

# Environmental Monitoring Report

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Semi-annual Report  
January – June 2014

## VIE: Phuoc Hoa Water Resources Project

Prepared by Hydraulic Project Investment and Construction Management Board No. 9 and Institute of Coastal and Offshore Engineering for the Socialist Republic of Viet Nam and the Asian Development Bank.

**MINISTRY OF AGRICULTURE AND RURAL DEVELOPMENT  
VIETNAM ACADEMY FOR WATER RESOURCES  
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**SIX-MONTHLY REPORT FOR  
ENVIRONMENTAL MONITORING**

*(January - June 2014)*

**PHUOC HOA WATER RESOURCES PROJECT  
ADB LOAN NUMBER: 2025 – VIE (SF)**

**PACKAGE OP4:**

**REGULATION, SUPERVISION AND SYNTHESIS FOR PACKAGES OF  
ENVIRONMENTAL MANAGEMENT**

**Ho Chi Minh City, July 2014**

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**Institute of Coastal and Offshore Engineering**  
Director

**Hydraulic Project Investment and  
Construction Management Board  
No. 9**

**Ho Chi Minh City, July 2014**

## **CURRENCY EQUIVALENTS**

(as of 01 July 2014)

Currency Unit - Vietnam dong (VND)  
\$1.00 = VND 21,270

## **ABBREVIATIONS 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	27 November 2003	08 April 2004	23 August 2004
	equivalent to US\$ 90 million					
Two AFD loans	EUR	29.6	million	20 November 2003	20 August 2004	20 August 2004
	equivalent to US\$ 2.270 million					
ADB loan supplemental	SDR	38.594	million	27 May 2011	27 May 2011	30 September 2011
	equivalent to US\$ 60 million					
AFD loan supplemental	EUR	20	million	25 May 2012	7 September 2012	7 September 2012
	equivalent to US\$ 25 million					
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 first six months 2014

### 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	08/01/2014	Representatives of ICMB9, OP4, BVI, and EMP packages	A briefings meeting
2	22/04/2014	Representatives of ICMB9, ADB, OP4, BVI, and MT2 package	Checking up on the outstanding issues of MT2 package regarding land use planning in submerged area of Phuoc Hoa reservoir.
3	23/04/2014	Representatives of ICMB9, ADB, OP4, BVI, and MT1 package	Surveying and assessing the implemented results of planting fruit tree, and the results of capacity building training.
4	12/05/2014	Representatives of ICMB9, OP4 and OP3.	The implementation of OP3 package.

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 2014, 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, MT3, MT7, OP3;
- Inspected, speeded up the EMP packages to implement the aide memoir of ADB on 26<sup>th</sup> October 2013.
- Cooperated with BVI to prepare the request proposal for MT9 package; extending the implementation time of OP4 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 2014 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 MT1, MT2, MT4, MT7, OP3, OP4, and others to implement works as indicated in the Aide-Memoir of ADB dated 26<sup>th</sup> October 2013.
- Supported ICMB9 in preparing the request documents for some EMP packages such as MT9, and OP4 (Extension).

### **3. Implementation of EMP packages in the first six months of 2014**

By this time, there is 11/14 packages were signed contract, these packages are implementing as follows:

#### **3.1. Package MT1**

Name of the package is '**Tan Bien National Park and Forest Protection program in Tay Ninh Province**'. The contract agreement of package was signed in September 2012, the implementing period of the package is 22 months since the date of signing of the contract. The consulting agency is '*Joint Venture Southern Sub - Institute of Forest Inventory and Planning and Institute for Water and Environment Research*'.

Based on the Interim Report, the implementing results (up to 30/06/2014) are presented as follows:

- **An assessment of the status of forests, monitoring of the residence and biodiversity of the National Park and Production Forest:**

- An assessment of the status of forests;
- Monitoring the forest fauna and flora;
- Monitoring the impact of humans;

All contents were finished, the areas of forestland and vegetation cover were assessed in 2007 and 2012 whereby identified the trends of each type of forest areas. The reasons of the change were also been analyzed (*Please see the details of the second Interim Report of this package*).

- **Monitoring the level and quality of groundwater:**

- Monitoring the groundwater level: *this task has been implemented at 6 wells throughout 20 stages (one stage per month), the one remaining stages will be implemented in July 2014;*
- Monitoring the groundwater quality: *has carried out six stages, the last stage will be implemented in June (has no analyzed results);*
- Monitoring the surface water quality and the aquatic biodiversity: *has carried out three stages in March and September 2013, and March 2014;*

- **Defining the National Park and Production Forest boundaries:**

- The demarcation of National Park has been carried out from 26 March to 5 April 2014. The consultant is finishing the procedure of handing over and acceptance.
- The demarcation of Production Forest has been carried out in April 2014.

- **Guidance on resettlement issues:**

- The details of the status of resettlement issues, and proposal resettlement plan have been presented in the first Interim Report of this package.
- **Capacity building and raising awareness program:**
  - Consultant has finished the capacity building and awareness-raising program.
  - Organized the field trip to the Cat Tien National Park from 27 to 29 September 2013;
- **Buffer zone economic development Program:** *including 2 parts (i) 50,000 fruit trees plantation programme (ii) Drafting the economic development and the improvement of the life quality of communities in project area packages through the development of breeding and agriculture.*
  - The plan of 50,000 fruit trees plantation program has been accepted by ICMB9 on 25/09/2013, and this program has finished in December 2013. The consultant has submitted the report of implemented results.
  - Drafting the economic development and the improvement of the life quality of communities in project area packages have been done.

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

- **Submitted reports:**
  1. The Inception Report;
  2. The Fourth Quarter Report of 2013 and the First Quarter Report of 2014;
  3. The Demarcation Report of National Park and Production Forest;
  4. The report of Buffer zone economic development Program;
  5. The report of Plantation Plan;
  6. The report of Awareness raising;
  7. The report of Capacity building for National Park staff;
  8. The First and the Second Interim Reports.

The consultant is conducting their tasks following the proposed plan. The details of implemented results are showed in the progress reports.

### **3.2. Package MT2**

Name of the package is '**Be River catchment protection study and Phuoc Hoa Reforestation and Forest Management**'. The contract agreement of package was signed in April 2010, the implementing period of the package is 40 months since the date of signing of the contract. The consulting agency is '*Infra – Thang Long Joint Stock Company*'.

Up to 30/06/2014, Task I '*Study on Be River catchment protection*' is considered finishing. Task II '*Supporting local government on implementing the forestation planning for the reservoir areas belong to Phuoc Hoa Project that were compensated*'. The implementing results are presented as follows:

- According to the Letter No.3789/BNN-TCLN on 22/10/2013 issued by MARD, Binh Phuoc Province People's Committee made a decision to insert 590 hectare of submerged areas of Phuoc Hoa Reservoir areas into the province's protective forest.
- The consultant organized the meetings on 20 February and 18 March 2014 that were presided by Binh Phuoc DARD, whereby Binh Phuoc Province People's Committee made a decision to assign Nha Bich, Minh Thang, Minh Lap, Minh Thanh and Tan Thanh People's Committee to manage the submerged areas for planting protective forest.
- Binh Phuoc Province People's Committee also assigned Dong Xoai Town, Chon Thanh District to update the land use planning for Phuoc Hoa Reservoir areas.

Thus, the consultant has conducted their task seriously, the second task (edited) has been done basically. They are waiting for the official comments of local government. See the details in the First Quarter Report of this package.

### **3.3. Package MT3**

Name of the package is '**Consultancy Services for Water Supply Stations for Lower Be River and Duc Hoa**'. The contract agreement of package was signed on 21 September 2011, the implementing period of the package is 26 months since the date of signing of the contract. The consulting agency is '*Thang Long Infrastructure Development Joint Stock Company*'.

Task 1 '***Understanding of the domestic water supply program for Be river basin and Duc Hoa area***' this task has been finished.

Task 2 '***Investigation, choice of location and technology, and preparation of cost estimate for water supply station in Be river basin***'

*The Domestic water supply station in Cay Truong Commune, Ben Cat District, Binh Duong Province, the following reports have been finished:*

- Feasibility Study;
- Design documents and drawings;
- Design cost estimate;
- Bidding documents;

- Choosing location for construction: Binh Duong Province People's Committee issued Letter to refuse the construction of water supply station. On 13 June 2014, ADB also issued Letter to refuse to support local in building the water supply station. Thus, the construction will not be implemented.

**Task 3 '*Investigation, choice of location and technology, and preparation of cost estimate for water supply station for Duc Hoa area*'**

*The Domestic water supply station in Tan My Commune, Duc Hoa District, Long An Province, the following reports have not been finished yet:*

- Feasibility Study;
- Design documents and drawings;
- Design cost estimate;
- Bidding documents.
- Choosing location for construction: On 09 May 2014, Long An Province People's Committee issued Letter No. 145/UBND-KT unified policy on taking back the plan of Binh Thuy Hamlet, Hoa Khanh Dong Commune, Duc Hoa District (instead of Tan My Commune as before) to construct the Duc Hoa water supply station belong to Phuoc Hoa Water Resource Project.

### **3.4. Package MT4**

Name of the package is '**Be River and Phuoc Hoa Fishery Management Programme**'. The contract agreement of package was signed in February 2010, the implementing period of the package is 50 months since the date of signing of the contract. The consulting agency is '*Research Institute for Agriculture 2 (RIA2)*'.

Up to 30/06/2014, the MT4 consultant completed the Inception report, and the annual reports of 2010, 2011, 2012, the First Interim Report, and the implementation result report in the first six months of 2013.

In the first six months of 2014, the consultant continued to implement the remaining tasks as required. According to the TOR, package MT4 consists of 09 specific tasks. the assessment of the implementation status as follows:

Task I "***Understanding the proposed Be River and Phuoc Hoa fishery, Reservoir and Fish pass management program***": this task has been finished.

Task II "***Monitoring hydrology and environmental flows management***": This task has been finished. The main data was assembled 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. By this time, the construction of the fish pass was finished.

Task IV “**Establishment of Be River and Phuoc Hoa forest and fisheries association**”: According to the report, these departments have worked with each commune and prepared personnel scheme, operational regulation, and these associations. At present, three fisheries associations were established, 01 in Binh Duong Province (An Thai Commune), and 02 in Binh Phuoc Province (Nha Bich, Than Thanh Commune).

Task V “**Operation and Protection of Fish Pass**”: This task has been finished. The data of discharge, flow, fish species, soil erosion, protection and operation of the fish pass will be performed in the Final Report.

Task VI “**Phuoc Hoa Reservoir fishery management plan**”: This task has been finished. The consultant has proposed the management alternates for reservoir’s aquaculture.

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**”: This task has been finished. The main contents of this task are to prepare fishery management plans and action plans for Be - Dong Nai Rivers basin.

Task IX “**Monitoring and evaluation of Be River fishery management program**”: This task has been finished.

In addition, the three main issues that were mentioned in the aide memoir of ADB on 26<sup>th</sup> October 2013 were solved, namely: (i) establishment of fisheries associations; (ii) Training for fisheries associations; (iii) the process of fish pass management.

### **3.5. Package MT5:**

Name of the package is ‘**Monitoring of water flow of Be, Sai Gon, Dong Nai, and Vam Co Dong Rivers**’. The contract agreement of package was signed in September 2009, the implementing period of the package is 50 months since the date of signing of the contract. The consulting agency is ‘*Southern Institute of Water Resource Research*’.

By this time, the consultant has monitored the water flow at nine stages, the last stage of this package is in October 2013. 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. The consultant has submitted the final report.

**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.
9	26/10/2013	31/10/2013	8	From Q1 to Q8	Stations from Q9 to Q12 have not been monitored yet, because construction has been not completed.

### 3.6. Package MT6:

Name of the package is '**Consultancy services for environmental monitoring**'. The contract agreement of package was signed in November 2009, the implementing period of the package is 52 months since the date of signing of the contract. The consulting agency is '*Southern Institute of Water Resource planning*'.

Up to 30/06/2014, the consultant completed their Inception Reports and monitoring result reports in 2010, 2011, 2012 and 2013, and the monitoring result report in April from 2010 to 2013, the first and the second Interim Report, and the Final Report.

The measurement and sampling activities at sites have been made as scheduled and following the process and norm. The monitoring stage in October 2014 is the last stage of this package.

### **3.7. Package MT7**

Name of the package is '**Consultancy services for environmental monitoring of construction contracts**'. The contract agreement of package was signed in October 2008, and was finished in October 2012. The implementing period of the package is 52 months since the date of signing of the contract. The consulting agency is '*Joint Venture of Institute for Water and Environment Research and Institute for Environment and Resource*'. The implementation time of extension phase of the package is 11 months from 11/2013 to 9/2014.

The consultant has not submitted the monitoring results reports of the first and the second quarters of 2014 so far.

#### *Specific activities in the first six-months of 2014 as follows:*

- Monitoring and inspection of the SEMP implementation of construction contractors;
- Independent samples to determine the concentration of dust in the air, noise, domestic water, drinking water, waste water;
- Independent inspection of the site and the record data of contractors;
- Interviews with local people, especially households located near the sites about environmental issues;
- Preparing the first and second quarter report of 2014.

In general, the activities of package have been done as TOR's contents closely, however, the progress of report preparation and the report submission (the first and second quarter report of 2014) is very slow compared to the plan.

### **3.8. Package MT8:**

Name of the package is '**Building, buying, installing consultancy of salinity monitoring devices**'. The contract agreement of package was signed in June 2011. The consulting agency is '*Tan Tien Automatic Technology Corporation*'. At present, the Consultant continues to support the monitoring stations, particularly support the OP3 package in operating and managing the stations.

### **3.9. Package MT9**

Name of the package is '**Post evaluation of Environmental Impacts**'. 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. At present, this package has not been implemented as planned.

### **3.10. Package MT10**

Name of the package is '**Capacity building, technology transfer, and**

**awareness rising**'. The contract agreement of package was signed in November 2009, and was finished in October 2011, the implementing period of the package is 24 months since the date of signing of the contract. The consulting agency is '*Southern Institute of Water Resource Research*'.

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.

### **3.11. Package OP3**

Name of the package is '**Operation and maintain salinity monitoring network**'. The contract agreement of package was signed in July 2013, and was finished in July 2014, the implementing period of the package is 13 months since the date of signing of the contract. ICMB9 is the direct execution unit with the support of environmental experts and local managerial staffs.

The specific staffs of the package are implemented management, operation, maintenance and report monitoring results from the three station.

Up to June 2014, package OP3 has finished the Inception Report, the Monitoring Results Report of 12 consecutive months (from July 2013 to June 2014). At present, this package is preparing final report.

#### **4. Management and operation at Phuoc Hoa headwork and Environment Protection works**

##### **4.1. Management and operation at Phuoc Hoa headwork**

###### **Management works:**

Shortly after taking over and putting to use the structure, the Dau Tieng – Phuoc Hoa IMC has established and assigned Phuoc Hoa Team to manage, operate, and protect the Phuoc Hoa Water Resource system, including the head works and vicinities, reservoir and inside reservoir, Phuoc Hoa – Dau Tieng transfer canal. Detecting and preventing unsafe behaviours for works such as stealing or damaging machineries and equipment; fishing in lake with dynamite; fishing in the fish pass; digging and vandalizing the canal banks; transgressing the work's protection areas. They are coordinating closely with local authorities to handle strictly the violations.

###### **Operation works:**

Phuoc Hoa Reservoir has been operated under “The temporary technical process of operating and maintaining the works” belong to Phuoc Hoa Project in accordance with Decision No.307/QĐ-BQL9 dated 23/05/2012, Letter No. 427/CV/BQL-TL9.3 dated 03/07/2012, and Decision No.1517 issued by Binh Phuoc Province People's Committee on “The temporary coordination regulation for multiple operation of irrigation reservoirs and hydropower on Be River such as Thac Mo, Can Don, Sok Phu Mieng, Phuoc Hoa”. The results show that the current operation is safe.

###### **Maintenance works:**

Pursuant to Decision No.487/QĐ/BNN-KH dated 21/02/2006 issued by MARD on the economic and technical norms in the management and exploitation of the irrigation systems of Dau Tieng – Phuoc Hoa IMC. And the consumption norm of material, fuel in machinery maintenance in order to supply materials (fuel, engine oil) to maintain the machinery of head works, opening and closing machines, backings.

##### **4.2. Environmental Protection works**

###### **Protecting and managing the submerged and reservoir areas:**

At present, the landmarks system for defining the reservoir area's protection boundary has not been set up, hence Phuoc Hoa – Dau Tieng IMC has no management plan, and protection works in these areas have many difficulties. Demarcated protected project of Phuoc Hoa Reservoir is in the proposal approval stage.

**Environmental protection works:**

In order to prevent illegal fishing status that affect fisheries resources, Phuoc Hoa – Dau Tieng IMC has coordinated with Phu Giao District's police and People's Committee (An Thai and Minh Thanh commune) to plug "No fishing" sign boards in the upstream and downstream area of Labyrinth spillway, in lake, dam's lower area, and the fish pass. It is however still the case not abides, especially at the bridge passing the Labyrinth spillway that obstructing the traffic.

Phuoc Hoa – Dau Tieng IMC sent the Phuoc Hoa Team to conduct statistical survey of factories, Processing Facilities in the basin, which are likely to cause pollution to Phuoc Hoa Lake in order to have suitable water resource protection solutions.

Phuoc Hoa – Dau Tieng transfer canal does not go through the resident areas much, hence the environmental status is quite good. In the long term, this canal however needs more suitable structure solution combine with the propaganda, and people's awareness rising of environmental protection. At present, Phuoc Hoa – Dau Tieng IMC has coordinated with local authorities to propagandize local people not discharge into the canal.

## 5. Environmental management program at construction sites

### 5.1. Main construction activities at the sites

Up to the end of June 2014, 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: BIDEKO (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: BIDEKO.

**Table 2: Total volume construction of PH4 package**

No.	Categories	Unit	Total	Finished
1	Steel	kg	684,641.44	547,713.15
2	Concretes	m <sup>3</sup>	42,904.29	33,894.39
3	Excavated soil	m <sup>3</sup>	416,405.77	407,287.80
4	Filling soil	m <sup>3</sup>	1,150,872.20	968,554.10
5	Filter breakstone	m <sup>3</sup>	3,999.87	3,415.44
6	Joint filler 10x10 mm	m	117,235.70	65,361.95
7	Geotextile fabric	m <sup>2</sup>	20,419.26	20,419.26
8	Asphalted paper	kg	19,552.37	19,552.37

Sources: ICMB9

### 5.2. 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.

### 5.3. Environmental monitoring results at the sites

Monitoring positions (air, water quality) were conducted by MT7 Consultant, which ensured to provide a general valuation about environment such as at the positions construction activities are taking place; gathering a large amount of workers; worker camp; nearest residential areas.

**Table 3: Environmental monitoring locations in PH4 construction sites**

No.	Constructors	Type	Code	Site	Coordinates	
					x	Y
1	Constructor CC5	Water	K0-WW1	Km0	682791	1226614
2			K0-DW1			
3			K0-PW1			
4	Constructor BIDECO	Air	K2-A1	Km2	681875	1224567
5			K7-A2	Km7	680052	1220325
6			K8-A3	Km8	679819	1219453
7	Constructor TTP and VMC	Air	K11-A4	Km11	680922	1216061
8		Water	K11-WR4			
9	Constructor TW JV	Air	K11-A5	Km13	681145	1214222
10		Water	K11-WW5			
11			K11-WR5			
12	Constructor BIDECO	Air	K15-A6	Km15	681039	1212436

### 5.4. Air quality

#### 5.4.1. Air

The first quarter is the dry months of year, very convenient for construction activities on the sites. The dry weather is however also convenient conditions for shedding dust in the air. Up to the first quarter, the rain appeared in many areas but not too much, hence it makes the air cooler, and prevents dust emission, however, the construction activities will deal with some obstacles.

According to MT7's independence monitoring result, the dust concentration in K13 position is high ( $437 \mu\text{g}/\text{m}^3$ ), over nearly 1.5 times higher than the regulation. At the end of Quarter I, constructors accelerated the construction progress, amount of workers and traffic densities in the sites increased too much combining with dry weather condition that leads to dust concentration dispersal increased from 2 to 5 times, especially at K8-A3, K13-A5 areas. Dust concentration at the remaining positions meet the regulation.

**Table 4: Monitoring results of dust concentration in PH4 construction sites – Quarter I&II of 2014**

No	Monitoring positions	Unit	Monitoring results		QCVN 05:2009 /BTNMT
			Quarter I	Quarter II	
1	K0-A1	µg/m <sup>3</sup>	160		300
2	K2-A1	µg/m <sup>3</sup>	215	203	300
3	K7-A2	µg/m <sup>3</sup>	210	<b>340</b>	300
4	K8-A3	µg/m <sup>3</sup>	<b>343</b>	273	300
5	K11-A4	µg/m <sup>3</sup>	210	163	300
6	K12-A5	µg/m <sup>3</sup>	260		300
7	K13-A5	µg/m <sup>3</sup>	<b>437</b>	267	300
8	K15-A6	µg/m <sup>3</sup>	247	183	300

*Sources: Monitoring result report of construction contracts in Quarter I & II of 2014 – MT7 package*

#### 5.4.2. Noise

Construction quantity of Quarter II decreased in comparison with the Quarter I, the density of traffic and workers also decreased, hence the noise still satisfies the regulation. The highest value of noise is 73.3 dBA at K11-A4 in Quarter I, and 70.7 dBA at K13-15 in Quarter II.

**Table 5: Monitoring results of noise in PH4 construction sites – Quarter I&II of 2014**

No	Monitoring positions	Unit	Monitoring results		QCVN 26:2010 /BTNMT
			Quarter I	Quarter I	
1	K0-A1	dBA	57.6		70
2	K2-A1	dBA	66.5	63.1	70
3	K7-A2	dBA	62.9	66.5	70
4	K8-A3	dBA	64.8	66.1	70
5	K11-A4	dBA	<b>73.7</b>	64.8	70
6	K12-A5	dBA	54.8		70
7	K13-A5	dBA	61.0	<b>70.7</b>	70
8	K15-A6	dBA	57.0	62.5	70

*Sources: Monitoring result report of construction contracts in Quarter I & II of 2014 – MT7 package*

#### General assessments:

In general, the monitoring period of the first six-months, the air pollution status occurred in the low level, primarily dust pollution in several construction areas, due to the traffic density of material transport. The mitigation solutions for dust

pollution by spraying water have no effect in these areas. Therefore, Constructors should raise the operation frequency of water spraying car to overcome the dust pollution.

### 5.5. Domestic water

The domestic water in construction packages is pumped from the groundwater in workers camp. The groundwater is pumped again from drilling wells at depths from 15 to 25 m. After pumping up, water is stored in tanks or drums. The domestic water uses for bathing, washing. Several workers camps use the domestic water to wash fresh food before being cooked. Observations with the naked eyes, the pumped water is quite transparent, not colour, not taste.

The analyzed results in the two quarter perform that all water samples have low quality, several indicators are not reached the standard for domestic water such as pH Total Fe, E.Coli, Total Coliform. The cause of contamination is that the pumped water has been contained in drums but not be carefully shielded hence leads to pollution. To handle this situation, MT7 Consultant instructed the constructors to clean the tanks and requested to build the roof in the containing water areas.

**Table 6: Monitoring results of domestic water in PH4 construction sites – Quarter I&II of 2014**

No.	Indicators	Unit	K0-PW1				K15-PW6			Column I QCVN 02: 2009/BYT
			K0-PW1	K2-PW1	K1-PW5	K15-PW6	K13-PW5	K8-PW5	K15-PW6	
1	pH	-	6.25	<b>5.24</b>	6.14	6.08	6.45	<b>5.17</b>	6.25	6 - 8,5
2	Total hardness	mg CaCO <sub>3</sub> /l	11	4	13	16.67	11	10.5	14.33	350
3	Total suspended Solid (TSS)	mg/L	6	1	3	0.83	3	1	0.67	-
4	Clorua, Cl <sup>-</sup>	mg/L	4	10	3	11.33	1	8.5	7.67	300
5	Nitrate, N-NO <sub>3</sub>	mg/L	0.1	0.14	0.05	0.08	0.04	3.1	0.045	-
6	Sulphate, SO <sub>4</sub> <sup>2-</sup>	mg/L	KPH	KPH	KPH	9	KPH	KPH	KPH	-
7	Mangan, Mn	mg/L	KPH	KPH	KPH	KPH	KPH	KPH	KPH	-
8	Total Fe	mg/L	0.34	0.23	0.58	KPH	<b>0.99</b>	KPH	0.26	0,5
9	E. Coli	CFU /100ml	<b>2</b>	KPH	<b>800</b>	<b>250</b>	<b>41</b>	<b>240</b>	<b>86.67</b>	0
10	Total Coliform	MPN /100ml	6	KPH	<b>4900</b>	<b>110.5</b>	<b>84</b>	<b>342.5</b>	<b>106</b>	50

*Sources: Monitoring result report of construction contracts in Quarter I & II of 2014 – MT7 package*

## 5.6. Drinking water

At the monitoring time, the drinking water in sites is purified bottled water (type 20 litres), several worksites use boiled water. In general, observed with the naked eye, the water is quite transparent, not colour, not taste.

**Table 7: Monitoring results of drinking water in PH4 construction sites – Quarter I&II of 2014**

No.	Indicators	Unit	Q1/2014				Q2/2014			QCVN 01:2009/ BYT
			K0-DR1	K2-DR1	K7-DR1	K15-DR6	K2-DR1	K8-DR1	K15-DR6	
1	pH	-	6	6.79	6,5 – 8,5	6.45	4.6	6.295	6.04	6 - 8,5
2	Colors	-	KPH	9	15	3	2	KPH	KPH	350
3	Total hardness	mg CaCO <sub>3</sub>	1	3	-	3.5	4	KPH	3	-
4	Temporary hardness	mg CaCO <sub>3</sub>	KPH	KPH	-	KPH	KPH	KPH	KPH	300
5	Clorua Cl <sup>-</sup>	mg/L	3	4	250	3.67	19	4	5.67	-
6	Total Fe	mg/L	KPH	KPH	0,3	0,12	KPH	0,08	KPH	-
7	Asen, As	mg/L	KPH	KPH	0,01	KPH	KPH	KPH	0.015	-
8	Total Coliform	MPN /100ml	1	120	KPH	KPH	KPH	18	17,5	0,5

*Sources: Monitoring result report of construction contracts in Quarter I & II of 2014 – MT7 package*

Most of the local purified water production companies use the production technique is not guaranteed that leads to unstable quality. The analyzed results at K0-DR1 and K2-DR2 show the pH indicator was not guaranteed. In addition, particularly at K0-DR1, K2-DR1, K8-DR1, K15-DR6 position, the drinking water with Total Coliform indicator exceeds the regulations of the Ministry of Health. The cause is that during the using period, the water has not been contained in the hygienic equipments. If this polluted situation extends, it will affect the health of staffs and workers in sites, especially the digestive systems.

## 5.7. Surface water

The surface water in project areas are primarily from Thay Cai canal, the other canals, ponds, paddy fields. Except the Thay Cai canal has great flow and good water circulation, the remaining canals have weak flow with the circulation of water flow is weak, easy to be polluted.

**Table 8: Monitoring results of surface water in PH4 construction sites – Quarter I&II of 2014**

No.	Indicators	Unit	Q1/2014			Q2/2014			Column B1, QCVN 08:2008 BYT
			K11-WR4	K12-WR5	K13-WR5	K2-WR1	K12-WR5	K13-WR5	
1	pH	-	7.25	6.25	6.36	6.75	2.55	5.22	5,5 – 9
2	COD	mg/L	11	39	51.33	7	29	29.11	30
3	TSS	mg/L	7	29	59.67	27.5	16	34.39	50
4	Total Oil	mg/L	KPH	1.465	1.09	0.5	KPH	0.795	0,1
5	E.Coli	CFU/100ml	<b>1.700</b>	KPH	<b>5.373</b>	<b>3.550</b>	KPH	<b>4.462</b>	100
6	Total Coliform	MPN/100ml	3.500	<b>49.000</b>	<b>83.930</b>	<b>8.100</b>	KPH	4.601	7.500

*Sources: Monitoring result report of construction contracts in Quarter I & II of 2014 – MT7 package*

The analyzed results show that the surface water samples in project areas are contaminated microorganism, the highest Total Coliform (83.930 MPN/100ml) was detected at K1-WR5 in Quarter I. In addition, since the limit of the water flow, the water on several canals has sign of organic pollutants, COD indicator exceeds the regulation from 1.6 to 2.8 times, the highest value is 51.33 mg/L at K13-WR5 position in Quarter I.

Oil pollution is also quite common for the surface water in construction sites, the monitoring areas have the oil concentration exceeded the regulation from 5 to 15 times.

### 5.8. Waste water

Domestic wastewater mainly contains residues, suspended solids (SS), organic compounds (BOD/COD), nutrients (N, P) and micro-organisms. The amount of domestic wastewater generated in the sites is not large, but due to the density of workers gathering in the workers camp areas is too high. Furthermore, the drainage and hygiene conditions has not ensured, hence the influence of wastewater on the environment is too large.

**Table 9: Monitoring results of surface water in PH4 construction sites – Quarter I&II of 2014**

No.	Indicators	Unit	Q1/2014		Q2/2014	Column B QCVN 14:2008/ BTNMT
			K0-WW1	K13-WW5	K13-WW5	
1	pH	-	6,79	6,83	<b>4,9</b>	5 – 9
2	COD	mg/L	14	131,3	269,5	-
3	TSS	mg/L	40	84	<b>220,5</b>	100
4	Total oil	mg/L	KHP	2,18	7,4	-
5	E.Coli	CFU/100ml	200	25.733	5,1x10 <sup>5</sup>	-
6	Total Coliform	MPN/100ml	<b>5.400</b>	<b>3,9 x 10<sup>5</sup></b>	<b>2,4x10<sup>8</sup></b>	5.000

Sources: Monitoring result report of construction contracts in Quarter I & II of 2014 – MT7 package

The analysed results show that the wastewater samples at workers camps with TSS indicators is high, but only at K13-WW5 in Quarter II, it is higher than the regulation about 2.2 times. On the other hand, the microbial contamination is one of the components were polluted highly and commonly. At K0-WW5, Total Coliform concentration is  $2,4 \times 10^8$  MPN/100ml in Quarter II that highest value during the monitoring time. On the other hand, the status of Oil pollution, and high COD concentration appeared at most of monitoring positions.

#### **5.9. Hazardous waste**

During construction, through observation and monitoring, we did not detect any toxic chemicals, chemical poisons or strange chemicals.

#### **5.10. Health and safety**

During the construction stage, subcontractors have good awareness in health and safety. In construction phase, there was not safety violation, disease or food poisoning at construction site. However, there are still some diseases such as flu, graze, sprains.

MT7 Consultant always pay attention to guide contractors on regulation for work-related health, safety on construction site, and we also always monitor the compliance of regulation on health and safety at work and safety and hygienic food.

#### **5.11. Socio-economic impacts**

The construction packages created job for people during construction stage.

However, there are some opposing views that the construction is the reason causes dust pollution and difficulties in transportation, especially in high construction density period. These issues are reflected by some households living along construction areas such as surroundings of Km 2+550, Km 7+050, Km8, Km 11 and Km 15.

#### **5.12. General conclusion of environmental status in sites**

The monitoring results of MT7 Consultant show that the constructors did not let any serious environmental problems happen. Nevertheless, several common environmental pollutions occurred in the worksites as follows.

- Dust pollution occurred in areas where the density of construction is high. The constructors has not paid attention more to mitigation solutions such as spraying water to keep moist; shielding the material transportations and the material yards, etc.
- The domestic water is polluted including the microbial contamination and the low pH indicator. Because the domestic water is pumped from the drilling

wells, the containing equipments are not hygienic.

- The surface water is polluted by the amount of oil that using in operating machineries, the TSS concentration in the water is high due to the solid waste has not been managed well.

As mentioned in the previous reports, the constructors are lack of staff, who are responsible for environmental management, hence the outstanding environment issues as mentioned above have not been controlled closely.

## **6. Water Environment**

### **6.1. Changes of the water flow and erosion status at riverbanks**

#### **6.1.1. Changes of the water flow**

The last monitoring stage of MT5 is in October 2013, the observed data has been showed in the last six-month report of OP4 package. In this report, we present briefly the statement of experts relating to the changes of the water flow from 2010 to 2013 (the detail of contents were performed in the final report of MT5 package, and will be detailed in the final report of OP4 package).

#### **❖ Be River basin:**

There are three monitoring stations in Be River, namely: Q4 at upstream of Phuoc Hoa Dam, Nha Bich Bridge; Q7 at the downstream of Phuoc Hoa Dam; Q5 at the lower of Be River (near Tri An confluence):

Observed data showed the changes of water flow over the years as well as before and after the impounding time of the Be River in July 2010. The practice of impounding affect obviously on the water flow of Be River in the upper of Phuoc Hoa Dam (Station Q4): cause of water level rise and water flow velocity decrease. If before the time of impounding, the mean value of water level during the dry season at station Q4 fluctuated from 29.0 to 30.0 m, hence it was higher than 42.0 m in the monitoring stages of April 2012 and 2013 (higher than the average water level in the monitoring stage of 2009 and 2010).

The observed data also showed that the impact of impounding the Be River (from 07/2010) and the transferring of water from Phuoc Hoa Reservoir to Dau Tieng Reservoir (04/2013) on the water flow regime are not too much. The changes of water flow over the years at stations depend on the weather as rain: rainy season begins soon or later, and how long it lasts, the operation of reservoirs in this region such as Srock Phu Mieng, Tri An, etc.

#### **❖ Vam Co Dong River basin:**

There are two monitoring stations in Vam Co Dong River, namely: Q1 at below the Tan Bien irrigation area and Ben Da stream; Q6 at the downstream of Xang Lon canal.

The observed data showed that the practice of impounding the Be River and the transferring of water from Phuoc Hoa Reservoir to Dau Tieng Reservoir are not affected on the water flow regime of Vam Co Dong River. The changes of water flow over the years in stations depend on the weather such as rain, flood over the years and tidal regime.

❖ **Sai Gon – Dong Nai River basin:**

There are three monitoring stations in Sai Gon – Dong Nai River, namely: Q7 behind the spillway; Q3 at upper of Ben Than intake on Sai Gon River; Q2 at Long Son, downstream of Dong Nai Bridge.

The changes of water flow in the river systems in the monitoring stage from 10/2009 to 10/2013 are the same as the Be and Vam Co Dong River, has not discovered any obvious impacts of the practice of impounding the Be River and the transferring of water.

❖ **General conclusion:**

At that, it can be concluded that the practice of impounding Be River has obviously affected on the hydrologic regime, the water flow in the upstream: rising the water level at Q4 even in the dry season. For downstream, the practice of impounding hardly affected, due to the function of Phuoc Hoa Dam aims to raise the water head.

The transfer of water may have a certain impact to water quality and salinity intrusion on Dong Nai River. In order to conclude exactly about the effects of water transfers, it should has a series of monitoring data of water quality and salinity that is continuous and long enough.

*6.1.2. The status of riverbanks erosion*

Beside the nine minor eroded locations in the upstream as mentioned in the last reports, up to now these old erosions are stable and new erosion locations have not been found. Similarly, these erosions in the downstream have been stable and new erosions did not occur. Vegetation cover on both sides of the river is growing stably.

For the water transfer canal, the eroded locations in the beginning of 2013 at Km36+800 were resolved. Throughout survey trips, we have not detected any new erosion locations.

*6.1.3. Variables of the vegetation cover along the Be riverbanks.*

By this time, the vegetation cover that distributes along both sides of Be River has not any significant changes, according to the surveying results of the MT2 package, this reach consists of two 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 was 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.

## **6.2. Changes of the water quality**

The last monitoring stage of MT6 is October 2013, the observed data has been showed in the results report of 2013 of package MT6 and the last six-months report of OP4 package.

The following present briefly the statement of experts relating to the changes of the water quality and aquatic life from 2010 to 2013 (the detail of contents were performed in the final report of MT6 package, and will be detailed in the final report of OP4 package).

### **6.2.1. Surface water quality**

#### **❖ Be River basin:**

There are 05 monitoring locations: Nha Bich (WQ01), Phuoc Hoa dam (WQ04), Phuoc Hoa Bridge (WQ05), Ma Da (WQ09), downstream of Be river (WQ10).

The monitoring results showed that, during the period 2010 – 2013 the water resource of Be River at the monitoring locations was quite good, and achieving the allowable criteria for domestic water supply according to the standard QCVN 08:2008/BTNMT Column A2 (it is good for domestic water supply if processed). It is also good for aquaculture demands (the standard 38:2011/BTNMT) and irrigation (the standard 39:2011/BTNMT).

At present, on the Be River basin, the wastewater from industrial and rubber production are serious polluted with some components beyond the discharging limits about tens or even hundreds of times (QCVN 01:2008/BTNMT-National Technical Regulation about Wastewater of Natural Rubber Processing, QCVN 40:2011/BTNMT - National Technical Regulation about Industrial Wastewater). However, according to observation in the sites during implementing the EMP, the wastewater discharges were very small, and on the other hand, the discharging points of pollution sources are far away from the monitoring point on the Be River, therefore, the impacts of them on the water quality of Be River have not be seen.

#### **❖ 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).

The water resource of Dong Nai River at monitoring locations (except the Ong Kep position) with the quality satisfied requirements (except Faecal Coliform) and could be used for domestic water supply pursuant to QCVN 08:2008/BTNMT Column A2, and for aquatic life and irrigation demands pursuant to QCVN 38:2011/BTNMT and QCVN 39:2011/BTNMT. In Ong Keo region, due to the impacts of salinity intrusion then the salinity of water sometime were greater than allowable criteria of irrigation water (QCVN 39:2011/BTNMT).

❖ **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).

Due to the impacts of acid sulfate soils from Cu Chi and Trang Bang area, the water quality of Sai Gon River at Be Than was slightly alum. Ben Than region is also affected by salinity intrusion but very weak, in the monitoring period 2010-2013, the highest salinity was 0.2 g/l, much less than allowable criteria for domestic water supply (QCVN 08:2008/BTNMT Column A2). The lower of Sai Gon River has been strongly affected by wastewater from Ho Chi Minh City with nutrient, organic matter, especially Faecal Coliform was higher than other rivers in the basin. The water quality of Sai Gon River upstream satisfied the criteria for domestic water supply that pursuant to QCVN 08:2008/BTNMT Column A2. In the lower areas (Tan Thuan), the water resource could not be used for any purposes (domestic, aquatic life, and irrigation).

❖ **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).

Vam Co Dong River is affected by acid sulphate soils area of Bo Bo, Thu Thua, domestic wastewater from small residential regions, production wastewater from industrial parks in the northern districts of Long An Province. The Vam Co Dong River at confluence areas with Tra Cu and Xang Lon canals was acidic in the rainy season ( $pH_{avr}$  about 5.2 and 5.4), and affected by salinity intrusion in the dry season (salinity about 3.5 g/l). Dissolved oxygen concentration was rather low and lowest at Ben Da area. The water of Vam Co Dong River satisfied for irrigation criteria (except some acidic water period), not for domestic water supply.

Water quality of Phuoc Hoa and Dau Tieng Reservoir, Phuoc Hoa - Dau Tieng water transfer canal, Tan Bien canal was good, satisfying criteria for domestic water, aquatic life and irrigation water.

❖ **General conclusion:**

In general, during period 2010-2013, most of water surface quality had not any obvious trends over time, except various components varied by natural rules or weather condition, including suspended solids are high in the rainy season due to washing out surface land; erosion in the flood season; salinity intrusion in the dry season (highest salinity of Dong Nai River in the dry season of 2011 due to low rainfall in 2010, then lowest discharge of the Dong Nai River in the dry season of 2011). pH decrease due to impact of acid sulphate soils.

In this period, it can be seen that the Sai Gon River was most affected, then Vam Co Dong River, Dong Nai, last the Dong Nai and Be River. However, there was not any clear trend of water quality deterioration of rivers.

**6.2.2. Groundwater quality:**

The groundwater was 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 GW10, 11 and 12. In addition, the three wells the National Lo Go – Xa Mat Forest were measured in including GW13, 14 and 15.

Overall, the groundwater quality of most monitoring wells of the EMP satisfied criteria in QCVN 09:2008/BTNMT – National Technical Regulation on groundwater. Some wells in Sai Gon and Vam Co Dong River basins were affected by alum with pH lower than allowable values in QCVN 09:2008/BTNMT. During the monitoring period, the groundwater quality did not any obvious trend. The quantity of several physical chemical components have changed but not by the construction of Phuoc Hoa Dam.

## 7. Biodiversity

### 7.1. Aquatic biodiversity

The same as monitoring surface water, the monitoring of aquatic biodiversity was also finished in 2013. For the status as well as the trend of species compositions, preliminarily there are several statements as follows:

The monitoring results showed that phytoplankton structure was recorded with 270 species, mainly on 6 phyla in which number of species of *Bacillariophyta* was highest with 100 species, accounting for 37.04% of total species, the density of them was also varied through the monitoring years. Zooplankton structure was recorded with 52 species belonging to 5 phyla in which *Arthropoda* was largest phylum with 35 species, accounting for 67.31% of total species, there were 23 species of zoobenthos. Fish species number was recorded highest in 2011 with 154 species, in which there were 10 species belonging to extinct endangered species in the Red Book of Viet Nam. Besides, for species diversity, there were alien 6 fish species imported from many countries, these kind of species are very dangerous to natural fisheries resources because of their huge production and rapid spawn.

Phytoplankton species number was highest in 2011 and then tended to decrease. There was a decrease trend for phytoplankton density from 2011 to 2013. There was a decrease trend of zooplankton from 2011 to 2013, on the contrary, the zooplankton density tended to increase year by year during monitoring. Zoobenthos tended to slightly decrease through the years in both composition and density. There was no large variation in fish species during monitoring.

### 7.2. 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 11].

**Table 10: 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	4,059	4,559	4,906	5,381	6,616	-
2	Fishing	Ton	518	468	536	280	264	250
3	Total output	Ton	4,577	5,027	5,442	5,661	6,880	7,200

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 12]. Total fisheries production was 643 tons and aquaculture productivity 7,078 tons in 2009. Since 2010, however, fishing and aquaculture productivity have decreased. Up to 2012, the fishing productivity was 377 ton, and the aquaculture productivity was 4,637 ton in the whole province.

The statistics shown 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.

In the whole province, there are 07 clubs "**Aquaculture Extension Club**" that helps farmer households develop their aquaculture careers. For aquaculture section, there are 05 teams "**Team of Capture Fisheries and Resource Protection**". The member votes the management board. In order to help the teams operating well, contribute to protect the fisheries resources, the aquaculture department participates in regular activities, opening training courses on technical introduction, propagandizing the law for aquatic resource protection, and help them with the breeder to renew the resources.

**Table 11: Fisheries development situation in Binh Phuoc province**

No.		Unit	2007	2008	2009	2010	2011	2012
1	Aquaculture							
	- Area	Ha	2,118	2,229	2,496	2,295	2,113	2,065
	- Productivity	Ton	5,269	6,102	7,078	6,393	6,052	4,637
2	Fishing	Ton	488	559	643	412	357	377
3	Total output	Ton	5,757	6,661	7,721	6,926	6,409	5,014

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.

Based on the newest data provided by MT6, total of 120 species fish and shrimp were identified at eleven surveyed stations belong to 11 orders, 31 families, and one specie of Riceland river prawn (*Macrobrachium mirabile*) and one specie of Giant river prawn (*Macrobrachium rosenbergii*) (see Item 6.1.1 in this report).

**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).

After the Fisheries Associations were established with the support of local authorities, relevant agencies such as Aquatic Centers, Agriculture Department have provided training, propaganda for aquatic resource protection, promulgating the regulation for team members. The exploitation and protection of fisheries resources of Phuoc Hoa and Be River is performed under co-management model. However, the government agencies have not prevented the exploitation activities in the fish pass timely. In addition, fishing by electric shocks has not been prevented yet.

Aquaculture sector: At present, there are 02 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).

**7.3. 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.

**7.3.1. Animal:**

Through preliminary interviews of inhabitants and forest protection staffs, the Lo Go Xa Mat National Park mainly appear some species, such as Wild boar (*Sus scrofa*), Long-tailed Macaques (*Macaca fascicularis*), Java mouse deer (*Tragulus javanicus*), Weasel (*Vivericula indica*), Squirrel (*Ratufa bicolor*), Giant Muntjac (*Muntiacus vuquangensis*), Wildcats (*Prionailurus bengalensis*), Polatouche (*Petaurista philippensis*), Lights Weasel (*Herpestes javanicus*), Gold Weasel (*Martes flavicula*), Small Loris (*Nycticebus pygmaeus*), Pig-tailed Macaque (*Macaca leonine*),

Porcupine (*Acanthion brachyurus*), Hare (*Lepus peguensis Blyth*), etc.

#### 7.3.2. Birds:

From the result and interview of inhabitants and forest protection staffs, there are 33 species. This species appear a lot namely White-crested Laughingthrush (*Garrulax leucolophus*), Oriental pied hornbill (*Anthracoceros albirostri*), Magpie (*Copsychus saularis*), Capercaillie (*Gallus gallus*), Drongo (*Dicrurus paradiseus*), Ringdove (*Streptopelia chinensis*), Pheasant (*Lophura diardi*). In addition, there are Sparrow (*Passer sp.*), Eagle (*Passer sp.*), Barbet (*Treron*), Red face Chicken (*Polyplectron germaini*), Black-throated Laughingthrush (*Garrulax chinensis*), Teal (*Dendrocygna javanica*), Yellow starling (*Sturnus*), Oriole (*Oriolus*), Weaverbird (*Dicaeum chrysorrheum*), Cormorant (*Little Cormorant*), Owls (*Otus.*), Green Pigeon (*Treron sp.*), Francolin (*Francolinus pintadeanus*), Heron (*Ardea*), Hawk (*Milvus migrans*), Flycatcher (*Hypothymis azurea*), Great hornbill (*Buceros bicornis*), Gracula (*Gracula religiosa*), Yellow haldi (*Aegithina tiphia*), etc.

## **8. Soil condition**

Overall, in the monitoring areas, the value of  $\text{pH}_{(\text{H}_2\text{O})}$  as well as  $\text{pH}_{(\text{KCl})}$  were rather low (3.5 and 2.5), they however met the standard TCVN 7377:2004 (Soil quality - pH indicator value in the land of Vietnam). Aluminum content in soil was 500 ppm, and total iron was 1.500 ppm. Furthermore, the total nitrogen and phosphorous were too low, especially, the total phosphorous usually does not appear or is very poor.

In terms of trends, the acid sulfate soils and soil solution have the chemical components that less variation over the years from 2010 to 2013. The aluminum content of surface water have decreased trend. The chemical components of groundwater of Duc Hoa Irrigation areas do not have any obvious variation trends.

## **9. Monitoring results of Administration House**

Based on the results report of package MT6, the monitoring results of Administration House during the construction phase (2010-2011) showed that the air was polluted, however, the amount of wastewater was small with the low levels of pollution.

During the operation phase (2012-2013), there were about 15 staffs of company working at Administration House frequently then the amount of garbage was small, the wastewater has been collected into storage containers, deposition tanks and then being penetrated into ground. Overall, the operation of Administration House has not affected on environment in this area and its vicinity.

## **10. Environment Awareness**

In 2013 and the beginning months of 2014, the EMP packages have conducted with a series of tasks, which contributed to enhance the environmental awareness of communities, management agencies, and the bit packages (the constructors).

Package MT1, the capacity building and raising awareness program for the National Park management board and relevant agencies was held in May 2013. The program has helped management staffs and local people comprehending more about the Tan Bien Irrigation Project, the important role of the National Park's preservation, land clearance, compensation and resettlement of the project, and the other issues relating to the environmental protection. Also in the scope of works, MT1 Consultant organized on tours to Cat Tien National Park.

Package MT2, the consulting workshop on Land use planning, land allocation, and protective forest in the Phuoc Hoa Reservoir that was held in March 2014. The workshop has helped staffs and local people comprehending more about the important role of the protective forests of reservoir and the water resource protection, aquiculture development, preventing erosion and deposition that help prolong the life of the lake.

Package MT7, after signing the extension contract, they have conducted the significant tasks, including meeting with the constructors, conducting field surveys and consulting the communities in the surrounding areas. Thereby officials explained and advised the technical solutions to help the environmental managers has more experience as well as greater awareness of environmental protection the sites.

In the last phase, Package MT10 belongs to EMP packages of Phuoc Hoa Project is conducted with major objectives as follows: (i) 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; (ii) Enhancing the awareness of Project and EMP stakeholders 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.

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.

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.

## **11. Conclusions and Recommendations**

### **11.1. Conclusions**

#### *11.1.1. The natural and social environments*

The monitoring results of the EMP packages during the period from 2010 to 2013 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 as well as for domestic purposes if processed. However, the lower areas and estuaries of Dong Nai, Vam Co Dong and Sai Gon Rivers are affected by salinity intrusion in the dry season, the increase in the organic matter and micro organism contaminations, hence create negative impacts on domestic and agricultural water supply. On the other hand, the whole reach that through over the resident areas, towns such as Ben Luc, Bien Hoa, Ho Chi Minh City show the sign of negative impacts on the water environment.

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. 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, however this issue has been solved up to now.

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 already got a suitable solution. The Fisheries Associations have been established and put into operation. We hope that the regulations and the mechanism of fisheries management will be implemented in the coming time, the fish resources in reservoir and Be River will be protected.

#### *11.1.2. 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)".

The land use planning reports were prepared by the Consultant, the consulting workshops have also been arranged at local areas in quarter I/2014.

Package MT3: The consultant has finished the designed reports. However, due to the construction of water supply station in Binh Duong Province is not really urgent, hence the People's Committee issued Letter to refuse the supporting package. With the water supply station in Long An Province, throughout lots of changes the construction locations, the People's Committee issued Letter to unify policy on taking back the plan of Hoa Khanh Dong Commune, Duc Hoa District til now.

Package MT4: The consultant has finished all their tasks and they are preparing the final report.

Package MT5: The consultant has finished all their tasks and they are preparing the final report.

Package MT6: The consultant has finished all their tasks and they are preparing the final report.

Package MT7: the consultant has not submitted the first and the second quarter reports of 2014 as planned.

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.

Package MT9: At present, this package has not been conducted as planned; hence, the remaining time to implement the package is very limited. Therefore, this package will not be implemented in this phase.

Package OP3: Based on the implementing results and compared with the TOR, by this time, the consultant conducts their tasks as planned. However, this package is also experiencing several disadvantages in getting the support from the equipment providers.

#### *11.1.3. 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.
- Receive the enthusiastic support from local authorities, agencies, and local people.

- Cooperation, sharing, and support among EMP consultants.
- Receive coordination and timely supports from ICMB9, BVI in all cases to assist the consultant in implementing their works.

***Disadvantages:***

In the first half of 2014, besides the above-mentioned advantages, the EMP tasks had certain difficulties as follows:

- For EMP packages, only 11 out of 14 packages are under the implementation but the workload is still heavy. 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 (MT2, MT3, MT4).

## **11.2. Recommendations**

### ***11.2.1. General recommendations for EMP packages***

- 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 MT7, the quarterly reports should be submitted on schedule.
- The consultants should submit the final reports with three full sets (hard copy and CD Rom).

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 activities 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, it is recommended that the Sponsor, the Investor consider organizing these above-mentioned activities

as soon as possible.

*11.2.2. Recommendation for each EMP packages*

- ✓ For package MT1: continues to implement next activities on the basis of the TOR.
- ✓ For package MT2: completing land use planning for the semi – flooded areas consistent with the Vietnam regulations, satisfy the purposes of project environment protection and should have the consent of local government.
- ✓ For package MT3: complete the procedure for handing over land use for bumping station in Long An..
- ✓ For package MT4: the consultant should complete the final report positively.
- ✓ For packages MT5: the consultant should complete the final report positively.
- ✓ For package MT6: the consultant should complete the final report positively.
- ✓ For package MT7: Strengthen inspection and monitoring the sites, support the constructors solve the current environmental issues and complete the quarterly reports as schedule.
- ✓ For package MT8: perfect the end of warranty procedures and hand over the whole monitoring station system to local government.

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