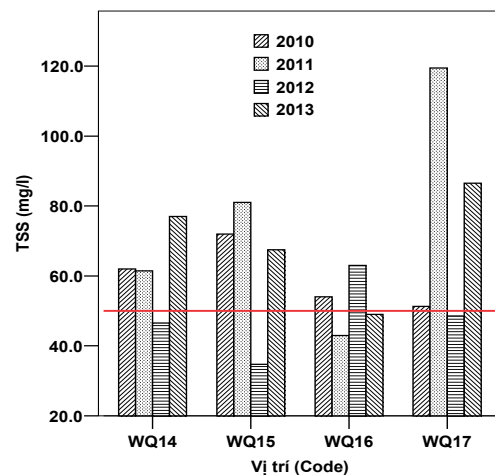


Figure 12: TSS of Sai Gon River in the dry season, 2010 - 2013

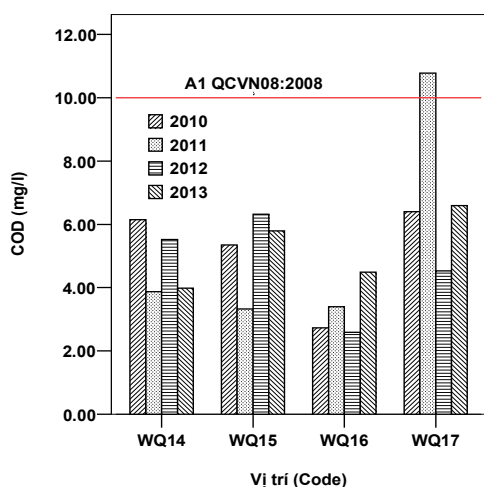


Figure 13: COD of Sai Gon River in the dry season, 2010 - 2013

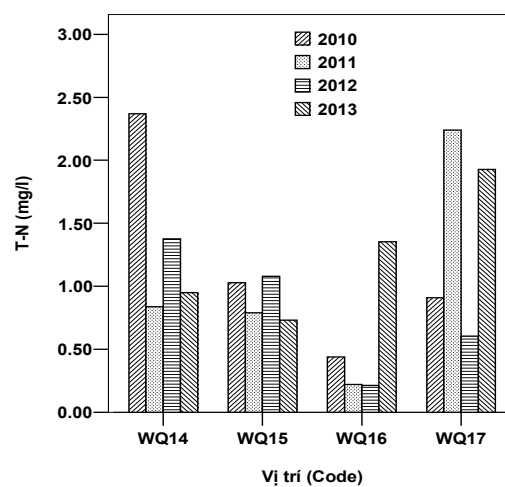


Figure 14: T-N of Sai Gon River in the dry season, 2010 - 2013

Table 6: Comparison of monitoring data in April 2013 with the data before project implementation, Sai Gon River

No.	Monitoring indicators	3/2003	4/2010	4/2011	4/2012	4/2013	A2 - QCVN 08:2008
1	TSS (mg/l)	72	51	62	22	84	30
2	PO ₄ ³⁻ (mg/l)	0.00	0.05	0.04	0.02	0.06	0.2
3	NO ₃ ⁻ (mg/l)	0.60	0.90	0.83	0.84	0.51	5
4	DO (mg/l)	5.0	4.5	5.1	5.6	4.4	5
5	COD (mg/l)	5.0	6.2	4.6	1.8	4.4	15

Source: Southern Institute of Water Resources Research, Phuoc Hoa EIA report, 2007

❖ Vam Co Dong River:

Monitoring stations in Vam Co Dong River located at Ben Da in Chau Thanh district, Tay Ninh province (WQ21), Tra Cu in Duc Hoa district, Long An province (WQ22), Ben Luc in Long An province, at the junction with Xang canal (WQ23).

Monitoring results in the first six months of 2013:

- In the monitoring stage, pH value in Vam Co Dong River fluctuated from 5.9 to 6.2. There is no significant differences among locations.
- Salinity intrusion in Vam Co Dong River was not remarkable, highest value measured at Ben Luc was 1.3 g/l.
- TSS values were low, fluctuated from 50 to 61 mg/l and tended to decrease from the upstream to the downstream, this trend is however not really clear.
- DO values were fluctuated from 4.0 to 6.3 mg/l, lowest value was measured in the reach where Vam Co Dong River flows through Duc Hoa area.
- The contents of nutrient and organic matters were low in comparison with the

level A2 of the standard. However, similar to Dong Nai and Sai Gon River, these contents tend to increase towards the downstream after flowing through Duc Hoa industrial zones, Long An Province. Particularly, the contents of nutrient in the reach where Vam Co Dong River flows through Ben Luc area (after the confluence of Xang canal) were higher than the other locations, where T-N was 2.06 mg/l and NO₂ was 1.5 mg/l.

- The amount of Fecal Coliform in the dry season 2013 fluctuated quite large from 0 to 4,300 MPN/100ml, the highest amount of Fecal Coliform was at Tra Cu (WQ22).

Comparison with the standard QCVN 08:2008/BTNMT

In general, the water quality in Vam Co Dong River in the dry season of 2013 was quite good, equivalent to the class A2 of the standard QCVN 08:2008/BTNMT, it was suitable to domestic water supply in case of having a suitable water treatment, aquatic life protection, and the other demands that need a lower water quality. The water quality of the reach, which flows through Duc Hoa area, Long An Province, tends to increase the level of pollution, especially the large amount of Fecal Coliform have been locally found at some positions.

Comparison of monitoring results through the years

- Comparison between pH monitoring results in April of the years 2010 - 2013 with pH in March 2003 at the station WQ23 in Vam Co Dong River shows that there were no significant differences in the absolute value.
- Salinity in the reach from Tra Cu to Ben Luc tends to decrease in the period of years 2010 – 2013. However, this tendency needs to be continued to monitor, because Duc Hoa channel is still in the construction process.
- Contents of nutrient and organic matters did not show the homogeneous tendency among monitoring stations. However, at WQ21, T-N tends to increase from 2010 to 2013, while COD content decreased. T-N tends to increase at remaining monitoring stations.
- The monitoring results mentioned above are also similar with monitoring results of the water quality that are measured by local agencies and the Directorate of Water Resources. In addition, the water quality of Vam Co Dong River besides the impacts of natural conditions such as acid sulphates soils, salinity intrusion, also be impacted by the waste sources of industrial parks, which has a strong development trend in recent year in Long An and Tay Ninh Provinces.
- There was no relationship between the water quality in Vam Co Dong River and the activities of building Phuoc Hoa dam in 2010-2013 periods.

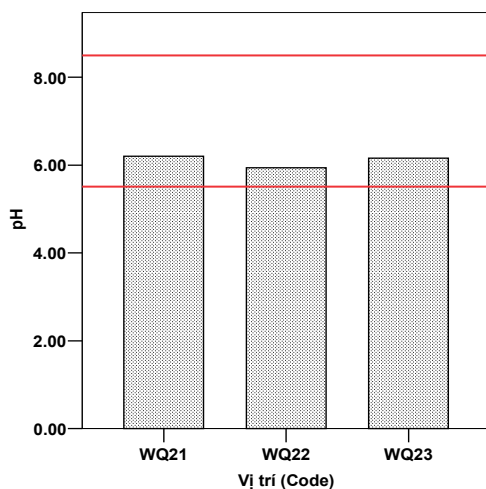


Figure 15: pH of Vam Co Dong River in the dry season, 2013

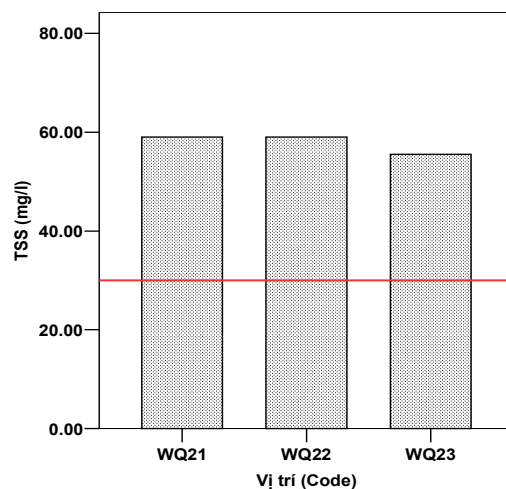


Figure 16: TSS of Vam Co Dong River in the dry season, 2013

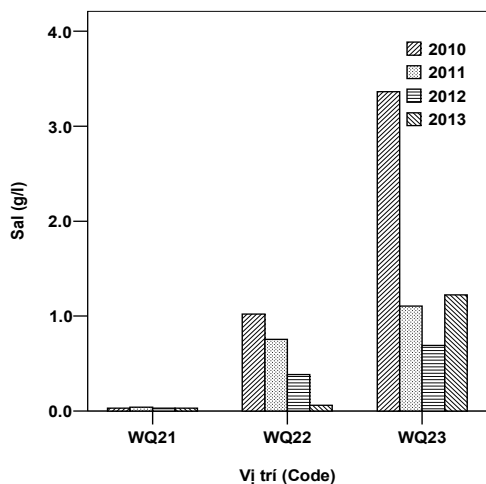


Figure 17: Salinity of Vam Co Dong River in the dry season, 2010 - 2013

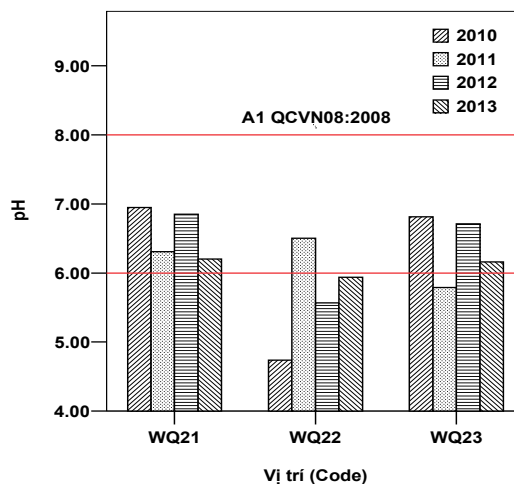


Figure 18: pH of Vam Co Dong River in the dry season, 2010 - 2013

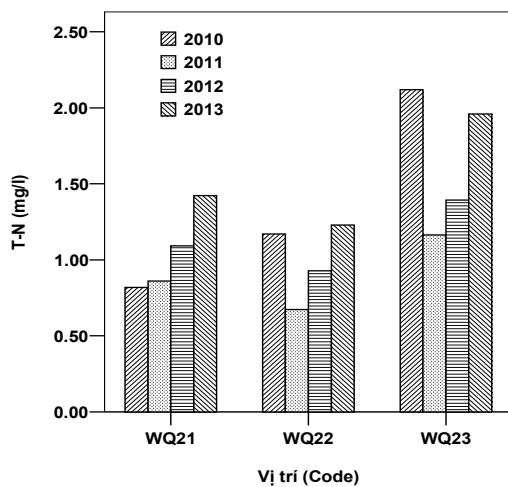


Figure 19: T-N of Vam Co Dong River in the dry season, 2010 - 2013

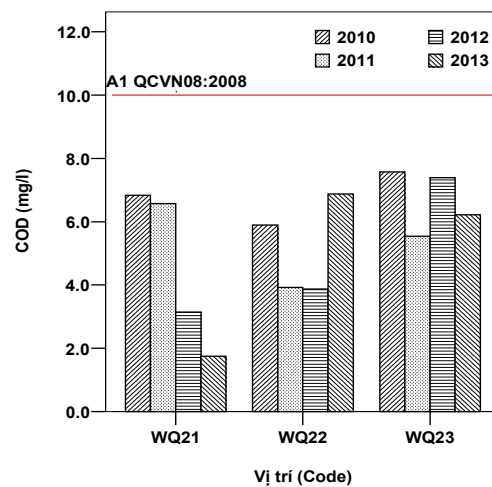


Figure 20: COD of Vam Co Dong River in the dry season, 2010 - 2013

Table 7: Comparison of monitoring data in April 2013 with the data before project implementation, Vam Co Dong River

No.	Monitoring indicators	3/2003	4/2010	4/2011	4/2012	4/2013	A2 - QCVN 08:2008
1	TSS (mg/l)	164	70	72	22	61	30
2	PO ₄ ³⁻ (mg/l)	0.00	0.03	0.01	0.02	0.07	0.2
3	NO ₃ ⁻ (mg/l)	0.40	0.70	0.78	0.84	1.46	5
4	DO (mg/l)	6.0	4.5	4.2	5.6	4.0	5
5	COD (mg/l)	8.0	6.0	6.7	1.8	7.3	15

Source: Southern Institute of Water Resources Research, Phuoc Hoa EIA report, 2007

❖ **Phuoc Hoa – Dau Tieng Transfer Canal, Duc Hoa and Tan Bien main Canals:**

From April 2012, the MT6 package implement additional monitoring activities at 5 more surface water stations. It includes 02 stations at beginning and ending of Phuoc Hoa - Dau Tieng Water Transfer Canal (WQ25, WQ26), 01 station on Tan Bien Canal (WQ06), and 01 station on Duc Hoa Canal.

Phuoc Hoa Reservoir and Phuoc Hoa – Dau Tieng Transfer Canal:

In general, the monitoring results show that water quality of reservoir and transfer canal was quite good. pH value in Phuoc Hoa Reservoir was 6.9 and in transfer canal was 6.8. Contents of organic and nutrient matters were too low, less than the class A1 of the standard QCVN 08:2008/BTNMT. Contents of heavy metal were low, less than detectable limit. Similarly, contents of microorganism were too low as well. TSS content in reservoir was 42 mg/l, and decreased to 32 mg/l after discharging into the transfer canal. TSS content was increased to 104 mg/l at the end of canal (Km 38+800). The cause of the increase of TSS is that the riverbank of canal was collapsed seriously at Km 36+800 in the monitoring time, the collapsed area extends about 50 meters long, and 2 – 3 m deep into the riverbank.

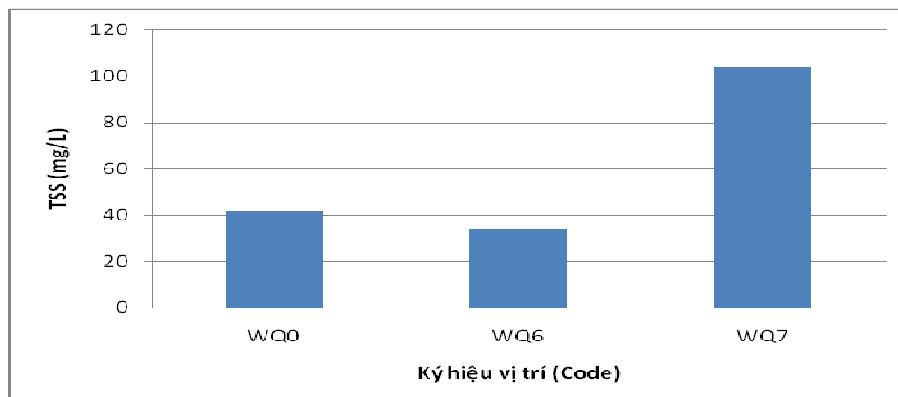


Figure 21: Variable of TSS in reservoir inside and transfer canal, April 2013

West Canal and Tan Bien Canal:

In Tan Bien canal, pH value was 6.2 and TSS content was 50 mg/l in the dry season. Contents of organic matters namely COD and BOD was less than the limit of class A1 of the standard QCVN 08:2008/BTNMT. However, DO content was rather low in the canal, 3.3 mg/l. where T-N was 1.6 mg/l, NO₂ was 1.02 mg/l. Even so, Tan Bien canal's water quality is equivalent to class A1 of the standard QCVN 08:2008/BTNMT, it is suitable to agricultural water supply.

5.2.2. Groundwater quality:

The groundwater is monitored at drilling wells or digging wells depended on characteristics and actual situation of wells in project area. The six wells in Binh Phuoc Province were measured including GW1, 2, 3, 4, 7 and 8; the three wells in Binh Duong Province were measured including GW5, 6 and 9; the three wells in Tay Ninh province were measured including GW13, 14 and 15. In addition, the three wells the National Lo Go – Xa Mat Forest were measured in including GW10, 11 and 12.

Monitoring results in April 2013:

Water level:

According to EIA report, the practise of raising water level in the upper of reservoir will impacts actively on the raising of groundwater level in the dry season from 2 to 4 m, it depends on the distant to the reservoir. For the lower area of reservoir towards the junction of Be River and Dong Nai River, the groundwater level in dry season will decrease from 1 to 2 m.

However, the monitoring results show that the groundwater level in the upper area of reservoir in Nha Bich and Hieu Cam commune increased in comparison with the same period of years 2010 – 2011, but the level of increase was insignificant, in range of 5 – 20 cm, it almost did not increase in comparison with year 2012. In the lower area of reservoir in Hieu Liem commune, the groundwater level in the dry season of years 2012 – 2013 had no significant change. The other areas of Binh Duong, Tay Ninh Province and Lo Go – Xa mat National park had no change of groundwater level. The fluctuation of groundwater level above was too low, and equivalent to the fluctuation of rainfall in this area from the previous rainy season.

We have not detected any significant and obvious changes from the Phuoc Hoa Reservoir. For the upper and lower areas of the reservoir, the water level should be continuing measured in order to monitor the groundwater level behaviour. For the Duc Hoa and Tan Bien irrigation areas, the construction work has not finished and we have not found any negative impacts from Phuoc Hoa project on the groundwater behaviour.

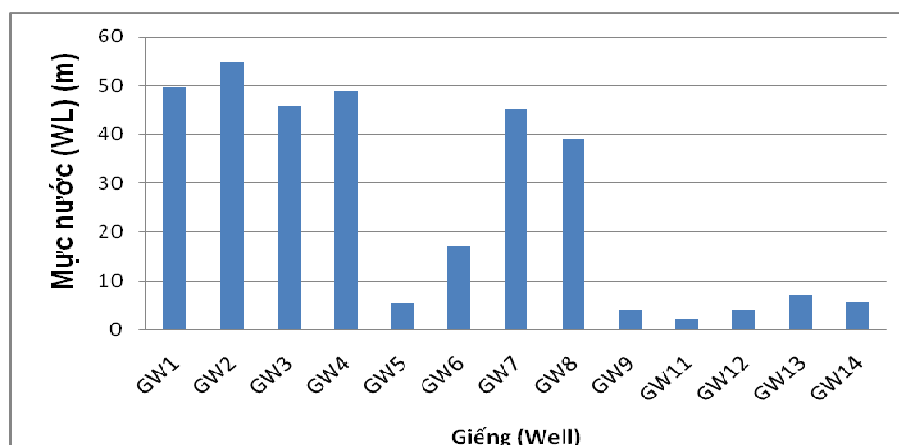


Figure 22: Variable of groundwater level in the dry season 2013 in project area (G10 and G15 locations were out of monitoring)

Water quality:

- In Binh Duong, Binh Phuoc and Tay Ninh regions, pH value was low and *did not met the standard QCVN 09:2008/BTNMT* (pH <5.5). Particularly, pH value met the standard QCVN 09:2008/BTNMT at GW1, GW6, GW10, and GW11.
- Content of nutrient was rather low. PO₄ content fluctuated in range of 0.01 – 0.19 mg/l, highest value was measured at GW06 in Binh Duong Province. NO₂ content was low as well, less than 0.012 mg/l, except GW10 has NO₂ content was higher than the standard QCVN 09:2008/BTNMT, 2.019 mg/l.
- The Fe content fluctuated in the range of 0.1 to 3.2 mg/l, lower than the standard QCVN 09:2008 (Fe < 5mg/l).
- The Mangan content fluctuated in the range of 0.042 to 0.193 mg/l, less than the standard QCVN 09:2008/BTNMT (Mn < 0.5 mg/l). In Binh Duong, Tay Ninh regions, the mangan content in rainy season is higher than that in the dry season, Xa Mat and Binh Phuoc regions have otherwise trend.
- Content of heavy metal namely Pb, Cd, Cu were less than the detection limit.
- Most wells were not contaminated by Fecal coliform, except the three wells namely GW03, GW1, GW15, Fecal coliform fluctuated in range of 201 – 430 MPN/100 ml.

In comparison with the standard QCVN 09:2008/BTNMT:

Monitoring results show that most of chemical and physical compositions were stable through the years and these results are *consistent with the groundwater standard QCVN 09:2008/BTNMT* for evaluating the groundwater quality, it is oriented toward many using purposes, except the low value of pH at some locations.

Comparison of monitoring results through the years:

- The monitoring results in the dry season in the period from 2010 to 2013 show that the groundwater quality did not present obvious trend.
- pH value at wells in the lower of Phuoc Hoa Reservoir in Binh Duong and Binh Phuoc areas had no significant change in the period from 2010 to 2013. pH value at the wells in Tay Ninh and Lo Go – Xa Mat areas tends to decrease slightly from 2010 to 2013.
- In 2013, content of nutrients at wells in Binh Duong, Binh Phuoc and Tay Ninh areas had higher value compared to 2011 and 2012.
- Total Fe content in the dry season of 2013 was higher than in 2012 at all wells. Total heavy metal content such as Mn, Cd, As, and Hg were less than the detection limit. There were no significant changes compared to the previous years.
- The other chemical and physical compositions had no clear difference in 2010 – 2012 period.

Comparison of data for the chemical and physical composition of groundwater in September 2005 with April 2010, 2011 and 2012 in Nha Bich commune, Chon Thanh District, Binh Phuoc Province show that there were no significant change of chemical and physical composition. There were many compositions such as Mn, Nitrate with the values were less than in 2005. Fecal Coliform was higher than the pre-project phase. [Table 8].

Table 8: Comparison of monitoring data with the data before the implementation of project

No.	Parameters	Sep.2005	Apr.2010	Apr.2011	Apr.2012	Apr.2013	QCVN 09:2008
1	pH	6.3	6.0	6.3	6.4	6.2	5.5 – 8.5
2	Nitrate (mg/l)	10	0.04	0.05	0.55	0.04	15
3	Total Fe (mg/l)	1.0	5.3	1.0	4.3	3.2	5
4	Mn (mg/l)	0.2	0.1	0.05	0.1	0.1	0.5
5	Fecal Coliform (MPN/100ml)	0	0	90	15	430	0

Source: Southern Institute of Water Resources Research, Phuoc Hoa EIA report, 2007

In general, there were some changes of the chemical and physical compositions in years. However, these changes were not affected by the construction activities of the Phuoc Hoa dam.

5.2.3. Water quality of Duc Hoa irrigation area:

Monitoring results of surface water quality parameters in Duc Hoa – Long An

compared to the Class B1 of the standard QCVN 08:2008/BTNMT are as follow:

- pH value of monitored water samples varied from 2.27 to 5.52. Comparison of these values with the standard QCVN 08:2008/BTNMT shows that most of these samples did not meet the standard.
- The NO_3^- content in ground water samples varied from 1.27 to 17.61 mg/l. The NO_3^- content of 4 samples among 12 monitored samples was higher than the class B1 of the standard QCVN 09:2008/BTNMT from 0.7 to 1.5 times.
- Total nitrogen content in monitored samples varied from 8.73 to 31.37 ppm. Total phosphorus content in monitored samples changed from 0 to 3.07 ppm.
- Total Fe content found at monitored locations fluctuated from 0.85 to 6.27 mg/l. In comparison with the standard QCVN 08:2008/BTNMT, it shows that most of the samples exceeded the standard from 1 to 4 times.
- Al^{3+} content that was found at monitoring locations varied from 0.34 to 5.21 mg/l. There was significant change of Al^{3+} content among monitored locations. Although there is no standard of the Al^{3+} content for the comparison of the groundwater, but the Aluminum is toxic to human health. Therefore, it needs to be considered the change of their content in the domestic water.

5.2.4. *Prediction of the water environment quality trend:*

Some preliminary predictions of water quality in the project area are based on monitoring results of 2010 – 2013 periods.

- Water quality of Be River is rather good, for this area is not highly populated, production activities have not developed yet, and streams discharge into Be River with the water quality is rather good. In future, industrial and domestic wastewater maybe will make negative impacts on water quality of Be River and Phuoc Hoa Reservoir, if we do not have any restricted solutions.
- Water quality of Dong Nai River is rather good, especially the area after Tri An Dam. However, at Bien Hoa City, the reach of Bien Hoa River has being impacted by socio-economic activities. The variable trend of water quality of Dong Nai River will be complicated due to the impacts of wastewater from towns and industrial parks in this area, especially after Hoa An Bridge.
- Water quality of Sai Gon River is not only affected by nature conditions (acidification, salinity intrusion in the lower areas), but also by human activities (alkaline cleaning activities, domestic wastewater, industrial wastewater) from the largest city of the entire nation in term of population size and economic development. The predictions of water quality of Sai Gon River in the reach flowing through Ho Chi Minh City will tend to decline due to the development of the city increasingly, particularly water pollution situation has

not improved too much.

- Water quality of Vam Co Dong River is not only affected by nature conditions, but also by human activities. Especially, it is impacted by acid sulphate soils in the upstream and salinity intrusion in the downstream. The developing trend of production activities in the upstream of this river (belong to Long An Province) can make the water quality to be worse.
- Groundwater quality has averaged; it is predict that impacts on groundwater caused by project activities are very low.
- Duc Hoa irrigation area (Long An) has not been finished yet, hence we can not give any specific statements about the impacts of protect upon environment and production activities of this region. However, the impacts of project in the irrigation area is able to increase in the rainy season in 2013, due to Phuoc Hoa construction activites are happening, as it rains, the rain water will sweep away toxins in the acid sulphatle soils into the canal systems.
- In recent years, the climate factors have great changes, it is probably due to the impacts of climate change and socio-economic development activites, hence the recognition of Phuoc Hoa Project impacts on this area will be very difficult. Besides the monitored data of the project, we need more in-depth study on environmental variables in order to recognize obviously the effects and the other negative impacts of the project.

6. Biodiversity

6.1. Aquatic biodiversity

Assessment the Aquatic biodiversity in the first six month of year based on the results of the monitoring stage in April of 2013 of Package MT6.

6.1.1. Fishes and shrimps

Total of 103 species fish and shrimp were identified at eleven surveyed stations belong to 11 orders, 31 families, 73 genus, and one specie of shrimp (*Macrobrachium rosenbergii*). The abundant of species composition at stations was rather high showed in species level, families level and order level.

There are 31 families in 11 orders, in there the dominating orders are *Cypriniformes* with 47 species (45.19%), *Perciformes* with 24 species (23.08%), next is *Siluriformes* with 18 species (17.31%).

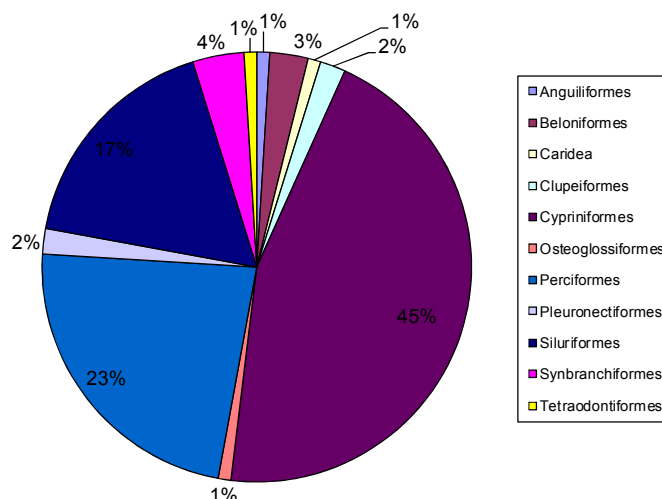


Figure 23: Percentage of fish species composition at all stations

In contrast, there are four orders with only one species (0.96%) such as *Anguiliformes*, *Carideames*, *Osteoglossiformes* và *Tetraodontiformes*. The remaining orders were varied from 2 to 4 species (1.92% – 3.85%).

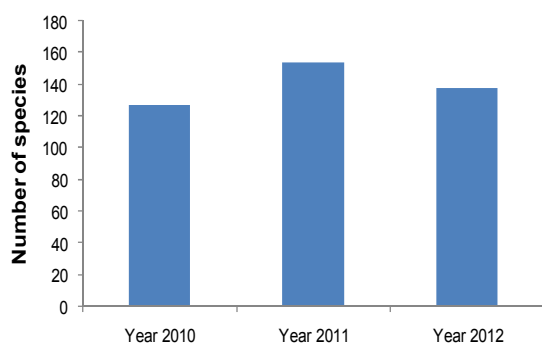


Figure 24: Graph on variables of number of species fish in three years

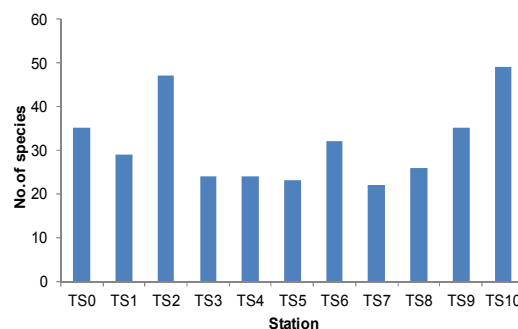


Figure 25: Graph on variables of number of species fish at monitoring stations in April 2013

Figure 24 indicated that there were slightly variables of the number of species fish through the years. The highest number of species was 154 species in 2011, the lowest was 127 species in 2010, and 138 species in 2012.

In total of 103 species of fishes and shrimp, there were three species in the red list of Vietnam at VU level (Vulnerable), they need to protect such as *Anguilla marmorata*, *Cirrhinus microlepis*, *Hemibagrus filamentus*, (Vietnam Red Book 2007).

Based on reproductive and migration characters of fishes can divide into three groups:

- Migrate to upstream: the fishes migrate to upstream to spawn, after that the fish larvae drifted downstream with the current to grow up and develop. Characteristics of this group was included *Henicorhynchus siamensis* at stations TS0, TS2, TS3, TS8, TS9, and TS10; *Puntioplites proctozysron* at stations TS0, TS1, TS2, TS3, TS4, TS5, TS6, TS9, and TS10; *Mystus nemurus* at stations TS2, TS5, and TS6; *Mystus mysticetus* at station TS6 and TS8.
- Migrate to downstream: Some species migrate to estuaries to spawn such as giant shrimp (*Macrobrachium rosenbergii*) at stations TS0, TS2, and TS6, the giant mottled eel (*Anguilla marmorata*) at station TS0. After that the fish larvae migrate to upstream to grow up and develop.
- Local migration: the fishes of this group tend to stay on the spot or migrate to wetlands to spawn. Some typical species such as snakehead (*Channa striata*), climbing perch (*Anabas testudineus*), bronze featherback (*Notopterus notopterus*), threespot gourami (*Trichogaster trichopterus*), walking catfish (*Clarias macrocephalus/batratus*).

6.1.2. Phytoplankton

The monitoring results at 11 stations show that the species composition of Phytoplankton was focused on 6 phylums, 75 species. In there, the phylum *Bacillariophyta* with the highest species composition that accounts for 41.33% (31 species), next is the phylum *Chlorophyta* accounts for 30.67% (23 species), the phylum *Cyanophyta* accounts for 18.67% (14 species), the remaining algae phyla account for a low rate, less than 14% of the total species. The dominant species of the algae phylum are classified by the following rank:

- The phylum *Bacillariophyta*: 31 species (41.33%)
- The phylum *Chlorophyta*: 23 species (30.67%)
- The phylum *Cyanophyta*: 14 species (18.67%)
- The phylum *Euglenophyta*: 3 species (4.00%)
- The phylum *Dinnophyta*: 2 species (2.67%)
- Th phylum *Chrysophyta*: 2 species (2.67%)

Figure 26 shows the fluctuation of species composition of phytoplankton at survey stations. The highest species composition found at TS2 was 39 species (52.0%), the lowest found at TS5 was 12 species (16.0%).

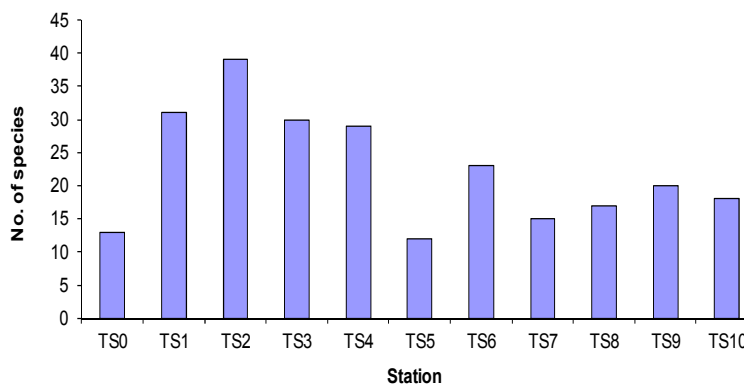


Figure 26: Graph on species composition of phytoplankton at survey stations

Almost of species at survey stations was fresh water species, they are good food for fishes and shrimps. Especially, there were no any toxic species such as *Pseudonitzschia spp.* and *Dinophysis caudata*.

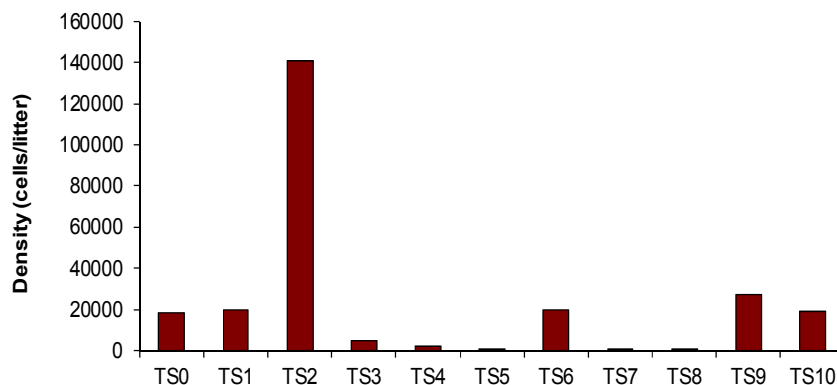


Figure 27: Graph on densities of phytoplankton at survey stations

The highest density of phytoplankton at TS2 station was 141,185 cells/litter (55.64%), after that TS9 station was 27,070 cells/litter (10.67%) In contrast, the four stations TS7, TS8, TS5 and TS4 were the lowest density with the number of cells in turn 510 cells/litter (with 0.20%), 710 cells/litter (with 0.28%), 895 cells/litter (with 0.35%) and 2,170 cells/litter (with 0.86%). In contrast, the four stations TS7, TS8, TS5 and TS4 had the lowest density were 510 cells/litter (0.20%), 710 cells/litter (0.28%), 895 cells/litter (0.35%) and 2,170 cells/litter (0.86%) in turn.

6.1.3. Zooplankton

There was 32 species of zooplankton belong to 5 phyla at 11 surveyed station. Phylum *Arthropoda* was the highest number of species that contains 21 species (occupy 65.63%), within sub-class *Cladocera* contains 5 species (occupy 15.63%) with some of common species by *Bosmina longirostris*, *Bosminopsis deitersi*, *Ceriodaphnia rigaudi*, etc, and sub-class *Copepoda* contains 12 species (occupy 37.5%) with some of common species by *Mesocyclops leuckarti*, *Microcyclops varicans*, *Thermocyclops hyalinus*, etc, sub-class *Ostracoda* contains 2

species (occupy 6.25%), sub-class *Decapoda* contains 1 species (occupy 3.13%). Next is phylum *Aschelminthes* including sub-class *Rotatoria* contains 5 species (occupy 15.63%). Next is phylum *Protozoa* contains 3 species (occupy 9.38%). *Mollusca* larval contains 2 species (occupy 6.25%). *Polychaeta* larval belongs to phylum *Annelida* contains 1 species (occupy 3.13%).

The species composition of zooplankton at surveyed stations fluctuated slightly. Similarly, the density of zooplankton at surveyed stations was varied slightly as well. The highest density was at TS2 with 24,000 cell/m³ (occupy 19.43%), and the lowest density was at two stations TS0 and TS8 with 5,000 cell/m³ (occupy 4.05%).

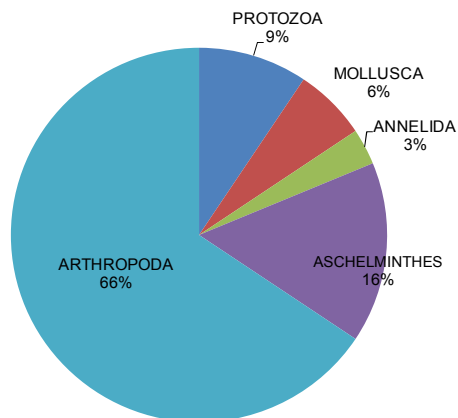


Figure 28: Structure of zooplankton species composition

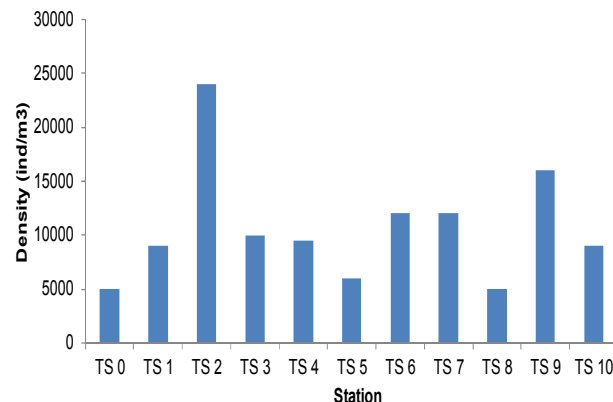


Figure 29: Fluctuation of zooplankton densities at stations

6.1.4. Zoobenthos

The species composition of zoobenthos found at 11 surveyed stations contains 18 species belong to 6 classes, 3 phyla. Phylum *Mollusca* was the highest number of species with 7 species (occupy 39%), next is phylum *Annelida* contains 6 species (occupy 33%), and phylum *Arthropoda* was the lowest number of species with 5 species (occupy 28%).

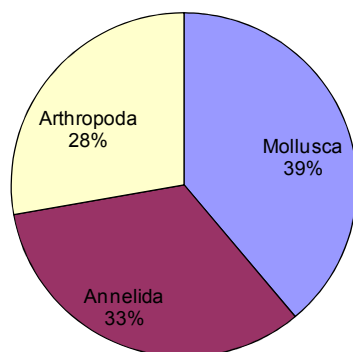


Figure 30: Percentage of zoobenthos composition at all stations (by phyla)

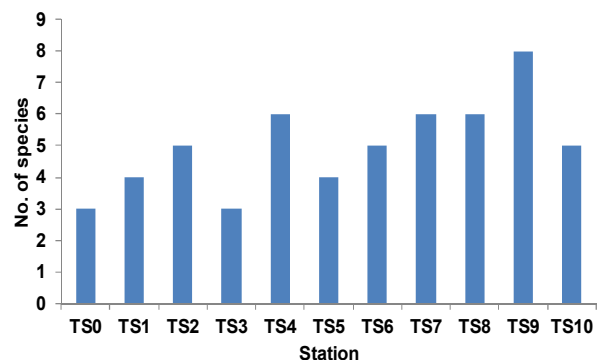


Figure 31: Graph on Fluctuation of zoobenthos species composition at all stations

Fluctuation of zoobenthos species composition at all stations with the number did not exceed 10 species. The highest species composition was at TS9 station contains 8 species (occupy 44.46%), next is the three stations TS4, TS7 and TS8 contain 6 species (33.3%).

6.1.5. Fishery productivity in Be River

❖ Binh Duong Province:

Based on the data of DARD of Binh Duong Province in 2012 show that, aquaculture productivity in 2012 was nearly 20 times higher than that in 2003 (302 tons) and increased approximately 35 times compared to 1996 (189 tons). In recent times, the increase of aquaculture productivity is rather high [Table 9].

Table 9: Fisheries development situation in Binh Duong Province

No.	Indicators	Unit	2007	2008	2009	2010	2011	2012
1	Aquaculture							
	- Area	Ha	469	495	517	398	420	415
	- Productivity	Ton	4059	4559	4906	5381	6616	-
2	Fishing	Ton	518	468	536	280	264	250
3	Total output	Ton	4577	5027	5442	5661	6880	7200

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 directly manages households.

❖ Binh Phuoc Province:

Based on the annual report of the Binh Phuoc DARD, the total fisheries productivity in the whole province has increased over the years for both fishing and aquaculture sectors until 2009 [Table 10]. Total fisheries production was 643 tons and aquaculture productivity 7,078 tons in 2009. Since 2010, however, fishing and aquaculture productivity have decreased.

The statistics show that between 2007 and 2009 the area of fish cultivation increased by 9%; the aquaculture output rose by 17%; Fisheries output rose nearly 16%, but the productivity of later years has decreased gradually. Fishing in pond and cage are the main types. In 2011, there were 126 cages, a decrease 2010 with 133 cages.

Table 10: Fisheries development situation in Binh Phuoc province

No.		Unit	2007	2008	2009	2010	2011
1	Aquaculture						
	- Area	Ha	2118	2229	2496	2295	2113
	- Productivity	Ton	5269	6102	7078	6393	6052
2	Fishing	Ton	488	559	643	412	357
3	Total output	Ton	5757	6661	7721	6926	6409

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 fishermen and plays a role as an advisory unit for the DARD on the fishery aspect in the whole provincial area. The fishing activities are managed by the Commune People's Committees.

Status of fishery resources in the Phuoc Hoa reservoir and downstream of the dam: Due to the fact that Phuoc Hoa reservoir is a reservoir with the open ecosystem, the species composition in the reservoir and along Be river did not changed too much. In the temporary report, the consultant presented surveyed species and updated the survey data of package MT6 by seasons that were presented in the six-monthly report and previous annual reports.

The situation of fisheries and aquaculture sectors in upstream reservoir and reservoir areas:

Fishing sector: At present, the local government has not yet conducted an inventory of the numbers of fishery households and the fishing output in the reservoir. Based on the survey results, the consultant MT4 found that many fisherman came from other provinces. These fisherman used many types of fishing gear such as fishing nets, fishing rods, fishing spears and even electrical tackles. This problem has not been addressed by the local government. These fisherman even caught fishes in the fish pass (this information was given by the local people). The government agencies should take action to prevent the exploitation of fish in the fish pass. In addition, the fishing by electric shocks must be prevented.

Aquaculture sector: At present, there are 2 fishing cages in Tan Thanh Communes along the Be river. In Binh Phuoc Province, some households living in the semi-flooded area are digging fishponds spontaneously (Hamlet 2, Minh Thanh Commune).

6.2. Terrestrial biodiversity of Lo Go – Xa Mat National Park (NP)

Based on the implementation results of package MT1, the terrestrial biodiversity has been mentioned, the mentioned results in MT1 report were the retrospective results of previous studies and the implementation results of package MT1 as follows:

The Birdlife Organization in 2000 reported that NP had many race species with large number of individuals. Institute of Tropical Biology in 2001 reported that have 29 species in which included some important species such as black-shanked douc langur (voọc chà vá chân đen), silver langur (voọc bạc), pig-tailed monkey (khỉ đuôi lợn), etc. There are 149 species of birds (estimated there are 162 to 173 species) in which there are 3 rare species: *Lophura diardi* (gà lôi hồng tía), *Leptotilos javanicus* (già đẫy Java), *Ciconia episcopus* (hạc cổ trắng). About amphibians, there

are 23 species, in which mainly contain *Ichthyophis bannanicus* (ếch giun) and *Micrhylla picta* (nhái bầu); there are 56 species of reptiles including lizards.

The results of investigating 10 monitoring routes and interviewing 6 hunters for common fauna that frequently appear in Lo Go – Xa Mat National Park as follows:

There are 33 species of birds was identified preliminary. The most appearance species are *Anthracoseros* (cao cát), *Copsychus* (chích chòe), *Phasianidae* (gà rừng), *Dicrurus paradiseus* (chèu bẻo cò đuôi chẻ), *Streptopelia chinensis tigrina* (cu gáy), *Lophura* (gà lôi). In addition, there are *Fringillidae* (se sẻ), *Accipiter trivirgatus* (ó), *Pycnonotus jocosus* (chào mào), *Megalaima lineata* (cu rốc), *Podargidae* (đớp muỗi), *Polyplectron germaini* (gà tiền mặt đỏ), *Parus major* (khướu bạc má), *Anas platyrhynchos* (le le), *Sturnidae* (sáo nghệ), *Oriolidae* (vàng anh), *Falconidae* (bù cắt), *Dicaeidae* (chim sâu), *Pharacrocoraxniger* (công cọc), *Strigidae* (cú mèo), *Treron* (cu xanh), *Gracupica nigricollis* (cường), *Francolinus pintadeanus* (đa đa), *Ardeidae* (diệc), *Accipiter bicolor* (diều hâu), *Muscicapidae* (đớp ruồi), *Buceros bicornis* (hồng hoàng), *Gracula religiosa* (nhông), *Coraciiformes* (sa sả).

About animals, preliminarily identified some species such as wild pig (lợn rừng), *Macaca fascicularis* (khỉ đuôi dài), *Tragulidae* (cheo cheo), *Viverricula indica* (chồn hương), *Sciuridae* (sóc), *Viverra megaspila* (chồn mướp), *Felis silvestris* (mèo rừng), *Hylopetes spadiceus* (sóc bay), *Pholidota* (trút), *Mustelidae* (chồn đen), *Martes flavigula* (chồn vàng), *Nycticebus coucang* (cu li), *Macaca nemestrina* (khỉ đuôi lợn), *Hystriidae* (nhím),...About Reptiles and Amphibians there are snake, *Gecko gecko* (tắc kè), *Varanidae* (kỳ đà), *Daboia russelii* (Rắn hổ bươm), *Pteranodon* (thằn lằn bay), etc.

7. Soil condition

Assessment of the monitoring results was made in the Duc Hoa irrigation area in 2013. In this period monitoring has been done in April. The results were presented as follows:

7.1. Soil

- The $\text{pH}_{\text{H}_2\text{O}}$ value at monitoring locations in this period varied from 3.21 to 4.82. The $\text{pH}_{\text{H}_2\text{O}}$ value at most of monitored locations met the standard TCVN 7377:2004 Soil quality - pH indicator value in the land of Vietnam, except two locations S61 and S62 was lower than the allowable limit.
- Most of the soil samples appeared to have high or very high organic contents. The total organic carbon content of soils varied from 0.37% to 7.03%, most of them met the standard TCVN 7376:2004 Soil quality – Carbon content indicator value in the land of Vietnam.
- Total Nitrogen content in monitored samples in April 2013 varied from 0% to 0.52%, especially Total Nitrogen content was not detected at some locations, while this value was too high at some other locations, exceeding the allowable limit of the standard TCVN 7373:2004 Soil quality – Nitrogen content indicator value in the land of Vietnam.
- Soil at project areas appeared to the poor level of total Phosphorous or not detected, all monitored results (April 2013) met the allowable limit of the standard TCVN 7374:2004 Soil quality – Phosphorous content indicator value in the land of Vietnam. The highest value of total Phosphorous was appeared in the top soil layer of the monitoring station S51 with 0.257%.

7.2. Soil solution

In the monitoring stage, the soil solution in monitored areas contains a high acidic content, the pH value of most soil samples was less than 4 and varied from 2.73 to 3.37. The lowest value appeared at SW12 and the highest value appeared at SW2, and pH value increased with depth.

Total Nitrogen content in the soil solution varied from 11.73 to 85.05 ppm. Total Phosphorous content in soil solution varied from 1.54 ppm to 7.54 ppm.

SO_4^{2-} concentration in the soil solution at monitored locations varied from 153 ppm to 318 ppm, the lowest value appeared at SW21 and the highest value appeared at SW11.

These monitoring results are similar to the soil testing results in this areas, it shows that the veneer soil in Duc Hoa irrigation area has the properties of actual acid sulphate soils with the high toxins and poor nutrition. In April 2013, the soil quality in this area has not been improved due to Duc Hoa canal has not completed yet. Because one of major tasks of Duc Hoa canal is improved the soil quality by water

resources for agricultural section.

8. Monitoring results of Administration House

There are about 15 staffs of company working at Administration House frequently. Groundwater is used for domestic purpose and the wastewater has been collected into storage containers, deposition tanks and then being penetrated into ground. Domestic solid wastes with mainly organic wastes and small amount have been gathered for drying and burning. The traffic density acrossing dam area is rather low, hence air is fresh and unpolluted.

- Waste water has been collected and flowed into the septic tank and seepage, the tank was constructed following the technical design and located away from the dam about 150 m, There are about 6-10 workers working in the Administration House, so waste water is negligible.
- For the Air quality: the Administration House located far away from residential areas, traffic density is too low, mostly motorbikes. At all monitoring locations, the air quality met the standard QCVN 05:2008/BTNMT, noise was measured with value 25 dBA, temperature is 30°C, and humidity is 70 %, equivalent to the air, temperature and humidity in this area at the same time.

The Administration House are complied with environmental hygiene requirements, and they do not cause any negative impacts on ambient air quality, as well as surface water and groundwater in this area.

9. Environment Awareness

Construction of Phuoc Hoa Water Resources is going to create a large-scale beneficial area that located in many different provinces, these areas are also impacted by project directly and indirectly on the socio-economic activities, and environmental status is also impacted certainly whereby it shows the need of environmental awareness activities. Besides control and mitigation purposes, it also helps local communities using the project's resources effectively including surface water resources.

Package MT10 belongs to EMP packages of Phuoc Hoa Project is conducted with major objectives as follows:

- Raising stakeholder's and manager's understanding of fundamental concepts and background science of environmental, water resources and natural resources management, as needed within the project development sites, surrounding areas and effected river basins in order to protect the environmental, water and natural resources.
- Enhancing the awareness of Project and EMP stakeholder's and manager's of: the potential environmental impacts of the project, content and function of the EMP framework and monitoring sub-programs applied to address impacts; and the role of the involvement of project managers, contractors, state agencies and the local community in implementation of the Project and in protection of local and regional environment, water and natural resources.

In order to ensure the proposed objectives are well done to raise the environment awareness of local communities, consultant had designed and performed many workshops. These workshops have been performed with many contents in all surrounding provinces in the project region, which concern the effective exploitation and protection of environmental resources. Throughout these workshops saw that manager's and local people's aspiration for learning out about project's information, fundamental concepts of environmental, environmental protection, reasonable natural resources using are too large. It mean that the environmental protection awareness of local communities will improve and enhance a lot if the source of information about project; knowledge of irrigations, environment, agriculture, forestation, and aquaculture, etc are diffused widely and easy to approach by many channel of propagandas.

Nevertheless, throughout these workshops and also community contacts in the process of implementing project could make sure that the present environmental awareness of local communities are still low. It is difficult to change the habit of life and production of local people, which had been shaped for a long time by few training workshops.

In addition, only a small part of local people and managers have opportunity to access and know the major information of the project, so that the propagation is still limited and has not the effective results in the community, the role of local authorities has not performed well. Therefore, right places, where were organized the training workshops, local people still have activities that harm the environment and project. These are the encroachment of the local people on the land that was acquired for the forestation to protect the Phuoc Hoa Reservoir catchments, many people living around the reservoir area built toilets inside the reservoir, fishing in the reservoir by forbidden tackles using electrical shock, and even fishing right the fish pass, etc. For the constructors, although the project has official provisions for environment protection and consequently receipt the reminders and warnings from supervisors, however some constructors has not executed right the environment protection engagements that cause environment pollution and adverse effect on local people.

Overall, it can be concluded that the practices of enhancing propagation, education, training to raise the local communities' and manager's awareness of environment protection are very essential, even when the project put into operation. On the other hand, it needs to pay attention to reasonable and practical sanctions, policy mechanism, and social support programs, etc.

10. Conclusions and Recommendations

10.1. Conclusions

10.1.1. The natural and social environments

The monitoring results of the EMP packages show that the water quality at monitoring stations in Be, Dong Nai, Sai Gon Rivers was rather good, it is suitable for aquatic conservation and irrigation water supply. However, the lower areas and estuaries of Dong Nai and Sai Gon Rivers are affected by salinity intrusion in the dry season, hence create negative impacts on domestic and agricultural water supply. Degree of salinity intrusion effect in the dry season of 2013 was significantly declined compared to the same period of the previous years.

The practice of transferring water from Phuoc Hoa Reservoir to Dau Tieng Reservoir in the dry season of 2013 has contributed significantly to irrigation water supply, environmental water improvement, salinity intrusion reduction in the lower areas of Sai Gon River in the reach from the downstream of Dau Tieng Reservoir to Thu Dau Mot City, but the water quality has no sign of improvement from Thu Dau Mot City towards Ho Chi Minh City.

In recent period, natural environment has no sign of negative impacts of the project. However, the end of transfer canal was collapsed seriously, the collapsed area extends over 50 meters length, and 2 – 3 meters deep into the riverbank, made the TSS content and organic matter in water, which discharged into Dau Tieng Reservoir, increased significantly.

Based on the monitoring results and the information that was provided by EMP packages and ICMB9, social issues related to the environment have not occurred in the project area. The problems of land occupation in the semi-flooded area have a suitable solution.

10.1.2. EMP packages

Package MT1: Based on the implementation results in comparison with the TOR of the consultancy contract, MT1 consultant has implemented the contract in accordance with required schedule and proposed workloads.

Package MT2: MT2 consultant has implemented the contract in accordance with required schedule and proposed workloads. Up to now, Task I was completed, Task II will be updated to be suitable for the actual situations that carry out “Land use planning and protective forestation for revocation areas (from +42.9 m to +44 m)”.

Package MT3: Based on the implementation results in comparison with the TOR of the consultancy contract, up to now, the implementation of this package is behind schedule. In addition, MT3 consultant lacks active in field survey, contacting local governments to determine the placements of water supply stations.

Package MT4: as mentioned in previous reports, during the implementation, the MT4 consultant was not active in coordinating with other EMP packages in order to collect necessary monitoring data for the use of the Package. They also lack active in contacting local government to promote the establishment of fisheries management association and monitoring the fish pass construction.

Package MT5: The consultant implemented their works timely, but the submission of reports is still delayed, needs to be improved.

Package MT6: in the first six months of 2013, the consultant implemented well the requirements as indicated in the consulting contract. However, the first six-monthly monitoring report of 2013 was not submitted timely.

Package MT7: At present, construction packages were completed. Therefore, the package MT7 should finish soon the extension contract procedures and carrying out surveying, supervising, monitoring the PH4 package.

Package MT8: this package was finished. Up to now, Consultant unit continues to support the investor in supplying information, operation instruction, and equipment maintenance for monitoring stations.

10.1.3. Advantages, disadvantages and outstanding issues:

Advantages:

The implementation of all EMP packages is consistent with the requirements of the proposed schedule and contents. These results have the following advantages:

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

Disadvantages:

In the first half of 2013, besides the above-mentioned advantages, the EMP tasks had certain difficulties as follows:

- For EMP packages, only 10 out of 14 packages are under the implementation but the workload is still quite big. In addition, each package implements different missions at different times. Therefore, the coordination between these packages is very difficult.
- The area of Phuoc Hoa reservoir is quite large and located in different

provinces. Therefore, it was very hard to find out the problems after the reservoir has been impounded. Some typical unexpected problems were mentioned in the previous reports.

- Some generated issues in the implementing process of EMP packages need cooperation, indicator notions of Employer, Sponsor, and also local agencies, therefore impact on the implementing progress of project.
- Several consultants (MT3, MT4) have confused and lacked active in cooperating with local agencies in the implementing process.

Outstanding issues:

The outstanding issues, which indicated in previous reports, have been solved by consultants. However, there are still some outstanding issues as follows:

- Submission of progress reports and providing information to Employer and supervision consultant on the implementation status of packages is still slow. This affects the data collection of the OP4 consultant. In addition, the consultants did not provide fully 03 sets of reports including hardcopy and CD Rom.
- After having comments from OP4 and BVI consultants, the revision and resubmission of reports to the Employer have not been made promptly.
- During the implementation, the consultants did not inform the detailed working programs to the local government, the Employer and the supervision consultant.

For each EMP packages, base on the conclusions of the meeting on 10th April and 22th July 2013 there are some problems that need to be consider carefully, these problems have been considered the outstanding issues in the implementation process, and need to be solved in the coming time as follows:

- ✓ For package MT1: some issues would be especially considered in the coming time such as the implementation of 50,000 fruit tree plantation and preparation of a model for buffer zone economic development. The economic development model needs to have the mutual agreement of local authorities.
- ✓ For package MT2: conducts the Task II “Land use planning and protective forestation for revocation areas (from +42.9 m to +44 m)” to meet the implementation progress of EMP packages.
- ✓ For package MT3: complete the procedure for handing over land use for water supply stations in Binh Duong and Long An.
- ✓ For package MT4: up to now, the remaining workload of this package consists of (i) Establishment of Aquatic Resources Protection and

Management Association; (ii) Training in exploiting and protecting aquatic resources; (iii) Monitoring, assessing the fish pass; (iv) Assessment of Phuoc Hoa reservoir fishery exploitation and aquaculture.

- ✓ For package MT5: In the coming time, Consultant should update frequently the water transfer plan of Phuoc Hoa – Dau Tieng canal. MT5 should works directly with ICMB9 about planning on field surveying and measuring according to approved budget.
- ✓ For package MT6: at the moment, this package conducts their tasks quite good following TOR. However, there is a delay in the submission of reports.
- ✓ For package MT7: has not finished the essential procedure for environment supervising and monitoring in PH4 worksites.

10.2. Recommendations

10.2.1. General recommendations for EMP packages

- The consultants should submit the inception report with three full sets (hard copy and CD Rom).
- Relevant agencies should resolve outstanding issues as mentioned in this report immediately.
- The consultants must comply with the deadline for the submission of reports as required in the TOR. The consultant should also summarise EMP packages implementation results in the middle and the end of the year.
- The consultants need to provide the detailed working plans to the local government during the implementation.
- For packages MT4, MT5 and MT6: the 6-monthly progress reports must be submitted immediately 15 days after the completion day.

In addition, as mentioned in Section 9 of this report. Training workshops on enhancing environmental awareness and raising environmental management capacity are very essential. These actives direct to the agencies, which receive, manage and operate the project (Dau Tieng – Phuoc Hoa IMC, provincial exploitation and management agencies, etc), and local authorities. Therefore, recommend the Sponsor, the Employer consider organizing these above-mentioned activities as soon as possible.

10.2.2. Recommendation for each EMP packages

- ✓ For package MT1: continues to implement next activities on the basis of the TOR.
- ✓ For package MT2: Conduct Task II with the contents of supporting the

Dam Owner, District and Commune People's committees carry out land use planning for the semi – flooded areas consistent with the Vietnam regulations, satisfy the purposes of project environment protection.

- ✓ For package MT3: complete the procedure for handing over land use for bumping station in Binh Duong and Long An. .
- ✓ For package MT4: The MT4 consultant needs to recheck all tasks of the Package. Since the Phuoc Hoa reservoir has been impounded, the fisheries management programs need to be prepared as well as the fisheries management team/association needs to be also established. In addition, the consultant needs to speed up the submission of reports. It is needed to actively collect and summarize data from EMP packages and in contact with local governments..
- ✓ For packages MT5: continues to implement next activities based on the implementation progress and approved budget.
- ✓ For package MT6: The MT6 consultant should continue to update the information and provide the necessary monitoring data so that the environmental condition in the Project areas can be reflected timely. The submission time of reports should be improved so that this problem will not affect the general schedule of the Project.
- ✓ For package MT7: recommend MT7 consultant to complete essential procedures promptly in order to continue to regulate, monitor the environment at PH4 package.
- ✓ For package MT8: continues to support the investor in supplying information, operation instruction, and equipment maintenance for monitoring stations.
- ✓ For package MT9: recommend the Sponsor comments early on the submitted TOR of MT9 package in order to set up the working plan.

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